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Southwestern Region

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Draft Environmental Impact Statement for the Coconino National Forest Land and Resource Management Plan, Volume 1

Coconino, Gila, and Yavapai Counties, Arizona

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Draft Environmental Impact Statement for the Coconino National Forest Land and Resource Management Plan

Coconino, Gila, and Yavapai Counties, Arizona

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Abstract

This draft environmental impact statement discloses the detailed analysis of each of the four alternatives (or programmatic strategies) for revising the 1987 forest plan. The analysis displays the anticipated progress toward the desired conditions as well as the potential environmental and social consequences of implementing each alternative. Alternative A is the no action alternative, which is the1987 forest plan, as amended. Alternative B is the proposed revised plan. Alternative C considers increases in the amount of wilderness and special areas, as well as increased opportunities for semiprimitive recreation. Alternative D considers fewer restrictions on human access, use, and infrastructure.

Summary

This draft environmental impact statement (DEIS) documents the analysis of alternatives developed for the programmatic management of the approximately 1.8 million acres administered by the Coconino National Forest (forest). The selected alternative will replace the 1987 "Coconino National Land and Resource Management Plan," as amended (1987 plan) that guides all natural resource management activities on the Coconino National Forest. The revised plan is intended to address new information and concerns raised since the 1987 plan was published; meet the objectives of Federal laws, regulations, and policies; address the changes in management anticipated to be needed over the next 15 years based on the analysis of the management situation; provide for clear direction in the form of desired conditions, objectives, standards, guidelines, suitability, management areas, and monitoring; incorporate the best available science; and provide a framework for adaptive management.

This DEIS discloses the detailed analysis of each of the four alternatives for revising the 1987 plan. The analysis displays the anticipated progress toward the desired conditions as well as the potential environmental and social consequences of implementing each alternative. Alternative A is the no action alternative, which would continue management under the 1987 plan. Alternative B is the proposed revised plan. Alternative C is similar to the proposed action, but it includes the recommendation of additional wilderness areas and additional management areas that provide additional protections to botanical and wildlife resources. Alternative D is also similar to alternative B, but in contrast to alternative C, it recommends no new wilderness areas and it provides additional access for mechanized recreation (e.g., mountain bikes) and energy infrastructure.

The notice of availability for this DEIS is published in the Federal Register. The notice of availability initiates a 90-day comment period on the proposed revised plan and DEIS. It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review.

Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative review or judicial review.

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Date Comments Must Be Received: No later than 90 days from the date of publication of the notice of availability in the Federal Register.

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Commonly Used Acronyms

ADEQ – Arizona Department of Environmental Quality

ADOT – Arizona Department of Transportation

AMS – analysis of the management situation

ASQ – allowable sale quantity

AUM – animal unit month

AZGFD – Arizona Game and Fish Department

BA – basal area

BLM – Bureau of Land Management

BMP – best management practice

CCF – hundred cubic feet

CFR – Code of Federal Regulations

CLF – Chiricahua leopard frog

CWD – coarse woody debris

d.b.h. – diameter at breast height

d.r.c. – diameter at root collar

EPA – Environmental Protection Agency

ESA – Endangered Species Act

ESR – ecological sustainability report

FACTS – Forest Service ACtivity Tracking System

FPR – forest plan revision

FR – forest road

FRCC – fire regime condition class

FSH – Forest Service Handbook

FSM – Forest Service Manual

FVS – Forest Vegetation Simulator

FY – fiscal year

GA – geological area

GFA – general forest area

GIS – geographic information system

HFRI – historic fire return interval

HUC – hydrologic unit code

IBA – important bird area

IMPLAN – IMpact Analysis for PLANning

IRA – inventoried roadless area

LRMP – land and resource management plan

LTSYC – long term sustained yield capacity

MA – management area

MAUM – thousand animal unit month

MBF – thousand board feet

MCF – thousand cubic feet

MIS – management indicator species

MRVD – thousand recreation visitor days

MSO – Mexican spotted owl

MVUM – motor vehicle use map

MWFUD – thousand wildlife and fish user days

NAAQS – National Ambient Air Quality Standards

NEPA – National Environmental Policy Act

NF – national forest

NFMA – National Forest Management Act

NFS – National Forest System

NPS – National Park Service

NVUM – National Visitor Use Monitoring

OHV – off-highway vehicle

ORV – outstandingly remarkable values

P – primitive

PAC – protected activity center

PAOT – persons-at-one-time

PFA – post-fledgling family area

PFC – proper functioning condition

PNV – present net value

PNVT – potential natural vegetation type

R – rural

RASES – Riparian Area Survey and Evaluation System

RMAP – Regional Riparian Mapping Project

RN – roaded natural

RNA – research natural area

ROS – recreation opportunity spectrum

SIO – scenic integrity objective

SMS – Scenery Management System

SMU – smoke management unit

SPNM – semiprimitive nonmotorized

TES – terrestrial ecosystem survey

TMDL – total maximum daily load

TMR – Travel Management Rule

TPA – trees per acre

U – urban

USDA – U.S. Department of Agriculture

USDI – U.S. Department of the Interior

USFWS – U.S. Fish and Wildlife Service

USGS – U.S. Geological Survey

VCC – vegetation condition class

VDDT – Vegetation Dynamic Development Tool

VSS – vegetative structural states

VQO – visual quality objective

WHMA – wildlife habitat management area

WOS – wilderness opportunity spectrum

WUI – wildland-urban interface

Chapter 1. Plan Revision Needs for Change

Document Structure

The Forest Service has prepared this draft environmental impact statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) (P.L. 91-190) and other relevant Federal and State laws and regulations. This DEIS discloses the indirect and cumulative environmental impacts that would result from the proposed action (proposed revised plan) and alternatives. The document is organized into four chapters, plus those sections described below:

- *Chapter 1. Plan Revision Needs for Change*: Includes information on the needs for change which were identified during the early stages of plan revision and the Agency's proposed revised plan for addressing those needs for change. This chapter also details how the Forest Service informed the public of the proposed revised plan and how the public responded.
- *Chapter 2. Alternatives:* Provides a more detailed description of the proposed revised plan as well as alternative methods for addressing the needs for change. It also provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences:* Summarizes the physical, biological, social, and economic environments affected by the proposed revised plan and the environmental consequences of implementing the proposed revised plan and other alternatives on these environments. This analysis is organized by need for change revision topic, and within each revision topic by resource area.
- *Chapter 4. Consultation and Coordination:* Lists preparers and agencies consulted during the DEIS development.

Other sections in the DEIS include:

- *Glossary*: Provides explanations for key concepts in the DEIS.
- *References*: Provides citations for references made in the DEIS.
- *Appendix:* Consists of multiple parts and provides more detailed information to support the analyses presented in the DEIS such as public comments and responses and an index of records.
- *Index*: Provides page numbers by topic.

Additional documentation, including specialist reports which contain more detailed analyses, may be found in the project record.

Location

The Coconino National Forest (hereafter referred to as the Coconino NF or forest) ranges in elevation from 2,600 to 12,633 feet. The northern part of the forest is dominated by the San Francisco Peaks, which includes the highest point in Arizona. The forest is located at the southern end of the Colorado Plateau and is one of six national forests in Arizona, sharing boundaries with the Apache-Sitgreaves, Kaibab, Prescott, and Tonto National Forests. The forest is steward to lands that are considered central to the way of life of 13 southwest American Indian tribes. The Navajo and Hopi Nations, in particular, are prominent neighbors north and east of the forest. Private land, as well as lands administered by the State of Arizona and National Park Service, abuts the forest. The Grand Canyon National Park, while not immediately adjacent to the forest, is an economic driver for communities in and around the forest. (See figure 1.)

Figure 1. Coconino National Forest vicinity map

Background

The existing "Land and Resource Management Plan for the Coconino National Forest" (1987 plan or forest plan) was completed in 1987. The 1987 plan, including its amendments, is the main document that guides forest managers' decisionmaking with respect to managing natural resources (e.g., soil, water, vegetation, and ecosystems) and human uses (e.g., recreation, thinning, livestock grazing, firewood gathering, special use permits, and search for solitude) of the Coconino NF.

Per direction in the National Forest Management Act of 1976 and its implementing regulations found in 36 CFR 219 (1982), every national forest must revise its land management plan:

- Every 10 to 15 years;
- When conditions or demands in the area covered by the forest plan have changed significantly;
- When changes in agency policies, goals, or objectives would have a significant effect on forest-level programs; and
- When monitoring and evaluation indicate that a revision is necessary.

Because the 1987 plan is outdated and does not reflect current conditions, the Coconino NF has been engaged in the process of revising its plan since 2006. During this process, the Coconino NF developed multiple programmatic strategies (or alternatives) for revising the plan.

Needs for Change

The purpose of this DEIS is to evaluate the different alternatives for revising the 1987 plan, including disclosure of their potential environmental consequences.

In preparation for plan revision, the Coconino NF identified guidance in the 1987 plan which is working, new conditions which need to be addressed, and ongoing challenges which could be better addressed. This preparatory work is documented in the "Analysis of the Management Situation," which was completed in May 2010 (USDA Forest Service 2010a). Through the "Analysis of the Management Situation," the Coconino NF identified current ecological and socioeconomic conditions and trends taking place on the forest and the associated "needs for change" to be addressed in the revised plan. The needs for change are grouped under three broad revision topics: (1) recreation, (2) forest community interaction, and (3) maintenance and improvement of ecosystem health.

There is a need to revise the 1987 plan to: (1) meet the legal requirements of the National Forest Management Act and the provisions of the 1982 Planning Rule,[1] (2) guide natural resource management activities on the forests for the next 10 to 15 years, and (3) address needed changes in management direction as identified in the three revision topics.

Revision Topic 1: Recreation

Conditions and Trends

Recreational use of the Coconino NF has changed significantly since the 1987 plan was developed. Some of the trends and conditions related to recreation include: increased use of developed recreation areas; changing demographics; increased conflicts in social values, culture, and expectations tied to public lands, for example between those who believe that only recreational activities that are less disruptive of nature (wildlife viewing or hiking) should occur on the forest and those who believe the forest should be equally available for all recreation types (hiking, off-road vehicle use, large group events); new types of recreation; the adoption of a new scenery management system; increased recognition of tribal cultural uses and values; and pressures on riparian, wilderness, and other special areas.

Needs for Change

To allow for changing trends and conditions, the proposed revised plan needs to:

- Update desired conditions and other plan components for recreation and scenery management where guidance is partial or absent in the 1987 plan,
- Update the plan components for existing special areas, and
- Incorporate special area recommendations and related plan components into the revised plan.

[1] The transition provisions (36 CFR 219) of the 2012 Planning Rule allow use of the 1982 Planning Rule to amend or revise plans.

Revision Topic 2: Community-forest Interaction

Conditions and Trends

Relationships with the surrounding communities have changed significantly since the 1987 plan was developed. Some of the trends and conditions related to forest–community interaction include: a shift from a commodity-based (timber, mineral development) to service-based (recreation) economy; the influence of forest management activities on the local economy and environment; population growth and loss of forest access or open space; and increased demand for community infrastructure.

Needs for Change

To allow for changing trends and conditions, the proposed revised plan needs to:

- Update plan language to acknowledge open space values,
- Update plan language to acknowledge potential future community growth and expansion desires,
- Update guidance on energy and mineral development,
- Provide guidance related to forest products and consideration of culturally important forest products,
- Clarify regulatory authorities relating to air quality and include approaches for addressing smoke and fugitive dust emissions, and
- Review and update plan guidance on communication sites.

Revision Topic 3: Maintenance and Improvement of Ecosystem Health

Conditions and Trends

Since development of the 1987 plan, there is new knowledge of forest ecosystems, and the emphasis of forest management has shifted from timber outputs to the maintenance and improvement of ecosystem health. Some of the trends and conditions related to ecosystem health include: recognition of each ecological resource on the forest, from soil to wildlife; forest resilience; changed frequency and severity of natural disturbances in fire-adapted ecosystems; the decline of aspen; the loss of understory species; lack of current plan direction for rarer ecosystems (e.g., tundra, spruce-fir, and riparian); susceptibility to uncharacteristic disturbances (e.g., fire, drought, and insects and disease); climate change; invasive species; and habitat connectivity.

Needs for Change

To allow for changing trends and conditions, the proposed revised plan needs to:

- Update desired conditions and objectives for soil resources.
- Integrate and update management direction for riparian, aquatic, and water resources.

- Incorporate desired conditions that reflect the composition, structure, and natural disturbance attributes appropriate for the different ecosystems, and integrate desired conditions across different resource areas.
- Address invasive exotic flora and fauna.
- Ensure plan components address concerns of forest analysis species[2] and their habitat.
- Address the importance of habitat connectivity.
- Address strategies to address effects of climate change.

Proposed Action

The Forest Service proposes to revise the existing land management plan for the Coconino National Forest. Proposed changes to the forest plan include updates to the desired conditions, objectives, standards, guidelines, special areas, suitability, and monitoring requirements that will guide management of the Coconino NF for the next 10 to 15 years. The proposed revised plan changes the description and allocation of the management areas to move toward forestwide desired conditions and to provide opportunities for a range of activities. The proposed revised plan focuses on the three revision topics identified above and incorporates significant issues raised during the scoping process where it was feasible to do so. It accompanies this document.

Plan Decisions

The proposed revised plan makes the following types of decisions:

- Desired conditions, goals, and objectives express an aspiration and form the basis for projects, activities, and uses that occur under the forest plan.
- Suitability determinations, standards, and guidelines set requirements to limit or guide forest uses or activities that are expected to occur under the forest plan.
- Management area and special designations, or recommendations for special designations, identify areas with different desired conditions, uses, standards, and guidelines.
- Monitoring and evaluation requirements for forest plan implementation.

While the forest plan strategically guides future management of the forest, it does not authorize projects or make site-specific project decisions. Those decisions are made following project-specific proposals and in conjunction with separate, site-specific National Environmental Policy Act (NEPA) analysis, with additional opportunities for public involvement.

Scope of the Analysis

The analysis in this DEIS is limited to the needs for change revision topics listed above and to those significant issues (discussed below). Many issues raised during the scoping process are beyond the scope of this plan revision process and will not be considered in the DEIS. For example, issues associated with site-specific activities that are addressed by project-level

[2] Forest analysis species are plant, animal, and aquatic species considered for analysis during the forest plan revision process.

decisions are not addressed. The designation of specific routes, trails, and areas for motorized vehicle travel will not be considered during plan revision because it is addressed in the separate environmental impact statement for public motorized travel planning on the Coconino NF (USDA Forest Service 2011e). Some issues (e.g., hunting regulations), although important, are beyond the authority or control of the Coconino NF and will not be addressed. In addition, some issues, such as wild and scenic river suitability determinations, will not be undertaken at this time, but will be addressed in the future in separate analyses.

Decision Framework

The regional forester for the Southwestern Region will make the final decision on the selected alternative for the proposed revised plan. The regional forester will review the proposed action (proposed revised plan), the other alternatives (A, C, and D), and the environmental consequences of each, then decide which plan alternative best addresses the identified needs for change, issues raised during the scoping process, the desired conditions, multiple use concept, diverse needs of people, and sustainable management of the Coconino NF 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).

Public Involvement

Informal public involvement began in mid-2006. Public meetings, information in the "Coconino National Forest Annual Stakeholders Report," letters, emails, phone calls, radio announcements, and postings to the Coconino National Forest Web site were used to share and gather information and encourage participation in the plan revision process. Plan revision team members also gave presentations, went to the field, and met with individuals and groups. Four topic-based workgroups were also formed to focus on special areas and socioeconomic, ecological, and species diversity. Information collected from the public was used to identify the needs for change. Topics brought forward by the public and other agencies were summarized in the "Analysis of the Management Situation" and presented to the Coconino National Forest leadership team. These topics included: species diversity, special management areas, livestock grazing, roads and trails, fuel reduction, forest products and industry, water and riparian areas, open space, land exchanges, and places of interest.

The notice of intent to prepare an EIS was published in the Federal Register on May 12, 2010. The notice of intent, which formally initiated the scoping process, requested public comment on the plan needs for change from May 12 through June 30, 2010.

After publication of the notice of intent, the Coconino NF held two rounds of open house or workshop style public meetings—one round in November 2010 and another in March 2011—to: (1) provide information on the current status of plan revision, (2) present and discuss language in the proposed revised plan, (3) receive input regarding whether the proposed revised plan adequately addressed the needs for change, and (4) identify other issues and concerns that still needed to be addressed. Public meetings were held in Flagstaff, Cottonwood, Happy Jack, and Camp Verde. The plan revision team also held "office hours" at locations in Flagstaff, Happy Jack, and Sedona to allow additional opportunities for the public to discuss the proposed revised plan with plan revision team members in a more one-on-one setting. Public input gathered from these meetings, as well as from written comments, was used to identify concerns that led to further refinement of the proposed revised plan as detailed in chapter 2. Those comments that

could not be addressed through making adjustments to the proposed revised plan were carried forward as issues and used to develop alternatives.

There will be additional opportunities for public involvement in the NEPA review and 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 National Forest Management Act regulations. Eligibility to appeal the regional forester's decision regarding the selected alternative is limited to persons and organizations that comment on the EIS or otherwise express an interest in the project during the formal 90-day comment period.[3]

Issues

Comments were received from the public, other agencies, and tribes in response to the notice of intent comment period and public meetings. The comments were analyzed to identify issues and frame their associated cause-and-effect relationships. Issues not identified as those already addressed by law or regulation, the proposed revised plan, other higher level decision, or those already covered by the 1987 plan were used to develop alternatives. Using comments from the public, other stakeholders, agencies, and tribes, the plan revision team developed the following list of issues to address in the DEIS analysis. For details on how these issues were specifically addressed, see the "Alternatives Considered in Detail" section of chapter 2.

Recreation Issues

- Mechanized use on trails may create no more impact than foot traffic in botanical and geological areas, so it should not warrant prohibition.
- Some recreation activities in the proposed revised plan, such as snowmobile use and recreational shooting, may cause noise and disturb other, different recreational activities and recreation settings.
- The proposed revised plan may not adequately meet the demand for wilderness areas and their associated primitive, undeveloped settings.

Use/Management Issues

- In the proposed revised plan, grazing may negatively impact the values for which research natural areas were designated.
- Recommending additional wilderness areas in the proposed revised plan would unnecessarily prohibit and further geographically constrain management activities and uses that would otherwise be allowed.
- Language in the proposed revised plan might unnecessarily restrain access/use of the forest for future energy infrastructure needs.

[3] Optional appeal procedures available during the planning rule transition period allowed by Title 36 CFR Part 219 subpart A.

Wildlife or Ecosystem Issues

- The proposed revised plan may not fully address disturbance of wildlife species from motor vehicle noise in areas on the forest.
- The proposed revised plan may not adequately promote habitat connectivity, nor promote the identification or removal of potential barriers to wildlife movement.
- Old growth forest components are underrepresented on the landscape and were better provided for in the 1987 plan than in the proposed revised plan.

Issues Already Decided by Law, Regulation, or Policy

Issue: *The proposed revised plan may not contain sufficient guidance to adequately protect quality and quantity of groundwater.*

Rationale: Water withdrawal is under forest control for Forest Service wells only and the Forest Service is responsible for the water quality drawn from those wells. National and regional groundwater policy directs forest well drilling and pumping not to adversely affect connected riparian habitat and/or water quantity and quality. The proposed revised plan does not reiterate existing law, regulation, or policy. Arizona Department of Water Quality controls adjacent water withdrawal from current and new wells.

Concern Already Considered in Analysis

Issue: *The proposed revised plan may not adequately address the northern goshawk.*

- *By removing standards associated with northern goshawk nest areas, post-fledgling areas, foraging areas, and goshawk prey species, the proposed revised plan may not adequately ensure the viability of this species.*

Rationale: The standards and guidelines related to northern goshawk in the 1987 plan as amended were analyzed as part of the 1987 plan (alternative A) and substantially incorporated into other alternatives. Consequently, this concern would not generate another alternative.

Chapter 2. Alternatives

Introduction

This chapter describes the proposed action and other alternatives that satisfy the purpose of and need for revision, addresses issues raised during scoping, and briefly discusses alternatives eliminated from detailed analysis. It includes a description and map of each alternative considered (see appendix A for maps). This section also presents the alternatives in a comparison table format, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

Process Used to Develop Alternatives

The alternatives considered in this document were developed by evaluating the ecological and social conditions and trends on the forest and identifying changes to the forest plan direction that would help improve forest conditions and trends, as documented in the "Economic and Social Sustainability Assessment" (USDA Forest Service 2008a); "Ecological Sustainability Report" (USDA Forest Service 2009); "Analysis of the Management Situation" (USDA Forest Service 2010a); and the "Potential Wilderness Evaluation Report" (USDA Forest Service 2011d). The 1987 plan was evaluated by the interdisciplinary team and other forest staff to determine what management direction was still relevant and should be retained in the proposed revised plan, as well as what was outdated and in need of revision, which resulted in the documents listed above. Input from American Indian tribes was carefully considered and incorporated in the development of the proposed revised plan and alternatives. Additionally, public meetings and public feedback periods were scheduled throughout the plan revision process to invite input on draft documents related to forest plan revision and to identify significant issues for inclusion in the proposed revised plan and development of plan alternatives analyzed in this document.

Alternatives to the proposed revised plan were developed when issues could not be incorporated into the proposed revised plan due to inherent conflicts in issues addressed (e.g., not enough wilderness areas versus too many wilderness areas). Some alternatives were analyzed in detail, while other alternatives were considered, but eliminated from further study. These eliminated alternatives and their respective rationales for elimination are stated below.

Limited resources constrain the potential achievements of any plan alternative and, as such, are considered in the environmental consequences disclosed in this document. However, depending on the type of plan component, limitations in resources may have a variable effect: with regard to their overall desired conditions, alternatives B, C, and D were written to be largely independent of the time or resources necessary for achievement; conversely, due to their specificity, plan objectives in each alternative were developed with consideration of the constraints in resources and timeframes in which they would be achieved.

Climate change was also considered during the development of alternatives B, C, and D and follows the strategy identified in "Southwestern Region Climate Change Trends and Forest Planning" (USDA Forest Service 2010g). Given the difficulty of providing specific management guidance relative to climate change, the nature of the alternatives to manage toward desired conditions regardless of current or changing conditions (such as climate change) is intended to allow management of the forest to adapt as necessary to continue moving toward ecological and social desired conditions.

Renewable Resources Planning Act Program

The 1982 Planning Rule provisions at 219.12(f)(6) require land management plans to respond to and incorporate the Renewable Resource Planning Act program objectives for each national forest as displayed in regional guides. There is no longer a regional guide for the Southwestern Region. This was withdrawn as required by the 2000 Planning Rule (36 CFR 219.35(e)). The last Renewable Resource Planning Act program was developed in 1995. In lieu of the Renewable Resource Planning Act program, the "USDA Forest Service Strategic Plan Fiscal Year 2007–2012" (USDA Forest Service 2007c) provides broad overarching national guidance for land management planning and national objectives for the Agency as required by the Government Performance Results Act. All of the alternatives in this EIS address these broad strategic objectives.

Alternatives Eliminated from Detailed Study

Federal agencies are required by the Council on Environmental Quality regulations 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 up until the release of this EIS include suggestions of alternative options for satisfying the purpose of and need for Agency action. The following alternatives were considered but dismissed from further evaluation in this EIS for the reasons summarized below.

1. **Prohibition of prescribed fires as a management tool:** This alternative considered the management of vegetation on the Coconino NF solely by mechanical means and would have eliminated the use of prescribed fire with the goal of reducing smoke-related impacts to air quality in surrounding communities. This alternative, however, was not considered in detail because it is inconsistent with the management needs of the fire-adapted ecosystems on the national forest. All alternatives considered in detail include direction to meet State and Federal air quality standards and reduce smoke impacts to the public. The following provides a detailed explanation of why prescribed fires are essential on the Coconino NF:

   Why is fire necessary on the landscape?

   Fire is an essential disturbance agent in fire-adapted/dependent ecosystems (i.e., Ponderosa Pine, Mixed Conifer with Frequent Fire, Piñon Juniper, Semidesert Grassland, and Interior Chaparral potential natural vegetation types (PNVTs)). For these ecosystems the viability of growth, structure, function, and health of the forest is dependent on a fire regime. Many of the processes that initiate plant germination, maintain wildlife habitat, maintain water quality/quantity, etc., require fire to burn through the forest at a regular interval (Moore et al. 1999). Mechanical removal of vegetation is effective in removing unsustainable densities and canopy cover of vegetation; however, it does not adequately reduce fuel loading or restore necessary ecosystem processes (Omni et al. 2002). In fact, mechanical treatment alone can increase available fuel and result in a more intense and faster spreading fire (Omni et al. 2002). If fire is removed from these systems, whether by policy, management decisions, etc., the resultant ecosystem is altered in a way that may jeopardize the overall sustainability and integrity of the system.

In the case of many southwestern forests, fire exclusion by past management actions has led to a change in ecosystem attributes, structure, and function. The buildup of vegetation debris

on the forest floor, in conjunction with higher vegetation densities and canopy cover, has resulted in an increase in fire intensity and severity, beyond the natural historical range of variability. Subsequent fires can result in rapid spread, high fire intensity, and high fire severity to levels at which managers cannot safely control (Moore et al. 1999).

2. **Sixteen-inch diameter restriction on cutting trees:** Alternatives A, B, C, and D include desired conditions and guidelines that foster old growth forest components and the retention of old trees, but do not include maximum diameter restrictions for tree harvest. Although the staff of the Coconino NF values large trees, the forest determined that applying this diameter restriction on cutting trees forestwide would limit future flexibility in management in terms of the narrowing range in conditions of forest structure and composition and would not help achieve forest desired conditions if applied unilaterally.

Fire-adapted forest systems in the Southwest were historically driven by frequent fire burning through an herbaceous understory to maintain open, uneven-aged conditions in ponderosa pine and dry mixed conifer forests. On today's southwestern landscapes, restoration treatments are used to lower the overstory density and to reduce continuous cover that will allow growth of groups of younger trees sufficient to reestablish these open, uneven-aged conditions and prevent uncharacteristic fire regimes. Ultimately, the goals of restoration are to provide healthy habitat function for plants and animals, lower fire risk to surrounding communities, and provide for economic and social benefits. Results of a study conducted by the Southwestern Regional Office (USDA Forest Service 2011c) question both the effectiveness and the sustainability of restoration treatments under a strategy that imposes diameter cut limits.

This analysis showed that within 3 decades, nearly all stands managed under a tree cutting size cap would be converted to an undesirable, even-aged condition. This level of landscape-scale homogeneity lacked biological diversity and indicated an unstable ecosystem subject to simultaneous large-scale disturbances, such as uncharacteristic fire.

The literature discusses a difficulty inherent in the use of diameter caps; essentially diameter caps present a uniform solution to the myriad issues presented by ecosystems, and as such, result in tradeoffs (Abella et al. 2006). For example, studies of diameter cap use and efficacy reflected similar conclusions, stating that while some ecosystem components may benefit from the use of diameter caps (e.g., wildlife that may benefit from higher tree densities), other components may be harmed (e.g., understory vegetation) (Abella et al. 2007).

Additionally, the results indicated that where diameter limits are imposed, the continued growth of residual trees following treatments would conflict with the intent of diameter limits and lead to a favoring of greater tree densities and basal area, heavier fuel loads, increased homogeneity of structure, lower biodiversity, and higher frequencies of uncharacteristic crown fires.

This alternative was eliminated from further consideration, but decisions to focus on cutting trees of a given size range could still be made at the project level where necessary to move existing conditions toward vegetative desired conditions.

3. **Specific consideration of a motorcycle trials area:** Although consideration of a motorcycle trials area was included in a working draft of the revised plan that was shared with the public for feedback during the scoping period, it was decided that consideration of a motorcycle trials area was too specific a recreation use to include in the plan. It was

determined that this and other similar specialized recreation uses would be more appropriately considered at site-specific levels.

4. **Recommendation of a national scenic area designation for the Sedona-Oak Creek area (the area covered by Amendment 12 of the 1987 plan)**: This alternative was eliminated from detailed consideration because the land adjustment plan direction central to the national scenic area proposal has been carried into the proposed action and alternatives, and the values sought through such a designation have been incorporated.
5. **Vegetation should be quantitatively assessed to ensure continued ecosystem function and sufficient forage for native ungulates and domestic livestock:** This alternative was not considered in detail because the desire to have functioning landscapes, including enough vegetation for ecosystem functioning and forage for native and domestic ungulates, is provided for by plan components for vegetation in the alternatives considered in detail and as part of the development of those plan components, vegetative forage was qualitatively analyzed for all species. It was determined by specialists that quantitative analysis as requested is not practical at the forest plan level because climate, site conditions, and native ungulate (such as pronghorn, mule deer, and white-tail deer) use of those sites can vary annually and on a longer term basis. Furthermore, Agency policy exists for evaluating the range conditions, drought, and determining permitted levels of livestock grazing on the forest and so would provide for adequate ecosystem function.
6. **Specification of road densities:** This alternative considered specifying road density limits across the forest to limit the impacts of roads on wildlife and watershed conditions. Because road impacts to both wildlife and watersheds are more complex than simple road densities and may be equally affected by road design and location, consideration of specifying road densities was eliminated from further consideration in the action alternatives. While alternative A (1987 plan), however, does include standards and guidelines related to road densities, plan language to mitigate road impacts to wildlife and watersheds is only included in alternatives B, C, and D.
7. **Designation of long-term research plots:** Long-term research plots are those established on the forest by external stakeholders in the early 1900s that remain in internal and/or external use. They are typically small plots located across the northern half of the forest and were intended to provide a sampling of the landscape-scale conditions north of the San Francisco Peaks. This alternative considered designating long-term research sites across the forest and would have limited other activities that would interfere with research purpose of the long-term sites. This alternative was not considered in detail because such designation would be too site specific for a programmatic forest plan. The special use permit that currently is issued for these sites does not provide exclusive use of the property and, therefore, allows forest management, recreation, and other activities to continue in its vicinity. Forest Service regulations (36 CFR 251.54 (e)(iv)) state that special uses, “will not create an exclusive or perpetual right of use or occupancy.”

Alternatives B, C, and D provide desired conditions and guidelines for managing research special use permits that would promote the continued use of long-term research sites. The value of research on the forest is recognized in the alternatives. As with all special uses, the restrictions on other forest activities are more appropriately considered on a case-by-case basis and managed by

site-specific projects and proposals on the basis of safety, managing user conflict, and the merits of the proposed use.

Alternatives Considered in Detail

Four alternatives are analyzed in detail in this document: alternative A (1987 plan); alternative B (proposed revised plan); alternative C, which considers increases in the amount of wilderness and special areas, as well as increased opportunities for semiprimitive recreation; and alternative D, which considers fewer restrictions on human access, use, and infrastructure.

This chapter provides a general overview of each alternative and discusses the manner in which each alternative meets the needs for change topics and significant issues defined in collaboration with the public during the planning process.

Elements Common to All Alternatives

All four alternatives have a number of features in common. In particular, they:

- Comply with applicable laws, regulations, and policies;
- Conserve soil and water resources and do not allow significant or permanent impairment of the productivity of the land;
- Provide protections for riparian areas;
- Maintain air quality that meets or exceeds applicable Federal, State, and/or local standards or regulations;
- Provide for and maintain diversity of plant and animal communities to meet overall multiple-use objectives;
- Provide for species' viability across the planning area;
- Include measures for preventing the destruction or adverse modification of critical habitat for threatened and endangered species;
- Use a common list of management indicator species. The management indicator species were selected based on regional guidance and recommendations from forest, Federal, and State agency specialists, modified. The following three management indicator species were used to compare and evaluate the alternatives: Mexican spotted owl, pronghorn antelope, and the pygmy nuthatch;
- Protect heritage resources;
- Recognize the unique status of Native American tribes and their rights retained by trust and treaty with the United States, including consultation requirements;
- Provide sustained multiple uses, products, and services in an environmentally acceptable manner (including leasable and locatable minerals, timber, livestock forage, and recreation opportunities); and
- Retain existing designated areas (e.g., wilderness areas, wild and scenic rivers, special areas).

In addition, the following features are common to all alternatives.

Desired Conditions

Desired conditions (or goals) that apply to all of the Coconino 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 B), which accompanies this document and are the same for alternatives C and D. While these desired conditions are used to analyze environmental consequences, alternative A provides its own set of stated goals and desired conditions.

Management Areas

Management area direction provides desired conditions, standards, and guidelines that apply to specific areas of the Coconino NF. Alternative A (the 1987 plan) identifies 38 management areas based on vegetation type. Alternatives B, C, and D use a common set of 15 management areas based on scenery, use, and geographic areas.

Monitoring Strategy

Each alternative has a monitoring strategy. Monitoring and evaluation provides the adaptive management strategy for determining the degree to which on-the-ground management is maintaining or making progress toward desired conditions.

Roadless Area Conservation Rule

All alternatives include management direction for inventoried roadless areas (IRAs) identified in the 2001 Roadless Area Conservation Rule. Alternative B includes direction that retains the undeveloped character of these areas. Comments received in the scoping process and between the draft and final EIS will help the Agency determine the scope of issues related to roadless area management and guide the analysis of environmental effects. Each alternative includes recreation opportunity spectrum and suitability direction that retains the roadless character of these areas and is compatible with the Roadless Area Conservation Rule. All roadless areas were considered for their wilderness potential.

Wilderness

Each alternative contains wilderness areas, but only two alternatives recommend new wilderness areas or expansions of existing wilderness areas. For alternatives A and D, there are no recommended areas or acres in addition to the 10 existing designated wilderness areas that total 156,374 acres[4] (8.5 percent of the forest[5]). For alternative B, 3 areas are recommended that encompass approximately 14,767 acres in addition to the existing wilderness acres, totaling 171,141 acres (9.3 percent of the forest). For alternative C, 13 areas are recommended that

[4] The Coconino, Kaibab, and Prescott National Forests share wilderness areas that total 442,502 acres. Within the Coconino National Forest administrative boundary, there are 10 designated wilderness areas, totaling 156,374 acres. Of these 10, the "Coconino National Forest Land and Resource Management Plan" provides direction for 8 designated wilderness areas, a total of 151,333 acres. The "Tonto National Forest Land and Resource Management Plan" provides direction for Mazatzal Wilderness, and the "Kaibab National Forest Land and Resource Management Plan" provides direction for Kendrick Mountain Wilderness.

[5] Percentages are based on the lands managed by the Coconino National Forest (1,837,498 acres).

encompass approximately 92,358 acres[6] in addition to the existing wilderness acres, totaling 248,732 acres (13.5 percent of the forest).

Wildland-Urban Interface

All alternatives 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. These wildland-urban interface areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites regardless of the distance involved.

Fire management strategies and other plan language, however, differ between alternative A and alternatives B, C, and D. Details of the features common to alternatives (as described above) can be found in the 1987 plan (as amended) or in the proposed revised plan that accompanies this document.

Alternative A (1987 plan)

General Overview

The National Environmental Policy Act (NEPA) requires a "no action" alternative, an alternative that does not vary from the existing management direction situation. This no action alternative generally serves as a baseline to which the effects of the proposed action and other alternatives can be compared. In this document, the no action alternative is alternative A, or the 1987 plan, as amended. An electronic copy of alternative A (the 1987 plan) is provided in its entirety on the Coconino National Forest Web site[7].

Alternative A describes objectives, standards, and guidelines (collectively, these are referred to as "plan components") for forest resources, including specific guidance for Mexican spotted owl, northern goshawks, and other wildlife species. Beside forestwide guidance, this alternative identifies additional guidance for 38 management areas with associated management emphasis.

Addressing Needs for Change

Recreation

Although this alternative directs that the recreation opportunity spectrum system should be used to increase opportunities for a wide variety of developed and dispersed recreation experiences, it does not offer comprehensive guidance for recreation or scenery management.

Alternative A does not have updated plan components for existing special areas, nor does alternative A include any new special area designations.

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[6] Alternative C recommends Hackberry Wilderness, the boundary of which is shared between the Coconino and Prescott National Forests. This number includes the entire recommended area, a total of 26,044 acres, of which 25,131 acres are on the Coconino National Forest and 913 acres are on the Prescott National Forest.

[7] http://www.fs.usda.gov/coconino/

Community–Forest Interaction

Alternative A recognizes that education and interpretation are primary tools to encourage good stewardship by the public. Alternative A encourages close partnerships with permittees, nonprofits, and other agencies to provide this service.

Alternative A does not have language to fully address open space values or to acknowledge potential future community expansion desires. Guidance and energy and mineral development is not updated in alternative A, nor is comprehensive guidance related to forest products or consideration of culturally important forest products provided. Alternative A does not provide clear information on regulatory authorities relating to air quality nor does it include approaches for addressing smoke emissions. Language in alternative A related to communication has not been reviewed or updated.

Maintenance and Improvement of Ecosystem Health

Alternative A, as amended, provides goals, objectives, standards, and guidelines established to protect ecosystems and maintain or improve ecosystem function. Plan components were established in 1987, although a number of sections have been subsequently updated by amendments or change notices. Much of the plan direction that comprises the no action alternative reflects the scientific understanding of ecosystem structure and function of approximately a decade or more ago.

Alternative A does not provide updated desired conditions and objectives for soil resources nor language that addresses invasive exotic animals or grasses. Management direction for riparian, aquatic, and water resources has not been integrated into existing alternative A language. This alternative does not provide desired conditions that reflect the composition, structure, and natural disturbance attributes appropriate for the different forest ecosystems, nor does it integrate desired conditions across different resource areas. Plan components in alternative A may not fully address concerns of forest analysis species and their habitat.

(Please see maps 1, 4, 25, 28, 30, and 31 related to alternative A in appendix A.)

Alternative B – Proposed Revised Plan

General Overview

The proposed revised plan would provide strategic, program-level guidance for managing the forest and its natural resources over the next 10 to 15 years. It was developed by a forest team of natural resource and other specialists (see chapter 4) in collaboration with the public, other agencies, government officials, and Native American tribes, among others, to respond to the need for change topics and, where possible, was adjusted to address some issues raised by the public that were discussed in chapter 1. A copy of the proposed revised plan (the proposed action) accompanies this document.

The proposed revised plan retains some of the direction from the 1987 plan, in particular key direction from amendments for the Sedona-Oak Creek Ecosystem (Amendment 12) and the Flagstaff/Lake Mary Ecosystem Analysis (Amendment 17). It differs from the 1987 plan, however, in a number of fundamental ways that are aimed at allowing forest management to be adaptable over time and to be able to adjust to site-specific conditions. Therefore, the proposed revised plan:

- Places emphasis on long-term, strategic vision or desired conditions—both with respect to natural resources and human uses—that projects and related management activities must maintain or make movement toward;
- Clarifies distinctions between plan components, including standards and guidelines, and the type of guidance they provide. Allows increased flexibility to achieve the desired conditions over time be reducing the number of standards and guidelines, and stating the intent behind each guideline so that the intent of the guidelines can be followed even if not the exact direction provided by the guideline itself;
- Includes objectives that provide measurable, time-specific activities intended to make progress toward desired conditions;
- Does not repeat existing law, regulation, and policy; and
- Identifies management approaches that can be used to achieve desired conditions.

Addressing Needs for Change and Concerns Raised in Scoping

If it was possible to do so, concerns raised during public scoping were incorporated into the proposed revised plan, either by modifying existing language or by adding new language. The following issues were those that have been incorporated into the proposed revised plan:

- Concerns tied to recreation:
  - Plan direction that steers managers away from single use trails may increase user conflict in the Fort Valley-Mount Elden Management Area.
  - The proposed revised plan may not address the imbalance of available trails between Sedona and the rest of the Verde Valley.
- Concerns tied to community/forest:
  - Smoke from prescribed fires may significantly affect nearby communities with respect to human health and impacts to local tourism.
- Concerns tied to ecosystem health:
  - Old growth forest components and large, pre-European settlement trees are underrepresented on the landscape and may not be adequately protected in the proposed revised plan.
  - Plan language relating to grazing management may not be sufficient to provide enough forage for ecosystem function as well as native wildlife, particularly in times of drought.
  - Proposed revised plan direction may not adequately protect against degradation of water quality from allowed uses on the forest.
  - The proposed revised plan may not adequately limit impacts to watershed condition from high road densities and road stream crossings.

These concerns have been incorporated in the alternative as described below.

Recreation

The proposed revised plan would recommend three new wilderness areas: an extension to the existing Strawberry Crater Wilderness; Davey's Wilderness, which would serve as an extension to the existing Fossil Springs Wilderness; and Walker Mountain, a new wilderness. It would change from the 1987 plan's Visual Management System to the Scenery Management System as the tool to evaluate scenery and consequently update desired scenery objectives. Recreation settings throughout the plan would be updated via the recreation opportunity spectrum. The proposed revised plan would also clarify that the relationship between outfitter and guide levels should be determined, in part, using encounter levels from the designated recreation opportunity spectrum class (e.g., rural, semiprimitive nonmotorized) for the area.

Additional modifications were made to refine the proposed revised plan based on concerns raised during public scoping. These modifications included:

- Including a forestwide management approach for dispersed recreation to consider single use trails to accommodate varying user experiences where trail design features cannot mitigate user conflicts or provide for a sustainable recreation setting;
- Including a forestwide management approach for dispersed recreation to include input from county trails coordinators and local groups and citizens when conducting trail planning;
- Designating the Cottonwood Basin Fumeroles as a geological special area; and
- Including desired conditions in the Volcanic Woodlands Management Area that highlights the scenic and cultural importance of the volcanic features in the area.

Community–Forest Interaction

The proposed revised plan would propose three new research natural areas.[8] West Clear Creek, Rocky Gulch, and an expansion of the existing San Francisco Peaks Research Natural Area; and maintain ongoing research that requires the elevation gradient provided by the San Francisco Peaks. It would also encourage collaboration with many partners to achieve desired conditions. Additionally, the proposed revised plan acknowledges open space values, as well as potential future community expansion desires; updates guidance on energy and mineral development; provide guidance related to forest products and consideration of culturally important forest products; clarifies regulatory authorities relating to air quality and includes guidelines and management approaches for reducing smoke emissions. The proposed revised plan would update plan guidance on communication sites by replacing a static list of communication site locations with criteria to provide flexibility to consider the requirements of new technology.

Additional modifications were made to refine the proposed revised plan based on concerns raised during public scoping. These modifications included:

[8] A West Clear Creek Research Natural Area, Rocky Gulch Research Natural Area, and expansion of the existing San Francisco Peaks Research Natural Area were proposed in the 1987 plan, but were never established. Although it proposes or re-proposes those research natural areas, this alternative identifies a different location for the proposed West Clear Creek Research Natural Area and a smaller area for the San Francisco Peaks Research Natural Area expansion. These adjustments were made to better meet the intent for their selection. Additional information can be found in the "Research Natural Area Evaluation Report" (USDA Forest Service 2013).

- Incorporating plan components to support long-term research and providing guidance to help streamline the research permitting process;
- Adding a guideline to research natural areas to guide grazing management in those areas: "Allotment management plans should have provisions to protect the uniqueness and/or ecological condition of the special areas;"
- A management approach in the Volcanic Woodlands Management Area included to foster collaboration with the National Park Service on projects that could affect their lands and/or mission; and
- Dropping the reference that new communication sites are "rare."

Maintenance and Improvement of Ecosystem Health

The proposed revised plan would provide desired conditions and associated plan components for all of the vegetation types that exist on the forest, as well as soils, watersheds, and aquatic and riparian systems. Desired conditions would generally reflect historical conditions where current conditions and legal obligations and authorities have not precluded attainment of these conditions. Desired conditions and other plan components would also address or update guidance on invasive species, unique habitats, wildlife disease, and habitat connectivity. Furthermore, the proposed revised plan would allow fire to play a more natural role on the landscape and includes plan components that would address habitat and life history needs of forest analysis species. This alternative would consider effects of climate change and strategies to address those effects.

Additional modifications were made to refine the proposed revised plan based on concerns raised during public scoping. These modifications included:

- Clarifying the important ecological function of old growth forest components and their presence/distribution on the landscape;
- Including plan direction relating to the managing for older structural stages in the ponderosa pine vegetation type;
- Clarifying that domestic livestock grazing maintains the desired composition, structure, and conditions of plant communities such that rangeland ecosystems are diverse, resilient, and functioning. Furthermore, forage, browse, and cover needs of wildlife and authorized livestock would be managed in balance with available forage.
- Including guidelines to reduce road impacts to wildlife and watershed condition, as well as encouraging collaboration with partners to improve habitat connectivity across the landscape; and
- Including desired conditions in the Volcanic Woodlands Management Area that cinder cones outside of the Cinder Hills Off-highway Vehicle Area maintain their integrity, form, and natural processes.

(Please see maps 2, 5, 8, 11, 14, 17, 20, 26, 28, 29, 30, and 32 related to alternative B in appendix A.)

Alternative C

General Overview

Alternative C responds to suggestions from the public for more land to be managed in primitive and natural settings with reduced human-related disturbance for the benefit of recreation, botanical, and wildlife resources. Under this alternative, additional wilderness areas would be

recommended on the forest, as well as other special areas, to provide additional protection to botanical and wildlife resources. Human-related disturbances are addressed in a number of ways. Alternative C also responds to ecological concerns related to presence or absence of old-growth composition and structure on the landscape[9].

Addressing Concerns Raised in Scoping

Several issues with the proposed revised plan were identified through public comments. Alternative C was developed to address the following concerns:

- Concerns tied to recreation:
  - Some recreation activities in the proposed revised plan, such as snowmobile use and recreational shooting, may cause noise and disturb other, different recreation activities and settings.
  - The proposed revised plan may not adequately meet the demand for wilderness areas and their associated primitive, undeveloped settings.
- Concerns tied to use/management:
  - In the proposed revised plan, grazing may negatively impact the values for which research natural areas were designated.
- Concerns tied to wildlife or ecosystem concerns:
  - The proposed revised plan may not fully address disturbance of wildlife species from motor vehicle noise in areas on the forest.
  - The proposed revised plan may not adequately promote habitat connectivity, nor promote the identification or removal of potential barriers to wildlife movement.
  - Old growth forest components are underrepresented on the landscape and were better provided for in the 1987 plan than in the proposed revised plan.

Recreation

Alternative C would address the recreation related issues listed above by making several changes to the proposed revised plan. To improve the forest's ability to meet the demand for wilderness areas and their associated primitive, undeveloped settings, alternative C would significantly increase the number of recommended wilderness areas. Alternative C would also expand the Cottonwood Basin Fumeroles Geological Area to highlight the outstanding botanical diversity of the area.

[9] Initial analysis on this alternative revealed that some of the prescriptive elements associated with the wildlife habitat management areas (e.g., limitations on motorized use and prohibitions on grazing in riparian areas, overnight camping, and recreational fires) would be unnecessarily limiting to the forest's ability to provide sustained multiple uses, products, and services in an environmentally acceptable manner. Rather than remove the alternative from detailed consideration, the alternative was modified to remove or reduce the overreaching prescriptive elements. Information on the modifications to alternative C and rationale for those modifications are available in the project record.

The wilderness areas that would be recommended under this alternative include all the potential wilderness areas that rated high for wilderness capability (i.e., high level of wilderness character), as well as areas that had medium capability but were raised by the public as deserving additional consideration as wilderness. Two potential wilderness areas that were rated to have medium capability, White Horse and Bismark, were not considered further because of management conflicts that would occur with the allowed mountain bike use on the Arizona National Scenic Trail and the Hart Prairie Fuels Reduction and Forest Health Restoration Project that fall within these potential wilderness areas. Plan language for all wildlife habitat management areas (WHMAs) and the wildlife species emphasized in each WHMA is listed in appendix F.

Additionally, recreation settings with less noise disturbance would be promoted through restrictions on snowmobile use and recreational (i.e., nonhunting) shooting in certain locations on the forest. New recreation and transportation suitability and recreational shooting and snowmobile use suitability tables would replace the recreation and transportation suitability table in the proposed revised plan. The replacement tables are included in appendix F.

The changes related with alternative C would result in the following modifications to the proposed revised plan:

- Recommendation for 13 new wilderness areas (Abineau, Barbershop, Black Mountain, Cedar Bench, Cimmaron-Boulder, Davey's, Deadwood Draw, East Clear Creek, Hackberry, Railroad Draw, Tin Can, Strawberry Crater, and Walker Mountain) totaling 92,386 acres.
- Expansion of the Cottonwood Basin Fumeroles Geological Area to a combined geological and botanical area totaling 1,850 acres.
- Restrictions on snowmobile use would be promoted in the Walnut Canyon Management Area and areas with a recreation opportunity spectrum objective of "semiprimitive nonmotorized."
- Restrictions on recreational (i.e., nonhunting) shooting would be implemented in botanical areas; geological areas; existing and recommended research natural areas; wildlife habitat management areas; and in the Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas, and parts of the Flagstaff Neighborwoods Management Area by identifying these areas as unsuitable for that activity.

Community–Forest Interaction

Alternative C considers several of the issues related to interaction between the community and forest. To ensure research natural areas are adequately protected, livestock grazing may be restricted in certain circumstances. Alternative C also responds to the issues related to noise disturbance and habitat connectivity for wildlife through the identification of wildlife habitat management areas (WHMAs). Designation of an area as a WHMA would provide a low disturbance wildlife habitat for native wildlife species, allow for improved wildlife habitat (including habitat connectivity), and protect water quality and soil, vegetation, and water resources by limiting motor vehicle traffic. New plan language associated with these changes would be incorporated into the proposed revised plan through additional plan components and modifications to the components in the proposed revised plan. Plan language for all WHMAs and the wildlife species emphasized in each WHMA is listed in appendix F.

The changes related with alternative C would result in the following modifications to the proposed revised plan:

- Restriction on livestock grazing in research natural areas unless it supports, or would not affect, the research purpose of that research natural area.
- Designation of 8 WHMAs (East Clear Creek, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, Second Chance, and modification of alternative B's Anderson Mesa Management Area direction and boundaries to further emphasize wildlife habitats) totaling 340,481 acres.
- Limitation on motorized dispersed camping in WHMAs to current levels.
- Limitation on public motor vehicle access in WHMAs.
- Limitation on public road density in the Anderson Mesa WHMA to an average of 1 mile or less of road per square mile.
- Limitation on large group recreation events and large commercial tours in WHMAs outside of developed sites.

Maintenance and Improvement of Ecosystem Health

Alternative C considers the issue that suggests that old-growth forest components were better provided for under the 1987 plan. The 1987 plan standards and guidelines associated with old-growth forest components were evaluated. Some of those old-growth forest components were edited to make it harmonize with the rest of the draft plan and some of the current plan language was dropped because it was already covered by a component in the draft plan. For example, instead of allocating 20 percent at the ecosystem management area or an arbitrary spatial designation of 10,000-acre blocks, old-growth forest allocations would be managed at each mid-scale unit (assessed by 6th code watersheds). The resulting old-growth direction would be incorporated into the proposed revised plan through additional plan components and modifications to the components in the proposed revised plan. The additional and modified plan language for old-growth management is listed in appendix F.

Key direction from the 1987 plan that would be incorporated into the proposed revised plan includes:

- Allocation of at least 20 percent of the naturally forested area by forest and woodland PNVTs in any landscape by 6th code watershed;
- Distribution of old growth would be in 100- to 300-acre stands;
- The Minimum Criteria for the Structural Attributes Used to Determine Old Growth.

(Please see maps 3, 6, 9, 12, 15, 18, 21, 23, 24, 26, 28, 29, 30, and 33 related to alternative C in appendix A.)

Alternative D

General Overview

Alternative D responds to public suggestions for no additional wilderness areas and to allow biking in botanical and geological areas. Alternative D also responds to issues regarding future energy corridor expansion needs.

Addressing Needs for Change and Issues Raised in Scoping

Recreation

Alternative D would be similar to the proposed revised plan, except that no new wilderness areas would be recommended. Additionally, mechanized recreation would be allowed on designated trails in botanical and geological areas.

Community–Forest Interaction

Alternative D differs from the proposed revised plan in that it would provide for expansion and/or increased access for future energy corridor needs, as well as modification of scenic integrity objectives along existing energy corridors for energy infrastructure.

Specifically, this alternative would change the scenic integrity objectives associated with the power line between Sycamore Canyon Wilderness and Red Rock Secret Mountain Wilderness to a low scenic integrity objective rating instead of a moderate rating. In addition, alternative D would consider using the Arizona Public Service Alternative Energy Corridor (along State Highway 87) as an alternate route for expanding capacity on the Western Area Power Administration line, which currently crosses two wild and scenic rivers and a designated wilderness. This corridor would also need to identify a route going north which would not require a plan amendment for scenic integrity objectives under this alternative (see appendix F).

Maintenance and Improvement of Ecosystem Health

Alternative D plan language would provide fewer restrictions tied to recreation in special areas and energy infrastructure and, as a result, could result in slightly greater impacts on overall ecosystem health of the forest.

(Please see maps 2, 7, 10, 13, 16, 19, 22, 27, 28, 30, and 32 related to alternative D in appendix A.)

Forest Service's Preferred Alternative

No preferred alternative has been identified at this time.

Alternatives Comparison

Table 1 presents quantitative and qualitative information comparing the potential for each alternative to address the topics identified in chapters 1 and 2. Table 2 summarizes the effects of each alternative. See corresponding sections of chapter 3 for more information.

Table 1. Comparison of alternatives[1]

No.	Topic and Indicator	Alt.	Comparison of Alternatives
1	Topic: Presence or absence of recreational shooting[2] opportunities. Indicator: Opportunities (in acres) provided by proposed revised plan or alternatives' language for recreation settings not disturbed by recreational shooting.	A	Total acres: 0 Total percentage of forest: 0
		B	Same as alternative A
		C	Total acres: 577,695 acres Total percentage of forest: 29 Existing and recommended research natural areas (RNAs), botanical and geological areas, wildlife habitat management areas (WHMAs), Walnut Canyon Management Area (MA), Sedona Neighborwoods MA, Long Valley MA, and part of the Flagstaff Neighborwoods MA (to be determined through project level decisions and analysis) would be not suitable for recreational shooting.
		D	Same as alternative A
2	Topic: Presence or absence of snowmobile use opportunities. Indicator: Opportunities (in acres) provided by proposed revised plan or alternatives' language for winter recreation with reduced noise disturbance.	A	Total acres: 202,636[3] Total percentage of forest: 11 Wilderness areas (WA) and seasonal closures (SC) would not be suitable for snowmobile use. WAs would include: Fossil Springs, Kachina Peaks, Kendrick Mountain, Mazatzal, Munds Mountain, Red Rock Secret Mountain, Strawberry Crater, Sycamore Canyon, West Clear Creek, Wet Beaver. SCs would include: Nordic Ski Center, Wing Mountain Cross-Country Ski Area, Pine Grove, Rattlesnake, and Woods.
		B	Same as alternative A Recommended wilderness areas would not restrict snowmobile use until congressionally designated or if otherwise determined by a site-specific, project-level decision closure.
		C	Total acres: 539,374[4] Total percentage of forest: 27 All designated WAs, SCs, primitive and semiprimitive nonmotorized acres, and the Walnut Canyon MA (with noted exceptions for ingress and egress to private inholdings within Walnut Canyon MA). WAs would include: same as alternative A. SCs would include: same as alternative A + Anderson Mesa WHMA.
		D	Same as alternative A

No.	Topic and Indicator	Alt.	Comparison of Alternatives
3	**Topic A:** Potential constraints to management activities from additional wilderness areas (WA). **Topic B:** Opportunities for primitive and undeveloped settings. **Indicator:** Potential (in acres) for WAs to constrain management activities and uses that otherwise would be allowed or, conversely, the oppportunity (in acres) provided by the proposed revised plan or alternatives' language for primitive and undeveloped settings through existing and recommended wilderness areas (EWA or RWA).	A	Total percent of WA[5] acres on forest: 8 EWA acres: 156,374 RWA acres: 0 EWAs would include: Wet Beaver, Fossil Springs, West Clear Creek, Strawberry Crater, Kachina Peaks, Kendrick Mountain, Red Rock Secret Mountain, Munds Mountain, Mazatzal, and Sycamore Canyon. RWAs would include: none.
		B	Total percent of WA acres on forest: 9 EWA acres: 156,374 RWA acres: 14,767 EWAs would include: same as alternative A. RWAs would include: Strawberry Crater, Davey's, and Walker Mountain.
		C	Total percent of WA acres on forest: 13 EWA acres: 156,374 RWA acres: 92,386 (includes 913 acres of Hackberry that is on the Prescott National Forest) EWAs would include: same as alternative A. RWAs would include: same as alternative B + Abineau, Railroad Draw, Deadwood Draw, Cedar Bench, Black Mountain, Cimmaron-Boulder, Hackberry, Tin Can, East Clear Creek, and Barbershop.
		D	Same as alternative A
4	**Topic:** Opportunities for mechanized use (bicycling and mountain biking) in botanical areas (BA) and geological areas (GA). **Indicator:** Opportunity (in acres) on the forest for mechanized use. **Indicator:** Potential resource impacts and user conflicts from mechanized recreation on existing or future trails in botanical and geological areas.	A	Total acres suitable for mechanized use: na Total percentage of forest: na Silent on allowing mechanized use on designated trails within special areas. The 1987 plan would manage its botanical and geological areas under MA 17, which emphasized the need to preserve the characteristic resources of the areas. In alternative A, mechanized use would be allowed in botanical areas as long as the use does not conflict with the purpose of the area.
		B	Total acres suitable for mechanized use: 1,842,756 Total percentage of forest: 92 Total acres unsuitable for mechanized use: 165,049 Total percentage of forest: 8 Mechanized use would not be suitable in BAs/GAs. BAs would include: Fern Mountain, Mogollon Rim, Fossil

No.	Topic and Indicator	Alt.	Comparison of Alternatives
			Springs, and Verde Valley. GAs include: Red Mountain, Cottonwood Basin Fumeroles. Threats to Arizona cliffrose (federally listed species) from bicycle impacts would be eliminated, but mechanized recreational opportunities in BAs/GAs would be reduced (e.g., Lime Kiln Trail closed to mountain bikes).
		C	Total acres suitable for mechanized use: 1,840,477 Total percentage of forest: 92 Total acres unsuitable for mechanized use: 167,327 Total percentage of forest: 8 Mechanized use would not be suitable in BAs/GAs. BAs would include: same as alternative B + Cottonwood Basin expansion. GAs include: same as alternative B. Threat to Arizona cliffrose from bicycle impacts would be eliminated, but mechanized recreational opportunities in BAs/GAs would be reduced (e.g., Lime Kiln Trail closed to mountain bikes).
		D	Total acres suitable for mechanized use: 1,849,425 Total percentage of forest: 92 Total acres unsuitable for mechanized use: 158,379 Total percentage of forest: 8 Mechanized use would be allowed on designated trails in BAs/GAs (such as the Lime Kiln Trail), as long as the use does not conflict with the purpose of the area. Where appropriate, it is possible to develop future trails. Mechanized use trails could adversely impact landforms, soil, and vegetation, unless carefully designed and managed to avoid social trails. Threats to Arizona cliffrose from bicycle impacts would be reduced more than alternative A but not as much as alternatives B and C.
5	**Topic:** Potential for single use trails to contribute to user conflict in the Fort Valley-Mount Elden MA. **Indicator:** Ability of proposed revised plan or alternatives to address user conflict on multiple use trails.	A	Silent on how to address user conflict on its trails, all of which are managed for multiple uses.
		B, C, and D	Recognize not all trails are well suited for a multiple use management strategy and have management approaches to consider single use trails where user conflict cannot be mitigated and to coordinate with local governments and groups when conducting trail planning. Plan components in the Ft. Valley-Mt. Elden MA would provide for a variety of trail experiences and users. Would be more adaptable than alternative A at embracing both strategies (multiple and single use trails) and relegating the designation of each trail type to a project-level, site-specific decision, such as a decision specific to the Ft. Valley-Mt. Elden MA. Additionally, coordination with local groups during the trail planning process would provide the opportunity to identify, diffuse, or avoid user conflicts.
6	**Topic:** Differing number of trail	A	Amendments 12 and 17 provide direction to incorporate community desires into recreation planning and to provide

No.	Topic and Indicator	Alt.	Comparison of Alternatives
	opportunities in Sedona and the rest of the Verde Valley. **Indicator:** Ability of proposed revised plan or alternatives to meet demand for trails in the Verde Valley outside of Sedona.		for trail connectivity with adjacent trail systems. As such, would contribute to meeting the recreation demands of Sedona and Flagstaff, but would not address the needs and goals of other communities.
		B, C, and D	Would recognize the need for a more diverse range of recreation opportunities in the Verde Valley MA, where the trail density is much lower than in the nearby Sedona area and describe a desired condition that provides a wider range of recreation services to the communities in this area. Would encourage community involvement and coordination in trail planning and have a management approach to coordinate with local governments and groups when conducting trail planning.
7	**Topic:** Reduction of risk of uncharacteristic fire and associated potential smoke concentration and duration from prescribed fires and wildfires to communities. **Indicator A:** Acres of treatment that reduces the risk of uncharacteristic fire. **Indicator B:** Expected smoke impacts to nearby communities from prescribed fire and wildfire management on the forest. **Indicator C:** Proposed plan or alternatives' ability to mitigate smoke impacts from prescribed fire or wildfire management and likely effects.	A	Would lower the risk of uncharacteristic fire primarily in accessible areas within ponderosa pine and mixed conifer with frequent fire vegetation (Management Area 3) with an emphasis on the wildland-urban interface. The number of acres is equivalent to the low end of the range of possible treatments in alternatives B, C, and D. In addtion to the above factors, potentially has a greater long-term risk of uncharacteristic fire because fewer acres would likely be mechanically thinned or prescribed burned than in alternatives B, C, or D. Would have fewer smoke effects on communities in the short term[6] (and more in the long term) than alternatives B, C, and D because it prohibits using wildfire with resource objectives in the wildland-urban interface and has fire suppression objectives and tactical language that effectively limits the forest's ability to manage wildfires for resource objectives in wilderness. Potentially has a greater risk of uncharacteristic fire in the long term because fewer acres would be mechanically thinned or prescribed burned than in alternatives B, C, and D (based on modeling) in addition to the above factors. In the long term, uncharacteristic wildfires would result in longer duration and higher concentrations of smoke. Contains plan components to minimize smoke production when projects impact smoke sensitive areas and monitor and document the effects of smoke from prescribed fires on smoke sensitive areas and adjust accordingly. Plan components also require warning signs posted on roads and other measures to mitigate smoke intrusions on airports, roads, and highways. None of the areas proposed as recommended wilderness are included in this alternative. The areas recommended as wilderness in alternatives B and C in general have little access, steeper slopes, and fewer past vegetation treatments than surrounding areas. Because of these factors, the likelihood of future vegetation treatments is low.
		B	Recommended wilderness in this alternative contains less than 1 percent of fire adapted vegetation; therefore, it would be unlikely to affect the use of wildfires that meet resource objectives on the landscape in a measureable way. At a localized level, the Walker Mountain recommended wilderness could limit the use of prescribed fires, wildfires with resource objectives, or treatments that could reduce the risk of uncharacteristic fire more so than if it were not recommended. Although treatments on Walker Mountain would be unlikely under any alternative due to topography,

No.	Topic and Indicator	Alt.	Comparison of Alternatives
			access, and slope, wilderness recommendation would further limit use of wildfire or prescribed fires even more due to decreased access and because hand tools are generally required in primitive ROS classes (used for recommended wilderness) or ROS classes within designated wilderness.
7		C	Recommended wilderness in this alternative contains about 4.5 percent of fire adapted vegetation; therefore, it would be unlikely to affect the use of wildfires on the landscape that meet resource objectives in a measureable way. At a localized level, alternative C would have the same effects as alternative B relative to the Walker Mountain recommended wilderness. In addition, the Black Mountain, Cedar Bench, Tin Can, and Deadwood Draw recommended wilderness areas could limit the use of prescribed fire, wildfires with resource objectives, or treatments that could reduce the risk of uncharacteristic fire more so than if they were not recommended because hand tools are generally required in primitive ROS classes (used for recommended wilderness) or ROS classes within designated wilderness.
		D	None of the areas proposed as recommended wilderness are included in this alternative. The areas recommended as wilderness in alternatives B and C in general have little access, steeper slopes, and fewer past vegetation treatments than surrounding areas. Because of these factors, the likelihood of future vegetation treatments is low.
		B, C, and D	Could lower the risk of uncharacteristic fire substantially more than alternative A. These alternatives have a range of objectives for mechanical thinning and prescribed fire in ponderosa pine that would reduce the risk of uncharacteristic fire. The lower end of the range is the same as in alternative A. The higher end of the range is over five times higher than the low end for thinning, two times higher for prescribed fire, and if implemented, would lower the risk of uncharacteristic fire significantly more in pine than alternative A. In addition, plan objectives would reduce the risk of uncharacteristic fire in mixed conifer with frequent fire (as would alternative A), as well as in all three grassland types, pinon juniper evergreen shrub, and pinon juniper with grass vegetation (unlike alternative A). Would have longer duration of smoke impacts in communities in the short term (and less in the long term) than alternative A because constraints to using wildfires with resource objectives in the wildland-urban interface and limitations to using wildfires with resource objectives in wilderness are removed. Compared to alternative A, there is a potentially lower risk of uncharacteristic fire in the long term at the high end of plan objectives (more acres treated) which would result in lower duration and concentration of smoke to communities from uncharacteristic fire. Contain plan components that dictate that decision documents for wildfires and prescribed burns should identify smoke sensitive areas and include objectives and courses of action to mitigate impacts to those areas. Additionally, components require that stakeholders and the public be notified about potential smoke from fire activities through methods of advanced notification through the media and smoke warning signs along roads when visibility may be reduced due to wildland fire.
		Common to All	All alternatives are expected to achieve legal obligations of the forest for air quality. There would be no difference in how alternatives affect air quality in terms of protecting human health since National Ambient Air Quality Standards are set at levels that are necessary to meet that objective.

No.	Topic and Indicator	Alt.	Comparison of Alternatives
8	**Topic:** Potential livestock grazing impacts to research natural areas (RNAs). **Indicator:** Expected livestock grazing impacts on biological and/or geological communities within RNAs.	A	Desired conditions are either missing or inadequate to guide projects in many of the forest's special areas. Alternative A is silent on grazing in its existing and proposed RNAs. Existing RNAs include: Oak Creek, San Francisco Peaks, Casner Canyon, and GA Pearson (located within experimental forest, so outside of Coconino NF administration). Proposed RNAs include: Rocky Gulch, West Clear Creek, and San Francisco Peaks expansion.
		B	Desired conditions are provided for each of the five existing and proposed Coconino administered RNAs. This explicit language provides direction that would retain and protect the specific ecologic feature(s) for which the RNA was designated. Additionally, a guideline is provided that would direct allotment management plans to have provisions to protect the uniqueness of the area. Existing RNAs are same as Alt. A. Proposed RNAs are same in name as alternative A, but alternative B identifies a different location for the West Clear Creek RNA and a smaller area for the San Francisco Peaks RNA expansion.
		C	Existing and proposed RNAs are same as alternative B.
		D	Like in alternatives A-B, in alternative D little to no grazing actually occurs in RNAs for the reasons described in alternatives A–B. As these reasons are not expected to change, the grazing situation would be expected to remain the same for these alternatives. Same breakdown of individual grazing situation in each RNA as in alternatives A and B. Same as alternative B
		A, B	Little to no grazing occurs in RNAs for the reasons described below. As these reasons are not expected to change, the grazing situation would be expected to remain the same for these alternatives: Oak Creek: no grazing occurs as area is not accessible to livestock due to topographic features. San Francisco Peaks (with expansion): not able to be grazed due to steep slopes and insufficient vegetation growth. Casner Canyon: no grazing occurs as area is inaccessible to livestock. Rocky Gulch: grazing is slight to nonexistent due to insufficient vegetation growth. West Clear Creek: grazing is slight to nonexistent due to topographic features.
9	**Topic:** Potential motor vehicle noise impacts to wildlife. **Indicator A:** Plan language that addresses motor vehicle disturbance and associated impacts to wildlife.	A	Transportation system guidance may cause potential ecological impacts in areas being disrupted by human activity from motorized travel, including noise disturbance to species. The recreation opportunity spectrum (ROS) for alternative A would have the least acres in the semiprimitive nonmotorized (SPNM) setting of all the alternatives[7]. Total acres for nonmotorized recreation on forest: 276,573 Total percentage of acres for nonmotorized recreation on forest: 15
	Indicator B: Opportunities (in	B	Total acres for nonmotorized recreation on forest: 387,145

No.	Topic and Indicator	Alt.	Comparison of Alternatives
9	acres) for areas not disturbed or less disturbed by motor vehicle noise.		Total percentage of acres for nonmotorized recreation on forest: 21
		C	Total acres for nonmotorized recreation on forest: 515,433 Total percentage of acres for nonmotorized recreation on forest: 28
		D	Total acres for nonmotorized recreation on forest: 378,764 Total percentage of acres for nonmotorized recreation on forest: 21
		Common to All	Desired conditions and guidelines would provide guidance to minimize impacts from roads on wildlife. Compared to alternative A, these alternatives would provide more protective guidance with respect to infrastructure management. Endangered species habitat is a factor for prioritizing decommissioning of roads, and disturbance from road maintenance would be avoided or minimized. The ecological consequences of closing, decommissioning, and naturalizing roads generally result in less noise disturbance to wildlife. An objective calls for naturalizing or decommissioning roads, potentially mitigating impacts to prairie dog/black-footed ferret habitat. This guidance would improve habitat through road decommissioning.
10	**Topic:** Representation and protection of old-growth forest components on the landscape **Indicator:** Environmental consequences of proposed revised plan or plan language that specifically retains or protects old-growth structure/large trees.	A	Plan components include standards to retain 20 percent developing or existing old-growth forest components across the landscape, with allocation at the ecosystem management area or 10k block.
		B	Provides a qualitative description of the distribution and amount of old-growth forest components across the landscape Plan components promote old-growth forest components and large, old trees distributed through the landscape, functioning properly, referencing pre-European conditions, and sustainable over time. Guidelines for ponderosa pine explicitly highlight the importance of uneven-aged management by managing for old-growth components as a proportion of the mid-scale units across the landscape.
		C	Retains the standards and guidelines from alternative A relating to old-growth forest components. Instead of allocation at the ecosystem management area or 10k block, however, old-growth forest component allocations would be by 6th-code watersheds.
		D	Same as alternative B
		B, C, and D	Sustainable amounts of older structural stages are dependent on, and limited by, management activities (e.g., burning, tree cutting, etc.) to promote open stands of trees conducive to growth and low severity fire. Although no alternative would treat enough acres, alternatives B–D would be improvements over alternative A. Over the long term, alternatives B, C, and D would have the greatest effect on creation and maintenance of very

No.	Topic and Indicator	Alt.	Comparison of Alternatives
			large trees, increasing their area to almost 20 percent, while alternative A would only reach 18 percent.
11	**Topic:** Promotion of habitat connectivity and identification/ removal of potential barriers to wildlife movement on the forest. **Indicator A:** Miles of roads potentially removed from primitive (P) and semiprimitive nonmotorized (SPNM) areas[8]. **Indicator B:** Environmental consequences of proposed revised plan or alternatives' language on habitat connectivity, including road impacts.	A	Lacks a strategic, comprehensive approach to connectivity of terrestrial and aquatic landscapes, although Amendments 12 and 17 better address the function and intent of connected habitats. Alternative A contains standard to maintain wildlife habitat for game species by providing interconnecting cover corridors. Direction in some management areas provides for wildlife corridors and travelways through the forest. Total miles of roads potentially removed from P and SPNM areas: 218
		B	Total miles of roads potentially removed from P and SPNM areas: 564
		C	Wildlife habitat management area direction would result in the removal of risk of habitat fragmentation or further habitat fragmentation for certain WHMAs. Total miles of roads potentially removed from P and SPNM areas: 847
		D	Total miles of roads potentially removed from P and SPNM areas: 563
		B, C, and D	Promote vision and intent regarding connectivity and include desired conditions: that would allow wildlife, aquatic, and botanical species that are genetically diverse and able to access adjoining habitat, to disperse, migrate, and meet their life history requirement and that would better ensure stream ecosystems, including ephemeral watercourses, would not be fragmented by infrastructure or development. Have desired conditions to provide wildlife with habitat patches that support viable populations for each species. Mitigation of habitat fragmentation for barriers such as roads would be considered on a site-specific basis throughout the life of the alternatives. Include forestwide management approaches for collaboration with private land owners and local governments to protect forest values from adjacent development impacts. This could result in less habitat fragmentation to forest resources from adjacent non-Federal uses by developing buffers on private lands. Scenery direction would allow discretion in choosing the most beneficial wildlife crossing methods as improvements along highway corridors are planned, allowing opportunities to reduce/remove existing barriers as well.
		Common to All	All alternatives provide direction for use of fence designs that would not impede animal movements.

No.	Topic and Indicator	Alt.	Comparison of Alternatives
12	**Topic:** Adequate forage for ecosystem function, particularly in times of drought, as well as for native wildlife. **Indicator:** Expected effects of proposed revised plan or alternatives' guidance on grazing management on native mammals and ecosystem function.	A	While existing law, regulation, and policy provide for grazing management, the lack of comprehensive desired conditions for PNVTs under alternative A could result in grazing management that would not consider desired conditions as fully as alternatives B–D.
		B,C, and D	Would be positive for range resources in the long-term due to increased herbaceous production from management activities that move PNVTs toward desired conditions, which would aid in livestock distribution and decreased competition for available forage.
		Common to All	Rangeland assessments would continue under all four alternatives at the site-specific allotment scale to determine if the desired conditions for rangeland health are being achieved. If it is determined that the desired conditions are not being achieved on an allotment, grazing management practices and/or the current levels of the grazing use would be modified.
13	**Topic:** Protection against degradation of water quality from allowed uses on the forest. **Indicator:** Water quantity and quality effects to aquatic habitats and other users who share water resources with the forest.	A	Water quality trends are expected to be static and as such, alternative A would be less likely to move a large number of watersheds, impaired waters, or maintain instream flow toward the desired conditions as quickly as alternatives B–D.
		B,C, and D	Water quality trends would be toward desired condition (i.e., meeting State water quality standards) based on proposed revised plan direction that emphasizes TMDL implementation and a focused, priority watershed treatment strategy. This direction is in addition to Federal and State mandatory and voluntary requirements, including BMPs, imposed by the Arizona Department of Environmental Quality. In addition to vegetation plan components would indirectly benefit water resources alternatives B–D. Alternatives B–D include forestwide management approaches for collaboration with private land owners and local governments to protect forest values from adjacent development impacts. This could result in greater watershed health to forest resources from adjacent non-Federal uses by developing buffers on private lands.
		Common to All	The Coconino NF must meet Federal and State water quality standards. Watersheds both on and off of the Coconino NF, however, are affected by non-forest actions and activities. All of the watersheds associated with the forest have private inholdings and appreciable areas outside of the forest boundary. On those lands, the presence of wells, unpaved roads, and grazing activities outside forest management and control also impact riparian function, groundwater and dependent species, and streamflow.

[1] Values given are approximate and based on computer mapping and other calculations. These values are subject to changes based on field verification and may differ from actual project layout and implementation.

[2] Recreational shooting does not include shooting at wild game under a valid hunting permit from the Arizona Game and Fish Department.

[3] This amount has been adjusted to eliminate any overlap between alternative A wilderness acres and alternative A seasonal closures.

[4] This amount has been adjusted to eliminate any overlap between alternative A acres (existing WAs and SCs), alternative C primitive and SPNM acres, alternative C Walnut Canyon Management Area acres, and alternative C Anderson Mesa Wildlife Habitat Management Area acres.

[5] WA = EWA + RWA; wilderness area acres = existing wilderness area acres + recommended wilderness area acres.

[6] There is an inverse relationship between short- and long-term smoke impacts to communities. The specific nature of the impacts would depend on the nature and location of the fire. In general, prescribed fires have lower concentration and duration of smoke compared to uncharacteristic fires that produce higher concentrations and duration of smoke. Alternatives that result in reduced prescribed fire treatments also reduce short-term smoke impacts; however, it is expected that they would lead to increased concentration and duration of smoke impacts to communities over the long term due to the buildup of fuels that result in larger uncharacteristic wildfires. In contrast, alternatives that increase short-term smoke impacts would likely reduce long-term smoke impacts because the potential for uncharacteristic wildfires would be reduced.

[7] Alternative A includes a unique ROS class called nonmanaged forest lands (NON-F). This ROS class was intended to represent all of the land within the administrative boundary of the forest but not managed by the forest. Over 8 percent of the forest (approximately 172,000 acres) falls into the NON-F ROS class. Alternatives B, C, and D do not use the NON-F ROS class, but instead they assign established ROS classes (e.g., urban, rural, roaded natural) to all lands within the administrative boundaries of the forest, including these nonmanaged forest lands. The plan does not have any authority over these lands unless they are part of the National Forest System. However, it is beneficial for the plan to inventory and identify recreation opportunities within these lands for a number of reasons, including maintaining a compatible recreation setting across landownerships and simplifying the process of setting management objectives for newly acquired or exchanged lands. Comparing alternative A to alternatives B, C, and D requires recognition that some of the acres or percentages assigned to ROS classes in alternative B, C, and D may be higher than alternative A due to the inclusion of a portion of the NON-F lands.

[8] Although available for removal from P and SPNM areas, a site-specific, project-level decision is still necessary before action can be taken. Closing, decommissioning, and naturalizing roads generally results in increased wildlife habitat connectivity, benefiting wildlife that need unfragmented habitat conditions in order to successfully migrate between resources during their lifecycle.

Table 2. Summary of effects

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Air Quality				
Smoke impacts	In the short term, alternative A would have fewer smoke impacts from wildfires followed by alternative C, but corresponding higher risks of smoke from uncharacteristic wildfires than alternatives B and D. In the long term, alternative A would have slightly more smoke impacts than alternatives B–D because it prohibits the use of wildfire with resource objectives in the wildland-urban interface that would lead to a greater risk of uncharacteristic wildfires in the long term.			
Aquatic Systems				
Water quality,water quantity, and watersheds	Due to gaps in plan direction, continuing implementation of alternative A would not improve impaired water quality; maintain instream flows, or riparian, soil, and watershed function; or move water resource toward desired conditions as quickly as alternatives B, C, and D.			
Biophysical Features				
Management of significant cave resources	No specific guidance for management of significant cave resources	Significant caves will be managed to preserve criteria for which they were nominated.		
Minimization of impacts to caves and sinkholes	300-foot buffer around cave entrances,but no clear direction that takes into account uncertainty and complexity of cave resources	200-foot buffer, or alternatively, cave surveys and/or site specific information would be used to modify buffer to more appropriate site mitigation. Alternatives B, C, and D are more likely to balance tradeoffs between surface management needs and protection of the cave resource.		
Mitigation of accidental or past alterations of cave resources	No direction	Guideline to proactively mitigate accidental or past alterations of cave resources would prevent continued degredation of caves impacted by past human activities and would provide mitigation of impacts on cave resources accidentally damaged due to a lack of information on the resource, wildland fire effects, or other unintentional changes to cave conditions.		
Direction for cliffs and talus slopes	No direction except maintenance of scenic views of red rock cliffs in Sedona area	Desired conditions, standards, and management approaches are included that will likely lead to better protection of cliffs and talus slopes.		
PNVT	**Departure From and Trend Relative to Desired Conditions**			
Ponderosa Pine – Vegetation	Moderate – Toward (alternatives B, C, and D move toward DCs faster)			
Ponderosa Pine – Fire Severity	High – Toward			

Resource		Alternative A	Alternative B	Alternative C	Alternative D
	Soil Condition/ Productivity	Low – Static	Low – Toward		
Mixed Conifer with Frequent Fire	Vegetation	Moderate – Toward	Moderate – Toward (alternatives B, C, and D move toward DCs faster)		
	Fire Severity	High – Toward			
	Soil Condition/ Productivity	Low – Static	Low – Slowly Toward		
Piñon-Juniper with Grass	Vegetation	Moderate – Toward			
	Fire Severity	Moderate-High – Toward			
	Soil Condition/ Productivity	Low – Away	Low - Slowly Toward		
Montane/ Subalpine Grassland	Vegetation	Low – Away	Low – Toward		
	Fire Severity	High – Away	High - Toward		
	Soil Condition/ Productivity	High – Static	High – Toward		
Great Basin Grassland	Vegetation	Low – Away	Low – Static		
	Fire Severity	High -Away	High – Static		
	Soil Condition/ Productivity	High – Slowly Toward	High - Toward		
Semidesert Grassland	Vegetation	High – Static	High – Toward		
	Fire Severity	Moderate - Static	Moderate – Toward		
	Soil Condition/ Productivity	High – Slowly Toward	High – Toward		
Interior Chaparral	Vegetation	Low – Away			
	Fire Severity	Low-Moderate – Away			
	Soil Condition/ Productivity	Low – Static	Low – Toward		
Piñon-Juniper Evergreen Shrub	Vegetation	Moderate – Away			
	Fire Severity	Moderate – Away			
	Soil Condition/ Productivity	Moderate – Away	Moderate – Slowly Toward		
Piñon-Juniper Woodland (Persistent)	Vegetation	Low – Static			
	Fire Severity	Moderate – Static			
	Soil Condition/ Productivity	Moderate – Away	Moderate – Slowly Toward		

Resource		Alternative A	Alternative B	Alternative C	Alternative D
Mixed Conifer with Aspen	Vegetation	Moderate – Away	Moderate – Static		
	Fire Severity	High – Away	High – Static		
	Soil Condition/ Productivity	Low – Static	Low – Slowly Toward		
Spruce-Fir	Vegetation	Moderate – Away			
	Fire Severity	Moderate – Away			
	Soil Condition/ Productivity	Low – Static			
Cottonwood Willow Riparian Forest*	Riparian Function	Moderate – Slowly Toward			
	Soil Condition/ Productivity	High – Slowly Toward			
Gallery Coniferous Riparian Forest*	Riparian Function	Low – Static			
	Soil Condition/ Productivity	Low – Static			
Mixed Broadleaf Deciduous Riparian Forest*	Riparian Function	Low – Slowly Toward			
	Soil Condition/ Productivity	Low – Static	Low – Slowly Toward		
Wetland*	Riparian Condition	By number,[1] Moderate – Slowly Toward	Low – Toward		
		By acres,[2] Low – Slowly Toward	Low – Toward		
	Soil Condition/ Productivity	High – Static	High – Toward		
Cienega*	Riparian Function	High – Static	High – Toward		
Alpine Tundra*	Vegetation	Moderate – Away			
	Soil Condition/ Productivity	Low – Static			
Desert Communities *	Vegetation	High – Away			
	Soil Condition/ Productivity	Moderate – Static	Moderate – Slowly Toward		
Montane Willow	Riparian Function	Low Static to Slightly Toward			

Resource		Alternative A	Alternative B	Alternative C	Alternative D
Riparian Forest*	Soil Condition/ Productivity	Low – Static	Low – Slowly Toward		
Species Viability					
Species Viability		All alternatives were determined to provide for species viability.			
Management Indicator Species Habitat Quality and Population Determinations					
Pronghorn		Habitat Quality: Stable to Declining, Except Soils which is Stable to Increasing	Habitat Quality: Stable to increasing		
		Population: Stable			
Mexican spotted owl		Habitat Quality: Increasing	Habitat Quality: Increasing (at greater rate than alternative A)		
		Population: Stable			
Pygmy nuthatch		Habitat Quality: Stable to Slightly Increasing	Habitat Quality: Stable to increasing		
		Population: Stable			
Scenery (acres by visual quality objective (VQO) for alternative A and scenic integrity objective (SIO) for alternatives B, C, and D)					
Very High/Preservation		156,491 acres	222,256 acres		
High/Retention		246,285 acres	872,615 acres		872,252 acres
Moderate/Partial Retention		453,914 acres	733,059 acres		731,081 acres
Low/Modification		930,661 acres	9,567 acres		11,916 acres
Very Low/Max. Modification		65,735 acres	0 acres		
Recreation Opportunity Spectrum Setting (percentage of forest)					
Nonmanaged Forest		8.6%	N/A		
Urban		NA	1.1%		
Rural		1.5%	4.3%	4.2%	4.3%
Roaded Natural (RN)		40.9%	38.7%	38.0%	38.8%
Semiprimitive Motorized (SPM)		35.6%	36.4%	30.7%	36.8%
Semiprimitive Nonmotorized (SPNM)		5.9%	11.0%	13.5%	11.3%
Primitive		0.03%	1.0%	5.0%	0.3%
Wilderness: Transition (WT)		1.6%	1.0%		
Wilderness: Semiprimitive (WSP)		4.7%	2.3%	2.4%	2.3%
Wilderness: Primitive (WP)		1.9%	2.9%		

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Wilderness: Pristine (WPS)	1.3%	3.0%		
Wilderness Areas				
Existing wilderness acres	156,374 acres			
Recommended wilderness acres	0 acres	14,767 acres	92,358 acres	0 acres
Wild and Scenic Rivers (WSR)				
Existing WSR mileage per plan language	43.5 miles			
Eligible WSR mileage per plan language	180.9 miles			
Research Natural Areas (RNAs) and Botanical, Geologic, and Environmental Study Areas				
Existing RNAs per plan language (number and acreage)	4 existing RNAs 3,622 acres			
Proposed RNAs per plan language (number and acreage)	2 proposed RNAs 1 expansion of an existing RNA 1,981 acres	2 proposed RNAS 1 expansion of an existing RNA 2,075 acres		
Existing botanical areas per plan language (number and acreage)	4 botanical areas 1,746 acres			
Proposed botanical areas per plan language (number and acreage)	0 proposed botanical areas 0 acres		1 proposed botanical area 1,416 acres	0 proposed botanical areas 0 acres
Existing geologic areas per plan language (number and acreage)	1 geologic area 1,201 acres			
Proposed geologic areas per plan language (number and acreage)	0 proposed geologic areas 0 acres	1 proposed geologic area 217 acres		
Existing environmental study areas per plan language (number and acreage)	3 environmental study areas 1,577 acres			
Proposed environmental study areas per plan language (number and acreage)	0 proposed environmental study areas 0 acres			
Minerals				
Portion of forest open to mineral entry	1,553,877 acres 85% of forest	1,538,894 acres 84% of forest	1,460,583 acres 79% of forest	1,553,661 acres 85% of forest
Existing and potential new withdrawals from mineral entry	283,621 acres 15% of forest	298,604 acres 16% of forest	376,915 acres 21% of forest	283,837 acres 15% of forest
Timber				

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Lands suitable for timber production	464,215 acres	527,681 acres	463,165 acres	527,681 acres
Allowable sale quantity (ASQ)	80,923 ccf for first decade	191,162 ccf for first decade		
Long-term sustained yield capacity (LTSYC)	90,100 hundred cubic feet (ccf)			
Forest Products				
Harvest—softwood sawtimber	41,251 ccf	167,222 ccf		
Harvest—softwood pulp	5,745 ccf	25,789 ccf		
Harvest—hardwood sawtimber	0 ccf			
Harvest—hardwood pulp	0 ccf			
Poles	24 ccf			
Posts	25 ccf			
Firewood	13,687 ccf			
All other products	122 tons			
Range				
Permitted head months	126,687 HMs	126,687 HMs	Approx. 112,595 - 122,801 HMs	126,687 HMs
Acres of range allotments with prohibition on motor vehicle use for range management	0	0	0	0
Forest Resource Present Net Value (PNV)				
Total PNV of all forest resources (range, recreation, minerals, timber, nonrecreation related special uses)	$(32,143,162)	$(14,677,415)	$(14,346,123)	$(14,677,415)

[1]"By number" indicates that departure and trend are determined across the actual number of individual wetlands/cienegas on the landscape.

[2] "By acres" indicates that departure and trend are determinedd across the total amount of acreage of wetlands/cienegas on the landscape.

*PNVT not fire adapted.

Chapter 3. Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the planning area and the effects of implementing each alternative to that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in chapter 2. Information in this chapter is based on resource reports and other supporting material that are located in the project record. Methodologies used in this analysis are described in "Appendix C: Methodology and Analysis Process."

Specialist reports[10] were developed for many resource areas as part of the DEIS process and information from those reports was used to create the DEIS. Subsequently, the specialist reports were edited per review-driven edits to the broader DEIS. There may still be an instance where the information in the specialist reports does not exactly match that of the DEIS. Should this situation arise, the DEIS contains the most up-to-date information.

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Because the land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. However, there may be implications, or long-term environmental consequences, of managing the forests under this programmatic framework. Those environmental consequences are described in this chapter. Consequences are based on predicted implementing activities and are meant to compare alternatives on a programmatic level, rather than provide exact measurements of effects.

Assumptions

The following assumptions were made for this analysis:

- Land management plans do not have direct effects. They do not authorize or mandate any site-specific projects or activities (including ground-disturbing actions). However, there may be implications, or longer term environmental consequences, of managing the forests under this programmatic framework.
- The plan decisions (desired conditions, objectives, standards, guidelines, management areas, monitoring) will be followed when planning or implementing site-specific projects and activities.
- Law, policy, and regulations will be followed when planning or implementing site-specific projects and activities.
- Funding levels will be similar to the past 5 years.
- The planning timeframe for the effects analysis is 10 to15 years; other timeframes may be specifically analyzed depending on the resource and potential consequences.
- Monitoring identified in the "Monitoring" chapter will occur and the land management plan will be amended, as needed during the life of the plan.

[10] These individual specialist reports may be found at the following Web site: http://go.usa.gov/jHnY

Cumulative Effects Common to All Resources

"Cumulative effects" is 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 on Environmental Quality 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 on all landownerships across an area that is deemed appropriate for the impacts being analyzed.

The analysis conducted for this project follows the "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis" issued by the Council on Environmental Quality 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 Council on Environmental Quality regulations do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Because the geographic area of consideration varies by resource, the analysis of cumulative effects for each resource may differ in temporal and spatial scale, as well as the activities that are considered in cumulative effects discussions for each resource.

The cumulative effects analysis contained in this chapter does not attempt to quantify the effects of past human actions by adding up all prior planning actions on an action-by-action basis. In order to understand the contribution of past planning actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past planning actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that are difficult to quantify that have affected the environment and might contribute to cumulative effects. Unless otherwise identified, cumulative effects are considered for the expected life of the revised plan (10 to 15 years).

Air

Affected Environment

The Clean Air Act of 1963 (P.L. 88-206) requires the Environmental Protection Agency (EPA) to set up National Ambient Air Quality Standards (NAAQS) to protect public health. There are six criteria pollutants for which these standards have been set: (1) carbon monoxide (CO), (2) lead, (3) nitrogen dioxide (NO_2),[11] (4) particulate matter smaller than 10 micrometers in diameter (PM_{10}) and particulate matter larger than 2.5 micrometers in diameter ($PM_{2.5}$), (5) ozone, and (6) sulfur dioxide (SO_2). These standards set the maximum average volume of the pollutant that is acceptable for sensitive populations, such as people with asthma and children and the elderly, over a given period of time. This measure is known as the concentration level of the primary standards. Secondary standards may also be set for protection of general welfare, which

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

particularly shows the concentration that affects visibility, and damage to buildings, plants, and animals.[12]

This analysis includes disclosure of effects on air quality from forest activities whose emissions are regulated by the Clean Air Act and those that are not, because both can produce emissions that impair air quality and, thus, indicate potential impact to human health and wildlife, such as nesting birds. Although some activities (such as vegetation treatments using mechanical equipment) produce very low emissions individually, those activities can cumulatively contribute to air quality effects.

The Regional Haze State Implementation Plan (ADEQ 2003) is designed to prevent future impairment of and remedy existing impairments of visibility, including smoke. It addresses acceptable levels of criteria pollutants that affect visibility such as particulate matter. The forest's responsibility under the State implementation plan to meet air quality regulations requires coordination with the EPA and other air regulatory agencies (State, county, and tribal), such as Arizona Department of Environmental Quality. Coordination efforts involve managing and mitigating air pollution from Forest Service activities through adherence to EPA standards and State-specific regulations. For example, the forest works with Arizona Department of Environmental Quality and follows Arizona's Forest and Range Management Burn Rule.[13] Prescribed fires and wildfires have the potential to produce smoke that impacts air quality. The magnitude of smoke is dependent on the amount of fuels consumed, type of fuels, extent, and duration. Only prescribed fire activity is typically regulated for smoke management (e.g., visibility and criteria pollutants) because wildfires are considered "natural events," which are excluded under the NAAQS regulations. However, sustained exceedance of air quality standards, such as a wildfire, may be investigated by EPA to determine if it is an exceptional event.

Areas that persistently exceed NAAQS for a criteria pollutant are called nonattainment areas. These areas must have a plan to meet the standard in the future and they may have additional regulations to control air emissions (Clean Air Act). For example, emission testing for vehicles is a common requirement in nonattainment areas for ozone and carbon monoxide.

Arizona is divided into 11 smoke management units (SMUs) (figure 1). The Coconino NF occurs within 3 SMUs: Colorado River Airshed (1), Little Colorado River Airshed (3), and Verde River Airshed (5). The forest's fire activity impacts the above 3 SMUs regularly. Also, it infrequently impacts the Lower Salt River Airshed (SMU 6). The Air Quality Division of Arizona Department of Environmental Quality considers airshed impairment across northern Arizona to be low (see figure 2) (USDA Forest Service 2009). The current conditions of the airsheds overlapping the forest are below the national standards for all criteria pollutants.

[12] See appendix C for current concentration standards (EPA 2011).

[13] See ADEQ's Web site: http://www.azdeq.gov/environ/air/smoke/download/prules.pdf

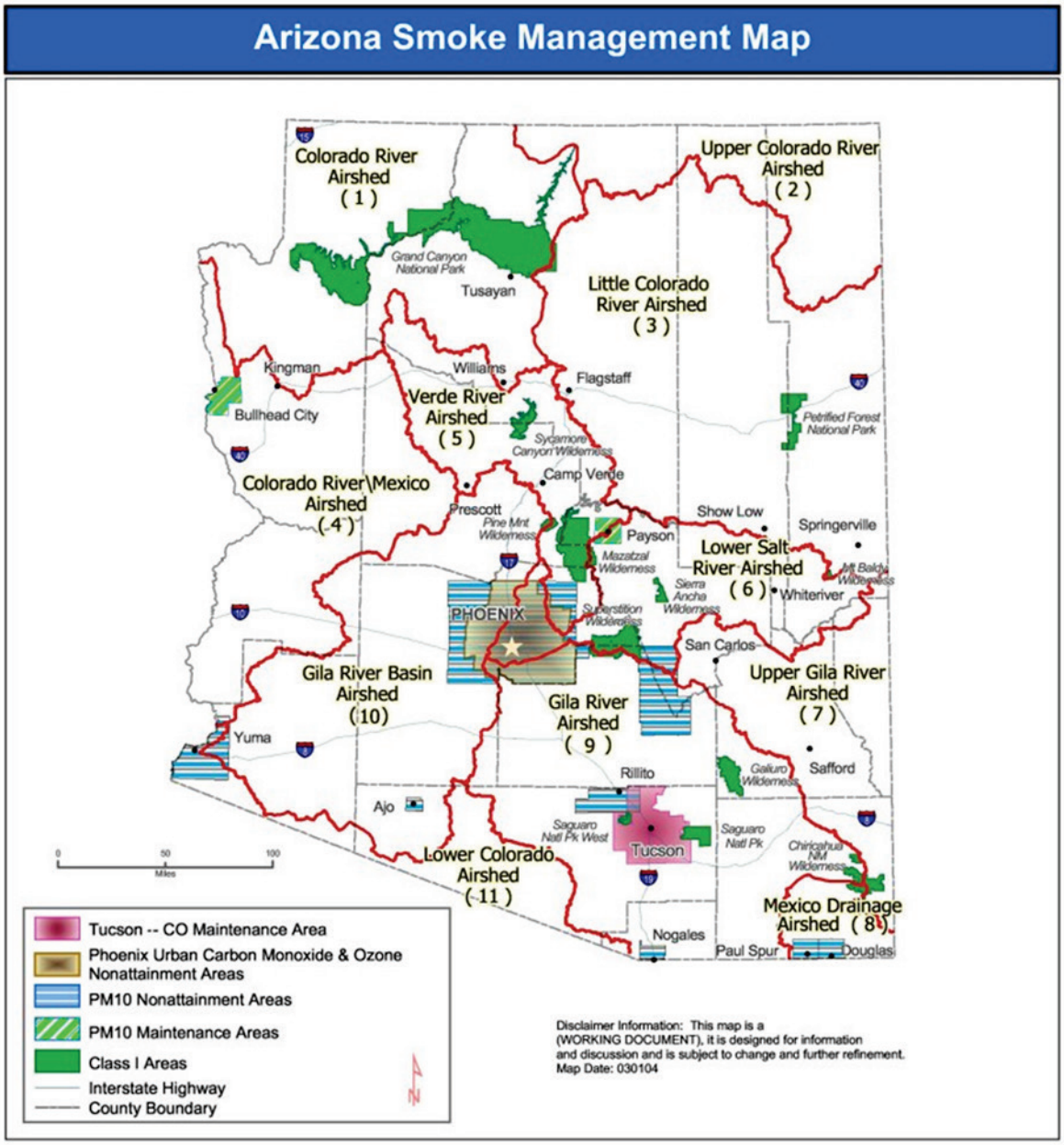

Figure 2. Arizona smoke management map

Smoke Management

Prescribed fires and wildfires may produce temporary, but major, amounts of smoke that contain particulate matter and carbon monoxide within the planning area. They may also produce a limited amount of ozone but typically not in concentrations that are a concern for air quality standards. The Forest Service coordinates with Arizona Department of Environmental Quality on the management of wildfires and uses emission reduction techniques to mitigate their impact on air quality (USDA Forest Service 2002b). Close coordination between the Agency and the

regulatory entity ensures an adaptive management strategy that is responsive to changing conditions that affect the production and retention of smoke. If Arizona Department of Environmental Quality determines that smoke from the prescribed fire is rising close to the concentrations in the NAAQS, the forest stops ignitions (i.e., discontinues use of drip torches and other ignition sources) and contains the fire in a less active condition.

Particulate matter is the primary pollutant of concern in fire management and the most likely to result in health and visibility effects. Particulate matter is very fine solid particles suspended in smoke. $PM_{2.5}$ particles, in particular, can become lodged in the deepest part of the respiratory system and are difficult for the body to expel (USDA Forest Service 2002b). Even though carbon monoxide (CO) from fire is a small contribution to air quality effects, like particulate matter, it can contribute large short-term concentrations.

Prescribed fire activity (planned ignitions) on the Coconino NF is the only activity directly regulated by the Arizona Department of Environmental Quality at this time. The forest averaged 19,143 acres of prescribed fire per year over the last 3 years, with the majority occurring in the Ponderosa Pine PNVT. The emissions from implementing any of the prescribed burns meet NAAQS, because the size of the burn area and weather conditions under which burning occurs is approved by the Arizona Department of Environmental Quality. Over the last 10 years, the prescribed fire activities on the Coconino NF have only resulted in one exceedance of the PM_{10} standard and no exceedances for other criteria pollutants. Therefore, the current forest fire activities are not significantly contributing to a future nonattainment status of the local area. The "Ecological Sustainability Report" (USDA Forest Service 2009) states that "air quality standards are maintained and visibility conditions are trending toward desired conditions. Under current management, airsheds that involve the Coconino are functioning and would continue to function in a way that contributes to ecosystem resiliency and diversity over time."

CO production and particulate matter are expected to be higher when more fuels are consumed, as demonstrated by uncharacteristic wildfires such as the Schultz Fire (2010) or Wallow Fire (2011). These uncharacteristic wildfire events are unpredictable in terms of the timing, frequency, and size of their occurrence, but they are less likely to occur in areas that are treated in a manner that results in vegetative structure, composition, and fuel loads that approximate historic conditions of the given vegetation type. Typically, prescribed fires and wildfires that can be managed to meet resource objectives have lower emissions in dry frequent fire forest types than fires with uncharacteristic fire behavior and fire effects (Lata 2011).

Visibility

"Atmospheric visibility is affected by scattering and absorption of light by particles and gases. Particles and gases in the air can obscure the clarity, color, texture, and form of what we see. Fine particles most responsible for visibility impairment are sulfates, nitrates, organic compounds, elemental carbon (or soot), and soil dust. Sulfates, nitrates, organic carbon, and soil tend to scatter light, whereas elemental carbon tends to absorb light. Fine particles ($PM_{2.5}$) are more efficient per unit mass than coarse particles (PM_{10} and larger) at causing visibility impairment" (USDA Forest Service 2002b). The limit of how far the eye can see is based on how quickly light (photons) are scattered or absorbed. In clear air, visibility is typically 350 kilometers (ADEQ 2003).

"In 1999, EPA issued regional haze regulations to manage and mitigate visibility impairment from the multitude of diverse regional haze sources (40 CFR Part 51)" (USDA Forest Service

2002b).[14] Wildfires and windblown dust are considered "natural" sources of emissions and the goal of the Southwestern Regional Haze Implementation Plan (ADEQ 2003) is to maintain visibility as close to natural levels as possible, not to maintain clear skies that allow for maximum visibility. Fugitive dust from human-caused disturbances (e.g., roads, construction sites, and prescribed fire activities) are considered sources of emissions that affect visibility, which can be managed to maintain as natural a level of visibility as possible (Regional Haze State Implementation Plan, ADEQ 2003). Uncharacteristic wildfires may increase haze above natural levels because of their severity, timing, and fuel conditions. Prescribed fires and wildfires that can be managed to meet resource objectives are managed to more closely mimic historic fire conditions, thus limiting their contribution to visibility impacts. Prescribed fires may be preceded by mechanical treatments that further reduce fuel consumption and therefore reduce the risk of uncharacteristic wildfire and associated effects to visibility.

A Class I area, designated by the Clean Air Act, is a classification that requires the highest level of protection under the act. Projects which may potentially impact Class I areas must address efforts to minimize smoke impacts on visibility. There is one Class I area on the Coconino NF, the Sycamore Canyon Wilderness. The forest infrequently impacts this Class I area due to predominant wind patterns which originate from the southwest and blow toward the northeast. Short-term impacts also occur from fire management activities on other national forests. Petrified Forest National Park is a Class I area within the Coconino NF's airshed, located about 120 miles east. This Class I area is very rarely impacted by Coconino NF fire activities (at a concentration that would affect visibility) due to its distance and relative location.

Other Forest Activities that Affect Air Quality

Mechanical treatments used for ecosystem restoration activities require the use of diesel powered heavy equipment in order to be carried out in a cost-effective manner. It results in the release of particulate matter, CO and NO_2 from combustion engines, and fugitive dust from the construction and use of National Forest System roads. The impact of this equipment to air quality is short term and very minor relative to transportation-based emissions. Mechanical treatment emissions typically produce lower concentrations than emissions from fire-related emissions, when treating an area of comparable size (Center for Environmental Quality 2011).

Fugitive dust is the detachment of soil particles as a result of human-caused or wind driven disturbance of bare soil. It is termed "fugitive" because it does not come out of a pipe, duct, smoke stack, etc. Two human activities increase the generation of fugitive dust above natural levels: (1) the creation of bare soil through road building, tillage, construction activities, etc. and (2) the disturbance of bare soil by wheels, blades, etc. (EPA 2009). Fugitive dust is not a regulated form of particulate matter in Arizona, but it does contribute to PM_{10}. Control techniques for fugitive dust include watering, chemical stabilization, and windbreaks. Forested areas with

[14] "Regional haze is visibility impairment produced by a multitude of sources and activities that emit fine particles and their precursors and are located across a broad geographic area. This contrasts with visibility impairment that can be traced largely to a single, large pollution source. Until recently, the only regulations for visibility protection addressed impairment that is reasonably attributable to a permanent, large emissions source or small group of large sources" (USDA Forest Service 2002b).

overstory vegetation that provides natural windbreaks and less bare soil have less potential to produce fugitive dust than more open areas with large areas of bare soil or intermittent bare soil.

Fugitive dust from vegetation treatments is not a major concern on the Coconino NF because the understory conditions of the vegetation types that are most likely to be treated (ponderosa pine and mixed conifer) do not support long distance transport of dust and have more moisture and ground cover to preserve soil aggregate stability. The forest's road system is the most likely contributor to fugitive dust in semiarid and arid vegetation types, including the Semidesert Grassland, Desert Communities, Interior Chaparral, and Piñon-Juniper Types of PNVTs. Of particular concern on the Coconino NF, are the calcareous soils of the Verde Formation, which are distinguishable by their white powdery texture. These soils have very high wind erodibility, and unmaintained roads on this soil type would have the greatest potential contribution to fugitive dust. There is currently no regulation of fugitive dust by the State or local government in or around the Coconino NF.

Campfire smoke in narrow canyons that have a lot of recreation use has also been a nuisance issue related to air quality on the Coconino NF. The forest has restrictions in place in the Oak Creek Canyon and the Sedona Neighborwoods Management Areas to limit campfires to designated campsites of which there are very few. Another localized air quality issue is the effect of smoke on nesting birds. This has been a consideration in the planning of prescribed fire ignitions for the last 15 years in the Sedona/Oak Creek Management Area (see the "Recreation" and "Wildlife, Fish, and Plants" sections for more information).

Environmental Consequences

Smoke Management

Common to All Alternatives

In the short term, there would be no difference in how alternatives affect air quality in terms of protecting human health, since NAAQS are set at levels that are necessary to meet that objective and the forest must also meet NAAQS standards. Therefore, under all alternatives, up to 30,000 acres would be burned annually while meeting the Coconino National Forest's legal obligations for air quality. As stated in alternatives B, C, and D: "Management activities do not exceed State or Federal emissions standards. Air quality on the Coconino NF meets state air quality standards for visibility and public health. Air quality related values, including high quality visual conditions, are maintained with the Class I Areas." These obligations pertain specifically to management activity of prescribed burning. Alternative A provides related guidance, to "Manage smoke from prescribed fires to meet legal standards and to provide for public safety." Due to prevailing wind conditions, prescribed fire activities and wildfires on the Coconino NF rarely affect the nonattainment portion of the SMU 5 (see figure 2).

There would be no difference in the effects of the plan alternatives on emissions from wildfires that are used to meet resource objectives in the short term (up to 15 years). Since wildfires are natural events, they are not regulated. However, on wildfires used to meet resource objectives, fire managers can greatly influence emission production by implementing emission reduction techniques. Some examples of emission reduction techniques used to reduce emissions include burning with drip torches and aerial support when atmospheric conditions are optimal, or limiting these operations when ventilation is poor. Even though only alternatives B, C, and D specifically point to use of these techniques, alternative A's silence on the issue has not impeded their

implementation because of the forest and Arizona Department of Environmental Quality's roles and involvement of smoke issues for these fires.

The amounts of carbon monoxide and particulate matter produced from fires are roughly similar among alternatives in the short term because of regulations and the consistent application of emission reduction techniques, but long-term effects of the alternatives are variable. Constraints like environmental and fuel conditions, fire leadership and resource availability and socio-political concerns would limit such opportunities, and do not vary across alternatives. However, alternatives do differ in their long-term effects (approximately 50 years) because limitations on vegetation management activities, such as from recommending wilderness areas, vary across alternatives and result in different risks of uncharacteristic fire. Under these vegetation management limitations, fuels are difficult to pre-treat mechanically, and in some cases, the use of wildfires or prescribed fire is limited and, thus, fire in these locations may be less frequent and would produce more emissions. Mechanical treatment would likely reduce smoke impacts in the long term due to greater combustion efficiency, which results in reduced fuel loads and, thus, reduces the probability of uncharacteristic wildfires. Mechanical treatments would reduce the departure of a PNVT from its historic condition by reducing tree density, which increases fire resilience and lowers the probability of uncharacteristic fire. However, this is only true given followup treatment (piling and burning or just prescribed burning) to reduce the fuels created from mechanical treatment (see "Effects" for alternatives A, B, C, and D).

As a result, there is an inverse relationship between short- and long-term smoke (see figure 3 below). Alternatives that result in reduced fire treatments also reduce the frequency of short-term smoke impacts; however, it is expected that they would lead to long-term increased smoke impacts to communities due to the buildup of fuels that result in larger uncharacteristic wildfires. It is assumed that because prescribed fires generally do not cause concentrations of particulate matter exceeding air quality thresholds, prescribed fire effects are of a lower magnitude than uncharacteristic fires.

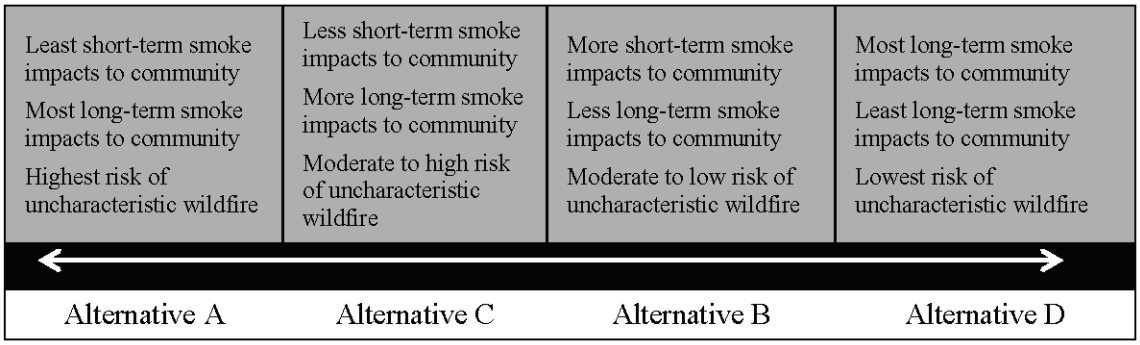

Figure 3. Short-term (15-year) and long-term (50-year) fire smoke impacts to communities, by alternative

In contrast, alternatives that do a better job of restoring vegetation types departed from their desired conditions would likely reduce long-term smoke impacts because the risk for uncharacteristic wildfires and, thus, days with particulate matter concentrations higher than air quality standards would be reduced (figure 3). These uncharacteristic wildfires produce more concentrated and toxic smoke impacts.

Alternative A

In the short term, alternative A would have the least impact to air emissions from wildfires, mainly due to restrictions on where they can be used to meet resource objectives and a general lack of emphasis on the ecological need for frequent fire. Alternative A explicitly prohibits using wildfires with resource objectives in the wildland-urban interface (WUI); therefore, this alternative would tend to have less intense smoke impacts to communities due to the fact that fires managed for resource objectives would be further away from communities. This increases the likelihood that ventilation would lower concentrations of smoke in the wildland-urban interface. Fire would only be permitted in wildland-urban interface when it is the result of a planned ignition under this alternative.

Alternative A also limits using wildfires to meet resource objectives in 156,374 acres of existing wilderness. The ability to use mechanical equipment for fuels reduction in wilderness is also restricted by the Wilderness Act of 1964 (P.L. 88-577) and Forest Service policy. These restrictions, however, increase the forest's contribution to air emissions in the long term because if fuels in wilderness cannot be reduced, uncharacteristic wildfire occurrence is more likely, given the results of past fire suppression. Uncharacteristic wildfires are harder to control due to the dry conditions under which they typically burn. As a result, they burn larger areas, consume more fuel and, therefore, produce more emissions. These fires would produce larger amounts of smoke than lower severity fires that could be managed to achieve resource objective, if not for the restrictions in the plan. In wildland-urban interface areas, not using wildfires to meet resource objectives would require more use of mechanical thinning to meet vegetative desired conditions and protect human life and property. Mechanical thinning results in different emissions (NO_2 and PM) that would have a lower impact on human health because they occur in lower volumes than emissions from fire and at a slower rate.

Alternative A has the least area of the forest managed for an unroaded recreation setting. Treatments in semiprimitive nonmotorized (SPNM) areas would require more post-treatment mitigation efforts to restore the desired recreation setting. If controlling costs is a major constraint on whether or not the work is completed, projects designed in these areas would be less intensive or fewer acres would be treated adequately to restore historic conditions, resulting in a higher risk of uncharacteristic wildfire. If landscape-scale projects, which would allow the forest to treat at the upper end of objectives in the plan, can be designed to offset those expenses, SPNM areas are more likely to be treated. It is unclear that these constraints would affect the risk of uncharacteristic wildfire.

Alternative B

Alternatives B would have slightly more smoke impacts on communities in the short term (than alternative A) because it would not prohibit the use of wildfire with resource objectives in the wildland-urban interface. As a result, there may be more frequent low-intensity fire managed in these areas, which would result in reduced fuels over the long term and, therefore, a lower risk to life and property from uncharacteristic wildfire.

Alternative B provides the greater opportunity for fire treatment than alternative A because it does not constrain the use of wildfires to meet resource objectives through restrictions on tactical strategies that can be used for managing fire in wilderness. It leaves those decisions more appropriately to comply with the Minimum Impact Suppression Tactics and Minimum Requirements Process, used throughout the Forest Service to identify which tools are necessary to

achieve fire management and safety objectives while keeping consistent with policy to use the methods that cause the least impact in wilderness. This direction provides flexibility to fire managers without sacrificing wilderness character. As a result, wildfire would play a more natural role in these ecosystems. This alternative also emphasizes the ecological need of frequent fire in appropriate vegetation types.

Alternative B recommends 14,767 acres of new wilderness, which is primarily in vegetation types where prescribed fire occurs less frequently. These recommended wilderness areas would add less than 1 percent (approximately 8,800 acres) of the forest that is moderately or highly departed from its historic fire regime to wilderness management. Recommendation of wilderness in this alternative would, therefore, be unlikely to affect the use of fire on the landscape in a measureable way.

Alternative B proposes to manage more of the forest for an unroaded recreation setting than alternative A. The smoke effects would be similar because of the uncertainty about what the outcome of this allocation on ecological restoration activities. Unlike in alternative A, permanent road construction under alternative B is not suitable in these areas and so the amount of mitigation needed to restore areas disturbed by road construction to their desired settings would be more. This has the potential to increase the cost of treatments in these areas, which may or may not lead to prescribed fires and wildfires with resource objectives. Thus, there is the uncertainty of smoke effects from increasing the area of this recreation setting.

Alternative C

Alternative C would allow for wildland-urban interface treatments and associated smoke impacts on communities (both short term and long term) that are similar to alternatives B and D.

While it would still be possible to restore fire-adapted ecosystems in these areas, constraints placed on the transportation system and the expansion of motor vehicle use and mechanical treatment in recommended wilderness would reduce the ability of the forest to meet resource objectives to restore fire-adapted ecosystems. In the vegetation types of Semidesert Grassland and Piñon-Juniper Evergreen Shrub[15], there is a much larger area of the PNVT under the recommended wilderness direction than under alternative B. In total, an additional 4.6 percent of Semidesert Grassland and 7.3 percent of Piñon-Juniper Evergreen Shrub would be at increased risk for uncharacteristic wildfire and associated smoke impacts. It is unlikely that the use of wildfires to meet resources objectives could be expanded enough to offset less prescribed fire use and mechanical treatments in these areas. As a result, these parts of the forest would be at increased risk for uncharacteristic wildfires and would subsequently have increased emissions should such fires occur.

Alternative D

Effects for alternative D are the same as for alternative B, with the exception of effects tied to recommended wilderness since none are recommended in this alternative.

[15] All of these vegetation types are highly or moderately departed from their reference fire regime.

Visibility

Common to All Alternatives

The effects to visibility in designated Class I areas from forest activities are most strongly correlated to smoke impacts. In the short term, the protocols and the frequency and rate of prescribed fire activities and wildfires with resource objectives would not vary by alternative and, therefore, there would be no difference in effects in designated Class I areas from these activities. However, in alternatives with a higher risk of uncharacteristic wildfire, Class I areas could have lower visibility on their haziest days because of the increased probability of heavier smoke productions. Alternatives with a lower risk of uncharacteristic wildfire would have more days when haze is present due to prescribed fire activities, but would have better overall visibility because the smoke emissions during wildfires would likely be lower because of lower fuel consumption.

Alternative A

Alternative A treats all wilderness areas as Class I areas and has numerous guidelines that operationally restrict when and how fire can be managed in wilderness. As a result, the use of prescribed fire in these areas would be restricted and could have a negative impact on other aspects of wilderness character, such as native vegetation and communities. Not being able to use fire effectively would mean fewer days with haze in these areas, but would increase their risk for uncharacteristic wildfires because there would be no method available for reducing fuel loading. In addition, some of the wilderness areas on the Coconino NF are impossible to manage in a way that achieves Class I area standards. For instance, weather systems affect visibility in the Kachina Peaks Wilderness and pollution sources outside of the Forest Service's authority to regulate.

Alternatives B, C, and D

Alternatives B, C, and D treat air quality as one of many wilderness characteristics to maintain and do not propose additional restrictions to prevent haze impacts. This would result in more days with haze, but the ability to have occasional smoke in these areas without the added restrictions of visibility would reduce the risk of uncharacteristic wildfire and prevent the loss of other wilderness characteristics in these areas. The presence of smoke in these areas is not likely to affect the wilderness character of the area, since smoke is evidence of natural processes at work.

Other Forest Activities that Affect Air Quality

Effects for All Alternatives

Under all alternatives, the forest anticipates maintaining or increasing the number of acres that are thinned using machinery to increase over current levels forestwide. As a result, the emissions of NO_2 from activities, such as thinning, hauling wood, and maintaining, improving or decommissioning roads, would be maintained or would slightly increase if treatments occurred at the higher end of range in vegetation treatment objectives.

All alternatives retain the plan direction for campfire restrictions to reduce smoke impacts in Oak Creek Canyon and Sedona Neighborwoods. As a result, campfires would not be a major contributor to air quality issues in the canyon. Air quality, such as visibility and particulate matter, would still be impacted to some extent by fire activities and use of fire for heating and debris removal on private inholdings in the canyon. Direction to consider the impacts to wildlife and in

particular nesting sites is also carried forward in all alternatives. There would be no increase in air quality impacts to these species that would be attributed to the plan direction (see the "Wildlife, Fish, and Plants" section for impacts to particular species).

In areas of the forest, where mechanical treatments and prescribed fire would likely be expanded to restore fire-adapted ecosystems, the National Forest System of roads and traffic on them is likely to increase during the life of these projects and then be reduced to current levels or less as these projects are completed and roads are closed, decommissioned, or obliterated. Even though these activities contribute to the detachment of fugitive dust, they would be occurring primarily in vegetation types such as ponderosa pine and mixed conifer that have relatively moister soil conditions and ground cover adequate to mitigate these impacts in the long term. In the short term, there could be localized increases in fugitive dust that could be a nuisance for visitors and nearby residents when weather conditions decrease soil moisture and increase the occurrence of dust being detached from soil, or with heavy traffic on unsurfaced or unmaintained roads. In the short term, fugitive dust would likely be highest in the immediate vicinity of mechanical thinning projects and over the long term in the semiarid vegetation types that have a high density of public use roads (ultimately dependent on the amount of traffic).

There would likely be some differences in the location of fire and vegetation treatments based on the differences in land allocations under the different alternatives and, therefore, some local differences in air quality impacts. Under alternative C, fewer acres would likely be treated mechanically compared to the other alternatives because this alternative has more wilderness recommendations and restrictions on where roads can be constructed. Most of these restrictions are located in the Upper Clear Creek watershed, Anderson Mesa, and the Beaver Creek portion of the Red Rock Ranger District. As a result, there would be less emissions of this type in the Little Colorado River airshed, but an increased risk for uncharacteristic wildfire. Alternatives A, B, and D would not vary in how NO_2 and particulate matter impacts from the use of mechanical treatments would be distributed geographically.

Plan objectives in alternatives B, C, and D to close or decommission roads where soil and watershed conditions are poor would help reduce fugitive dust by decreasing the amount of bare soil where these conditions occur. Managing a road system that is sustainable is a key factor in being able to meet the desired condition of meeting air quality standards including visibility and public health. Alternative A does not have similar objectives and, therefore, only addresses the construction of new roads. This difference under alternative A would result in more fugitive dust from roads that are not properly located.

Cumulative Effects

Common to All Alternatives

Cumulative effects to fire related to smoke impacts are examined from the standpoint of the sum of the effects of past management activities over the past 10 years on the Coconino NF. Cumulative effects are then explored in the larger spatial context of the forest's vegetation and fire management practices to the surrounding landscape and assessed in 15 and 50 years. The boundary for cumulative effects for air quality is the airsheds that overlap the forests and considers activities that affect those airsheds, regardless of the source of the emission. Since smoke impacts are transient in nature, the assessment of cumulative effects is different than other issues and resource areas. For instance, a fire smoke source can be off-forest but still impact the Coconino NF. The opposite is also true. Cumulative effects from prescribed fires on Federal,

State, and tribal lands are largely mitigated through implementation of the Enhanced Smoke Management Program in the State Implementation Plan.

Future emissions from the forest's prescribed fire activities would likely remain within legally acceptable limits with the potential for rare exceptions. This would be due both to the forest fire managers continuing practices that manage emissions and the Arizona Department of Environmental Quality's regulatory efforts. Alternative impacts would likely not substantially affect future emissions relative to drivers that do not vary across alternatives.

On a larger scale, State and Federal jurisdictions must follow the same Arizona Department of Environmental Quality regulatory statutes regarding prescribed fire. Therefore, exceedance of air quality standards would likely not occur from prescribed fire. However, all jurisdictions would face challenges of increasing the use of wildland fire treatments while managing smoke impacts.

Smoke emissions from wildfires have more potential (relative to prescribed fire) to exceed State and Federal standards on the Coconino NF and across the larger landscape in 15 and 50 years. This is primarily related to the fact the prescribed fires are burned under specific conditions that have previously been evaluated to lessen or reduce smoke impacts. Prescribed fire also falls under the Arizona Department of Environmental Quality regulation that helps coordinate smoke impacts, which helps avoid impacts to human health. Wildfires, on the other hand, can burn under very extreme conditions that inhibit the ability for managers to manage smoke impacts because the emphasis is often suppression or management of the fire to protect values.

The Little Colorado airshed has been impacted within the last 15 years by the two largest wildfires in the history of Arizona: the Rodeo-Chediski and Wallow. As a result, the mixed conifer within this airshed on other national forests has been reset successionally, and it is uncertain if the areas will recover the same vegetation type as existed before these fires. The mixed conifer vegetation on the Coconino NF, which has not yet had uncharacteristic fire in the mixed conifer vegetation types, has, by default, an increased percentage of forested area within the airshed. Therefore, the forest's contribution to the risk of uncharacteristic fire and resulting impacts to air quality in this airshed is correspondingly greater due to the decrease in forested areas that are at risk for uncharacteristic wildfires in the airshed.

Visibility in Class I areas is likely to be impacted to some extent by the cumulative impact of smoke from multiple jurisdictions, but the trend is likely to decrease for particulate matter because of legal requirements and coordination with the Arizona Department of Environmental Quality. Impacts to visibility may occur from concentrations lower than the NAAQS levels meant to protect human health. When prevailing wind conditions are present, fires in southern California may also impact these airsheds. The cumulative risk of uncharacteristic wildfire throughout southern California and Arizona would be the biggest potential impact to visibility. The frequency and intensity of these fires would have the biggest impact on haze in Class I airsheds. Alternatives B and D would do the most to lessen the potential for this impact.

The Grand Canyon National Park Class I area is approximately 60 miles northwest of the Coconino NF and is occasionally impacted by smoke from fires on the northern part of the forest. The three main pollutants of concern in the canyon are ozone, particulate matter, and SO_2. The sources of these pollutants in the Grand Canyon are not limited to regional sources within the SMU. Coal-fired power plants in the Four Corners region and industrial and metropolitan sources from California, Nevada, Arizona, and Mexico contribute to the pollution in this airshed because

the prevailing winds can transport pollutants over long distances. In addition, wildfire and prescribed fire from other Department of the Interior lands in the area contribute smoke that reduced visibility at the park (National Park Conservation Association 2010).

The release of NO_2 from mechanical treatments on the forest is miniscule compared to the emissions from Phoenix, Los Angeles, and freight traffic along the I-40 corridor. Transportation accounts for approximately 50 percent of the emission of NO_2 in the United States (Rodrigue 2011). Approximately 380 million tons of freight is moved out of Los Angeles every year via trucking and one of the four major routes for these goods cuts through the upper third of the Coconino NF (FHWA 2005). Therefore, this freight traffic has a significant contribution to NO_2 levels regionally and within the Coconino NF. In comparison, the impacts from vegetation management on the Coconino NF are not a major contributor of this pollutant regionally. Overall, however, air pollution in airsheds over the forest remains below national standards.

The roads on the Coconino NF would be the forest's major contributors to fugitive dust. How much soil is detached and when depends on the activities that would be occurring on the road, the type of vehicle being used, and the road condition. Likewise, dirt roads on private land also contribute to fugitive dust. The biggest industrial contributor is typically construction, especially when a semiarid or arid site is cleared of all vegetation prior to construction. Even though the construction industry is currently slow because of the recession, it is probable that migration to the Southwest will continue over the life of the plan and that the areas to the north of Phoenix will continue to be an attractive community, especially for seniors as services historically have increased proportionally to their population. These demographic changes are likely to continue to drive construction in the analysis area, and it is expected that these activities would have a greater impact on fugitive dust generation. These developments would also increase the demand for improved roads on the forest to access new neighborhoods. This could locally reduce the forest's contribution to fugitive dust.

Cumulative effects of smoke impacts in the Oak Creek Canyon and Sedona Neighborwoods Management Areas largely depend on the contribution of private inholdings. If older wood burning stoves are updated with more efficient designs and wood burning fireplaces with propane or natural gas inserts, then the overall smoke impacts are likely to be reduced. The Forest Service contribution has been fairly stable since many sites in the canyon have been converted from overnight camping to day use per Amendment 12 in the 1987 plan. There are now fewer developed sites, and campfires outside of these sites are prohibited. There is unlikely to be further reductions in available campsites because two remaining campgrounds have been recently reconstructed and all alternatives carry forward direction the 1987 plan to continue the restriction on dispersed campfires.

Aquatic Systems

Water Quality, Quantity, and Watersheds

Affected Environment

Water Quality

Surface water quality was assessed in major perennial stream reaches and lakes on the forest by comparing existing conditions (State Water Quality Categories 1 to 5) with desired conditions that are set by the State under authority of the Clean Water Act of 1972 (P.L. 92-500). Water quality standards are based on types of uses by people and wildlife. The general classification used for

surface water quality by the Arizona Department of Environmental Quality is attaining, attaining some uses, inconclusive/not assessed, notattaining, and impaired for the identified uses:

- **Category 1** – Surface waters assessed as "attaining all uses." All designated uses are assessed as "attaining."
- **Category 2** – Surface waters assessed as "attaining some uses." Each designated use is assessed as either "attaining," "inconclusive," or "threatened."
- **Category 3** – Surface waters assessed as "inconclusive." All designated uses are assessed as "inconclusive" due to insufficient data to assess any designated use (e.g., insufficient samples or core parameters). By default, this category would include waters that were "not assessed" for similar reasons
- **Category 4** – Surface waters assessed as "not attaining." At least one designated use was assessed as "not attaining" and no uses were assessed as "impaired."
- **Category 5** – Surface waters assessed as "impaired." At least one designated use was assessed as "impaired" by a pollutant. These waters must be prioritized for total maximum daily load (TMDL) development.

Based on these State water quality categories, any stream listed as Category 5 or Category 4 in the watershed is considered highly departed from reference conditions. Nonlisted streams, or Categories 1 to 3, were identified as not impaired and are considered to meet the desired condition.

Reference or historic water quality was assumed to be sufficient to sustain ecological systems and species and be of equivalent quality as attaining all uses as intended by the State water quality standards. Nonpoint sources of pollution such as roads, timber harvesting, extensive livestock grazing, recreation, and non-characteristic fire were neither widespread nor frequent.

Water quality of Coconino NF's lakes and streams is variable. Approximately 33 miles (or 15 percent) of streams (50 miles when including lands of other ownership) and 5 reservoir lakes on the forest are classified as impaired or Category 5 (the category of most severe water quality problems) and are not attaining beneficial uses designated by the Arizona Department of Environmental Quality or EPA. The causes of the impaired condition are *E.coli* exceedances in Oak Creek that are likely from leaky septic systems and high levels of recreational swimming and mercury exceedances in fish tissue for the lakes.

An additional 24 miles (approximately 11 percent) are classified as not attaining or Category 4 (the next most severe water quality category). Most of Category 4 stream miles are located in the Verde River and its tributaries, where past and current impairments of the turbidity water quality standard have occurred. These stream miles do not meet State and Federal water quality standards and do not support designated beneficial uses including either aquatic and warm water fisheries or full body contact (swimming).

A TMDL is a written analysis that determines the maximum amount of a pollutant that a surface water can assimilate (the "load"), and still attain water quality standards during all conditions. The TMDL allocates the loading capacity of the surface water to point sources and nonpoint sources identified in the watershed, accounting for natural background levels and seasonal variation, with an allocation set aside as a margin of safety. The forest has the following five approved TMDLs designed by the Arizona Department of Environmental Quality in response to

past water quality impairments: (1) Verde River for turbidity; (2) Stoneman Lake for dissolved oxygen, pH, and nutrients; (3) Oak Creek at Slide Rock for pathogen (*E. coli*); (4) Oak Creek Basin, including Munds Creek, for nitrogen and phosphorus; and (5) Lake Mary Regional TMDL[16] for mercury in fish tissue. These TMDLs strive to improve water quality through recommended appropriate management activities by the forest and State agencies.

On the Coconino NF, the most important nonpoint sources of pollution are from sediment generated from roads near drainages. The forest currently implements and monitors site-specific best management practices (BMPs) for all activities with the potential to pollute Arizona's waters. These BMPs include: water quality monitoring, implementation of TMDL report recommendations,[17] implementation and monitoring of BMPs for all projects that have the potential to increase nonpoint pollution, and State certification and mitigation of temporary point source pollution through the Clean Water Act's National Pollution Discharge Elimination System regulations. Wastewater treatment sites associated with campgrounds and administrative sites are the only potential point sources of water pollution the forest manages at this time.

Recommendation of wilderness can influence the ability to manage wildfires. Wildfires may either be suppressed or allowed to burn and managed to meet resource objectives. Fires managed to meet resource objectives would help maintain or make progress toward desired conditions. A variety of factors are used to determine whether wildfires should be suppressed, and the likelihood of suppression was evaluated for each recommended wilderness. The factors considered included: continuity and availability of fuels, adjacency to and comparative size of existing wilderness, size of recommended wilderness area, existing condition of topography and roads affecting accessibility for equipment or foot travel, and proximity to values at risk such as buildings, water developments, and power lines). Although wildfires with resource objectives are authorized in wilderness areas, it is accomplished much less frequently than in areas outside of wilderness mainly because threatened resource values (e.g., wildlife habitat, heritage resources, and timber values) are more difficult to protect due to limitations on accessibility and tools that can be used in suppression or in fire management activities within wilderness areas. Each recommended wilderness was rated according to the likelihood that wildfires would be suppressed (see the "Vegetation" and "Fire" sections for more discussion). These rankings fell into two broad categories used for analysis: (1) low likelihood that wildfires would be suppressed and, therefore, the wildfires would likely be managed to meet resource objectives that move resources toward desired conditions and (2) moderate to high likelihood that wildfires would be suppressed.

Water Quantity

Surface Water

Surface water includes perennial streams, reservoirs, lakes, wetlands, stock ponds, and seeps and springs. Many plant and animal species rely on perennial stream water for survival. The extent of

[16] The five lakes with mercury exceedances in fish tissue have a recently approved TMDL and can be found at the following Web site: http://www.azdeq.gov/environ/water/assessment/download/Lake_Mary_Region_Draft-6-16-2010.pdf

[17] More information may be found at the following Web site: http://azdeq.gov/environ/water/assessment/assess.html

perennial stream courses has shifted slightly over time. The Homestead Act of 1862 (P.L. 37-64) facilitated the transfer of some lands containing streams into private ownership, and the creation of dams on East Clear Creek and Leonard Canyon formed CC Cragin Reservoir and Knoll Lake, respectively. Diversions and irrigation ditches reduce streamflow along some stream segments and have been operational for many years. Most diversions and ditches are located off-forest.

Perennial stream miles on forest administered and managed lands are about 229 miles, and 296 miles of perennial stream miles are on lands of other ownership that lie within the forest boundary. There are about 944 intermittent stream miles and 3,743 ephemeral stream miles on forest administered and managed lands and 1,019 intermittent and 4,164 ephemeral stream miles on non-forest administered lands within the forest boundary.[18]

Reference levels of water yield are unknown; however, research suggests that water yield in pre-settlement, open-canopied ponderosa pine forests was higher than in the closed-canopy forests that are prevalent today (USDA Forest Service 2007b). Studies in paired watersheds (i.e., watersheds that are similar in nature with regard to their vegetation and soils) in Arizona have shown that there was a short-term increase in water yield following thinning in ponderosa pine forests (Moir and Ludwig 1979).

Surface flow depends on precipitation and the recent drought, along with overstocked forests, has reduced flows in some stream reaches occupied by native fish.

Surface water is procured and used for livestock watering, wildlife including fish, domestic use, irrigation, fish consumption, and swimming. Under Federal reserved water rights,[19] surface water is also available for administrative use, such as firefighting and road maintenance.

Forest acquisition of instream flow certified water rights also protects perennial stream water quantity for riparian habitat used by wildlife, fish, and recreation. The following forest streams have instream flow applications that have been approved, and they have assessments pending Arizona Department of Water Resources water right certification: East Clear Creek, Oak Creek, Red Tank Draw, and Sheepshead Creek. Spring Creek, Wet Beaver Creek, Walker Creek, Sycamore Creek, Fossil Creek, and the Verde River have certified water rights for instream flow. It is expected that the Arizona Department of Water Resources will award certified water rights for all perennial streams following protest resolution. Seven instream flow water rights have been procured on the forest. The remaining water rights are pending resolution of formal protest.

Current surface water use on the forest is slightly higher than in the early 1980s because new campgrounds and day-use areas were created in response to increased recreation use. However, it

[18] The stream miles noted here have been updated since the 2009 "Ecological Sustainability Report."

[19] Federal reserved water rights associated with public lands are reserved to satisfy the purposes for which the public land was established. These water rights, however, are subject to court adjudication.

is estimated that overall forest water yield[20] has been static to slightly downward over the last 20 years due to the following two conditions:

1. Greater tree and shrub basal area and cover have been observed in several vegetation types or PNVTs and recorded over the last 20 years (see aerial photo analysis and "Anderson Mesa Landscape Scale Assessment Vegetation Group Specialist Report," Forest Service 2004a) which may result in increased evapotranspiration and decreased runoff and water yield.
2. Drought conditions have prevailed in most years since about 1999 and may have contributed to decreased precipitation, runoff, and water yield. Climatic (or drought) and vegetative conditions on the Little Colorado River watersheds are similar to the Verde River watersheds and, therefore, water yield trend is estimated to be similar (static to slightly downward).

Past studies (Moir and Ludwig 1979) indicate that vegetative treatments to increase surface water yield only result in short-term water yield increase (1 to 3 years). Today, treatments with the specific objective to increase water yield are not being considered on the forest although some projects may indirectly provide water yield benefits. Therefore, a detailed analysis of water yield has not been done. It is estimated that forestwide, current water yield (supply) is similar to or slightly less than in the early 1980s due to: (1) recent climatic drought conditions and (2) greater evapotranspiration from increased tree basal areas resulting in increased water loss and decreased water yield.

Groundwater

Since the vast majority of well withdrawals occur off-forest, they are not within the forest's authority to control. Forest Service groundwater policy (Forest Service Manuals 2560, 2880, and 2543) as well as Agency technical guides, however, provide direction for well drilling and pumping on the forest and specify that these activities are not to adversely affect connected riparian habitat and water quantity and quality. Because existing direction outside of the plan was considered to be adequate, additional guidance related to groundwater is not provided under any alternative and, therefore, not analyzed in this environmental impact statement.

Watersheds

Watersheds are cataloged using a uniform hierarchical system developed by the U.S. Geological Survey. The United States is divided and subdivided into successively smaller hydrologic units. The hydrologic units are nested within each other, from the largest to the smallest. This analysis focuses on subbasins (referred to as 4th code watersheds) and smaller watersheds within them (5th and 6th code watersheds).

[20] Output of water yield or water supply (used synonymously in this analysis) is the amount of water which leaves the immediate site to become surface water yield or groundwater recharge. Essentially, it is the difference between total precipitation and actual evapotranspiration.

Watershed condition encompasses several resource conditions. These conditions, including soil, riparian, and aquatic habitat conditions, affect the quality, quantity, and timing of waterflows. Watershed conditions within the 6th code watersheds were evaluated, and the initial assessment was conducted in February and March 2011 using the national watershed condition framework and assessment tool (USDA Forest Service 2011s and 2011t).

Watershed condition can range from properly functioning (i.e., in a natural pristine state) to impaired (i.e., in a severely altered state). Watersheds in properly functioning condition have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within their range of natural variability for these processes. Properly functioning watershed conditions create and sustain terrestrial, riparian, aquatic, and wetland habitats that are capable of supporting diverse populations of native aquatic and riparian dependent species. In general, the greater the departure from the natural pristine state, the more impaired the watershed condition is likely to be. Properly functioning watersheds are commonly referred to as healthy watersheds.

Watershed condition classification is the process of describing watershed condition in terms of discrete categories (or classes) that reflect the level of watershed health or integrity. In this analysis, watershed health and integrity are considered to be conceptually the same. Watersheds with high integrity are in an unimpaired condition in which ecosystems show little or no influence from human actions.

The Forest Service Manual (FSM 2521.1) uses three classes to describe watershed condition:

- **Class 1 (Properly Functioning)** – These watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are functioning properly.
- **Class 2 (Functioning-at-Risk)** – These watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are functioning at risk.
- **Class 3 (Impaired)** – These watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are impaired function.

For 6th code watersheds, approximately 21 percent are properly functioning, 65 percent are functioning-at-risk, and 14 percent are impaired. Overall, approximately 79 percent of 6th code watersheds are not properly functioning and are considered departed from reference condition.

Table 3 identifies the number of 6th code watersheds, grouped by 4th code watersheds, that overlap the forest in each watershed condition class and lists some of the common factors that have contributed to the more degraded conditions.

Table 3. Summary of watershed condition for 6th code watersheds

4th Code Watershed	Number of 6th Code Watersheds	Number of 6th Code Watersheds in Each Condition Class			Common Degrading Factors
		Class 1: Functioning Properly	Class 2: Functioning-at-Risk	Class 3: Impaired	
Canyon Diablo	26	2	20	4	High road density, poor fire regime conditions, impaired water quality, at-risk wetland conditions, well pumping
Havasu Creek	1	0	0	1	Very low acreage on forest
Lower Little Colorado River	16	7	8	1	Impaired soil conditions, poor fire regime conditions, high road density
Lower Verde River	22	1	18	3	Impaired and unsatisfactory soil conditions, poor aquatic biota condition, poor fire regime conditions
Middle Little Colorado River	15	4	10	1	High road density and close proximity to stream courses, poor fire regime conditions, impaired and unsatisfactory soil conditions, at-risk riparian conditions, poor aquatic biota and habitat conditions
Upper Verde River	39	8	22	9	Unsatisfactory soil and riparian conditions, impaired water quality, poor fire regime conditions, high road density and in close proximity to streams, poor aquatic biota and habitat conditions, well pumping
Tonto Creek	1	0	1	0	Very low acreage in forest
Total		**22**	**79**	**19**	

Many of the impaired watersheds are found around communities including Flagstaff, Sedona, and Camp Verde. The ratings given to these watersheds reflect the effects of development, such as added runoff from high density of roads, high recreation impacts to riparian area, aquatic biota and habitat, high well withdrawals of groundwater, and increased sources of water pollution as compared to undeveloped land. Functioning-at-risk watersheds dominate the forest and are the result of human impacts that have reduced soil and riparian condition, created poor fire regime condition classes through fire suppression, high road densities, and high occurrence of stock tanks that reduce timing of streamflows. The majority of properly functioning watersheds are located in wilderness areas relatively free of human development and impacts or in Ponderosa Pine or Great Basin Grassland PNVTs where roads and streams are scarce.

Environmental Consequences

Alternatives are compared based on their ability to move the water resources (i.e., water quality, water quantity, and watershed condition) toward desired conditions.

Common to All Alternatives

Under all alternatives for ground-disturbing activities including trail maintenance and new construction, implementation of best management practices (FSH 2509.25 and 2509.22) per plan guidelines would be effective in reducing sediment and improving watershed conditions.

Although not quantified, the amount of human and livestock disturbances in riparian areas would be similar among all alternatives and would probably equally impact riparian function. Even with the livestock grazing restrictions for research natural areas in alternative C, it is anticipated to be similar because no or limited grazing occurs within research natural areas.

Instream flow water rights would be maintained and procured at similar levels under all alternatives.

Alternative A

Alternative A (or the 1987 plan, as amended) has several standards and guidelines related to protecting water resources including: procurement of instream flow water rights; protection of riparian areas though filter strips; and maintaining 80 percent crown cover, 80 percent emergent vegetation cover, and three age classes of woody riparian species. The guidance provided in alternative A for water resources, however, is lacking in a number of aspects:

- Alternative A contains vague and outdated plan direction language to improve impaired waters toward supporting or attaining designated beneficial uses or meeting State water quality standards. Lack of direction to focus treatments on improving impaired waters where they are most needed would likely lead to continued water degradation and fewer improvements in water quality than would otherwise occur under the other alternatives.
- Alternative A does not contain any specific desired conditions for watershed condition. Alternative A has management emphasis statements that use outdated, less accurate language and does not focus on soil and riparian function or overall watershed condition. Instead, it has management goals to have all soils in satisfactory soil condition by 2020 and 80 percent of riparian recovery by 2030. Under current and past rates of plan implementation, however, these goals have not been achieved and are unrealistic and unattainable under current budgets. Alternative A would not focus treatments to improve these functions where they are most needed, resulting in reduced watershed function and water quality, as well as associated riparian and soil function than could otherwise occur. The lack of plan direction specific to 6th hydrologic unit code (HUC) watersheds would result only in site specific water resource improvement and would be less likely to improve overall watershed condition, including associated water quality, riparian, and soil function.
- Does not contain any plan objectives to implement treatments designed to move watersheds toward properly functioning condition (PFC). The lack of plan objectives and direction to move watersheds to PFC would continue to result in fewer planned and implemented treatments resulting in less focused and less improvement of water quality,

riparian, soil, and watershed function than would otherwise occur under the other alternatives.

- Does not contain guidance for implementing Arizona Department of Environmental Quality TMDL recommendations to improve impaired waters on the forest; therefore, water quality improvement projects would only occur on an opportunity basis. In addition, they would be less likely to be implemented and more likely to result in a static trend in water quality.
- Does not provide a focused approach to watershed restoration. It does not provide guidance to prioritize treatments within particular watersheds and would not result in substantially removing degrading factors that cause functioning-at -risk or impaired watersheds to improve. Because of the lack of objectives, the level of mechanical treatments would likely be less than other alternatives. As a result, it would be unlikely that entire watersheds would be restored except on an opportunity basis and, therefore, watershed function would continue to be lower than would otherwise occur under the other alternatives.

Due to these gaps in plan direction, continuing implementation of alternative A would not improve impaired water quality; maintain instream flows, or riparian, soil, and watershed function; and would not move water resources toward desired conditions as quickly as alternatives B, C, and D.

Alternatives B, C, and D

In addition to other plan direction that would indirectly benefit water resources (e.g., vegetation desired conditions), alternatives B, C, and D would provide the following plan direction directly related to water resources:

- Plan guideline to consider and implement TMDL recommendations on impaired waters. Implementing this guideline under alternatives B, C, and D would result in more improvement to impaired waters and, therefore, improvement in water quality more so than alternative A.
- Desired conditions for water quality to meet or exceed Arizona water quality standards and to support identified designated beneficial uses and native aquatic species, as well as to sustain a level that retains the biological, physical, and chemical integrity of the aquatic systems that would benefit survival, growth, reproduction, and migration of native aquatic and riparian species. Improved plan language including desired conditions for water quality would result in the focused emphasis on treating impaired waters requiring improvement to support the identified beneficial uses and native aquatic species more so than alternative A. Therefore, alternatives B, C, and D would result in improved water quality and would support identified beneficial uses and native aquatic species more so than alternative A.
- Desired condition for maintaining adequate quantity and timing of waterflows so as to retain or enhance ecological functions, including aquatic species and riparian vegetation consistent with existing water rights and claims. Specifically, water quantity (base flows) of intermittent and perennial streams are seasonally sustained while peak flows and flood potential occur within the historic range of variability for that stream system. New and existing instream flow water rights are maintained or procured. While instream flow water rights would be maintained and procured at similar levels under all alternatives, the plan language under these alternatives is improved and more focused on riparian

ecological function relative to alternative A and would support improving ecological function as they relate to water quantity and watershed function.

- Desired condition for watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their potential natural condition (Class 1). These desired conditions under alternatives B, C, and D would provide more focused plan implementation with respect to 6th code watersheds, while alternative A does not. Therefore, overall watershed improvement at the 6th code watershed level would be expected under these alternatives, but not under alternative A. The objective and guideline direct watershed improvement on priority 6th code watersheds would result in trending toward properly functioning condition (Class 1). Identified objectives to treat 6th HUC watersheds would result in improved water quality, riparian, soil, and watershed function and a trend toward PFC at a watershed scale, where alternative A does not.

There are no measurable differences in plan components for riparian improvement among alternatives B, C, and D, except in number of recommended wilderness areas. The additional wilderness areas would restrict active management actions such as mechanized equipment, and would result in fewer disturbances to riparian areas and improved riparian function. Few roads and trails, however, are currently present in the areas recommended as wilderness, wildlife areas, management areas, and research natural areas under alternative C, and grazing would still be allowed in many of those areas; therefore, predicted riparian improvement would be similar to or a little better than alternatives B and D.

Implementing vegetation-related objectives under alternatives B, C, and D could cause short-term increase in water yield to connected stream courses, springs, and groundwater, but this effect would be expected to last less than 10 years according to research (USDA Forest Service 1979). Also as a result, vegetation treatments would reduce hazardous fuels and associated risk of uncharacteristic wildfire that stem from overstocked forests and woodlands. Consequently, this would reduce the risk of accelerated erosion and sediment delivery into connected stream courses and, thus, maintain water quality.

While water quality trends would be expected to be static for alternative A, trends for alternatives B, C, and D would be toward desired condition (i.e., meeting State water quality standards) based on proposed revised plan direction that emphasizes TMDL implementation and a focused, priority watershed treatment strategy. This direction is in addition to mandatory and voluntary requirements, including best management practices, imposed by the Arizona Department of Environmental Quality.

Alternatives B, C, and D have objectives to directly treat watersheds; therefore, some positive trend is expected along with the effects of (1) maintained and improved streamflow, groundwater, and water quality on impaired streams and (2) protection against water quality degradation (identified as a key issue).

Alternatives B, C, and D would concentrate treatments, based on objectives, in focus watersheds, which allow a better opportunity for restoring or maintaining watershed condition on five to seven 6th code watersheds, or between 100,000 to 140,000 acres, within the first 10 years following plan approval. The focused watershed treatment strategy would target those watersheds with impaired waters or waters not attaining designated beneficial uses, and the treatments should trend toward meeting identified plan desired conditions. Indirect consequences of these treatments include: reduction of hazardous fuels around communities; restoration of watershed

conditions, including soil and riparian conditions; improvement of water quality and aquatic habitat; and contribution to economic stability by creating jobs.

Alternative B

Recommendation of wilderness in alternative B could indirectly impact water quality in connected waters. The 1,179-acre Davey's recommended wilderness is in the Lower Fossil Creek 6th code watershed (Fossil Creek–Lower Verde River 5th code) that is connected to Fossil Creek. Wildfires in this recommended wilderness would likely be managed for resource objectives if possible. Wildfires managed to meet resource objectives in fire-adapted PNVTs in this wilderness would reduce PNVT departure and lower the risk of uncharacteristic fire. There would be an increased likelihood of restoring the natural fire return interval in this area. This would indirectly lower the risk of sediment delivery into Fossil Creek. Short-term exceedances of water quality would be expected; however, the risk and magnitude of this effect would be less than what could result from uncharacteristic fire if fires were suppressed and fuel loads from vegetation continued to increase.

Another effect is that there would be a moderate to high likelihood that wildfires would be suppressed in the Walker Mountain recommended wilderness. Wildfires would burn until they are suppressed. Where uncharacteristic fuel loads occur and burn, portions of upland and riparian PNVTs would likely burn under conditions associated with uncharacteristic fire, and riparian structure and function would be reduced. Where effectively suppressed, moderate to high PNVT departures in the recommended wilderness would be maintained; and the risk of uncharacteristic fire would increase. Suppressing fires would likely not result in 100 percent suppression of all acres in recommended wilderness, leading to a portion that would likely burn under conditions of uncharacteristic fire or high severity. Portions where fire suppression would not occur could burn under conditions of high severity and indirectly increase the risk of sediment delivery into the connected waters. A much higher risk and magnitude of short-term exceedances of water quality would be expected in those areas.

Alternative C

Recommendation of wilderness in alternative C would indirectly impact water quality in connected waters of six recommended wilderness areas: Barbershop, East Clear Creek, Railroad Draw, Davey's, Cimarron-Boulder, and Hackberry. These recommended wilderness areas lie within the West Clear Creek and Beaver Creek 5th code watersheds and the following 6th code watersheds: Middle Lower West Clear Creek, Upper Wet Beaver, Walker Creek, and Wet Beaver Creek. The connected drainages are: East Clear Creek, Barbershop Canyon, Yeager Canyon, Fossil Creek, and the Verde River. Wildfires in these recommended wilderness areas would likely be managed for resource objectives if possible and, consequently, they would reduce departures in fire-adapted PNVTs and lower the risk of uncharacteristic fire. There would be an increased likelihood of restoring the natural fire return interval in these localized areas. This would indirectly lower the risk of sediment delivery into the connected waters. Short-term exceedances of water quality would be expected as a result of wildfires with resource objectives, but this would result in a much lower risk and magnitude than fire suppression.

There would be a moderate to high likelihood that wildfires would be suppressed in the Black Mountain, Cedar Bench, Walker Mountain, and Deadwood Draw recommended wilderness areas. Wildfires would burn until they are suppressed. Where uncharacteristic fuel loads occur and burn,

portions of upland and riparian PNVTs would likely burn under conditions associated with uncharacteristic fire, and riparian structure and function would be reduced. Where effectively suppressed, moderate to high PNVT departures in the recommended wilderness areas would be maintained; and the risk of uncharacteristic fire would increase. This would indirectly increase the risk of losing riparian structure and function and sediment delivery into connected waters in future fires. Suppressing fires would likely not result in 100 percent suppression of all acres in recommended wilderness, leading to a portion that would likely burn under conditions of uncharacteristic fire or high severity. Portions where fire suppression would not occur could burn under conditions of high severity and would indirectly increase the risk of sediment delivery into the connected waters. A much higher risk and magnitude of short-term exceedances of water quality would be expected in those areas.

About 2.5 miles of roads that connect to perennial streams in the Lower Clear Creek 5th HUC watershed could potentially be closed under separate project level decisions. These are in the Anderson Mesa WHMA. Because the location of the closed roads is unknown, it cannot be determined whether alternative C would result in reduced sediment delivery in this watershed or not. Alternative C recommends a 1 mile per square mile road density in this WHMA. Unlike the other alternatives, the density of roads designated as open could increase only slightly in the future due to this recommended density. The current density is approximately 1.1 miles per square mile. Sediment delivery would remain approximately the same in this alternative because of the recommended road density and because the motor vehicle use map is updated annually; whereas sediment delivery could potentially increase in alternatives A, B, and D depending on what roads might be redesignated as open.

Riparian Resources

Riparian resources on the Coconino NF include riparian forests, wetlands/cienegas, and springs. These areas are characterized by vegetation that is adapted to flooding as a natural disturbance and is highly associated with water.

There are four riparian forest PNVTs on the Coconino NF: Cottonwood Willow, Montane Willow, Mixed Broadleaf, and Gallery Coniferous. The Wetland Cienega PNVT encompasses discrete bodies of water such as wetlands, cienegas, lakes, and reservoirs and their associated vegetation composition and structure. Wetlands may be saturated with water year round, seasonally, or on a less than annual basis. Cienegas are linear streams associated with spring recharge that are primarily herbaceous and do not have woody vegetation (as the riparian forest types do). The dominant vegetation in Wetland Cienega PNVT on the Coconino NF is hydrophytes, or “water loving” plants (see “Affected Environment” for further description). None of these vegetation types are fire adapted, but wetlands are occasionally burned to maintain open water for waterfowl.

Springs can be a sub-PNVT feature of wetlands, cienegas, and some streams. They are pools of water, running water, or a combination of both, and generally support lush and diverse aquatic or riparian vegetation, as well as a variety of invertebrates. There are several types of springs on the forest, including hanging gardens and seeps. Hanging gardens refer to the vegetation associated with springs that emerge from cliffs and ledges. Seeps are low volume springs typically supporting herbaceous vegetation and forming a small puddle or pool.

Riparian function was evaluated from onsite assessments and, at a finer scale than midscale vegetation analysis used for other PNVTs, integrates the contributions to ecosystem resiliency and threats for soil, water, and vegetation interactions. This section describes the departure and trend of each of the riparian forest PNVTs, the Wetlands Cienega PNVT, and springs, in terms of their riparian function, which is tied to properly functioning condition. Comparatively, there is not as much information available for cienegas and springs as other topics discussed in this section.

PFC was evaluated using the Riparian Area Survey and Evaluation System or RASES (USDA Forest Service 1989) which is a site-specific riparian survey method. RASES is used to map and evaluate riparian reaches, including the type and location of stream riparian areas; in this case, riparian forest PNVTs. It measures vegetation, soil, stream channel, and water characteristic and delineates riparian type. Another consideration in assigning PFC classes to riparian reaches was the data collected onsite. The Coconino NF riparian PNVT GIS layer has been updated using RASES data and more recent Regional Riparian Mapping Project (RMAP) mapping. This resulted in more accurate mapping and the consequent identification of additional cienegas in the Wetland Cienega PNVT, additional acres of Montane Willow Riparian PNVT, and the additional Gallery Coniferous Riparian Forest, a PNVT not previously identified in the "Ecological Sustainability Report" (USDA Forest Service 2009). RASES uses a narrower geographical extent than RMAP and, therefore, interpolating these two data sources requires the assumption that the larger, regionally mapped area is proportionally in the same condition as the RASES onsite evaluation. Little riparian condition information, however, has been collected for Gallery Coniferous Riparian Forest and the cienegas. Given that Gallery Coniferous Riparian Forest is largely inaccessible, as are some of the cienegas, it was assumed that the inaccessible portions are not impacted enough by human activities, including permitted livestock grazing, to impair their functional characteristics.

Affected Environment – Riparian Forests

All Riparian Forest Types

There are about 778 miles of riparian forest areas associated with streams within the Coconino NF administrative boundary, of which 588 miles are managed by the Forest Service (USDA Forest Service 1989). Forty-four percent of the riparian forest types (excluding Gallery Coniferous because of lack of data) are in PFC, which means that adequate vegetation, landforms, or large woody debris is present to dissipate stream energy associated with high flows; filter sediment, capture bedload, and aid in floodplain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks; develop diverse ponding and channel characteristics to provide habitat for fish, waterfowl and other uses, and support greater biodiversity. When riparian forests are properly functioning, vegetation composition, structure and function is diverse, productive, and provides habitat for those species that rely on them for their survival.

Areas in PFC are presumed resilient to a range of natural disturbances and provide a variety of conditions that contribute to ecological diversity. The conditions evaluated to determine PFC, when they are present to the extent possible at a given site, are assumed to provide fully functional riparian area habitat for those plant and animal species that rely on it for their survival. There is a diverse composition and distribution of plants and the quality of the habitat supports the native species that rely on it.

Twenty-three percent of the riparian forest areas (excluding Gallery Coniferous) are classified as functioning-at-risk, which means that they are in functional condition, but they have an existing soil, water, or vegetation attribute that is evaluated to determine PFC to make them susceptible to degradation. Areas that are functioning-at-risk are less resilient to threats to their vegetation types. However, riparian areas in functioning-at-risk condition still provide enough diverse ecological conditions (including plants) to support wildlife, fish, and rare plants, and have the capability to improve plant and soil composition, structure, and function.

Six percent of the riparian forest areas (excluding Gallery Coniferous) are classified as nonfunctional. This means they lack adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and, thus, are not reducing erosion or improving water quality. Riparian areas that are nonfunctional have the lowest level of plant diversity, are most vulnerable to threats, and comparatively, contribute the least toward ecological sustainability compared to PFC and functioning-at-risk classes.

The remaining 26 percent of stream riparian areas lack information and, therefore, are in unknown condition, because they are too remote to provide onsite evaluation. However, inaccessibility also means there is probably low impact from human disturbances and threats. There are no PFC data for Gallery Coniferous Riparian Forest, but it is likely at PFC because it is largely inaccessible to humans and livestock.

Methods used to derive departures for riparian forests PNVTs and the Wetland Cienega PNVT are described in appendix C.

Threats common to all riparian forest PNVTs that are within Forest Service control are:

- **Uncharacteristic fire** in watersheds of fire-adapted PNVTs. The increased risk of uncharacteristic fire results from past fire exclusion which allowed forest conditions to become denser and more prone to fires that burn into the tree canopy, rather than predominantly in the understory. Uncharacteristic fires can result in high burn severity, accelerated erosion and excessive sedimentation to connected stream courses, excessive or increased waterflow, and uncharacteristic flooding, which can result in scouring of the stream channel and the removal of vegetation and coarse woody debris in the riparian PNVTs. Uncharacteristic fire can also spread from adjacent fire-adapted PNVTs into riparian PNVTs, especially during drought. These conditions result in loss of vegetation and drying of the riparian area, and it can facilitate establishment or spread of invasive nonnative vegetation.
- **Evapotranspiration rates** are increased by overly dense forests drawing more water, resulting in reduced water yield and streamflow to downstream riparian forests that depend on that water. The risk of uncharacteristic fire of adjacent fire-adapted PNVTs is evaluated in the “Vegetation” and Fire section of this chapter.
- **Dispersed recreation** has the potential to disturb riparian vegetation and bank stability. In doing so, it creates areas of bare soil that leads to erosion and sedimentation into streams and reduces riparian function and water quality.

The threats listed above are discussed under environmental consequences for riparian PNVTs to the extent that the Forest Service can influence them.

All of the stream riparian areas classified as functioning-at-risk are in Cottonwood Willow, Mixed Broadleaf Deciduous, and Montane Willow Riparian Forest PNVTs, and all of the nonfunctional stream miles are in Cottonwood Willow and Montane Willow Riparian Forest PNVTs. All of the riparian forest PNVTs are predicted to either retain their current low departures or move slowly toward reference condition under current management, with the exception of particular 5th code HUC watersheds. (See table 4.)

The 5th code HUCs of most concern are Upper Clear Creek, Beaver Creek, Oak Creek, and portions of Fossil Creek-Lower Verde River.

The perennial streams of most concern are portions of East Clear Creek and its tributaries, Beaver Creek, Oak Creek, Fossil Creek, Dry Beaver Creek, Red Tank Draw, Walker Creek, and the Verde River.

The Upper Clear Creek HUC is at risk because of dispersed recreation, legacy of improperly located and poorly maintained roads (especially user-created roads), legacy off-highway vehicle use, and ungulate herbivory, which is under control of the Arizona Game and Fish Department. This HUC includes East Clear Creek, its tributaries and intermittent stream courses with riparian habitat. The areas of most concern are those that are accessible to human activities.

The accessible areas of the Beaver Creek 5th code HUC are at risk because of legacy off-highway vehicle use, dispersed recreation, legacy of improperly located and poorly maintained roads (especially user-created roads), and legacy grazing. This HUC includes Beaver Creek, Dry Beaver Creek, Red Tank Draw, Walker Creek, and some intermittent stream courses with riparian vegetation.

The accessible areas of the Oak Creek 5th code HUC are threatened by dispersed recreation and a legacy of improperly located and poorly maintained roads (especially user-created roads and social trails). The lower portion of Oak Creek is affected by legacy grazing issues and legacy off-highway vehicle use. This HUC includes Oak Creek, Spring Creek, and intermittent stream courses with riparian vegetation. Water quality in Oak Creek is also affected by *E. coli* from septic systems associated with private development, wildlife, and swimming. Only swimming in localized areas is in Forest Service control. Legacy road, off-highway vehicle use, and grazing issues refer to vegetation removal, soil compaction, soil loss, and erosion associated with past grazing practices; with areas that were open to off-highway vehicles prior to implementation of the Travel Management Rule; and issues with past road maintenance. Although some of the causes of the departures have been addressed, particularly with the Travel Management Rule, the sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas heal.

Fossil-Lower Verde River HUC is at risk of high amounts of dispersed recreation, legacy off-highway vehicle, and poorly located and maintained roads (especially user-created roads).

Table 4. Riparian forest condition, departure, and trend on forest administrated land by PNVT

PNVT	Acres on the Forest	Percent of Forest	PFC (Miles)[1]	Functioning-at-Risk (Miles)	Non-Functioning (Miles)	Unknown (Miles)	Percent of Area Departed from Reference Condition[2]	Riparian Functional Condition Departure[3]	Projected Trend Current Management
Cottonwood Willow Riparian Forest	2,507	0.1%	42.5	35.8	4.7	2.4	49	Moderate	Slowly toward except for portions of the Fossil Creek-Lower Verde River and Oak Creek 5th code HUCs which have a static trend
Mixed Broadleaf Deciduous Riparian Forest	3,612	0.1%	86.5	30.8	0	19.4	26	Low	Majority is slowly toward except Beaver Creek 5th code HUC, which is high/slow trend toward reference.
Montane Willow Riparian Forest	3,829	0.2%	189.7	57.8	15.4	4.5	28	Low	Slowly toward to static except Upper Clear Creek 5th code HUC, which has a high departure and a static trend
Gallery Coniferous Riparian Forest	200	<0.1%	2.5	0	0	Unknown	Unknown	Low	Static

[1] Values are approximate. Note that some segments of riparian PFC mapped were outside of riparian PNVT polygons and, therefore, total miles of 513.9 is less than the overall Forest RASES stream layer of 588 miles. However, values are reliable enough to interpret wide ranges of riparian functional condition departure. Gallery Coniferous Forest reaches are generally located in riparian areas not easily accessible to humans, elk, or permitted livestock and are, therefore, inferred to be without those associated disturbances and likely at PFC and static trend.

[2] Provide this represents the percentage of total known acres not in PFC, including unknown miles.

[3] Riparian and wetland condition is considered highly departed from reference conditions when 66 percent or more of inventoried riparian areas are functioning-at-risk or nonfunctional. Low departure is when less than 33 percent of inventoried riparian areas are functioning-at-risk or nonfunctional. Moderate is between low and high

Cottonwood Willow Riparian Forest

Cottonwood Willow Riparian Forest currently covers about 2,507 acres of the Coconino NF. It is located on the Red Rock Ranger District between 2,500 and 4,300 feet in elevation. It is patchily distributed along the lower elevation and low gradient reaches of perennial streams including the Verde River, Oak Creek, West Clear Creek, Wet Beaver Creek, Dry Beaver Creek, and Fossil Creek as well as other perennial and intermittent streams and tributaries. Much of this PNVT along the Verde River, lower Oak Creek and lower Wet Beaver Creek is either privately owned or managed by Arizona State Parks. In general, riparian vegetation occurs along the stream channel and associated higher stream terraces that support a mix of riparian and upland vegetation, including mesquite and desert willow. Dominant vegetation includes: Fremont cottonwood, willow, ash, box elder, alder and others. Various grasses and forbs are usually present. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs. Flooding is the primary disturbance. The seasonality and the quantity of water in floods are key factors in the germination and establishment of riparian vegetation.

Overall, the riparian functional condition for this PNVT is moderately departed (49 percent) from reference conditions and is slowly trending toward reference conditions. There are localized areas that have a static trend relative to reference conditions (either functioning-at-risk or nonfunctional conditions) as a result of high dispersed recreational impact. These areas include Fossil Creek, most of the Verde River and associated tributaries, and other easily accessible areas of the lower reaches of West Clear Creek, Beaver Creek, Oak Creek, Fossil Creek, and Lower Oak Creek have been the most impacted by the ground disturbance and vegetation removal from high intensity unmanaged recreation. Lower Oak Creek is most impacted by degraded water quality resulting from unmanaged sanitation.

In addition to those threats common to all riparian forest PNVTs, the Cottonwood Willow Riparian Forest PNVT is also impacted by excessive or poorly timed livestock grazing in localized areas, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type.

There are few weed species, but some such as Russian knapweed, yellow starthistle and Malta starthistle, tamarisk, tree of Heaven, and giant reed rank high for invasiveness, so this PNVT is considered moderately departed from reference condition for weeds. Riparian dependent invasive exotic plant species are also anticipated to cause a decline in quality of native species regeneration and potential reduction in instream flows. The projected trend for noxious and/or invasive exotic weeds is away from reference conditions under current management.

Plants such as tamarisk, giant reed, and tree of Heaven will limit and eventually cause a decline in quality of existing vegetation by reducing native cottonwood and willow regeneration potential. Instream flows may be reduced as a result, because these exotic, woody plants draw more water from the water table than native trees (USDA Forest Service 2009). In addition, there have been significant increases in fire intensity and severity in Cottonwood Willow Riparian Forest in the Southwest due to invasive species, primarily tamarisk and Russian olive. Severe fires remove cottonwoods from burn areas and can convert these sites to a nonnative species mix.

Mixed Broadleaf Deciduous Riparian Forest

Mixed Broadleaf Deciduous Riparian Forest covers about 3,612 acres of the Coconino NF. Found between 3,300 and 6,400 feet in elevation, it is patchily distributed across the forest and includes Sycamore Canyon, mid-elevation portions of West Clear Creek, Oak Creek, Beaver Creek, and Fossil Creek, and associated tributaries. It consists of a vegetation mix of riparian woodlands and shrublands with various dominant species, depending on site-specific characteristics. Vegetation can include: Arizona sycamore, thin leaf alder, willow, Arizona cypress, conifers, box elder, narrow leaf or Fremont cottonwoods, velvet ash, and Arizona walnut. It often contains oaks and conifers, including Arizona cypress, from adjacent uplands. This PNVT is not a fire-adapted system, but is susceptible to fire entering from adjoining PNVTs, particularly during drought years. Ponderosa Pine and Dry Mixed Conifer PNVTs are adjacent to this PNVT in numerous locations. Flooding and drought are the primary disturbances.

Overall, Mixed Broadleaf Deciduous has a low departure (26 percent) from reference conditions with a slow trend toward reference conditions. Localized portions of this PNVT in upper reaches of Red Tank Draw, Beaver Creek, Dry Beaver Creek, and Oak Creek have moderate departures (functioning-at-risk) with a static trend. These functioning-at-risk areas include the accessible upper portions of Beaver Creek and Oak Creek, which are at risk because of impacts from high levels of dispersed recreation. Impacts include soil compaction, damage to vegetation, and sanitation issues, particularly from swimming.

In addition to those threats common to all riparian forest PNVTs, Mixed Broadleaf Deciduous Riparian Forest PNVT is also affected by invasive exotic species. This PNVT has few weed species, but some, such as diffuse knapweed, yellow starthistle, and Malta starthistle rank high for invasiveness. Exotic annual grasses, such as red and ripgut brome, are widely dispersed at variable densities and can cause major changes in ecosystem integrity if not controlled. This PNVT has low departure for weeds, but it is projected to move away from reference conditions. Fire occurrence could increase as a result, and the plants of this ecosystem are not adapted to the frequency at which exotic annuals burn (USDA Forest Service 2009). The presence of Himalayan blackberry, a very competitive species, is a relic of past homesteading within this PNVT. Himalayan blackberry reproduces vegetatively and its fruits are spread by humans and wildlife; thus, control is difficult.

Furthermore, Mixed Broadleaf Riparian Forest PNVT is also potentially impacted by excessive or poorly timed livestock grazing, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type.

Montane Willow Riparian Forest:

Montane Willow Riparian Forest is located mainly from 4,700 to 8,600 feet in elevation. It is scattered along perennial streams such as Upper Clear Creek and its tributaries, seasonally intermittent streams, wet meadows, and isolated springs at higher elevations. It covers about 3,829 acres. Trees include Bebb's willow, narrowleaf cottonwood, velvet ash, cherry, box elder, Arizona walnut, and Arizona alder. Dominant shrubs include red osier dogwood, willows, and woods rose. The understory consists of a variety of grass and grasslike species, including sedge, spikerush, and deergrass. Outlying populations of this vegetation type may have unique genetic components. Flooding is the primary disturbance in stream systems. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs.

Montane Willow Riparian Forest has a low departure from reference conditions and is moving toward reference conditions or has a static trend depending on location. There are localized areas of high departures from reference with a static trend. These functioning-at-risk or nonfunctional areas include the Upper Clear Creek 5th HUC watershed (which contains East Clear Creek and most of its tributaries) and the Fern Mountain Botanical Area. These departures from reference are primarily due to vegetative impacts from elk, managed grazing, nonpoint sources of sediment from roads, and water diversions to private land (Fern Mountain).

In addition to those threats common to all riparian forest PNVTs, Montane Willow Riparian Forest PNVT also faces a threat of excessive or poorly timed livestock grazing, which can remove excessive amounts of vegetation, contribute to a loss of soil function, and alter vegetation structure and composition within the vegetation type. Additionally, excessive wildlife herbivory occurs at levels that prevent attainment of desired conditions in this PNVT. Herbivory at this level can substantially modify the structure and composition of herbaceous and woody understory and negatively influence ecosystem processes, such as properly functioning soil. The Forest Service is not responsible for managing wildlife populations.

Furthermore, this PNVT faces a moderate threat of invasive exotic plant species by the introduction of weeds from those adjacent PNVTs that contain higher abundance and diversity of weeds. Invasive exotic plant species are a threat because riparian dependent invasive weeds would limit and eventually cause a decline in quality of native species regeneration potential.

Gallery Coniferous Riparian Forest

Gallery Coniferous Riparian Forest covers about 200 acres of the Coconino NF. This “canyon bottom forest” is located in areas such as Jack’s Canyon (north of State Highway 87) on the Mogollon Rim Ranger District and the upper end of the West Fork of Oak Creek. Dominant tree species typically include: subalpine fir, Engelmann spruce, Douglas-fir, quaking aspen, narrowleaf cottonwood, bigtooth maple; box elder, alder, willows, Gambel oak, ponderosa pine, and Rocky Mountain juniper. Dominant shrubs include willows and woods rose. The understory consists of a variety of grass and grasslike species including sedge, Baltic rush, spikerush, and deergrass. This PNVT experiences periodic flooding and high water tables. This PNVT is not a fire-adapted system; instead, fire enters from adjoining PNVTs.

All of this PNVT for which there is available data is in properly functioning condition with a low departure and a static trend. The remainder of the PNVT is assumed to be in properly functioning condition with a similar departure, because most reaches are inaccessible to humans and animals and, thus, it should have relatively low disturbance compared to the ones for which data are available. Because of the inaccessibility, few management activities are expected to occur under current management, resulting in a static trend.

This PNVT has those threats common to all riparian forest PNVTs.

Environmental Consequences – Riparian Forests

All Riparian Forest Types

Overall, implementing plan direction in alternatives B, C, and D have about the same, and the greatest, potential to improve resources and trend toward desired conditions.

This is based on predicted implementation of plan components, including objectives. The least potential for improvement to riparian resources is through implementation of plan direction in alternative A. The primary differences between plan direction in alternative A versus alternatives B, C, and D are additional plan objectives that prescribe realistic riparian resource restoration projects for streams. Examples of these include upland soil and watershed improvement projects that would improve riparian functional condition and projects to naturalize and decommission roads that would reduce riparian habitat fragmentation, alteration of riparian habitats, erosion, and sediment delivery into streams. (See table 5.)

Table 5. Summary of riparian function departure values and trends

PNVT	Forest Acres	Percent of Forest	Existing Riparian Function Departure Percent/Trend	Alt. A. Riparian Function Departure Percent/Trend	Alts. B, D Riparian Function Departure Percent/Trend	Alt. C Riparian Function Departure Percent/Trend
Cottonwood Willow Riparian Forest	2,507	0.1	Moderate (49%)/ Slowly Toward	Moderate (46%)/ Slowly Toward		
Middle Fossil Creek			Moderate/ Static	Moderate/ Static	Low/ Toward	
Lower Oak Creek			Moderate/ Static	Moderate/ Static	Moderate/ Toward	
Mixed Broadleaf Riparian Forest	3,612	0.1	Low (26%)/ Slowly Toward	Low (23%)/ Slowly Toward		
Beaver Creek 5th code HUC			High/ Slowly Toward	High/ Slowly Toward	Moderate/ Toward	
Montane Willow Riparian Forest	3,829	0.2	Low (28%)/ Static to Slowly Toward	Low (25%)/ Static to Slowly Toward		
Upper Clear Creek 5th code HUC			High/ Static	High/ Toward	Moderate/ Toward	
Gallery Coniferous Riparian Forest	200	<0.1	Low/ Static	Low/ Static		

*Departure was assessed as low (0 to 33 percent), moderate (34 to 66 percent), or high (greater than 66 percent).

Common to All Alternatives

Current management on properly functioning condition riparian forest areas would maintain that riparian condition (resulting in a static trend) because most of these sites are remote enough to be unaffected by human disturbance and/or would be protected by best management practices and other mitigations.

For all alternatives, best management practices used in trail maintenance and new trail construction would effectively reduce sediment and improve watershed conditions. In general, areas currently in properly functioning condition are expected to remain in that condition based on implementation of best management practices for managing roads, timber, and grazing management in all alternatives. Some of those areas are inaccessible to grazing or recreation, or they are areas in which grazing has been removed over the past 10 years. Riparian areas with a functioning-at-risk rating would show an upward trend where best management practices and other mitigation efforts are effectively protecting riparian values. Areas on the Coconino NF where permitted livestock grazing has been removed (e.g., the Verde River) have improved and would continue to do so. Progress toward reference conditions would be slowed in areas of relatively high elk grazing in Montane Willow Riparian Forest or in localized areas of high dispersed recreation (e.g., Fossil Creek).

Riparian conditions are expected to improve with implementation of the Coconino NF Travel Management Decision (USDA Forest Service 2011m), because it would reduce associated motorized recreational impacts in riparian areas such as accelerated soil erosion, soil compaction, and vegetation loss. These roads may continue to exist for administrative purposes, but would have less traffic that detaches soil particles and increases sedimentation. In addition, off-road motor vehicle use would be limited, which could also result in reduced sedimentation.

The “Verde Wild and Scenic River Comprehensive River Management Plan” states that vegetation recovery, development, and maintenance of riparian vegetation characteristics necessary for riparian-dependent species shall not be hindered by forest management activities (USDA Forest Service 2004b). The majority of Cottonwood Willow Riparian Forest on the Coconino NF is found along the Verde River, of which the southern segments are designated as a wild and scenic river. Vegetation management direction only includes inventory, mapping, and development of an integrated pest management plan for invasive plant species.

The ways in which these alternatives address threats to water quality and sedimentation from recreation impacts in riparian areas, especially Oak Creek, are discussed in the “Recreation” section in this chapter. Effects to Fossil Creek would be addressed through the current development of the “Fossil Creek Comprehensive River Management Plan,” a process which is occurring on a parallel timeline to the forest plan revision process.

Gallery Coniferous Riparian Forest is currently at a low departure level for vegetation with a static trend. The location and inaccessibility of most of this vegetation type prevents active management, other than use of fire, more so than plan direction in any of the alternatives. Therefore, in the absence of an uncharacteristic wildfire, it is expected to remain at the current departure and trend under all alternatives, and there exists no known difference in expected outcomes among alternatives because of the inaccessibility of and lack of data for the Gallery Coniferous Riparian Forest PNVT.

All alternatives include measures to prevent, control, and eradicate priority infestations of invasive exotic weeds, and they are expected to have the same effects on the management of invasive weeds.

Alternative A

Continuing implementation of alternative A would slowly move a small percentage of riparian areas to the desired condition of properly functioning, resilient riparian areas. Under alternative

A, management of riparian resources would continue in accordance with direction in the 1987 plan (as amended). Direction under alternative A, generally does not distinguish between the four riparian forest PNVTs.

Management emphasis of the 1987 plan has outdated language and lacks direction for how to accomplish riparian recovery. Implementation goals and objectives within the 1987 plan—to have 80 percent of riparian recovery by the year 2030 and the remaining 20 percent would be significantly improved—are not realistic under current and expected future budgets. Over the last 10 years, only about 75 to 150 acres (or 3 percent of total riparian acreage) were improved with structural and nonstructural treatments (e.g., fencing or removal of grazing, respectively). This has resulted in moderate to low departure and, overall, a trend that is likely to remain static or slowly move toward desired conditions.

Continuing to implement direction in the 1987 plan (alternative A) for treatments, including riparian treatments and road removal and upland watershed treatments, would continue to occur on an opportunity basis and improve riparian function or promote riparian habitat connectivity and/or reduce riparian fragmentation commensurate with funding and workforce associated with the opportunity. Because of these opportunities to treat riparian areas and to naturalize or decommission roads, riparian vegetation would improve locally along streambanks, aiding in the ability to filter sediments; capture bedload and aid flood plain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; and dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality. This would be sufficient to allow a slow trend toward desired conditions at the landscape scale.

In addition, fire exclusion in PNVTs that adjoin these riparian forest types has facilitated conifer encroachment (in Mixed Broadleaf and Montane Willow Riparian Forests), which is shading out riparian deciduous trees and shrubs and, thereby, increasing the risk for uncharacteristic fire in these PNVTs. Uncharacteristic wildfire would kill riparian vegetation, facilitate establishment of invasive exotic plants, and dry riparian areas. Continuing implementation of alternative A would slowly move a small percentage of riparian areas to the desired condition of properly functioning, resilient riparian areas, but it would not be sufficient to address threats that affect the PNVT on a landscape scale.

Riparian condition and nutrient cycling function are expected to improve with the forestwide allowable use guidelines for livestock grazing (new page 66-1 in the 1987 plan). These guidelines are intended to be used when site-specific information is not available and provide guidance, so there is sufficient vegetative ground cover to maintain soil productivity. Projected future litter and vegetation conditions (nutrient cycling function) should improve and approach historic levels under the 1987 plan grazing guidelines as long as allowable use levels in the plan are met.

In riparian PNVTs, the Riparian and Open Waters Management Area (MA 12) provides the primary direction for managing and protecting riparian features and functions. While most of the direction in this section supports properly functioning riparian forests, riparian improvement is hindered by standards and guidelines in MA 12 that prohibit precommercial thinning in riparian areas or areas with riparian characteristics. Precommercial thinning is a tool used to remove young conifers, whose encroachment increases the risk of uncharacteristic fire in these PNVTs and moves understory conditions away from desired conditions.

The Sedona-Oak Creek area (Amendment 12 of the 1987 plan, or MAs 21 to 29) contains riparian forest direction as well. While management areas such as Oak Creek (MA 14) and Lower Oak Creek (MA 23) address threats to these PNVTs and have some direction to restrict activities that negatively impact water resources, others such as Savannah (MA 27) do not provide any direction for riparian resources. Management areas outside of the Sedona-Oak Creek area have direction that could hinder progress toward desired conditions for this PNVT, because it would prevent successful active restoration. Given this plan direction, current conditions would likely persist, resulting in natural succession patterns, barring major droughts or uncharacteristic fire.

Under alternative A, plan direction includes fire suppression objectives and language that makes it difficult to implement the reintroduction of fire as a natural disturbance across a large part of the forest. As a result, the increase in risk of uncharacteristic fire to adjacent riparian vegetation types would correspondingly increase.

A significant portion of Cottonwood Willow Riparian Forest would benefit from clear plan direction, but alternative A would not provide adequate direction to manage the PNVT as a whole. Functioning-at-risk areas along the Verde River (Cottonwood Willow Riparian Forest PNVT) where cattle have been removed (almost all of Coconino NF along the Verde River) show an upward trend (USDA Forest Service 2007d) and are expected to improve to properly functioning condition where excluded from livestock grazing. Nonfunctional areas should improve over time if plan grazing utilization guidelines are followed. If grazing exceeds plan guidelines, riparian conditions would remain static.

For Mixed Broadleaf Deciduous Riparian Forest, the majority of this PNVT is found in wilderness (MA 1) and within the Amendment 12 area. These management areas protect this resource because they minimize or address the major threats to the vegetation type, except for those segments of the vegetation type that are found in uplands of the associated watershed or outside of Forest Service control. This means that while direct impacts to the vegetation type would be minimized, there would be little direction to manage indirect effects from activities in the surrounding watershed that could be sources of sedimentation.

Under alternative A, fire-adapted PNVTs such as Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen would not move vegetative conditions as much toward desired conditions as alternatives B, C, and D. Fire return intervals for Ponderosa Pine and Mixed Conifer with Frequent Fire would also continue to worsen, relative to other alternatives, and increase the risk of uncharacteristic fire that could negatively impact adjacent riparian PNVTs.

Alternatives B, C, and D

Alternatives B, C, and D would move the condition of riparian areas faster toward the desired condition of properly functioning, resilient riparian areas than alternative A because plan objectives are more realistic. There are no measurable differences in plan objectives for riparian improvement among alternatives B, C, and D. As a result, alternatives B and D would move riparian condition and function toward desired conditions at about the same rate.

The primary differences between plan direction in alternative A versus alternatives B, C, and D are the updated and more accurately defined desired conditions to include managing for fire, vegetative diversity, and riparian function and a guideline for more flexible width of the streamside management zone depending on site-specific conditions protecting water quality and the functioning of riparian forests. Compared to alternative A, implementation of alternatives B,

C, and D plan direction and objectives could lead to more stream and upland soil and watershed improvement projects that would result in improved riparian functional condition and more road naturalization and decommissioning. Desired conditions promote reducing riparian fragmentation and improve habitat connectivity.

Reductions in the modification of riparian areas, erosion, and sediment delivery into streams would collectively decrease. Road systems can degrade riparian function when located in riparian streamside management zones. Implementing the plan direction in alternatives B, C, and D would naturalize or decommission some roads located in riparian areas and, consequently, it would improve riparian area function that would not occur under alternative A direction. As a result of plan language in alternatives B, C, and D, riparian function would be improved.

Alternatives B, C, and D have objectives to directly treat riparian areas, as well as to remove roads and improve upland watershed condition. Therefore, some positive trend is expected along with reducing riparian fragmentation and the threat of excessive sedimentation. Implementing plan direction for soil and water resource improvement projects prescribed in alternatives B, C, and D would result in improved soil condition and reduce the threat of high-severity fires that might threaten riparian function and water quality. This clearer direction on how to actively restore functioning-at-risk and nonfunctional riparian types is more likely to result in restoring more of these areas to properly functioning condition than would occur under alternative A.

Currently, the forest does not permit livestock grazing along the Verde River. This restriction has resulted in improved riparian conditions along the river during the last 10 years, and this is common to all alternatives. Many other allotments have also reduced occurrence of livestock grazing in perennial streams to hardened areas or to times when grazing pressure does not adversely affect riparian area condition. To meet desired conditions in alternatives B, C, and D, it is expected that these restrictions would continue, or if drought conditions or other threats cumulatively impact the riparian conditions, the restrictions could be expanded.

For stream systems, alternatives B, C, and D could structurally treat between 200 and 500 acres every 10 years. The midpoint acreage is 350, which is similar to alternative A and would restore about 10 percent of departed riparian forest PNVTs. If the upper estimate of the objective is realized, then alternatives B, C, and D would improve overall function and resiliency through riparian treatment more than alternative A. Riparian vegetation would improve along streambanks aiding in the ability to filter sediments; capture bedload and aid flood plain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; and dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality.

Alternative C restricts grazing in research natural areas. However, this restriction does little to change the effects to current and proposed research natural areas among alternatives because little to no grazing occurs in these areas under current management.

Alternative C also recommends that portions of the forest are not suitable for recreational shooting. This change in suitability would not impact riparian function.

Desired conditions for all riparian forests states, “flooding is a primary disturbance, not fire. Fire is a disturbance from incursions originating in adjacent systems and may creep into riparian corridors. Fire in riparian areas is influenced by the fire regime condition class in adjacent vegetation types…” (FW-Veg-Rip-All-DC-10). According to the “Vegetation and Fire” analysis

(see "Environmental Consequences" in the "Vegetation and Fire" section) under alternatives B, C, and D, Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Aspen, and those PNVTs adjacent to riparian forests (and more likely to introduce fire to riparian forest PNVTs), would move toward desired conditions and closer to their natural fire regimes as a result of plan objectives and the removal of other restrictions to fire management that would be present under alternative A. As a result, the landscape-scale risk of uncharacteristic fire to riparian forest PNVTs would be less under these alternatives than under alternative A.

For Cottonwood Willow, desired conditions for alternatives B, C, and D for this PNVT state:

> *"Associated higher stream terraces support a mix of riparian and upland vegetation, including mesquite and desert willow…Flood plains tend to have higher surface litter and diversity of species, more protective ground cover, and greater vegetation productivity (i.e., biomass) than terraces. Consequently, flood plains have greater ability to resist erosion and recycle nutrients."*

If management activities under these alternatives were to occur at current levels, it would then be expected that the departure would remain moderate and the trend would be slowly toward desired conditions. Management activities that would occur in this PNVT beyond levels assumed for this analysis, however, would help make additional progress toward stated desired conditions.

Mixed Broadleaf Deciduous Riparian Forest is currently at a low level of vegetative departure with a trend toward reference conditions. Desired conditions under alternative B for this PNVT include the following language:

> *"Generally, both terraces and flood plains have high amounts of protective litter and plant cover and are not compacted. Consequently, terraces and flood plains are able to resist erosion and recycle nutrients."*

Under alternatives B, C, and D, the departure would be expected to remain low and have a trend that would be slowly toward desired conditions. Management activities that would occur in this PNVT beyond levels assumed for this analysis, however, would help make additional progress toward stated desired conditions.

Montane Willow Riparian Forest is currently at a low level of vegetative departure with a trend of static to slowly toward desired conditions. Desired conditions include that, "soils have high amounts of litter and plant cover, and a spongy, moist surface in terraces and wet meadows. Such desired conditions would support the maintenance and improvement of this PNVT.

With respect to livestock grazing, alternatives B, C, and D provide desired conditions that riparian areas are rarely impacted negatively by livestock, and supporting guidelines focus on management of livestock grazing that provides for retention of desired plan species and ensures plant recovery. Guidelines also direct that salt and other supplements, as well as range improvements be placed in locations where riparian areas and other sensitive locations would not be affected by trampling. These alternatives also call for functioning watersheds, with quantities of water in amounts and during times necessary to support vegetation, wildlife, and communities that depend on these resources. Desired conditions and guidelines also direct that new and existing instream water rights are maintained or procured to ensure that enough water is guaranteed to provide for habitat needs, as well as other needs on the forest over the long term.

Alternative B

Recommended wilderness in alternative B would have minor and localized impacts on riparian PNVTs. The 1,179-acre Davey's recommended wilderness includes 30 acres (1.1 percent of Cottonwood Willow Riparian Forest). Wildfires in this recommended wilderness would likely be managed for resource objectives. Cottonwood Willow Riparian Forest would be protected through guidance in the proposed revised plan to maintain a streamside management zone, and few direct impacts would be anticipated. Some fire creep into the riparian area could occur; however, it is expected to be minor in extent. Since riparian PNVTs are not fire adapted, riparian structure and function could be reduced in areas where fire creep occurs. Overall, wildfires managed to meet resource objectives in Davey's recommended wilderness would reduce the departure of fire-adapted PNVTs and lower the risk of uncharacteristic fire. It would also increase the likelihood of restoring the natural fire return interval in this localized area. This would indirectly lower the risk of sediment delivery into connected waters associated with this riparian PNVT. Only 1.1 percent of Cottonwood Willow Riparian Forest would be located in recommended wilderness areas where wildfires with resource objectives would be used. This could have localized effects; however, it would not affect the sustainability of this PNVT at the forest level.

There would be a moderate to high likelihood that wildfires would be suppressed in the Walker Mountain recommended wilderness, which contains 26 acres of riparian habitat (19 acres in Mixed Broadleaf Deciduous Forest and 7 acres in Cottonwood Willow Riparian Forest). Wildfires would burn until they are suppressed. Where uncharacteristic fuel loads occur and burn, portions of upland and riparian PNVTs would likely burn under conditions associated with uncharacteristic fire, and riparian structure and function would be reduced. Where effectively suppressed, the moderate to high PNVT departures in the recommended wilderness would be maintained; and the risk of uncharacteristic fire would increase. Suppressing fires would likely not result in 100 percent suppression of all acres in wilderness, leading to a portion that would likely burn under conditions of uncharacteristic fire or high severity. Portions where fire suppression would not occur could burn under conditions of high severity and indirectly increase the risk of sediment delivery into the connected waters. A much higher risk and magnitude of short-term exceedances of water quality would be expected in those areas. However, because only 0.2 percent of riparian forest PNVTs would be located in recommended wilderness areas where wildfires have a moderate to high likelihood of being suppressed, the sustainability of riparian PNVTs would not be affected even though there could be localized effects.

Alternative C

Recommended wilderness in alternative C would have localized impacts on riparian forest PNVTs but would not affect the sustainability of the PNVTs at the forest level. There are 948 acres of riparian habitat (9.5 percent of riparian forest PNVTs) associated with recommended wilderness areas in which wildfires have a low likelihood of being suppressed. Six recommended wilderness areas (Barbershop, East Clear Creek, Railroad Draw, Davey's, Cimarron-Boulder, and Hackberry) include Cottonwood Willow Riparian Forest (15.4 percent of PNVT acres), Mixed Broadleaf Deciduous Forest (3.6 percent of PNVT acres), and Montane Willow Riparian Forest (11.3 percent of PNVT acres). Wildfires in these recommended wilderness areas would likely be managed to meet resource objectives if possible. Riparian PNVTs would be protected through guidance in the proposed revised plan to maintain a streamside management zone, and few direct impacts would be anticipated. Some fire creep into the riparian area would likely occur; however,

it is expected to be minor in extent. Since riparian PNVTs are not fire adapted, riparian structure and function could be reduced in areas where fire creep occurs. Overall, wildfires managed to meet resource objectives in fire adapted PNVTs in these wilderness areas would reduce PNVT departures and lower the risk of uncharacteristic fire. This would indirectly lower the risk of sediment delivery into connected waters associated with these riparian PNVTs. Only 9.5 percent of forest riparian PNVTs would be located in recommended wilderness areas where wildfires would be managed to be meet resource objectives. This could have localized effects yet would not affect the sustainability of riparian PNVTs at the forest level.

There would be a moderate to high likelihood that wildfires would be suppressed in the Black Mountain, Cedar Bench, Walker Mountain, and Deadwood Draw recommended wilderness areas. These recommended wilderness areas collectively contain 232 acres of riparian habitat. There are 199 acres (5.5 percent) in Mixed Broadleaf Deciduous Forest, 24 acres (1 percent) in Cottonwood Willow Riparian Forest, and 9 acres (0.9 percent) in Montane Willow Riparian Forest. Wildfires would burn until they are suppressed. Where uncharacteristic fuel loads occur and burn, portions of upland and riparian PNVTs would likely burn under conditions associated with uncharacteristic fire, and riparian structure and function would be reduced. Where effectively suppressed, the moderate to high PNVT departure in the recommended wilderness would be maintained; and the risk of uncharacteristic fire would increase. Suppressing fires, however, would likely not result in 100 percent suppression of all acres in wilderness, leading to a portion that would likely burn under conditions of uncharacteristic fire or high severity. Portions where fire suppression would not occur could burn under conditions of high severity and indirectly increase the risk of sediment delivery into the connected waters. A much higher risk and magnitude of short-term exceedances of water quality would be expected in those areas. However because only 2.3 percent of riparian forest PNVTs would be located in recommended wilderness areas where unplanned natural ignitions have a moderate to high likelihood of being suppressed, the sustainability of riparian PNVTs as a whole would not be affected even though there could be localized effects.

Alternative C restricts grazing in research natural areas. However, this restriction does little to change the effects to current and proposed research natural areas among alternatives because little to no grazing occurs in these areas under current management.

Alternative C also recommends that portions of the forest are not suitable for recreational shooting. Shooting is not a ground-disturbing activity and would not impact riparian function.

Alternative D

In contrast to the other alternatives, mechanized recreation on designated trails in botanical and geological areas is allowed (i.e., is considered suitable) under alternative D as long as the use does not conflict with the purpose of the area. It would also be possible to develop future trails, where appropriate. Mechanized recreation on designated trails would not affect riparian condition at the landscape level, because there are few acres of riparian PNVTs within these areas. There could be localized effects which could include soil compaction, accelerated erosion, and vegetation loss. Additionally, it is unlikely trails would be designated within streamside management zones, and best management practices would be followed under all alternatives. Therefore, it is unlikely that allowing mechanized recreation on designated trails in botanical and geological areas would result in different effects to riparian resources at the landscape level as compared to alternatives B and C. Alternative D could result in more localized effects than

alternatives B and D (which do not allow mechanized uses in these areas) and fewer localized effects than alternative A (which could allow mechanized use anywhere in a botanical and geological area as long as the use does not conflict with the purpose of the area).

Affected Environment – Wetlands/Cienegas and Springs

Wetlands/cienegas range from seasonally to permanently wet and unmapped perennial springs or headwater streams where groundwater intersects the surface, creating pools or channels. Wetlands are areas that are inundated by water with a frequency sufficient to support, and under normal precipitation supports, a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions (i.e., presence of hydric soil) for growth and reproduction.

On the Coconino NF, the wetlands/cienegas primarily occur at elevations ranging from 6,200 to 7,200 feet and cover about 9,879 acres. Wetlands on the Coconino NF are generally disconnected from groundwater and perched above regional groundwater tables and, thus, are completely reliant on precipitation for water input. Therefore, standing water and vegetation in wetlands can fluctuate greatly—from basically nonexistent in dry periods to highly productive wetlands in wet periods. Other key processes include the development and presence of hydric soils, decomposition, and nutrient cycling, as well as the topography. The combination of these processes result in unique vegetative components such as rushes, sedges, flat sedges, spike rushes, and aquatic vegetation in pools. Natural disturbances are drought and flooding. Natural fire is an infrequent disturbance, entering from adjacent vegetation types during drought conditions, but fire may be used as a tool to maintain wetland conditions that are beneficial to specific wildlife.

There are approximately 78 identified wetlands (9,859 acres) on the forest. There are several wetland types: semipermanent, seasonal, ephemeral, and reservoir/lakes. Many of the wetlands have been modified by dams and stock tanks to increase water permanency. Most wetlands are in the vicinity of Anderson Mesa which is on the east-central side of the forest; they range in size from Mormon Lake at about 5,500 acres to less than 10 acres in size; however, most wetlands on the forest are relatively small. Larger sized wetlands are associated with reservoirs, such as Upper and Lower Lake Mary, or with natural lakes such as Stoneman and Mormon Lakes. Larger wetlands are more resilient to threats and are more likely to be in PFC as a result. Therefore, the number of wetlands in PFC may underrepresent the acres in PFC and the number of wetlands that are departed may overrepresent the acres impacted.

Eighty-one percent of the identified wetland acres (55 percent of total wetlands) on the forest are at PFC. Nine percent of the identified wetland acres (38 percent of total wetlands) are classified as functioning-at-risk. Thirty wetlands are functioning-at-risk riparian condition, 43 are properly functioning, and none are nonfunctioning. The remaining wetlands are reservoirs. Given that 38 percent of wetlands are functioning-at-risk, this PNVT is considered moderately departed.

The forest contains 20 acres of cienegas, a linear stream associated with groundwater/spring recharge that is primarily herbaceous and does not have woody vegetation (as the riparian forest types do). An example of a cienega is Buck Springs on the Mogollon Rim Ranger District. Most cienega areas now have stock tanks or dams associated with them that were constructed many years ago. Stock tanks and dams have altered vegetation composition and structure and soil condition, because water persistence and depth has changed, negatively affecting riparian

function. Most cienegas do not have PFC condition data, but those assessed were moderately departed.

Historically, wetland cienega soil condition was mostly satisfactory as soil productivity was high overall, with both high surface litter and understory and forage production. Currently, most of the Wetland Cienega PNVT on the forest has moderate (considering number of wetlands)/ low (considering acres of wetlands) departure from reference condition with a trend of slowly toward desired conditions. Unsatisfactory soils are present due to a combination of effects from legacy livestock grazing that goes back to the early 1900s, wildlife herbivory, and managed grazing to a lesser extent. Soils are commonly compacted with reduced porosity, litter, vegetative cover, and production that impair nutrient cycling functions.

Threats to wetland cienega include excessive wildlife herbivory, legacy off-highway vehicle use, dispersed recreation in localized and accessible areas, drought, and managed grazing in localized areas. Springs have the same threats as wetland cienega. In addition, springs are threatened by fire exclusion in fire-adapted PNVTs in their associated watersheds and well pumping in localized areas. Groundwater pumping, however, is outside of Forest Service authority to control.

There are different kinds of springs on the forest such as seeps and hanging gardens. Springs occur where groundwater is forced to the soil surface, offering sufficient moisture to support hydrophytic or riparian vegetation. Water from springs may be found in pools or streams or seep from cracks in cliffs or the ground, or a combination of these. In addition, waterflow can vary between years and within years. Water chemistry can be unique. Springs can support both herbaceous and woody riparian vegetation.

Knowledge about the functional and ecological condition of the approximate 340 springs on the forest is limited and, therefore, their departure is unknown. Given what is known about the condition of observed springs and the threat of falling groundwater levels near Flagstaff and in the Verde Valley, springs on the Coconino NF are assumed to be highly departed where they are not fenced off to ungulate herbivory. Many springs occur in inaccessible areas protected from herbivory and, therefore, they are assumed to be in functional condition and not departed. Where information has been collected, a majority of unfenced springs and springs that have been modified with pipelines and tanks or have been heavily grazed by livestock or elk are classified as either nonfunctional or functioning-at-risk. Forest springs are located in the Middle Little Colorado River, Canyon Diablo, Lower Little Colorado River, Upper Verde River, and Lower Verde River 5th code watersheds. Unfenced accessible springs are considered at risk because of the increased potential for excessive use from recreationists, livestock, and wildlife.

Environmental Consequences – Wetland/Cienega and Springs

The primary differences between plan direction in alternative A versus alternatives B, C, and D are plan components that prescribe realistic objectives for restoration of wetland cienegas and springs as well as updated desired conditions. There are no measurable differences in plan component objectives for riparian improvement among alternatives B, C, and D. For wetland cienega and spring riparian areas, continuing implementation of alternative A results in opportunistic and slower improvements compared to alternatives B, C, and D. Alternatives B, C, and D could result in more rapid achievement of riparian areas to the desired condition of properly functioning, resilient riparian areas. Table 6 summarizes the differences in impacts from plan components, including objectives, among the alternatives.

Table 6. Summary of departure values and trends for wetland/cienega and springs

PNVT	Amount on Forest	Percent of Forest	Existing Riparian Departure Percent/Trend	Alt. A. Riparian Departure Percent/Trend	Alts. B, C, D Riparian Departure Percent/Trend
Wetland	78 wetlands, 9,859 acres		By number: Moderate (41%)/Toward; By acres: Low (9%)/Toward	By number: Moderate (41%)/Slowly Toward; By acres: Low/Slowly Toward	By number: Low (19%)/Toward; By acres: Low/Toward
Cienega	20 acres		High	Static About 3% would move toward	Toward
Springs	340 known springs	Unknown	High for accessible unfenced springs. Low for fenced springs or those with poor access. Toward for about 25 (10%) springs	Static 0% or by opportunity would move toward	Toward About 25 springs or 10% toward

Alternative A

Management of wetland cienega would continue in accordance with direction in the 1987 plan (as amended). Wetland cienega direction is nonexistent or vague and does not provide clear direction to maintain or restore wetlands toward desired condition of properly functioning, resilient riparian areas.

Continuing implementation of alternative A would probably not move a large number of wetlands or large number of wetland acres, cienegas, and springs to the desired condition of properly functioning resilient riparian areas as quickly as alternatives B, C, and D because it lacks objectives specific to Wetland Cienega PNVT and springs. In addition, alternatives B, C, and D include direction on improvement to nonfunctional and functioning-at-risk wetlands, whereas alternative A lacks this direction. Wetland Cienega PNVT and springs are expected to remain static, under alternative A. Under this alternative, treatments—including riparian treatments and road removal and upland watershed treatments—would occur only on an opportunity basis.

Because of the lack of objectives, wetland riparian vegetation and root masses would probably not improve nor stabilize shoreline features against cutting action; dissipate energy to reduce erosion and sedimentation, and improve water quality; or improve floodwater retention and groundwater recharge. There is a lack of plan direction to provide for these functional aspects of wetlands and to provide for PFC, and so projects do not have to be designed to mitigate effects to these wetland characteristics. As a result, wetland cienega function is expected to be static and not improve under alternative A.

Management of springs would continue in accordance with direction in the 1987 plan (as amended). Spring management and restoration direction is nonexistent or vague and does not provide clear direction to maintain or restore toward desired condition of properly functioning,

resilient spring riparian areas. A small proportion of springs have been restored or protected since the 1987 plan was approved. Alternative A treatments that would benefit springs would occur only on an opportunity basis. Continuing implementation of alternative A would likely result in a static trend because of a lack of emphasis on spring restoration and little to no improvement of riparian function of springs and would probably not move many springs to the desired condition of properly functioning, resilient riparian areas as quickly as alternatives B, C, and D.

Because of the similarities in threats and sensitivity of springs relative to other riparian resources, alternative A's approach for addressing threats to wetland/ cienega would be similar to that of riparian forest PNVTs.

Alternatives B, C, and D

The Wetland /Cienega PNVT is currently at a moderate level of vegetative departure with a static trend toward desired conditions. Herbivory in unprotected areas could lead to a shift toward earlier successional species and shorter vegetative structure. The plan objective under alternatives B, C, and D is to restore 5 to 10 wetlands per decade to a properly functioning condition. With continued protection and at that objective level, this PNVT would be expected to move toward desired conditions over time. Any additional management activities that occur in this PNVT would help make progress toward stated desired conditions.

Alternatives B, C, and D include plan components that would move wetlands and cienegas toward identified desired conditions and reduce the departure of this PNVT. Desired conditions specify that: (1) wetlands, reservoirs, and lakes provide healthy soil and water resources to support diverse vegetation for native and desirable nonnative riparian and aquatic species habitat; (2) wetland vegetation has diverse age class, a diverse composition of native species, and includes species that indicate maintenance of riparian soil moisture characteristics; and (3) wetlands are maintaining or trending toward PFC, and soil condition and riparian function are in satisfactory condition on most acres. As a result, maintenance of soil cover, reduced sheet erosion, and improved nutrient cycling and soil productivity would occur.

Implementation of the objective to restore between 5 to 10 wetlands every 10 years currently not in PFC would result in wetland restoration between 15 to 30 percent of the total number of wetlands not in PFC. As a result, wetland riparian vegetation and root masses would improve or stabilize shoreline features against cutting action; dissipate energy to reduce erosion and sedimentation and improve water quality; or improve floodwater retention and groundwater recharge. In contrast, alternative A lacks objectives for wetland cienega restoration.

For springs, alternatives B, C, and D have an objective to restore riparian function to at least 25 springs not in PFC within 10 years to provide water quantity and aquatic habitat for the recovery of plant and animal species. There are approximately 340 known springs on the forest, but functional condition assessment information for them is variable. Restoring 25 springs would equate to at least 10 percent of known springs, which would be significant progress toward achieving desired conditions for springs. In contrast, alternative A lacks plan components including objectives for spring restoration.

Because of the similarities in threats and sensitivity of springs relative to other riparian resources, the approach for addressing threats to wetland cienega under alternatives B, C, and D would be similar to that of riparian forests PNVTs.

Cumulative Effects for Water and Riparian Resources

The cumulative effects analysis for water and riparian resources are assessed at the 4th code HUC or subbasin scale and are temporally bounded by the next 10 to 15 years. Disturbances that impact riparian vegetation or compact or detach soil can reduce riparian function and condition and are considered and assessed at the 4th code watershed scale with some further detail at the 5th code watershed scale.

Influences come from within and outside the forest boundary and, cumulatively, they impact soil and water resources. The relative proportion of the area administered by the Coconino NF within a 4th code HUC provides a spatial boundary for the cumulative effects contributed by forest activities. The percent of lands managed within the subbasins by the forest ranges from less than 1 percent to 57 percent. Where multiple landownership exists, it is important that the forest work with the appropriate organizations and individuals.

While the forest contains riparian acres of three out of seven watersheds: Middle Little Colorado River (48 percent of the riparian acres in the watershed are on the forest), Upper Verde River (36 percent) and Lower Verde River (21 percent), the majority of riparian acres in these watersheds, however, still lie on other landownerships. Therefore, cumulative effects include activities on the forest as well as other public and privates lands.

All alternatives would maintain or improve riparian conditions on the forest. There are activities outside forest control and on lands of other ownership, however, that impact riparian and water resources.

There are several threats to the Cottonwood Willow Riparian Forest PNVT that are mostly outside the control of Forest Service management. Water diversions and increasing human development in the watersheds in lands adjacent to the forest have affected water quantity and seasonality of historical flood regimes as well as groundwater availability to these systems. Consequently, portions of Cottonwood Willow Riparian Forest are now perched above the water table and its long-term sustainability may be in jeopardy.

Water quality in Oak Creek within the Upper Verde 4th code watershed is also affected by *E. coli* from septic systems associated with private development, wildlife, and swimming. Only swimming on NFS lands is in Forest Service control.

The middle stream reaches of Fossil Creek (part of the Lower Verde 4th code watershed) and Oak Creek are impacted by activities on non-Forest Service lands and improperly located roads. The portions of streams that are of most concern are the middle reach of Fossil Creek due to recreation impacts and Oak Creek because of recreation impacts, improperly located roads, and septic systems associated with private development.

Drought is another influence that is outside of forest control.

While all alternatives would maintain or improve riparian and water resources on the forest, activities outside of forest control limit the ability of riparian and water resources to improve at a watershed scale.

Biophysical Features

Caves, Cliffs, and Talus Slopes

Affected Environment

Caves and Cave Resources

The forest has many caves[21] due to the area's unique geologic composition and history. Two types of caves are found on the forest, lava tube caves and caves found in karst[22] and pseudokarst terrain such as in the Verde Formation sediments. Most of the lava tube caves are found on the Flagstaff Ranger District associated with basaltic lava flows. Caves developed in karst terrain are found on the Mogollon Rim, Flagstaff, and Red Rock district and are developed in the Kaibab Limestone Formation. Sinkholes are found in the surficial bedrock in the Sedona area which formed from the collapse of large water filled underground cave systems developed in the Redwall Limestone (Lindberg 2010). There are even caves located in the Verde Valley associated with the Verde Valley Formation sediments.

To date, the forest has information on more than 50 caves across the area. Local cavers have also offered limited information to forest staff on cave resources, and there are likely many more caves and cave resources known on the forest by these caving groups. Of these caves, the forest has six caves that have been nominated as significant caves[23] and seven that have been identified for the potential as being nominated as significant. The six significant caves variously meet the criteria for significance on the basis of their geologic/mineralogic/paleontologic values, biota, cultural values, hydrologic values, recreational, educational, or scientific values.

Forest wildlife biologists periodically monitor caves for bat use. White nose syndrome is a condition associated with the deaths of over a million bats in the United States and Canada since its discovery in the winter of 2006–2007 in New York State. A fungus, *Geomyces destructans*, is considered the primary causal agent of white nose syndrome. This fungus thrives in cold and humid conditions of caves and mines, which provide prime hibernating habitat for many bat species. It is suspected that the fungus is spreading through bat to bat, bat to cave, and/or human transmission into cave environments. In 2010, *Geomyces destructans*, the fungus associated with white nose syndrome was found on the cave myotis bats in western Oklahoma, bringing the fungus within 250 miles of New Mexico. Both New Mexico and Arizona have a diverse bat fauna that includes 28 species, almost half of which hibernate to some degree during the winter.

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[21] The Federal Cave Resources Protection Act defines "cave" as any naturally occurring void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the Earth or within a cliff or ledge (including any cave resource therein, but not including any vug, mine, tunnel, aqueduct, or other manmade excavation) and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or manmade. Such term shall include any natural pit, sinkhole, or other feature which is an extension of the entrance.

[22] Terrain created by the chemical solution of the bedrock, including carbonate rocks, gypsum, and to a minor extent on other rocks, and characterized by disrupted surface drainage, abundant enclosed depressions, and a well-developed system of underground drainage systems, which may include caves. The term "pseudokarst" is sometimes used to distinguish karst terrain formed on non-carbonate bedrock, such as sandstone.

[23] A cave located on NFS lands that meets the criteria in Title 36, Code of Federal Regulations, sections 290(c) or 290(d) (36 CFR 290 (c) or (d)), and has been designated in accordance with section 290.3(e).

In response, the Southwestern Region began working with our Federal, State, and private partners during the summer of 2010 to begin addressing this critically important issue. Interagency white nose syndrome response and communications plans have been finalized for the State of New Mexico. Furthermore, the Southwestern Region is working with the State of Arizona to develop similar plans. Several forests within the Southwestern Region have begun working to increase public awareness, collect information on bat hibernacula, and initiate surveillance efforts for signs of the fungus or the associated disease (USDA Forest Service Memo, March 25, 2011, White Nose Syndrome Handbook).

The "White Nose Syndrome Handbook" has been prepared to assist forests in taking steps to address the disease. This handbook includes sections on decontamination protocols, emergency closure orders, tribal considerations, abandoned mine lands considerations, surveillance, working with partners, communication tools, and National Wildlife Health Center submission guidelines.

The Forest Service has a memorandum of understanding with the Cave Research Foundation as of 2010 (USDA Forest Service 2010b). The Forest Service has had a long-standing relationship with this organization prior to the memorandum of understanding. The purpose of this memorandum of understanding is to foster cooperation to achieve more effective and efficient management and study of caves, and to establish a framework upon which the Cave Research Foundation and Forest Service may cooperatively conduct scientific research, mapping, and interpretive activities on forests.

The forest has worked in the past with various caving groups including the Central Arizona Grotto, Escabrosa Grotto, Cave Research Foundation, Bat Conservation International, Arizona Regional Association, American Cave Conservation Association, and the Arizona State Game and Fish Department (USDA Forest Service 1992b).

Review of the forest's cave records indicated that local cavers conduct their own use and impact monitoring of some caves. Sign-in sheets are present within some caves as well. When impacts are noted they have contacted the Forest Service and described the impacts. The impacts noted in the files have been vegetation removal at cave entrances and sedimentation from nearby roads from bar or relief ditches and refuse within caves.

Cliffs

The forest has many types of cliff resources. Examples include Jacks Canyon climbing area on the Mogollon Rim, the many canyons of streams draining the Mogollon Rim plateau such as East Clear Creek, Barbershop Canyon, West Clear Creek, Fossil Creek, and others. There are other canyon areas in the Verde Valley and Sedona area including Oak Creek Canyon and Sycamore Canyon. Most of these canyons are incised in sedimentary bedrock. Other cliff resources may be found in canyons cut through basalt lava flows such as Jacks Canyon in Upper Beaver Creek watershed and in volcanic depressions such as Stoneman Lake.

Cliffs provide important habitat for birds to roost and nest. In addition, several plant species grow on cliffs and ledges.

Talus Slopes

Talus is a deposit of large angular fragments of physically weathered bedrock, usually at the base of a cliff or steep slope. Scree and rubble are also used synonymously with talus. Talus slopes[24] occur on all three ranger districts. Examples of talus slopes occur above the tree line on the San Francisco Peaks, on basaltic cinder cones in the eastern part of the San Francisco Volcanic Field, as sedimentary and basaltic talus in Oak Creek Canyon, as basaltic talus slopes below mesas such as at Chavez Pass, and on the flanks of Hackberry Mountain. Talus slopes can be devoid of vegetation or sparsely vegetated. Rare plants and animals are associated with talus deposits. Disturbance from recreation or management activities can destabilize the talus slopes and alter the habitat.

Environmental Consequences

Alternative A

Management and protection of caves along with cliffs and talus slopes allows for the recognition, protection and conservation of unique and diverse geological features, and their associated hydrology, cultural resources, rare plants, and animals that occupy or occur in these habitats. Caves designated as being significant are protected under Federal law and regulation, but existing laws and regulations are broad based and are not prescriptive. For example, protection buffers are not mentioned in the law or implementing regulation. Thus, the forest plan can provide a more specific direction for the protection and management of caves and other biophysical resources.

Alternative A closely follows management direction provided in FSM 2356 with respect to policy, protection, conservation, research, and education, overall management of cave resources and evaluating impacts to caves during project planning. Alternative A is consistent with the general intent of the Federal Cave Resource Protection Act of 1988 (P.L. 100-691). The goals for cave management encourage partnerships with caving organizations, scientists, and outdoor recreationists. Under alternative A, Amendment 9 added standards and guidelines to protect caves and caves resources as a result of the Federal Cave Resource Protection Act. However, this alternative did not establish desired conditions, standards and guidelines for cliffs and talus slopes. Overall, this alternative's standards and guidelines to minimize impacts to caves would be beneficial and protective of the cave resource, but the lack of additional plan direction for cliffs and talus slopes would result in those biophysical features being managed only to protect scenery and species habitat. Cliffs and talus slope features would then be vulnerable to impacts where scenery and species habitat are not concerns.

Plan direction in alternative A for biophysical features focuses primarily on the inventory, monitoring, and protection of caves. Monitoring and use restrictions are also described and management techniques would be adjusted for caves based on results of monitoring.

Plan direction under alternative A also states that caves used by bats are to be protected. Bat populations and use are to be monitored in consultation with State and Federal agencies. Research in caves requires a permit which is issued on a case-by-case basis with the district ranger.

[24] Talus slope is the term used for specific reference to the surface of the talus. A talus slope is a steep, concave slope where rubble is deposited. It is also known as a debris slope.

Additionally, coordination with the county sheriff's department caving organizations to plan for cave search and rescue is also described in the alternative.

Various standards and guidelines in alternative A are described to ensure that ground-disturbance activities do not impact caves and karst features. Impacts of activities would be evaluated for impacts to soil, hydrology, water quality, or disturbances to cave features. A 300-foot radius around a cave entrance would be evaluated for effects as well as infeeder drainages and the surface area on top of the cave. Drilling or seismic surveys, etc., would be carefully evaluated and appropriate buffers established so that the cave is not affected. Caves with high resource values would be evaluated for mineral withdrawal. Cave exploration and techniques of exploration would be carefully considered. Wildlife habitat provided by caves would be conserved. Partnerships would be encouraged with caving organizations, scientists, and outdoor recreationists. Caves and cave resources would be managed to provide a range of recreational opportunities. Cave conservation would be promoted through interpretation and education.

Management of the forest's cliffs and talus slopes, including the stability and integrity of talus slopes and cliffs and their ecosystems, is not addressed in alternative A except with respect to maintenance of the scenic views of the red rock cliffs of the Sedona area, Management Area 22. The lack of plan direction for these features and the habitats they provide would likely result in the protection of these features only where scenery that are associated with talus slopes and cliffs are a concern, or where associated with plan direction for specific species (e.g., peregrine falcon).

Although alternative A provides guidance for the protection of cave resources, it lacks clear guidance to manage cliffs and talus slopes other than those related to specific scenery and species habitat concerns. This lack of direction would likely result in more localized disturbance to cliffs and talus slopes from recreation or management activities such as road construction than alternatives B, C, and D.

Alternatives B, C, and D

Plan direction for caves, cliffs, and talus slopes would not differ among alternatives B, C, and D. Overall, the more comprehensive plan direction would lead to better maintenance of the geological and habitat features that caves, cliffs, and talus slopes provide.

The general description section of "Biophysical Features" in these alternatives describe general definitions of caves, cliffs, and talus slopes and their important physical, ecological, and cultural attributes. Desired conditions are described for significant caves which are consistent with the purposes of the Federal Cave Protection Act of 1988. The desired condition statements emphasize maintenance and protection of habitat for wildlife in caves and natural development of the overall cave ecosystem; archaeological, geological, paleontological, and biological features are left in their natural state and not disturbed by cave visitors/water and the hydrological system of the cave is not altered or polluted; diseases such as white nose syndrome are not introduced into caves; and some caves are open to general recreation and public education.

With respect to cliffs and talus slopes, the desired condition statements emphasize the natural undisturbed condition, especially where they provide important habitat for birds, plants, or other species of concern. Recreational rock climbing is allowed on cliffs, but is managed so as to not impact rare or threatened species.

One standard and several management approaches are included under alternatives B, C, and D to manage significant caves to preserve the criteria for which they were nominated and designated and apply measures to prevent introduction or spread of diseases in caves.

Various guidelines are also provided to minimize impacts of management actions to caves, sinkholes, cliffs, and talus slopes and work toward minimizing or eliminating potential impacts. This is accomplished through cave protection buffers of 200 feet for caves and sinkholes or alternatively projects would be able to use cave surveys and site-specific information to modify the buffer to more appropriate site mitigation. For instance, if there is a drainage that is uphill of a cave entrance that could be a source of siltation which extends past the 200-foot restriction, project-level clearances may make the buffer longer in one direction and narrower to incorporate topographic information about the site. Alternatively, if the activity itself could occur within the 200-foot buffer with other physical mitigations without damaging the cave entrance or passageways, it may still be able to meet the guideline. Similar to alternative A, guidelines would also stipulate that water well or other drilling, blasting, and seismic exploration should not impact or damage biophysical features given guidelines under alternatives B, C, and D. The guidelines in these alternatives allow greater flexibility for site-specific determinations of necessary precautions to avoid impacting cave resources.

Finally, one guideline stipulates that gating and cave closures should be implemented to protect caves as a last resort and, if implemented, should follow Bat Conservation International recommendations. This would result in most caves on the forest being open to recreational use, but it also gives the forest the flexibility to prevent major alteration of the cave resource from this use without impacting wildlife access to caves. This strategy would encourage partnership with the caving community and would help the forest involve interested publics more actively in understanding the management needs of caves and finding solutions to management challenges that arise from human introduction to cave environments. As a result, these alternatives would better balance the social value of caves with the ecological values.

Alternatives B, C, and D also provide a proactive guideline that directs the forest to mitigate accidental or past alterations of caves on the forest, whereas alternative A does not include this direction. As a result, alternatives B, C, and D would prevent continued degradation of caves that have been impacted by past human activities and mitigation of cave resources that were accidentally damaged because of lack of information on the resource, wildland fire effects, or other unintentional changes to the cave conditions.

Various management approaches are proposed and include cooperation and exchange of information about biophysical features between the Forest Service, other agencies, and groups that are involved with caves or other biophysical features to help preserve and manage caves and educate and interpret caves for the public.

Distinct from alternative A, which does not address cliffs and talus slopes as important geological features and habitats, alternatives B, C, and D also provide desired conditions for talus slopes and cliffs in addition to caves. Measures to prevent the introduction and spread of diseases into caves is also a desired condition in alternatives B, C, and D, whereas disease prevention is not mentioned in alternative A. Management approaches in alternatives B, C, and D emphasize coordination, cooperation, and partnerships with other agencies, cavers, and scientists to protect, monitor, and develop information about caves, cliffs, and talus slopes and the key resources associated with them. This emphasis on cooperation and education is more extensive than

alternative A. Assessment of impacts to caves and cave protection buffer zones are more clearly described in alternatives B, C, and D than in alternative A. Under alternatives B, C, and D, desired conditions for caves, cliffs, and talus slopes are clearly expressed along with some standards and guidelines and management approaches and would likely lead to better protection of caves, cliffs, and talus slopes. Alternatives B, C, and D would, therefore, maintain the habitats and resource values these biophysical features provide better than alternative A, especially with respect to cliffs and talus slopes, and disease prevention in caves.

Cumulative Effects

The timeframe and boundary of this analysis is for the next 10 to 15 years and includes National Forest System (NFS) lands within the Coconino NF boundary, and the local communities within the boundary and closely adjacent to the forest boundary.

Caves, cliffs, and talus slopes are present on other nearby national monuments such as Montezuma Well, and Walnut Canyon and Sunset Crater National Monuments, and protected under management plans of those national monuments. Plan direction under all alternatives that foster interagency cooperation and exchange of information would provide for increased opportunities to develop partnerships with the scientific community, researchers, and conservationists interested in the areas and would expand our collective knowledge about the features and characteristics of all of our caves, cliffs, and talus slopes. Management of caves, cliffs, and talus slopes on the forest to preserve the physical, biological, and cultural values would contribute to the presence and maintenance of these resources across the broader region.

Geological Resources

Affected Environment

Geological Special Areas

For more information on existing and recommended geological areas, see the “Special Areas” section.

Volcanic Woodlands Management Area

This management area is located in the northern part of the forest. It includes the northwestern and eastern extent of the San Francisco volcanic field surrounding San Francisco Mountain and areas surrounding the Sunset Crater National Monument. Red Mountain Geological Area is found within this management area as well as many other volcanic cinder cones and lava fields. Volcanic Woodlands Management Area is only found in alternatives B, C, and D.

Paleontological Resources

Paleontological resources are fossilized remains, traces, or imprints of organisms, preserved in or on the Earth’s crust that provide information about the history of life on Earth, excluding any materials associated with archaeological resources or any cultural item.

All fossils including invertebrate fossils are regulated and protected under the Paleontological Resource Preservation Act of 2009 (P.L. 111-011).

The forest has many paleontological resources, most of which are only well known by paleontologists associated with universities, the Museum of Northern Arizona, the U.S. Geological Survey, and the Arizona State Geological Survey.

Paleontological resources on the forest include:

- Invertebrate fauna such as brachiopods, corals, sponges, trilobites, mollusks, stromatolites, forams, radiolarians, and conodonts.
- Plants such as ferns, horsetails, conifers, cycads, and palm fronds.
- Trace fossils such as arthropods, spiders, ant lions, and other insects.
- Vertebrate fauna such as fish, shark teeth, reptiles, amphibians, horses, camels, gomphotheres, mastodons, rodents, and tracks of these fauna.

To date, the forest has documentation of several reports and Museum of Northern Arizona fossil location records pertaining to fossil resources. Fossil tracks and trackways are known from the Verde Formation sediments near Camp Verde and Cottonwood that consist of camel tracks. Other camel tracks have been noted in the Verde Formation along the Verde River near Beasley Flat and in the Cottonwood Basin near the Teepee Rocks (Cottonwood Basin Fumeroles). In 2005, paleontological resources consisting of shark teeth, invertebrates, and nautiloids have been recorded and previously collected by the Museum of Northern Arizona from the Kaibab Formation along Lake Mary Road (Gillette, D. personal communication, December 22, 2004). Also in 2005, during a pipeline construction project along State Highway 179 near Sedona, slabs of rock containing large examples of Permian plan fossils were found associated with the Hermit Formation (Gore 2005). These slabs containing the fossils were never removed or collected from the site due to their large size, but were covered over with other rock and soil.

Environmental Consequences

The land management plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carryout any project or activity. Because the land management plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. However, there may be implications, or long-term environmental consequences, of managing the forest under this programmatic framework.

Alternative A

This alternative did not recognize the significance of the shape, form, and function of geologic features except for the geology expressed at the Red Mountain Geological Area and within the wild and scenic rivers proposed for eligibility such as Fossil Creek. Outside of the Oak Creek Sedona Management Area 12, alternative A does not recognize the importance of geology for scenery, aesthetics, or its recreational value.

Geological Resources Management

Unique geological areas or features on the forest, other than the Red Mountain Geological Area, would not have this degree or level of conservation and would not be designated as special areas. There would be no special area management for other geologically important areas such as the Cottonwood Basin Fumeroles or other potential geological special areas. The Cottonwood Basin Fumeroles Geological Area is within Management Area 11 - Verde Valley in the 1987 plan. No

mention is made of the Cottonwood Basin Fumeroles or geological resources in this management area section of the plan. As a result, geological resource values of unique or special geological features could be impacted by human activities such as recreation or management activities (e.g., logging, grazing). Other consequences would be that there would be less opportunity for research, education, and interpretation of the geology of the areas.

Volcanic Woodlands Management Area

Alternative A recognizes parts of the northern, western, and eastern extent of the San Francisco volcanic field as having significant volcanic features for area management. The proposed Volcanic Woodlands Management Area overlaps with many management areas of the 1987 plan including the major ones shown in table 7.

Table 7. Management areas in the Coconino NF

Management Area Name	MA Number	Acres
Cinder Hills	013	13,711
Transition grassland and sparse piñon-juniper above the Mogollon Rim	010	22,329
Craters	031	29,939
Doney	033	40,034
Deadman Wash	032	58,132
Ponderosa pine and mixed conifer on less than 40 percent slope	003	69,914
Piñon-juniper woodlands on less than 40 percent slope	007	173,351

Alternative A recognizes the remarkable geological, glacial, and volcanic features of the Strawberry Crater, Kachina Peaks, and Kendrick Mountain Wilderness areas. The various other MAs outside of the volcanic wilderness areas have variable management. The Cinder Hills volcanic area with its cinder cones lava fields is managed as an off-highway vehicle use area, and it emphasizes this type of recreational opportunity. The Craters Management Area is another volcanic area with many cinder cones and pumice craters and is managed for more remote and dispersed recreation opportunities. Deadman Wash Management Area is also composed of volcanic terrain featuring cinder cones and piñon-juniper woodlands and grasslands. Its management focus is to protect, maintain, and restore grasslands and maintain a largely untracked/unroaded landscape. The Craters and Deadman Wash Management Areas are both managed for the maintenance of volcanic cinder ecosystems and for maintenance of untracked cinder cone slopes. The direction for logging on cinder cones in Management Area 3, Ponderosa Pine Mixed Conifer Less Than 40 Percent Slope, is that logging activities are restricted to slopes of 25 percent or less using conventional skidding. In addition, cinder cone or other slopes (pumice fields) with a severe potential for sheet and gully erosion require specific management practices to avoid any impairment of their soil productivity.

Under alternative A, lava fields and volcanic cinder cones in the northern and eastern edge of the forest and their associated vegetation, wildlife, scenery, and water resources would continue to be managed within several management areas. The management direction in these management areas is specific about discouraging off-trail use outside the Cinder Hills area and also describes

the level of scenic integrity that would be maintained. Many considerations are built into the management direction for retention of the scenic values, wildlife and plant species adapted to cinder cones and lava flows, soil productivity, and slope stability that would promote the maintenance of the geological integrity of the volcanic areas.

Paleontological Resources

Under alternative A, there are no desired conditions, standards, guidelines, or management approaches for paleontological resources. As a result, paleontological resources may be overlooked or not protected fully during project planning and implementation, and line officers would be unaware of the variety of paleontological resources on the forest or the needs for management and protection of paleontological resources. Relationships with research paleontologists and public awareness and education about paleontological resources would not be fostered if the plan is silent about these important resources. However, since there is now a law for the protection of paleontological resources, project planning and implementation would have to duly comply with the law and any future implementing regulations. The law provides for permits to collect paleontological resources including permit specifications, curation of resources, and criminal penalties for unauthorized removal, damage, or sale of paleontological resources.

In summary, the consequences of implementing this alternative not containing any direction on the management of paleontological resources would be that paleontological resources would only be managed as directed by existing law and regulation. Because existing laws and regulations focus primarily on collection and lack guidance on protecting these resources from other types of impacts, the paleontological resources that are known and unknown on the forest would be managed and protected in a limited manner.

Common to Alternatives B, C, and D

Paleontological Resources

Alternatives B, C, and D would provide desired conditions for paleontological resources while alternative A does not address these at all. The desired conditions in alternatives B, C, and D would emphasize preservation from management or other adverse impacts from visitors or other threats and protection so that vandalism, theft, and damage is rare. The desired condition for casual collecting and curation is consistent with the Paleontological Resources Preservation Act and would allow future latitude and flexibility for when the implementing regulations become established and when the terms like “reasonable amount” are defined.

Additionally, two guidelines are provided under these alternatives. One guideline conserves and protects known locations of moderate/unknown to very high potential to impact significant paleontological resources (i.e., potential fossil yield classes 3, 4, and 5). Most of the forest’s paleontological resources are class 3 (i.e., moderate/unknown potential); however, the forest does have examples of class 5 (i.e., very high potential) vertebrate tracks that are poorly covered and have significant value because of the preservation status and the diversity of fossil tracks that are preserved at a locality. The second guideline would provide for closure to casual fossil collecting or would require a permit for such collecting to protect areas that contain other resources in addition to paleontological resources.

Alternatives B, C, and D also provide several management approaches to emphasize interagency collaboration and coordination, particularly with the scientific community that would lead to the further identification, protection, and preservation of paleontological resources.

Paleontological surveys are another management approach emphasized in areas where there is a high potential to encounter these resources. Pre-disturbance surveys are not required by existing law or regulation, so this would represent an additional measure that is a very proactive and protective. Under this management approach, impacts to known locations of paleontological resources could be better mitigated before ground-disturbing activities occur.

Other management approaches include: the stabilization, preservation, and monitoring of fossil localities at risk to various threats such as erosion and vandalism; partnering with partners such as the Museum of Northern Arizona and Northern Arizona University; and promoting education and interpretation. All of these management approaches are consistent with current law and Forest Service policy and would assist with preserving paleontological resources on the forest.

Alternative C

Volcanic Woodlands Management Area

The environmental consequences of alternative C are the same as for alternative B.

Paleontological Resources

The consequences of alternative C are the same as for alternatives B and D for paleontological resources. The only difference is that with designation of the larger Cottonwood Basin Fumeroles Geological and Botanical Area, there would be better protection and education about vertebrate fossil tracks (camel tracks) that are known from the Verde Formation within the special area.

Alternative D

Geological Area Management

Alternative D is similar to alternative B, concerning geological resources. The only difference from alternative B is that it allows mechanized recreation (e.g., bicycles) on designated trails in botanical and geological areas. The development of designated trails for mechanized travel within the interior of the botanical and geological areas would result in increased disturbances to the landforms, soils, and plants in localized areas. A benefit of designated trail systems is that they can be routed away from locations where rare plants are growing or where there is a geologic feature that is eroding or sensitive to disturbance, while still providing access for bicyclists. Trails can be routed around permanent obstacles (e.g., rock outcrops or large trees). Another positive benefit of trails within geological and botanical areas is that interpretative signs can be constructed along the trail route to foster knowledge and appreciation of the botany and geology.

Trails have similar effects to roads in that they both decrease slope stability on steep slopes, increase water diversion potential, and increase erosion and sedimentation on most all slopes. On steep terrain in the headwaters of watersheds or above stream channels and watercourses, trails cut into the slopes would decrease the slope stability of the areas, alter surface hydrology of the slopes, and cause erosion and sedimentation into channels. Proper trail design with attention to grade and water drainage would be critical to reducing erosion potential and maintaining slope stability. Trail maintenance would also cause impacts to the soils and vegetation from clearing,

brushing, and tread grading. Trails where mechanized travel is allowed, such as using bicycles, would have greater impacts than foot trails to the ground surface, because bicycle wheels dig into the trail and loosen soil and rock. Off-trail biking may become an issue in areas that have inviting hills and challenging obstacles such as the Cottonwood Basin Fumeroles. The brushing height would also be greater on trails that are used by bicycles. In summary, shared use trails for hiking and bicycling have both positive and negative benefits within geological and botanical areas.

Volcanic Woodlands Management Area

The environmental consequences of alternative D would be the same as for alternative B.

Paleontological Resources

The environmental consequences of alternative D would be the same as for alternative B for paleontological resources.

Cumulative Effects

The timeframe and boundary of this analysis are the next 10 to 15 years and include NFS lands within the Coconino NF boundary and the local communities within and closely adjacent to the forest boundary.

Paleontological resources are present on other nearby national monuments such as Montezuma Castle Well and Tuzigoot Monument, as well as on nearby tribal lands. The management approaches that foster interagency cooperation and exchange of information would provide for increased opportunities to develop partnerships with the scientific community, researchers and conservationists interested in the areas and would expand our collective knowledge about the features and characteristics of all of our paleontological resources. Protection of unique geological resources on the forest would contribute to the presence and maintenance of these resources across the region.

Soil

Soils are a physical element of the environment made up of mineral particles (e.g., sand, silt, and clay), air, water, and organic matter. Soils form by the interaction between climate, organisms, topography, parent material, and time. Soils store water, supply nutrients for plants, and provide a medium for plant growth. Soils also provide habitat for a diverse number of below-ground organisms.

This section summarizes current conditions and departures between current and reference conditions and associated trends, for soil condition, soil productivity, and biological soil crusts. Further information on soils, departure, and trend by PNVT, can be found in the “Ecological Sustainability Report” (USDA Forest Service 2009) and “Soils Specialist Report for the Ecological Sustainability Report” (USDA Forest Service 2007a).

Affected Environment

Soils of the Coconino NF have developed primarily from volcanic and sedimentary origins. Soils range from very shallow to deep, old and well developed to recent and less developed, and occur on all slope ranges from nearly level to very steep. Elevations on the forests range from almost

12,667 feet in the San Francisco Peaks Alpine Tundra to less than 2,600 feet in the Verde Valley desert soils, which provides soil climate in upland soils ranging from cryic (cold) to thermic (hot) soil temperature regimes, and from udic (moist) to aridic (dry) soil moisture regimes. Herbage (i.e., herbaceous plant growth) productivity ranges from near 3,000 pounds per acre in the wettest areas, to less than 25 pounds per acre in the driest, raw cindery soils. Except for Alpine Tundra PNVT, PNVTs historically had mostly satisfactory soils. Departures from this reference condition are noted where they have deviated from historical or reference conditions.

Soil Condition and Productivity

Soil condition is an evaluation of soil quality based on factors that affect vital soil functions and is based on the primary soil functions of soil hydrology, soil stability, and nutrient cycling. Historically, most areas on the forest (89 percent) are inferred to have been in satisfactory[25] soil condition and about 11 percent of the areas were inherently unstable.[26] Currently, about 62 percent of the soils are in satisfactory soil condition, about 20 percent are impaired,[27] about 7 percent are in unsatisfactory[28] condition, and about 11 percent are inherently unstable. Human disturbances during the last 100 to 125 years are believed to have caused impacts and declines in soil condition (USDA Forest Service 2009). Major disturbances that were absent historically include: livestock and elk herbivory (i.e., vegetation consumption), vegetative treatments, dispersed recreational and off-highway vehicle use, and establishment and use of roads and trails. Fire is a disturbance that existed historically, but is now largely absent at past frequencies and severities. Historic fire regimes maintained many portions of the Ponderosa Pine and Piñon-Juniper Evergreen Shrub PNVTs in open stands with more herbaceous understory and protective litter.

Approximately 62 percent of the soils on the forest are considered to be in satisfactory soil condition, about 20 percent are impaired, about 7 percent are in unsatisfactory condition, and about 11 percent are inherently unstable. Recent drought conditions have contributed to reduced vegetative growth and ineffective ground cover.

Overall, about 27 percent of the soils, located within 10 PNVTs—Cottonwood Willow Riparian, Desert Communities, Great Basin Grassland, Montane Subalpine Grassland, Piñon-Juniper Evergreen Shrub, Piñon-Juniper with Grass, Piñon-Juniper Woodland (Persistent), Semidesert Grassland, and Wetland Cienega—are classified as being impaired or unsatisfactory and considered departed from desired and reference[29] conditions (table 8). These departures indicate a reduction or loss in soil function and the possibility that they may not be able to sustain ecological functions and soil productivity.

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[25] Satisfactory: soil function is being sustained and soil is functioning properly and normally.

[26] Inherently unstable: soils are naturally eroding faster than they are renewing and are functioning normally.

[27] Impaired: The ability of the soil to function properly and normally is reduced and/or there is increased vulnerability to degradation.

[28] Unsatisfactory: A loss of soil function has occurred such that the soil is unable to maintain resource values, sustain outputs, or recover.

[29] Reference conditions are the conditions thought to be present historically (pre-European settlement).

Soil in the Ponderosa Pine, Mixed Conifer types and Spruce-Fir, Mixed Broadleaf Deciduous Riparian Forest, and Montane Willow Riparian Forest PNVTs, however, is mainly in satisfactory condition. Soil is mainly in satisfactory, but inherently unstable condition in both Alpine Tundra and Interior Chaparral PNVTs. These soils are located on very steep slopes where natural erosion rates exceed tolerable rates and are eroding faster than they are renewing themselves, but are functioning properly and normally. Most PNVTs contain inherently unstable soils. All of Alpine Tundra and more than 88 percent of Interior Chaparral acres are considered inherently unstable. Around 28 percent of the acres in Semidesert Grassland and Piñon-Juniper Evergreen Shrub PNVTs fall into this category, while the remaining PNVTs have 10 percent or less of their acres in this condition.

The Coconino NF has experienced multiple years of drought since about 1997. This has resulted in reduced upland vegetative growth and ineffective ground cover, putting the soil at risk of accelerated erosion, loss of soil productivity, and increasing sediment delivery to streams during storm events causing local water quality degradation.

Table 8. Current departures and trends of soil condition class from reference condition by PNVT within lands managed by the Coconino NF

PNVT	Total Acres	Soil Condition Class				Departure[1] and Trend from Reference Condition
		Satisfactory	Satisfactory, but Inherently Unstable	Unsatisfactory	Impaired	
Cottonwood Willow Riparian Forest	2,507	0%	2%	1%	97%	High – slowly toward
Mixed Broadleaf Deciduous Riparian Forest	3,612	89%	6%	1%	3%	Low – static
Montane Willow Riparian Forest	3,829	77%	16%	3%	4%	Low – static
Gallery Coniferous Riparian Forest	200	32%	68%	0%	0%	Low – static
Desert Communities	63,548	0%	54%	8%	38%	Moderate – static
Semidesert Grassland	89,683	0%	4%	54%	41%	High – slowly toward
Great Basin Grassland	92,908	13%	0%	42%	45%	High – toward
Montane Subalpine Grassland	23,429	31%	0%	0%	69%	High – static
Interior Chaparral	50,471	11%	89%	0%	0%	Low – static
Piñon-Juniper with Grass	261,426	68%	4%	11%	17%	Low – away
Piñon-Juniper Evergreen Shrub	263,834	8%	36%	0%	57%	Moderate – away
Piñon-Juniper Woodland (Persistent)	75,393	28%	12%	0%	60%	Moderate – away
Ponderosa Pine	791,896	99%	0%	1%	0%	Low – static
Mixed Conifer with Frequent Fire	49,619	100%	0%	0%	0%	Low – static
Mixed Conifer with Aspen	37,083	100%	0%	0%	0%	Low – static
Spruce-Fir Forest	13,946	91%	9%	0%	0%	Low – static
Alpine or Tundra	939	0%	100%	0%	0%	Low – static
Wetland Cienega	3,112	5%	0%	60%	36%	High – static
Grand Total	**1,827,434**	**62%**	**11%**	**7%**	**20%**	

[1] Departure ratings from reference conditions: Low signifies 34 percent or less of the acres are in impaired or unsatisfactory condition. A moderate departure signifies a departure of 34 to 66 percent, and high departure is a difference of 67 percent or greater.

Soil productivity is a combination of soil organic matter, litter cover, and estimated understory and forage production. Soil productivity can vary widely within a PNVT based on the site potential. In general, the most productive soils are within Montane Subalpine Grassland and Wetland Cienega PNVTs followed by Great Basin Grassland. These soils have high amounts of organic matter and are capable of producing the greatest amount of understory and forage under conditions of the PNVT. Current understory and forage productivity, however, appears to be low to moderate.

The soils with the lowest productivity and lowest amount of organic matter are located in riparian forests (Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, Mountain Willow Riparian Forest, Gallery Coniferous Forest), Desert Communities, and Alpine Tundra PNVTs. These PNVTs cannot be expected to produce high amounts of understory and forage because they have low amounts of surface organic matter due to dry climate or having been recently formed.

Piñon-Juniper Woodland, Piñon-Juniper Evergreen Shrub, and Ponderosa Pine PNVTs currently have low to moderate soil productivity (organic matter and understory and forage production) but have the potential, based on reference condition, to become more productive and produce higher amounts of understory in areas with low cover. As cover decreases through fire, insect and drought outbreaks, or vegetative treatments, herbaceous understory and forage production are anticipated to increase.

Soil Crusts

An important component that affects soil condition is the condition of soil crusts. Microbiotic crusts are the community of organisms, including cyanobacteria,[30] green algae, microfungi, mosses, liverworts and lichens, living at the surface of soils (USGS 2006). Biological soil crusts are commonly found in Piñon-Juniper Woodland, Semidesert Grassland, and Desert Communities on the forests and to a limited extent in other vegetation types dryer than Piñon-Juniper Woodland. Of most importance is the role crusts play in maintaining productivity of the Semidesert and Great Basin Grasslands and woodland ecosystems.

Crusts are well adapted to severe growing conditions, but poorly adapted to compressional disturbances. Domestic livestock and elk grazing, and more recently, recreational activities (hiking, biking, and off-road driving) place a heavy toll on the integrity of the crusts. Disruption of the crusts brings decreased organism diversity, soil nutrients, stability (and increased soil loss), and decreased organic matter and soil productivity.

Most areas where crusts have been observed show damage to biological soil crusts and currently cover less than 5 percent of the soil surface. Biological soil crusts are most prevalent in coarse-textured soils especially in Piñon-Juniper and Semidesert Grassland (Steinke, R., personal observations, 1989–2011).

[30] Cyanobacteria is aquatic bacteria that obtains its energy through photosynthesis.

Environmental Consequences

Forestwide desired conditions are equivalent to reference conditions for this resource. These desired conditions and guidelines are fairly similar under all alternatives. Plan language under all alternatives directs implementing site-specific BMPs for ground-disturbing projects. Alternatives B, C, and D, however, provide additional soil and PNVT specific desired conditions, standards and guidelines, and objectives focusing on sustaining soil function including resisting erosion, compaction, and sustaining soil nutrient cycling. For example, alternative A does not recognize the importance of protecting soil crusts to maintain soil productivity while alternatives B, C, and D provide a description of desired conditions for soil crusts. Implementing this direction should result in better protection of soil crusts necessary to maintain soil productivity compared to alternative A. Although alternatives B, C, and D differ in plan direction, such as the number of recommended wilderness, areas with semiprimitive nonmotorized recreation settings, wildlife habitat management areas, and allowance of mechanized recreation in botanical and geological areas, soil condition, function, and productivity are not expected to differ substantially between these alternatives except in wildlife habitat management areas under alternative C because of the relatively fewer roads, trails, areas suitable for motorized trails, and limited motorized dispersed camping corridors that would result in changed conditions from the difference in plan guidance.

Table 9 displays the projected trends in soil condition and productivity based on predicted changes in soil condition including change in vegetative ground cover, soil loss, and soil structure. Each vegetation type was examined to see whether soil conditions would generally trend toward, away, or remain static with the implementation of plan components including desired conditions, guidelines, and objectives of each alternative. The general effects to soil function of common management activities, such as forest restoration activities (mechanical and burning treatments), roads, recreation, grazing, and special uses under each alternative were considered in the evaluation of alternatives. The table shows the estimated trends in PNVT soil condition and productivity for all alternatives.

Table 9. Estimated trends in soil condition/productivity for each PNVT by alternative

PNVT	Current Departure from Desired Conditions[1]	Trend Relative to Desired Conditions			
		Alt. A[2]	Alt. B	Alt. C	Alt. D
Cottonwood Willow Riparian Forest	High	Slowly toward			
Mixed Broadleaf Deciduous Riparian Forest	Low	Static	Slowly toward		
Montane Willow Riparian Forest	Low	Static	Slowly toward	Slowly toward	Slowly toward
Gallery Coniferous Riparian Forest	Low	Static			
Desert Communities	Moderate	Static	Slowly toward		
Semidesert Grassland	High	Slowly toward	Toward		
Great Basin Grassland	High	Slowly toward	Toward	Toward	Toward

PNVT	Current Departure from Desired Conditions[1]	Trend Relative to Desired Conditions			
		Alt. A[2]	Alt. B	Alt. C	Alt. D
Montane/ Subalpine Grassland	Overall High (High for Montane, Low for Subalpine)	Static	Toward	Toward	Toward
Interior Chaparral	Low	Static	Toward		
Piñon-Juniper with Grass	Low	Away	Slowly toward	Slowly toward	Slowly toward
Piñon-Juniper Evergreen Shrub	Moderate	Away	Slowly toward		
Piñon-Juniper Woodland (Persistent)	Moderate	Away	Slowly toward	Slowly toward	Slowly toward
Ponderosa Pine	Low	Static	Toward		
Mixed Conifer (Frequent Fire)	Low	Static	Slowly toward		
Mixed Conifer with Aspen	Low	Static	Slowly toward		
Spruce-Fir	Low	Static			
Alpine Tundra	Low	Static			
Wetland Cienega	High	Static	Toward	Toward	Toward

[1] Current departure estimates (USDA Forest Service 2007d and 2009). Desired conditions are equivalent to reference conditions.
[2] Alternative A is based on the past 10-year average of treatments. Alternatives B, C, and D are based on midpoint of the objective level of treatments.

Generally, alternative A's trend is variable ranging from away to slowly toward desired condition and at variable rates. Alternatives B, C, and D would move toward their identified desired conditions at faster rates depending on PNVT. Plan language in alternative A states maintain or enhance soil productivity. The goal to maintain or enhance soil productivity is similar to the proposed action desired condition where soil condition and productivity is sustained. However, plan language in alternatives B, C, and D provide additional and more site-specific direction that favors maintenance and improvement of soil condition and productivity.

Alternative C is similar to B and D, except it recommends 13 new wilderness areas, 8 additional management areas for wildlife habitat, restricts grazing in research natural areas, designates some areas as not suitable for recreational shooting and designates some management areas as semiprimitive nonmotorized. Compared to alternatives B and D, implementing direction in alternative C plan direction would probably result in similar improvement in soil condition and productivity. Few roads and motorized trails are present under current conditions and so the improvement to soil would be small. Also, grazing would continue in the recommended wilderness areas under alternative C, so there would be no improvement to soils from changes in grazing. Therefore, predicted soil improvement would be similar to alternatives B and D.

Under alternative D, mechanized recreation on designated trails in botanical and geological areas could add to loss of soil productivity and contribute to sediment into connected stream courses

and degrade water quality but would be very minor in extent. There are very few acres of riparian areas present and trails would not be designated within streamside management zones so changes in soil condition and productivity would be similar to alternatives B and C.

There are no measurable differences among alternatives B, C, and D in plan components or anticipated outcomes for soil improvement. The primary differences between alternative A versus B, C, and D are added emphasis on managing or treating specific PNVTs, increases in upland soil and watershed improvement projects, and in road naturalization and decommissioning. This would improve soil condition and long-term soil productivity faster in alternatives B, C, and D than in alternative A.

Alternative A

With respect to fire, alternative A would result in a trend toward less acreage treated and higher fire intensities, mainly due to constraints on wildfires to meet resource objectives and a lack of emphasis on fire restoration.

Common to All Riparian Forest Types and Wetland Cienega

Riparian direction under alternative A is lacking or vague and does not provide clear direction to maintain or restore riparian areas toward maintaining or improving soil condition toward satisfactory condition or sustaining soil function where the soil has the ability to resist erosion, infiltrate water, and recycle nutrients. The current rate of implementation for soil improvement is low and centered largely on improving grazing strategies. Without specific plan emphasis and objectives targeting this PNVT, soil improvement (soil condition and productivity) for the remaining areas not in satisfactory condition under alternative A would be limited and would probably remain the same or static as it relates to movement toward desired conditions.

Cottonwood Willow Riparian Forest

There is a high departure in the soil condition (98 percent) and high departure in soil productivity in this PNVT because most of the acreage that is departed occurs on stream terraces where most recreation use occurs. Current management is resulting in improvements and a slow trend toward desired conditions in most locations. There are localized areas where the trend is away from satisfactory conditions due to high recreation use or where improved cattle grazing strategies have not yet been implemented. Under current management direction (including improved grazing strategies), overall soil condition and productivity would trend slowly toward desired conditions in most areas. Current rate of implementation for soil improvement in this PNVT is unknown, but estimated to be low and would take decades to bring all soils into satisfactory condition.

Under alternative A, litter, vegetation composition, and understory productivity are expected to slowly improve. In some areas, however, both soil condition and productivity are trending away from desired conditions where improved grazing strategies have not yet been implemented, as well as in high recreation impacted areas such as Fossil Creek and other major tributaries to the Verde River.

The current rate of implementation for soil improvement in this PNVT is low and centered largely on improving grazing strategy and not mechanical treatments.

Mixed Broadleaf Deciduous Riparian Forest

The departure of this PNVT from desired conditions is low, soil mostly satisfactory (about 94 percent), and the projected trend is static for soil condition and productivity. Most of this PNVT is located in areas with no motorized or livestock access and, therefore, has limited soil disturbance. Under alternative A, this is not projected to change. Litter, vegetation composition, and understory productivity are expected to remain about the same or improve in impaired or unsatisfactory soils that are minor in extent. The goal of attaining all areas in satisfactory condition has, for the most part, already been attained.

Alternative A's forestwide goal of attaining all areas in satisfactory condition may be possible since about 94 percent of this PNVT is already in satisfactory condition. However, current rate of implementation for soil improvement in this PNVT is low and centered largely on improving grazing strategy and not mechanical treatments.

Montane Willow Riparian Forest

The soil condition in this PNVT is mostly satisfactory (about 93 percent) and soil productivity is similar to desired condition. There are some areas in Upper Clear Creek that probably have higher amounts of unsatisfactory soil conditions than the data suggest (Steinke, R., personal observations, 1989–2011). Under alternative A, both soil condition and productivity are projected to remain static in the future. Litter, vegetation composition, and understory productivity are expected to remain about the same or improve in impaired or unsatisfactory soils that are minor in extent. The goal of attaining all areas in satisfactory condition has for the most part, already been attained.

Alternative A's forestwide goal of attaining all areas in satisfactory condition may be possible since about 93 percent of this PNVT is already in satisfactory condition.

Gallery Coniferous Riparian Forest

The soil condition in the Gallery Coniferous Riparian PNVT is almost all satisfactory, and soil productivity is similar to desired condition. Overall, soil productivity is functioning normally, and can maintain soil productivity levels necessary to sustain ecological systems.

Under alternative A, both soil condition and productivity are projected to remain static in the future. Litter, vegetation composition, and understory productivity are expected to remain about the same. The goal of attaining all areas in satisfactory condition has, for the most part, already been attained.

Alternative A's forestwide goal of attaining all areas in satisfactory condition may be possible since about 99 percent of this PNVT is believed to be in satisfactory condition. Since soil condition is almost at desired conditions, implementing additional plan components above alternative A would not improve soil condition and productivity except in the 1 percent that has impaired soils.

Wetland Cienega

The soil condition in this PNVT is highly departed (5 percent satisfactory soils), and soil productivity is moderately departed from desired conditions in unfenced wetlands. This is not expected to change because herbivory by elk is not expected to change. Wetlands excluded from

any grazing trend rapidly toward satisfactory soil conditions and improved soil productivity. Unfenced wetlands, however, are expected to remain departed from desired conditions.

Under alternative A, both soil condition and productivity are projected to remain static in the future due to herbivory by cattle and elk. Herbivores are attracted to isolated water sources and the associated vegetation, particularly during drought conditions. Although management of cattle and fencing of wetlands from herbivores can improve soil condition over a portion of the PNVT, herbivory would maintain unsatisfactory soil conditions over the majority of these wetlands. Elk numbers are predicted to remain relatively static. Litter, vegetation composition, and understory productivity are expected to remain about the same.

Continuing implementation of alternative A would probably not maintain or improve soil condition or productivity or move a large number of wetlands to identified desired conditions as quickly as alternatives B, C, and D.

Desert Communities

The soil condition in this PNVT is moderately departed (about 54 percent in satisfactory condition) with a static trend. There is declined nutrient cycling, reduced ability to infiltrate water, and the inability of soil to resist erosion. Soil productivity has a moderate departure and a static projected future trend. Soil productivity is very low overall with very low surface litter and very low understory and forage productivity.

Under alternative A, soil condition is projected to remain impaired or unsatisfactory with a static trend over the next couple of decades due to high level of soil disturbance and limited annual precipitation received especially if drought persists. Current grazing strategies and restricted cross-country off-highway vehicle travel should very slowly move soil organics and vegetative production toward desired condition with normal precipitation. Soil conditions, however, would remain static with continued drought. The current rate of implementation for soil improvement in this PNVT is very low and centered largely on improving grazing strategy and not mechanical treatments. Without specific plan emphasis and objectives targeting the Desert Communities PNVT, soil improvement would be very limited, slow, and on an opportunity basis. Under alternative A, litter, vegetation composition, and understory productivity are expected to remain about the same over the short and long term.

Semidesert Grassland

Both soil condition and soil productivity are highly departed from desired conditions (only about 4 percent satisfactory soils) in this PNVT due to historic and current grazing strategies, lack of fire, scattered trees (juniper-grassland ecotones), and improperly located roads.

Under alternative A, soil condition and productivity are projected to slowly move toward desired conditions as improved grazing strategies are implemented and roads are closed. Soil improvement would be slow due to the arid climate and lack of plan emphasis on treating this PNVT. This trend would also be slowed due to the continued lack of fire. Under alternative A, litter, vegetation composition, and understory productivity are expected to slowly improve in the short and long term.

The current rate of implementation for soil improvement in this PNVT is very low and centered largely on improving grazing strategy and not mechanical treatments. Without specific plan

emphasis and objectives targeting this PNVT in alternative A, soil improvement would be very limited and slow.

Interior Chaparral

Both the current soil condition and soil productivity are similar to desired condition with high amounts of satisfactory soils (near 100 percent). This is not projected to change in the future. Under alternative A, soil condition and productivity are projected to remain static. Litter, vegetation composition, and understory productivity are expected to remain about the same. The goal of attaining all areas in satisfactory condition has, for the most part, already been attained.

Piñon-Juniper Types (Piñon-Juniper with Grass, Piñon-Juniper Evergreen Shrub, and Piñon-Juniper Woodland)

In Piñon-Juniper with Grass, there is a low departure for both soil condition (about 72 percent in satisfactory condition) and soil productivity with trends generally away from desired conditions especially where the canopy is more than about 30 percent.

For Piñon-Juniper Woodland and Piñon-Juniper Evergreen Shrub PNVTs, there is a moderate departure for both PNVTs soil condition (about 40 percent in satisfactory condition) and soil productivity with trends generally away from desired conditions especially where the canopy is more than about 30 percent. The lack of fire has also contributed to the development of areas with high cover and a loss of herbaceous understory particularly in the Piñon-Juniper Evergreen Shrub PNVT. Herbaceous understory helps hold soil in place and carries fire. Due to rockier and drier soils and subsequent reduced herbaceous vegetative layer, the Piñon-Juniper Woodland PNVT, is less likely to carry a ground fire and more likely to contain older, denser tree stands. However, canopies above about 30 percent have reduced the herbaceous understory, vegetative ground cover, and soil condition and productivity on this PNVT also. Consequently, structure, composition and processes are departed from desired conditions.

Alternative A has a goal to put all soils in satisfactory soil condition that are currently not in satisfactory soil condition by year 2020. Piñon-juniper implementation rates for tree reduction, however, are not objectives in the 1987 plan. Current management, treatment rates are about 900 acres per year or 0.003 percent of the PNVT per year. At this rate, it would take over 100 years to thin all unsatisfactory and impaired soils. Many areas are eroding faster than they are renewing themselves putting soil productivity at risk. It takes dozens of years to build 1 inch of soil in this PNVT. Overall, soil condition is projected to move slowly away from desired condition except in areas where the trees have been thinned. In thinned areas, soil condition should move toward desired condition with the return of an herbaceous understory.

Under alternative A, soil condition and productivity are projected to move away from desired conditions, as tree cover continues to increase reducing herbaceous understory and soil condition and productivity. Any soil improvement would be slow due to the arid climate and lack of plan emphasis on treating this PNVT. This trend would also be slowed due to the continued lack of fire. Under alternative A, litter, vegetation composition, and understory productivity are expected to remain about the same in the short and long term.

Current rate of implementation for soil improvement in this PNVT is low and centered largely on improving grazing strategy and only limited mechanical treatments. Without specific plan emphasis and objectives targeting this PNVT, soil improvement would be very limited and slow.

Ponderosa Pine

Soils in the Ponderosa Pine PNVT are almost all in satisfactory condition (99 percent). Although the forest is overstocked and herbaceous understory reduced compared to desired conditions, the amount of protective duff layer is more than adequate to protect against accelerated erosion and loss of soil productivity. Because herbaceous understory is somewhat reduced, nutrient cycling is nearly impaired. The risk of wildfire resulting in large areas of high burn severity can be high during spring and summer months that could result in appreciable loss of soil and productivity and risk degradation of water quality along connected streams. Projected trends under alternative A are static for both soil condition and soil productivity, but the areas of dense trees and high canopy cover are vulnerable to uncharacteristic wildfire. High burn severity fires would pose a risk to soil condition and watershed condition in areas where soils have a moderate to high erosion hazard, which account for nearly a third of the PNVT.

Taking into account the potential for landscape-level watershed degradation following wildfire disturbances, one-third of this PNVT based on the soils with moderate or high erosion hazard would be at risk of trending away following wildfire in soil condition and productivity. In open areas, or areas that have had restoration treatments, herbaceous understory and nutrient cycling function would improve to satisfactory condition in treated areas and remain static in untreated areas. Overall, soil condition and productivity would likely remain static.

Litter, vegetation composition, and understory productivity are expected to remain about the same. The goal of attaining all areas in satisfactory condition has, for the most part, already been attained. Current implementation of hazardous fuel reduction is moving these PNVT toward vegetative desired conditions and improving herbaceous understory along with soil condition and productivity.

Mixed Conifer Types (Mixed Conifer with Frequent Fire and Mixed Conifer with Aspen)

From a soil condition and soil productivity standpoint, these two PNVTs are similar in that they have mostly satisfactory soil condition (greater than 95 percent) that are close to desired conditions and, therefore, have low departure. Under alternative A, alternative A ’s forestwide goal of attaining all areas in satisfactory condition has, for the most part, already been attained, and projected future trends for both soil condition and productivity are static since litter, vegetation composition, and understory productivity are expected to remain about the same.

In the Mixed Conifer with Frequent Fire, the fire regime is believed to be more frequent than the Mixed Conifer with Aspen and closely approximates the Ponderosa Pine PNVT with respect to potential degradation of soil condition and productivity. Conditions in Mixed Conifer with Frequent Fire, consequently, could pose a risk to connected waters and water quality in the event of a large wildfire. High burn severity fires pose a risk to soil condition and watershed condition in areas where soils have a moderate to high erosion hazard, which account for more than half of these PNVTs.

Alternative A would allow fire treatments on fewer acres and at a slower rate compared to plan direction proposed under alternatives B, C, and D. From a soil resource standpoint, this would indirectly result in slower maintenance and improvement of stand structure resulting in less improvement of the herbaceous understory vegetation and soil nutrient cycling function, and indirectly cause higher risk of uncharacteristic wildfire that poses risk to soil productivity and water quality.

Montane/Subalpine Grassland

Soil condition in Montane Grasslands is highly departed, but has a low departure in Subalpine Grasslands. Soil productivity is moderately departed in Montane grasslands and has a low departure in Subalpine grasslands. Under alternative A, soil condition and productivity are projected to remain static from desired conditions.

In the Montane Grasslands portions where impaired soils are prevalent, areas of impaired soils have reduced soil productivity are expected to remain impaired (static trend) due to continued grazing, especially by elk. Trends are trending toward desired condition in isolated areas where grazers are excluded; however, these are in very limited areas of the PNVT.

Currently, both Montane and Subalpine portions of this PNVT have moderate to high overall soil productivity. Montane portions, however, have low to moderate surface litter and low to moderate herbaceous production and, thus, are departed from desired conditions for these two productivity characteristics. Areas of reduced soil productivity are expected to continue in the future due to grazing, especially by elk. Subalpine meadows have litter and understory and forage production near desired conditions. High soil productivity is expected to remain into the future and, thus, has a static trend.

Under alternative A, litter, vegetation composition, and understory productivity are expected to remain about the same in the short and long term.

The current rate of implementation for soil improvement in this PNVT is very low and centered largely on improving grazing strategy and not mechanical treatments. Without specific plan emphasis and objectives targeting this PNVT, soil improvement would be very limited.

Spruce-Fir

The satisfactory soil conditions (near 100 percent) are little changed between historic and current conditions. These soils have high amounts of vegetative ground cover to prevent accelerated erosion. Likewise, soil productivity is similar to desired conditions. Soil is functioning normally and maintaining levels necessary to sustain ecological systems. There is a static trend from current condition to projected future soil condition and productivity.

Under alternative A, soil condition and productivity are projected to remain static. Litter, vegetation composition, and understory productivity are expected to remain about the same. The goal of attaining all areas in satisfactory condition has, for the most part, already been attained.

Alpine Tundra

This PNVT has low departure from desired condition (soils are either satisfactory or satisfactory and inherently unstable) for both soil condition and soil productivity and are projected to remain

static. Litter, vegetation composition, and understory productivity are expected to remain about the same. The goal of attaining all areas in satisfactory condition has for the most part, already been attained and is expected to be maintained under alternative A.

Alternatives B, C, and D

With respect to fire, given that frequent fire decreases fire behavior (and resultant severity), the alternatives that allow for more fire treatment acres would lead to less uncharacteristic fire behavior. Alternatives B, C, and D would generally allow for more treatment acres; however, this trend could be the opposite in key areas on the far southeast end of the forest. These alternatives would designate large areas as semiprimitive nonmotorized. This designation would potentially limit mechanical and fire treatment opportunities due to restricted access.

Similar to alternatives B and D, alternative C would result in more acreage treated due to fewer constraints on wildfires to meet resource objectives and a clear emphasis on fire restoration. Wilderness designation constraints to fire treatment are increased logistical complexity (access limitations) and a reduction in fire management tools (e.g., chain saws, engines, bulldozers, aviation resources). Special area designations (e.g., research natural areas, botanical areas) do not explicitly prohibit fire treatment. However, these designations result in increased complexity due to added coordination requirements and competing resource objectives. For example, research natural areas have ongoing research projects that often have specific requirements (e.g., fire, spring fire, fall fire) that can make fire treatment difficult or impractical. Further, alternative C would likely reduce mechanical treatment opportunities; therefore, potentially limit fire treatment due to stand conditions being dense and more volatile.

All Riparian Forest Types and Wetland Cienega

For all riparian forest types (Montane Willow Riparian, Gallery Coniferous Riparian, Mixed Broadleaf Deciduous Riparian, and Cottonwood Riparian PNVTs) and Wetland Cienega, Alternatives B, C, and D would include plan components that would move riparian areas toward identified desired conditions. In addition, a guideline directing identification of a vegetated streamside management zone, maintenance of 80 percent herbaceous cover and limited and localized soil compaction and trampling of vegetation should be to the extent where permanent damage to perennial plants would not occur and result in the maintenance of soil cover, reduced sheet erosion, and improved nutrient cycling and soil productivity. The forestwide objective of restoration of 200 to 500 acres of any nonfunctional or functioning-at-risk riparian PNVT within 10 years would treat and improve about twice as many acres as estimated in alterative A or 10 percent of total riparian areas forestwide and proportionally more per plan life of 15 years. For wetlands, the objective of restoration of 5 to 10 wetlands/10 years would improve at least 15 to 30 percent of total wetlands over 10 years and proportionally more per plan life of 15 years.

Under alternatives B, C, and D, riparian vegetation and protective vegetative ground cover would increase and aid in the filtering of sediments, improve soil structure, improve nutrient cycling, improve water retention and groundwater recharge, and develop root masses that stabilize against cutting action associated with high waterflow, thereby reducing erosion, improving water quality and maintaining soil productivity. As a result, alternatives B, C, and D would likely maintain or improve soil condition and productivity and move a large number of riparian areas to identified desired conditions more quickly than alternative A. Although implementing plan direction under alternatives B, C, and D would move soils to desired conditions faster than alternative A,

movement toward desired conditions would probably still be slow based on overall small numbers of acres identified for restoration in plan objectives.

Desert Communities

Implementing plan direction in alternatives B, C, and D has desired conditions and guidelines where erosion is not accelerated and shows little sign of compaction. In addition, biological soils crusts would be present to improve nutrient cycling and stabilize soils, and excessive ground disturbance on calcareous soils would be avoided to limit churning highly erodible calcareous soil to the surface exposing it to high rates of wind erosion and surface infertility.

Therefore, implementing plan direction for alternatives B, C, and D should equally result in very slow improvement over the plan life as a result of improved grazing strategies, road decommissioning, and removal of off-highway vehicles in erodible soils. Soil improvement would be slow due to the arid climate and lack of plan emphasis on treating this PNVT.

Semidesert Grassland

Alternatives B, C, and D have desired conditions and objectives to treat this PNVT at a rate of 3,500 acres in 10 years, plus the overall forestwide soil objective of maintenance and improvement of soil condition on 100,000 to 350,000 acres within 10 years, although most of those acres would likely occur in the Ponderosa Pine PNVT. Since there are about 86,000 acres of impaired or unsatisfactory soils in the Semidesert Grassland PNVT, it would take decades to treat all and reach desire conditions. Alternatives B, C, and D, however, have additional plan components directing treatment of impaired and unsatisfactory soils such that they are trending toward satisfactory soil conditions both within and out of high priority watersheds.

Therefore, implementing plan direction for alternatives B, C, and D would move these PNVTs toward desired conditions a little faster than alternative A. Treatments would increase protective vegetative ground cover and improve soil productivity and function. Consequently, water infiltrates and disperses properly, and soil withstands accelerated erosion and recycles nutrients. Herbaceous vegetative cover would be improved or maintained at levels that contribute to suitable hydrologic function, soil stability and nutrient cycling, and better adapt to climate change. Compaction and erosion would be improved and minimized due to improved plant productivity.

In addition, alternatives B, C, and D could concentrate treatments in focus watersheds needed soil improvement, which allow a better opportunity for restoring or maintaining watershed and soil condition in these PNVTs because these PNVTs have some of the poorest soil conditions of the forest.

Implementing direction for alternatives B, C, and D would result in soil improvement projects including mechanical thinning with lop and scatter, herbicide, or prescribed fire treatments of invaded woody species that would have the following indirect consequences; would result in improved herbaceous understory biomass, protective vegetative ground cover, reduced soil erosion, improved water quality, and soil productivity.

In addition, implementing plan direction in alternatives B, C, and D specific direction would require maintaining soil hydrologic function, soil stability, and nutrient cycling resulting in

minimal erosion and compaction and a diversity of grass and forbs at or near potential. In addition, biological soils crusts would be present to improve nutrient cycling and stabilize soils.

Overall, implementing management direction in alternatives B, C, and D would equally improve the ability of the soil to resist erosion, infiltrate water, recycle nutrients, and move toward desired conditions a little faster than alternative A.

Interior Chaparral

From a soil condition and productivity standpoint, the identified desired conditions have, for the most part, already been met. No specific plan objectives are needed or included in the revised plan alternatives B, C, and D to maintain soil productivity in this PNVT. Implementing direction for desired conditions in B, C, and D would emphasize maintenance of vegetative ground cover. Sufficient protective vegetative ground cover (35 to 45 percent) would be maintained to protect soil from accelerated erosion and, therefore, would maintain soil productivity. Soil nutrient cycling would be improved through maintenance of biological soil crusts. There is a guideline that directs fire treatments to maintain diversity of habitat and plant community in seral stages that would indirectly improve soil nutrient cycling and reduce the risk of moderate severity wildfires that may pose risk to soil productivity, connected waters, and water quality.

Under alternative A, trend of soil condition and productivity is static. Implementing additional plan direction under alternatives B, C, and D, would better assure soil condition and productivity are maintained and moving toward desired conditions compared to alternative A.

Piñon-Juniper Types (Piñon-Juniper with Grass, Piñon-Juniper Evergreen Shrub, and Piñon-Juniper Woodland)

Alternatives B, C, D have desired conditions and objectives to treat the Piñon-Juniper PNVTs (see table 1) at a rate of 1,000 to 10,000 acres in 10 years plus the overall forestwide soil objective of maintenance and improvement of soil condition on 100,000 to 350,000 acres within 10 years, although most of those acres would likely occur in the Ponderosa Pine PNVT. Since there are nearly 75,000 acres of impaired or unsatisfactory soils in these PNVTs, it would take decades to treat all and reach desired conditions. Alternatives B, C, and D, however, have additional forestwide plan components directing treatment of impaired and unsatisfactory soils such that they are trending toward satisfactory soil conditions both within and out of high priority watersheds.

Alternatives B, C, and D have desired conditions that would require vegetation management and natural disturbances to develop sufficient organic ground cover and native herbaceous vegetation that protects soil from accelerated erosion and compaction. Managing ground cover and tree density to meet these desired outcomes would improve soil condition trend and move these PNVTs slowly toward desired conditions, whereas alternative A would trend away due to lack of treatment emphasis.

Therefore, implementing plan direction for alternatives B, C, and D would move these PNVTs slowly toward desired conditions. In areas treated, the following scenario would occur, protective vegetative ground cover would increase, soil productivity and function would improve and function normally and properly so water infiltrates and disperses properly, withstands accelerated erosion, and recycles nutrients. Herbaceous vegetative cover would be improved or maintained at

levels that contribute to suitable hydrologic function, soil stability, and nutrient cycling and better adapt to climate change. Compaction and erosion would be minimized due to improved plant productivity.

Alternative A does not have PNVT-specific objectives and soil improvement would occur only on an opportunity basis, likely far less than in alternatives B, C, and D and, based on recent trends, would continue to move away from desired conditions. Under alternative A, soil condition would not improve as quickly as implementing plan direction in alternatives B, C, and D.

In addition, alternatives B, C, and D concentrate treatments in focus watersheds needed soil improvement, which allow a better opportunity for restoring or maintaining watershed and soil condition in these PNVTs because these PNVTs have some of the poorest soil conditions of the forest.

PNVT specific direction for all piñon-juniper types in these alternatives direct presence of sufficient plant litter and coarse woody material to resist accelerated erosion and essential to promote nutrient cycling (USDA Forest Service 1994) and water retention that should result in maintenance and improvement of soil condition and productivity. In addition, biological soils crusts would be present to improve nutrient cycling and stabilize soils.

Implementing plan direction for alternatives B, C, and D would result in soil improvement projects including mechanical thinning, lop and scatter, treatment of encroached grasslands, maintenance of previously converted areas on grassland soil types, and reduction of hazardous fuels through prescribed or wildfires managed for resource objectives that would result in improved herbaceous understory biomass, protective vegetative ground cover, reduced soil erosion, and improved soils. For the Piñon-Juniper Evergreen Shrub PNVT, implementing direction for alternatives B, C, and D includes greater emphases on use of wildfire to meet resource objectives. This should result in a reduction of hazardous fuels that pose risk to watershed condition and water quality from potential uncharacteristic wildfires that generally result in large areas of high burn severity.

Forestwide, implementation of plan direction in alternatives B, C, and D would equally move and at the same rate the soil resource to the identified desired conditions. Overall, compared to alternative A, implementing management direction in alternatives B, C, and D would equally improve the ability of the soil to resist erosion, infiltrate water, and recycle nutrients. Under alternative A, soil condition and productivity would probably move away from, whereas alternatives B, C, and D would move slowly toward desired conditions.

Ponderosa Pine

From a soil condition and productivity standpoint, the identified desired conditions have for the most part, already been met. From a vegetative desired condition standpoint, however, desired condition has not been met (see the “Vegetation and Fire” section). Even though this PNVT is dominated by satisfactory soil conditions, additional maintenance is required to improve nutrient cycling and reduce the risk of uncharacteristic wildfires that pose a risk to soil productivity and water quality.

Alternatives B, C, and D have plan desired conditions and 10-year objectives to treat the Ponderosa Pine PNVT (see table 1) over 50,000 to 260,050 acres, prescribe fire over 150,000 to 300,000 acres, and 135,000 acres of wildland fires to meet resource objectives. Plus the overall

forestwide soil objective of maintenance and improvement of soil condition on 100,000 to 350,000 acres within 10 years and most of those acres would likely occur in the Ponderosa Pine PNVT.

Implementing plan direction for alternatives B, C, and D would move this PNVT even closer toward desired conditions compared to alternative A. In areas treated, the following scenario would occur, soil productivity and function would improve even within the satisfactory condition class and function normally and properly so water infiltrates and disperses properly, withstands accelerated erosion, and recycles nutrients. Herbaceous vegetative cover would be improved or maintained at levels that contribute to suitable hydrologic function, soil stability and nutrient cycling, and better adapt to climate change. Compaction and erosion would be minimized due to plant diversity.

In addition, alternatives B, C, and D concentrate treatments in focus watersheds needed soil improvement, which allow a better opportunity for restoring or maintaining watershed and soil condition in this PNVT because there is high emphasis to treat this PNVT due to high wildfire risk and potential for increased biomass production that may contribute to local economic sustainability.

In addition, desired conditions for alternatives B, C, and D would emphasize maintenance of vegetative ground cover sufficient to protect soil against accelerated erosion, promote water infiltration, and maintain woody material that contributes to long-term soil productivity (USDA Forest Service 1994). Alternatives B, C, and D would strive to create a landscape where low-severity wildfires are characteristic for the PNVT resulting in lower risk to downstream water quality and maintenance of soil productivity.

Implementing direction for alternatives B, C, and D would result in soil improvement projects including mechanical thinning and reduction of hazardous fuels through prescribed or wildland fires to meet resource objectives that would result in improved herbaceous understory biomass, protective vegetative ground cover, reduced soil erosion, and improved soil. The greater emphasis on the use of fire to meet resource objectives in alternatives B, C, and D should also result in a reduction of hazardous fuels that pose risk to watershed condition and water quality from potential uncharacteristic wildfires that generally result in large areas of high burn severity.

Implementing plan direction would reduce hazardous fuels and associated risk of high burn severity stemming from overstocked forests and woodlands and, consequently, would reduce the risk of accelerated erosion and sediment delivery into connected stream courses, thus maintaining water quality.

Implementing desired conditions and objectives under alternatives B, C, and D that lower tree density could cause a short-term increase in water yield to connected stream courses, springs, and groundwater, but would be expected to last less than 10 years according to research (USDA Forest Service 1979).

Implementing management direction in alternatives B, C, and D would equally maintain or improve the ability of the soil to resist erosion, infiltrate water, and recycle nutrients. Under alternative A, soil condition and productivity would remain static or not improve as quickly as implementing plan direction in alternatives B, C, and D.

Mixed Conifer Types
(Mixed Conifer with Frequent Fire and Mixed Conifer with Aspen)

For Mixed Conifer with Frequent Fire, alternatives B, C, D have plan desired conditions and objectives to use low-severity fire in the frequent fire PNVT on up to 8,000 acres per 10 years and 7,500 acres per 10 years for wildfires managed to meet resource objectives, plus the overall forestwide soil objective of maintenance and improvement of soil condition on 100,000 to 350,000 acres within 10 years, although most of those acres would likely occur in the Ponderosa Pine PNVT. Recent soil condition and productivity trend is static because the soil surface has adequate ground cover to reduce accelerated erosion. However, implementing plan direction for alternatives B, C, and D would improve soil nutrient cycling and, although slowly, would move conditions toward identified desired conditions better than alternative A. In areas treated with fire, soil productivity and function would improve even within the satisfactory condition class and function normally and properly so water infiltrates and disperses properly, withstands accelerated erosion, and recycles nutrients. Herbaceous vegetative cover would be improved or maintained at levels that contribute to suitable hydrologic function, soil stability and nutrient cycling, and better adapt to climate change. Compaction and erosion would be minimized due to plant diversity.

In addition, implementing direction for desired conditions in B, C, and D would emphasize maintenance of vegetative ground cover sufficient to protect soil against accelerated erosion, promote water infiltration, and maintain coarse woody material that contributes to long-term soil productivity (USDA Forest Service 1994). Alternatives B, C, and D would strive to create a landscape where low-severity wildfires are characteristic for the PNVT (high-severity wildfires could occur on a rare basis in Mixed Conifer with Aspen) resulting in lower risk to downstream water quality and maintenance of soil productivity.

Implementing direction for alternatives B, C, and D (reduction of hazardous fuels) through prescribed or wildfires managed to meet resource objectives would result in improved herbaceous understory biomass, protective vegetative ground cover, reduced soil erosion, and improved soil. Allowing low-severity fire plays a large role and should result in improved herbaceous understory growth improving soil condition and productivity and a reduction of hazardous fuels that pose risk to watershed condition and water quality from potential uncharacteristic wildfires that generally result in large areas of high burn severity.

Overall, compared to alternative A, implementing management direction in alternatives B, C, and D would equally maintain or improve the ability of the soil to resist erosion, infiltrate water, recycle nutrients, and slowly move soil condition toward identified desired conditions. Under alternative A, soil condition and productivity would remain static or not improve as quickly as implementing plan direction in alternatives B, C, and D.

The desired conditions related to soil condition and productivity for Mixed Conifer with Aspen PNVT are similar to Mixed Conifer with Frequent Fire. In the plan direction for this PNVT and elsewhere, there is improved direction for aspen in alternatives B, C, and D, however, compared to alternative A, that better clarifies where aspen should generally be found and its role on the landscape.

Great Basin Grasslands

Alternatives B, C, and D have objectives to treat between 10,800 and 12,400 acres during the 10 years following plan approval that would assure that soil condition function is improved and

soil productivity maintained on those acres. Overall, the amount of acres that would be treated is 11.6 to 13 percent of total PNVT acres, but the result would move these acres toward identified desired conditions equally but faster than alternative A.

Montane Subalpine Grassland

Alternatives B, C, and D have objectives to specifically treat this PNVT. In addition, alternatives B, C, and D have a forestwide objective of maintenance and improvement of soil condition on 100,000 to 350,000 acres within 10 years. Most of the improvements would probably occur in the Ponderosa Pine PNVT, but some could be targeted in this PNVT.

Alternatives B, C, and D have objectives to treat between 7,600 and 11,400 for the 10 years following plan approval that would assure that soil condition function is improved and soil productivity maintained on those acres. Overall, the amount of acres that would be treated is between 32 and 48 percent of total PNVT acres but the result would move these acres toward identified desired conditions equally but faster than alternative A. Alternatives B, C, and D have additional guidelines directing maintenance of at least 90 percent protective vegetative ground cover that would protect against accelerated erosion and maintain soil productivity. Since there are only about 16,000 acres of impaired soils in these PNVTs, it would be possible to treat most of the PNVTs over the life of the plan and reach identified desired conditions. Given alternatives B, C, and D have additional plan components directing treatment of impaired and unsatisfactory soils such that they are trending toward satisfactory soil conditions, implementing plan direction for alternatives B, C, and D would move these PNVTs slowly toward desired conditions. In areas treated, soil productivity and function would improve and function normally and properly so that water infiltrates and disperses properly, withstands accelerated erosion, and recycles nutrients. Herbaceous vegetative cover would be improved or maintained at levels that contribute to suitable hydrologic function, soil stability and nutrient cycling, and better adapt to climate change. Compaction and erosion would be improved and minimized due to improved plant productivity.

In addition, alternatives B, C, and D could concentrate treatments in focus watersheds needing soil improvement, which allow a better opportunity for restoring or maintaining watershed and soil condition in these PNVTs because these PNVTs have some of the poorest soil conditions of the forest.

Implementing direction for alternatives B, C, and D would result in soil improvement projects including mechanical thinning with lop and scatter, herbicide, or prescribed fire treatments of invaded woody species that would have the following indirect consequences; would result in improved herbaceous understory biomass, protective vegetative ground cover, reduced soil erosion, improved water quality, and soil productivity.

In addition, implementing plan direction in alternatives B, C, and D would require maintenance of ground cover and herbaceous vegetation sufficient to protect from accelerated erosion and promote water infiltration and nutrient cycling function. Soil function would be sustained. When implemented, the guideline to maintain at least 40 percent vegetative ground cover would adequately protect soil against accelerated erosion and maintain soil productivity.

Spruce-Fir

From a soil condition and productivity standpoint, the identified desired conditions have, for the most part, already been met. No specific plan objectives are needed or included in the revised plan alternatives B, C, and D to maintain soil productivity. There is, however, a guideline that directs minimal and confined soil and vegetation disturbance from management activities to maintain soil productivity and 6th HUC watershed condition in class 1 (functioning condition).

Implementing direction for desired conditions in B, C, and D would emphasize maintenance of vegetative ground cover sufficient to protect soil against accelerated erosion, promote water infiltration, and maintain coarse woody material that contributes to long-term soil productivity (USDA Forest Service 1994). Alternatives B, C, and D would strive to create a landscape where mixed and some high-severity wildfires are characteristic for the PNVT and function to maintain stand density, structure, and plant composition. High-severity fires could infrequently occur but not to the extent where it would risk long-term impairment to connected waters downstream or cause loss of productivity over major portions of the 5th or 6th HUC watershed.

Because almost all soils in this PNVT are in satisfactory condition, alternatives B, C, and D would continue to maintain soil condition in satisfactory condition and maintain soil productivity similar to current conditions (alternative A).

Alpine Tundra

From a soil condition and productivity standpoint, the identified desired conditions have, for the most part, already been met. No specific plan objectives or guidelines are needed or included in the revised plan alternatives B, C, and D to maintain soil productivity.

Forestwide soil desired conditions stated alternatives B, C, and D would continue to maintain soil condition in satisfactory condition, maintain soil productivity similar to alternative A and, therefore, trends would also be expected to be static.

Cumulative Effects

The cumulative effects are being assessed at the 4th code watershed or subbasin scale (table 10) forestwide across PNVTs and are temporally bounded by the next 10 to 15 years. Activities that result in disturbances to vegetation, compact or detach soil and, therefore, reduce soil condition, function, and productivity are considered.

Because it is impractical to complete a quantitative cumulative watershed effects analysis at this scale of strategic planning, effects are evaluated qualitatively. Detailed quantitative cumulative watershed effects analyses are be analyzed at the project level. Nearly all of the management activities conducted by the forest have the potential to affect soil function, condition, and productivity. Their cumulative impact to a watershed depends upon the actions and the watershed's sensitivity to disturbance.

Table 10 displays the 4th code HUC watersheds intersecting the forest. Influences come from within and outside of the forest boundary and cumulatively impact soil and water resources. Percentages of each 4th code watershed administered by the forest are displayed and are relevant to the potential cumulative effects Coconino NF activities may contribute to the subbasins. The percentage of lands managed within the subbasins by the forest ranges from less than 1 percent to 57 percent.

Table 10. 4th code watersheds and percent ownership

4th Code Watershed	Percent Watershed on the Forest	Percent Watershed Off Forest
Havasu Creek – 2,933 square miles	0.2%	99.8%
Middle Little Colorado River – 2,522 square miles	15%	85%
Canyon Diablo – 1,199 square miles	57%	43%
Lower Little Colorado River – 2,393 square miles	15%	85%
Tonto Creek – 1,048 square miles	0.2%	99.8%
Upper Verde River – 2,507 square miles	40%	60%
Lower Verde River – 1,965 square miles	24%	76%
Forest Totals at 4th code Scale	**19.7%**	**80.3%**

All of the watersheds associated with the forests have private inholdings and appreciable areas outside of the forest boundary (ranges from 43 to 99 percent). Many of the impacts occur on lands of other ownership, such as unpaved roads, grazing, recreation that may result in reduced soil function, soil condition, and productivity. Activities on state and private land are not in the control of the forest. These activities could cumulatively affect and are probably at greater risk of soil degradation than soil on NFS lands. This would occur in private, tribal, or city owned lands where land development and greater ground disturbance generally occurs compared to NFS lands. The activities described below could cumulatively affect soils on the Coconino NF.

Urbanization near and adjacent to the forest can contribute substantially to cumulative watershed effects. Development has the potential to affect soil resources through accelerated erosion and loss of soil productivity. As private properties, especially inholdings, change from ranch or undeveloped land to subdivisions or higher density uses, encroachment into national forest becomes more frequent resulting in resource impacts and decline in soil function and condition. All of these activities tend to increase the level and area of disturbance, reduce soil condition and long-term soil productivity within the administrative boundary of the forest to a degree that may be greater than forest management activities under all alternatives in those affected areas.

In addition to the above potential impacts, activities on lands of other ownership that have a high risk of adverse soil impacts include mining, increased trail density and use, and trampling of riparian areas.

Entities like The Nature Conservancy and Verde Valley Land Preservation Institute can assist in acquiring key parcels, particularly related to riparian and the Verde River that would help maintain or improve soil conditions. The Nature Conservancy's interest in acquiring Verde River properties and water rights may result in continued land acquisition cases depending on available funding. The interest in protecting the Verde River may become higher as Northern Arizona University works on their Verde Valley Initiatives. Support for land acquisition or other forms of protection of the Verde River and its tributaries may result in protection of soil, riparian and water resources, and overall soil function, condition, and productivity both outside and within forest boundaries in the Middle and Lower Verde 4th code watersheds.

Implementation of Travel Management Rule decisions across the Coconino NF and adjacent national forests would appreciably improve soil conditions with the closure of many roads and dispersed campsites outside riparian areas and springs. The Prescott, Kaibab, and Apache-Sitgreaves National Forests are conducting similar travel management analysis and are expected to restrict motorized cross-country travel and limit and close many high-risk roads that may pose a risk to soil, riparian area, and water quality. These actions should cumulatively reduce onsite erosion and, overall, maintain or improve soil productivity in watersheds.

Neighboring forests with similar forest plan revision efforts underway include the Prescott, Kaibab, and Apache-Sitgreaves National Forests. The Coconino NF shares portions of 4th HUC watersheds and, therefore, planning efforts directing soil resource management would indirectly impact all forests. The aforementioned forests have developed plan guidance and desired conditions similar to the Coconino NF, and are expected to move soil resources toward identified desired conditions, resulting in maintenance or improvement of soil condition and productivity.

Other projects or planning efforts that would generally result in management direction that would improve soil condition and productivity, as well as associated water quality and riparian and watershed function, and would not contribute to negative cumulative effects to soils include Flagstaff Regional Plan, Verde Valley Regional Plan, Sedona community plan, national monuments' management plans, Sedona and Flagstaff community fire plans, State Lands Department plans, Rogers Lake, and Coconino County Open Space Plan.

Vegetation and Fire

Healthy, resilient landscapes have greater capacity relative to nonfunctioning ecosystems to survive natural disturbances and large-scale threats to ecological sustainability, especially under changing and uncertain future environmental conditions, such as those driven by climate change and increasing human uses (Fulé 2008). Fire is a critical evolutionary force that has helped shape the vegetation of the Coconino NF. The resiliency of much of the forest is dependent upon fire as a frequent disturbance process. Because the structure and function of vegetation are closely intertwined with the role of fire, they are examined together in this section. Further information can be found in the "Ecological Sustainability Report" (USDA Forest Service 2009) and vegetation modeling outputs. Smoke impacts as a result of fire are analyzed under the "Air Quality" section.

Affected Environment

The Coconino NF has a high diversity of vegetative communities (also called vegetation types or potential natural vegetation types) due to its wide range of elevations, complex topography, and presence of perennial water. Vegetative communities at the lowest elevations are more typical of Sonoran Desert while the highest elevation vegetative community, alpine tundra, is the only one in Arizona. In between, there are extensive areas of piñon-juniper, ponderosa pine, and mixed conifer forests interspersed with grasslands and scattered pockets of aspen at higher elevations. Riparian vegetation lines stream courses of perennial and intermittent water (USDA Forest Service 2009). Ponderosa pine and piñon-juniper vegetation communities dominate the forested landscape, covering approximately 76 percent of the forest (Table 11).

Potential natural vegetation types (PNVTs) on the forest were initially evaluated for vegetative departures from reference conditions using methods described in the "Ecological Sustainability

Report" (USDA Forest Service 2009). Subsequently, PNVT spatial distribution was further refined and adjusted based on new information, current science, local knowledge, and field verification. Table 11 provides the amount of the various PNVTs on the forest and reflects acreage changes as a result of these updates. Mixed Conifer was divided into two types based on the presence of quaking aspen and differences in the fire regimes: Mixed Conifer with Aspen and Mixed Conifer with Frequent Fire. Piñon-Juniper Woodland was also divided into two types based on differences in fire regimes: Piñon-Juniper with Grass and Piñon-Juniper Woodland (Persistent). The acres of Desert Communities and Semidesert Grassland PNVTs were refined to more accurately reflect arid desert soil types and rare desert plant indicator species. Finally, updated riparian mapping resulted in refinement of riparian acres and the addition of a new riparian forest PNVT, Gallery Coniferous Forest. Riparian PNVTs are discussed under "Riparian Resources."

Table 11. Update to PNVTs and amounts on the forest

Previous PNVT Description	Initial PNVT Acres	Initial Percent of Forest	Current PNVT Description	Current PNVT Acres	Current Percent of Forest
Desert Communities	6,339	0.3%	Desert Communities	63,548	3.5%
Interior Chaparral	50,687	2.8%	Interior Chaparral	50,471	2.7%
Cottonwood Willow Riparian Forest	2,017	0.1%	Cottonwood Willow Riparian Forest	2,507	0.1%
Mixed Broadleaf Deciduous Forest	2,562	0.1%	Mixed Broadleaf Deciduous Forest	3,612	0.2%
Montane Willow Riparian	557	<0.1%	Montane Willow Riparian	3,829	0.2%
Not Previously Included			Gallery Coniferous Riparian Forest	200	<0.1%
Wetland Cienega	1,140	0.1%	Wetland/Cienega	9,879	0.5%
Semidesert Grasslands	147,573	8.0%	Semidesert Grasslands	89,683	4.9%
Great Basin Grasslands	94,277	5.1%	Great Basin Grasslands	92,913	5.1%
Montane Subalpine Grasslands	24,199	1.3%	Montane Subalpine Grasslands	23,429	1.3%
Piñon-Juniper Woodland	301,675	16.4%	Piñon-Juniper with Grass	261,432	14.2%
			Piñon-Juniper Persistent	75,393	4.1%
Piñon-Juniper Evergreen Shrub	300,154	16.3	Piñon-Juniper Evergreen Shrub	263,835	14.4%
Ponderosa Pine	807,424	43.8%	Ponderosa Pine	791,897	43.1%
Dry Mixed Conifer	79,060	4.3%	Mixed Conifer w/Frequent Fire (Dry)	49,619	2.7%
Not Previously Included			Mixed Conifer w/Aspen (Wet)	37,083	2.0%
Spruce-fir	13,942	0.8%	Spruce-fir	13,946	0.8%
Alpine Tundra	941	0.1%	Alpine Tundra	939	0.1%

Fire was a natural disturbance that maintained reference conditions in the following 11 fire-adapted PNVTs: Semidesert Grassland, Great Basin Grassland, Montane/Subalpine Grassland, Interior Chaparral, Piñon-Juniper with Grass, Piñon-Juniper Evergreen Shrub, Piñon-Juniper Woodland (Persistent), Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Aspen, and Spruce-Fir. The other PNVTs (including Riparian Forest Types and Wetland and Cienegas) experienced fire infrequently and had different primary natural disturbances such as flooding or climate variability.

The current conditions of the PNVTs are summarized in two tables that show different aspects of terrestrial (i.e., nonriparian) PNVTs on the forest. Table 12 summarizes current vegetation departure and trends from reference condition, historical fire severity, and changes in fire return intervals by PNVT. It also identifies primary threats to the PNVTs and departure characteristics. Vegetation departures are focused on differences in vegetative states as they relate to ecosystem composition and structure. Historic and current fire return intervals show differences in disturbance patterns and relate to ecosystem process and function. The methods to determine vegetative departure are described in the "Ecological Sustainability Report." Vegetation departure can reflect the disparity between current and reference condition or can be modeled into the future to show changes in departure over time depending on types and amount of treatments. Table 13 summarizes the dominant Vegetation Condition Classes (VCC) for nonriparian PNVTs. VCC describes vegetation structure in terms of its contribution to fire severity and intensity and its ability to carry characteristic fire. VCC is an alternate approach to Fire Regime Condition Class (FRCC) that was used in the "Ecological Sustainability Report." It originates from LANDFIRE; is derived from relatively coarse data, and only represents the disparity between current and reference conditions Vegetation Condition Classes are described in more detail below.

Departure values represent the difference between current and reference conditions for individual characteristics. For nonriparian PNVTs, characteristics that were evaluated included: structure (vegetation states) of the dominant life forms (e.g., grass, shrub, and tree) and cover. Vegetation departure was assessed as low (0 to 33 percent), moderate (34 to 66 percent), or high (greater than 66 percent). Primary reasons for departures include: fire suppression and livestock grazing, lack of characteristic fire, and invasive exotic plants. While weeds are generally localized, present at low densities, or low-priority species in most PNVTs, some PNVTs face increased threats by exotic, invasive species because they can alter fire regimes, increase erosion, and compete with native plants.

Historically, over two-thirds of the Coconino NF had a fire return interval of less than 35 years (USDA Forest Service 2009) and years of fire suppression and livestock grazing have resulted in missed fire return intervals. Semidesert Grassland, Great Basin Grassland, Montane/Subalpine Grassland, Piñon-Juniper with Grass, Ponderosa Pine, and Mixed Conifer with Frequent Fire PNVTs have evolved with and are dependent on frequent fire to maintain their growth, structure, function, and health. Without fire, the accumulation of debris on the forest floor would increase fire intensity and severity. When an ecosystem is departed from its natural fire regime, the resulting intensity and severity of the fire is uncharacteristic and kills more vegetation. Such uncharacteristic fire also poses a greater threat to values at risk,[31] such as infrastructure, and public and firefighter safety (Moore et al. 1999). Fires that occur in departed ecosystems can result in rapid spread, high fire intensity, and high fire severity to levels at which managers cannot safely control (Moore et al. 1999). Fire exclusion has led to a dramatic change in ecosystem structure and function and increased potential for uncharacteristic fire behavior.

[31] Values at risk encompass a wide range of ecological and social values that could be negatively impacted by wildfire, including wildlife habitat, soils, watershed, riparian and water resources, heritage resources, and recreation amenities.

Table 12. Summary of vegetation and fire changes compared to reference conditions, PNVT threats, and departure characteristics

PNVT	Acres on the Forest (Percent of Forest)	Current Vegetation Departure[1]/ (Percent Departure)/ Future Trend	Historic Fire Return Interval (HFRI) and Severity[2]	Current Fire Return Interval	PNVT Threats[3]	Primary Departure Characteristics
Desert Communities	63,548 (3.5%)	High (77%)/ Unknown	Not fire adapted	Unknown	Invasive exotic plants; Road construction and maintenance	Increased late seral herbs and shrubs with >15% cover and invasion of exotic plant species
Semidesert Grassland	89,683 (4.9%)	High (100%)/ Away	0 to 35 years Low Severity	500+ years	Fire exclusion/ uncharacteristic fire	Lack of characteristic fire disturbance, significant shift to shrubs and trees, increased closed shrub states, and invasion of exotic plant species
Great Basin Grassland	92,913 (5.1%)	Low (10%)/ Away	0 to 35 years Low Severity	500+ years	Fire exclusion;	Lack of characteristic fire disturbance, significant shift to shrubs and trees, increased closed shrub states and invasion of exotic plant species
Montane/ Subalpine Grassland	23,429 (0.8%)	Low (32%)/ Away	0 to 35 years Low Severity	500+ years	Fire exclusion/ uncharacteristic fire	Lack of characteristic fire disturbance, tree encroachment, increased closed shrub states, invasive plants
Interior Chaparral	50,471 (2.7%)	Low (26%)/ Static	Primarily 200+ years High Severity; some 0 to 35 years High Severity	384 years	Fire exclusion	Lack of characteristic fire disturbance
Piñon-Juniper with Grass[4]	261,432 (14.2%)	Moderate (55%)/ Away	0-35 years Low Severity to Mixed Severity	**	Fire exclusion/ uncharacteristic fire	Increased tree density and reduced understory species cover and diversity
Piñon-Juniper Evergreen Shrub	263,835 (14.4%)	Moderate (50%)/ Away	35-200+ years Mixed Severity	500+ years	Fire exclusion/ uncharacteristic fire	Increased tree density and reduced understory species cover and diversity
Piñon-Juniper Woodland (Persistent)[4]	75,393 (4.1%)	Low (25%)/ Static	35-200+ years High Severity	192 years	Fire exclusion/ uncharacteristic fire	Increased tree density & significant shift to small and medium sized trees, and reduced understory species cover and diversity

PNVT	Acres on the Forest (Percent of Forest)	Current Vegetation Departure[1]/ (Percent Departure)/ Future Trend	Historic Fire Return Interval (HFRI) and Severity[2]	Current Fire Return Interval	PNVT Threats[3]	Primary Departure Characteristics
Ponderosa Pine	791,897 (43.1%)	High (79%)/ Away	0-35 years Low Severity	344 years	Fire exclusion/ uncharacteristic wildfire; insects and disease	Increased tree density & significant shift to closed medium aged forest; reduced understory species cover and diversity; increased risk of uncharacteristic, high severity fire; and invasion of exotic plant species
Mixed Conifer with Frequent Fire[4]	49,619 (2.7%)	Moderate (64%)/ Away	0-35 years Low Severity	130 years	Fire exclusion/ uncharacteristic wildfire; insects and disease	Increased tree density and significant shift to closed medium-aged forest with shifts in species composition to more shade tolerant species reduced understory species cover and diversity, increased risk of uncharacteristic, high severity fire
Mixed Conifer with Aspen[4]	37,083 (2.0%)	Moderate (62%)/ Away	35-200 year Mixed Severity	**	Fire exclusion/ uncharacteristic wildfire; insects and disease	Increased tree density and shifts in species composition to more shade tolerant species, increased fuel loading and continuity
Spruce-Fir	13,946 (0.8%)	Moderate (49%)/ Static to Away	200+ years High Severity	500+ years	Fire exclusion/ uncharacteristic wildfire; insects and disease (e.g., exotic spruce aphid)	Increased tree density and shifts in species composition to more shade tolerant species, increased fuel loading and continuity
Alpine Tundra	939 (0.1%)	Low (32%)/ Unknown	NA	NA	None within Forest Service control.	None within FS control.

[1] Vegetation departure was assessed as low (0–33%), moderate (34–66%), or high (>66%).

[2] Severity: Low severity fires kill/topkill 25% or less of the dominant overstory and are primarily surface fires. Less than 75% of the dominant overstory is replaced in mixed severity fires which are a combination of crown and surface fire. High severity fires replace more than 75% of the dominant overstory as a crown fire. Also called stand replacement fire.

[3] Within Forest Service control. See "Climate Change" section for analysis of potential climate change effects. Other PNVT threats not within FS control include excessive wildlife herbivory, drought, and fragmentation on lands off-forest. These other threats are considered in cumulative effects.

[4] Piñon-Juniper Woodland and Piñon-Juniper with Grass were lumped together in the analysis in the "Ecological Sustainability Report," as were the two mixed conifer types.

** Not available in the "Ecological Sustainability Report."

Fire Regime Condition Class (FRCC) was used in the "Ecological Sustainability Report" to quantify how departed vegetative structure is from historical conditions in relation to the role fire historically played in that system (Hann and Bunnell 2001, Hardy et al. 2001, Hann et al. 2004). The different classes describe the degree of departure from the historical fire regime (as defined by the intensity and frequency of historic fires) and summarize changes in forest composition, structure, fire frequency and intensity, fuel composition, fire mosaic, and the extent and timing/seasonality of future fires[32].

Two outcomes are possible when a vegetation type is highly departed in terms of FRCC. The first is that intensity, severity, and extent of fires can alter because of changes in vegetation conditions, and the second is that a PNVT is no longer able to carry characteristic fire across the landscape. An example of the latter is the Piñon-Juniper with Grass PNVT. In this PNVT, fire exclusion has resulted in missed fire return intervals which, in turn, facilitated tree establishment. Canopy cover increased as tree density increased which reduced the abundance and vigor of understory vegetation. Consequently, surface fire can no longer be carried by the understory facilitating the establishment of more trees and closed conditions. Changes like this would be most pronounced in frequent fire PNVTs where disruption of fire return intervals has resulted in higher departures. Within reference conditions, fire would be self-regulating and would maintain fire intensity and severity more consistently. As a result, the risk of uncharacteristic fires increases, or the ability to carry fire would be reduced. In vegetation types where the disruption of fire disturbance is closer to reference conditions, the environmental consequences of fire exclusion are not as great and, therefore, are not as likely to produce uncharacteristic fires.

Vegetation Condition Class, analysis of changes in fire return intervals, and analysis of fire severity replaced FRCC in this analysis[33]. Vegetation Condition Class (VCC) is classified in the LANDFIRE database and represents the vegetation element in FRCC. VCC, has three condition classes: low (VCC I), moderate (VCC II), and high (VCC III) which represent departure from natural vegetative condition (LANDFIRE 2013). A limiting factor is that trends cannot be predicted with VCC.

For frequent-fire systems, vegetation in VCC I is more resistant and less likely to lose key ecosystem components (e.g., native species, large trees, soil) after a disturbance. Fire behavior and other associated disturbances are similar to those that occurred prior to fire exclusion. For example, Ponderosa Pine in VCC I would have a vegetative structure similar to historic conditions when fires were generally high frequency, low intensity surface fires and vegetation consisted of all-aged open stands and clumps of trees. This is considered to be within the historic range of variability. Vegetation in VCC II and VCC III is moderately to highly altered, or departed, from historic conditions (e.g., denser, less open, fewer age classes, fewer clumps). This

[32] The forest desired conditions are similar but not equal to historical conditions for Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen PNVTs, given management considerations for Mexican spotted owl and goshawks. This is important because FRCC describes how departed a system is from historical conditions, not from desired conditions.

[33] VCC was originally referred to as FRCC by LANDFIRE and in the "Ecological Sustainability Report" (USDA Forest Service 2009). However, LANDFIRE changed the designation from FRCC to VCC (2012) because the classification methods within the LANDFIRE database did not include the two primary fire regime factors (departure from historic frequency and severity) that are required to calculate FRCC as defined by Hann and Bunnell (2001).

vegetation would be outside the range of historic variability, less resistant to disturbances, and more likely to lose key ecosystem components following a disturbance. Fuels may be more contiguous and present in high amounts increasing the likelihood of uncharacteristic fires. In VCC II and VCC III, fires may be larger and more severe compared to historic conditions.

Table 13 shows the estimated VCC for each PNVT. Approximately 90 percent of the forest is moderately to highly departed from historic conditions and classified as VCC II and VCC III. Only about 10 percent of the entire forest is dominated by VCC I (low departure).

Table 13. Dominant vegetation condition class by non-riparian PNVTs

PNVT	Dominant Vegetation Condition Class
Desert Communities	VCC I/ Not fire adapted
Semidesert Grassland	VCC II
Great Basin Grassland	VCC III
Montane Subalpine Grassland	VCC III
Interior Chaparral	VCC I and II
Piñon-Juniper Grassland	VCC III
Piñon-Juniper Evergreen Shrub	VCC II
Piñon-Juniper Woodland (Persistent)	VCC II
Ponderosa Pine	VCC III
Mixed Conifer with Frequent Fire	VCC III
Mixed Conifer with Aspen	VCC III
Spruce-Fire Forest	VCC II
Alpine Tundra	VCC III/Not fire adapted
Riparian PNVTs are discussed under “Riparian Resources”	

Acres Treated

Over the life of the plan, approximately 290,000 acres have been mechanically treated forestwide. Prior to 1996, the forest treated about 199,000 acres and management strategy was focused on even-aged forest management, using the shelterwood system. The land management plan was amended in 1996 to incorporate updated direction for northern goshawks, Mexican spotted owls, and old growth and an uneven-aged forest management strategy. From 1988 to 2006, commercial vegetation treatments averaged 10,000 acres harvested per year (USDA Forest Service 2011r).

Snags

Snags are standing dead or dying trees. They can be of varying sizes, species, and decay classes. They include large snags, partial snags, and trees with broken tops, sloughing bark, wide

lightning scars (greater than 4 inches wide) or snags capable of supporting large stick nests or nesting cavities. They are used for nesting, roosting, perching, and feeding sites by bats, birds, and mammals. There have been several snag studies on or near the forest. Ganey (1999) found a median of two snags per acre on the Coconino and Kaibab National Forests. Coconino NF Forest Inventory Analysis data (Manthei 2011b, 2011c, and 2011d) show the number of snags per acre (see table 14):

Table 14. Existing and desired number of snags by PNVT

PNVT	Existing 18+ inches d.b.h. per acre	Desired 18+ inches d.b.h.[1] per acre
Piñon-Juniper Grassland	1.8	Scattered across landscape
Ponderosa Pine	1.3	1-2 snags
Mixed Conifer with Frequent Fire	3.3	3

[1] The desired ranges are from regional averages that represent each state. Regional guidance documents available on the Forest Service Southwestern Region Web site at:http://www.fs.usda.gov/main/r3/landmanagement/planning

Both of these studies show that current snag densities in these PNVTs meet the guidelines in the current forest plan and are within the range of desired snags per acre by size and vegetation type.

Snag density and abundance can change in response to stand density, uncharacteristic wildfire, insects and disease, and drought. In unnaturally dense stands, live trees may be more stressed due to increased competition for water and nutrients, more vulnerable to drought or insects and disease, and may subsequently die. Wildfires can support the creation of new snags by killing existing live trees, and can also consume existing snags. Consequently, snag densities and the size class distribution of snags can change rapidly.

Old-Growth Forest Components

The 1987 plan, as amended, requires that at least 20 percent of each forested ecosystem management area be developed or maintained for old-growth function and distributed in 100- to 300-acre stands. This approach managed Ponderosa Pine and Mixed Conifer stands (mid-scale) primarily for large trees, high stocking levels (70 to 100 square feet of basal area per acre), and high cover (40 to 60 percent), which tend to promote even-aged structure which is contrary to desired conditions. Current science points to old growth in frequent, low-severity fire regimes as being characterized by uneven-aged structure comprised of groups of trees and single trees interspersed in open grass–forb–shrub interspaces where old growth tree components typically occur at the fine scale and structural features of old growth are distributed throughout the uneven-aged forest.

Desert Communities

On the Coconino NF, the Desert Communities PNVT occurs in the Verde Valley where the Upper Sonoran Desert PNVT merges with the forest. It ranges in elevation from 2,700 to 4,000 feet and covers approximately 63,548 acres (3.5 percent of the forest). It generally occurs in creosote-dominated, alluvial position and on old stream terraces adjacent to the Cottonwood Willow

Riparian Forest PNVT. Vegetation includes: desert scrub, grasses, and some succulents; however, some areas may be barren with abundant sand, rock, gravel, scree, or talus. The dominant species are creosote bush and mesquite, but other species may include: cat claw acacia, saltbush, desert broom, desert willow, Apache plume, hedgehog cacti, cholla, and tabosa grass. Desert Communities supports a unique community of endemic plants adapted to its calcium-rich soils; it also supports a plant, Arizona cliffrose, which is federally listed as endangered and only occurs in a very restricted portion of this PNVT. Climate is the primary natural disturbance, and extreme climate variability (namely from temperature and precipitation) can cause temporary and localized shifts in vegetative composition.

According to reference conditions, Desert Communities was less fragmented and its vegetative structure was mostly open with sparse vegetation, as only 20 percent of the area contained dense vegetation of shrubs and understory species. Current conditions for this PNVT are highly departed from reference conditions due to increased fragmentation from urbanization and increased density in vegetation structure. In addition, it contains a few invasive exotic plant species which, although they are at low densities, they are widely dispersed across the area. The opportunity for their spread and colonization across new sites is high due to the presence of high-use roads such as State Highways 89A and 179, which have numerous weed infestations. The increased abundance and distribution of invasive exotic annual grasses is likely to result in an increase in the frequency and severity of wildfires.

Semidesert Grassland

On the Coconino NF, the Semidesert Grassland PNVT occurs in the Verde Valley and is bounded by the Desert Communities PNVT at lower elevations and Piñon-Juniper Woodland or Interior Chaparral PNVTs at upper elevations. Its elevation range is approximately 3,000 to 4,500 feet, and it covers approximately 89,683 acres (approximately 5 percent of the forest). It contains numerous roads and private land parcels, and it adjoins the communities of Camp Verde, Cornville, and Cottonwood. Current vegetation is dominated by perennial bunchgrasses; shrubs such as crucifixion thorn, velvet mesquite, cat claw mimosa, agaves, and turbinella oak; forbs which may include various buckwheat species; and trees such as Utah juniper and red-berried juniper. Wildfire is a natural disturbance within this PNVT, and Semidesert Grassland is characterized by low-severity fire that occurs every 0 to 35 years.

According to reference conditions, the Semidesert Grassland PNVT was less fragmented than present (due to less human development), and the vegetative structure of the grasslands was more open with fewer trees and shrubs. Frequent low-intensity fires were the principal driving force that formed and maintained the open structure of Semidesert Grassland. Current conditions are highly departed from reference conditions as its extent has substantially decreased (namely due to increased private development), and fire frequency has decreased. Increased interface with developed private land increases the difficulty in maintaining frequent low-intensity fire in this PNVT. The departures in composition and structure that resulted from fire exclusion include alterations in many other subcomponents such as structural stage, stand age, canopy cover, and mosaic pattern, fuel composition, and fire frequency, severity, and pattern. The departed attributes do not allow for the natural fire disturbance cycle and, thereby, alter future fire disturbance processes. Lack of fire in this PNVT would likely result in a trend away from reference conditions relative to fire return interval and a continued shift to shrub- and tree-dominated grasslands into the future. Due in large part to fire exclusion, about 30 percent of the Semidesert Grassland on the south end of the forest have become so shrub and tree invaded that they have

likely undergone a vegetation type conversion with little potential to be restored to open native grassland condition (USDA Forest Service 2009). A few, widely distributed invasive exotic plant species are present, including red brome.

Great Basin Grassland

On the Coconino NF, the Great Basin Grassland PNVT occurs at elevations between 4,800 and 7,500 feet and covers approximately 92,913 acres (approximately 5 percent of the forest). Great Basin Grassland is more arid than Montane Subalpine Grassland, and typical locations include Anderson Mesa and near Wupatki National Monument. Dominant species in this PNVT are mostly grasses such as: Western wheatgrass, spike muhly, black grama, Indian ricegrass, threeawn, blue grama, fescue, James' galleta, and Sandberg bluegrass. Shrubs and, to a lesser extent, trees are also present and may include: sagebrush, salt brush, Ephedra, snakeweed, winterfat, rabbitbrush, sparse one-seeded juniper, and Colorado piñon pine. Natural disturbances are: weather, natural soil movement (e.g., natural shrink-swell and surface cracking), and wildfire. Great Basin Grassland is characterized by low-severity fire that occurs every 0 to 35 years.

According to reference conditions, nearly three-fourths of the Great Basin Grassland PNVT was in open, mid-development grasses and forbs with about one-fifth of it in late development shrubs and trees with open canopy. Fire entered this grassland type from adjacent fire-adapted PNVTs. Current conditions are similar to reference conditions; however, some shrub and tree invasion is occurring along the edge of grasslands, and there has been a shift from small to large tree sizes. Although this PNVT contains only a few invasive exotic species, some plants (camelthorn and diffuse knapweed) are ranked high for invasiveness. In addition, cheat grass is widely dispersed at low densities and could cause major changes in ecosystem integrity if not controlled The departures in composition and structure that resulted from fire exclusion include alterations in many other subcomponents such as structural stage, stand age, canopy cover, and mosaic pattern, fuel composition, and fire frequency, severity, and pattern. Despite these changes, Great Basin Grassland is still at low departure, and modeling indicates that it is trending away from desired conditions.

Montane Subalpine Grassland

On the Coconino NF, the Montane Subalpine Grassland PNVT occurs at elevations between 6,550 and 9,200 feet, with some small, unmapped patches existing at higher elevations. This PNVT covers approximately 23,429 acres (approximately 0.8 percent of the forest), and consists of two subtypes: Montane Grasslands and Subalpine Grasslands. Montane grasslands occur above the Mogollon Rim and extend upward to about 7,800 feet in elevation and include locations such as Kendrick Peak, Antelope Park, and Mule Park. Species in this subtype include: muttongrass, mountain muhly, spike muhly, Arizona fescue, blue grama, red threeawn, squirreltail, yarrow, and pine dropseed. Subalpine Grassland typically occurs above 7,800 feet in areas such as Freidlan Prairie on the San Francisco Peaks. Species in this subtype include: pine dropseed, nodding brome, various sedges, Arizona fescue, mountain junegrass, mountain muhly, muttongrass, and squirreltail. In both subtypes, trees may also be present in trace amounts within the grasslands and along their periphery. The primary natural disturbance is wildfire which reduces the number of tree seedlings and saplings that establish in grasslands, especially on the perimeter. Montane Subalpine Grassland PNVT has a 0- to 35-year fire frequency and fires of low severity (surface

fires most common) to mixed severity (i.e., less than 75 percent of the dominant overstory vegetation replaced).

According to reference conditions, Montane Subalpine Grassland was less fragmented before changes occurred in land ownership to private property owners and State and other Federal agencies. Its vegetative structure was more open or dominated by grass species; and it did not contain any invasive exotic species. This open structure was formed and maintained primarily by frequent low-intensity fire entering from adjacent fire-adapted PNVTs. By default, fire has been excluded from this PNVT due to fire exclusion in adjacent fire-adapted PNVTs. Consequently, vegetation structure is trending away from reference conditions and is approaching moderate departure. There has been a shift from grass to trees, especially trees encroaching at the PNVT's perimeter. The departures in composition and structure that resulted from fire exclusion include tree encroachment and alterations in the pattern and diversity of understory species resulting from fire intrusions. The presence of a few invasive exotic species that are ranked high for invasiveness, such as leafy spurge, also represent a departure from reference conditions.

Interior Chaparral

On the Coconino NF, the Interior Chaparral PNVT occurs at lower elevations, mostly in the Verde River basin, between the Semidesert Grassland and Piñon-Juniper Evergreen Shrub PNVTs. Its elevation ranges from 3,750 to 7,300 feet, and it covers approximately 50,471 acres (approximately 3 percent of the forest). Its location varies from widely scattered pockets within grasslands and woodlands to more extensive areas on steep slopes. Vegetation includes: turbinella oak, mountain mahogany, manzanita, desert ceanothus, silk tassel, Stansbury cliffrose, and sumac. Interior Chaparral is characterized by high severity fire that occurs primarily every 200+ years; however, some high severity fire may occur every 0 to 35 years.

According to reference conditions, Interior Chaparral is composed of 93 percent dense shrubs with a closed canopy and no understory, 5 percent grass and open shrubs, and 2 percent grass and forb regeneration. Current conditions are similar to reference conditions in the PNVT's extent, structure, and composition. A few invasive exotic plant species are present in this PNVT; however, because their populations are few in number and acreage, this PNVT is rated low for departure from reference conditions with respect to weeds. The projected trend for vegetation structure and composition is static, but the trend for invasive exotic species is away from desired conditions because of the anticipated spread of nonnative grasses from adjacent PNVTs.

Piñon-Juniper with Grass

On the Coconino NF, the Piñon-Juniper with Grass PNVT occurs at elevations between 5,000 and 8,300 feet and covers approximately 261,432 acres (14.2 percent of the forest). This PNVT is distributed in upland and valley settings or where local conditions are inherently favorable for grasses, and it is often found on moderately deep soils and gentle topography. Tree species includes: piñon pine and Utah and one-seed juniper (which are most common) and alligator juniper at higher elevations. Its understory consists of annual and perennial grasses (with forbs) including: blue grama, needle and thread grass, and western wheatgrass. Shrubs may be present, but they are a minor component. Piñon-Juniper with Grass is characterized by low-severity to mixed-severity fire that occurs every 0 to 35 years.

According to reference conditions, Piñon-Juniper with Grass was generally uneven-aged and open in appearance. Trees occurred as individuals, but occasionally in smaller groups, and they ranged from young to old. Shrubs were scattered and a dense, nearly continuous herbaceous understory included: native grasses, forbs, and annuals. Romme et al. (2009) estimated that probable fire behavior would be moderate surface fire spread, limited torching, and low tree mortality (in mostly smaller stems) in this PNVT when conditions are typical of the 80th percentile fire weather following a single ignition event in piñon and juniper vegetation with significant grass cover and sparse tree density. Under extreme fire weather conditions, there would be probable extensive surface fire spread and torching, and moderate mortality across all tree sizes.

Current conditions are moderately departed from reference conditions and are trending away. Within this PNVT, there are currently more trees per acre and greater cover than under reference conditions due to fire exclusion and weather patterns which have favored tree germination and establishment. As a result, understory abundance and diversity has decreased. In severe cases of tree encroachment, former grasslands and savannas have undergone a vegetation type conversion, including a change in fire regime, to juniper or piñon-juniper woodlands. The expansion of piñon and/or juniper into previously nonwooded areas is resulting in a more homogenous landscape that, in some areas, is suppressing understory herbaceous growth and consequently the potential for surface fires. The pronounced departures in composition and structure that resulted from fire exclusion include alterations in many other subcomponents such as: structural stage; stand age; canopy cover; mosaic pattern; fuel composition; and fire frequency, severity, and pattern. The departed attributes do not allow for the natural fire disturbance cycle and, thereby, alter future fire disturbance processes. Areas that have been affected by the Ips bark beetle infestation over the past decade, however, are expected to trend toward reference conditions.

Piñon-Juniper Evergreen Shrub

Piñon-Juniper Evergreen Shrub PNVT occurs at elevations between 4,000 and 6,900 feet and covers approximately 263,835 acres (approximately 14 percent of the forest). It usually occupies hills, plains, mountains, and escarpments below the Mogollon Rim. This PNVT is dominated by open to closed shrub canopy of evergreen oaks, such as turbinella oak and some tree forms of Emory and Arizona white oak and Stansbury cliffrose. Codominate species include single-needle piñon pine and Utah juniper, and some areas contain alligator juniper and Arizona cypress. A grassy understory may be present in areas with decreased tree cover, and herbaceous ground cover is dominated by warm season grasses including blue and sideoats grama and needle and thread grass. Piñon-Juniper Evergreen Shrub is characterized by mixed severity fire that occurs every 35 to 200+ years.

According to reference conditions, Piñon-Juniper Evergreen Shrub was dominated by shrubs and medium to very large open, grown trees, and invasive exotic species were not present. Current conditions are moderately departed from reference conditions as this PNVT is now less extensive and mid-scale vegetation analysis indicates a shift to more closed tree canopies and a loss of herbaceous understory. There are a few invasive exotic species within Piñon-Juniper Evergreen Shrub, but because their populations are few in number and acreage, this PNVT's departure is rated at moderate. Overall, this PNVT's vegetation structure and composition is expected to trend away from reference conditions as tree canopy becomes increasingly closed.

Piñon-Juniper Woodland

On the Coconino NF, Piñon-Juniper Woodland (also called Persistent Piñon-Juniper Woodland) occurs at elevations between 3,000 and 7,500 feet and covers approximately 75,393 acres (approximately 4 percent of the forest). Piñon-Juniper Woodland is characterized by high severity fire that occurs every 35 to 200+ years. It is located mainly in the north and east portions of the forest on the lower slopes of mountains and upland rolling hills. This PNVT ranges from sparse stands of scattered, small trees growing on poor substrates to relatively dense stands of large trees on more productive sites. However, tree density and cover may fluctuate in response to disturbance and climatic variability. Tree species include: piñon pine and Utah and one-seed juniper (which are most common) and alligator juniper at higher elevations. Shrubs may include: Stansbury cliffrose, Gambel oak, saltbrush, big sagebrush, and limited areas of turbinella oak and manzanita. Understory species is mostly comprised of annual and perennial grasses including: blue grama, needle and thread grass, and western wheatgrass. Natural disturbances in Piñon-Juniper Woodland include endemic levels of insects and disease and wildfire.

According to reference conditions, Piñon-Juniper Woodland was mostly open with a mosaic of small, medium, and large trees overtopping a herbaceous understory. Fires were more frequent and generally did not "thin from below" (i.e., they did not kill predominantly small trees), but rather tended to kill all or most of the trees, regardless of size, within the places that burned. In addition, invasive exotic species were not present. Overall, current conditions have a low departure from reference conditions, and the PNVT's trend from reference conditions varies. Areas that are overstocked with trees are expected to trend away and the remaining areas are expected to have a static trend. Currently, there is an overall shift toward small and medium sized trees with loss of herbaceous understory and large trees with open canopy, mainly because of a history of fire suppression activities. This PNVT is rated low for departure with respect to weeds.

Ponderosa Pine

Ponderosa Pine is the largest PNVT on the forest. It occurs from 5,300 to 8,200 feet in elevation and covers approximately 791,897 acres (or approximately 48 percent) of the forest. In addition to the dominant overstory species (ponderosa pine), other trees include: Gambel oak; Douglas-fir; piñon pine; Utah Rocky Mountain and alligator juniper; and aspen in small, localized areas. Snags (or dead standing trees) are also present. Understory vegetation includes a mixture of shrubs and grasses including: manzanita, Fendler's ceanothus, Arizona fescue, mountain muhly, screw leaf muhly, and blue grama. In some areas, ponderosa pine occurs as savannah with extensive grasslands interspersed between widely spaced clumps or individual trees (USDA Forest Service 2009).

According to reference conditions, ponderosa pine primarily occurred as open, all-aged forests, with a widespread herbaceous understory, and its composition and structure was maintained by frequent, low-intensity fires and endemic levels of insects and disease. Ponderosa Pine is characterized by low severity fire that occurs every 0 to 35 years. Historic logging practices (e.g., railroad logging on the north side of the forest) originating in the 1880s focused on even-aged silvicultural systems, particularly clearcutting. Logging companies purchased timber rights from the transcontinental railroads which had been granted "checkerboarded" or alternating sections of land from the Federal Government. Many of these sections in the north were clearcut prior to establishment of the Coconino NF in 1908 (USDI 1995). However, the railroad line only

penetrated as far south as Allen Lake, into the northern edge of what is now known as the Mogollon Rim Ranger District.

Prior to 1930, early cutting had an even-aged management strategy that was mainly a seed-tree system with an emphasis on high-grading. The first cutting treatments retained more large trees on the southern portion of the forest, and the first entry occurred several decades later on the southern portion compared to the northern portion. The forest did a lot of tree pruning to accelerate the higher-grade lumber from logs during the period of the mid-1940s through the mid-1950s. This practice was discontinued due to higher labor costs and lumber markets not yielding the select grade lumber to justify the investment costs of pruning. During the 1950s up until the early 1990s, there was little emphasis on density management except for precommercial thinning. The primary emphasis was on selective cutting (e.g., sanitation, salvage, removing poor risk trees, improvement, mature tree harvest, free selection). The Colorado Plateau Pulpwood contract (1959 to 1989) focused on thinning trees, generally 6 to 13 inches d.b.h. which had the result of an all-aged appearance since spacing of trees was the objective. Reforestation (which also increased an all-aged appearance) was accelerated in the mid-1960s, peaked in the early 1980s and tapered off to sporadic plantings by the early 1990s. From the mid-1970s to early 1990s, the primary emphasis shifted to density management, specifically, regulated even-aged management using a shelterwood management system. In the early 1990s, little thinning was done due to a lack of Knutsen-Vanderberg dollars or project dollars and the loss of the timber industry. A 1996 plan amendment shifted emphasis once again, this time to primarily uneven-aged selection management systems targeting forest structure and tree density. In addition, in the middle to late 1990s, efforts like the Greater Flagstaff Forests Partnership changed the focus to commercial thinning and breaking up the even-aged stands. In the early 2000s, the National Fire Plan also shifted the focus to treatments in the wildland-urban interface (personal communication Greco 2013).

Current conditions within Ponderosa Pine are highly departed and trending away from reference conditions because the amount of cover is higher, trees are denser and more continuous, fuel loads are higher, and more even-aged stands of trees exist due to the exclusion of fire. Open canopy stands are extremely deficit, and there is more even-aged structure than desired. Stands growing under these conditions are less resilient and sustainable over time, because they are under greater competitive stress and are more susceptible to threats including: uncharacteristic wildfire; invasive, exotic species; and widespread infestations of disease. Another consequence of fire exclusion and the interruption of the frequent fire regime is the decline in understory species diversity and abundance which exists because tree density is higher and less sunlight reaches the forest floor. Secondary threats include uncharacteristically intense wildfire and increased susceptibility to insect and disease from increased plant competition for water during times of drought. Desired conditions for this PNVT are similar to reference conditions in that a more open, less dense, and all-aged forest is favored. However, a complete return to reference conditions is unfeasible, because human development within and adjacent to this PNVT greatly limits the extent of treatments that could occur, namely due to constraints placed on fire and vegetation treatments due to social values and regulations such as air quality and Endangered Species Act regulations.

Mixed Conifer with Frequent Fire

On the Coconino NF, Mixed Conifer with Frequent Fire PNVT (also called Dry Mixed Conifer) occurs at elevations ranging from 7,000 to 8,900 feet and covers approximately 49,619 acres

(2.7 percent of the forest). It is located between lower elevation Ponderosa Pine and Mixed Conifer with Aspen PNVTs and the higher elevation Spruce-Fir PNVT. This PNVT is dominated by mainly shade-intolerant trees such as ponderosa pine, southwestern white pine, limber pine, quaking aspen, and Gambel oak, and there is a lesser presence of shade-tolerant species such as white fir and blue spruce. Additionally, shade mid-tolerant species, such as Douglas-fir, are common; aspen may occur as individual trees or small groups; and maple is generally found in wetter sites, canyons, and draws. An understory of various grasses, forbs, and shrubs is also present. The primary natural disturbances in this PNVT are wildfire and endemic levels of insects and disease. The normal fire regime is generally considered to be low severity, similar to Ponderosa Pine, with fire return internals of less than 35 years. Like Ponderosa Pine, this PNVT co-evolved with fire; therefore, fire was the driving force that formed and maintained the openness of stands and appropriate conditions for the maintenance of early succession species and made them less susceptible to insect and disease.

According to reference conditions, Mixed Conifer with Frequent Fire was a mostly open landscape and was dominated by largely mature and old trees; however, all age classes of trees were present. A widespread herbaceous understory was also present. Current conditions are moderately departed and trending away from reference conditions, namely because of the lack of fire. Current fire frequency is far below reference conditions and is trending away. As a result of fire exclusion, shade-tolerant species, such as white fir, are increasing in the understory. Consequently, tree density is high in most places, and conditions for early succession species are not being maintained or created.

Douglas-fir dwarf mistletoe is thought to be currently more widespread and continuous in distribution than in reference conditions due to the exclusion of fire and the increased amount of dense multilayered stands (USDA Forest Service 2009). Based on present understanding of mistletoe ecology, increases in host abundance over the past 150 years, decreases in fire frequency, and evidence of previous forest conditions and fire regimes, it can be inferred that southwestern dwarf mistletoe abundance (severity and distribution) was likely lower historically and current conditions are likely similar to those described by Hessburg and Beatty (1985). Hessburg and Beatty estimated that 32 percent of the commercial acres of ponderosa pine on the Coconino NF were infected with dwarf mistletoe, an increase from 30 percent found in a similar survey 30 years earlier (Lynch et al. 2007). Compared to reference conditions, this level of insect and disease is outside the historic range of variability, and the possible introduction of white pine blister rust, which was recently discovered for the first time in eastern Arizona, could further elevate mortality levels. This nonnative disease is one of the most damaging tree diseases in North America, affecting trees of all sizes, but has not been detected on the Coconino. Mixed Conifer with Frequent Fire, however, has few weed species (USDA Forest Service 2009).

Aspen is distributed throughout this Mixed Conifer with Frequent Fire as small groups and individual trees. Aspen populations are declining in this PNVT because of fire exclusion but also due to insect defoliators, drought, and heavy ungulate browsing.

Mixed Conifer with Aspen

On the Coconino NF, the Mixed Conifer with Aspen PNVT (also called Wet or Infrequent-Fire Mixed Conifer) occurs at elevations between 8,000 and 10,400 feet and covers approximately 37,083 acres (2 percent of the forest). It occurs on mountain slopes such as the San Francisco Peaks and may also occur in canyons and north-facing slopes such as on Hutch Mountain and

Mormon Mountain. Aspen populations are declining in these PNVTs due to insect defoliators, drought and heavy ungulate browsing. Dominant and codominant species include: Douglas-fir, New Mexico locust, southwestern white pine, and limber pine, and late seral species such as maple, white fir, and blue spruce. Ponderosa pine may be present in minor proportions. The absence of significant quantities of Engelmann spruce and/or corkbark fir distinguishes Mixed Conifer with Aspen from the Spruce-Fir PNVT. Its understory contains a wide variety of shrubs, grasses, and forbs, and it generally has more sedges, mosses, and liverworts than Mixed Conifer with Frequent Fire and more leaf litter because there are more deciduous species. Disturbances typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly mixed-severity fires at 35- to 200-year frequency) and small-scale, frequent disturbances (e.g., fire, insect, disease, wind).

Current conditions are moderately departed and trending away from reference conditions. Nearly 80 percent of this PNVT is denser, with higher canopy cover, indicating that a greater percentage of this PNVT is in a late successional state than in reference conditions. Consequently, shade-tolerant species are more prevalent and early successional, more fire-tolerant species are declining. As a result, the risk of uncharacteristic fire that is larger in extent and possibly more severe is higher than reference conditions. Mortality due to insect and disease is likely to continue because of the high proportion of dense stands, lack of fire, and the possible introduction of white pine blister rust, which was recently discovered for the first time in eastern Arizona. This nonnative disease is one of the most damaging tree diseases in North America, affecting trees of all sizes, but has not been detected on the Coconino.

Spruce-Fir

On the Coconino NF, the Spruce-Fir PNVT occurs at elevations between 8,400 and 12,000 feet and covers approximately 13,946 acres (less than 1 percent of the forest). It is within the Kachina Peaks Wilderness and represents some of the coldest, wettest, and highest elevation sites on the forest. Spruce-Fir is often dominated by Engelmann spruce but contains other species depending on elevation. The understory commonly includes: currants, maples, honeysuckle, common juniper, alpine clover, and sedges. Disturbances in Spruce-Fir typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly fire) and small-scale frequent disturbances (e.g., fire, insect, disease, wind). This PNVT is characterized by infrequent, high-severity fire (fire return interval of over 200 years). Other major disturbances were wind or snow-related.

According to reference conditions, structure, and composition of the Spruce-Fir forest type was governed by complex interactions between multiple disturbance agents. Spruce beetle outbreaks cause extensive tree mortality and modify stand structure by reducing the average tree diameter, height, and stand density while dramatically increasing fuel loading. Insect and disease populations will often remain endemic for hundreds of years as the younger forests mature. Spruce-Fir forests characteristically experienced infrequent, high-severity fires, typically following epidemic beetle infestations in susceptible, mature forests. Invasive exotic species were not present.

Vegetative structure is moderately departed from reference conditions and is static to trending away. There is a surplus of younger age classes and fewer old age classes due to extensive wildfires that occurred in the early 1900s. Because the majority of this PNVT (80 percent) is located in designated wilderness and has been subject to little management, except for fire

suppression, it has either taken on old-growth conditions or is trending toward developing old growth. Although approximately 340 acres are affected by the spruce beetle, this acreage is considered to be within historic levels. Two invasive exotic species (Dalmatian toadflax and houndstongue) are present in Spruce-Fir, but their populations are few in number and acreage and they have a low ranking for invasiveness. Therefore, they are not considered a threat to this PNVT.

Alpine Tundra

On the Coconino NF, about 939 acres of the Alpine Tundra PNVT occur in the Kachina Peaks Wilderness (approximately 0.1 percent of the forest), beginning around 10,600 feet in elevation and continuing to the top of Humphrey's Peak, the highest point in Arizona. It is the only area of Alpine Tundra in Arizona, and it is one of the southernmost extents of this PNVT in the United States. Alpine Tundra consists of three main habitat associations: boulder fields, talus slopes, and meadowlike areas. It is typically barren with sparse vegetation including: grasses, forbs, lichens, and low shrubs. Dwarf, wind-twisted trees are present near the tree line where trees transition to Alpine Tundra vegetation. One of the plants it supports, San Francisco Peaks ragwort, is federally listed as threatened. Alpine Tundra is not a fire-adapted PNVT; instead, its natural disturbance processes are related to episodic weather events including extreme temperatures, solar radiation, winds, avalanches, and moisture. While wildfires and invasive exotic species have had little effect on this PNVT, off-trail recreation can trample plants and damage habitat, especially outside of winter.

Current conditions in Alpine Tundra are similar to reference conditions, probably because this PNVT is located within an existing wilderness area and current management has sought to reduce recreation impacts (the primary human disturbance in this PNVT) by restricting off-trail use. Invasive exotic species are currently absent from this PNVT, namely because of its remoteness from roads and management activities. Over time, this PNVT may move away from reference conditions as localized warmer and drier climate conditions persist. These conditions could produce pronounced changes in the PNVT's composition and structure by increasing plant mortality, plant stress, and shifts toward meadow species rather than talus slope species. Consequently, it is expected to become moderately departed after 15 years and 50 years.

Sub-PNVT Tree Features

Aspen: Aspen occurs in multiple PNVTs across the forest on cool, wet sites. It is an important component of Mixed Conifer vegetation types and a minor component of Ponderosa Pine and Spruce-Fir vegetation types. Aspen communities in the Southwest have been declining for decades. This decline is attributable to altered fire regimes and heavy browsing by ungulates combined with fires, insect defoliators, drought and the inability of aspen regeneration to survive browsing has resulted in conversion of aspen to coniferous forest (USDA Forest Service 2009). Aspen mortality has been greatest in the low elevation range.

During the past 5 to 10 years, more than half of aspen sites below 7,500 feet elevation have experienced high rates of mortality (Fairweather et al. 2007). Drought conditions are expected to exacerbate this decline as stressed trees become more susceptible to damaging agents and mortality. Aspen at higher elevations would become increasingly susceptible and higher rates of mortality should be expected. As overstory aspen weaken and die and competition from conifers increase, successful sprouting (suckering) is expected to decline. Combined with heavy browse

pressure from ungulates, drought, frost, and insect defoliation can prevent aspen regeneration from reaching maturity, except within fenced areas. Extensive mortality of the established aspen component combined with an almost complete regeneration failure at lower elevations (less than 8,500 feet), indicates that future persistence of aspen on the Coconino NF is not assured, except in relict locations at lower elevations (Lynch et al. 2007; Fairweather et al. 2007). Fairweather et al. (2007) found that since 2000, affected sites at less than 7,500 feet in elevation experienced, on average, greater than 95 percent mortality by the summer of 2007; sites located at elevations of 7,500 to 8,500 feet had 61 percent rate of mortality; and 16 percent mortality was observed at sites higher than 8,500 feet in elevation.

Aspen has been selected as an ecological indicator for alternatives B through D and is included in the monitoring program for these alternatives.

Maple: In Arizona, bigtooth maple occurs as a shade-tolerant, seral understory tree or shrub in Douglas-fir, white fir, and subalpine fir (*Abies lasiocarpa*) habitat types (DeVelice and Ludwig 1983, as cited in Tollefson 2006). On the Coconino NF, this species is most prominent in the Mogollon Rim Botanical Area, a 339-acre white fir–bigtooth maple community, and represents a unique vegetation type found in Arizona only at a few locations along the Mogollon Rim. Bigtooth maple is a deciduous, small tree or shrub of variable size, and its form is dependent upon the moisture regime. In canyon bottoms and along streams it grows as a tree with single or multiple trunks reaching 50 feet (15 meters) tall and 1 foot (30 centimeter) in diameter, while on dry canyon slopes it grows as a shrub with 2 or more stems reaching 26 feet (8 meters) tall. It occupies cool, shaded draws and intermittent stream drainages in the high mountains and plateaus of central and southern Arizona and southern New Mexico (Little 1950, as cited in Tollefson 2006; Bassett et al. 1987). It is currently more abundant in the bottom than in the top of snowmelt drainages on the Mogollon Rim in central Arizona (Martin 2001, as cited in Tollefson 2009).

In Arizona and New Mexico, the white fir–bigtooth maple habitat type typically occurs along stream courses. These riparian areas are considered high-quality fish and wildlife habitat (Fitzhugh et al. 1987, as cited in Tollefson 2006). Bigtooth maple is a dominant species in broadleaf riparian woodlands in Arizona, which are used by a variety of wildlife species (Brown et al. 1977, as cited in Tollefson 2006). In central and southern Arizona and southern New Mexico, the dense cover in white fir–bigtooth maple forests serves as excellent black bear habitat (Bassett et al. 1987, as cited in Tollefson 2006). Although white fir–bigtooth maple forest occurred on only 1 percent of a study area on the Mogollon Plateau, Arizona, it accounted for 12 percent of black bear use.

Gambel Oak: Gambel oak occurs with ponderosa pine and mixed conifer with frequent fire in Arizona, growing primarily as an understory or mid-story tree. Most fire history studies have discovered that surface fires burned ponderosa pine-Gambel oak forests on average at least once every 13 years or less before policies of fire exclusion beginning in the late 1800s (Abella and Fulé 2008a). Similar to pure ponderosa pine forests, fire exclusion, wood harvesting, livestock grazing, and other factors have altered forests with Gambel oak forests since Euro-American settlement in the late 1800s. Research published to date suggests that densities of small diameter oaks have sharply increased in the past 140 years in ponderosa pine–Gambel oak forests (Abella and Fulé 2008b). Less clear, however, is whether large diameter oaks have dwindled because of firewood harvest or other factors (Mast 2003). Empirical evidence suggests that increasing densities of conifer species are shading out Gambel oak, contributing to its decline. Diameter distributions at Camp Navajo, Arizona, in 1883 and in 1994 to 1995, suggest that densities of

oaks greater than 10 inches (25 centimeters) in diameter have actually increased slightly since 1883 (Abella and Fulé 2008b). Overall, the number of small diameter oaks on the landscape is higher than under reference conditions.

Alligator Juniper: Alligator juniper and blue spruce are additional tree species that are highlighted in the current forest plan. Alligator juniper occurs within several PNVTs, including Ponderosa Pine, Piñon-Juniper with Grass, Piñon-Juniper with Evergreen Oak, and Mixed Conifer with Frequent Fire; often occurring in transition zones. Species dominance among junipers appears to be related to elevation and precipitation patterns. In southern Arizona and southwestern New Mexico, where annual precipitation comes primarily during the summer monsoon, alligator juniper dominates in mesic (moist) sites often at higher elevations. Due to its ability to resprout after fire, alligator juniper may achieve dominance on a post-fire site more rapidly and, where it occurs, more frequent fires would be required to suppress small trees and maintain a savanna structure (Miller and Rose 1999). Both piñon and alligator juniper in north-central Arizona fall below the historical range for mean tree height and mean tree diameter. The smaller mean tree sizes potentially indicate sites that are more heavily dominated by young trees than occurred historically (Gori and Bate 2007).

Aerial photographs from 1935 and 1991 were used in an analysis of vegetation change in southwestern New Mexico. Dramatic changes occurred on gently sloping mesas where relatively dense stands of alligator juniper replaced former grasslands and juniper savannahs. During the 56-year period, grasslands and juniper savannas decreased from a combined 15 percent of the study area to less than 2 percent (Miller and Rose 1999). Similar encroachment by alligator juniper is occurring in grassland vegetation types on the Coconino.

Blue Spruce: In its southern range (southwestern Colorado, Arizona, and New Mexico) blue spruce is part of the widespread mixed conifer forest as a component of several diverse habitat types often occurring in stream bottoms and meadow borders across the forest.

In general, blue spruce dominates habitats that are too warm for Engelmann spruce and subalpine fir and that are wetter than those typically occupied by ponderosa pine. Shrub associates include Gambel oak, as well as alders and willows on the moister sites. Over the bulk of its range, blue spruce is most frequently associated with Douglas-fir and ponderosa pine, and with white fir on mesic sites in the central Rocky Mountains. Blue spruce is seldom found in large numbers, but on streamside sites it is often the only coniferous species present. Blue spruce is classed as intermediate in terms of shade tolerance. On cool sites, a dense or moderately dense canopy favors regeneration of subalpine fir, blue spruce, white fir, and Engelmann spruce, to the exclusion of Douglas-fir. On warm sites, an open canopy favors ponderosa pine, whereas a moderate canopy favors Douglas-fir (Burns and Hankala 1990). Spruce aphid is an exotic insect that established on the San Francisco Peaks about 1999. This insect feeds on tree sap through needle stomata and damages Engelmann spruce and Colorado blue spruce of all size classes. Blue spruce, however, is less susceptible to spruce aphid than is Engelmann spruce, so in some areas it would replace Engelmann spruce if heavy aphid mortality occurred (Lynch et al. 2007).

Environmental Consequences

NFMA requires the Forest Service to determine the suitability of National Forest System lands for timber production and has specific requirements for timber suitability analysis in land management plans. The Agency makes a distinction between timber harvest as a resource use

(e.g., timber production) and timber harvest as a management tool to achieve desired conditions. Under lands suitable for timber production, periodic harvests are expected to occur as a tool for meeting land condition outcomes. Under timber harvest, periodic entries are not scheduled but are permitted where necessary to achieve plan or project-level resource objectives. Timber suitability is described in more detail in appendix G.

A variety of factors was considered when determining lands suitable for timber production including lands where timber production would cause irreversible resource damage, adequate restocking not assured, non-forested lands, and lands that have been administratively withdrawn. Tentatively suitable lands were then further reduced by those areas where it is not cost efficient or where plan alternatives would have plan components that are not compatible with timber harvest such as recommended wilderness, allocated old growth, Mexican spotted owl protected activity centers, and experimental forests. Alternative C had the lowest acreage of lands suitable for timber production (463,165 acres) primarily because of the acreage of recommended wilderness and the distribution of lands managed for old-growth emphasis. Alternatives B and D had the highest amounts of lands suitable for timber production (527,681 acres) because the amount of recommended wilderness in alternative B was already not considered suitable timber as it is made up of mostly piñon-juniper PNVTs, and because management of old-growth forest components under these alternatives would not automatically restrict areas from timber production. Alternative A (464,215 acres) had slightly more acres than alternative C of lands suitable for timber production but fewer acres than alternatives B and D primarily due to the distribution of lands managed for old-growth emphasis.

Environmental consequences of all alternatives were evaluated using a variety of vegetation models, such as the Vegetation Dynamic Development Tool (VDDT) and the Forest Vegetation Simulator (FVS), and available data to predict effects of different management options (see appendix C for more information). Alternatives were evaluated not only on plan guidance, but they were also evaluated for where management actions would be needed to make progress toward desired conditions. Average implementation rates under the 1987 plan (alternative A) of 10,000 acres per year and plan objectives for alternatives B, C, and D were used to estimate future management activities. Plan objectives, however, do not necessarily capture all activities that would occur, including those that would help make further progress toward desired conditions.

Vegetative models were used to estimate conditions and trends of selected PNVTs[34]. Qualitative evaluations were conducted for PNVTs that were not modeled. For vegetation types that have unknown trends and have received little past management, it was assumed that there would be little to no change over current management levels under alternative A.

This analysis assumed that budgets would remain at current levels and based only on the implementation of plan objectives. Over the anticipated 10- to 15-year lifespan of the revised plan, the forest has a limited capacity to significantly alter trends in all vegetation types and move them toward desired conditions. Limitations are imposed by fluctuating and uncertain annual

[34] PNVTs modeled for this analysis were Semidesert Grassland, Great Basin Grassland,Piñon-Juniper with Grass, Ponderosa Pine, and Mixed Conifer with Frequent Fire.

funding, the lack of a current market for sawtimber, pulp, and biomass to offset cost of treatments, competing resource objectives, weather conditions, fuel conditions, and availability of fire management resources. However, all management activities, including those that would be accomplished if additional funding and resources were available, would be designed to move toward stated plan desired conditions.

The metric to compare existing PNVT conditions to desired PNVT conditions is level of departure. There are two types of departure described below: (1) vegetation departure and (2) fire departure. Vegetation departure represents the difference between current and desired conditions for different PNVT characteristics (Table 15). These characteristics describe structure (e.g., understory, shrub, tree), canopy cover of dominant vegetation (i.e., open or closed), and age/size classes (e.g., seedling/sapling, medium to very large trees). For example, a highly departed grassland would be currently dominated by closed canopy shrubs and trees instead of being dominated by perennial grasses, and an open canopy of shrubs would be more representative of desired conditions. More details on vegetative departures are in the "Ecological Sustainability Report" (USDA Forest Service 2009) and appendix C.

Fire departure was evaluated using three characteristics: vegetation condition class, fire return interval, and fire severity (Table 15). Collectively these characteristics provide information about ecosystem function, fuels composition, and fire extent/pattern as they relate to fire regime. For example, a frequent fire PNVT with its natural fire regime restored would have a desired fuel profile and resultant fire regime characteristics. As vegetative structure and composition (i.e., quantity, type, and arrangement of fuel on the landscape) would affect fire behavior, fire would also affect vegetative composition and structure. Predicted future fire return intervals are based on stated plan objectives for acres treated with prescribed fire within each PNVT. While plan objectives likely do not capture all activities that would occur under the alternatives, they were used to determine likely fire departure as it relates to fire return interval. Where no prescribed objectives were specified in a PNVT, it was assumed that none would occur. For example, there are no plan objectives for prescribed burning in the grasslands. Consequently, the trends for fire return interval are predicted to be "away" from desired conditions. The current fire return interval (USDA Forest Service 2009) was compared to the historic fire return interval (HFRI) for each PNVT. Vegetation condition class does not effectively predict departure from historic fire return interval so estimates were made where current fire return intervals were unavailable. It will take more than the life of the plan to return frequent fire PNVTs to a range within the HFRI due to decades of fire exclusion. However, the high end of plan objectives for prescribed burning in ponderosa pine is at a scale large enough to shift the fire return interval toward desired conditions.

Predicted future fire severity levels are based on historic and predicted vegetative departure and trends. PNVTs were modeled that had plan objectives for mechanical treatments (Ponderosa Pine, Mixed Conifer with Frequent Fire, Piñon-Juniper with Grass, Great Basin Grassland, Semidesert Grassland, and Montane/Subalpine Grassland). Although VCC can be used as an inference of the current departure from historic fire severity, VCC cannot be used to determine the trend for this fire regime element. VCC was not projected over time for this analysis. However, similar to how VCC can be used as an inference of departure from historic fire severity, vegetative trends can be used to estimate the departure from historic fire severity over time. PNVTs with a predicted trend toward desired conditions would have reduced threat from uncharacteristic fire and would have severities that are more similar to reference conditions. Modeled trends reflect whether vegetative condition is moving toward or away from reference/desired conditions. In this situation, there

would also be a trend toward the historic/reference conditions for fire severity. Likewise, if trends indicate that the vegetative condition is moving away from PNVT, there would also be a trend away from the historic departure for fire severity (table 16).

Table 15. Vegetation departure rating and trend by alternative

PNVT	Vegetation Departure Rating[1] and Trend							
	Alternative A		Alternative B		Alternative C		Alternative D	
	15 Year	50 Year	15 Year	50 Year	15 Year	50 Year	15 Year	50 Year
Cottonwood Willow Riparian Forest (2,505 acres)	Not fire adapted	Not fire adapted	Not fire adapted	Not fire adapted	Not fire adapted	Not fire adapted	Not fire adapted	Not fire adapted
Gallery Coniferous Riparian Forest (200 acres)	*	*	*	*	*	*	*	*
Desert Communities (63,548 acres)	High/ Away	High/ Away	High/ Away	High/ Away	High/ Away	High/ Away	High/ Away	High/ Away
Semidesert Grassland (89,683 acres)	High/ Static	High/ Static	High (94)/ Toward	High (85)/ Toward	High (94)/ Toward	High (85)/ Toward	High (94)/ Toward	High (85)/ Toward
Great Basin Grassland (92,913 acres)	Low/ Away	Moderate/ Away	Low (12)/ Static	Low (11)/ Static	Low (12)/ Static	Low (11)/ Static	Low (12)/ Static	Low (11) Static
Montane Subalpine Grassland (23,429 acres)	Low/ Away	Low/ Away	Low (14)/ Toward	Low (4)/ Toward	Low (14)/ Toward	Low (4)/ Toward	Low (14)/ Toward	Low (4)/ Toward
Interior Chaparral (50,471 acres)	Low/ Away	Moderate/ Away	Low/ Away	Moderate/ Away	Low/ Away	Moderate/ Away	Low/ Away	Moderate/ Away
Piñon-Juniper with Grass (261,432 acres)	Moderate (42)/ Toward	Moderate (48)/ Away	Moderate (41)/ Toward	Moderate (43)/ Static-Away	Moderate (41)/ Toward	Moderate (43)/ Away	Moderate (41)/ Toward	Moderate (43)/ Static-Away
Piñon-Juniper Evergreen Shrub (263,835 acres)	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away
Piñon-Juniper Woodland (Persistent) (75,393 acres)	Low/ Static	Low/ Static	Low/ Static	Low/ Static	Low/ Static	Low/ Static	Low/ Static	Low/ Static

PNVT	Vegetation Departure Rating[1] and Trend							
	Alternative A		Alternative B		Alternative C		Alternative D	
	15 Year	50 Year	15 Year	50 Year	15 Year	50 Year	15 Year	50 Year
Ponderosa Pine (791,897 acres)	Moderate (58)/ Toward	Moderate (58)/ Static	Moderate (51)/ Toward	Moderate (51)/ Static	Moderate (51)/ Toward	Moderate (51)/ Static	Moderate (51)/ Toward	Moderate (51)/ Static
Mixed Conifer with Frequent Fire (49,619 acres)	Moderate (39)/ Toward	Moderate (39)/ Static	Moderate (34)/ Toward	Low (30)/ Toward	Moderate (34)/ Toward	Low (30)/ Toward	Moderate (34)/ Toward	Low (30)/ Toward
Mixed Conifer with Aspen (37,083 acres)	Moderate/ Away	High/ Static	Moderate/ Static	Moderate/ Static	Moderate/ Static	High/ Static	Moderate/ Static	Moderate/ Static
Spruce-Fir[2] (13,946 acres)	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away
Alpine Tundra (939 acres)	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away	Moderate/ Away

[1] Numbers in parenthesis represent departure ratings for modeled PNVTs, which represent the difference between current and reference conditions (0 to 33 = low, 34 to 66 = moderate, greater than 66 = high).

[2] The departure within the Spruce-Fir Forest PNVT is considered to be within reference conditions because it historically had infrequent, high severity fires with a fire return interval of over 200 years (USDA Forest Service 2009).

* Since Gallery Coniferous Riparian Forest PNVT accounts for less than 1 percent of the forest, the fire regime impacts would come from the adjacent PNVT.

Table 16. Summary of vegetation condition class, vegetation trend, predicted fire return interval trend, and predicted fire severity trend by PNVT[1]

PNVT	Existing VCC	Vegetation Trend		Predicted Fire Return Interval Departure and Trend	Predicted Fire Severity Departure and Trend	
		Alt. A	Alts. B, C, D	All Alts.	Alt. A	Alts. B, C, D
Desert Communities	VCC I	Not fire adapted	No change	Not fire adapted		
Semidesert Grassland	VCC II	Static	Toward	High/Away	Moderate/ Static	Moderate/ Toward
Great Basin Grassland	VCC III	Away	Static	High/Away	High/Away	High/Static
Montane/ Subalpine Grassland	VCC III	Away	Toward	Moderate/Away	High/Away	High/ Toward
Interior Chaparral	VCC I and II	Away	Away	Moderate/Away	Low to Moderate/ Away	Low to Moderate/ Away
Pinon-Juniper with Grass	VCC II and III	Toward	Toward	High/Away	Moderate to High/ Toward	Moderate to High/ Toward
Piñon-Juniper Evergreen Shrub	VCC II	Away	Away	High/Away	Moderate/ Away	Moderate/ Away
Piñon-Juniper Woodland (Persistent)	VCC II	Static	Static	Low/Away	Moderate/ Static	Moderate/ Static
Ponderosa Pine	VCC III	Toward	Toward	High/slowly Toward	High/ Toward	High/ Toward[2]
Mixed Conifer with Frequent Fire	VCC III	Toward	Toward	High/Slowly Toward	High/ Toward	High/ Toward
Mixed Conifer with Aspen	VCC III	Away	Static	High/Away	High/Away	High/Static
Spruce-Fir	VCC II	Away	Away	High/Static	Moderate/ Away	Moderate/ Away
Alpine Tundra	VCC III	Not fire adapted				

[1] Trends for fire return interval and fire severity are the same for 15 and 50 years. Vegetative departure trends were used because VCC cannot be projected.

[2] Implementation of the higher end of plan objectives would result in trend toward desired conditions. Implementation of the lower end of plan objectives would result in trend away from desired conditions.

Common to All Alternatives

Overall, trends for vegetation as it relates to fire and fire severity would improve in all alternatives in Piñon-Juniper with Grass, Ponderosa Pine,[35] and Mixed Conifer with Frequent Fire PNVTs. A trend toward desired conditions means the ecological system is moving toward characteristic fire, including a reduction in severity and a reduction in the risk of uncharacteristic fire.

Trends for vegetation as it relates to fire and fire severity would remain static in all alternatives for Piñon-Juniper Woodland PNVT. A static trend means that the PNVT is neither moving toward nor away from the ecological systems' characteristic fire regime so that current departures would be maintained.

Alternatives B, C, and D

Trends for vegetation as it relates to fire and fire severity would remain static in alternatives B, C, and D in Great Basin Grassland and Mixed Conifer with Aspen PNVTs. A static trend means that the PNVT is neither moving toward nor away from the ecological systems' characteristic fire regime.

Plan objectives for prescribed burning in Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs would move fire return intervals toward desired conditions at a faster rate than in alternative A. This is a net improvement in ecosystem processes and functions related to fire as a natural disturbance (e.g., understory productivity, nutrient cycling, maintenance of open conditions). In the long run, fire intervals that are closer to desired conditions would also promote characteristic rates of tree regeneration, age diversity, and the maintenance of subdominant species such as aspen and Gambel oak.

Fire return intervals would not improve in grassland or piñon-juniper PNVTs nor in Mixed Conifer with Aspen or Spruce-Fir because there are no plan objectives for prescribed fire. Trends could improve where wildfire with resource objectives is used; however, the location and extent is unpredictable.

Summary of Vegetation and Fire Effects

Alternatives B and D are expected to move all PNVTs and old growth forest components the fastest toward desired conditions, followed by alternative C and then alternative A. For Semidesert Grassland, Great Basin Grassland, Interior Chaparral, Piñon-Juniper with Grass, Piñon-Juniper Evergreen Shrub, and Piñon-Juniper Woodland PNVTs progress toward desired conditions, with respect to ecosystem function and resilience to disturbance, would be greater under alternative D than alternative B primarily due to the limitations on vegetative treatments that result in recommended wilderness in alternative B.

[35] Implementation of the higher end of plan objectives in alternatives B, C, and D would result in a trend toward desired conditions. Implementation of the lower end of plan objective would result in a trend away from desired conditions.

A PNVT's vegetative condition and fire ecology are interrelated because of the co-evolution of these habitat characteristics. Vegetative consequences have impacts to the fire ecology of PNVTs (especially frequent fire PNVTs) and the converse is also true. Since alternatives B, C, and D would potentially progress the fastest toward and maintain vegetative and fire desired conditions for all PNVTs, these alternatives would result in less departed fire conditions than alternative A. In other words, the fire return interval, fire severity, fuels composition, and fire extent/pattern would deviate less from desired conditions under alternatives B, D, and C, respectively, than alternative A due to alternative A having less mechanical and fire treatments. This would be more pronounced for the frequent fire PNVTs because more fire cycles are missed under their shorter fire return interval. Hence, there are greater departures over time in frequent fire PNVTs.

Old growth components consist of large trees, snags, logs, and coarse woody debris. Over the 15-year life of the plan, alternatives B, C, and D would improve the proportion of large trees 8 percent more than existing and 3 percent more than alternative A. Over the long term, alternatives B, C, and D would improve the proportion of large trees 13.7 percent more than existing and 2.3 percent more than alternative A. There is no difference between alternatives for snags greater than 18 inches d.b.h. All are predicted to maintain 2.7 snags per acre, both over the life of the plan and over the long term. Over the life of the plan, alternative A would result in slightly more tons per acre of logs and coarse woody debris compared to alternatives B, C, and D (3.7 compared to 3.5). Alternatives A and C are over three times higher than what is desired for downed logs in old-growth stands using the minimum old-growth table. Alternatives B and D are over two times higher than what is desired for downed logs throughout the landscape in this PNVT. Maintaining the fire regime would remove competition from seedlings and saplings, which allows the PNVT to reach late seral stages which support large trees more quickly, and would reduce the risk of uncharacteristic fire which would damage or destroy old-growth components.

In terms of maintaining old-growth forest components, the fire regime is very important because it removes competition from saplings, which allows the vegetation type to reach its climax state more quickly and maintains understory conditions. In addition, maintaining the fire regime condition class in adjacent stands helps reduce the risk of uncharacteristic wildfire that can damage or destroy old-growth components. Over the long term, alternatives B, C, and D would have the greatest effect on creation of very large trees, increasing the area to almost 20 percent, while alternative A would only reach 18 percent.

Snag levels would generally be similar between alternatives, with differences resulting from clarification in snag guidelines in alternatives B, C, and D. There would also be slight impacts from conditions under alternatives B, C, and D, creating fewer smaller snags from competition induced mortality.

With respect to sub-PNVT features, alternatives B, C, and D would better support maple and aspen stands because of a stated plan objective and other plan components in those alternatives that would promote multiple age classes and healthy populations. Under alternative A, maple regeneration would be a byproduct of other treatments, and aspen would be closely tied to maintaining or enhancing firewood production rather than an important component of certain vegetation types.

All alternatives would recognize Gambel oak as important to wildlife with all ages and sustained sprouts, acorns, and cavities. Oak is emphasized as a critical component for the Mexican spotted owls, and all alternatives would follow approved recovery plans.

Under alternative A, plan direction would retain large alligator juniper, but doing so would also promote even-aged structure and denser canopy conditions, which would increase the risk of uncharacteristic fire in these stands and would lead to increased mortality of older trees from fire. Alternatives B, C, and D would not explicitly discuss the management of alligator juniper, but would incorporate this species as part of desired conditions for a diversity of tree species and age classes within PNVTs.

Under all alternatives, management would provide for blue spruce where it occurs.

Effects Common to All Vegetation Types

Common to All Alternatives

All alternatives would have the same effects on the management of invasive, exotic species. Under alternative A, Amendment 20 of the 1987 plan incorporates the "Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds" (USDA Forest Service 2005a). Under alternatives B, C, and D the same direction is incorporated by reference per the following guideline: "Measures should be incorporated into project planning, implementation, and monitoring to: prevent, control, and eradicate priority infestations of invasive, exotic species using an integrated pest management approach; minimize project impacts on native species; and improve watershed condition." The associated footnote specifically points to the Weeds FEIS or more current direction. Both methods of incorporation would allow the forest to address the threat of invasive, exotic species for all vegetation types.

There is a trend away from desired conditions under all alternatives in Interior Chaparral and Piñon-Juniper Evergreen Shrub PNVTs. Historically, these PNVTs experienced mixed severity fires with 25 to 75 percent overstory replacement as being within the natural range of variability. These trends would lead to increased potential for uncharacteristic fire and higher severity. This would result in increased soil heating and more erosion and sedimentation into connected drainages. Post-disturbance native vegetation would likely be resilient to increases in severity because it is adapted to fire and resprouts rapidly post-fire. Also, increased potential for uncharacteristic fire would result in a higher likelihood of nonnative or invasive species establishment, including cheatgrass, which could alter fire regimes.

Piñon-Juniper Woodland PNVT is a more sparse and rocky system with inherently less understory to carry fire. This PNVT is adapted to high severity, full stand replacement fire (75 percent and higher overstory replacement). The predicted static fire severity trend should not alter this PNVT because of its longer fire return interval and adaptation to higher severity fires.

Under all alternatives, there would be fewer openings and young trees, less aspen and understory, and more medium to large trees in Mixed Conifer with Aspen PNVT because of an increase in fire return interval. Aspen decline would likely continue in part because fire is not being reintroduced in this PNVT at characteristic frequencies; excessive ungulate herbivory is expected to continue in most locations; and climate change could negatively impact the sustainability of aspen due to hotter and drier conditions, regardless of plan objectives. Overall, fire severity in this PNVT remains static, with mixed to high severity, and is within the natural range of variability.

Under all alternatives, several plan components (e.g., timing restrictions), policies, and regulations collectively narrow the window of time in which treatments could occur in Mexican spotted owl protected activity centers (PACs) and northern goshawk post fledgling areas (PFAs).

All alternatives would limit disturbance to Mexican spotted owls and northern goshawks during the breeding season. In combination with the air quality and water quality related restrictions discussed below, timing restrictions would result in a narrow window of opportunity for management activities within protected activity centers and post-fledgling areas, including any preparation work like marking or building firelines that would also be influenced by budget and weather.

All alternatives include language to coordinate with the Arizona Department of Environmental Quality on smoke to maintain air quality and to reduce soil disturbance (See "Air Quality" for more information). Stipulated best management practices would limit activities during wet weather to protect water quality and mitigate erosion and soil loss (See "Water and Soil Quality" and "Water Quantity" for more information). Collectively, these factors could result in fewer acres in PACs and PFAs being treated under all alternatives. This would result in areas of increased vulnerability to uncharacteristic fire and insect and disease and areas not conducive to the reintroduction of characteristic fire without undesirable effects. This would impact about 15 percent of Ponderosa Pine, 3 percent of Mixed Conifer with Frequent Fire, 48 percent of Mixed Conifer with Aspen.

Alternative A

Generally, alternative A (the 1987 plan) emphasized timber commodity production and did not recognize the importance of fire disturbance in restoring fire dependent PNVTs as directly as the other alternatives. Desired conditions are generally lacking for PNVTs that are not forested, and alternative A does not emphasize the role of natural disturbances for non-forested PNVTs. This means that management of these ecosystems has generally been considered in project planning primarily with respect to grazing management, watershed condition, or wildlife.

Under alternative A, wildfires that meet resource objectives would be restricted in the wildland-urban interface in approximately 26 percent of the fire-adapted PNVTs. This would limit the ability of fire to play its natural role in reducing the departure of these vegetation types, and these portions of the PNVTs would be at a higher risk of having uncharacteristic fire. This is particularly a concern for Montane/Subalpine Grassland because nearly 70 percent is located in the wildland-urban interface. Although wildfires generally do not occur within this PNVT because of the lack of trees, this direction would also keep the natural process of fire entering this PNVT from adjacent PNVTs. As a result, these grasslands would be less likely to return to historic fire return intervals.

Alternative A also has plan components that effectively prohibit managing wildfire for resource objectives in wilderness areas. In Management Area 1-Wilderness, managing wildfire for resource objectives is limited because of tactical restrictions and goals for fire suppression that are inconsistent with allowing fire to play its natural role on the landscape.

Alternative A includes management direction arranged by management areas (MA) rather than by PNVT. Because of this, there may be a wide range in direction for any given PNVT depending on how many different MAs it overlaps. A full description of management areas can be found in the 1987 plan (USDA Forest Service 1987). Because alternative A does not provide guidance by such delineations, PNVTs often cross multiple management areas and the direction for managing PNVTs is often scattered, incomplete, or missing. The result is the potential that progress toward ecological vegetative desired conditions would be hindered by vague plan language or plan

language that articulates other management emphases. Where PNVTs fall within multiple MAs and where there is little to no direction on vegetative desired conditions, progress toward desired conditions could be delayed. This potential hindrance on progress toward vegetative desired conditions is mentioned by PNVT where it exists.

Alternative A would not allow timber harvest except for firewood and fire risk abatement in established protected activity centers for Mexican spotted owls. Permitted treatments would be low intensity prescribed burning and thinning up to 9 inches d.b.h.; however, treatments up to 9 inches d.b.h. may not be sufficient to reduce fire risk in some cases and low intensity prescribed burning may not be possible without prior mechanical treatments. Treatments to improve conditions for Mexican spotted owls or their prey would not be permitted due to restrictions from former Mexican spotted owl recovery plan remaining in the 1987 plan. Although all alternatives have language to follow approved recovery plans, these treatment restrictions would result in a higher risk of uncharacteristic fire, insects and disease, and less than optimal conditions in some protected activity centers under alternative A. This would affect about 39 percent of Mixed Conifer with Aspen, 15 percent of Mixed Conifer with Frequent Fire, and 10 percent of Ponderosa Pine PNVTs.

Northern goshawks primarily occupy Ponderosa Pine and the two mixed conifer PNVTs. Plan components in alternative A describe northern goshawk habitat in terms of vegetative structural stages (VSS) classes as described in Reynolds et al. (1992). Appendix C provides a crosswalk between the model states used in VDDT modeling and vegetative structural stages in the 1987 plan. Under alternative A, direction in the 1987 plan would be followed to maintain and improve goshawk habitat. The vegetative states that best represent foraging area (States J and K[36]) are projected to increase in Ponderosa Pine from 4.4 percent currently to 18.8 percent after 15 years and then remain stable at 18.8 percent after 50 years. Consequently, the overall structure would be more supportive of characteristic fire and more resilient to insect and disease. For States L and M, which are more representative of northern goshawk post-fledgling areas and nest stands, the percentages remain the same over 15 and 50 years (about 24 percent). In Mixed Conifer Frequent Fire, States J and K would increase from 5 percent to 21.7 percent after 15 years and then 21.6 percent after 50 years. For States L and M[37], the distribution would move from 57.4 percent (dominated by trees 10 to 20 inches d.b.h.) to 37.4 percent to 37.1 percent, but after 50 years, the distribution between very large (greater than 20 inches d.b.h.) and medium trees would become much more balanced.

None of the areas proposed as recommended wilderness are included in this alternative. The areas recommended as wilderness in alternatives B and C, in genera, have little access, steeper slopes,

[36] Refers to transitional (seral) states described in the Vegetation Dynamics Development Tool (VDDT). State J represents open, uneven-aged forest conditions (30 percent or less cover) dominated by medium-sized trees 10 to 20 inches d.b.h. State K represents open, uneven-aged forest conditions (30 percent or less cover) dominated by very large trees over 20 inches d.b.h.

[37] State L represents closed, uneven-aged forest conditions (over 30 percent cover) dominated by medium-sized trees 10 to 20 inches d.b.h. State M represents closed, uneven-aged forest conditions (over 30 percent cover) dominated by very large trees over 20 inches d.b.h.

and fewer past vegetation treatments than surrounding areas. Because of these factors, the likelihood of future vegetation treatments is low.

Alternative B

Alternative B would retain some of the direction from the 1987 plan, in particular, key direction from amendments for the Sedona-Oak Creek Ecosystem (Amendment 12) and the Flagstaff/Lake Mary Ecosystem Analysis (Amendment 17). It differs from alternative A; however, in a number of fundamental ways that are aimed at allowing forest management to be adaptable over time and to be able to adjust to site-specific conditions. This alternative also recommends three additional wilderness areas.

Alternative B includes desired conditions, standards, and guidelines for each PNVT and the habitats they provide by articulating clear long-term management goals and mitigating potential impacts from activities. In addition to management goals and mitigating guidelines, however, active management may also be required to make progress toward desired conditions. In absence of better information on what management activities may take place over the next 10 to 15 years, plan objectives and the assumption of level budgets were used to consider the effects of this alternative, which in many cases would limit the alternative's ability to achieve desired conditions. If more resources and funding become available than was assumed in this analysis, any additional management activity would be required to be consistent with desired conditions and other plan direction, so would further contribute toward achieving desired conditions.

Under alternative B, plan components that describe desired conditions and other guidance such as guidelines and management approaches relating to vegetation and fire as a natural disturbance are specifically provided by PNVT. Direction found in other areas of the plan that could also influence vegetative conditions, such as scenery and wilderness designations, was also considered. Complete plan language may be found in the proposed revised plan.

Alternative B's desired conditions were designed to promote and maintain all the attributes of the "Management Recommendations for the Northern Goshawk" (Reynolds et al. 1992). All the essential elements of these recommendations are maintained by moving toward uneven-aged conditions with a mix of age classes. The states that best represent foraging area (States J and K) are projected to increase in Ponderosa Pine from 4.4 percent currently to 26.1 percent after 15 years and stabilize at 25.9 percent after 50 years. For States L and M, which are more representative of PFA and nest stands, the percentages decrease over 15 and 50 years (24.2 to 19.8 to 19.7 percent), but after 50 years, the distribution between very large (greater than 20 inches d.b.h.) and medium trees would become more balanced. In Mixed Conifer with Frequent Fire, States J and K would increase from 5 percent to 33.2 percent after 15 years and then stabilize at 33.1 percent after 50 years. For States L and M, the distribution would move from 57.4 percent (dominated by trees 10 to 20 inches d.b.h.) to 28.6 percent then to 28.1 percent, but after 50 years, very large tree (greater than 20 inches d.b.h.) distribution would be greater than medium trees.

Alternative B would recommend three new wilderness areas: an extension to the existing Strawberry Crater Wilderness, Davey's which would serve as an extension to the already existing Fossil Springs Wilderness, and Walker Mountain, a new wilderness. Table 17 lists the PNVTs that are included within the additional recommended wilderness. Although this alternative recommends three new wilderness areas, there would be little reduction to the number of acres

suitable for timber production[38] because there are less than 30 acres of Ponderosa Pine in the recommended addition to Strawberry Crater Wilderness.

Table 17. PNVTs within recommended wilderness (alternative B)

PNVT	Associated Recommended Wilderness	Acres of PNVT in Recommended Wilderness (Percent of Recommended Wilderness)	Acres of PNVT Forestwide (Percent of Forestwide PNVT in Recommended Wilderness)
Semidesert Grassland	Davey's, Walker Mountain	638 (4.3%)	89,683 (0.7%)
Great Basin Grassland	Strawberry Crater	2,327 (15.8%)	92,913 (2.5%)
Interior Chaparral	Walker Mountain	1,707 (11.6%)	50,471 (3.4%)
Piñon-Juniper with Grass	Strawberry Crater	3,648 (24.7%)	261,432 (4.1%)
Piñon-Juniper Evergreen Shrub	Davey's, Walker Mountain	4,215 (28.5%)	263,835 (1.6%)
Piñon-Juniper (Persistent)	Davey's, Strawberry Crater, Walker Mountain	2,148 (14.6%)	75,393 (2.8%)
Ponderosa Pine	Strawberry Crater	29 (0.2%)	791,897 (less than 0.01%)

A prerequisite for becoming an inventoried potential wilderness area is a lack of recent mechanical or mechanized vegetation treatments; thus, recommended wilderness areas may have more departed conditions than the PNVT forestwide. While 69 percent of the recommended wilderness in alternative B is at least moderately departed and trending away from desired conditions, these areas may actually be more highly departed than the overall PNVT. When an area that is highly or moderately departed from the desired conditions (e.g., Davey's, Strawberry Crater, and Walker Mountain) is recommended as wilderness, vegetation treatments would be more expensive to carry out and possibly less likely to occur due to the need to maintain the primitive and undeveloped aspects of recommended wilderness, as well as the limited access and steeper slopes than the surrounding landscapes. The wilderness recommendation would create a need to mitigate the effects from the use of mechanized and motorized equipment. There would also be limitations on expanding the footprint of motorized vehicle use, especially where soils do not readily recover from short-term motor vehicle impacts so that the evidence of modern human presence or occupation would be minimal. As a result, areas near roads that are along the boundary of the recommended wilderness may have small scale treatments, but the interior of these areas is unlikely to be treated under this alternative. Fewer and less extensive vegetation treatments could increase the risk of uncharacteristic fire within the recommended wilderness and

[38] Lands suitable for timber production are identified as having the ability to provide a sustainable supply of forest products, consistent with plan desired conditions. Although nonsuitable timber lands may also be managed toward desired conditions, areas that are suitable for timber have the most management flexibility and, therefore, greatest economic feasibility to move those areas toward desired conditions.

the surrounding area. As a result, vegetation conditions in these areas may be more vulnerable to uncharacteristic fire.

Although the use of prescribed fire and wildfire with resource objectives would continue to be permissible when an area is recommended for wilderness designation, recommendation of wilderness can influence wildfire response and a variety of factors are considered to inform the appropriate response to a wildfire in recommended wilderness. These factors include: continuity and availability of fuels; adjacency to and comparative size of existing wilderness; size of the recommended wilderness area; topography and existing condition of roads affecting accessibility for equipment or foot travel; and proximity to values to protect such as buildings, water developments, power lines, and natural and cultural values. When analyzing the environmental consequences of adding a wilderness designation to an area, several factors that could limit the ability to manage fires and, therefore, future opportunities for using wildfire with resource objectives were evaluated. For example, although prescribed fires and wildfires with resource objectives are authorized in wilderness areas (i.e., it is not prohibited by law or policy), it may be accomplished much less frequently than in areas outside of wilderness, primarily due to threatened values at risk. These values (e.g., natural and cultural values and infrastructure) are more difficult to protect due to limitations on accessibility and tools that can be used during suppression or fire management activities within the adjacent recommended wilderness area.

When considered cumulatively, these factors help determine the potential of a recommended wilderness area to affect future fire management decisions in that area (see Table 18). Each potential wilderness under alternatives B and C were ranked to evaluate the conditions and management implications of each potential wilderness area and how wilderness recommendation would affect fire management response. A range of effects would be expected depending on the time of year and fire behavior. Generally, the higher the ranking, the higher the likelihood fire managers would use a full suppression strategy. If a suppression response is implemented and successful, the number of acres burned would remain small. The probability of this response being successful over the long term is low. If the suppression response to wildfire is unsuccessful, there is a high probability that fire will burn uncharacteristically through much or all of the recommended wilderness area, and the number of acres burned could be high. There would also be a higher probability of adverse impacts to wilderness characteristics from fire suppression efforts. An area was ranked as zero (0) if the wilderness recommendation did not influence the appropriate response to wildfire (see “Fire Suppression Rankings for Potential Wilderness Map” in appendix A). Wildfires may be allowed to burn under certain conditions in any ranking.

For example, a recommended wilderness area that is very small and adjacent to an existing wilderness area, such as Davey’s, would have a very small effect to fire management and to vegetation conditions (i.e., wilderness designation would not influence the appropriate fire management response). On the other hand, a relatively large area that is flammable and highly accessible in its current condition and is highly departed from its vegetation and fire desired conditions would have a higher likelihood of receiving a suppression response strategy which could result in short term reduction of uncharacteristic fire and higher likelihood of large uncharacteristic fire in the long term if suppression is unsuccessful.

Table 18. Likelihood of altered fire management response with wilderness recommendation

Fire Suppression Rank and Potential Wilderness Area	Acres
No Difference (ranking: 0)	
Abineau	415
Barbershop	1,305
East Clear Creek	2,017
Railroad Draw	1,220
Strawberry Crater	6,611
Very Low Likelihood (ranking: 1)	
Davey's	1,779
Low Likelihood (ranking: 2)	
Cimmaron-Boulder	15,305
Hackberry	26,044
Moderate Likelihood (ranking: 3)	
Black Mountain	9,746
High Likelihood (ranking: 4)	
Cedar Bench	5,782
Tin Can	3,972
Walker Mountain	6,377
Very High Likelihood (ranking: 5)	
Deadwood Draw	11,785

For alternative B, Strawberry Crater was ranked a zero (0) as having no effect on the decision to suppress or allow for unplanned natural ignitions that meet resource objectives to burn within the area. For Davey's, the likelihood that a wilderness recommendation would affect these decisions is predicted to be very low (1). Even though Davey's is adjacent to a larger existing wilderness, the values at risk in the high demand recreation area of the Fossil Springs Wild and Scenic River would be the strongest influence on operational fire decisions within the recommended wilderness. Because these conditions would have a stronger influence on the role of fire on the landscape than the recommendation of wilderness, neither of these areas would result in a difference in the risk of uncharacteristic fire between alternatives.

Walker Mountain, however, was ranked as a high likelihood (rating of 4) that a suppression strategy would be employed. This is because much of the area has continuous fuels; vegetation departure is high; values at risk in the nearby Beaver Creek communities could be negatively impacted by mechanized and motorized methods of fire management; and the size and topography of the area would not naturally contain fire within the recommended wilderness.

Consequently, the likelihood of large uncharacteristic fire would be lower in the short term if suppression is successful. The likelihood of large uncharacteristic fire would be higher in the long term and in the short term if suppression is not successful. The likelihood of wildfires with resource objectives being allowed to burn would be lower.

Recommended wilderness areas in this alternative contain less than 1 percent of fire-adapted vegetation; therefore, it is unlikely they would affect the use of wildfires that meet resource objectives on the landscape in a measureable way. In addition, it is unlikely these recommended wilderness areas would increase the departure of any of the vegetation types at a landscape scale. Walker Mountain constitutes only 3.4 percent of the Interior Chaparral vegetation type across the landscape and has a set of management restrictions on road access and vegetation management under all alternatives; it is unlikely that recommending this area as wilderness would increase the departure of this vegetation type at a landscape scale. For other PNVTs associated with Walker Mountain, this area represents less than 2 percent of Piñon-Juniper Evergreen Shrub, Piñon-Juniper Woodland, and Semidesert Grassland within the forest boundary.

Alternatives B, C, and D

Under alternatives B, C, and D, there is no restriction on where wildfires that meet resource objectives could occur. It is difficult to know how many acres would be treated in this manner under the plan, but in all cases, these fires would help reduce vegetation departure and fire severity; restore the natural fire regime; and reduce the risk of uncharacteristic fire across the landscape.

Alternatives B, C, and D would not include plan direction from the former Mexican spotted owl recovery plan and, like all alternatives, would follow approved recovery plans. Under the revised recovery plan (2012), treatments to improve Mexican spotted owl habitat, in addition to reducing risks to uncharacteristic fire would be allowed.

Alternative C

Alternative C differs from alternative B by recommending 10 additional new wilderness areas (Abineau, Barbershop, East Clear Creek, Railroad Draw, Cimmaron-Boulder, Hackberry, Black Mountain, Cedar Bench, Tin Can, and Deadwood Draw). It would also designate eight wildlife habitat management areas and would modify the Anderson Mesa Management Area direction found in alternative B to further emphasize wildlife habitats.

Table 19 provides information about those PNVTs that fall within the recommended wilderness under alternative C. This alternative recommends 10 wilderness areas in addition to alternative B's 3 recommended areas, 71,635 acres (93 percent) of the recommended wilderness areas. The amount of recommended wilderness in alternative C would limit opportunities to use vegetation treatments, as described in alternative B, to move those areas toward desired conditions. However, it would not alter the trend and departure of those PNVTs at a landscape level. Departure and trends for all modeled PNVTs under alternative C are predicted to be the same as alternative B.

Recommendation of wilderness in alternative C would have a minor effect to the acreage of lands suitable for timber production because 71,635 acres (93 percent) of the recommended wilderness areas are within vegetation types that are not managed for periodic harvest such as piñon-juniper, grassland, and shrub dominated PNVTs. The remaining 7 percent would be considered not

suitable for timber production, whereas they would be considered suitable under alternatives A and D.

Under alternative C, the Strawberry Crater, Barbershop, East Clear Creek, Abineau, and Railroad Draw areas would all be recommended as wilderness but would not have an effect on either the use of wildfires that meet resource objectives or on the departure of their associated PNVTs. The reason for drawing this conclusion about these areas varies by recommended wilderness area.

The rationale for Strawberry Crater was previously explored in the "Alternative B" section, and as this recommended area contains all of the Great Basin Grassland and Piñon-Juniper with Grass vegetation types recommended for wilderness, there would be no difference in effects between alternatives B and C for these two PNVTs.

Both Barbershop and East Clear Creek are currently inventoried roadless areas, defined by steep canyons with a riparian area at their base. Consequently, managing these areas as recommended wilderness would have only minor differences in terms of their availability for vegetation treatments or for how fire suppression management decisions would be made. For Abineau and Railroad Draw, both areas are less than 1,000-acre additions to much larger existing wilderness areas and neither is near developed areas. Therefore, they would be unlikely to pose an additional threat to values at risk and, thus, would not be a high priority for fuels reduction vegetation treatments. Forest decisions to suppress fire or manage wildfires that meet resource objectives for these areas would not be impacted because these recommended wilderness areas are both too small and too distant from developed areas to significantly impact the larger, overall context in which fire management decisions are made. These four recommended wilderness areas (Barbershop, East Clear Creek, Abineau, and Railroad Draw) include less than 1 percent of the Montane Subalpine Grassland, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen PNVTs forestwide. Because of the low proportion, there would be a negligible difference in effects to the habitat quality or ability of the area to restore historic fire regime intervals of these vegetation types among alternatives.

There would be little effect to Ponderosa Pine PNVT at the landscape level as a result of wilderness recommendation; however, there would be an increased risk of uncharacteristic fire in some localized portions of the PNVT. Strawberry Crater, Barbershop, East Clear Creek, Abineau, and Railroad Draw recommended wilderness areas incorporate about 3,394 acres (0.4 percent) of the Ponderosa Pine PNVT. Recommendation as wilderness would not have an effect on either the use of wildfires that meet resource objectives or on the departure of their associated PNVTs. Tin Can and Deadwood Draw incorporate 1,076 acres (0.1 percent) of Ponderosa Pine. These two recommended wilderness areas have a high and very high likelihood of decreasing the use of wildfires that meet resource objectives based on their fire management response rankings. This is because of nearby values at risk in the southern portion of the Verde Valley. Recommendation of Tin Can and Deadwood Draw wilderness areas may result in increased likelihood of uncharacteristic fire in localized areas. Because these are some of the driest sites on the forest, pine may not regenerate following uncharacteristic fire and there could be a reduction in the extent of Ponderosa Pine in this area. This difference would not affect departure of the PNVT at the landscape scale differently than other alternatives, but it could have localized effects.

Table 19. PNVTs within recommended wilderness (alternative C)

PNVT	Recommended Wilderness	Acres of PNVT in Recommended Wilderness (Percent of Recommended Wilderness)	Acres of PNVT Forestwide (Percent of Forestwide PNVT in Recommended Wilderness)
Desert Communities	Black Mountain, Cedar Bench, Cimmaron-Boulder, Deadwood Draw, Hackberry	1,016 (1.1%)	63,548 (1.6%)
Semidesert Grassland	Black Mountain, Cedar Bench, Cimmaron-Boulder, Davey's, Deadwood Draw, Hackberry, Walker Mountain	12,186 (13.3%)	89,683 (13.6%)
Great Basin Grassland	Strawberry Crater	2,327 (2.5%)	92,913 (2.5%)
Montane/ Subalpine Grassland	Railroad Draw	6 (0.01%)	23,429 (0.03%)
Interior Chaparral	Walker Mountain	1,707 (1.9%)	50,471 (3.4%)
Piñon-Juniper with Grass	Strawberry Crater	3,648 (4.0%)	89,683 (4.1%)
Piñon-Juniper Evergreen Shrub	Black Mountain, Cedar Bench, Cimmaron-Boulder, Davey's, Deadwood Draw, Hackberry, Railroad Draw, Tin Can, Walker Mountain	50,635 (55.4%)	263,835 (19.2%)
Piñon-Juniper Woodland (Persistent)	Black Mountain, Cedar Bench, Cimmaron-Boulder, Davey's, Deadwood Draw, East Clear Creek, Hackberry, Strawberry Crater, Tin Can, Walker Mountain	13,665 (14.9%)	75,393 (18.1%)
Ponderosa Pine	Abineau, Barbershop, Deadwood Draw, East Clear Creek, Railroad Draw, Strawberry Crater, Tin Can	4,470 (4.9%)	791,897 (0.6%)
Mixed Conifer with Frequent Fire	Barbershop	283 (0.3%)	46,619 (0.6%)
Mixed Conifer with Aspen	Abineau	347 (0.4%)	37,083 (0.9%)

Under alternative C, the recommendation of the Hackberry, Cimarron-Boulder and Davey's recommended wilderness areas would not increase the departure or likelihood of uncharacteristic fire for Cottonwood-Willow Riparian Forest, Semidesert Grassland, Piñon-Juniper Evergreen Shrub, or Piñon-Juniper Woodland. These 3 areas represent 15 percent of the Cottonwood Willow, about 7 percent of the Semidesert Grassland, about 10 percent of the Piñon-Juniper

Evergreen Shrub, and about 11 percent of the Piñon-Juniper Woodland on the forest. Although Hackberry and Cimarron-Boulder are large areas, they are already managed primarily as inventoried roadless areas, and as the remainder of the areas are generally inaccessible, recommendation of these two areas would be unlikely to result in reduced vegetation management or changes in fire suppression decisionmaking. Cottonwood-Willow Riparian forests, in particular, would unlikely have differences in effect between alternatives B and C because over 90 percent of the recommended wilderness where this PNVT is found is already managed either as an inventoried roadless area or as a wild and scenic river (Verde River). These two types of special areas have management restrictions that already preclude many vegetation treatments and influence the ability to manage wildfires that meet resource objectives. The effects and rationale from recommendation of Davey's are the same under alternatives B and C.

Other recommended wilderness areas incorporate these PNVTs as well. However, based on their fire suppression ranking (table 18), these wildernesses have a moderate to very high likelihood of changing the Forest Service's ability to manage wildfires that meet resource objectives. These wilderness areas are: Black Mountain, Cedar Bench, Deadwood Draw, Tin Can, and Walker Mountain. This means about 4 percent of the piñon-juniper PNVTs and 6 percent of the Semidesert Grassland PNVT would have an increased risk of uncharacteristic fire and increased vegetative departure. For Piñon-Juniper Evergreen Shrub, which is anticipated to remain moderately departed and continue to move away from desired conditions, alternative C would result in a slightly more departed landscape than alternatives A, B, and D. For the Piñon-Juniper Woodland PNVT, the wilderness recommendation would have less of an effect because there is not a treatment objective for this PNVT under any alternative that wilderness restrictions would influence. Additionally, it is only slightly moderately departed (see PNVT sections below for more information.) For Semidesert Grassland PNVT, the increased risk of uncharacteristic fire would accelerate the trend of predicted fire departure and could affect the ability to treat invasive plants, both of which would keep this PNVT from moving toward desired conditions as it is predicted to do under alternatives B and D.

Under alternative C, Walker Mountain recommended wilderness area would have an effect on the use of wildfires that meet resource objectives, but it would not have an effect on the departure of Interior Chaparral PNVT. Walker Mountain, an area recommended for wilderness under alternative B and managed as an inventoried roadless area under alternatives A and D, is the only recommended wilderness area that contains the Interior Chaparral PNVT. Analysis for Walker Mountain is explained previously in the "Alternative B" section, and as this recommended area contains all of the Interior Chaparral recommended for wilderness, there would be no difference in effects between alternatives B and C for this PNVT.

For Desert Communities, less than 2 percent of this PNVT would be recommended for wilderness under alternative C. Desert Communities is highly departed and occurs across five different recommended wilderness areas. About 0.2 percent of the PNVT is included in recommended wilderness (Cimarron-Boulder and Hackberry) where it is unlikely that wilderness recommendation would influence fire suppression strategies. For the remaining portion of this PNVT within recommended wildernesses (Black Mountain, Cedar Bench, and Deadwood Draw), recommendation would have a moderate to high likelihood of influencing fire suppression strategies. Although some localized areas may have increased departure (particularly within Black Mountain and Cedar Bench), at a landscape scale, the departure of this PNVT would be similar between alternatives B and C. As a result, the effects to these PNVTs from the wilderness

recommendations in alternative C would not be very different than the effects under alternatives B and D.

WHMAs would be managed for habitat restoration through the establishment of natural fire regimes in appropriate soil and vegetation types and a reduction of road density. Fire exclusion has altered many fire regime attributes such as fire return interval, fire severity, fuels composition, and fire extent/pattern. Eleven percent of the fire-adapted PNVTs forestwide that are highly or moderately departed from desired conditions are found in WHMAs (excluding Anderson Mesa) in alternative C. Eighty-nine percent of the fire-adapted portion of the WHMAs (excluding Anderson Mesa) are moderately or highly departed from desired conditions. This means that the vast majority of the area may not be in a condition that would be able to support characteristic fire without vegetation treatments prior to its introduction. Therefore, these PNVTs would likely remain on their current trajectory or trend further away from desired conditions. Also, the risk of uncharacteristic fire would remain high.

Proposed public road density reduction to an average of 1 mile of road per square mile through future projects and other actions on Anderson Mesa should have no impact on achieving desired conditions. WHMAs with restricted or limited public motorized access would still permit motorized vehicle use for restoration and fire suppression activities, as well as emergency action. Therefore, motorized restrictions in WHMAs would have minimal impact on the forest's ability to achieve desired conditions because they account for such a small percentage of the respective PNVTs forestwide.

Alternative D

Alternative D differs from alternative B, in terms of vegetation management, primarily in that it would not recommend any additional wilderness areas. The result is that more than 12,000 acres would potentially remain available for mechanical vegetation management.

It can be reasonably expected that alternative D could have a more positive effect on the PNVTs associated with the potential wilderness areas under alternative B, thus moving them slightly closer to desired conditions. The difference between alternatives D and B is that alternative D would have a negligible effect on proposed management of all other PNVTs.

Forest and Woodland Vegetation Types

Old-Growth Forest Conditions

Common to All Alternatives

In addition to operable forested areas that are actively managed for desired conditions, areas designated as wilderness, as well as areas outside of wilderness with slopes greater than 40 percent may also be assumed to qualify as having existing or developing old-growth forest components for forested and Piñon-Juniper PNVTs because these areas have evolved naturally, except for fire exclusion. There are currently more than 200,000 acres of forest and piñon-juniper woodland vegetation types that occur in wilderness or on slopes greater than 40 percent that have not had any timber harvesting activity and, therefore, contain and would likely continue to contain old-growth components under all alternatives. Under all alternatives, these areas are expected to sustain old-growth tree components.

Alternative A

In the 1987 plan in the forest and woodland vegetation types, old growth is managed as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area. A table under forestwide direction describes minimum levels for old-growth attributes such as large trees, snags, and logs. Accounting for canopy and rooting zones and natural between group interspaces, this minimum level of trees would provide less ability than alternatives B and D to promote vertical structure and age class diversity because the available growing space is occupied by the minimum required trees. This density of trees would tend to maintain a more continuous canopy than alternatives B and D that would be more conducive to crown fire. Consequently, alternative A would result in more closed canopy even-aged conditions than alternatives B and D. This structure and age class diversity does not reflect frequent low severity fires characteristic of Ponderosa Pine, Mixed Conifer with Frequent Fire, and Piñon-Juniper with Grass PNVTs. There would be fewer openings and less understory. Compared to alternatives B and D, old-growth stands in these PNVTs would be at higher risk for uncharacteristic fire and, when they do burn, there is likely to be more area in mixed severity with 25 percent to 75 percent loss of dominant overstory, compared to loss of 25 percent or less which is characteristic of low severity fires. Old-growth stands would be less resilient to endemic levels of disturbances. Alternative C is similar to alternative A.

In the Piñon-Juniper PNVT, 1987 plan direction also identifies slopes greater than 15 percent as having the majority of old growth.

Alternative C

Alternative C would retain some of the language from the 1987 plan, in particular old-growth management (see appendix F); however, it differs in a number of fundamental ways that are aimed at allowing forest management to be adaptable over time and to be able to adjust to site-specific conditions. Plan components would manage old growth in 100- to 300-acre stands over 20 percent of the landscape following the minimum attribute table in forestwide direction. In the 80 percent area outside of these old-growth stands, management would largely follow the plan components for desired conditions in alternative B. Twenty percent of the landscape managed in old-growth stands would have a higher likelihood of uncharacteristic fire and mixed severity fire similar to alternative A, and it is not likely these areas would be sustainable over the longer term because desired conditions do not include large stands of even-aged young forest as replacement old growth. The other 80 percent would be more resilient and have a greater likelihood of characteristic fire. Based on current science for frequent, low severity fire regime forest types, old growth was characterized by uneven-aged structure comprised of groups of trees and single trees interspersed in open grass–forb–shrub interspaces. Old-growth tree components typically occurred at the fine scale (less than 10 acres) and were composed of small, old tree groups interspaced with similarly sized groups of younger trees, seedlings to mid-aged trees.

Alternatives A and C

Under alternatives A and C, stands in the Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen PNVTs designated as old growth would be removed from the suitable timber base. This is because management under the 1987 plan would emphasize even-aged, closed canopy conditions dominated by trees greater than 18 inches d.b.h. across at least 20 percent of the forested ecosystem management areas. Acres managed for old growth under these alternatives would still be available for vegetation management to maintain old growth attributes, but they would be managed as lands where periodic timber harvest is unpredictable, unnecessary,

or undesirable to achieve management goals. The effects of old-growth direction under this alternative are discussed by PNVT in subsequent sections. These two alternatives are the least similar to desired conditions for old growth.

Alternatives B and D

Plan components under alternatives B and D would promote old-growth components within an uneven-aged matrix of tree groups and forest at the mid-scale, aggregated across the landscape in frequent fire forest types and would be more consistent with desired conditions than alternatives A and C.

Ponderosa Pine

Analysis Assumptions

Fire Departure and Trend: Regardless of the alternative, the Ponderosa Pine PNVT requires frequent fire to maintain its composition, structure, and overall health. Fire historically occurred about every 2 to 12 years in Ponderosa Pine. Forestwide fire treatment levels between 52,000 and 100,000 acres per year in the ponderosa pine would be required to be within the range of its natural fire return interval. Attaining a low fire departure including the desired fire return interval is unrealistic given current budgets and air quality concerns. In addition, there are relatively few acres of ponderosa pine that have the structure and composition that allows treatment with fire only. Many acres need mechanical treatment prior to burning to minimize fire severity and excessive damage to vegetation and soil. However, all alternatives have objectives that would slowly improve vegetative structure and composition of the PNVT and reduce the risk of uncharacteristic fire. Over the life of the plan, vegetation treatments would allow natural fire regimes to be reintroduced to new areas on the landscape over the life of the plan.

Vegetation Departure and Trend: Additional assumptions are located in appendix C.

- Plan objectives are achievable over the next 10 years.
- Alternatives were modeled out 15 years and 50 years. The 15-year time period was designed to represent the life of the proposed revised plan, and the 50-year time period was designed to demonstrate longer term trends. As with any predictive model, it should be assumed that accuracy may decline the farther out in time that a given simulation is projected.
- Desired conditions for Ponderosa Pine Forest and Mixed Conifer with Frequent Fire are most heavily represented by the combination of transitional states D, E, J, and K, with the majority being in states J and K. The important distinction is that states J and K are both multistoried (i.e., uneven-aged) with at least three age classes represented, including adequate openings for planned regeneration immediately after treatment. Although a state is described as “medium” or “very large” trees, trees of all sizes or ages are included. For example, state J is dominated by medium trees of 10- to 20-inch diameter at breast height (d.b.h.), but it would also include a more or less balanced representation of seedlings or saplings, small trees (5 to 10 inches d.b.h.), and very large trees (20 inches d.b.h. or higher) as well because it represents a multistoried, uneven-aged state. Similarly, state I contains primarily very large trees and is described as single storied (i.e., even-aged) with closed canopy, but it may also contain up to one other distinct size or age class and scattered single trees of different sizes. Closed canopy is greater than or equal to 30 percent canopy cover. Open canopy is less than 30 percent canopy cover.

- Ponderosa pine-Gambel oak accounts for approximately 40 percent of the Ponderosa Pine PNVT on the forest based on forest inventory analysis data.
- Modeling for alternative A (the 1987 plan) assumes that uneven-aged silvicultural systems (e.g., group selection) would be the predominant system(s) used; thus, Vegetation Dynamics Development Tool (VDDT) projects the modeled PNVTs to improve over current conditions with alternative A.
- Low severity fires are characterized by 0 to 25 percent top-kill of vegetation when burned, and mixed severity fires are characterized by 25 to 75 percent top-kill of vegetation when burned[39].

To translate desired conditions for vegetation into measureable states for modeling, it was assumed that if the model shows that Ponderosa Pine is at least 88 percent in a combination of medium and very large trees with open canopy conditions (less than 30 percent canopy cover) and occasional even-aged (single storied) or primarily uneven-aged (multistoried) structure, then the PNVT would be in primarily uneven-aged open forest conditions[40] that would have occurred in reference condition (see table 20) (Romme et al. 2009). Since uneven-aged structure is more resilient to natural and human-caused disturbances than predominantly even-aged structure and supports more diverse wildlife habitat, having more of the forest in uneven-aged rather than even-aged structure is an indicator that an alternative is approaching desired conditions.

The desired distribution of 7.8 percent across the landscape of closed states represents nesting habitat for northern goshawk and recovery nesting and roosting habitat for Mexican spotted owls, excluding Mexican spotted owl protected activity centers. These habitats include occasional even-aged dynamics that occurred in reference conditions (Romme et al. 2009), particularly on north-facing slopes and canyons. The Mexican spotted owl habitat is primarily in closed-canopy condition in the ponderosa pine-Gambel oak subtype of this PNVT. As desired distributions are approached, the total PNVT departure would decrease.

As stated in the "Affected Environment," departure values represent the difference between current and desired conditions for individual characteristics. These were calculated for major PNVTs on the forest. Individual vegetation characteristics that were evaluated were: species composition, structure (vegetation classes) of the dominant life forms (grass, shrub, tree), and the disturbance processes that define each PNVT (USDA Forest Service 2009). Ponderosa Pine modeling mainly addresses plan objectives and does not account for direction in the 1987 plan that challenges the forest's ability to manage wildfires in the wildland-urban interface and wilderness. The modeling also does not account for a change in emphasis in the 1987 plan from commodity focused in the early years of implementation to restoration focused during more recent years. These differences between alternatives are addressed qualitatively.

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[39] Low severity fires cause less than 25 percent average replacement of the above ground dominant overstory within a typical fire perimeter. Mixed severity fires cause between 25 and 75 percent average replacement. See LANDFIRE Web site: http://www.landfire.gov/NationalProductDescriptions14.php

40 Assumes that 40 percent of the ponderosa pine forest type on the Coconino National Forest is pine-oak forest type. Ponderosa Pine and Mixed Conifer with Frequent Fire consist of 14 different states, but it is desirable for the majority of these forest types to be in states D, E, J, and K.

Large Tree and Old-Growth Attributes: Although a state is described as "medium" or "very large" trees, trees of other sizes or ages are also included in the state. A "large" tree is not always old, and an old tree is not always large, however, some feel that a 16-inch d.b.h. tree is representative of a "large" tree in the Southwest. For the purposes of this analysis, it was assumed that 40 percent of the medium sized tree states would count toward old growth forest components and large trees and 60 percent of the very large size tree states (approximately equal to 24-inch+ d.b.h. trees) would count toward old-growth forest components and large trees.

Old-Growth Attributes: The VDDT model computes the area occupied by transitional states based upon simulated treatments, but tree size is not always a good indicator of tree age or old-growth attributes. Outputs from the FVS, using forest inventory analysis data for the Coconino NF, were used to compute and compare attributes that are indicative of old-growth forest structure. Values come from the existing forest plan, The Minimum Criteria for the Structural Attributes Used to Determine Old growth Forest, Replacement (USDA Forest Service 1987, pp. 70–72), and are used only as a baseline for comparison between alternatives. As uneven-aged conditions are restored, particularly in the frequent, low severity fire types (i.e., Ponderosa Pine and Mixed Conifer with Frequent Fire), the concept of managing 20 percent of the forest for old-growth "stands" becomes outdated. Instead, the desired conditions provide for maintenance and development of old-growth components over 100 percent of the landscape.

These minimum criteria used for comparison were provided by forest cover type for high site conditions. Site quality is defined as the vegetative productive capacity of a site and, in this analysis, refers to the average height of dominant or codominant trees at 100 years of age. The break between low and high sites is 70 feet for Ponderosa Pine Mixed Conifer, and undefined for Piñon-Juniper. The high site criteria were used to provide more conservative targets for this analysis. If high site criteria are met, then low site criteria would also be met. Approximately 70 percent of the Ponderosa Pine type, however, is considered to be low site (Manthei 2011a).

Common to All Alternatives

As shown in table 20, all alternatives would improve PNVT departure over the current condition; however, alternatives B, C, and D would move closer to desired conditions (lower departure) than alternative A.

In some areas, there would be an increased risk of uncharacteristic fire because of denser stand conditions. Aspen and other early seral species could continue to decline where late seral species or closed canopy conditions are emphasized. Areas outside of protected activity centers and areas outside recovery nesting and roosting habitat for Mexican spotted owls in the Ponderosa Pine-Gambel Oak subtype would generally be managed for large trees, large hardwoods, large snags, and large downed woody debris.

Fire treatment objectives would slowly move this PNVT toward the historic fire return interval. This would result in more areas where open conditions are maintained, nutrient cycling occurs, and age class diversity is promoted.

Table 20. Comparison of Ponderosa Pine PNVT states among desired distribution, existing distribution, and each alternative

Ponderosa Pine VDDT Model State	Desired Distribution	Existing Distribution	Alt. A		Alts. B, C, D	
			15 Year	50 Year	15 Year	50 Year
Grass, Forb, Brush/Shrub[1]	0.0%	0.8%	2.5%	2.3%	2.1%	2.0%
Seedling/Sapling, Even-aged, Open and Closed[2]	1.4%	0.0%	11.9%	11.9%	12.4%	12.0%
Small Trees, Open, Even-aged[3]	1.4%	19.3%	4.7%	4.7%	5.4%	5.5%
Very Large and Medium Trees, Open, Even-aged[4]	88.0% more than half multistoried	6.4%	10.4%	10.4%	8.7%	9.0%
Very Large and Medium Trees, Open, Uneven-aged[5]		4.2%	18.8%	18.8%	26.1%	25.9%
Small Trees, Closed, Even-aged[6]	1.4%	0.0%	17.3%	17.3%	13.8%	13.9%
Very Large and Medium Trees, Closed, Even-aged[7]	7.8%[10]	45.1%	8.6%	8.9%	9.0%	9.2%
Very Large Trees and Medium Trees, Closed, Uneven-aged[8]		24.2%	24.0%	24.1%	19.8%	19.7%
Total PNVT Departure[9]		79%	58%	58%	51%	51%

[1] Includes Grass, Forb, Brush/Shrub resulting from uncharacteristic fire (delayed recovery time (State N))
[2] In the VDDT modeling described in appendix C, this row represents states B and F
[3] In the VDDT modeling described in appendix C, this row represents state C
[4] In the VDDT modeling described in appendix C, this row represents states D and E.
[5] In the VDDT modeling described in appendix C, this row represents states J and K.
[6] In the VDDT modeling described in appendix C, this row represents states G
[7] In the VDDT modeling described in appendix C, this row represents states H and I.
[8] In the VDDT modeling described in appendix C, this row represents states L and M.
[9] Departure from reference conditions = high (over 66 percent), moderate (34 to 66 percent), and low (0 to 33 percent).
[10] Desired distribution does not include Mexican spotted owl protected activity centers, which would be managed under the Mexican spotted owl recovery plan

The numbers in table 21 reflect the percentage reductions described under assumptions for large tree and old-growth attributes. Percentages used to calculate large, old trees account for growing site differences (e.g., soil, topography, moisture) encountered across the forest while providing a reasonable estimate for old-growth forest components.

Table 21. Proportion of Ponderosa Pine PNVT states dominated by medium and very large trees, by alternative

Proportion of Ponderosa Pine PNVT States Dominated by:	Existing Distribution	Alt. A		Alts. B, C, D	
		15 Year	50 Year	15 Year	50 Year
Medium Trees (10 to 20 inches d.b.h.)[1]	28.1%	22.9%	15.7%	20.8%	13.5%
Very Large Trees (over 20 inches d.b.h.)[2]	5.9%	10.8%	17.3%	13.8%	19.6%
Distribution Subtotal	34.0%	33.7%	33.0%	34.5%	33.1%

[1] Adjusted by 40 percent to represent old-growth components
[2] Adjusted by 60 percent to represent old-growth components

It is important to view these results in terms of not only the area occupied by stands of trees in the medium and large tree states but also the area occupied in the desired states within these size classes. For instance, 95.5 percent of the entire Ponderosa Pine PNVT is desired to occur within medium and very large tree states with about 90 percent growing in open canopy conditions dominated by uneven-aged structure and only a minor amount in closed canopy, even-aged states. After 15 years, all alternatives increase at approximately the same rate, less than 1 percent. Although the area occupied by the medium and very large tree states actually decreases slightly after 50 years, all alternatives move toward desired conditions for large, old trees by favoring both medium and very large trees growing in more open, uneven-aged conditions. Medium and very large trees growing in these conditions have less competitive stress and are more resilient to disturbance. Over the long term, alternatives B, C, and D would have the greatest effect on creation of very large trees, increasing the area to almost 20 percent; while alternative A would only reach 18 percent.

Table 23 and table 24 display modeled predictions of old-growth attributes for each alternative over time. Forest Vegetation Simulator (FVS) outputs were averaged for each combination of states (medium and very large trees with open canopy and medium and very large trees with closed canopy) that had old large trees, in both even- and uneven-aged conditions. Desired condition values were then weighted by the modeled percentages predicted for each combination of states after 15 and 50 years. Because achievement of desired conditions will likely take a century or more, these numbers reflect higher than desired percentages of even-aged, closed canopy conditions. The data displayed in these tables represents only 40 percent of the medium, and 60 percent of the very large, tree states, which are most likely to have old-growth components.

Under all alternatives, Ponderosa Pine would move slowly toward the desired fire return interval.

Alternative A

While alternative A does not necessarily prevent attainment of desired conditions in Ponderosa Pine, the somewhat narrow focus on commodity production, dwarf mistletoe eradication, and fire suppression would hinder the progress toward the overall desired conditions of this PNVT. Under alternative A, management direction is cumbersome because the Ponderosa Pine PNVT falls in 29 different management areas across the forest, with each management area providing different direction that is designed to address particular attributes or concerns that are prominent within each.

Due to the lack of fire restoration direction and fewer acres treated, alternative A would maintain the vegetation condition class at high departure and maintain high fire severity, whereas alternatives B, C, and D would move toward desired conditions for both vegetation trend and fire severity. Alternative A would move toward the desired fire return interval more slowly than the other alternatives. Alternative A would provide more general desired conditions in regard to the composition, structure, and function of Ponderosa Pine compared to alternatives B, C, and D, but it is more prescriptive in terms of desired density and has direction to minimize natural disturbances in some management areas.

Treatments occurring under the guidance in alternative A would result in more area with higher stocking densities in Mexican spotted owl nesting and roosting habitat and consequently greater vulnerability to uncharacteristic fire. This is because alternative A has plan components that originated from the 1995 "Mexican Spotted Owl Recovery Plan" (USDI 1995b) in addition to direction to follow approved recovery plans. The Mexican spotted owl recovery plan was revised in 2012 (USDI 2012b). For example plan components in alternative A only allow precommercial thinning in Mexican spotted owl protected activity centers (PACs) to reduce fire risk and for firewood, and do not allow treatments to improve habitat. The new recovery plan guidance allows prescribed fire treatments as well as thinning appropriate to improve habitat resiliency. The 1987 plan language also limits the size of trees to be thinned in PACs to 9 inches, whereas the new recovery plan does not include this restriction.

Compared to alternatives B, C, and D, alternative A would reduce fire treatments forestwide due to constraints to managing wildfire for resource objectives in the wildland-urban interface and wilderness areas. This would result in higher potentials for PNVT-wide uncharacteristic fire than the other alternatives, which support managing wildfire for resource objectives in the wildland-urban interface and in wilderness (but without the alternative A constraints). Alternative A doesn't emphasize natural disturbances and restoration.

Because alternative A would allocate 20 percent of this PNVT to old growth using existing forest plan guidance, it would be difficult to achieve the desired condition of predominantly uneven-aged, open forest conditions.

Ponderosa Pine would trend toward desired conditions under alternative A and shift to more open canopy conditions and increases in uneven-aged multistoried stand structure, particularly in medium and very large trees. The Ponderosa Pine PNVT is currently about 30 percent open and 70 percent closed compared to the desired condition of 90 percent open and 10 percent closed. VDDT modeling estimates that with about 10,000 acres of vegetative treatment per year, this PNVT would have about 40 percent open and 60 percent closed canopy conditions in 50 years. Currently, 28 percent of Ponderosa Pine is estimated to be uneven-aged compared to almost 100 percent in desired conditions. VDDT modeling estimates that with about 10,000 acres of vegetative treatment per year, 43 percent of this PNVT would be in uneven-aged, multistoried conditions in 50 years. There is a predicted decrease in closed canopy, single story even-aged conditions over time. Understory abundance, diversity, and distribution would be expected to improve at 15 and 50 years primarily in areas where more open stand conditions have been created. Trends for vegetation and fire return intervals would also move toward desired conditions (fire severity would remain static), mirroring the shifts in stand structure. This means that fire return intervals are expected to shorten; and with improvement in vegetation structure, the risk of uncharacteristic fire would also decrease.

The forest is currently involved with the Four Forest Restoration Initiative, a collaborative effort to analyze a landscape level forest restoration treatment within ponderosa pine types across four national forests, including the Coconino NF, and 2.4 million acres located along the Mogollon Rim. If this project were approved and implemented under alternative A, effects to the Ponderosa Pine PNVT would be comparable to those analyzed for alternative B for vegetation and fire, except for differences in effects attributed to the differences in plan direction such as the ability to manage for the role of natural fire. It is, however, important to recognize that implementation of the size and scope of the Four Forest Restoration Initiative under alternative A would require site-specific plan amendments and, thus, alternative A would not support large-scale restoration without plan amendments.

The 1987 plan (alternative A) contains sometimes contradictory and confusing direction for snag retention, which is an important feature of wildlife habitat in ponderosa pine. Depending on the location and whether or not the area is designated old-growth forest or northern goshawk or Mexican spotted owl habitat, the minimum size for snags may be 12, 14, or 18 inches (table 22). Overall, alternative A would not increase the snags above 18 inches in size that are important for Mexican spotted owls and northern goshawks, but it would slightly increase the 12- to 18-inch category of snags, which still have some utility to wildlife.

Table 22. Snags per acre by diameter at breast height classes in Ponderosa Pine

Timeframe	8 to 12 inches d.b.h.	12 to 18 inches d.b.h.	18+ inches d.b.h.
Existing	2.8	1.2	1.3
15 years	3.1	1.8	1.4
50 years	2.8	1.6	1.4

Table 23 and table 24 display modeled predictions of old-growth attributes for each alternative over time. FVS outputs were averaged for each combination of states (medium and very large trees with open canopy and medium and very large trees with closed canopy) that had old large trees, in both even- and uneven-aged conditions. Desired condition values were then weighted by the modeled percentages predicted for each combination of states after 15 and 50 years. Because achievement of desired conditions will likely take a century or more, these numbers reflect higher than desired percentages of even-aged, closed canopy conditions. The data displayed in these tables represent only 40 percent of the medium and 60 percent of the very large tree states, which are most likely to have old-growth components.

For old-growth attributes, under alternative A, the Ponderosa Pine PNVT is predicted to meet or exceed all minimum high site criteria except for canopy cover (table 23). However, cover is computed on a per acre basis and includes openings and interspaces not planned for regeneration. Areas within the PNVT managed for forested cover (with the inclusion of regeneration openings) are expected to meet the minimum criteria for cover. At least 20 percent of each forested ecosystem management area would be allocated to be managed for old-growth forest structure.

Table 23. Ponderosa Pine old growth attributes (alternative A)

Old Growth Attributes		90	20/ Ac	50%[1]	1 Ton/ Ac	1/ Ac (14"+)	
		BA/AC	18" TPA	Percent CC	CWD	Snags 12-18"	Snags >18"
Year 15	Medium (40%) and Large Trees (60%)	142	22	47	3.7	4.0	2.7
Year 50	Medium (40%) and Large Trees (60%)	127	20	43	3.5	3.5	2.7

[1] Uses average of FVS output and cover calculation developed on the Kaibab National Forest (Shepperd et al. 2002)

It is important to view these results in terms of not only the area occupied by stands of trees in the medium and large tree states but also the area occupied in the desired states within these size classes. For instance, 95.5 percent of the entire Ponderosa Pine PNVT is desired to occur within medium and very large tree states with about 90 percent of that growing in open canopy conditions dominated by uneven-aged structure and only a minor amount in closed canopy, even-aged states. After 15 years, all alternatives increase at approximately the same rate, less than 1 percent. Although the density of area occupied by the medium and very large tree states actually decreases slightly after 50 years, all alternatives move toward desired conditions for large, old trees by favoring both medium and very large trees growing in more open, uneven-aged conditions. Medium and very large trees growing in these conditions have less competitive stress and are more resilient to disturbance. Over the long term, alternatives B, C, and D would have the greatest effect on creation of very large trees, increasing the area to almost 20 percent, while alternative A would only reach 18 percent.

In terms of old-growth attributes within the Ponderosa Pine PNVT, alternative A's plan components would emphasize old-growth attributes and large trees (with snags and downed logs) distributed through at least 20 percent of the landscape at multiple scales. There are several examples of direction from alternative A that support this effect. For instance, northern goshawk guidelines state the goal of maintaining 40 percent of the forested area outside of Mexican spotted owl habitat as predominantly trees of 18- to 24-inch d.b.h. and 24-inch and higher d.b.h. Also, under alternative A, at least 20 percent of the naturally forested area by forest type would continue to be developed or retained for old-growth function. Both of these pieces of plan direction would support the development and maintenance of old-growth forest components.

After 15 years, the total area occupied by medium and very large tree states would remain static at about 34 percent and then slightly decline to about 32 percent. However, the level of departure for this PNVT would drop from near high to moderate as cover is reduced, growth is increased, and stand structure becomes more uneven aged. Those areas dominated by very large trees in open canopy states increase from 1.2 to 11.5 percent after 50 years, with the majority converting to uneven-aged stand structure. In 50 years, closed-canopy states would experience a large decrease from current levels except for uneven aged which nearly doubles in area. Stands dominated by very large trees would increase in all states over the next 50 years, except for single storied, closed canopy. Alternative A would make less progress toward creation of very large tree states and overall uneven-aged (desired) conditions than alternatives B, C, and D.

Because of past harvesting practices, particularly on the north side, the forest is currently deficit in the very large tree structural stages (states E, I, K, M).[41] In an effort to meet these targets, projects would continue to focus on treating structural stages of primarily mid-sized trees to reduce competitive stress and decrease the risk of uncharacteristic fire, which would then support their development into old-growth forest components. Harvest of larger diameter trees is no longer the focus of forest management. However, there are occasions where the harvest of large trees is prescribed to move toward desired conditions, such as when they have encroached into other PNVTs or to promote desired uneven-aged forest conditions. The natural fire regime promotes and maintains the stand structure consistent with desired conditions and associated old-growth components; thus, restoring fire to the landscape would also encourage and maintain uneven-aged forest attributes. Because alternative A would result in the least acreage of fire treatment, the trend for vegetation and fire severity would remain static compared to trends toward desired conditions in alternatives B, C, and D. It would do the least to promote and maintain desired structural conditions in ponderosa pine.

Alternative A does not distinguish between the two mixed conifer PNVTs, which differ in species composition, structure, and fire regimes.

Overall, alternative A would generally move ponderosa pine toward desired conditions and provide for old and large trees across the landscape. It would not be able to support fire restoration as well as alternatives B, C, and D and, therefore, it would increase the risk of uncharacteristic wildfire.

Alternatives A and C

Plan language regarding the downed logs varies slightly between alternatives. Plan components in alternative A and C for old-growth stands describe an average of 2 logs per acre, greater than 12 inches at midpoint, and greater than 15 feet long. This would result in a lower average (2 compared to 3) of longer logs (15 feet compared to 8 feet) than alternatives B and D. The language in alternatives A and C for old-growth stands would be less representative of the frequent low severity fires characteristic of this PNVT.

Plan language regarding the minimum size and distribution of snags varies by alternative. Alternatives A and C would have at least 1 snag per acre in old-growth stands (minimum diameter of 14 to 16 inches d.b.h.) and, thus, snags would be more evenly distributed in old growth with a smaller minimum diameter than the other alternatives. Alternatives B and D would average 1 to 2 snags per acre with a minimum diameter greater than 18 inches d.b.h., and there could be some areas without snags and other areas with groups or clumps of snags. Snag density and distribution under alternative A would be less representative of the frequent low severity fires characteristic of this PNVT.

[41] State E = very large, open canopy, even-aged; state I = very large, closed canopy, even-aged; state K = very large, open, uneven-aged; state M = very large, closed canopy, uneven-aged.

Alternatives B, C, and D

Table 24. Ponderosa Pine old-growth attributes (alternatives B, C, and D)

Old Growth Attributes		90	20/acre	50%[1]	1 Ton/Ac	1/acre (14"+)	
		BA/AC	18"TPA	Percent CC	CWD	Snags 12-18"	Snags >18"
Year 15	Medium (40%) and Large Trees (60%)	128	20	44	3.5	3.6	2.7
Year 50	Medium (40%) and Large Trees (60%)	116	18	41	3.4	3.3	2.7

[1] Uses average of FVS output and cover calculation developed on the Kaibab National Forest (Shepperd et al. 2002)

Desired conditions under alternatives B, C, and D state that old-growth structure occurs throughout the landscape, generally in small areas as individual old-growth components, or as clumps and groups of old growth. Old-growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old-growth components shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). Under these alternatives, the Ponderosa Pine PNVT is predicted to meet or exceed all current minimum high site criteria used under the existing forest plan except for cover and the number of 18-inch d.b.h. trees per acre (Year 50). Although alternatives B, C, and D would not use these criteria as a measure of growth attainment, the criteria still provide a useful comparison of movement toward desired conditions between alternatives. Under each of these alternatives, old-growth attributes are expected to be developed and maintained across the landscape rather than on just 20 percent.

As previously mentioned, cover is computed on a per acre basis and includes openings and interspaces not planned for regeneration. Areas within the PNVT managed for forested cover (with the inclusion of regeneration openings) are expected to meet the minimum criteria for cover, especially when considering that two-thirds of this PNVT is low site, requiring only 40 percent cover.

Data analyzed for the number of 18-inch d.b.h. trees per acre in the Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs came only from the four very large tree states (greater than 20-inch d.b.h.), so that that attribute wouldn't be overestimated. The four medium tree states include trees 10- to 20-inch d.b.h., so approximately 20 percent could be 18-inch d.b.h. or greater. The quadratic mean diameter for 3 of the 4 medium tree states was 16.4-inch d.b.h. or greater, indicating that the distribution is skewed toward larger trees in those states. The number of estimated trees in those 3 states averaging 16.4-inch d.b.h. is approximately 187 per acre. If only 5 percent of those were greater than 18-inch d.b.h., then another 9 trees per acre would meet the criteria. Thus, it can be reasonably expected that alternatives B, C, and D would still meet the minimum high site criteria after 50 years while providing for old-growth attributes over a much larger percentage of the landscape than alternative A.

Alternatives B, C, and D would promote uneven-aged conditions that feature a balance of age classes, from young to old, that more closely approximate desired conditions. Extent and distribution of old-growth forest components would no longer be tied to the current guidance for

20 percent of the naturally forested area by forest type but would achieve more medium and very large trees that would provide for current and future old-growth attributes across the landscape.

Alternatives B and D

Plan language regarding the minimum size and distribution of snags in old growth varies by alternative. Alternatives B and D would average 1 to 2 snags per acre with a minimum diameter greater than 18 inches d.b.h., and there could be some areas without snags and other areas with groups or clumps of snags. This differs from alternatives A and C, in which there would be at least 1 snag per acre in old-growth stands (minimum diameter of 14 inches d.b.h.) and, thus, they would be more evenly distributed in old growth with a smaller minimum diameter. Alternatives B and D would be more representative of the frequent low severity fires characteristic of this PNVT and, at a minimum, would result in an average of larger logs.

Plan language regarding the downed logs in old-growth stands varies slightly between alternatives. Alternatives B and D would result in a minimum of logs greater than 12 inches at midpoint, greater than 8 feet long, and averaging 3 per acre. Alternatives A and C would result in a minimum of logs greater than 12 inches d.b.h. and greater than 15 feet long averaging 2 per acre. These alternatives account for shorter logs and a higher minimum density than alternatives A and C in old-growth stands which is likely a better reflection of the frequent low severity fires characteristic of this PNVT.

Alternative B

Alternative B would be less prescriptive than alternative A in terms of desired conditions. The proposed treatment of additional acres under alternative B would provide for closer achievement of desired conditions than alternative A, primarily resulting from more acres treated and converted from even to uneven-aged structure, and additional dense, closed canopy converted to open canopy conditions. Alternative B also has comprehensive desired conditions and guidelines for ponderosa pine that applies across the landscape wherever this vegetation type occurs. This more consistent approach would lead to better implementation of projects that move toward desired conditions than alternative A. This alternative also proposes three recommended wilderness areas, Strawberry Crater, Davey's, and Walker Mountain.

Alternative B allows fire to play a more natural role on the landscape and reduce the risk of uncharacteristic fire by removing constraints on tactical fire decisions and use of prescribed fire from alternative A. Standard decisionmaking processes for fire have become much more formalized and inclusive than they were in 1987, and so plan components in alternative A that were meant to guide the use of fire on the forest are now more a hindrance than a help.

Since alternative B would increase prescribed fire treatment acreage and acres of wildfires managed for resource objectives, fire severity trends would improve at a faster rate relative to alternative A. However, fire treatment based on plan objectives would remain insufficient to completely restore fire regimes because most of the forest is highly departed from desired condition. Fire return intervals would improve slowly. There would still be increased risk of uncharacteristic fire on a landscape scale, but overall conditions that allow for the management of wildfires to meet resource objectives and the use of prescribed fire for maintenance would be improved.

Under alternative B, overall departure from desired conditions for open canopy conditions within this PNVT would decrease after 15 years, moving from high to moderate and dropping an

additional 10 percent beyond that predicted for alternative A. This trend is due to additional acres being treated under this alternative, creating more open, uneven-aged conditions that are closer to desired conditions and would be more resilient to disturbances. The range of treated acres analyzed ranged from 5,000 to 26,000 acres. Movement toward desired conditions in Ponderosa Pine is a function of acres treated: the more acres treated the greater movement toward desired conditions. The level of departure would continue to improve, dropping further into the moderate range after 50 years. The huge disparity between closed and open canopy conditions would decrease more under alternative B compared to alternative A after 50 years, and the amount of area with uneven-aged structure would start to occupy a large majority within medium and very large trees. Alternative B would put this PNVT on a trend toward desired conditions by improving stand structure, opening up the canopy, and reducing the overall departure.

Understory vegetation is expected to respond favorably to treatment under alternative B. The amount of open canopy in the PNVT moves from 30 percent to approximately 44 percent after 50 years, which would favor increased grass, forb, and shrub production. Thus, Ponderosa Pine would become more structurally diverse.

Alternative B would increase prescribed fire treatment acreage from 10,000 to 20,000 acres and acres of wildfires managed for resource objectives would be predicted to increase slightly to 33,500 acres per year; thus, fire severity would remain highly departed from desired conditions but trend toward desired conditions. The predicted annual acreage of wildfires managed for resource objectives, however, would be dependent on many factors beyond the control of managers such as smoke management and air quality, timing restriction related to species protection, and social values and concerns, and so actual treated acres could be less. Fewer acres treated would then result in the trends for fire severity away from desired conditions.

For retaining snags, the outcomes of alternative B would be similar to alternative A, but the contradicting guidelines would be removed from the plan and, therefore, there would be more consistent project implementation.

Alternative B would only slightly improve the percentage of old-growth structure over alternative A (+1 percent), but it would improve the structural distribution of large trees from predominantly closed- and single-storied to multistoried and open. If more acres could be treated, particularly smaller size classes that are closed canopy, the area represented by open, medium, and large trees would continue to rise and, thus, support more vigorous and large old trees than alternative A. Alternative B would increase prescribed fire treatment and would be predicted to slightly increase wildfires managed for resource objectives. This would result in predicted fire severity toward desired conditions and slow improvement in fire return interval. This alternative would do the most to promote and maintain old-growth forest components.

After 15 years, the total area occupied by medium and very large tree states would remain static at about 34 percent, and then slightly decline to about 33 percent. However, the level of departure for this PNVT would drop from near high to low-moderate as cover is reduced, growth is increased, and stand structure becomes more multistoried. Very large trees in open canopy states would increase from 2 percent to 24 percent after 50 years, and they would be dominantly uneven-aged. Closed canopy states would experience a large decrease from current levels in 50 years except for uneven-aged, which nearly doubles in area. Stands dominated by very large trees would increase in all states over the next 50 years except single storied, closed canopy.

Under alternative B, tree size would be less of a determining factor when delineating old-growth forest components than under alternatives A and C. While alternative A's plan direction tends to place more emphasis on creation and maintenance of large diameter, even-aged stands.

Plan direction under alternative B, particularly language about the use of thinning, prescribed fires, and wildfires with resource objectives to protect old-growth forest components would also allow for greater movement toward desired conditions. Methods of protecting existing old-growth forest components may include vegetative treatments in adjacent areas, especially those areas that are situated upwind or are topographically lower. This alternative includes the guideline to promote structural diversity; thus, the development of old-growth conditions should be encouraged in areas where old-growth attributes is lacking. Vegetation treatments would be designed such that replacement structural stages and age classes are proportionally present to assure continuous representation of old-growth characteristics across the landscape over time.

Most of the areas within recommended wilderness areas contain PNVTs that are highly or moderately departed from the desired conditions. There is a lack of recent mechanical vegetative treatment (a prerequisite for becoming an inventoried potential wilderness area) and the recommended wilderness areas tend to be remote or have relatively poor access either due to rugged topography and steep slopes. Because of these factors and even without wilderness designation, mechanical vegetation treatments would be more expensive to carry out and possibly less likely to occur. Wilderness recommendation would create an additional need to mitigate the effects of mechanized and motorized equipment post-treatment in order to maintain wilderness character and wilderness scenic integrity objectives, especially where soils do not readily recover from short term motor vehicle impacts. As a result, it is unlikely that the interior portions of the recommended wilderness would be treated under this alternative, although accessible areas along the boundary of the recommended wilderness may have small-scale treatments. Thus, while 69 percent of the recommended wilderness in alternative B is at least moderately departed and trending away from desired conditions, these areas may actually be more highly departed than the overall PNVT. These factors plus fewer and less extensive vegetation treatments could increase the risk of uncharacteristic fire within the recommended wilderness areas and the surrounding area; however, the effects to individual PNVTs or localized areas could vary from this.

Recommended wilderness in alternative B would have no effect to departure on Ponderosa Pine or risk of uncharacteristic fire at the PNVT level primarily due to the small extent of pine. The effects would be in the Strawberry Crater Wilderness. A total of 29 acres of Ponderosa Pine PNVT occurs within this recommended wilderness area. In this case, it is unlikely that wilderness recommendation would influence strategies to manage wildfires. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire regime in these localized areas.

Alternative C

Alternative C analyzed the same range of acres treated as alternative B. Less than 6 percent of this PNVT under this alternative would be allocated to recommended wilderness (4,470 acres). Of the 4,470 acres allocated to recommended wilderness, approximately 2,097 acres are within an inventoried roadless area and 1,917 acres are in PACs. Vegetation treatments in these areas would follow inventoried roadless area regulations and policies and the Mexican spotted owl recovery plan under all alternatives. Taking inventoried roadless areas and PACs into account, approximately 1,960 of these 4,470 acres are not already subject to limitations on the ability to conduct vegetation treatments due to the recommended wilderness areas under this alternative.

These 1,960 acres would be distributed across five 5th code watersheds and four recommended wilderness areas (Tin Can, Railroad Draw, Strawberry Crater, and Deadwood Draw), further diluting any potential effect to departure. Consequently, any difference between alternatives B and C would be negligible, and it is assumed that this alternative would move toward desired conditions as quickly as alternatives B and D and, therefore, would have the potential to move slowly toward desired conditions. It is also assumed that the areas within recommended wilderness that are outside of PACs and inventoried roadless areas would be managed for developing old growth.

There is no historical evidence of 100- to 300-acre old-growth stands in Ponderosa Pine in the Southwest. The 100- to 300-acre old-growth stands in Ponderosa Pine would support mixed severity fires rather than the frequent, low severity surface fires that are more characteristic of this PNVT. This is because the old-growth structure described in the plan components would support more continuous canopy, even-aged conditions, and higher stocking levels than would result under characteristic fire. In these old-growth stands, the available growing space would be occupied by the recommended density of large trees (minimum of 20 trees that are 18 inches in diameter or greater). Accounting for canopy and rooting zones and natural between group interspaces and tree density, there would be little ability to promote vertical structure and age class diversity.

Snag retention effects for alternative C would be the same as alternative B in areas outside of allocated old growth and would be the same as alternative A for allocated old growth.

Alternative C is expected to be similar to alternative B and would not greatly improve the percentage of old growth over alternative A (+1 percent), but it would improve the structural distribution of large trees from predominantly closed and single storied to multistoried and open. Alternative C retains the standards and guidelines from alternative A relating to old-growth forest components. However, instead of allocating old-growth forest components at the ecosystem management area or 10,000-acre block, these components would be allocated by 6th code watershed. Although these standards and guidelines are retained, they would not have as big an impact on the old growth representation as the additional acres treated in this PNVT under alternatives B, C, and D. It would do slightly less than alternative B to promote and maintain old-growth forest components due to potential reductions in fire treatment from recommended wilderness designations.

Recommended wilderness in alternative C would have little effect to departure on Ponderosa Pine or risk of uncharacteristic fire at the PNVT level primarily due to the small extent of pine. The effects would be in small localized areas. A total of 4,470 acres of Ponderosa Pine PNVT occur within the recommended wilderness areas. As described in alternative B, wildfires in about 1,076 of these acres (about 0.1 percent of the PNVT) would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility and few vegetative treatments due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, high departure, closed canopy conditions); and threatened values outside the wilderness. These acres lie within the recommended Tin Can and Deadwood Draw wildernesses. Consequently, there would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring the natural fire interval.

There would be minimal impact to the remaining Ponderosa Pine acres from wilderness recommendation because there are only 3,394 acres of pine (0.4 percent of the PNVT), distributed in five different recommended wilderness areas (Abineau, Babershop, East Clear Creek, Railroad Draw, and Strawberry Crater). Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire regime in these localized areas. Vegetation treatments would be more expensive to carry out and possibly less likely to occur because of the need to mitigate the effects from the use of mechanized and motorized equipment post-treatment and limitations on expanding the footprint of motorized vehicle use. As a result, an increase in tree density and canopy cover would likely continue in these localized areas. These areas would not able to carry fire because of the indirect effect of reducing the understory due to higher amounts of canopy.

Alternative D

Alternative D analyzed the same range of acres treated as alternatives B and C. The differences between this alternative A and alternative B would have no effect on the Ponderosa Pine PNVT (see the analysis and discussion of departure from desired conditions for alternative B). Since alternatives B and D are very similar in terms of fire treatment, the resulting consequences on fire regimes and predicted trends for fire severity are similar.

Mixed Conifer with Frequent Fire

Analysis Assumptions

Fire Departure and Trend: As with ponderosa pine, fire departures for this and other PNVTs were evaluated based on recent rates of implementation for alternative A and stated plan objectives for alternatives B, C, and D to determine how expected vegetation condition class, fire return intervals, and fire severity would change under each alternative over the next 50 years.

Vegetation Departure and Trend: To translate desired conditions for vegetation into measureable states for modeling, it is assumed that if the model shows that Mixed Conifer with Frequent Fire PNVT is at least 60 percent in a combination of medium and very large trees with open canopy conditions and even-aged (single storied) or primarily uneven-aged (multistoried) structure, then the PNVT would be in primarily uneven-aged open forest conditions[42] that represent desired condition (table 25). The 25 percent desired distribution for closed canopy provides for desired conditions indicative of Mexican spotted owl habitat particularly on north-facing slopes and in canyons (Romme et al. 2009). As the desired distribution is approached, the total PNVT departure from desired conditions is decreased.

[42] Mixed Conifer with Frequent Fire consist of 14 different states, but it is desirable for the majority of these forest types to be in States D, E, J, and K.

Table 25. Comparison of Mixed Conifer with Frequent Fire vegetation states among desired distribution, existing distribution, and each alternative

MCFF VDDT Model State	Desired Distribution	Existing Distribution	Alt. A		Alts. B, C, D	
			15 Year	50 Year	15 Year	50 Year
Grass, Forb, Brush/Shrub[a] Seedling, Sapling, Open, Single Story Seedling, Sapling, Closed, Single Story[1]	9.0	0.5%	17.4%	17.3%	20.3%	20.7%
Small Trees, Open, Even-aged[2]	3.0	1.0%	0.4%	0.4%	0.4%	0.4%
Very Large and Medium Trees, Open, Even-aged[3]	60.0%	2.0%	2.1%	2.1%	1.6%	1.7%
Very Large and Medium Trees, Open, Uneven-aged[4]		5.0%	21.7%	21.6%	33.2%	33.2%
Small Trees, Closed, Even-aged[5]	3.0	9.9%	8.9%	9.3%	10.1%	10.1%
Very Large and Medium Trees, Closed, Even-aged[6]	25.0%	24.5 %	12.1%	11.9%	5.8%	5.8%
Very Large and Medium Trees, Closed, Uneven-aged[7]		57.1%	37.4%	37.2%	28.6%	28.1%
Total PNVT Departure[8]	64%		39%	39%	34%	30%

[1] Includes Grass, Forb, Brush/Shrub including those resulting from uncharacteristic fire (delayed recovery time).
[2] In the VDDT modeling described in appendix C, this row represents state C.
[3] In the VDDT modeling described in appendix C, this row represents states D and E.
[4] In the VDDT modeling described in appendix C, this row represents states J and K.
[5] In the VDDT modeling described in appendix C, this row represents state G.
[6] In the VDDT modeling described in appendix C, this row represents states H and I.
[7] In the VDDT modeling described in appendix C, this row represents states L and M.
[8] Departure from reference conditions = high (greater than 66 percent), moderate (34 to 66 percent), and low (0 to 33 percent)

Large Tree and Old-Growth Attributes: Medium-sized trees are those that are between 10 and 20 inches d.b.h., and medium-sized stands are those that are dominated by trees of that size in terms of basal area per acre or stand density index. Although a “large” tree is not always old, and an old tree is not always large, some feel that a 16-inch d.b.h. tree is representative of a “large” tree in the Southwest. For the purposes of this analysis, it was assumed that 40 percent of the medium-sized tree states (approximately16-inch+ d.b.h. trees) would count toward old-growth forest components and large trees, and 60 percent of the very large size tree states (approximately 24-inch+ d.b.h. trees) would count toward old-growth forest components and large trees. The numbers in table 26 reflect these percentage reductions.

Table 26. Existing and expected distribution of medium and large trees in Mixed Conifer with Frequent Fire (all alternatives)

Mixed Conifer with Frequent Fire PNVT	Existing Distribution	Alt. A		Alts. B, C, D	
		15 Year	50 Year	15 Year	50 Year
Medium Trees (10 to 20 inches d.b.h.)	31.1%	22.3%	11.8%	18.4%	8.3%
Very Large Trees (20+ inches d.b.h.)	6.7%	13.9%	21.1%	19.8%	28.6%
Distribution Subtotal	37.8%	36.2%	32.9%	38.2%	36.9%

It is important to view these results not only in terms of the area occupied by stands of trees in the medium and large tree states, but also the area occupied in the desired states within these size classes. For instance, 85 percent of the entire Mixed Conifer with Frequent Fire PNVT is desired to occur within medium and very large tree states, with about half of that growing in open canopy conditions dominated by uneven-aged structure and only a minor amount in closed canopy, even-aged states.

Old-Growth Attributes: Under alternative A, Mixed Conifer with Frequent Fire is predicted to meet or exceed all minimum high site criteria, except for canopy cover. As with ponderosa pine, it is expected that areas managed for forested cover (with the inclusion of regeneration openings) would meet the minimum criteria for cover, and be allocated to no less than 20 percent of each forested ecosystem management area. (See table 27.)

Table 27. Mixed Conifer with Frequent Fire old-growth attributes (alternative A)

Old-Growth Attributes		100	16 per acre	60 Percent	2 tons per acre	2.5/ acre (16"+)	
		BA/AC	20"TPA	Percent CC	CWD	Snags 12-18"	Snags >18"
Year 15	Medium (40%) and Large Trees (60%)	148	23	43	9.9	9.8	10.7
Year 50	Medium (40%) and Large Trees (60%)	142	22	41	9.7	9.7	11.1

Desired conditions for old-growth forest components are the same for Mixed Conifer with Frequent Fire as Ponderosa Pine (see table 28). Under alternative B, Mixed Conifer with Frequent Fire is predicted to meet or exceed all minimum high site criteria currently used to measure old-growth attributes, except for cover. As with alternative A, it is expected that areas of this PNVT managed for forested cover (with the inclusion of regeneration openings) would meet the minimum current criteria for old-growth cover and be well distributed across the landscape. As with ponderosa pine, old growth criteria used to determine old-growth attributes under the existing 1987 plan were used only as a baseline for comparison among alternatives. As uneven-aged conditions are restored, particularly in the frequent, low-severity fire types (i.e., ponderosa pine and mixed conifer with frequent fire), the concept of managing 20 percent of the forest for

old-growth "stands" becomes outdated. Instead, the desired conditions provide for maintenance and development of old-growth components over 100 percent of the landscape.

Table 28. Mixed Conifer with Frequent Fire old growth attributes (alternatives B, C, and D)

Old-Growth Attributes		100	16 per acre	60 Percent	2 tons per acre	2.5 per acre (16"+)	
		BA/AC	20"TPA	Percent CC	CWD	Snags 12-18"	Snags >18"
Year 15	Medium (40%) and Large Trees (60%)	136	22	40	9.5	9.6	11.4
Year 50	Medium (40%) and Large Trees (60%)	124	20	36	9.1	9.4	12.1

Common to All Alternatives

A minimum of 25 percent of this PNVT would be managed to promote a closed-canopy condition dominated by medium and very large trees to provide for Mexican spotted owl nesting and roosting habitat that could be occupied in the future (recovery nesting and roosting habitat). This is in addition to areas managed as protected activity centers. All alternatives would follow approved recovery plans. Barring fire or other disturbances at a large scale, old-growth components are expected to remain static or increase over time in protected activity centers and recovery nesting and roosting habitat and would continue to support the habitat needs of Mexican spotted owl under all alternatives. Areas outside of protected activity centers and areas outside recovery nesting and roosting habitat would generally be managed for large trees, large hardwoods, large snags, and large downed woody debris. Consequently, there would be an increased risk of uncharacteristic fire because of denser stand conditions. Aspen and other early seral species could continue to decline where late seral species or structure is emphasized.

Fire treatment objectives would slowly move this PNVT toward the historic fire return interval. This would result in more areas where open conditions are maintained, nutrient cycling occurs, and age class diversity is promoted.

Alternative A

Alternative A has plan components that originated from the 1995 "Mexican Spotted Owl Recovery Plan" (USDI 1995b) and has guidance to follow approved recovery plans. The Mexican spotted owl recovery plan was revised in 2012 (USDI 2012b). About 15 percent of this PNVT occurs in Mexican spotted owl protected activity centers. The 1987 plan (alternative A) would limit treatment in Mexican spotted owl protected activity centers to thinning trees up to 9 inches d.b.h. with activities restricted to outside the breeding season. In contrast, the revised recovery plan guidance would allow prescribed fire treatments as well as thinning appropriate to improve habitat resiliency. As a result, treatments occurring under the guidance from the 1987 plan result in more area with higher stocking densities in Mexican spotted owl nesting and roosting habitat.

Alternative A would move Mixed Conifer with Frequent Fire toward desired conditions by reducing the overall vegetative departure. Departure from desired conditions within this PNVT would decrease with alternative A after 15 years, but would still remain moderately departed under this alternative. Reversing the trend at this time is critical because the current departure is

listed at 64 percent, only a few percentage points from high. Open, multistoried conditions in the medium and very large tree states would increase from 5 to over 17 percent after 15 years, and then are projected to remain static at around 17 percent over 50 years, indicating that not enough acres are being treated to achieve a majority of the PNVT in open, uneven-aged states.

As a result of not developing enough open conditions, seedlings, saplings, and small trees would continue on a negative trajectory while movement of very large-sized trees would progress toward desired conditions. Medium-sized trees in open, multistoried conditions would see an initial increase and then decline after 50 years as they grow into the very large size class and are not replaced by small trees. Because of the increased competition as result of not enough acres being treated, the smaller trees would not grow at a rate sufficient to replace medium and large trees. These conditions also would favor shade-tolerant species recruitment over species such as juniper, oak species, ponderosa pine, and Douglas-fir, which under desired conditions would be codominant over this vegetation type. Where open stand conditions are created, understory vegetation diversity and distribution would be expected to increase. This alternative would improve ecosystem function and resilience to disturbance in the Mixed Conifer with Frequent Fire PNVT by moving toward more open, uneven-aged conditions.

The 1987 plan contains sometimes contradictory direction for snag retention, which is an important feature of wildlife habitat in this PNVT. Depending on the location and whether or not the area is designated old growth or northern goshawk or Mexican spotted owl habitat, the minimum size for snags may be 12, 14, or 18 inches (table 29). The differing direction in snag guidelines has been a source of confusion with the 1987 plan. In addition, for mixed conifer areas outside of northern goshawk post-fledgling areas, the direction is to leave at least three snags per acre. Differing direction on the number and size of snags to retain would have the potential to cause inconsistency during project implementation and layout.

Additional direction for Mexican spotted owl restricted habitat states, except where otherwise noted, forest plan old-growth standards and guidelines are to be implemented to maintain and promote development of owl habitat. As a result, acres of existing old growth mixed conifer components should increase as developing old-growth components mature, but modeling shows that it does not under this alternative. After 15 years, the total area occupied by medium and very large tree states would experience a slight decline (less than 1 percent) and then continue to decline by another 0.6 percent. However, the sum total of areas dominated by very large trees is predicted to triple from less than 7 percent to almost 21 percent after 50 years and become dominantly uneven aged. The area occupied by trees greater than 20 inches d.b.h. is predicted to reach 20 percent after 50 years. Therefore, it is predicted that activities under this alternative would meet the 20 percent old-growth standard.

Under alternative A, fire restoration is also not addressed as a critical element of forest management for this PNVT. Since this PNVT has a frequent fire return interval, a lack of fire would have increasingly deleterious impacts because more fire cycles would be missed. Further, constraints to managing wildfire for resource objectives in the wildland-urban interface and wilderness areas would reduce fire treatments forestwide. Alternative A would have the least acreage of fire treatment and result in no improvement in vegetative structure (as it relates to fire) or in predicted fire severity. It would do the least to promote and maintain old-growth components on the landscape compared to the other alternatives.

Table 29. Snags per acre by diameter at breast height classes in Mixed Conifer with Frequent Fire (alternative A)

Timeframe	8 to 12 inches d.b.h.	12 to 18 inches d.b.h.	18+ inches d.b.h.
Existing	8.0	4.5	3.3
15 years	9.1	5.1	6.8
50 years	8.8	4.6	6.4

Alternatives A and C

Plan language regarding the minimum size and distribution of snags varies by alternative. Alternatives A and C would have at least one snag per acre in old-growth stands (minimum diameter of 14 to16 inches d.b.h.) and, thus, snags would be more evenly distributed in old growth with a smaller minimum diameter than the other alternatives. Alternatives B and D would average 3 snags per acre with a minimum diameter of greater than 18 inches d.b.h., and there could be some areas without snags and other areas with groups or clumps of snags. Snag density and distribution under alternative A would be less representative of the frequent low severity fires characteristic of this PNVT.

Plan language regarding the downed logs varies slightly between alternatives. Plan components in alternatives A and C in old-growth stands describe an average of 4 logs per acre, greater than 12 inches at midpoint, and greater than 16 feet long. This would result in a higher average (4 compared to 3) of longer logs (16 feet compared to 8 feet) than alternatives B and D. The language in alternatives A and C in old-growth stands would be less representative of the frequent low-severity fires characteristic of this PNVT. Alternative A does not distinguish between the two mixed conifer PNVTs, which differ in species composition, structure, and fire regimes.

In alternatives A and C, plan components specify 100- to 300-acre old-growth stands in Mixed Conifer with Frequent Fire although there is no historical evidence of large scale, even-aged old-growth stands in this vegetation type. Stands of this size would support mixed severity fires rather than the frequent, low severity surface fires that are more characteristic of this PNVT. This is because the old-growth structure described in the plan components would support more continuous canopy, even-aged conditions, and higher stocking levels than would result under characteristic fire. In these old-growth stands, the available growing space would be occupied by the recommended density of large trees (minimum of 20 trees that are 18 inches in diameter or greater). Accounting for canopy and rooting zones and natural between group interspaces and tree density, there would be little ability to promote vertical structure and age class diversity.

Alternative B

Plan objectives in alternative B would provide for closer achievement of desired conditions than alternative A, primarily by converting more acres from closed canopy to open canopy conditions. These conditions would allow for increased growth and vigor, and it would make stands more resilient to uncharacteristic disturbances such as insects, disease, and drought. Understory vegetation is predicted to improve in both distribution and species diversity as cover is reduced.

Under alternative B, the overall departure from desired conditions within Mixed Conifer with Frequent Fire would decrease from moderate to low after 15 years. Thus, it would move this

PNVT toward desired conditions by reducing the overall departure to low. The long-term trend would continue to move toward desired conditions, but at a relatively slow pace. Seedlings, saplings, and small trees would continue on a negative trajectory, while movement of medium and larger sized trees would slowly progress toward desired conditions. While some improvement would be made toward overall ecosystem health, there would continue to be more area of even-aged, closed canopy forest than would be desired. Movement toward desired conditions is increased and projected to be maintained compared to alternative A because more acres would be treated.

The projected fire treatment for alternatives B, C, and D would improve the current fire return interval of 130 years to approximately 36.7 years, near the historic and desired fire return interval.

Direction for snag retention would be clarified under this alternative, and the overall effects on snag retention would be similar to alternative A. The minimum desired number of snags per acre would be maintained and the smaller size class would decrease slightly because there would be less competition induced mortality from denser conditions than alternative A. (See table 30.)

Table 30. Snags per acre by diameter at breast height classes in Mixed Conifer with Frequent Fire (alternative B)

Timeframe	8 to 12 inches d.b.h.	12 to 18 inches d.b.h.	18+ inches d.b.h.
Existing	8.0	4.5	3.3
15 years	8.9	5.2	7.1
50 years	8.6	4.9	7.0

Alternative B would do the most to promote and maintain old-growth components across the landscape. It would result in a larger portion of the landscape being occupied by very large trees than alternative A. Uneven-aged structure, including promotion of mature and old age classes, would be managed for across the landscape rather than just over 20 percent of the forest as directed in alternative A. In addition, alternative B would be more effective at maintaining and enhancing the current distribution after 50 years. Since alternative B would increase prescribed fire treatment and would be predicted to slightly increase wildfires managed for resource objectives, it would move vegetative structure and fire severity toward desired conditions.

Plan direction under alternative B, particularly language about the use of prescribed fire and wildfire with resource objectives to protect old-growth forest components, would also allow for greater movement toward desired conditions. Methods of protecting existing old-growth components may include thinning and use of prescribed fires and wildfires in adjacent areas, especially those areas that are situated upwind or are topographically lower. This alternative includes the guideline, “to promote structural diversity, the development of old-growth conditions should be encouraged in areas where old-growth components are lacking.” Vegetation treatments would be designed such that replacement structural stages and age classes are proportionally present to assure continuous representation of old-growth components across the landscape over time.

Over the long term, alternative B would have the greatest effect on creation of very large trees, increasing their area to approximately 28 percent, while alternative A would only reach

21 percent. Since the natural fire regime promotes and maintains the stand structure consistent with desired conditions for old-growth forest attributes, restoring fire to the landscape also encourages and maintains old-growth forest components. After 15 years, the total area occupied by medium and very large tree states would experience a slight increase (less than 1 percent) and then decline by a little over 1 percent from existing conditions. The sum of areas dominated by very large trees is predicted to increase significantly from near 7 percent to 28 percent under alternative B. As with alternative A, medium tree states would experience a corresponding decline as trees grow into the very large tree states at a faster rate than they can be replaced by smaller trees.

Alternatives B and D

Plan language regarding the minimum size and distribution of snags varies by alternative. Alternatives B and D would average 3 snags per acre with a minimum diameter of greater than 18 inches d.b.h., and there could be some areas without snags and other areas with groups or clumps of snags. This differs from alternative A, in which there would be at least 1 snag per acre in old-growth stands (minimum diameter of 14 to 16 inches d.b.h.) and, thus, they would be more evenly distributed in old growth with a smaller minimum diameter. Alternatives B and D would be more representative of the frequent low severity fires characteristic of this PNVT.

Plan language regarding the downed logs varies slightly between alternatives. Alternatives B and D would result in a minimum of logs greater than 12 inches at midpoint, greater than 8 feet long, and averaging 3 per acre. These alternatives account for shorter logs and a lower minimum density than alternatives A and C in old-growth stands which is likely a better reflection of the frequent low-severity fires characteristic of this PNVT. Alternative A does not distinguish between the two mixed conifer PNVTs, which differ in species composition, structure, and fire regimes.

Alternatives B, C, and D

Alternatives B, C, and D distinguish between the two mixed conifer PNVTs, which differ in species composition, structure, and fire regimes. In these alternatives, desired conditions are more reflective of the differences between these PNVTs, such as fire regime and structure. Alternative A lumps Mixed Conifer and Ponderosa Pine vegetation together.

Alternatives B, C, and D would not include any references to the original recovery plan for the Mexican spotted owl. These alternatives would refer to using the most current version of this recovery plan only.

Alternative C

Effects to departure and trend are the same as alternative B except as noted below.

Although alternative C recommends 13 new wilderness areas, none of these areas are a significant portion of the Mixed Conifer with Frequent Fire PNVT. Overall departure from desired conditions for fire and vegetation is expected to be similar to alternative A for old-growth stands and similar to alternative B for areas outside of old growth.

Recommended wilderness in alternative C would have little effect to departure on Mixed Conifer with Frequent Fire or risk of uncharacteristic fire at the PNVT level primarily due to the small extent of this PNVT in recommended wilderness. A total of 283 acres (0.5 percent of the PNVT) of Mixed Conifer with Frequent Fire PNVT only occur within Barbershop recommended

wilderness, and it is unlikely that wilderness recommendation would influence wildfire suppression strategies. However, because of limited access, it is likely that little management has occurred in this area so pretreatment would likely be needed before fire could be used with minimal negative effects. If Barbershop becomes a wilderness area, pretreatment options would be minimized to the point that an increase in tree density and canopy cover would likely continue in these acres.

Alternative D

Alternative D would have the same effects as alternative B, because the differences in plan direction do not affect this PNVT.

Mixed Conifer with Aspen

Common to All Alternatives

A minimum of 25 percent of this PNVT would be managed to promote a closed-canopy condition dominated by medium and very large trees to provide for Mexican spotted owl nesting and roosting habitat that could be occupied in the future (recovery nesting and roosting habitat). This is in addition to areas managed as protected activity centers. All alternatives would follow approved recovery plans. Barring fire or other disturbances at a large scale, old-growth components are expected to remain static or increase over time in protected activity centers and recovery nesting and roosting habitat and would continue to support the habitat needs of Mexican spotted owl under all alternatives. Areas outside of protected activity centers and areas outside recovery nesting and roosting habitat would generally be managed for large trees, large hardwoods, large snags, and large downed woody debris.

The lack of fire treatment objectives would move this PNVT away from the historic fire return interval. This would result in more areas where denser conditions and higher canopy are maintained, and there would be fewer openings and shade intolerant species like aspen. Consequently, there would be an increased risk of uncharacteristic fire because of denser stand conditions.

Alternative A

Alternative A has plan components that originated from the 1995 “Mexican Spotted Owl Recovery Plan” (USDI 1995b) and in addition has guidance to follow approved recovery plans. The Mexican spotted owl recovery plan was revised in 2012 (USDI 2012b). All mixed conifer is considered to be Mexican spotted owl restricted or protected habitat, the current forest plan has guidance to follow all approved recovery plans and the Mexican spotted owl recovery plan provides primary guidance for desired density and structure within this PNVT. A large portion of this PNVT occurs in nonsuitable timberlands, primarily Mexican spotted owl protected activity centers that only allow thinning trees up to 9 inches d.b.h. with activities restricted to outside the breeding season. The current forest plan includes language based on the 1995 recovery plan; some of this guidance has changed in the revised Mexican spotted owl recovery plan. For example, the 1987 plan guidance may continue to limit treatment in Mexican spotted owl nest cores, whereas the new recovery plan guidance allows prescribed fire treatments as well as thinning appropriate to improve habitat resiliency. The current forest plan language also limits the size of trees to be thinned in protected activity centers to 9 inches, whereas the new recovery plan does not include this restriction. As a result, treatments occurring under the guidance from the

1987 plan result in more area with higher stocking densities in Mexican spotted owl nesting and roosting habitat.

Alternative A provides only general desired conditions in regard to the composition, structure, and function of mixed conifer compared to alternative B. Alternative A includes an objective to recruit aspen on 254 acres per decade. It proposes to treat more acres of aspen than the other alternatives. However, the management area that this objective applies to does not incorporate all of the potential sites that are within this PNVT and, therefore, it would not support aspen recruitment on as many locations on the forest, although the objective proposes to treat more acres than the objective in alternatives B, C, and D.

Old-growth direction for this PNVT is the same as Mixed Conifer with Frequent Fire. Predicted treatment in Mixed Conifer with Aspen that support old-growth forest components would be based on the needs of Mexican spotted owl habitat, which would be focused on removing trees less than 18 inches and less than 9 inches in protected activity centers. Therefore, trees over 18 inches would be maintained and competition in smaller trees would be reduced allowing increased growth rates that would recruit new old-growth forest components more quickly.

In the current plan in the forest and woodland vegetation types, old growth is managed as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area. A table under forestwide direction describes minimum levels for old-growth attributes such as large trees, snags, and logs. Accounting for canopy and rooting zones, and natural between group interspaces, the minimum level of trees would provide less ability than alternatives B and D to promote vertical structure and age class diversity because the available growing space is occupied by the minimum required trees. This density of trees would tend to maintain a more continuous canopy than alternatives B and D that would be more conducive to crown fire. Consequently, alternative A would result in more closed canopy even-aged conditions than alternatives B and D. This structure and age class diversity is not reflective of frequent low-severity fires characteristic of Ponderosa Pine, Mixed Conifer with Frequent Fire, and Piñon-Juniper with Grass PNVTs. There would be fewer openings and less understory. Compared to alternatives B and D, old-growth stands in these PNVTs are at higher risk for uncharacteristic fire and when they do burn, there is likely to be more area in mixed severity with 25 to 75 percent loss of dominant overstory, compared to loss of 25 percent or less which is characteristic of low-severity fires. Old-growth stands would be less resilient to endemic levels of disturbances. Alternative C is similar to alternative A.

Snags are expected to increase because continued implementation of fire suppression objectives in the current plan would tend to increase tree density and, thus, more snags would be created due to competition induced mortality and susceptibility to insects and disease.

Alternatives A and C

Plan language regarding the total basal area in old-growth stands differs between alternatives. Total basal area in alternatives A and C has a recommended minimum of 80 to 100 square feet per acre. This is a narrower range than the 20 to 180 square feet per acre landscape wide, including old growth, that would result from implementation of alternatives B and D. Fire in old-growth stands would tend toward the higher end of mixed severity as a result of the alternative A plan language and a larger proportion of the old-growth stands burning hotter with more overstory mortality. The narrower range of total basal area would not be as representative of the characteristic mixed severity fire regime as alternatives B and D.

Plan language regarding the minimum size and distribution of snags in old growth varies by alternative. Alternatives A and C would have at least 2.5 snags per acre in old-growth stands (minimum diameter of 14 to 16 inches d.b.h.) and, thus, snags would be more evenly distributed in old growth with a smaller minimum diameter than the other alternatives. The overall density of snags would be substantially lower in old-growth stands compared to alternatives B and D. Alternatives B and D would average 1 to 5 snags per acre for snags with a minimum diameter greater than 18 inches d.b.h., and for snags greater than 8 inches d.b.h., there would be an average of 20 per acre. In alternatives B and D there could be some areas without snags and other areas with groups or clumps of snags. The distribution and density of snags in old-growth stands would be less representative of a mixed severity fire system than alternatives B and D.

Plan language regarding the downed logs in old-growth stands varies between alternatives. Plan components in alternatives A and C describe an average of 4 logs per acre, greater than 12 inches at midpoint, and greater than 16 feet long. Downed log requirements in alternatives B and D are combined with coarse woody debris and there are different tons per acre depending on seral stage. Mid-seral stages would have 20 to 40 tons per acre including downed logs and late seral stages would have at least 35 or greater tons per acre. This would also apply to alternative C in areas outside of old-growth stands. Compared to alternatives B and D, plan direction in alternatives A and C old-growth stands would result in lower amounts of coarse woody debris and downed logs and a less variable distribution of this material in old-growth stands. This would be less representative of the mixed severity fire every 35 to 200 years that is characteristic of the Mixed Conifer with Aspen PNVT.

Alternative B

Under alternative B, management would not be expected to change from current levels, thus maintaining the current level of moderate departure and static in relation to desired conditions. Because of better defined desired conditions and because fire would be allowed to play a more natural role, alternative B would be expected to move closer to desired conditions than alternative A. Portion of Mixed Conifer with Aspen, outside of Mexican spotted owl activity centers, would be able to achieve desired conditions of more diverse stand structure and composition and could become more open which could improve understory conditions. In addition, the risk of uncharacteristic fire would be lessened and aspen stand regeneration and maintenance would be carried out. The portions of this PNVT within Mexican spotted owl habitat would follow the approved recovery plan.

Alternative B better describes desired conditions at multiple scales including desired density ranges in terms of basal area per acre and endemic levels of disturbances such as insects, disease, fire, and weather as part of the desired conditions; while alternative A seeks to minimize natural disturbances to them. As a result, alternative B better supports desired conditions for this PNVT and would create more diverse conditions outside of Mexican spotted owl protected activity centers and recovery nesting and roosting habitat.

Alternative B would better support aspen recruitment acres in PNVTs where aspen occurs because of a larger treatment objective than alternative A. This objective would also be more effective because it can be applied anywhere on the landscape, not just in a particular management area or PNVT.

Plan direction under alternative B, particularly language about the use of planned and unplanned natural ignitions to protect old-growth forest components, would allow for greater movement

toward desired conditions. Methods of protecting existing old-growth forest components may include thinning, prescribed fire, and use of wildfire in adjacent areas, especially those areas that are situated upwind or are topographically lower. This alternative includes the guideline, “to promote structural diversity, the development of old-growth conditions should be encouraged in areas where old-growth forest components are lacking.” Vegetation treatments would be designed such that old-growth patches are maintained across the landscape over time.

Alternatives B, C, and D

Snags are expected to increase under alternatives B, C, and D due to removing fire suppression objectives, removing restrictions on the use of fire in wilderness and in the wildland-urban interface, and allowing endemic levels of insect and disease. However, snags would not increase as much as alternative A.

Alternatives B and D

Plan language regarding the total basal area in old-growth stands differs between alternatives. Total minimum basal area in alternatives B and D is 20 to 180 square feet per acre landscape wide, including old growth. This is a higher variability than the recommended minimum of 80 to 100 square feet per acre in alternatives A and C. The wider range of total basal area would be more representative of the characteristic mixed severity fire regime compared to alternatives A and C. There would tend to be a lower proportion of the dominant overstory in old-growth stands replaced during a mixed severity fire.

Plan language regarding the minimum size and distribution of snags in old growth varies by alternative. Alternatives B and D would average 1 to 5 snags per acre for snags with a minimum diameter of greater than 18 inches d.b.h., and for snags greater than 8 inches d.b.h. there would be an average of 20 per acre. In alternatives B and D, there could be some areas without snags and other areas with groups or clumps of snags. Alternatives C and A would have at least 2.5 snags per acre in old-growth stands (minimum diameter of 14 to 16 inches d.b.h.) and, thus, snags would be more evenly distributed in old growth with a smaller minimum diameter than the other alternatives. The overall density of snags would be substantially higher in old-growth stands compared to alternatives A and C. The distribution and density of snags in old-growth stands would be more representative of a mixed severity fire system than alternatives A and C.

Plan language regarding downed logs in old-growth stands varies between alternatives. Downed log requirements in alternatives B and D are combined with coarse woody debris and there are different tons per acre depending on seral stage. Mid-seral stages would have 20 to 40 tons per acre including downed logs and late seral stages would have at least 35 or greater tons per acre. This would also apply to alternative C in areas outside of old-growth stands. Plan components in alternatives C and A describe an average of 4 logs per acre, greater than 12 inches at midpoint, and greater than 16 feet long which is an estimated 2.5 to 3 tons per acre. Compared to alternatives A and C, plan direction in alternatives B and D old-growth stands would result in higher amounts of coarse woody debris and downed logs and higher variability in the distribution of this material in old-growth stands. This would be more representative of the mixed severity fire every 35 to 200 years that is characteristic of the Mixed Conifer with Aspen PNVT

Alternative C

Alternative C is expected to have the same effects as alternative B regarding the level of departure from desired (reference) conditions except for the following.

Alternative C differs from alternative A in the areas outside of old-growth stands. In alternative C, direction for the PNVT outside of these areas would be similar to alternatives B and D.

Recommended wilderness in alternative C would have little effect to departure on Mixed Conifer with Aspen or risk of uncharacteristic fire at the PNVT level primarily due to the small extent of this PNVT. A total of 347 acres (0.9 percent of the PNVT) of Mixed Conifer with Aspen PNVT only occurs within the Abineau recommended wilderness. Wildfires on these acres would likely be managed to meet resource objectives, if possible, and would have a low likelihood of being suppressed. However, because of limited access, it is likely that little management has occurred in this area, so pretreatment would likely be needed before fire could be used with minimal negative effects. If Abineau becomes a wilderness area, pretreatment options would be minimized to the point that an increase in tree density and canopy cover would likely continue in these acres. This analysis process is described under alternative B for Ponderosa Pine.

Alternative D

Alternative D is expected to have the same effects as alternative B for level of departure from desired (reference) conditions.

Spruce-Fir

Common to All Alternatives

The Spruce-Fir PNVT accounts for less than 1 percent of the forest. Virtually no timber or vegetation management has occurred in this other than Snowbowl Ski Area removing hazardous trees and expanding ski runs in 2011. Because of limited management opportunities based on wilderness and other plan direction, Spruce-Fir would experience little change and would maintain moderate departure with a trend away from desired conditions for vegetation and fire severity.

The lack of fire treatment objectives would result in this PNVT remaining highly departed in terms of fire return intervals. This would result in more areas where denser conditions and higher canopy are maintained, and there would be fewer openings and shade intolerant species like aspen. Consequently, Spruce-Fir would not move toward desired conditions under any alternative.

Alternative A

Alternative A lacks plan components that focus on the composition, structure, and function of this PNVT. Spruce-Fir is located primarily within management areas that limit vegetation management. More than three-quarters of this PNVT is in designated wilderness or managed as part of other special areas. The next largest portion of this PNVT is part of the Inner Basin Management Area, which is managed to protect drinking water sources for Flagstaff and does not allow timber management.

Guidelines potentially hampering the use of wildfire to achieve desired conditions in wilderness areas exist in the 1987 plan.

Based on the “Minimum Criteria for the Structural Attributes Used to Determine Old-Growth” table in the 1987 plan (as amended), the average forest age and size is increasing. Barring a major natural disturbance, this trend would be expected to continue. This is not consistent with desired conditions for Spruce-Fir PNVT. Desired conditions are to have a balance of early–mid–late forest successional stages.

Alternative B

Because many of the use restrictions to protect wilderness character, special areas, and drinking water sources, the percentage of Spruce-Fir that is actively managed would not be expected to change over current levels under alternative B. However, the Inner Basin and other management that restricted commercial harvest under alternative A would not be restricted under alternative B. This would only slightly increase the area that could be treated (still less than 10 percent of Spruce-Fir), but it would allow for some management flexibility where there was none previously. Most of these areas, however, are on steep slopes, less feasible to treat, and have a higher risk of sedimentation and other resource damage. Mexican spotted owl protected activity centers would further influence the types of treatments that could occur. Therefore, these changes do not necessarily result in different effects than alternative A. As with alternative A, this PNVT is expected to remain at the current moderate departure level, within its desired conditions, but trending slightly away as the time between major disturbances increases.

Guidelines for Spruce-Fir state, "(S)oil and vegetation disturbance from management activities should occur in confined, localized areas where impacts to soil condition and vegetation is minimized to maintain long-term soil productivity and continue moving the majority of the 6th code watershed toward a functioning Class 1 condition."

Guidelines potentially hampering the use of wildfire to achieve desired conditions in wilderness areas have been removed for the proposed revised plan; therefore, it is reasonable to conclude that plan components for alternative B would allow for faster movement to desired conditions than alternative A.

Because the majority of this PNVT is in wilderness or on steep slopes, proposed management under alternative B is not expected to differ from alternative A, and effects to old-growth characteristics and large tree retention are expected to be the same as alternative A.

Alternatives C and D

Effects of alternatives C and D are expected to be the same as alternative B for level of departure from desired (reference) conditions because all of the Spruce-Fir PNVT is either in designated wilderness or Mexican spotted owl protected activity centers.

Piñon-Juniper with Grass

Analysis Assumptions

Fire Departure and Trend: Fire departures for this and other PNVTs were evaluated based on recent rates of implementation for alternative A and stated plan objectives for alternatives B, C, and D to determine how expected fire return intervals would change under each alternative over the next 50 years.

Vegetation Departure and Trend: Regardless of alternative, this PNVT requires frequent fire to maintain its composition, structure, and overall health. The desired conditions are for approximately half of the trees in the Piñon-Juniper Grassland PNVT to be medium to very large sized trees growing in open canopy conditions, with another 10 percent of these sized trees growing in closed-canopy conditions. Piñon pine and juniper have slower growth rates, and trees greater than 20 inches diameter at root collar are relatively rare across the landscape. However, it is desirable to have some very large trees as reflected by the medium to very large trees (states D and G). Widespread tree mortality caused by a piñon Ips outbreak in 2001 to 2003 is primarily

responsible for the existing high percentage of grass, forb, and shrub. Because disturbances, primarily low-severity fires, would not occur as often as desired, those open areas would begin to fill in with trees. Although medium and very large trees growing in open-canopy conditions would increase under all alternatives, the same sized trees with closed canopy would increase at an even higher rate. (See table 31).

Table 31. Comparison of Piñon-Juniper with Grass PNVT states among desired distribution, existing distribution, and each alternative

Piñon-Juniper with Grass VDDT Model State	Desired Distribution	Existing Distribution	Alt. A		Alts. B, C, D	
			15 Year	50 Year	15 Year	50 Year
Grass, Forb, Brush/Shrub[1]	5.0	23.0%	12.9%	3.6%	13.6%	3.8%
Seedling/Sapling, Open, Even-aged	25.0%	16.0%	9.1%	3.5%	9.1%	4.1%
Small Trees, Open, Even-aged		26.0%	10.7%	4.8%	11.0%	4.6%
Seedling/Sapling, Closed, Even-aged		17.0%	11.0%	4.5%	10.7%	4.2%
Subtotal[2]		59%	30.8%	12.8%	30.8	12.9%
Medium and Very Large Trees, Open[3]	50.0%	2.0%	12.7%	19.7%	13.8%	24.7%
Small Trees, Closed, Even-aged[4]	10.0%	13.0%	29.0%	24.5%	27.3%	23.0%
Medium and Very Large Trees, Closed[5]	10.0%	3.0%	14.7%	39.4%	14.7%	35.8%
Total PNVT Departure[6]	0%	60%	42%	48%	41%	43%

[1] State A – Represents post-replacement/disturbance (after wildfire, insects, disease, or vegetation management).
[2] States B, C, and D – Represent mid-development size classes (less than 10 inches diameter at root collar), with primarily open canopy.
[3] State D – Represents late development size classes (greater than 10 inches diameter at root collar) with open canopy.
[4] State F – Represents mid-development small trees (5 to 10 inches diameter at root collar) with closed canopy.
[5] State G – Represents late development size classes (greater than 10 inches diameter at root collar) with closed canopy.
[6] Departure from reference conditions = high (greater than 66 percent), moderate (34 to 66 percent), and low (0 to 33 percent)

Large Tree and Old-Growth Attributes: Diameter growth for piñon pine (*Pinus edulis*) is slow, especially on poor sites, where 80 to 100 years can elapse before diameters reach even 10 to 15 centimeters (4 to 6 inches). On better soils, however, 150-year old trees may grow to a diameter of 30 centimeters (12 inches). Mean annual diameter growth of piñon culminates at about 1.8 centimeters (0.7 inch) per decade, when trees are approximately 50 years old (Ronco, 1990 as cited in Burns and Hankala 1990). For the analysis of piñon-juniper grasslands, it is assumed that increased amount of area occupied by states or combinations of the medium and very large tree states, is also movement toward desired old-growth conditions. Because of their slower growth rates, the majority of trees in medium tree state would qualify as old-growth forest components. No percent reduction was applied to trees in this PNVT as was the case with Ponderosa Pine and the Mixed Conifer PNVTs. All of the very large tree states were assumed to

qualify as old-growth forest components, since any piñon or juniper tree that is 20 inches diameter at root collar or greater is expected to be at least 200 years old. (See table 32.)

Table 32. Piñon-Juniper with Grass distribution of medium and very large trees, by alternative

Piñon-Juniper with Grass PNVT	Existing Distribution	Alt. A		Alts. B, C, D	
		15 Year	50 Year	15 Year	50 Year
Medium and Very Large Trees (10 to 20 inches d.b.h.), Open and Closed	5.0%	27.4%	59.1%	28.5%	60.5%
Desired Distribution	60.0%	60.0%	60.0%	60.0%	60.0%

Old-growth attributes: Under alternative A, the Piñon-Juniper with Grass PNVT is predicted to meet or exceed all minimum high site criteria for old-growth attributes. (See table 33.)

Table 33. Piñon-Juniper with Grass old-growth attributes (alternative A)

Old-Growth Attributes		24	30/acre	35%	1 ton/ acre	1/acre (10"+)
		BA/AC	12" TPA	% CC	CWD	Snags>10"
Year 15	Medium and Large Trees	110	45	34	2.1	6.4
Year 50	Medium and Large Trees	118	47	37	2.2	6.8

Under alternatives B, C, and D the Piñon-Juniper with Grass PNVT is predicted to meet or exceed all minimum high site criteria for old growth attributes. (See table 34.)

Table 34. Piñon-Juniper with Grass old-growth attributes (alternatives B, C, and D)

Old-Growth Attributes		24	30/acre	35%	1 ton/ acre	1/acre (10"+)
		BA/AC	12" TPA	% CC	CWD	Snags>10"
Year 15	Medium and Large Trees	109	45	34	2.1	6.3
Year 50	Medium and Large Trees	113	46	36	2.1	6.6

Common to All Alternatives

The fire return interval for all alternatives is predicted to trend away from desired conditions because the fire treatment objectives are not large enough to shift this large PNVT toward its reference frequent, low severity fire regime. Historically, fire would have maintained more open conditions. Lack of sufficient amounts of fire treatments would facilitate increased tree and shrub cover and decreased proportion of area dominated by grasses and forbs. Mechanical treatments would be sufficient to improve the trend in all alternatives over the life of the plan, but over time,

growth is predicted to exceed the benefits resulting from the treatments causing a shift away from desired conditions over the long term.

Alternative A

Under alternative A, this PNVT would be managed as woodland with a predominantly closed canopy that would restrict restoration of the grassland component. The silvicultural systems recommended provide enough flexibility to move toward desired conditions. However, existing direction to manage for at least 30 percent cover would leave too much cover across the landscape to support the grass understory of this PNVT, inhibiting the ability to restore fire necessary to maintain the desired open conditions. This PNVT is overlapped by 20 current management areas under the 1987 plan, with 54 percent in Piñon-Juniper Woodland, Less than 40 Percent Slope (MA 7) and approximately 12 percent in Transition Grassland and Sparse Piñon-Juniper above the Mogollon Rim (MA 10), which could lead to conflicting direction when managing the PNVT as a whole. Plan direction in the 1987 plan provides for shelterwood, clear-cutting, and uneven-aged silvicultural systems, and it specifies to manage for at least 30 percent cover in MA 7.

Desired conditions for this PNVT would be very difficult, if not impossible to achieve under alternative A, because the majority (54 percent) lies within MA 7, which requires management for at least 30 percent cover; while the desired vegetative structure is to have 80 percent of this PNVT managed at 30 percent or less cover. Historically, this PNVT experienced more frequent fire and disturbance, which maintained the grassy condition. With increasing tree cover, the fine fuels would be shaded out and the ability to carry lower intensity fire would decrease. Increasing fuel loads associated with tree cover would contribute to increased risk of uncharacteristic fire effects, which could threaten retention of large trees.

Alternative A would limit treatments on steeper slopes designed to adjust tree stocking and structure, and improve ecosystem function and resilience to disturbance. Increased competition from seedlings, saplings, and small trees that historically would have been thinned by fire is expected to continue to hamper the development of very large trees in this PNVT. Plan direction in alternative A (MA 7) limits mechanical treatment of piñon-juniper woodlands to slopes of 15 percent or less only, and generally only provides for old growth forest components on slopes above 15 percent. The emphasis is primarily placed upon extraction of firewood and miscellaneous convertible forest products rather than restoration of desired (reference) conditions. However, the general direction for exclusion of fire and mechanical treatments on slopes over 15 percent within piñon-juniper woodlands would likely be detrimental to piñon-juniper grasslands, which developed under a more frequent fire regime.

Modeling results indicate that alternative A would reduce the overall departure of Piñon-Juniper with Grass, but the amount of acres treated would not be enough to maintain or continue to move toward desired conditions over the long term. Departure from desired conditions within this PNVT would decrease after 15 years, but it would begin to increase again after 50 years (see table 31 for more information). After 50 years, the level of departure would still be lower than existing conditions, primarily a result of increased area occupied by medium and very large trees growing in open conditions, which increases from 2 to 20 percent. Alternative A moves areas dominated by medium to very large trees with open canopy conditions closer to the desired condition of 50 percent, but seedlings, saplings, and small trees in open canopy conditions would trend away as overall cover becomes more closed because of the lack of fire and other disturbances. Seedlings,

saplings, and open small tree states would decline as they grow into larger size classes, canopies close, and conditions suitable for regeneration opportunities decline.

While initial movement toward desired conditions is achieved in the short term, over time acres treated would not be able keep up with tree growth and canopy cover and, thus, understory vegetation would decline. Understory vegetation would likely increase in both distribution and diversity in the medium to very large and open tree state corresponding to the increase in area occupied. However, the projected increase in the closed canopy states would essentially serve to offset that gain. Because of the lack of fire to maintain an open canopy, the grass, forb, brush/shrub state would continue to decline as seedlings and saplings reestablish and encroach into these openings. Under alternative A, the numbers of snags would be expected to remain static or increase.

The overall amount of medium and large trees (old-growth forest components) within this PNVT would increase under alternative A, but the model lumps these size classes and doesn't show the percentage breakout. Mechanical treatments on slopes over 15 percent that could set stands on a faster trajectory toward old-growth conditions would not occur because of restrictions in alternative A. Medium-sized trees growing in open canopy conditions, which is this PNVT's desired condition, would increase after 15 years then slow down after 50 years. Because of slower growth rates in piñon-juniper forests, by the time a tree becomes medium-sized (10 to 20 inches diameter at root collar) it has already reached an age of 150 years old or greater.

As with other frequent fire PNVTs, the natural fire regime would promote and maintain the stand structure consistent with desired conditions and would encourage and maintain old-growth attributes within this PNVT. Fire treatment levels in this PNVT are insufficient to promote and maintain large tree/old-growth structure under this alternative. This is compounded by the lack of understory (grasses and forbs) that is necessary to carry fire across the landscape at a scale that would meet desired conditions. Even though mechanical treatments would improve conditions over the life of the plan, the fire treatments needed to maintain these improvements would be lacking. Consequently, the open conditions created by the vegetation treatments would fill in over time.

Alternative B

Alternative B would provide specific guidance for managing this PNVT, including desired conditions, objectives, and guidelines. The larger proposed treatment objective under alternative B would lead to greater progress toward desired conditions than alternative A. Alternative B is somewhat less restrictive than alternative A in terms of vegetation management by focusing more on the desired conditions rather than prescribing how to achieve them. Desired conditions for the PNVT state that: (1) trees occur as individuals, but occasionally in smaller groups and range from young to old; (2) scattered shrubs and a dense herbaceous understory including native grasses, forbs, and annuals are present to support frequent surface fires; (3) the composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances (e.g., insects, diseases, and fire) and climate variability; and fires are typically low severity (Fire Regime I). These desired conditions would provide the potential for improvement in condition class (a decrease in departure) for this PNVT.

Alternative B would move closer to desired conditions after 15 years and maintains a lower departure level than alternative A after 50 years. The level of departure would approach low but would still remain in the moderate range after 50 years. The short-term improvement initially

realized would begin to reverse and resume a negative trend over the long term. This alternative would move toward desired conditions by moving medium sized tree states with open canopy conditions closer to desired conditions, but seedlings, saplings, small, and very large trees in open canopy conditions would trend away as overall cover becomes more closed.

Under alternative B, the numbers of snags are correspondingly expected to remain static or increase. Table 35 illustrates the estimated averages of snags per acre for Piñon-Juniper with Grass.

Table 35. Piñon-Juniper with Grass estimated average of snags per acre

	8” to 12” d.r.c.	12” to 18” d.r.c.	18”+ d.r.c.
Snags per acre	5.0	3.8	1.8

This alternative would move toward desired conditions by increasing the percentage of medium to very large sized trees with open canopy conditions. Alternative B would increase the amount of old-growth forest components in this PNVT by approximately 5 percent more than alternative A; thus, the PNVT would be closer to desired conditions and less departed. If more acres could be treated, particularly smaller size classes with closed canopy, the area represented by medium and large trees would continue to rise. Similar to alternative A, fire treatment levels would be insufficient to promote and maintain large tree/old-growth structure and other vegetation desired conditions under alternative B.

Alternative B would reduce the overall vegetative departure from desired conditions more than alternative A, but the amount of acres treated would still not be enough to maintain or continue to move toward desired conditions over the long term. Similar to alternative A, the lack of fire treatment in this frequent fire PNVT would still result in a trend away from desired conditions with respect to fire return intervals. However, this alternative would provide for increased growth and vigor and make treated stands more resilient to uncharacteristic disturbances.

Recommended wilderness in alternative B would have little effect to departure on Piñon-Juniper with Grass or risk of uncharacteristic fire at the PNVT level primarily due to the small extent of the PNVT in recommended wilderness. The effect would be localized. A total of 3,648 acres of Piñon-Juniper with Grass PNVT (1 percent of the PNVT) occurs within Strawberry Crater recommended wilderness. It is unlikely that wilderness recommendation would influence wildfire management strategies. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire regime in these localized areas. In the area recommended for wilderness, vegetation treatments would be more expensive to carry out and possibly less likely to occur because of the need to mitigate the effects from the use of mechanized and motorized equipment post-treatment and limitations on expanding the footprint of motorized vehicle use. As a result, tree encroachment would likely continue. These areas would not able to carry fire because of lack of understory and naturally occurring cinder soils.

Alternative C

Recommended wilderness in alternative C would have little effect to departure on Piñon-Juniper with Grass or risk of uncharacteristic fire at the PNVT level primarily due to the small extent of the PNVT in recommended wilderness. The effect would be the same as alternative B.

Alternative D

Plan components for Piñon-Juniper with Grass in alternative D would result in the same general management and acres of treatment as alternatives B and C because the difference in plan components would not impact this PNVT.

Piñon-Juniper Woodland

Common to All Alternatives

Because Piñon-Juniper Woodland has a long fire return interval and generally has a stand-replacement fire regime, barring a major disturbance, the amount of old-growth forest components, large trees and snags per acre are expected to remain static or increase under all alternatives. Vegetative structure and fire severity are predicted to remain static. Because no fire objectives are included under any alternative, fire return interval is predicted to trend away from desired conditions.

Alternative A

Because this PNVT is currently at low departure and within its historical fire rotation, under alternative A, the Piñon-Juniper PNVT would likely remain at low departure with a static trend from desired conditions. Any increase in departure would be considered to be within desired conditions because the PNVT has a fire rotation of over 200 years.

Under the 1987 plan, all Piñon-Juniper Woodland were lumped together under Management Areas (MA) 7 and 8, and not split out by differences in ecological characteristics except for Grassland and Sparse Piñon-Juniper above the Mogollon Rim (MA 10), which overlaps 17 of the 18 PNVTs across the forest. Piñon-Juniper Persistent falls primarily under MA 7 – Piñon-Juniper Woodland less than 40 Percent Slope, MA 11 – Verde Valley, and MA 8 – Piñon-Juniper Woodland Greater than 40 Percent Slope. MA 7 is the only one with mechanical vegetation management guidelines, emphasizing management on a sustained-yield basis for firewood and miscellaneous convertible products. However, exceptions would occur if dispersion requirements for wildlife habitat components are not met on these steep slopes.

Without major disturbances, the amount of old growth forest components within this PNVT would remain static or improve under alternative A, but mechanical treatments on slopes over 15 percent that could set stands on a faster trajectory toward old-growth conditions would not occur. Plan direction in alternative A (MA 7) limits mechanical treatment of Piñon-Juniper Woodland to slopes of 15 percent or less only and generally provides for old growth forest components on slopes above 15 percent. The emphasis is primarily placed upon extraction of firewood and miscellaneous convertible forest products rather than restoration of desired conditions. This management approach limits treatments on steeper slopes that could be designed to adjust composition and structure, and improve ecosystem function and resilience to disturbance.

All piñon-juniper management areas in the 1987 plan emphasize prescribed fire and wildfires with resource objectives, except there is no provision for the use of wildfire in the wildland-urban interface, which have a suppression objective of 10 acres. The suppression objective in wildland-urban interface areas could hamper efforts to reduce buildups of hazardous fuels and would limit the ability for fire to play its natural role when it is determined that it is safe to do so.

Alternatives A and C

In alternatives A and C, old growth would be distributed in 100- to 300-acre stands primarily on greater than 15 percent slopes across the landscape. This should not result in a change in fire severity because this area is rocky (i.e., fire spread would not change), and high severity is already characteristic of this PNVT. In contrast, distribution of old growth in alternatives B and D would not be stands but in old-growth attributes of large old trees, snags, and logs across the landscape, not primarily on slopes greater than 15 percent.

Alternative B

Similar to alternative A, the Piñon-Juniper Woodland PNVT would likely remain at low departure from desired conditions and on a static trend under alternative B, because there are no treatment objectives and the PNVT is not far from desired conditions. The density and structural trends would continue to increase vulnerability to insect and disease outbreaks, but this PNVT is within its historic range of variability.

By focusing more on the desired conditions rather than prescribing how to achieve them, alternative B would be somewhat less restrictive than alternative A in terms of vegetation management. Such direction would offer more flexibility to manage this PNVT toward desired conditions.

Old-growth attributes would be distributed across the landscape and not in 100- to 300-acre stands primarily on greater than 15 percent slopes as in alternatives A and C. This would be more reflective of a high fire severity system.

Recommended wilderness in alternative B would have varying effects to risk of uncharacteristic fire in Piñon-Juniper Woodland. There would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring natural fire return interval in the Walker Mountain recommended wilderness which has about 665 acres (about 0.8 percent of the PNVT). As described in alternative B under Ponderosa Pine, wildfires would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility and few vegetative treatments due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, high departure, closed canopy conditions); and threatened values outside the wilderness.

There would be localized impact to the remaining Piñon-Juniper Woodland acres from wilderness recommendation. There are 1,483 acres (1 percent of the PNVT) distributed in Strawberry Crater and Davey's recommended wilderness areas. Wilderness recommendation would have a low likelihood of influencing wildfire suppression strategies. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring natural fire return intervals in these localized areas.

Alternative C

Approximately 13,665 acres are recommended for wilderness under this alternative, which amounts to about 18 percent of this PNVT. Despite the fact that these additional acres would be unlikely to have mechanical vegetation treatment in the future because of recommended wilderness, the Piñon-Juniper Woodland PNVT would likely be similar to alternative B and remain at low departure from desired conditions with a static trend, because there are no treatment objectives and it is not far from desired conditions. The density and structural trends

would continue to increase vulnerability to insect and disease outbreaks, but this PNVT is within its historic range of variability.

Recommended wilderness in alternative C would have varying effects to risk of uncharacteristic fire in Piñon-Juniper Woodland. The effects would be in small localized areas. As described in alternative B under Ponderosa Pine, wildfires in about 3,995 of these acres (about 5 percent of the PNVT) would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility and few vegetative treatments due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, high departure, closed canopy conditions); and threatened values outside the wilderness. These acres are scattered within five recommended wildernesses: Black Mountain, Cedar Bench, Tin Can, Walker Mountain, and Deadwood Draw. Consequently, there would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring the natural fire interval.

There would be localized impact to the remaining Piñon-Juniper Woodland acres from wilderness recommendation. There are 9,670 acres of this PNVT (0.4 percent of the PNVT), distributed in five different recommended wildernesses: East Clear Creek, Strawberry Crater, Davey's, Cimmaron-Boulder, and Hackberry. It is unlikely that wilderness recommendation would influence wildfire suppression strategies. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire regime in these localized areas. However, because of limited access, it is likely that little management has occurred in these areas so pretreatment would likely be needed before fire could be used with minimal negative effects. If these five become wilderness areas, pretreatment options would be minimized to the point that an increase in tree density and canopy cover would likely continue in these acres.

Alternative D

Plan components for the Piñon-Juniper Woodland PNVT in alternative D would result in the same effects as alternatives B and C.

Piñon-Juniper Evergreen Shrub

Common to All Alternatives

Under all alternatives, vegetative structure (as it relates to fire) and fire severity in Piñon-Juniper Evergreen Shrub are predicted to trend away from desired conditions due to the anticipated lack of vegetation and fire treatment. Fire return interval is also predicted to trend away. This would result in an increase in the area burned at the higher end of mixed fire severity and increased soil loss and overstory mortality. This would facilitate establishment and spread of invasive plant species, such as cheatgrass, which can alter the fire regime and timing of fires and to which many species may not be adapted.

Alternative A

Piñon-Juniper Evergreen Shrub has no treatment objectives under alternative A, and would likely remain moderately departed and continue trending away because tree density and cover would continue to increase, shading out understory species and maintaining more smaller to medium sized trees than desired. These factors tend to exacerbate the lack of disturbance, primarily fire, modifying the shrub and tree age class distribution and increasing the potential for severe fires.

These vegetation structural trends tend to increase vulnerability to insect and disease outbreaks. It is possible under alternative A, that Piñon-Juniper Evergreen Shrub could become highly departed over the next 15 to 50 years. However, it is also possible that tree densities could begin to decline due to increasing insect or fire activity as result of climate change, which would support increased grass and shrub cover indicative of a more static trend.

Alternative A does not recognize the different types of piñon-juniper. It combines the different types under MA 7 and MA 8, except for Grassland and Sparse Piñon-Juniper above the Mogollon Rim (MA 10), which overlaps 17 of the 18 PNVTs across the forest. Piñon-Juniper Evergreen Shrub is primarily covered under Piñon-Juniper Woodland with Less Than 40 Percent Slope (MA 7), which is the only one with a mechanical vegetation management guideline, emphasizing management on a sustained-yield basis for firewood and miscellaneous convertible products on 0 to 15 percent slopes. Old growth, cover, and snags would generally be provided on slopes greater than 15 percent. However, exceptions would occur if dispersion requirements for wildlife habitat components are not met on these steep slopes.

Although mechanical treatments on slopes over 15 percent that could set stands on a faster trajectory toward old-growth conditions would not occur, old growth forest structure and large tree retention within this PNVT are expected to remain static or increase in the absence of major disturbances.

All piñon-juniper management areas emphasize prescribed fire and the use of wildfires with resource objectives, except there is no provision for the use of wildfire in the wildland-urban interface. Alternative A's direction would limit mechanical treatment of Piñon-Juniper Woodland to slopes of 15 percent or less only within MA 7, and it would generally only provide for old growth forest components on slopes above 15 percent. This management approach limits treatments on steeper slopes designed to adjust composition and structure and improve ecosystem function and resilience to disturbance.

Alternatives A and C

In alternatives A and C, old growth would be distributed in 100- to 300-acre stands primarily on greater than 15 percent slopes across the landscape. Old-growth stands would tend to have fire at the higher end of mixed severity, which would result in greater overstory mortality. There would be less age class diversity and more even-aged and closed canopy conditions compared to areas outside of these stands. There would also be less understory and fewer openings. In contrast, distribution of old growth in alternatives B and D would not be stands but in old growth attributes of large old trees, snags, and logs across the landscape, not primarily on slopes greater than 15 percent.

Alternative B

Under alternative B, Piñon-Juniper Evergreen Shrub includes an objective to treat 3,750 acres every 10 years with low to mixed severity naturally ignited wildfire. This amount would depend on wildfire starts within this PNVT, conditions at the time of a start, and resources at risk. Fire could be allowed to exceed this acre objective if accomplishing benefits to the resources as determined through interdisciplinary team review.

Piñon-Juniper Evergreen Shrub would likely remain moderately departed with respect to vegetation departure and continue trending away because tree density and cover would continue to increase. As a result, understory species would be shaded out and more small and medium

sized trees would be maintained than desired. These factors tend to exacerbate the lack of disturbance, primarily fire and, thus, modifying the shrub and tree age class distribution and increasing the potential for severe fires.

The vegetation structural trends would increase vulnerability to insect and disease outbreaks which often target large, older trees and lead to more snags. Because of the natural fire objective, it is likely that under alternative B, Piñon-Juniper Evergreen Shrub would remain moderately departed over the next 15 to 50 years. If conditions are suitable for more acres to be treated with naturally ignited fire than the objective, the trend could become static, but it would require 10 or more times the current objective level of treatment. Assuming that naturally ignited fires were to occur and were managed in this PNVT, alternative B would move closer to desired conditions than alternative A.

Use of wildfires with resource objectives would reduce competition by removing smaller trees and increasing vigor of those remaining. Although only small-scale effects are expected at the treatment level objective of 375 acres per year, it is anticipated to be more effective at slowing the departure of this PNVT from desired conditions than alternative A. Old-growth structure and large tree retention within this PNVT are expected to remain static or increase in the absence of major disturbances.

Old growth attributes would be distributed across the landscape and not in 100- to 300-acre stands primarily on greater than 15 percent slopes as in alternatives A and C. The PNVT would have structure and composition characteristic of a mixed severity system. This differs from alternatives A and C because these PNVTs would tend to have fire at the higher end of mixed severity and result in higher overstory mortality.

Recommended wilderness in alternative B would have varying effects to risk of uncharacteristic fire in Piñon-Juniper Evergreen Shrub. The effects would be in small localized areas. As described in alternative B under Ponderosa Pine, wildfires in about 3,474 of these acres (about 1 percent of the PNVT) would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility and few vegetative treatments due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, high departure, closed canopy conditions); and threatened values outside the wilderness. These acres occur within Walker Mountain recommended wilderness. Consequently, there would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring the natural fire interval.

There would be little impact to the remaining Piñon-Juniper Evergreen Shrub acres from wilderness recommendation. There are 741 acres (about 0.3 percent of the PNVT) within Davey's recommended wilderness. Wildfires on these acres would likely be managed to meet resource objectives if possible and would have a low likelihood of being suppressed. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire return interval in this localized area.

Alternative C

The majority of acres recommended for wilderness under alternative C is within Piñon-Juniper Evergreen Shrub. This PNVT would have over 50,000 acres in recommended wilderness, which is almost one-fifth of the entire PNVT across the forest. However, approximately 9 percent of the

PNVT would have a moderate to high likelihood of influencing fire suppression decisions because of decreased accessibility and available tools. Because of the condition of these areas and the fact that naturally ignited fires may be managed in the majority of the PNVT, movement toward desired conditions and level of departure are expected to be similar as alternative B.

The effects of implementing alternative C on large tree retention are expected to be the same as alternative B, because treatment objectives would be unchanged and small compared to the size of the PNVT and, as a result, additional wilderness would likely not hinder expected management.

Recommended wilderness in alternative C would have varying effects to risk of uncharacteristic fire in Piñon-Juniper Evergreen Shrub. The effects would be in scattered localized areas. As described in alternative B under Ponderosa Pine, wildfires in about 24,150 of these acres (about 9 percent of the PNVT) would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility and few vegetative treatments due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, high departure, closed canopy conditions); and threatened values outside the wilderness. These acres occur within Black Mountain, Cedar Bench, Tin Can, Walker Mountain, and Deadwood Draw recommended wilderness. Consequently, there would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring the natural fire interval.

There would be little impact to the remaining Piñon-Juniper Evergreen Shrub acres from wilderness recommendation. There are 26,488 acres (about 10 percent of the PNVT) within Railroad Draw, Davey's, Cimmaron-Boulder, and Hackberry recommended wilderness. Wildfires on these acres would likely be managed to meet resource objectives, if possible, and would have a low likelihood of being suppressed. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire return interval in this localized area. However, because of limited access, it is likely that little management has occurred in this area so pretreatment would likely be needed before fire could be used with minimal negative effects. If these five areas become wilderness, pretreatment options would be minimized to the point that an increase in tree density and canopy cover would likely continue in these acres, depending on site-specific conditions.

Alternative D

Because of the similarity between alternatives D and B, effects to this PNVT are expected to be the same as alternative B.

Forest and Woodland Sub-PNVT Tree Features

Aspen

Alternative A

Under alternative A, management of aspen is not expected to change over current levels, resulting in continued decline and trend away from desired conditions. Acres of aspen qualifying as old growth forest components are expected to experience a corresponding decline as the level of departure continues to move away from desired conditions.

Plan components under alternative A would not impede movement toward desired conditions, but they are closely tied to maintaining or enhancing firewood production. Because of the need to

protect aspen sprouts from being browsed, the limiting factor would continue to be the cost per acre for treatment and protection, volunteer assistance, and limited funding available.

Alternative A has variable direction for the management of aspen depending on the management area where the stand is found, which could create inconsistencies in project design. In the 1987 plan, quaking aspen was not separated out into its own PNVT because, on the Coconino NF, it most often occurs in small localized areas and is a component of several different PNVTs, such as Ponderosa Pine and Mixed Conifer types. MA 3 provides guidance to manage the approximately 12,100 acres identified as the pine-aspen capability area for aspen, on a regulated, sustained-yield basis to maintain aspen as a component of the forest. MA 5 (Aspen) emphasizes a combination of wildlife habitat, visual quality, firewood production, watershed condition, and dispersed recreation with other resources and uses managed to be compatible. MA 4 includes an objective for converting approximately 254 acres per decade to aspen.

Alternative A identifies aspen/conifer lands to be managed for aspen to include all stands having a minimum of 25 percent of the total stems (greater than 5 inches d.b.h.), and which are suitable for aspen regeneration. Stands having less than 25 percent of total stems (greater than 5 inches d.b.h.) in aspen would be evaluated through the environmental analysis process to determine management objectives and direction. Therefore, decisions on what areas are managed for aspen regeneration would depend on the interdisciplinary team's professional judgment when less than 25 percent of total stems are aspen, which is increasingly the case. On aspen/conifer lands determined to be managed as ponderosa pine or mixed conifer through environmental analysis, existing aspen stems may be cut. This does not address the threat of the decreasing aspen component in this PNVT very well, because it allows for removal of aspen that, given its current decline, would be outdated direction.

Alternative A does provide for protection of aspen from excessive wildlife and livestock herbivory by requiring that treated areas be appropriately protected to prevent browsing of new sprouts. Elk fencing and jack straw treatments are typically means of meeting this direction.

Alternative B

Alternative B would better support aspen recruitment acres in PNVTs where aspen occurs than alternative A. The treatment objective would be more effective because it can be applied anywhere on the landscape, not just in a particular management area or PNVT.

Alternative B is expected to have a slightly more positive affect on level of departure from desired conditions for aspen than alternative A. On the Coconino NF, aspen most often occurs in small localized areas and within several different PNVTs, but it was not included in the vegetation models because it occurs at too small of a scale for the models (USDA Forest Service 2009). Alternative B's objective to restore natural processes, such as fire, to the landscape and implementation and maintenance of 1,000 acres of aspen and maple every 10 years would slow down the trend and rate of departure. Plan components under alternative B focus on restoration of natural processes to achieve desired conditions. Desired conditions are incorporated that reflect the composition, structure, and natural disturbance attributes of different ecosystems and are integrated across different resource areas.

Alternative B does not specifically require protection of aspen. However, because the desired conditions are to promote and maintain aspen across the landscape, alternative B would require

protection barriers in most locations to achieve given current ungulate populations and grazing practices.

Alternatives C and D

Effects of alternatives C and D are expected to be the same as alternative B for level of departure from desired (reference) conditions.

Maple

Common to All Alternatives

The white/fir big tooth maple vegetation community within the Mogollon Rim Botanical Area is maintained in the same way under all alternatives (see the "Special Areas" section for more information on botanical area management).

Alternative A

Alternative A would manage big tooth maple areas in Management Areas 3 and 19 so that the coniferous overstory that provides shading for existing and regenerated maple areas would have basal areas of at least 120 square feet per acre in10- to 16-inch overstory trees. It would also manage for 280 snags greater than 12 inches d.b.h. and greater than 15 feet high per 100 acres, and it would stipulate that snags are to be randomly dispersed. This direction is more specific than alternatives B, C, and D, but may actually prevent maple regeneration. The Forest Service found that historic logging removed much overstory of ponderosa pine and Douglas-fir; these activities resulted in a more open canopy that accelerated the growth and development of big tooth maple without retarding conifer establishment (Moir and Ludwig 1979). Thus, direction to maintain 120 square feet of basal area per acre under alternative A could inhibit growth and establishment of big tooth maple.

Alternative A has no objectives for maple regeneration, so it would always occur as a byproduct of other treatments. This would not result in as much maple regeneration as alternatives B, C, and D.

Alternatives B, C, and D

The desired condition for big tooth maple under alternatives B, C, and D states, "Where they naturally occur, all age classes of aspen and maple are present in groups or patches and are regenerating and vigorous." Alternatives B, C, and D include plan objectives to achieve 1,000 acres of aspen and maple restoration within 10 years of plan approval, which would promote the health and sustainability of these important components of wildlife habitat. These alternatives also have more strategic desired conditions for this tree by promoting multiple age classes and healthy vigorous populations; while, alternative A is more tactical and discusses the coniferous overstory that provides shade for existing and regenerated maple. As a result, alternatives B, C, and D better support maple stands outside of the botanical area.

Gambel Oak

Common to All Alternatives

All alternatives recognize Gambel oak as important to wildlife with all ages and sustained sprouts, acorns, and cavities. Oak is emphasized as a critical component for Mexican spotted owls, and all alternatives would follow approved recovery plans. This direction would provide for

maintenance and recruitment of large oak within the Ponderosa Pine PNVT, where conditions are suitable for oak to grow. It would also ensure the presence of younger age classes of oak to support replacement of large oak over the long term and a diversity of age classes of oak.

Alternative A

Direction for management of Gambel oak under alternative A is to improve wildlife habitat; provide firewood, with silvicultural prescriptions developed to provide a balance of age classes within a 10,000-acre block; and provide a sustained yield of sprouts, mast, cavities, and foliage volume. There are two oak prescriptions: (1) nonindustrial wood or when oak comprises 50 percent or more of the stand's basal area per acre (unsuitable timberlands) and (2) oak in association with suitable timber ponderosa pine stands.

Under alternative A, the management emphasis is heavily weighted on firewood when Gambel oak occurs outside of suitable ponderosa pine stands. When associated with suitable pine, emphasis is placed on wildlife habitat. Shelterwood harvesting (even-aged system) is prescribed for both suitable and unsuitable timberlands under this alternative. Within unsuitable timberlands, harvesting of excess Gambel oak overstory is encouraged once regeneration is established and certified, provided that at least 10 seed trees per acre are left standing to die of natural causes. Within suitable pine stands managed for wildlife habitat, larger oaks may be harvested as long as the Gambel oak component less than 5 inches d.b.h. does not fall below 20 percent of the total stand basal area per acre (square feet).

Alternative A would provide for retention of fewer large oaks per acre than alternatives B, C, and D, and promote less structural diversity. This is because age class distribution would be provided more at the landscape level (10,000-acre block) than at the stand level. Creation and maintenance of desired conditions would also be almost equally reliant upon mechanical treatments as natural processes, such as fire.

Alternatives B, C, and D

Alternatives B, C, and D have desired conditions and more emphasis on larger oak and the functional importance of oak in the ecosystem for wildlife and for fire and vegetation conditions than alternative A. The desired conditions state, "In the Gambel oak subtype, all sizes and ages of oak trees are present, and large oak snags (greater than 10 inches) are a well-distributed component. The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and climate variability." As a result, these alternatives are more comprehensive than alternative A.

Alternatives B, C, and D would have more prescribed fire and thinning in the Ponderosa Pine-Gambel Oak community than alternative A, which would result in maintenance of the larger oak component. Using data from two northern Arizona pine-oak sites, Abella and Fulé (2008a) found that survival of oaks greater than 6 inches (15 centimeters) in diameter exceeded 66 percent at both sites after fall or spring prescribed burning, while survival was low (11 to 20 percent) for small stems less than 2 inches (5 centimeters) in diameter. These data support the findings of Fulé et al. (2005) that large oaks can be maintained during burns and are consistent with oak's persistence in frequent-fire pre-settlement forests. Onkonburi (1999) found that ponderosa pine thinning resulted in the largest increase in oak diameter growth compared to oak thinning or prescribed burning. In an ecological restoration experiment near the south rim of the Grand Canyon, oak diameter growth also tended to be greater in areas where pine had been thinned

relative to burn-only and control treatments (Fulé et al. 2005). Therefore, it is expected that the increased thinning and burning objectives under these alternatives would not only promote more oak sprouting, but also greater retention of larger oaks than alternative A.

Alligator Juniper

Alternative A

Alternative A would retain large alligator juniper in Ponderosa Pine-Mixed Conifer on Less Than 40 Percent Slopes (MA 3). However, alligator juniper occurs across a much broader area than just this PNVT, and it is generally found in high elevation transition zones between piñon-juniper and pine vegetation types. An alligator juniper of 8 inches d.b.h. may be 30 or 170 years old. Chojnacky (1997) found that in New Mexico, the average age at this diameter was approximately 108 years. As a result, the protection of trees over 12 inches d.b.h. may have left many stands of this species densely vegetated and prevented them from being thinned adequately unless the stand is more than 50 percent alligator juniper, and it is not always clear how old the trees being retained are. This also promotes even-aged structure and denser canopy conditions which would increase the risk of uncharacteristic fire in these stands and would lead to increased mortality of older trees from fire.

Alternatives B, C, and D

Alternatives B, C, and D would not explicitly discuss the management of alligator juniper but instead have desired conditions to retain a diversity of tree species in various PNVTs where alligator juniper occurs. This would encourage a wider variety of age classes of alligator juniper, which provides for a more stable population over time. This would benefit species that prefer alligator juniper with a variable structure. Depending on the condition of the stand as a whole, this direction may also decrease the risk of uncharacteristic fire damaging older alligator juniper.

Blue Spruce

Common to All Alternatives

Alternative A states the following direction, “Prescriptions will preserve existing stands.” Alternatives B, C, and D do not explicitly discuss the management of blue spruce, but instead have desired conditions to retain a diversity of tree species in various PNVTs where blue spruce occurs. Both of these approaches would provide for preservation of blue spruce where it occurs, because they are often found in steep drainages that are cool and wet and so the microclimate and topography limit mechanical treatment opportunities.

Grassland Vegetation Types

Great Basin Grassland

Common to All Alternatives

The fire return interval for all alternatives is predicted to trend away from desired conditions due to the lack of fire treatment objectives. Historically, fire would have maintained more open conditions in this grassland especially in suitable soils and areas adjacent to fire-adapted PNVTs where fire would have spread into adjoining grassland. Lack of fire would facilitate increased tree and shrub cover and decreased proportion of the area in grassland state.

Alternative A

This alternative does not distinguish between different grassland types on the forest which differ based on elevation, soil, and species composition. Much of the direction for grasslands is outdated.

Other than the suppression objectives, management direction in alternative A would not hinder actions that would move toward desired conditions, and the suppression objectives can vary, depending on conditions and resources at risk. Plan direction would provide suitable guidance in terms of general desired conditions, but it would remain silent on composition, structure, and function. This PNVT is within 16 different management areas under the 1987 plan, but 85 percent is included within only three management areas: Piñon-Juniper Woodland Less Than 40 Percent Slope (MA 7), Grassland and Sparse Piñon-Juniper Above the Mogollon Rim (MA 10), and Deadman Wash (MA 32). Prevailing direction in the 1987 plan would allow for using prescribed fire and wildfires with resource objectives, except there is no provision that would allow the use of wildfire with resource objectives in the wildland-urban interface. It would also maintain and improve grasslands in the Deadman Wash Management Area by including removing encroaching piñon-juniper and reintroducing fire. The suppression objective would be 10 acres or less in areas mapped as the wildland-urban interface. In areas outside the wildland-urban interface, the suppression objective would be to hold fire on 1,000 acres or less.

Management at current levels under alternative A, however, would tend to increase tree cover, both young and old, and would move Great Basin Grassland away from desired conditions. Vegetative structure (as it relates to fire) and fire severity are also predicted to trend away from desired conditions. This PNVT is currently at low departure and is trending away from desired conditions. Continued encroachment of trees and shrubs and a corresponding decline in herbaceous species could affect fire's natural role in this PNVT. Departure is expected to remain low over the first 15 years and move into moderate after 50 years. Historically, this PNVT consisted mostly of grasses with interspersed shrubs and areas of encroaching piñon and juniper trees (USDA Forest Service 2009). Desired conditions for Great Basin Grassland included approximately 5 percent of the PNVT in the mid-development closed-canopy state, which consisted of some very large shrubs with closed canopy and some very large trees with open canopy. This state is currently estimated to be almost four times greater than desired. Although Great Basin Grassland is currently in low (10 percent) departure, about 84 percent of this PNVT is in moderate or high FRCC departure. Fire departure for this PNVT would, therefore, likely move from low to high with a trend away from desired conditions.

Alternative B

Alternative B is expected to move closer to desired conditions than alternative A, because of its objective to treat between 1,080 and 1,240 acres per year. This is despite additional recommended wilderness acres. Modeling suggests that these treatments would stop the trend of increasing shrub and tree encroachment, fewer trees and shrubs would become established, and the PNVT would remain similar to reference conditions. Fire exclusion within and adjacent to this PNVT has contributed to departure because it has created conditions that encourage tree encroachment. Vegetation, as it relates to fire and fire severity, would remain static and departures are not expected to change. Due to the lack of prescribed fire objectives, the fire return interval for this PNVT would trend away from its characteristic fire regime, contributing to continued tree encroachment.

Recommended wilderness in alternative B would have little effect on the risk of uncharacteristic fire in Great Basin Grassland PNVT. The effects would be in the Strawberry Crater recommended wilderness. As described in alternative B under Ponderosa Pine, wildfires in about 2,327 of these acres (about 2 percent of the PNVT) would have a low likelihood of being suppressed. Wildfires on these acres would likely be managed to meet resource objectives, if possible. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire return interval in this localized area.

Alternatives B, C, and D

Alternatives B, C, and D distinguish between grassland types on the forest and provide updated desired conditions that are tiered to the differing conditions of the respective grasslands.

Alternatives C and D

Effects of alternatives C are expected to be the same as alternative B. Effects of alternative D are expected to be the same as alternative B except for wilderness.

Semidesert Grassland

Common to All Alternatives

The fire return interval for all alternatives is predicted to trend away from desired conditions due to the lack of fire treatment objectives. Historically, fire would have maintained more open conditions in this grassland especially in suitable soils and areas adjacent to fire-adapted PNVTs where fire would have spread into adjoining grassland. Lack of fire would facilitate increased tree and shrub cover and decreased the proportion of the area dominated by grasses and forbs.

Alternative A

This alternative does not distinguish between different grassland types on the forest which differ based on elevation, soil, and species composition. Much of the direction for grasslands is outdated.

Because of the lack of ecological desired conditions for this PNVT in alternative A, management activities would be more prone to overlook vegetative needs, further hindering progress toward desired conditions. This PNVT is within 17 different management areas under the 1987 plan, but 88 percent is included within Grassland and Sparse Piñon-Juniper above the Mogollon Rim (MA 10), Verde Valley (MA 11), and Savannah (MA 27). The direction in the 1987 plan for prescribed fire, wildfires with resource objectives, and suppression objectives is the same as those listed for Great Basin Grassland, except MA 27 specifies that: low-intensity fire is acceptable unless life and property are threatened, low-intensity prescribed burns are desired, and invading vegetation is to be eliminated, as needed, through mechanical and prescribed fire treatments where piñon-juniper woodland is maintained in a grassland condition. Beyond using prescribed fires and wildfires to accomplish resource objectives, the 1987 plan provides little to no direction in terms of vegetative desired conditions for Semidesert Grassland.

Under alternative A, vegetation in Semidesert Grassland PNVT is expected to remain highly departed with a static trend. Vegetative structure (as it relates to fire) and fire severity are not expected to change over the life of the plan. This is a result of changes in vegetative conditions resulting from fire exclusion and impacts from unmanaged recreation, including the introduction and spread of invasive weeds. Under alternative A, management is not expected to increase

substantially over current levels. Continued management at historic levels could lead to an irreversible shift toward shrubs and trees in about 30 percent of this PNVT (USDA Forest Service 2009) and a shift toward more severe fires.

Alternative B

Alternative B would provide clearer direction in terms of treatment objectives and desired conditions, allowing for a greater ability to reduce PNVT departure and move toward desired conditions than alternative A. This alternative includes an objective to mechanically restore or enhance 3,500 acres of Semidesert Grassland during every 10-year period during the life of the plan.

Proposed management under alternative B would not be expected to create a dramatic change over current levels, but the high departure would be reduced and reset to a more favorable trend. Alternative B includes an objective to restore or enhance 3,500 acres of Semidesert Grassland during every 10-year period for the life of the plan. The slight increase in management over historic levels could be enough to impede a possible irreversible shift toward shrubs and trees in about 30 percent of this PNVT. Under alternative B, this PNVT would be expected to remain highly departed, but vegetative conditions should begin trending slightly toward desired conditions, moving from 100 percent current departure to 85 percent estimated departure after 50 years. Given the lack of plan objectives for fire treatment in this PNVT, the fire return interval would be the same as alternative A: high departure that trends away from desired conditions.

Recommended wilderness in alternative B would have varying effects to risk of uncharacteristic fire in Semidesert Grassland PNVT. The effects would be in scattered localized areas. As described in alternative B under Ponderosa Pine, wildfires in about 506 of these acres (about 0.6 percent of the PNVT) would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility and few vegetative treatments due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, high departure, closed canopy conditions); and threatened values outside the wilderness. These acres occur within Walker Mountain recommended wilderness. Consequently, there would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring the natural fire interval.

There would be little impact to the remaining Semidesert Grassland PNVT acres from wilderness recommendation. There are 132 acres (about 0.1 percent of the PNVT) within Davey's recommended wilderness. Wildfires on these acres would likely be managed to meet resource objectives if possible and would have a low likelihood of being suppressed. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire return interval in this localized area.

Alternatives B, C, and D

Alternatives B, C, and D distinguish between grassland types on the forest and provide updated desired conditions that are tiered to the differing conditions of the respective grasslands.

Alternative C

Effects to departure and trend are the same as alternative B except as noted below.

Under alternative C, portions of this PNVT would be unlikely to have mechanical vegetation treatments to prevent tree encroachment because about 12,000 acres (11 percent of this PNVT) is recommended as wilderness. Given the high level of departure in this PNVT and the plan objective of 3,500 acres of mechanical treatment every 10 years, there would be localized areas where departure would remain high due to lack of treatment. These localized areas would be scattered in seven different recommended wilderness areas. This is not expected to result in a different trend at the PNVT level compared to alternatives B and D. This is because there would be nearly 77,500 acres outside of wilderness and there should be no shortage of areas to treat; thus, wilderness designation would not be a limiting factor at this treatment rate for over 5 decades. Like alternative B, vegetative structure (as it relates to fire) and fire severity would likely continue trending toward desired conditions.

Recommended wilderness in alternative C would have varying effects to risk of uncharacteristic fire in Semidesert Grassland PNVT. The effects would be in scattered localized areas. As described in alternative B under Ponderosa Pine, wildfires in about 5,687 of these acres (about 6.3 percent of the PNVT) would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility for vegetation treatments and fire management due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, high departure, closed canopy conditions); and threatened values outside the wilderness. These acres occur within Black Mountain, Cedar Bench, Walker Mountain, and Deadwood Draw recommended wilderness areas. Consequently, there would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring the natural fire interval.

There would be little impact to the remaining Semidesert Grassland PNVT acres from wilderness recommendation. There are 6,499 acres (about 7 percent of the PNVT) within Davey's, Cimmaron-Boulder, and Hackberry recommended wilderness areas. Wildfires on these acres would likely be managed to meet resource objectives, if possible, and would have a low likelihood of being suppressed. Consequently, there would be a lower risk of uncharacteristic fire and uncharacteristic fire severity along with an increased likelihood of restoring the natural fire return interval in this localized area. However, because of limited access, it is likely that little management has occurred in these areas so pretreatment would likely be needed before fire could be used with minimal negative effects. If these areas become wilderness, pretreatment options would be minimized to the point that an increase in tree density and canopy cover would likely continue in these acres.

Alternative D

Effects from alternative D are expected to be the same as alternative B, except no wilderness is recommended in alternative D.

Montane Subalpine Grassland

Common to All Alternatives

The fire return interval for all alternatives is predicted to trend away from desired conditions due to the lack of fire treatment objectives. Historically, fire would have maintained more open conditions in this grassland especially in suitable soils and areas adjacent to fire-adapted PNVTs where fire would have spread into adjoining grassland. Lack of fire would facilitate increased tree and shrub cover and decreased proportion of the area dominated by grasses and forbs.

Alternative A

This alternative does not distinguish between different grassland types on the forest which differ based on elevation, soil, and species composition. Much of the direction for grasslands is outdated.

Beyond the guideline to reintroduce fire's natural role, alternative A would provide little to no direction on desired conditions for this PNVT and, therefore, lacks guidance or direction that would lead to better ecosystem health. This lack of desired conditions could result in decreased attention to any further departures from desired conditions. This PNVT would fall within 18 different management areas under alternative A, the majority (54 percent) of which is included in Ponderosa Pine Mixed Conifer Less Than 40 Percent Slope (MA 3) and Mountain Grassland (MA 9). Management Areas 10 and 35 account for another 21 percent. With the exception of the Lake Mary Watershed (MA 35) protection objectives, these management areas stipulate that fires are suppressed at 100 acres or less, wildfires with resource objectives are not used as a management tool in the wildland-urban interface, and annual average wildfire acreage burned should not exceed 750 acres per year over a 10-year period. These fire management restrictions are designed to protect ponderosa pine suitable timberlands, but they would inhibit restoration of this PNVT.

Under alternative A, Montane/Subalpine Grassland is expected to remain at low departure with a trend away from desired conditions. Vegetation structure (as it relates to fire) and fire severity would also trend away. Management at current levels could lead to continued tree encroachment, loss of open conditions, and a reduction in conditions dominated by grasses and forbs.

Alternative B

Alternative B better describes desired conditions for Montane Subalpine Grassland than alternative A. Alternative B is expected to move toward desired conditions because of its objective to treat between 760 and 1,140 acres per year. Treatments would focus on removal of encroaching conifers and reintroduction of fire. Desired conditions for alternative B state, "the composition, structure, and distribution of native vegetation reflect a mix of early-, mid-, and late-seral stages. Early seral stages would typically contain more forbs and, as stages get older, they are dominated by more grasses and fewer forbs. Vegetation height, density, and cover support the historic fire return interval, where fire played a role, while providing food and cover for wildlife species, including pronghorn. Historic fire is thought to be low-intensity fire with a 1- to 35-year fire return interval and is generally dependent on the fire regime in adjoining vegetation types. Tree and shrub cover are each less than 10 percent. There are inclusions and variability within the landscape as well as ecotones on the fringes. There is regeneration, seed head production, and balance of grasses and forb species, including warm and cool season species in most years and within the capability of soil type." As a result of treatment objectives, this alternative would move this PNVT closer to desired conditions than alternative A, which has very little guidance for projects in providing for the structural, compositional, or functional ecology of this vegetation types.

The projected future trend for vegetation is toward desired conditions because of treatment objectives that reduce encroaching conifers and reintroduce fire. Vegetative structure (as it relates to fire) and fire severity are projected to move toward desired conditions as well. Under alternative B, this PNVT would be expected to remain at low departure with a positive trend, going from 32 percent departure to less than 5 percent after 50 years.

Alternatives B, C, and D

Alternatives B, C, and D distinguish between grassland types on the forest and provide updated desired conditions that are tiered to the differing conditions of the respective grasslands.

Alternatives C and D

Implementation of alternatives C and D is expected to be the same as alternative B. There are 6 acres of this PNVT in the Railroad Draw recommended wilderness in alternative C. There are no impacts from wilderness recommendation due to this small extent.

Other Vegetation Types

Desert Communities

Alternative A

Because of the lack of ecological desired conditions for Desert Communities in alternative A, management activities would be more prone to overlook vegetative needs, further hindering progress toward desired conditions. Beyond using prescribed fire and wildfire to accomplish resource objectives, the 1987 plan provides little to no direction on desired conditions for this PNVT, which would limit the plan's ability to direct progress toward desired conditions. This PNVT is within 10 different management areas under the 1987 plan, but 87 percent is included within the Verde Valley Management Area (MA 11). However, there is no specific direction for other types of treatment beyond fire suppression objectives within the Verde Valley Management Area, and fire is not a key ecological process.

Desert Communities are currently highly departed with an unknown trend toward desired conditions. Under alternative A, management would not be expected to increase substantially over current levels. Sustained management at historic levels could lead to a continued increase in cover, altered vegetative structure and composition, and fires burning at a severity, frequency, or scale outside the historic range of variability (USDA Forest Service 2009). Additionally, increased or sustained recreation in this PNVT could also influence vegetative conditions due to ground disturbance and the spread of exotic, invasive weeds. Under alternative A, this PNVT is expected to remain highly departed with a probable trend away from desired conditions.

Alternative B

Although alternative B would be expected to have the same effects on Desert Communities as alternative A based on the lack of plan objectives, alternative B would provide clearer direction in terms of desired conditions, allowing for a greater potential to reduce PNVT departure and move toward desired conditions. Desert Communities are currently highly departed with an unknown trend. Alternative B provides for desired conditions that specify, "predominant plant species are native shrubs, forbs, and grasses in various age classes." Under alternative B, management is not expected to increase substantially over current levels, but the high vegetative departure should also make this PNVT a higher consideration for management depending on available resources. Sustained management at historic levels could lead to a continued increase in cover, altered vegetative structure and composition, and fires burning at a severity, frequency, or scale outside historic range of variability (USDA Forest Service 2009). A guideline to avoid excessive ground disturbance would limit accelerated erosion and would minimize bringing more calcareous soil to the surface. Bringing calcareous soil to the surface would limit soil plant nutrient availability.

Under alternative B and assumptions that there would be little active vegetation management, this PNVT would be expected to remain highly departed with a probable trend away from desired conditions.

There is no Desert Communities in recommended wilderness in alternative B.

Alternatives C and D

Effects from alternatives C and D are expected to be the same as alternative B.

There are 1,016 acres of Desert Communities (1 percent of the PNVT) distributed in 5 recommended wilderness areas in alternative C: Cimarron Boulder, Hackberry, Black Mountain, Cedar Bench, and Deadwood Draw. Limited access associated with wilderness could make it more difficult to suppress wildfires and to treat invasive annual grasses, which can spread fire and shorten fire return intervals if they become widespread. This could increase the risk of uncharacteristic fires in scattered localized areas more so than the other alternatives.

Interior Chaparral

Common to All Alternatives

The fire return interval for all alternatives is predicted to trend away from desired conditions because all alternatives lack fire treatment objectives. Historically, fire would have maintained more open conditions in some areas and a higher proportion of early seral stages. Lack of fire treatments would facilitate increased tree and shrub cover and decreased the proportion of the area dominated by grasses and forbs.

Alternative A

In contrast to the other alternatives, alternative A lacks desired conditions specific to this PNVT.

Beyond using prescribed fire and wildfire with resource objectives, the 1987 plan provides little to no direction on desired conditions for this PNVT and may hinder the plan's ability to direct progress toward desired conditions. This PNVT is within 19 different management areas under the 1987 plan, but 76 percent is included within wilderness. Four other management areas make up the majority of the remaining area: Verde Valley (MA 11), Oak Creek Canyon (MA 14), Neighborwoods (MA 24), and Redrock Frontcountry (MA 26). Management direction in the 1987 plan for Oak Creek Canyon, Neighborwoods, and Redrock Frontcountry provide only scenery and recreation objections. The Verde Valley Management Area, however, includes suppression objectives to minimize cost and provide for personnel safety except where suppression objective is 10 acres or less in areas mapped as the urban interface. In areas outside the wildland-urban interface, the suppression objective is to hold fires to 1,000 acres or less. In addition, prescribed fire and wildfire with resource objectives in this management area can be used for treatments, except there would be no provision for the use of wildfire to meet resource objectives in the wildland-urban interface. There is also no provision to use prescribed fire and mechanical methods to achieve fire management goals. Active management may occur on only approximately 5,500 acres or 11 percent of the entire PNVT.

Interior Chaparral is currently at a low level of vegetative and fire departure with a static trend toward desired conditions. Management under alternative A could lead to decline in vegetative structure and fire severity and away from desired conditions.

In the wildland-urban interface of Interior Chaparral, risk of fire to lives and property is great even when the conditions of this PNVT approach desired conditions. There are no desired vegetative conditions for wildland-urban interface in alternative A that provide for health and safety. In Oak Creek Canyon Management Area, where most of the wildland-urban interface in this PNVT is located, the suppression objective is 10 acres and a guideline to "use prescribed fire and mechanical methods to achieve fire management goals." However, it never specifies these goals. This nonspecific direction is inadequate to balance the ecological and social issues necessary to manage for fire and vegetation desired conditions in wildland-urban interface areas within this PNVT.

Alternative B

Alternative B describes desired conditions for this PNVT better than alternative A and provides for the structural, compositional, and functional ecology of the PNVT. There are no plan level treatment objectives. Any management activities that would occur in this PNVT beyond the levels assumed for this analysis, however, would be assumed to make more progress toward the stated desired conditions than alternative A. Alternative B for Interior Chaparral articulates ecological desired conditions including, "During early stages of succession, Interior Chaparral contains a grass and forb component in the understory. The middle to late development stages are dense, nearly impenetrable thickets with considerable (about 35 to 45 percent of soil surface) shrub litter (e.g., small stems, leaves). Standing dead material may accumulate in areas that have not burned for several decades. Greater than 70 percent of chaparral is middle to late development closed canopy with some openings of grasses and forbs. Canopy ranges from 40 percent at dry sites to 80 percent at wetter sites. Interior Chaparral is in a constant state of transition from young to older stages and back again, with fire being the major disturbance factor. Natural high-severity fires (75+ percent mortality or top kill) occur once every 35 to 100 years. Long fire return intervals allow for reestablishment of seed bank and development of fuel loads and spatial continuity of fuels necessary for fire." As a result, this alternative would move this PNVT closer to desired conditions than alternative A, which provides very little plan guidance regarding the desired structural, compositional, or functional ecology of this PNVT.

Over the life of plan and assuming no treatments, this PNVT would remain at low departure and trend away from desired conditions, and by 50 years, it is projected to be moderately departed. Vegetative structure (as it relates to fire) and fire severity would trend the same way. This would result in a higher proportion of the area in older-aged closed canopy condition than desired.

There are 9,699 acres (about 20 percent of the PNVT) in wildland-urban interface. This PNVT naturally has high flammability and rates of fire spread, making it difficult to control and increasing safety risk to residents and firefighters. Residents in this area need conditions that provide adequate evacuation time in the case of a wildfire. Under alternative B, the mid-scale desired condition for Interior Chaparral is to have less dense and younger age classes within WUI than other portions of the PNVT.

Mid-scale desired conditions also provide for the high scenic integrity that overlaps the Oak Creek Canyon, one of the most popular recreational areas on the forest. Alternative B's plan direction better supports the tradeoffs necessary for managing this PNVT to balance ecological and social desired conditions than alternative A.

Recommended wilderness in alternative B would have varying effects to risk of uncharacteristic fire in Interior Chaparral PNVT. The effects would be in 1,707 acres (3 percent of the PNVT) in

Walker Mountain recommended wilderness. As described in alternative B under Ponderosa Pine, wildfires would have a moderate to very high likelihood of being suppressed. This is due to a combination of management limitations including: limited accessibility and few vegetative treatments due to wilderness recommendation; vegetative characteristics within the wilderness (e.g., continuous fuels, vegetative trend); and threatened values outside the wilderness. Consequently, there would be localized increased risk of uncharacteristic fire and higher than desired fire severity, along with decreased likelihood of restoring the natural fire interval.

Alternatives C and D

Implementation of alternatives C and D is expected to be the same as alternative B in terms of plan direction.

Alpine Tundra

Common to All Alternatives

Other than protection, there would be little to no management direction for this PNVT that would cause effects to vary by alternative, because all of the threats within Forest Service control have been addressed by current management. Off-trail hiking is prohibited in the Kachina Peaks Wilderness above tree line, and the area has been reserved from grazing for over a decade. None of the alternatives would vary in effects for the 40 acres of this PNVT within the Snowbowl Ski Area, because none would lead to changes in the operating permit for the site. Alpine Tundra is currently at a low level of departure and is trending away from desired conditions. The most significant threat to this PNVT is increases in temperature due to climate change and, as a result, the departure could rise from low to moderate and the trend would continue moving away (see "Climate Change" section).

Alternatives B, C, and D better described desired structure, composition, and function of this PNVT. However, given its low disturbance under wilderness management, this is unlikely to result in differences in effects among alternatives.

Cumulative Effects

Summary

The rate of implementing changes in Forest Service fire and vegetation management and similar shifts in methods on other Federal lands have been slowly increasing since 1996, and they have begun to shift the static trend of previous years toward desired conditions. The majority of land management agencies with lands adjacent to or near the forest are also shifting their management toward restoring ecological structure and function to which the Coconino NF plan alternatives B, C, and D would contribute. Alternatives B, C, and D propose to restore (using mechanical and fire treatments) more acres than alternative A, moving the Ponderosa Pine, Mixed Conifer with Frequent Fire, Piñon-Juniper with Grass, Great Basin Grassland, and Semidesert Grassland PNVTs closer toward desired conditions and decreasing their departure from desired conditions. Alternative A would not contribute as much to this trend because of its timber commodity focus, lack of information on non-forested vegetation types, lower objectives for treatment, and restrictions on the use of fire in its natural role. Alternative A has the northern goshawk guidelines which would contribute to uneven-aged and open structure, but the rate of implementation would not been sufficient to make landscape scale changes.

Spatial Boundary Considered for Cumulative Effects

The cumulative effects temporal boundary for the vegetation and fire analysis was considered to be the next 10 to 15 years, and the spatial boundary was considered to be the Bailey's ecological sections that surround or are overlapped by the Coconino NF (figure 4) and are located within the State of Arizona. Sections describe broad areas of similar subregional climate, geologic origin, composition, and development; local topography; and drainage networks. Figure 4 shows the majority of the forest (71 percent) in the White Mountains–San Francisco Peaks–Mogollon Rim Section, a lesser proportion in the Tonto Transition Section (26 percent), and the least amount in the Painted Desert Section (3 percent). Remaining lands within the sections are owned or managed by other national forests, the State of Arizona, Bureau of Land Management, National Park Service, Department of Defense, several tribes, and numerous private entities (USDA Forest Service 2009).

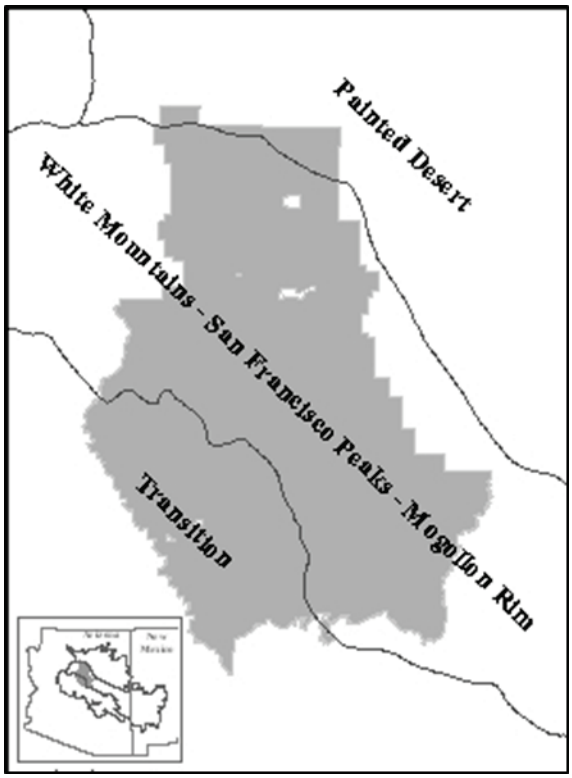

Figure 4. Coconino National Forest in the context of Bailey's Ecological Sections

Table 36 shows the proportion of the ecoregional sections that the Coconino NF overlaps. The ecological niche of the Coconino NF is most prominent in the White Mountains–San Francisco Peaks–Mogollon Rim Section where the contribution toward ecological sustainability is measured as nearly 10 percent of the entire section. Within the portions of the sections that lie within Arizona, the Coconino NF makes up between approximately 0.7 percent in the Painted Desert Section to 20 percent in the White Mountains–San Francisco Peaks–Mogollon Rim Section. This means that the conditions of PNVTs on the Coconino NF would contribute most toward the ecological communities and processes that represent the White Mountain–San Francisco Peaks–Mogollon Rim Section and secondarily providing sustainable conditions for the ecosystems

within the Tonto Transition and Painted Desert Sections (USDA Forest Service 2009). For this cumulative effects analysis, however, the portions of these sections that fall within Arizona are considered as a whole.

Table 36. PNVT percentage on the forest and spatial contribution to Bailey's Ecological Sections

Bailey's Ecological Section	Total Acres of Section	Portion within the Coconino NF		
		Acres	Percent of Section	Percent of Section in Arizona
Painted Desert	8,934,545	60,453	0.7%	0.7%
White Mountains–San Francisco Peaks–Mogollon Rim	13,471,798	1,305,813	9.7%	20.2%
Tonto Transition	7,559,438	471,225	6.2%	6.2%

Activities on Lands of Other Ownership

Activities on lands of other ownership within these sections also contribute to the condition of ecological communities and processes. Table 37 includes information considered in this cumulative effects analysis about the management of lands of other ownership, specifically activities that are likely to occur over the next 10 years.

Table 37. Management plans for other lands considered in cumulative effects for vegetation and fire

Project	Description and Relevant Effects	Effects Timeframe	Relevant Measure(s)
Arizona Forest Resource Strategy (2010)	Restoring declining ecosystems and protecting healthy ones to ensure the Nation's lands are resilient to threats and impacts, including climate change.	Current	Amount of declining ecosystems restored. Amount of healthy ecosystems protected.
Coconino County Comprehensive Plan (2003)	The Coconino County Comprehensive Plan includes the following goals: Improve forest health and promote the restoration of forest ecosystems. Conserve plant communities and improve the health of vegetative ecosystems. Conserve and enhance the natural qualities of environmentally sensitive lands.	Current and under revision	Amount of forested ecosystems restored.
Yavapai County Comprehensive Plan (2003)	These principles are intended to support desired characteristics of community and rural living throughout Yavapai County in accord with the natural environment. Promote planned development approaches that preserve open space. Prevent breaking up rural areas characterized by farms, ranches, areas of natural habitats, and wildlife corridors. Maintain open space between communities, including coordinating with land agencies (i.e., State Land Department, Forest Service, BLM).	Current and under revision	Amount of open space preserved in Tonto Transition.
Navajo County Comprehensive Plan (2004)	Goal 8: Reduce the danger from fire for all residents living in a wildland-urban interface or near a national forest boundary. Encourage developers and owners to incorporate fire safe development standards including defensible spaces and construction materials. Encourage adoption of the Urban Wildland Interface Code (2000 Edition), which addresses creation of defensible spaces, by local fire districts. Discourage high-density development in areas where fire protection and other emergency services are not readily available. Encourage adoption of a community fire plan.	Current	Amount of threats to property and ecosystem health reduced in White Mountains–San Francisco Peaks–Mogollon Rim.

Project	Description and Relevant Effects	Effects Timeframe	Relevant Measure(s)
Camp Navajo (Department of Defense) Integrated Resource Management Plan	Forest treatments are planned to begin the process of moving toward restored forest conditions in terms of density, structure, fire intensity, and frequency. The Camp Navajo Integrated Resource Management Plan includes the following goals: Provide a diversity of forest conditions. Reintroduce fire to the ponderosa pine forest type at 3- to 7-year intervals.	Current	Amount of forested ecosystems restored in White Mountains–San Francisco Peaks–Mogollon Rim
Flagstaff Area Monuments (Wupatki, Sunset Crater Volcano, and Walnut Canyon National Monuments) General Management Plan (2007)	The "Centennial Strategy of the Flagstaff Area National Monuments" includes performance goals to: Restore native habitats by controlling invasive species and reintroducing key plant and animal species. Restore the most degraded vegetation types, improve habitats for the most at-risk species, and understand and mitigate impacts from accelerating climate change.	Current	Amount of native habitat and degraded vegetation restored. Amount of invasive species controlled. Amount of plant and animal species reintroduced. White Mountains–San Francisco Peaks–Mogollon Rim and Painted Desert
Adjacent National Forests – proposed revised plans	Guidance documents have been developed by the Southwestern Regional Office (R3) Revision Team to provide regional consistency for ongoing land management plan revisions. (The Apache-Sitgreaves, Coconino, Coronado, Kaibab, and Prescott National Forests are currently in plan revision under the 1982 Planning Rule provisions.) Local variation, specific to each planning effort is allowed, subject to consistency with best science and review by the revision team.	Current and under revision	Amount of threats to ecosystem health reduced. Amount of ecological function and resiliency restored.
Bureau of Land Management	Arizona strategic goals for sustainability include: • Water – Living rivers preserve and enhance healthy vegetation, wildlife, and growing communities. • Ecological Function – Enhanced ecological conditions support healthy plant and wildlife communities. • Working Landscapes –Best multiple-use management practices enhance resource values.	Current	Amount of ecological function and resiliency restored.

Project	Description and Relevant Effects	Effects Timeframe	Relevant Measure(s)
Native American Tribes – Integrated Resource Management Plans	Forest management plans appear in many forms, reflect many different approaches and vary tremendously in their content, depth, and coverage. This diversity is appropriate in so far as it is necessary to serve specific tribal goals, but makes monitoring and comparison of plans and their implementation more difficult (IFMAT 2003).	Current and under revision	Amount of threats to ecosystem health reduced. Amount of ecological function and resiliency restored.
Fish and Wildlife Service – Strategic Plan	The U.S. Fish and Wildlife Service's (USFWS) mission is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. USFWS recognizes that fish and wildlife conservation is based on not only intervention to protect individual species but also intervention to protect, enhance, or restore habitat upon which these species depend for survival.	Current (individual species recovery plans may be under revision)	Amount of habitat protected. Amount of habitat restored.

Vegetation Treatments on Adjacent Lands

Over 75 percent of the non-reservation land within Coconino County is managed by the Forest Service, National Park Service, Bureau of Land Management, and Arizona State Land Department. Other nearby Federal, State, and local jurisdictions share similar strategic goals with respect to fostering collaboration and ecosystem health, including promoting fire-adapted ecosystems, resiliency to climate change, and species habitat.

The first 10 years of the 1987 plan on the Coconino NF and surrounding national forests were driven much more by the production of forest products, and they were managed largely by using even-aged silvicultural methods, such as shelterwood and seed tree cuts. The legacy of this approach is reduced structural diversity and a general deficit of large and old trees. Other past management actions that are common on Department of the Interior and Forest Service land that are still contributing to effects today include fire suppression (over several decades) and the lack of thinning in the sapling, small, and medium diameter classes, giving rise to a surplus of trees that would likely continue to dominate untreated acres for several more decades.

From 2003 to 2011, the majority of acres treated by the Department of the Interior and Forest Service in Arizona were primarily density reduction treatments that focused on lowering fuel hazard and resulted in maintaining the landscape's even-aged structure, which does not contribute to moving the landscape toward desired conditions of open and uneven-aged structure (table 38). Past vegetation growth, trends, previous management and disturbance patterns, and annual weather patterns have contributed to the current vegetative composition, structure, densities, and conditions present today.

Table 38. Average annual fuels treatments by Department of Interior agencies and Forest Service within Arizona 2003 to 2011

Agency	WUI			Other – Outside WUI		
	Fire	Mechanical	Total	Fire	Mechanical	Total
Bureau of Indian Affairs	5,280	11,345	16,625	23,359	5,051	28,410
Bureau of Land Management	1,851	2,595	4,446	11,392	1,891	13,283
Fish and Wildlife Service	3,262	95	3,357	5,831	511	6,342
National Park Service	1,820	345	2,165	7,353	508	7,861
Forest Service	35,184	29,503	64,687	51,140	14,948	66,088
Total	**47,397**	**43,883**	**91,280**	**99,075**	**22,909**	**121,984**
Average Total Rx Fire Treatments per year (2003–2011)						**146,472**
Average Total Mechanical Treatments per year (2003–2011)						**66,792**
Total						**213,264**

Source Forests and Rangelands Web site: http://www.forestsandrangelands.gov/resources/reports/

Future vegetation management strategies across all other national forests within Arizona are expected to be quite similar to the actions proposed for the Coconino NF. Except for the Tonto National Forest, they all are revising their land management plans within 1 to 3 years of each other, using generally the same vegetation desired conditions for forest and woodland PNVTs, with uneven-aged silviculture, and returning fire and other natural disturbances to their natural roles as the primary action emphases. Vegetation treatment projects would be planned to restore or move toward desired conditions. Both prescribed fire and the use of wildfire with resource objectives are expected to continue as management strategies on the forest.

The National Park Service is making some progress toward restoring degraded and at-risk vegetation communities, but their plan language is less specific and doesn't give a good indication of how their future actions would affect vegetation structure and composition in relation to restoring reference conditions on lands that they manage.

Likewise, Coconino County has adopted a plan that supports ecological restoration of both fire and vegetative structure. Camp Navajo is also changing its management to be more consistent with adjacent national forests in managing their forested vegetation types. Forest conditions at Camp Navajo are highly departed from pre-settlement reference conditions in terms of forest density and structure, and the frequency and intensity of fire (Buttrey 2011). Forest treatments are planned, however, to begin the process of moving stands toward reference conditions.

State lands are making progress toward restoring grasslands PNVTs and Piñon-Juniper with Grass PNVT because it can be tied to their grazing operations, but their mandate to make a profit from their activities has limited their capacity to restore ecological conditions in Ponderosa Pine PNVT because of a lack of market for timber. However, over the past decade, the Arizona State Forestry Division has mechanically treated approximately 14,000 acres of ponderosa pine across the State (table 39). Northern Arizona University has also treated nearly 2,000 acres on State managed land within the Centennial Forest near Flagstaff. A majority of treatments occur in the wildland-urban interface and are considered hazardous fuel reduction, but over 2,300 acres have also been restored to reference conditions. If the Four Forest Restoration Initiative is successful, market conditions may change and lead to increased levels of forest restoration treatments on State timberlands.

Table 39. Fuels treatments by Arizona State Forestry Division, Arizona Game and Fish Department, and Northern Arizona University 2002 to 2012

Department/Division	Fire	Mechanical	Total
Arizona State Forestry Division	865	13,979	14,804
Arizona Game and Fish Department	1,973	37,066	39,039
Northern Arizona University	178	1,895	2,073

The Arizona Game and Fish Department has also made progress in restoring wildlife habitat conditions over the past decade, accomplishing over 37,000 acres of mechanical and prescribed burn treatments. Much of the work has been completed on Anderson Mesa, restoring savannah and grassland vegetation types.

Navajo and Yavapai Counties' plans are still primarily focused on fire protection and loss of open space and have not yet made the shift toward considering these issues as a part of the need to manage vegetation composition, structure, and function to move the landscape toward reference conditions (table 37). As a result, their plans would not contribute as much toward the trend of restoring ecological structure and function in vegetation types as the actions of Federal agencies, Coconino County, and Camp Navajo. The largest ecological restoration near future effort affecting the White Mountains–San Francisco Peaks–Mogollon Rim Section would be the Four Forests Restoration Initiative, which is currently being planned for at least 750,000 acres of NFS lands across northern Arizona. Treatments are expected to focus on ecosystem restoration, primarily in the ponderosa pine forest type. Management actions associated with many future projects covered under that large-scale NEPA analysis may be implemented for the duration of this 10- to 15-year planning cycle.

Invasive Species Treatments on Adjacent Lands

Treatment of invasive weeds under all plan alternatives would have a positive effect toward controlling invasive weeds in and around the forest. On average, the forest has been treating 2,000 acres of invasive weeds per year of the 10,000-acre annual goal stated in the "Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott National Forests" (Weeds FEIS) (USDA Forest Service 2005a). This would be a substantial contribution under all alternatives to the collaborative efforts in the San Francisco Peaks and Yavapai Weed Management Areas.

Within these areas, Arizona Department of Transportation is the next biggest contributor to invasive management. With assistance from the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, Arizona Department of Transportation has used biological controls along Interstate 17. Arizona Department of Transportation treats approximately 500 to 800 acres a year within the cumulative effects area along Interstates 17 and 40 and many U.S. highways with herbicide and mechanical treatment.

Within Coconino County, the city of Flagstaff, and Flagstaff Unified Public Schools, there are regular efforts to treat weeds on private land, in particular along county roads, the Rio de Flag, and Picture Canyon. On school campuses adjacent to NFS lands, there have also been treatments to manage invasive weeds. In the Yavapai Weed Management Area, treatments along the Verde River between the Prescott and Coconino National Forests and the cities of Clarkdale and Cottonwood have been coordinated through the Verde Valley Restoration Working Group.

The Bureau of Indian Affairs also treats for invasive weeds along highways and works with constituents to identify and map invasive weeds on rangelands adjacent to the forest. The National Park Service is working with adjacent landowners to treat tamarisk and other invasive species in accordance with their Centennial Plan. As a whole, these efforts represent a sizeable increase in weed treatment across the cumulative effects area and the plan alternatives contribute a sizeable percentage of acres treated because of the content of the Weeds FEIS.

Other Factors on Adjacent Lands

Other factors outside the control of the Coconino NF that affect the condition of PNVTs in and around the forest include development on private land and impacts from ungulate game species on vegetation, particularly aspen. Development of private land adjacent to the forest since 1990

has converted large portions of some vegetation types to urban or rural residential settings. Population growth in counties that overlap the forest have grown on average between 20 and 55 percent from 1990 to 2000 and between 15 and 26 percent from 2000 to 2010 (U.S. Census 1990, 2000, and 2010). Even with this population growth, these counties are still relatively low density, and so population growth has expanded the footprint of towns and cities outward.

In Coconino County, a large percentage of the Montane Subalpine Grassland PNVT has undergone a vegetation type conversion, and in Yavapai County, much of the development has been and is continuing to occur in the riparian forest types, Semidesert Grassland, and Desert Communities PNVTs. Development increases fragmentation and decreases the ability of fire to play its natural role in the surrounding area. New homes and property developments change and increase the amount of values-at-risk from fire and, therefore, change the decision on whether to suppress fire or allow it to play a more natural role. Adjacent properties can also become vectors for the introduction of exotic, invasive species.

Quaking aspen has been declining across the Southwest for decades. Given the increase in populations of ungulate game species populations, aspen sprouts have been heavily browsed because they are a preferred food source. Protection of aspen, using fences or other exclusion methods, is provided for in all alternatives. However, wildlife exclosures are expensive to develop and maintain, and resources are limited. Therefore, it is expected that aspen communities would continue to decline because of the continued pressure of wildlife herbivory on aspen regeneration. Increased acres of mechanical treatment and reintroduction of fire in alternatives B, C, and D, however, would be expected to stimulate additional aspen regeneration across larger areas; thus, potentially increasing chances of survival where it is not protected.

Wildlife, Fish, and Plants

For more information on species resources, see the respective sections in other parts of the DEIS in chapter 3.

Background

The vegetative and species diversity found on the forest is largely unique in comparison to the surrounding landscape as it has 18 potential natural vegetation types (PNVTs), a wide elevation range (2,500 feet to 12,000 feet), and perennial streams in a largely arid southwestern landscape.

This section evaluates and discloses the potential environmental consequences to species that may result from the adoption of a revised land management plan for the Coconino NF. It provides a summary of species viability assessments and examines in detail consequences to federally listed and proposed species and critical habitat, Forest Service regionally sensitive species, migratory birds, eagles, and management indicator species.

The National Forest Management Act regulations require that habitat is managed to support viable populations of all species within the planning area (1982 Planning Rule provisions at 36 CFR 219). The focus of this evaluation is on the condition of the habitat provided on Coconino NF. Condition was represented by departure values or distribution of vegetative states as described in the sections on “Vegetation and Fire,” “Soil,” and “Aquatic Systems.” For planning purposes, a viable population is regarded as one that has the estimated numbers and distribution

of reproductive individuals to ensure its continued existence is well distributed in the planning area.

A forest planning species[43] list, developed collaboratively in 2008, contains 146 plant and animal (terrestrial and aquatic) species that were identified to be at risk from threats to their habitat or from species-specific threats, out of over 1,800 species initially considered. It incorporates species found or potentially found on the Coconino NF, including 17 threatened and endangered species (3 of which are classified as experimental nonessential populations[44] by the U.S. Fish and Wildlife Service), 67 species on the regional forester's sensitive species list (5 of which are also candidates for listing by the U.S. Fish and Wildlife Service), and 61 other forest planning species. The initial list of 1,800+ species came from entities that identify or rank species of concern such as the U.S. Fish and Wildlife Service, Arizona Game and Fish Department, and NatureServe. The list also included species on the regional forester's sensitive species list and included feedback from a species diversity working group and species experts (USDA Forest Service 2009). As information about these species was gathered, many species were not considered further because their home range did not overlap the forest; there was insufficient information to determine occurrence on the forest or conduct analysis; there were taxonomic uncertainties; the species were considered secure in the planning area; or they were unaffected by management. The forest planning species list was reviewed to see if NatureServe conservation status had changed for any of the original 1,800+ species, and using updated information from the Museum of Northern Arizona (Stevens and Ledbetter 2012) and the "State Wildlife Action Plan from Arizona Game and Fish Department" (AZGFD 2010). Changes in the forest planning species since the "Ecological Sustainability Report" are summarized in the "Wildlife, Fish, and Plants" section of appendix C.

A coarse filter/fine filter approach was used to evaluate species. The coarse filter aspect looked at primary habitat associations and habitat threats while the fine filter addressed species specific threats. The 146 forest planning species were first grouped by habitat association, represented by water, and broadly defined vegetation types historically present in the planning area or PNVTs. PNVTs represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail (Schussman et al. 2006). PNVTs combine potential vegetation and historic fire regime to form ecosystem classes useful for forestwide assessments. Species were also grouped with special features (e.g., springs, cliffs), elements that are at scales above or below the PNVT level. Species were also associated with primary species-specific threats, those that could threaten their viability. Forest planning species and their habitat and threats are shown in table 42, Table 43, and table 44.

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[43] Forest planning species were identified only for forest plan revision purposes and hold no special regulatory status beyond existing State and Federal status.

[44] Experimental nonessential population is a population (including its offspring) of a listed species designated by rule published in the Federal Register that is wholly separate geographically from other populations of the same species. An experimental population may be subject to less stringent prohibitions than are applied to the remainder of the species to which it belongs. The loss of an experimental population would not appreciably reduce the prospect of survival of the species in the wild (Definition accessed online on June 26, 2013 from the Fish and Wildlife Service's Endangered Species Glossary Web site: https://www.fws.gov/endangered/about/glossary.html.)

This coarse filter/fine filter process was used to help develop and refine desired conditions, standards, and guidelines for the revised plan. Species specific plan direction was developed where needed for threats which the Forest Service could impact through management and for which the Forest Service has jurisdictional control.

Overview of Species Analysis Process

The analysis for each species considers the following:

- Trends in quantity, quality, and distribution of habitat;
- Trends in distribution and abundance of the species;
- How likely the species would be limited by its habitat;
- How habitat quantity, quality, and distribution would be affected by Forest Service management actions expected to occur within the planning area; and
- How each plan alternative addresses threats under the control of the Forest Service to species and their habitat so species viability is maintained.

The focus of this evaluation is on habitat provided on NFS lands. Private lands within or surrounding the forest may contribute to, or hinder, maintenance of species viability on NFS lands, but they are not relied upon to meet the regulatory requirements. For this reason, habitat abundance was assessed based on the amount of habitat found on NFS lands and habitat distribution was assessed based on the condition of the habitat, or distribution of vegetative states, relative to desired conditions. The condition of habitat on intermixed ownerships was assessed in cumulative effects.

Following the identification of the forest planning species, a two-stage filtering process, coarse filter[45] and fine filter[46] was used to evaluate whether the primary threats and adequacy of plan direction to provide for abundance, distribution, and habitat quality for each species adequately provided for species viability. The coarse filter/fine filter process considered habitat, special features (both coarse filter), and species-specific needs (fine filter).

[45] Example of coarse filter: Ponderosa pine is highly departed from reference conditions and is threatened by uncharacteristic fire. It has greater proportions of closed canopy and less abundant and vigorous understory compared to the open all-aged structure of reference conditions. The long-tailed vole relies on the understory in ponderosa pine for food and cover. Current conditions do not provide the abundance and quality of habitat of reference conditions. Plan components that promote natural fire return intervals and fire severity, a structure similar to reference conditions, and describe desirable understory conditions address the primary threats to the habitat and species. In this way, the coarse filter addresses threats to the species.

[46] Example of fine filter: Chiricahua leopard frogs are threatened by chytrid fungus, a fatal fungal disease of amphibians. Plan components that describe the composition, structure and function of their habitat and address habitat threats may maintain the resiliency and natural disturbances in their habitat but are insufficient to address species threats. Consequently, fine filter or species-specific guidelines were needed in the proposed revised plan to specifically address the threat of disease.

The following steps elaborate on the species analysis process described above:

Step 1 – F Rank: Forest Ranks or F Ranks were developed for the list of 146 forest planning species. The ranking process generally followed the conventions used by NatureServe and others in defining State and Global Ranks. The F Ranks were used in the viability risk assessment as a categorical variable representing a species' current abundance.

Step 2 – Habitat: A list of habitats important to each species in the analyses was developed.

Step 3 – Abundance: Abundance is the amount of habitat compared to reference conditions and within the capacity of the forest. Abundance values (consisting of rare, occasional, and common) were used to categorize the projected abundance of each habitat after 15 years of implementing each plan alternative (see appendix C for more details). Fifteen years is considered the life of the plan during which a trajectory for habitat improvement or protection would be set. Fifteen years was also considered the point in time for which vegetative modeling would most accurately reflect progress toward achieving desired conditions and the consequences of plan direction between alternatives could be reasonably compared. Most PNVTs were classified as common, for example, the cottonwood willow that exists today was cottonwood willow historically.

Step 4 – Habitat Quality: Habitat quality was assessed by examining habitat departure relative to desired conditions or the condition of the habitat. Departure values (consisting of poor, fair, or good) were used to categorize the expected distribution of PNVT states or proper functioning riparian conditions relative to desired conditions within 15 years. Habitat condition affects the movements and interactions of individuals among the suitable habitat patches found on NFS lands. This approach relies on the assumption that the condition of habitat, or distribution of vegetative states, similar to that which supported associated species during recent evolutionary history would likely contribute to their maintenance in the future, and the further a habitat departs from reference distribution, the greater the potential risk to viability of associated species.

Step 5 – Likelihood of Limitation: Habitat abundance and departure values were then combined to create one variable to indicate the general likelihood that the habitat would be limiting to populations of associated species. This "likelihood of limitation" was described as low, moderate, or high. In general, habitat elements that are rare and highly departed are those most likely to cause risk to viability of associated species; those that are common with a low departure are least likely to cause risk to viability of associated species. In this general context, habitat limitation refers to a habitat factor, quantity, distribution, or quality, which potentially results in risk to the viability of the species within the planning area.

Step 6 – Species Likelihood of Limitation Rating: Providing for species viability requires providing habitat (within capacity of forest) in a condition that allow existing populations to persist. The ability of existing populations to respond to available habitat depends in part on the populations' current robustness, which is generally a function of size. In general, for a given habitat condition, small populations would be at greater risk than large populations. To reflect this, the likelihood of habitat limitation variable (step 5) was combined with a species' F Rank (step 1) for each species/habitat element interaction to generate this rating.

Step 7 – Coarse Filter Process: Species addressed in the coarse filter process were those whose viability risk was due to habitat-related threats and there were no species-specific threats. The coarse filter analysis examined how plan components addressed habitat threats and maintained the viability of the species. Species addressed here did not receive additional

analysis. Species not fully addressed here were carried forward for more detailed fine filter analysis.

Step 8 – Fine Filter Process: Fine filter analysis examined how plan components addressed species-specific threats. The combination of coarse and fine filter is intended to maintain species viability.

Table 40 shows the key to the F-ranks, and Table 41 shows the PNVT abbreviations used in the list of threatened, endangered, and candidate species and Southwestern Region Sensitive Species that were analyzed. Table 42, Table 43, and table 44 list the habitat associations, threats, and forest ranking for federally listed, Southwestern Region Sensitive Species, and other forest planning species that were identified using the viability analysis process above (steps 1 and 2) and for which there are viability concerns. Additional information on the habitats can be found in the "Vegetation and Fire," "Aquatic Systems," and "Soil" sections.

Table 40. Key for forest (F) rankings

F Ranking	Description
F1	Very rare on the forest within its habitat – occupies a very small portion of its habitat.
F2	Rare on the forest within its habitat - occupies a small portion of its habitat
F3	Uncommon on the forest within its habitat
F4	Common on the forest within its habitat
F5	Widespread and abundant on the forest within its habitat
F?	Present on the forest but abundance information is insufficient to develop risk
FP	Possibly could occur on the forest, but documented occurrences not known
FN	Occurs on the forest, but no breeding population is documented on the forest
FO	Occurs off the forest
FH	Occurred on forest historically, but no known extant populations

Table 41. Key information for primary habitat associations, by PNVT

Abbreviation	PNVT name	Abbreviation	PNVT Name
DC	Desert Communities	MSG	Montane Subalpine Grassland
IC	Interior Chaparral	PJG	Piñon-Juniper with Grass
CWRF	Cottonwood Willow Riparian Forest	PJES	Piñon-Juniper Evergreen Shrub
MBDRF	Mixed Broadleaf Deciduous Riparian Forest	PJW	Piñon-Juniper Woodland
MWRF	Montane Willow Riparian Forest	PP	Ponderosa Pine
GCRF	Gallery Coniferous Riparian Forest	MCFF	Mixed Conifer with Frequent Fire
WC	Wetland Cienega	MCA	Mixed Conifer with Aspen
SDG	Semidesert Grassland	SF	Spruce-Fir
GBG	Great Basin Grassland	AT	Alpine Tundra

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 of 1973 (P.L. 93-205), as amended. Pursuant to Section 7 (2) (a) of the Endangered Species Act, a biological assessment would be prepared to assess the effects of implementing the Coconino NF plan selected alternative on endangered or threatened species and ensure that proposed actions in the selected alternative would not jeopardize the continued existence of listed species.

As described in the “Background” section above, the Coconino NF has habitat or potential habitat for 17 threatened and endangered species, which includes 3 nonessential experimental populations of threatened and endangered species. Per table 42, Gila trout and black-footed ferret occurred historically on the forest but have been extirpated. Yuma clapper rail possibly occurs on the forest, but it would be on the far northern extent of its range, and there are no documented occurrences. The majority of threatened and endangered species on the forest are associated with perennial streams and riparian habitat. Designated proposed and critical habitats are also listed in table 42. These do not change by alternative.

Table 42. Threatened and endangered species with their habitats and threats

Name/Status	Critical Habitat	Recovery Plan	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Amphibians						
Chiricahua leopard frog *Lithobates chiricahuensis* **Threatened**	232 acres	Yes	F1	CWRF, MBRDF, MWRF, WC Springs. Ephemeral drainages within Recovery Unit 5	14 occupied sites in and around constructed and natural waters. Suitable habitat: 101,329 acres.	Disease, mining activities, managed grazing.
Birds						
California condor *Gymnogyps californianus* **Experimental nonessential**	None	Yes	FN	Cliffs. Could use many PNVTs	No occupied habitat. Two sitings on forest. Suitable habitat: 116,378 acres.	Energy development (transmission lines).
Mexican spotted owl *Strix occidentalis lucida* **Threatened**	575,100 acres	Yes	F2	PP Gambel oak, MCFF, MCA Cliffs and canyons, large trees and snags 18″ and greater, coarse woody debris, attributes of old growth, shade canopy > 40%.	118,341 acres of protected activity centers (PACs) representing 190 occupied or formerly occupied sites that occur wholly or partly on the forest. Suitable habitat: 403,461 acres.	Disturbance at occupied nest sites and roosts from activities such as dispersed recreation, fire suppression activities. Managed grazing.
Southwestern willow flycatcher *Empidonax traillii extimus* **Endangered**	472 acres	Yes	F1	CWRF, MBDRF, MWRF, Springs	No occupied nesting habitat. Only single migratory and floater birds have been observed. 9,947 acres of potentially suitable habitat not including springs.	Disturbance at occupied nest sites from activities such as dispersed recreation and research activities. Managed grazing can result in disturbance to nesting flycatchers and their young and can facilitate nest parasitism by cowbirds which associate with livestock. Treatments to control tamarisk.

Name/Status	Critical Habitat	Recovery Plan	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Yuma clapper rail *Rallus longirostris yumanensis* **Endangered**	None	Yes	FP	CWRF, MBDRF, WC	No occupied habitat. Documented adjacent to, but not on forest. 1,094 acres of suitable habitat along Verde River and along Dry Beaver Creek downstream from Stage Stop Day Use Area.	None
Fish						
Colorado pikeminnow *Ptychocheilus lucius* **Experimental nonessential**	None	Yes	F2, FN	Perennial streams, CWRF, MBDRF	Occupied and potentially suitable: 35.2 miles.	Disease
Gila chub *Gila intermedia* **Endangered**	11.8 stream miles	No	F1	Perennial streams, CWRF, MBDRF	Occupied and potentially suitable: 6.8 miles.	Disease
Gila topminnow *Poeciliopsis occidentalis occidentalis* **Endangered**	None	Yes	F1	Perennial springs Perennial streams, CWRF, MBDRF	Occupied: 9.1 miles[4], potentially suitable: 13.7 miles.	Disease
Gila trout *Oncorhynchus gilae gilae* **Threatened**	None	Yes	FH	Perennial streams, MBDRF, MWRF, GCRF	Occupied: 0. Potentially suitable: 23.3 miles.	Disease
Little Colorado spinedace *Lepidomeda vittata* **Threatened**	About 31 stream miles	Yes	F1	Perennial streams, MWR, GCRF	Occupied: 32.7 miles . Potentially suitable: 123.5 miles.	Disease
Loach minnow *Tiaroga cobitis* **Endangered**	79.8 miles	Yes	F1	Perennial streams, Riparian forest PNVTs	Occupied: 9.1 miles (same as for Gila topminnow). Potentially suitable: 45 miles.	Disease
Razorback sucker *Xyrauchen texanus* **Endangered**	42.7 miles	Yes	F2	Perennial streams, CWRF, MBDRF	Occupied and potentially suitable: 35.2 miles.	Disease

Name/Status	Critical Habitat	Recovery Plan	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Spikedace *Meda fulgida* **Endangered**	117.7 miles	Yes	F1	Perennial streams, CWRF, MBDRF	Occupied: 9.1 miles (same as for Gila topminnow). Potentially suitable: 73.2 miles.	Disease
Mammals						
Black-footed ferret *Mustela nigripes* **Endangered**	None	Yes	FH	GBG, MSG, PJG	No occupied habitat. 377,775 acres of potentially suitable habitat (last confirmed sighting 40 years ago).	None
Mexican Gray Wolf *Canis lupus baileyi* **Experimental non-essential**	None	Yes	FN	No primary. Could use many	No occupied habitat. Potentially suitable habitat: 1,264,270 acres. Two sitings on forest.	None
Plants						
Arizona Cliffrose *Purshia subintegra* **Endangered**	None	Yes	F1	DC, Verde Formation	Occupied habitat: 2,225 acres. Potentially suitable habitat: 57,571 acres.	Managed grazing, dispersed recreation, mining.
San Francisco Peaks Ragwort *Packera franciscana* **Threatened**	743 acres	Yes	F1	AT, talus slopes	Occupied habitat: 213 acres. Potentially suitable habitat: 939 acres.	Disturbance from off-trail hiking and localized avalanche abatement.

[1] This includes the species primary habitat and special feature association.
[2] The current estimated habitat includes the amount occupied or number of records.
[3] Includes only the fine filter threats that are under Forest Service control. Species with fine filter threats are further analyzed through the fine filter process. Species with no fine filter threats (none) are evaluated at the coarse filter (habitat) level.
[4] Occupied habitat is considered the perennial portion of Fossil Creek, upstream of the permanent barrier in the Mazatzal Wilderness.

Sensitive Species

The Coconino NF has occupied or potential habitat for 67 Southwestern Region Sensitive Species. There are 3 amphibians, 9 birds, 7 fish, 7 invertebrates, 12 mammals, 26 plants, and 3 reptiles that are present or possibly present on the forest. Headwater chub, Gila chub, roundtail chub, Western yellow-billed cuckoo, Page Springsnail, and northern Mexican gartersnake are also candidates for listing.

Table 43. Southwestern Region sensitive species with their habitats and threats

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Amphibians				
Arizona toad *Bufo microscaphus*	FH	CWRF, MBDRF, springs, ephemeral and intermittent drainages.	No occupied sites. Potential suitable habitat along the Verde River from West Clear Creek to the East Verde confluences (27.9 miles).	Disease
Lowland leopard frog *Lithobates yavapaiensis*	F1	CWRF, MBDRF, WC, springs, ephemeral and intermittent drainages	One occupied site at Fossil Creek. Potential suitable habitat: 5,573 acres not including springs and drainages.	Disease
Northern leopard frog *Lithobates pipiens*	F2	WC, springs, ephemeral and intermittent drainages, constructed waters	147 estimated occupied sites in constructed and natural waters between Mormon Lake and the Mogollon Rim. Potential suitable habitat: 9,879 acres not including springs, drainages, or constructed waters.	Disease
Birds				
Abert's towhee *Pipolo aberti*	F3	CWRF, ephemeral and intermittent drainages, adjacent mesquite	Occupied habitat: About 902 acres. Suitable habitat: 1,378 acres not including the drainages.	None
American peregrine falcon *Falco peregrinus anatum*	F4	Cliffs	Occupied habitat: 32 known nesting pairs. Suitable habitat: 109,048 acres.	Disturbance during the breeding season from human activities such as rock climbing and overflights.

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Bald eagle *Haliaeetus leucocephalus*	F3	CWRF, MBDRF, MWRF, PP, large trees and snags in these PNVTs, cliffs.	Occupied habitat: 6 breeding areas and 11 confirmed winter roosts. Suitable habitat: 56,670 acres (excluding cliffs). 27 potential winter roosts.	Disturbance at occupied nest sites and active winter roosts from activities such as dispersed recreation, motorized recreation, off-highway vehicles, special uses, and management activities such as vegetative treatments, burning, road, trail or facility construction. Transmission lines (energy development) can cause electrocution. Communication towers (energy development) can result in collisions.
Clark's grebe *Aechmophorus clarkia*	F3	WC (Mormon Lake)	Occupied habitat: 1 nesting area. Suitable habitat: 5,297 acres.	Disturbance at nesting colonies from activities such as dispersed recreation.
Common black hawk *Buteogallus anthracinus*	F4	CWRF, MBDRF, MWRF	Occupied habitat: 32 nesting areas. Suitable habitat: 4,186 acres.	Disturbance at occupied nest sites from activities such as dispersed recreation.
Ferruginous hawk *Buteo regalis*	F3	SDG, GBG, MSG	No occupied nesting habitat. Suitable: 89,722 acres of migratory habitat.	None
Northern goshawk *Accipiter gentilis*	F3	PP, MCFF, MCA, large trees, snags, coarse woody debris	Occupied habitat: 83 post fledgling areas (including 3 shared with other forests) that total 54,686 acres. Suitable habitat: 878,599 acres.	Disturbance within active post fledgling areas from dispersed recreation, special uses such as large group events, and management activities such as burning or vegetative treatments.

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Western burrowing owl *Athene cunicularia hypugaea*	FP	GBG, MSG, PJG	No occupied sites. Suitable habitat: 374,544 acres.	None
Western yellow-billed cuckoo *Coccyzus americanus occidentalis* Also candidate for listing	F2	CWRF, MBDRF, mesquite bosques	Occupied sites: 18 representing 16.28 stream miles (1,790 acres habitat along the Verde River and its tributaries). Suitable habitat: 7,520 acres.	Disturbance during the breeding season from dispersed recreation activities such as hiking and camping, camping in developed campgrounds, and motorized travel.
Fish				
Bluehead sucker *C. discobolus*	F3	Perennial streams, riparian forest PNVTs	Occupied and Suitable: 123.5 miles.	Disease
Desert sucker *Catostomus clarki*	F3	Perennial streams, riparian forest PNVTs	Occupied and Suitable: 163.5 miles.	Disease
Headwater chub *Gila. nigra* Also Candidate for listing	F2	Perennial streams riparian forest PNVTs	Occupied and Suitable: 13.7 miles.	Disease
Little Colorado sucker *Catostomus sp.*	F3	Perennial streams, all riparian PNVTs	Occupied and Suitable: 123.5 miles.	Disease
Longfin dace *Agosia chrysogaster*	F3	Perennial streams, CWRF, MBDRF	Occupied and Suitable: 163.5 miles.	Disease
Roundtail chub *Gila. robusta* Also a Candidate for listing	F2	Perennial streams riparian forest PNVTs	Occupied and Suitable: 280.3 miles.	Disease
Sonora sucker *Catostomus insignis*	F3	Perennial streams, riparian forest PNVTs	Occupied and Suitable: 163.5 miles.	Disease
Invertebrates				
A mayfly *Homoleptohyphes quercus*	F1	Perennial streams, MBDRF	Occupied habitat: multiple sites in Oak Creek. Suitable habitat: 44.3 miles.	None
California floater *Anodonta californiensis*	FH	Perennial springs, perennial streams, riparian forest PNVTs	No occupied sites. Suitable habitat: 287.8 miles not including springs.	Loss of host fish due to invasive animal species

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Fossil springsnail *Pyrgulopsis simplex*	F1	Perennial springs, perennial streams, CWRF, MBDRF	Occupied: multiple springs in the Fossil Creek watershed. Suitable: 13.7 miles not including springs.	None
Four-spotted skipperling *Piruna polingii*	F3	MWRF,WC, springs	Occupied habitat: 2 occupied areas. Suitable habitat: 13,708 acres, not including springs.	None
Nitocris fritillary *Speyeria nokomis nitocris*	F3	WC, springs	Occupied habitat: 1 occupied area. Potentially suitable: 9,879 acres not including springs.	None
Nokomis fritillary *Speyeria nokomis nokomis*	FO	Same as Nitocris Fritillary	Same as Nitocris fritillary.	None
Page springsnail *Pyrgulopsis morrisoni* Also a Candidate for listing	F1	Perennial springs, perennial streams, CWRF	No occupied sites on the forest. Suitable: Springs in the Page Springs area of Oak Creek.	None
Mammals				
Allen's lappet-browed bat *Idionycteris phyllotis*	F3	Large trees and snags in PP, MCFF, and MCA; caves	Thirteen occupied roosts. Suitable habitat not including caves: 61,798 acres.	Disease, disturbance to active maternity or winter roosts in caves by activities such as dispersed recreation and caving.
Dwarf shrew *Sorex nanus*	F2	Talus slopes in subalpine portion of MSG, SF, AT.	One occupied area: Inner Basin on the San Francisco Peaks. Suitable habitat: 17,337 acres.	None
Greater western mastiff bat *Eumops perotis californicus*	FN	Cliffs	No occupied sites. Suitable habitat: 110,335 acres.	None
Long-tailed vole *Microtus longicaudus*	F3	Understory in MSG, PP, MCFF, MCA,SF, AT	Three occupied locations: San Francisco Peaks, Little Spring, and a crater near the San Francisco Peaks. Potentially suitable habitat: 41,681 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Merriam's shrew *Sorex merriami leucogengys*	F3	Understory in PP, PJG, MSG	Three known occupied locations: Hart Prairie, Mars Hill, Sawmill Springs, southeast of Mormon Lake. Potentially suitable habitat: 317,365 acres.	None
Navajo Mogollon vole *Microtus mogollensis navaho*	F3	Openings in PP, MCFF, MCA, PJW	Six known occupied areas: San Francisco Peaks, Sawmill Springs, Long Valley Ranger Station, Pivot Rock Spring, Lee Johnson Springs, Kehl Spring Campground. Suitable habitat: 291,080 acres.	None
Pale Townsend's big-eared bat *Corynorhinus townsendii pallescens*	F3	Cliffs, caves, archaeological sites	Occupied habitat: 9 known roosts. Suitable habitat: 110,335 acres not including caves and archaeological sites.	Disturbance to active maternity or winter roosts by activities such as tours at archaeological sites, dispersed recreation, caving, and climbing, disease.
Plains harvest mouse *Reithrodontom ys montanus*	F2	DC, SDG, IC	Occupied habitat: one known area in the vicinity of Camp Verde. Suitable habitat: 3,028 acres.	None
Southwestern river otter *Lutra canadensis sonora*	FH	Streams in CWRF and MBDRF	No known occupied habitat. Suitable habitat: 186 miles of streams within the two PNVTs.	None
Spotted bat *Euderma maculatum*	FN	Would use cliffs and caves	No occupied habitat. Suitable habitat 110,335 acres.	Disease, disturbance to active maternity or winter roosts in caves by activities such as dispersed recreation and caving.
Western red bat *Lasiurus blossevillii*	F3	Deciduous trees in CWRF, MBDRF, MWRF, PP	Two occupied areas: West Clear Creek Wilderness, Kachina Village area. Suitable habitat: 324,754 acres.	None
Wupatki Arizona pocket mouse *Perognathus amplus cineris*	F2	GBG near Wupatki National Monument	No occupied habitat. Suitable habitat approximately 13,000 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Plants				
Alcove bog orchid *Platanthera zothecina*	F1	MBDRF	11 occupied sites totalling about one acre. Suitable habitat: 9,135 acres	High levels of dispersed recreation in West Fork of Oak Creek
Arizona bugbane *Actaea arizonica*	F1	Canyons in MBDRF, GCRF, MWRF	Ten occupied sites totaling about 185 acres. Suitable habitat: 7,641 acres.	High levels of dispersed recreation in West Fork of Oak Creek
Arizona sneezeweed *Helenium arizonicum*	F2	PP, MSG, WC	Occupied habitat: about 500 acres (202 records). Suitable habitat: 424,008 acres.	None
Arizona sunflower *Helianthus arizonensis*	F1	GBG	Occupied habitat: 1 acres (2 records). Suitable habitat: 92,913 acres.	None
Bebb's willow *Salix bebbiana*	F1	MWRF, springs	Occupied habitat: < 50 acres (10 records). Suitable habitat: 3,829 acres not including springs.	Water diversion
Blumer's dock *Rumex orthoneurus*	F1	MWRF, springs	Occupied habitat: < 1 acre (1 record). Suitable habitat: 3,829 acres not including springs	Water diversion
Cliff fleabane *Erigeron saxatilis*	F1	Cliffs and ledges in canyons	Occupied habitat: < 1 acre (8 records). Suitable habitat: 29,453 acres.	None
Cochise sedge *Carex ultra*	F1	MBDRF, MWR, springs.	Occupied habitat: <1 acre (2 records). Suitable habitat: 7,441acres not including springs.	None
Crenulate moonwort *Botrychium crenulatum*	F1	AT	Occupied habitat: < 1 acre (5 records). Suitable habitat: 939 acres.	None
Disturbed (Tusayan) rabbitbrush *Chrysothamnus molestus*	F1	Calcareous soils in GBG	Occupied habitat: 340 acres. Suitable habitat: 8,040 acres.	None
Flagstaff beardtongue *Penstemon nudiflorus*	F3	PJES, PP	Occupied habitat: 500 acres (124 records). Suitable habitat: 895,117 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Flagstaff pennyroyal *Hedeoma diffusa*	F1	Rocky dolomitic limestone cliffs and ledges in PP	Occupied habitat: >700 acres representing 258 occurrences. Suitable habitat: 111,552 acres.	Disturbance from crushing or removal of plants from activities such as road construction and maintenance, vegetative treatments, burning.
Grand Canyon agave Agave phillipsiana	F1	Archaeological sites on limestone soils in SDG, PJES, DC.	Occupied habitat: <10 acres. Suitable habitat: 417,066 acres.	None
Hairy clematis (Arizona leatherflower) *Clematis hirsutissima* var. *hirsutissima*	F1	Dolomitic limestone soils in PP	Occupied habitat: 15 acres. Suitable habitat: 569,400 acres.	Disturbance from crushing or removal of plants from activities such as road construction and maintenance, vegetative treatments, burning, slash piles that cover and burn plants.
Heath-leaf wild buckwheat *Eriogonum ericifolium*	F1	Verde Formation in DC	Occupied habitat: 25 acres. Suitable habitat: 57,571 acres.	None
Lyngholm's cliffbrake *Pellaea lyngholmii*	F1	Limestone and sandstone cliffs	Occupied habitat: < 1 acre (4 records). Suitable habitat: 53,381 acres.	None
Metcalfe's tick trefoil *Desmodium metcalfei*	F1	MBDRF, PJES	Occupied habitat: < 1 acres (2 records). Suitable habitat: 267,447 acres.	None
Mogollon thistle *Cirsium parryi* ssp. *mogollonicum*	F1	Springs	Occupied habitat: < 1acre (3 records). Suitable habitat: 5 acres	Invasive plants such as bull thistle.
Mt. Dellenbaugh sandwort *Arenaria aberrans*	F1	SDG, IC, PJES, PP	Occupied habitat: < 1 acres (7 records). Suitable habitat: 1,065,886 acres.	None
Ripley's wild buckwheat *Eriogonum ripleyi*	F1	Verde Formation in DC	Occupied habitat: 25 acres. Suitable habitat: 57,571 acres.	None
Rusby milkwort (Hualapai milkwort) *Polygala rusbyi*	F2	Verde Formation in DC, SDG, PJES	Occupied habitat: < 500 acres . Suitable habitat: 84,636 acres.	None
Rusby's milkvetch *Astragalus rusbyi*	F1	Basalt soils in PP, MCA, Aspen	Occupied habitat: < 50 acres. Suitable habitat: 503,283 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Senator Mine alum-root *Heuchera eastwoodiae*	F1	Cliffs in canyons	Occupied habitat: < 1 acre (2 records). Suitable habitat: 55,505 potential acres of cliffs in canyons.	None
Sunset Crater beardtongue *Penstemon clutei*	F1	PP, cinder soils	Occupied habitat: 50 acres. Suitable habitat: 15,314 acres.	Ground disturbing activities that crush or remove plants such as mineral activities, dispersed recreation.
Tonto Basin agave *Agave delamateri*	F1	Archaeological sites on limestone soils in SDG, PJES, DC	Occupied habitat: <50 acres. Suitable habitat: 62,136 acres.	None
Verde Valley sage *Salvia dorrii var. mearnsii*	F2	Verde Formation in DC, SDG, PJES	Occupied habitat: >50 acres. Suitable habitat: 57,571 acres.	None
Reptiles				
Narrow-headed gartersnake *Thamnophis rufipunctatus*	F1	CWRF, MBDRF, MWRF, perennial streams	Occupied habitat: about 15 miles (Oak Creek and a few sitings from the Verde River). Suitable habitat: 38.3 miles.	None
Northern Mexican gartersnake *Thamnophis eques* Also a Candidate for listing	F1	CWRF, MBDRF, WC, perennial streams, ephemeral and intermittent drainages	No occupied habitat. Suitable habitat: 59.2 miles from the Verde River from the Fossil confluence upstream to Clarkdale.	None
Reticulate Gila monster *Heloderma suspectum suspectum*	F3	DC, IC, CWRF, SDG, PJES, ephemeral and intermittent drainages	Occupied habitat: 7,680 acres. Suitable habitat: 470,044 acres not including drainages.	None

[1] This includes the species primary habitat and special feature association.

[2] The current estimated habitat includes the amount occupied or number of records.

[3] Includes only the fine filter threats that are under Forest Service control. Species with fine filter threats are further analyzed through the fine filter process. Species with no fine filter threats (NA) are evaluated at the coarse filter (habitat) level.

Other Species

There are 62 other species whose viability may be at risk (7 birds, 4 invertebrates, 4 mammals, and 47 plants) that are present or possibly present on the Coconino NF.

Table 44. Other forest planning species with their habitats and threats

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Birds				
Evening grosbeak *Coccothraustes verspertinus*	F3	Deciduous trees in MCFF and MCA	Occupied habitat and potentially suitable: 2,881 acres.	None
Golden eagle *Aquila chrysaetos*	F3	Cliffs. Occasionally snags and large trees in PP.	Occupied habitat: 9 nesting areas. Suitable habitat: 10 potential nesting areas and 110,335 acres of potential cliff sites.	Disturbance at occupied nests from activities such as rock climbing, dispersed recreation, motorized recreation, special uses, and management activities such as vegetative treatments, burning, road, trail or facility construction. Transmission lines (energy development) can cause electrocution. Communication towers (energy development) can result in collisions.
Golden-crowned kinglet *Regulus satrapa*	F3	MCFF, MCA, SF	Occupied and suitable habitat: 100,648 acres.	None
McGillivray's warbler *Oporonis tolmiei*	F4	MBDRF, MWRF, MCFF, MCA	Occupied and suitable habitat: 94,143 acres.	None
Piñon jay *Gymnorhinus cyanocephalus*	F4	PJES, PJG, PJW	Estimated occupied and suitable habitat: 204,552	None
Swainson's thrush *Catharus ustulatus*	F1	MCA, SF	Estimated occupied and suitable habitat: 41,186.	None
Three-toed woodpecker *Picoides dorsalis*	F3	MCFF, MCA, SF	Estimated occupied and suitable habitat: 100,648 acres.	None
Invertebrates				
Alberta arctic *Oeneis alberta daura*	F2/F3	MSG, MCA, Springs	Occupied and suitable habitat: 29,174 acres, not including springs.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Arizona snaketail *Ophiogomphus arizonicus*	F2	Perennial springs, perennial streams, CWRF, MBDRF	Occupied habitat: Multiple sites in Oak Creek. Suitable: 287.8 (Stevens and Ledbetter 2012).	None
Persephone's darner *Aeshna persephone*	F2	Perennial springs, perennial streams, CWRF, MBDRF	Occupied habitat: <1 stream mile (one site in Oak Creek). Suitable: 287.8 miles (Stevens and Ledbetter 2012).	None
Redrock stonefly *Anacroneuria wipukupa*	F1	Perennial springs, perennial streams, CWRF, MBDR	Occupied habitat: Collected at 10 sites in 5 different streams across central AZ. Suitable: 287.8 (Stevens and Ledbetter 2012) not including springs.	None
Mammals				
Beaver *Castor canadensis*	F3	Streams, CWRF, MBDRF, MWRF	Occupied habitat: 719. Suitable habitat: 1,438 acres.	None
Gunnison's prairie dog *Cynomys gunnisoni*	F3	GBG, MSG, PJG	Occupied habitat: 7,294. Suitable habitat: 377,775 acres.	None
Pronghorn antelope *Antilocapra americana*	F3	GBG, Montane Grasslands, SDG	Occupied and suitable habitat: 206,025 acres.	Disturbance during fawning season from activities such as motorized use, off-highway vehicles, management activities such as vegetative treatments, burning. Fence construction.
Southwestern myotis *Myotis auriculus*	F3	Medium to large Gambel oak in PP-Gambel oak subtype, snags. Caves.	Occupied habitat: 15 known roosts. Suitable habitat: 303,450 acres not including caves.	Disease, disturbance to active maternity or winter roosts in caves by activities such as dispersed recreation and caving.
Plants				
Apache beardtongue *Penstemon oliganthus*	F1	MSG	Occupied habitat: < 1 acre (5 records). Suitable habitat: 23,429 acres.	None
Arizona phlox *Phlox amabilis*	F3	PJG, PP, DC, SDG	Occupied habitat: < 1 acre (5 records). Suitable habitat: 1,206,560 acres.	None
Arizona whitefeather *Ivesia arizonica var. arizonica*	F1	Cliffs in canyons	Occupied habitat: < 1 acre (2 records). Suitable habitat: 97,418 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Aspen *Populus tremuloides*	F3	PP, MCFF, MCA, SF	Occupied habitat: 3,450 acres. Suitable habitat: 47,322 acres.	None
Basin bladderpod *Lesquerella cinerea*	F3	DC, SDG, PJES	Occupied habitat: < 5 acres (40 records). Suitable habitat: 417,066 acres.	None
Bearded cinquefoil *Potentilla crinita var. lemmonii*	F1	PP	Occupied habitat: < 1 acre (5 records). Suitable habitat: 791,897 acres.	None
Bearded gentian *Gentianopsis barbellata*	F3	AT	Occupied habitat: 200 acres. Suitable habitat: 939 acres.	None
Bigelow's onion *Allium bigelovii*	F2	DC, SDG	Occupied habitat: < 1 acre (5 records). Suitable habitat: 153, 231 acres	None
Black sropseed *Sporobolus interruptus*	F3	PP, GBG, MSG, PJES, PJG	Occupied habitat: > 6,000 acres (48 records). Suitable habitat: 1,433,990 acres.	None
Black spleenwort *Asplenium adiantum-nigrum*	F1	Rocky outcrops and cliffs (dacite rock formations)	Occupied habitat : < 1 acre (1 record). Suitable habitat: 2,787 acres.	None
Ebony spleenwort *Asplenium playtneuron*	F1	Rocky outcrops and cliffs (dacite rock formations)	Occupied habitat: < 1 acre (4 records). Suitable habitat: 2,787 acres.	None
Blackroot sedge *Carex elynoides*	F1	AT	Occupied habitat: < 1 acre (record). Suitable habitat: 939 acres	None
Bollander's quillwort *Isoetes bolanderi*	F1	WC	Occupied habitat: < 1 acre (1 record). Suitable habitat: 2,545 acres.	None
Bristlecone pine *Pinus aristata*	F3	SF	Occupied and suitable habitat: 13,946 acres.	None
Colorado blue columbine *Aquilegia caerulea var. pinetorum*	F1	MCA, SF	Occupied habitat: 1 acre (6 records). Suitable habitat: 51,028 acres.	None
Common moonwort *Botrychium lunaria*	F1	SF, AT, MSG (subalpine portion)	Occupied habitat: < 1 acre (23 records). Suitable habitat: 17,121 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Corkbark (subalpine) fir *Abies lasiocarpa var. arizonica**	F3	SF	Occupied and suitable habitat: 13,946 acres.	None
Creeping milkvetch *Astragalus troglodytus*	F3	PJES, PP	Occupied habitat: < 5 acres (47 records). Suitable habitat: 1,055,733 acres.	None
Dane's dwarf gentian *Gentianella tenella*	F2	AT	Occupied habitat: < 5 acres 9 records. Suitable habitat: 939 acres.	None
Diamond Valley suncup *Camissonia gouldii*	F1	Cinder soils in the Sunset Crater volcanic field	Occupied habitat: < 1 acre (12 records). Suitable habitat: 15,314 acres.	None
Different-nerve sedge *Carex heteroneura*	F1	AT	Occupied habitat: <5 acres (4 records). Suitable habitat: 939 acres.	None
Fossil Creek bedstraw *Galium collomiae*	F1	Biophysical features (basalt palisade cliffs)	Occupied habitat: < 5 acres (20 records). Suitable habitat: 34,058 acres.	None
Graceful buttercup *Ranunculus inamoenus var. subaffinis*	F1	SF, AT	Occupied habitat: < 5 acres (30 records). Suitable habitat: 14,884 acres.	None
Grassy slope sedge *Carex oreocharis*	F1	MSG, MWRF, AT	Occupied habitat: < 5 acres (8 records). Suitable habitat: 28,197 acres.	None
Hall's milkweed *Asclepias hallii*	F1	MCA	Occupied habitat: < 1 acre (2 records). Suitable habitat: 37,083 acres.	None
James rubberweed *Hymenoxys jamesii*	F2	PJES, PP	Occupied habitat: < 1 acre (1 record). Suitable habitat: 1,055,732 acres.	None
Jones' spider flower *Cleome lutea var. jonesii*	F3	CWRF, MBDRF, MWRF, DC, SDG,PJES	Occupied habitat: < 5 acres (18 records). Suitable habitat: 427,013 acres.	None
Jones' wild buckwheat *Eriogonum jonesii*	F2	PJG, PP	Occupied habitat: < 5 acres (8 records). Suitable habitat: 1,053,329 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Macdougal's aletes *Aletes macdougalii*	F1	MCFF	Occupied habitat: < 1 acre (1 record) mid slope lower West Fork. Suitable habitat: 49,619 acres.	None
Macoun's false bindweed *Calystegia macounii*	F1	Human structures (historic railroad grades)	Occupied habitat: < 5 acres (5 records). Suitable habitat: 1,326 acres.	None
Mearn's lotus *Lotus mearnsii var. mearnsii*	F3	DC, SDG, limestone soils, PJES, PP	Occupied habitat: 20 acres (15 records). Suitable habitat: 97,817 acres.	None
New Mexico alum-root *Heuchera novomexicana*	F1	MBDRF, cliffs in canyon	Occupied habitat: < 1 acre (5 records). Suitable habitat: 485 acres.	None
Oak Creek triteleia *Triteleia lemmoniae*	F2	PP, WC	Occupied habitat: < 1 acre (20 records). Suitable habitat: 801,776 acres.	None
Pond lily *Nuphar lutea*	F1	WC	Occupied habitat: < 5 acres. Suitable habitat: 9,879 acres.	None
Reflected moonwort *Botrychium echo*	F1	SF	Occupied habitat: < 1 acre (1 record). Suitable habitat: 13,946 acres.	None
Rothrock's hedge-nettle *Stachys rothrockii*	F2	GBG, MSG, PJES, PP, MCA	Occupied habitat: < 5 acres (10 records). Suitable habitat: 1,209,158 acres.	None
Rough Whitlow-grass *Draba asprella* var. *asprella*	F1	PP, MBDR	Occupied habitat: < 5 acres (5 records). Suitable habitat: 795,509 acres.	None
Serrate phacelia *Phacelia serrata*	F3	PP, cinder soils	Occupied habitat: 50 acres (26 records). Suitable habitat: 15,314 acres.	None
Silver milkvetch *Astragalus subcinereus*	F1	PJES	Occupied habitat: < 1 acre (5 records). Suitable habitat: 263,835 acres.	None
Skunk-top scurfpea *Pediomelum mephiticum*	F1	SDG, PJES	Occupied habitat: < 1 acre (5 records). Suitable habitat: 353,518 acres.	None

Name	F Ranking	Primary Habitat[1]	Current Estimated Habitat[2]	Fine Filter Threats Under FS Control[3]
Spider saxifrage *Saxifraga flagellaris*	F1	AT	Occupied habitat: < 1 acre (1 record). Suitable habitat: 939 acres.	None
Thurber's (scarlet) cinquefoil *Potentilla thurberi* var. *sanguinea*	F1	PP	Occupied habitat: < 1 acre (3 records). Suitable habitat: 791,897 acres.	None
Timberland blue-eye-grass *Sisyrinchium longipes*	F1	MSG,PP, MCFF,MCA,SF,AT	Occupied habitat: < 5 acres (9 records). Suitable habitat: 916,913 acres.	None
Utah bladder fern *Cystopteris utahensis*	F2	Sandstone or limestone cliffs	Occupied habitat: 5 acres (20 records). Suitable habitat: 56,669 acres.	None
Western mouse-tail *Myosurus nitidus*	F2	PJES, PP	Occupied habitat: < 1 acre (4 records). Suitable habitat: 1,055,733 acres.	None
Western porterella *Porterella carnulosa*	F1	Ephemeral and intermittent stream courses	Occupied habitat: < 1 acre (2 records). Suitable habitat: 2,545 acres.	None
Yavapai wild buckwheat *Eriogonum pulchrum*	F2	PJG	Occupied habitat: < 1 acre (2 records). Suitable habitat: 261,432 acres.	None

[1] This includes the species primary habitat and special feature association.
[2] The current estimated habitat includes the amount occupied or number of records.
[3] Includes only the fine filter threats that are under Forest Service control. Species with fine filter threats are further analyzed through the fine filter process. Species with no fine filter threats (NA) are evaluated at the coarse filter (habitat) level.

Introduction to Species Analysis

The Coconino National Forest provides diverse habitats for species. The coarse filter analysis analyzes the habitat quantity and quality and how the alternatives address threats to them. The "Wildlife, Fish, and Plants" section summarizes effects to these habitats that are described and analyzed in greater detail in other sections of chapter 3. The "Aquatic Systems" section in this document describes the different types of water and riparian vegetation on the forest and discusses the current and projected conditions for water, watersheds, and riparian resources. The "Vegetation and Fire" section describes the different vegetation types and their current and projected condition and trends. The "Soil" section describes soil conditions across the forest. The "Biophysical Features" section describes caves, cliffs, and talus slopes on the forest. This information is not repeated in detail in this section.

Coding used in this analysis refers the reader to specific plan components that would apply by alternative. Alternative A is the current forest plan as amended. The code for alternative A starts with the page number followed by the paragraph or bullet number. For example, p. 22-1 par 1 points to the first paragraph on page 22-1. Alternatives B, C, and D point to coding in the proposed revised plan which follows major headings in the plan. For example, FW-WFP-DC-

1and 2 points to forestwide direction (FW) in the "Wildlife, Fish and Plants" section (WFP) and specifically to desired conditions numbers 1 and 2. The code SA-Wild-KPeaks-S-1, 2-3 refers to the plan section on "Special Areas" (SA) which includes wilderness (Wild) as one type of special area, the name of the wilderness, Kachina Peaks (KPeaks) and standards (S) 1, 2 and 3 in that section.

Coarse and Fine Filter Analysis

Species addressed in the coarse filter analysis are those who lack species-specific threats within Forest Service authority to their population viability. For most of these species, the likelihood of habitat limiting their resilience or increasing their vulnerability to stochastic events was low to moderate, which means that plan components that support desired conditions for the habitat, in general, are likely sufficient to provide for the species. However, for some species, this risk was moderate to high indicating that the species is believed to have a limited range on the forest or that it only occurs where certain habitat features are present, so it could be vulnerable to altered disturbance regimes. As plan components were developed, the interdisciplinary team particularly considered the habitat conditions that are required for these species. As a result, the likelihood of limitation rankings (see appendix C) created a feedback loop to make sure that species without species-specific or fine filter threats had all of their habitat needs addressed by the coarse filter plan components.

Analysis of coarse filter plan components and their ability to address threats to habitat is based on the ability of alternatives to address concerns of habitat abundance, quality, and threats to PNVTs and other special habitat features (such as biophysical features and aquatic systems). The coarse filter species whose primary threats are equivalent to those of the habitat and which habitats they are associated with are discussed under each PNVT. For these species, if plan components for an alternative address the threats to these habitats, then the threats to the species would also be addressed. As a result, the viability of these species' population is met by the alternatives and they are not further analyzed in the fine filter analysis. Species for which the coarse filter is inadequate to address their threats are discussed further in the fine-filter analysis section.

The "Wildlife, Fish, and Rare Plants" section also has a discussion of how plan components in each alternative address the multi-PNVT threats of uncharacteristic fire and invasive plants, which are common to most PNVTs and landscape-scale human impacts such as the roads system and dispersed recreation.

Environmental Consequences for All Species

Common to All Alternatives

Plan components in all alternatives support managing for viable self-sustaining populations of special status species, contributing to the survival and recovery of listed species, and allowing for the repatriation of extirpated species (new p. 22-1, par 1; FW-WFP-DC-1, 2). All alternatives have a standard such that direction for species listed as threatened, endangered, proposed, or candidate take precedence over direction for species not listed by the U.S. Fish and Wildlife Service as well as direction to comply with approved recovery plans (replacement p. 64, par 2; FW-WFP-S-1; FW-WFP-G-1,2).

All alternatives have language that would improve conditions for Southwestern Region sensitive species and would support and provide habitat and potentially suitable habitat for viable, self-

sustaining populations (new p. 11-1, par 1; replacement p. 23-1, par 1; FW-WFP-DC-1, 2, 5; FW-Veg-All-DC-12).

All alternatives would comply with species conservation agreements, assessments, and strategies. Alternative A has language to follow approved or more recent conservation strategies or assessments for bald eagles (new p. 206-100, par 6), Arizona leatherflower (hairy clematis) (new p. 65-7, par 8), and Arizona bugbane (new p. 206-10, no. 6), whereas alternatives B, C, and D expand following conservation strategies, assessments or plans to a forestwide guideline to improve the status of species and prevent Federal listing (FW-WFP-G-2). Both plans protect species addressed under these approved documents, however, alternatives B, C, and D would address these species without waiting for the plan to be amended.

Alternative A

In alternative A, connectivity of habitats is primarily addressed through tactical and area-specific plan language (i.e., the Flagstaff Lake Mary Ecosystem Area (FLEA), Sedona-Oak Creek Area, Highway Corridor 180) or habitat specific (Ponderosa Pine Mixed Conifer Less Than 40 Percent Slope, Piñon-Juniper Woodland Less Than 40 Percent Slope, Grassland and Sparse Piñon-Juniper Above the Rim, Riparian and Open Water) (replacement p. 124, par 2; replacement p. 124-1, par 2; replacement p. 125, par 1; replacement p. 126, pars 1, 3, 4, 5; p. 133, pars 1, 2; replacement p. 204, pars 1-2; replacement p. 148, par 6 no. 2; replacement p. 151, par 3; p. 152, par 3, nos. 3-4; p. 153, nos. 7-8; replacement p. 164, par 5; p. 174, par 6; new p. 206-4, par 7; new p. 206-11, par 3; p. 206-50, par 6, 8, no. 3; p. 206-51, par 3; p. 206-51, par 3-4; new p. 206-73, par 1; new p. 206-76, pars 3-4 ; new p. 206-76, par 5; new p. 206-103, par 6; new p. 206-105, par 7; new p. 206-107, par 5; and new p. 206-111, par 5). Some areas are not completely covered by this language including Semidesert Grassland PNVT, Desert Communities PNVT, and steeper slopes in Ponderosa Pine PNVT, mixed conifer, and piñon-juniper habitats. Despite lack of plan direction, the steeper slope habitats have maintained connectivity due to lack of management due to topography.

Unlike the other alternatives, plan components in this alternative would maintain specific travel corridors such as near Fort Valley and A-1 Mountain, within urban/rural influence zones near Flagstaff and along the State Highway 89A corridor (new p. 206-113, par 4; new p. 206-114, pars 1 and 2). It would also maintain large tracts of unfragmented habitat and maintain Woody Ridge as a semiprimitive nonmotorized recreation opportunity spectrum (ROS) setting with walk-in hunting. This alternative has an objective for land acquisition to reduce habitat fragmentation for antelope and other grassland species whereas the other alternatives lack this guidance.

Alternatives B, C, and D

Alternatives B, C, and D have an objective to implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions during each 10-year period of the life of the plan (FW-WFP-O-1). There are also objectives to restore or enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat during each 10-year period of the life of the plan (FW-WFP-O-3, 4).

The habitat conditions in alternatives B, C, and D would promote pollinator success and survival (FW-Veg-All-DC-15), provide microsites and refugia for species with restricted ranges (FW-WFP-DC-5) and would provide the resiliency and redundancy necessary to maintain species

diversity and metapopulations (FW-WFP-DC-3). As defined in the proposed revised plan for alternatives B, C, and D, habitats would include the microclimate or smaller scale elements needed for rare plants and animals and elements and structure and function of the PNVTs exist in sufficient quantities to provide habitat and refugia for the associated species (FW-WFP-DC-5). Alternatives B, C, and D also include a desired condition that endemic rare plant communities are intact and functioning (FW-Veg-All-DC-13).

Alternatives B, C, and D would implement at least 10 actions to benefit sensitive species that contribute to positive trends to avoid the need for listing during each 10-year period of the life of the plan (FW-WFP-O-2). In addition, they would restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat during each 10-year period of the life of the plan (FW-WFP-O-3-4).

Plan language in alternatives B, C, and D address connectivity of habitats at a broad, strategic level inclusive of large ecological units. These alternatives address connectivity for watersheds, streams, ephemeral watercourses, springs, all vegetation, and all piñon-juniper vegetation through desired conditions that would promote access to new habitats, perpetuation of genetic diversity, species movements, dispersal, and migration (FW-Wtrshed-DC-2; FW-Aq-Strm-DC-4; FW-Aq-Spr-DC-10; FW-Veg-All-DC-4; FW-WFP-DC-6-7). There are desired conditions that would promote the connectivity of Great Basin and Semidesert Grassland PNVTs based on soil types and guidelines that would promote unfragmented mesquite bosques especially where adjacent to riparian habitat (FW-Veg-Grass-GB&MSG-DC-3; FW-Veg-Rip-All-G-4).

Barriers to movement or mortality hazards like roads would be addressed through objectives to naturalize or decommission 200 to 800 miles of unauthorized roads and system roads (a prioritization scheme for unneeded roads that includes threatened, endangered, or sensitive species habitat) and desired conditions stating that human-caused barriers or habitat alternations (such as temperature changes or loss of streamflow) do not exclude them from using stream courses (FW-RdsFAC-O-1, FW-RdsFAC-G-5; FW-WFP-DC-8). There are provisions to allow movement barriers where it is necessary to protect native fish from nonnative species until watershed restoration allows connectivity to be restored (FW-WFP-DC-8). In addition, desired conditions for grazing would promote large areas of unfragmented open space to sustain biological diversity and ecological processes (FW-Graz-DC-1).

Several management approaches are beneficial for addressing issues associated with barriers and connectivity. Collaboration with partners and stakeholders on grassland restoration, grassland connectivity, and education is encouraged through a management approach for Great Basin and Montane/Subalpine Grasslands. Management approaches under the heading of “Roads” encourage working with the Arizona Game and Fish Department, Arizona Department of Transportation, Arizona Wildlife Linkages Working Group, and others to identify linkages and barriers to wildlife movements, mitigation during project design, and improvement of wildlife movements across interstate highways.

Unlike alternative A, these alternatives do not prescribe amounts of habitat per unit area that should be left to provide connecting habitat such as 30 percent cover in a 10,000-acre area in alternative A. They provide broad direction, leaving it to the project level to decide the details depending on site-specific conditions. Cover patches would be retained on and scattered across the landscape as a consequence of the desired conditions for groups and clumps of trees and early seral states that support seedlings, saplings, small trees, and shrubs. Also unlike alternative A,

these alternatives do not mention known travelways such as the one near the Fort Valley and A-1 Mountain areas, along the State Highway 89A corridor, or in the wildland-urban interface, nor do they mention unfragmented areas such as near Woody Ridge and Walnut Canyon.

Summary of Changes in the Amount of Species Habitat by Alternative

The tables in the beginning of the "Wildlife, Fish, and Rare Plants" section show the estimated amount of habitat for each species considered in the DEIS. Depending on plan objectives, the amount of habitat could change by alternative when the species habitat was a particular modeled vegetative state, such as open vegetative states. Plan objectives could also change the quality of the habitat but not the amount. The amount of habitat was not expected to change if there were no plan objectives or if the species habitat was considered to be the entire PNVT. Table 45 shows how the amount of habitat[47] changes by alternatives for six Southwestern Region sensitive species. These species are discussed within their respective PNVTs below. For all other species and under all alternatives, there would no changes in the amount of habitat from current conditions. Changes to the quality of habitat are also discussed under the respective PNVTs in this section.

Table 45. Amount of habitat for species by alternative

Conservation Status	Common Name	Alt. A	Alt. B	Alt .C	Alt. D
SW Region Sensitive	Allen's Lappet-Browed Bat	529,842 acres not including caves	542,063 acres	Same as B	
SW Region Sensitive	Long-Tailed Vole	50,592 acres	64,393 - 64,707 acres	Same as B	
SW Region Sensitive	Merriam's shrew	172,534 acres	196,478 - 197,415 acres	Same as B	
SW Region Sensitive	Navajo Mogollon Vole	107,895 acres	138,999 - 139,936 acres	Same as B	
SW Region Sensitive	Plains Harvest Mouse	102,512 acres	98,027 acres	Same as B	
SW Region Sensitive	Western Red Bat	247,148 acres	245,564 acres	Same as B	
All other species		No change from existing and no difference between alternatives			

The amount of a species habitat is different from critical habitat. The tables at the beginning of the "Wildlife, Fish, and Plants" section also show designated or proposed critical habitat for

[47] The amount of a habitat is different from critical habitat. The tables at the beginning of the "Wildlife, Fish, and Rare Plants" section also show designated or proposed critical habitat for species listed under the Endangered Species Act. U.S. Fish and Wildlife Service is the agency responsible for critical habitat; thus, the amount of critical habitat does not change by alternative.

species listed under the Endangered Species Act. U.S. Fish and Wildlife Service is the agency responsible for critical habitat, thus, the amount of critical habitat does not change by alternative.

Species Analysis by PNVT

Desert Communities PNVT and the Verde Formation

Coarse Filter

Affected Environment

Amount and Distribution: On the Coconino NF, the Desert Communities PNVT occurs in the Verde Valley where Upper Sonoran Desert species merge with the forest. The PNVT covers approximately 63,548 acres (3.5 percent of the forest) and generally occurs in creosote-dominated, alluvial position, and on old stream terraces adjacent to the Cottonwood Willow Riparian Forest PNVT. Desert Communities supports a unique community of endemic plants adapted to its calcium rich soil, including Arizona cliffrose, which is federally listed as endangered and only occurs in a very restricted portion of this PNVT.

The Verde Formation is found in the central Verde Valley and is interspersed with State and private land. It is found primarily within the Desert Communities and Semidesert Grassland PNVTs and covers about 57,617 acres in soil units 350 and 385. It consists of arid, soft, and ancient lakebed soils that have a high pH, high amounts of calcium, and are easily eroded. Plants associated with this formation are specially adapted to these unique physical and chemical properties and have a restricted range.

Habitat Quality: The Desert Communities PNVT, including the Verde Formation, currently has a high vegetative departure with unknown trend, and moderate soil condition departure with a static trend. The parcels under Forest Service and State Parks management are the most intact and contain the highest quality habitat for plants associated with the Verde Formation.

Risk Factors: The two primary risk factors are invasive plant species and dispersed recreation off of designated trails.

Desert Communities contain a few invasive plant species which, although at low densities, rank high for invasiveness and some nonnative annual grasses (such as red brome) are widely dispersed at low densities. Nonnative grasses can cause major changes in ecosystem integrity if not controlled (USDA Forest Service 2009). The opportunity for their spread and colonization across new sites is high due to the presence of high use roads, such as State Highways 89A and 179, which have numerous weed infestations. Vegetation in this PNVT is generally widely spaced and limited by arid soils and climate. Increased abundance and distribution of invasive exotic annual grasses would fill in the spaces between plants, increase competition for water and nutrients, and increase the continuity of fuels. This could result in increased frequency and severity of wildfires. Because most species in this habitat are not adapted to more frequent fire disturbance, mortality of native species would occur and disturbance-adapted invasive or nonnative annual vegetation could spread.

The main threat to the Verde Formation ecosystem is dispersed recreation off of designated trails due to increasing recreation demand in the Verde Valley. Social trails and off-trail activities on this type of soil can remove vegetation and accelerate erosion more rapidly than on other sites within Desert Communities and Semidesert Grasslands. In addition, off-trail mountain biking

entering the 1,208-acre Verde Valley Botanical Area from Dead Horse State Park has led to a proliferation of social trails that has accelerated erosion within the botanical area and habitat for associated plant species.

Associated Species: There are a total of 14 species associated with Desert Communities (table 42, Table 43, and table 44).

- One is federally listed: Arizona cliffrose (endangered);
- Eight are Forest Service sensitive species: Heath-leaf wild buckwheat, plains harvest mouse, Ripley's wild buckwheat, Rusby milkwort, reticulate Gila monster, Tonto Basin agave, Grand Canyon agave, and Verde Valley sage; and
- Five are other forest planning species: Arizona phlox, Basin bladderpod, Bigelow's onion, Mearn's lotus, and Jones spider flower.

Of the 14 species associated with the Desert Communities habitat, 6 are also associated with the Verde Formation:

- One is federally listed: Arizona cliffrose (endangered);
- Four are Forest Service sensitive species: Heath-leaf wild buckwheat, Ripley's wild buckwheat, Rusby milkwort, and Verde Valley sage; and
- One is an other forest planning species: Mearn's lotus

The coarse filter analysis was inadequate to address all the threats of Arizona cliffrose which is further evaluated in the fine filter section below. The reticulate Gila monster also uses ephemeral and intermittent drainages for movement between suitable habitat, hunting, and dispersal. Ephemeral and intermittent drainages are further discussed in the section on riparian resources.

Environmental Consequences – Desert Communities PNVT and the Verde Formation

Habitat Quality

Common to All Alternatives

All alternatives address the threat of invasive plants by pointing to the "Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weed" (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners (replacement pg. 23, par 8; new pg. 206-72, par 8; new pg. 206-75, par 9; new pg. 206-76, par 7, 8, 9; new pg. 206-79, par 7; FW-Invas-DC-1; FW-Invas-G-1-5 and Management Approaches for Invasive Species in the proposed revised plan).

Many of the species associated with Desert Communities and the Verde Formation occur in the existing Verde Valley Botanical Area, which affords them additional protection. Heath-leaf wild buckwheat, Ripley's wild buckwheat, Rusby milkwort, and Verde Valley sage share habitat with Arizona cliffrose, an endangered species. All four species are endemic to northern and central Arizona, so the protections for Arizona cliffrose and for the Verde Valley Botanical Area also protect other species associated with the Verde Formation.

All alternatives contain an eligible segment for the Sycamore Creek Wild and Scenic River and habitat which contain populations of Jones' spider flower. As designated and eligible wild and scenic river segments promote low motorized use and protecting outstandingly remarkable values, which includes riparian habitat, there should be low net impact in these areas, although higher impacts could occur in segments with a recreational emphasis. However, until comprehensive river management plans are finalized for each eligible segment, the level of human use is unknown, so it is not possible to estimate resource impacts to the Jones' spider flower.

Basin bladderpod lies within the designated segment of the Verde Wild and Scenic River. This plant is protected because this segment has management that is protective in nature for outstandingly remarkable values, which includes riparian habitat (P.L. 90-542, Wild & Scenic Rivers Act, 1968, as amended, Section 10(a) and Section 12(a) and the "Verde Wild and Scenic River Comprehensive River Management Plan").

Alternative A

Desert Communities PNVT is currently highly departed with an unknown trend toward desired conditions. Beyond using prescribed fire and wildfire with resource objectives to treat vegetation, alternative A provides limited desired conditions for this PNVT and much of the direction is outdated. This PNVT is expected to remain highly departed. The risk of uncharacteristic fire is anticipated to remain high.

All alternatives are similar in their approach to invasive plants except alternative A's plan direction would manage only manage Forest Service administrative or permitted activities and uses to minimize the risk of invasive species introduction and spread and does not provide direction on managing how public forest user activities contribute to this threat.

Plan language that pertains to recreation impacts is generally outdated for Desert Communities and the Verde Formation. Management Area 11 (Verde Valley) includes only 1,000 acres of Desert Communities. It has vague language that states that recreation opportunities within the area should be compatible with other resources management (p. 90 par 2; replacement p. 167 par 2) rather than directly addressing dispersed recreation impacts. Language for the portion of Desert Communities and Verde Formation that lies within the Sedona-Oak Creek Planning Area more directly addresses the threat of dispersed recreation to the Verde Formation.

Forestwide direction for sensitive plants and for bicycling do support avoidance of resource-recreation conflicts by directing the forest to identify and protect areas containing threatened, endangered, and sensitive plants and to regulate bicycle use if significant conflicts occur (replacement p. 23 par 2, replacement p. 58 par 1, replacement p. 59 par 5) but does not do a good job of linking the risk of this use to the sensitive soil of the Verde Formation and, therefore, provides less protection and direction than alternatives B, C, and D. There is also direction that provides the general purpose for the Verde Valley Botanical Area, but it does not directly address the threat of dispersed recreation, especially mechanized recreation like mountain bikes which are having indirect impacts to rare plants (replacement p. 194 par 3). Combined, however, this direction does provide enough direction to manage for protection of the plants associated with this unique soil feature.

Plains harvest mice are a Forest Service sensitive species in the Southwestern Region. It is associated with Desert Communities, Semidesert Grassland, and Interior Chaparral PNVTs. It is

one of the few species that has changes in the amount of habitat between alternatives. Alternative A is assumed to have the same amount of habitat as existing (102,512 acres). There are no plan objectives for Desert Communities and Interior Chaparral, so the amount of habitat in these two PNVTs would be similar to existing. However, alternative A has 4,485 more acres of habitat than alternatives B, C, and D primarily due to changes resulting from plan objectives for Semidesert Grassland. This alternative would be expected to maintain the viability of this species and not contribute to listing because there would be over 100,000 acres of open habitat to provide food and cover needed for reproduction, movements, and population maintenance.

Alternatives B, C, and D

The departure and trend would not change under these alternatives.

These alternatives would better protect habitat quality than alternative A (Table 46). They provide clearer desired conditions, allowing for a greater potential to reduce PNVT departure and move toward desired conditions and protect suitable and occupied habitat for sensitive plants. A guideline to avoid excessive ground disturbance would limit accelerated erosion and would minimize bringing more calcareous soil to the surface. Bringing calcareous soil to the surface could limit soil plant nutrient availability. Alternatives B, C, and D would be expected to have the same consequences on Desert Communities as alternative A, based on the lack of plan objectives.

In addition, the recreation direction in these alternatives better integrates: the need to protect sensitive resources from the impacts of motorized and nonmotorized recreation; the need to rehabilitate unauthorized trails so as to prevent accelerated erosion; and the need to potentially restrict national forest visitor activities where they would inhibit site restoration or cannot be made compatible through appropriate mitigations These alternatives also emphasize conveying a land ethic to visitors that promotes decreased recreation impacts to biological communities and biodiversity so as to protect natural resources through a sense of stewardship. This integration of social and resource values and incorporation of restrictions, mitigations, and education is a more comprehensive approach to addressing the threat of dispersed recreation within the Verde Formation. It also is broader than alternative A's direction because it recognizes the value of the underlying physical substrate, not just the biotic community as a source of habitat quality and stability.

Alternatives B, C, and D have updated forestwide direction regarding the threat of invasive or nonnative plants. Desired conditions would encourage the sustainability of native and desirable nonnative species by promoting invasive plants at levels that do not disrupt ecological functioning and emphasizing native plant species in various age classes. Forestwide guidelines would prevent and control spread of nonnative and invasive species and would restore natural species composition and ecosystem function. In addition, management approaches would prioritize areas for controlling invasive species and maintain an inventory of invasive species on the forest.

Also, there are several protections for the Verde Formation within the Verde Valley Botanical Area, which protects Verde Formation plant species. Within this area, alternatives B, C, and D have desired conditions to reduce human impacts on plant communities and to exclude recreation uses where they are negatively impacting the resource. This direction better clarifies that the primary purpose of these special areas is the botanical resource and that visitor use may be removed where it cannot be made compatible.

As mentioned previously, Plains harvest mice are a Forest Service sensitive species associated with Desert Communities, Semidesert Grassland, and Interior Chaparral PNVTs. It is one of the few species that has changes in the amount of habitat between alternatives. There are no plan objectives for Desert Communities and Interior Chaparral, so the amount of habitat in these two PNVTs would be similar to existing. Alternatives B, C, and D would have 4,485 fewer acres of habitat (total of 98,027 acres) than alternative A primarily due to changes resulting from plan objectives for Semidesert Grassland. Overall, the rate of improvement would not keep pace with tree and shrub growth. The amount of habitat in the perennial bunchgrass with open shrubs and trees would decrease, and the amount of habitat in the open perennial bunchgrass vegetative state would increase by nearly 5,400 acres. This latter state is representative of desired conditions in this grassland. According to mid-scale data, this state does not currently occur and would not occur in alternative A. These alternatives would be expected to maintain the viability of this species and not cause a trend toward listing because the amount of habitat would maintain species populations, movements, and reproduction, and portions of the habitat would move closer to desired conditions and provide food and cover.

Alternative B

Alternative B would restrict mechanized travel such as mountain biking because it is listed as a unsuitable use for botanical and geological areas (see "Recreation and Transportation Suitability" table 15 in the proposed revised plan). This would provide the most protection for the species that occur within this botanical area, Arizona cliffrose, Verde Valley sage, Mearn's lotus, Ripley wild buckwheat, Rusby milkwort, plains harvest mouse, and reticulate Gila monster (table 46).

Alternative C

Effects from mechanized travel for alternative C are less than the other alternatives.

Alternative D

In alternative D, mechanized travel would be suitable, but only on designated trails in botanical areas. This would allow for continued access by bicycles, but would limit their impacts to trails that are determined by the Forest Service, which would allow the Agency to better mitigate the impacts of this use. This provides better protection to rare plants than alternative A, but would have more impacts than alternative C.

Table 46. Plan components under alternatives B, C, and D that would maintain the viability of species associated with Desert Communities and the Verde Formation at the coarse filter/habitat level

Location Code in Proposed Revised Plan	Intent of Plan Components	Benefiting Species
FW-Veg-All-DC-13, FW-Veg-DC-DC-5	Endemic rare plant communities and habitats for Arizona cliffrose are intact, functioning, connected, and preserved.	Arizona cliffrose, Verde Valley sage, Rusby milkwort, Ripley's wild buckwheat.
FW-Veg-All-DC-14	Unique plant community habitats (including the Verde Valley Formation, calcareous soils/alkaline clay) maintain self-sustaining populations of associated native plant species.	Arizona cliffrose, Verde Valley sage, Rusby milkwort, Ripley's wild buckwheat.

Location Code in Proposed Revised Plan	Intent of Plan Components	Benefiting Species
FW-Veg-DC-DC-1, 3, 6	Healthy soils support a variety of native species, including endemic plants such as Arizona cliffrose. Soils are friable, biologically diverse, and there is little sign of compaction. Erosion occurs at natural rates. Biological crusts improve nutrient cycling and soil stabilization.	Arizona cliffrose, Verde Valley sage, Rusby milkwort, Ripley's wild buckwheat.
FW-Veg-DC-DC-2, 4	Predominant plant species are native shrubs, forbs, and grasses in various age classes. Vegetation cover does not lead to uncharacteristic fire and fires are rare because this is not a fire-adapted community. There is successful regeneration and establishment of native endemic plants.	All plant species associated with Desert Communities PNVT and the Verde Formation, Plains harvest mouse, reticulate Gila monster.
FW-Veg-DC-DC-G-1	Avoid excessive ground disturbance limiting accelerated erosion and would minimize bringing more calcareous soil to the surface.	Arizona cliffrose, Heath-leaf wild buckwheat, Ripley's wild buckwheat, Rusby milkwort, and Verde Valley sage.
FW-Invas-DC-1	Invasive plants are absent or in low abundance, do not occur at levels that disrupt ecological functioning and that maintain the sustainability of native and desirable nonnative species.	All associated species
FW-Invas-G-1	Measures should be incorporated into planning and implementation of projects to prevent, control, contain, and eradicate priority populations of invasive species that have the greatest threats to native species populations, watershed condition, ecosystem health, and biological diversity.	All associated species
FW-WFP-DC-14	Permits for cutting stalks off of agaves should not be issued in order to protect stalks used as nesting and overwintering habitat for key pollinators of desert ecosystems, such as carpenter bees. Exceptions may be made for limited research purposes.	All associated plant species
FW-Hrtg-DC-1	Historic and prehistoric sites are preserved and protected for their cultural importance and are generally free from adverse impacts, or impacts are minimized through tribal consultation. Site integrity and stability is protected and maintained on sites that are susceptible to imminent risks or threats, or where values are rare or unique.	Tonto Basin agave, Grand Canyon agave
FW-SpecUse-G-13	Outfitter-guide motor vehicle use and camping activities should be excluded from areas with sensitive resource issues, such as a high density of archaeological sites or areas with sensitive or rare plants.	All associated plant species

Location Code in Proposed Revised Plan	Intent of Plan Components	Benefiting Species
FW-Rec-Disp-DC-1, 2, 3	Recreation activities are balanced with the ability of the land to support them, and create minimal user conflicts. Recreation demand is balancde with other forest desired conditions unless increasing capacity results in unacceptable negative effects on natural resources. Managed recreation stays within this capacity with the exception of holiday weekend use levels that may exceed capacity on a short-term basis. Recreation activities do not significantly impact resources such as soils, vegetation and wildlife.	All associated species
FW-Rec-Disp-DC-7	Resource damage from unauthorized motorized trails is minimal. Unauthorized trails are rehabilitated and mitigate long-term soil and water impacts. Motorized trails are located with minimal impacts to cultural sites, highly erodible soils, wildlife and botanical resources.	All associated species
FW-Rec-Disp-DC-14	Trail use remains on the established tread, especially in high traffic or sensitive areas such as the Verde Valley Botanical Area.	All species associated with Desert Communities PNVT and the Verde Formation.
SA-RNABotGeo-DC-7, SA-RNABotGeo-DC-8, SA-RNABotGeo-G-1,	Desired conditions to reduce human impacts on plant communities and to exclude recreation uses where they are negatively impacting the resource. Nonmotorized recreation is allowed on a limited basis on designated trails to protect soil conditions. Verde Valley Botanical Area preserves a unique desert community containing Arizona cliffrose.	Arizona cliffrose, Heath-leaf wild buckwheat, Ripley's wild buckwheat, Rusby milkwort, and Verde Valley sage.

Summary of Species Effects

Considering the coarse filter analysis, plan components in all alternatives maintain the viability and do not cause a trend toward listing for Heath-leaf wild buckwheat, plains harvest mouse, Ripley's wild buckwheat, Rusby milkwort, reticulate Gila monster, Tonto Basin agave, Grand Canyon agave, and Verde Valley sage, Arizona phlox, Basin bladderpod, Bigelow's onion, Mearn's lotus, and Jones' spider flower.

From the landscape perspective, the species associated with Desert Communities have a moderate likelihood of being limited by their habitat. This PNVT has been primarily affected by a legacy of past management including off-highway vehicles and livestock grazing from which it is slowly recovering, however, the threat of invasive plants causes it to have a trend away from reference conditions. All alternatives incorporate plan direction for invasive plants and maintain the Verde Valley Botanical Area, which provides additional protection to rare and endemic plant populations, as well as to the plains harvest mouse and reticulate Gila monster. In addition, the PNVT is slowly recovering from legacy impacts from off-road driving and past livestock grazing.

Alternatives B, C, and D better address threats from different types of recreation and provide updated plan components that better balance biotic, physical, and social factors than alternative A. Plants in the Verde Valley Botanical Area are most protected by alternatives B and C, which do

not allow mechanized dispersed recreation, then by alternatives B and D which allow mechanized use on designated trails. Rare and endemic plants in the Verde Valley Botanical Area are least protected by alternative A, which has no restrictions on mechanized use in this special area.

Fine Filter – Arizona Cliffrose

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Arizona cliffrose is a rare edaphic endemic plant and occurs in four disjunct population areas: Burro Creek in Mohave and Yavapai Counties, Cottonwood in Yavapai County, Horseshoe Lake in Maricopa and Yavapai Counties, and near Bylas in Graham County. The four known populations of this endangered shrub are spread across a 200-mile zone of central Arizona. The status of each population is thought to be static or on an upward trend (USFWS 2010).

Habitat: The Cottonwood population is mainly on the forest, is the largest of the four populations, and totals about 2,225 acres (Maschinski et al. 2006). A recovery plan has been prepared, but no critical habitat has been designated (USFWS 1995a). Arizona cliffrose is restricted to nutrient deficient calcareous soils. In the Verde Valley, Arizona cliffrose only grows on Verde Formation soils, which are arid soft ancient lakebed soils that have a high level of pH, high amounts of calcium, and erode easily. The species is associated with Desert Communities PNVT.

The Cottonwood population and its habitat are dissected by two high use roads, U.S. Highway 89A and State Route 179, which have numerous weed infestations, and it is located near some Verde Valley communities with typical urban interface activities occurring in the surrounding areas.

The Cottonwood population occurs on lands managed by the forest, State Trust Lands and Dead Horse Ranch State Park. The Kingman Field Office of the Bureau of Land Management, Bureau of Reclamation, Tonto National Forest, and the San Carlos Apache Indian Reservation manage the other three areas.

On the forest, most Arizona cliffrose populations occur within the Verde Valley Botanical Area (1,140 acres in MA 17 – Special Areas), established in the 1987 forest plan specifically for this plant and its habitat (Management Areas 17 – Special Areas). A small portion of the population is outside of the botanical area in the adjacent Verde Valley (Management Area 11 – Verde Valley).

Risk Factors: Landscape-level primary habitat threats: Desert Communities is threatened by invasive plants, particularly exotic annual grasses. Invasive plants compete with native species for scarce moisture. If they become well established, they can cause a change in fire frequency or fire severity to which native species would not be adapted. The potential for uncharacteristic fire has increased due to the proximity to the growing communities in the Verde Valley and increased recreation. These habitat threats are addressed in the coarse filter section.

Other threats include: roads construction and maintenance, utility corridors, and land exchanges (USFWS 1995a). Construction and maintenance of roads and utility corridors could decrease the amount of habitat, change hydrology, contribute to erosion, and introduce invasive weeds. Land

exchanges from Federal ownership to other entities could contribute to urbanization or other actions causing habitat loss or degradation.

Species Threats: The recovery plan for this species cites grazing and mining as threats to the Cottonwood population. In addition, mountain biking on the Lime Kiln Trail has impacted the soil and crushed some cliffrose plants in the Verde Valley Botanical Area. There is no livestock grazing in the botanical area and South Gyberg pasture, which has most of the populations. Although the recovery plan cites mining as a threat to Arizona cliffrose, most mining and exploration has been in the Burro Creek and Horseshoe Lake populations, which are outside the Coconino NF. This area has low potential and mining is unlikely to occur (see "Minerals and Energy" section of this chapter).

Environmental Consequences – Arizona Cliffrose

The previous coarse filter section compares the alternatives in regards to threats to Desert Communities, the Verde Formation, and overall habitat for Arizona cliffrose.

All Alternatives

In addition to the plan components common to all alternatives described at the end of the "Introduction to the Species Analysis Process," plan components in all alternatives supporting managing for viable self-sustaining populations of special status species, contributing to the survival and recovery of listed species, and allowing for the repatriation of extirpated species (p. 22-2 par 1; FW-WFP-DC1-2). All alternatives have a standard such that direction for species listed as threatened, endangered, proposed, or candidate take precedence over direction for species not listed by the U.S. Fish and Wildlife Service as well as direction to comply with approved recovery plans (replacement p. 64 par 2, FW-WFP-S-1, FW-WFP-G-1,2).

Under all alternatives, management and guidance for Arizona cliffrose would be subject to consultation with the U.S. Fish and Wildlife Service and other law, regulation, and policy. All alternatives would manage botanical areas to protect their unique qualities (replacement p. 25, par 4; p. 79, par 10; replacement p. 195 par 9; SA-RNABotGeo-DC7). The Verde Valley Botanical Area is managed to preserve a unique limestone-dependent vegetative community containing Arizona cliffrose (replacement p. 195 par 10; SA-RNABotGeo-DC-8). Visitor use is limited (replacement p. 195, par 6; SA-RNABotGeo-G1); allotment management plans protect the uniqueness and ecological condition of special areas (replacement p. 195, par 10; SA-RNABotGeo-G4) and have minimal damage from fire suppression tactics (replacement p. 196, par 5; SA-RNABotGeo-G2).

Alternative A

Alternative A regulates grazing through the annual allotment management plans and states that these plans will have provisions to protect the uniqueness and/or ecological condition of research natural areas and botanical areas (replacement p. 195, par 10).

There are other plan components in this alternative that would benefit this species. For example, botanical areas are managed to maintain existing conditions and natural processes for research and public enjoyment (replacement p. 194, par 2). There would be no assigned grazing capacity (replacement p. 195, par 7), and timber harvest and firewood cutting would be prohibited (replacement p. 195, par 11). These areas would be sought for withdrawal from locatable mineral entry, and would not be affected by special use authorizations and vehicular intrusions

(replacement p. 196, par 1, 2, 3, 5). These provisions would protect this species and improve habitat conditions.

In the botanical area, bicycle use has led to the widening of the trail prism, erosion, and crushing of plants along the Lime Kiln Trail. Alternative A is the most permissive of the alternatives and would not preclude dispersed recreation or off-trail use in botanical areas. It has a guideline that would protect cliffrose by regulating bicycling if there are conflicts (replacement p. 59, par 5). This is described in more detail in the coarse filter section on Desert Communities.

Alternatives B, C, and D

Table 47 displays plan components that maintain and protect the overall habitat for Arizona cliffrose.

These alternatives would provide protection for the plant community and soil components required by the Arizona cliffrose and its associated plant community. In addition, alternatives B, C, and D provide desired conditions for the Desert Communities PNVT that are largely absent from alternative A. Collectively, these address community conditions, natural processes, and habitat components absent from alternative A.

Allotment management plans would have provisions to protect the uniqueness and/or ecological condition of the special areas. This guidance would continue the current policy of regulating livestock use in the botanical area through the allotment management plan. While this language would not provide protection for those individuals outside of the botanical area, these individuals and other rare species on the forest are protected by forestwide plan components. This would better allow consideration of such features as soil condition and Arizona cliffrose occurrences during allotment analyses.

Alternatives B and C

These alternatives would protect Arizona cliffrose individuals or other areas where soil and vegetation impacts are undesirable. This is described in more detail in the coarse filter section on Desert Communities. These alternatives would also provide additional protection through elimination of mechanized travel in the Verde Valley Botanical Area, which contains a large percentage of this species on the forest. Under this alternative, uses such as bicycle riding would not be suitable in the Verde Valley Botanical Area. These alternatives would protect Arizona cliffrose more than alternatives A and D.

Alternative D

This alternative would provide more protection to individual Arizona cliffrose plants from mountain biking compared to the other alternatives but not as much as alternatives B and C. Mountain biking would be allowed only on designated trails in botanical areas, so only individual plants might be affected by the associated erosion or crushing (see appendix F).

Table 47. Plan components under alternatives B, C, and D that would protect Arizona cliffrose at the fine filter level

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Veg-All-DC-13	Endemic rare plant communities and habitats for Arizona cliffrose are intact, functioning, connected, and preserved.

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Veg -DC-1-6	Functional soils support a variety of native species, including endemic plants such as Arizona cliffrose. There is successful regeneration and establishment of native endemic plant species. There is little sign of soil compaction or accelerated erosion and arroyos are recovering. Plant cover does not lead to uncharacteristic fire and fires are rare. Excessive ground disturbance should be avoided to limit accelerated erosion and to minimize bringing more calcareous soil to the surface. Population numbers for Arizona cliffrose remain static or increase over the long term. Soils are friable, biologically diverse, and support biological soil crusts to improve nutrient recycling and soil stabilization.
FW-Rec-Disp-DC-14 FW-Rec-Disp-DC-2, 3, 17	Trail use remains on the established tread, especially in high traffic or sensitive areas such as the Verde Valley Botanical Area. Demand for recreational activities is balanced against unacceptable negative effects to natural resources. New areas of disturbance from dispersed recreational activities will be rare.
SA-RNABotGeo-G-4	Allotment management plans would have provisions to protect the uniqueness and/or ecological condition of the Verde Valley Botanical Area
SA-RNABotGeo-DC-7 SA-RNABotGeo-DC-8, SA-RNABotGeo-G-1	Desired conditions reduce human impacts on plant communities and exclude recreation uses where they are negatively impacting the resource. Nonmotorized recreation is allowed on a limited basis on designated trails to protect soil conditions. Verde Valley Botanical Area preserves a unique desert community containing Arizona cliffrose.
FW-Graz-G1-7	New and existing water developments, corrals, and other handling and loading facilities should not adversely affect occupied sensitive plant habitat. New water developments should not be constructed in ephemeral or intermittent stream courses to avoid alteration of stream course hydrology. Livestock salting should be located away from known locations of Southwestern Region sensitive plant species so these resources are not affected by associated trampling: Treated areas should be given sufficient rest to ensure plant recovery and that perennial plants would not be permanently damaged by grazing. Nonstructural and structural range improvements should be used and/or located so they do not conflict with rare species and should be relocated and modified when found incompatible. Intensity, timing, duration, distribution, and frequency of livestock grazing should provide for growth, reproduction, and retention of adequate residual cover of desired plant species.
FW-RdsFac-G-2, 3, 9	Road construction and maintenance should use BMPs to minimize effects to highly erodible soils and road alterations should be considered where current location of the road is accelerating soil erosion or having long-term impacts to soil productivity and condition. Existing transportation corridors should be used or realigned before new roads are constructed.
FW-LndAdj-G-1	Lands containing habitat for threatened or endangered species are prioritized for acquisition.
FW-SpecUse-DC-1, 3 FW-SpecUse-G-2	Rights-of-way and authorization for road construction protects national forest and other affected ownerships' lands and resources. New utility corridors avoid botanical areas as a desired condition and should minimize ecological impacts.
Proposed revised plan table 15: "Recreation and Transportation Suitability"	Elimination of mechanized travel from the Verde Valley Botanical Area provides additional protection to a large percentage of this species on the forest.

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-WFP-G-1, 2	Direction to comply with approved recovery plans. Direction for species listed as threatened, endangered, proposed, or candidate takes precedence over direction for species not listed by the U.S. Fish and Wildlife Service.

Summary of Species Effects

Arizona cliffrose is vulnerable to perturbations in the environment because of small population sizes and localized habitat due to unique and specific soil conditions. The implementation of all alternatives would result in a "may affect" determination for Arizona cliffrose and its habitat and the viability of the species would be maintained. The reasons for these findings are described above as well as in the coarse filter section on Desert Communities and the Verde Formation, and in the environmental consequences common to all sections in the "Introduction." Implementation of plan components related to vegetation treatments, livestock grazing, recreation management, watershed management, wildlife, fish or rare plants management, or land acquisition in any of the alternatives may have short-term effects, but would produce long-term benefits to the maintenance and improvement of habitat and Arizona cliffrose populations on the Coconino NF. Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in maintain the viability and persistence of the populations of this species because:

- Plan guidance in the "Wildlife, Fish and Plants" section provides protections for this species by directing the forest to follow recovery plans and improve habitat to promote the recovery of species (replacement p. 64 par 2; FW-WFP-G-1, 2). This strengthens existing Federal law, policy, and Forest Service Manual direction; and
- All alternatives maintain the unique qualities of the Verde Valley Botanical Area which contains habitat for the majority of Arizona cliffrose.

Alternatives B, C, and D would better maintain the viability of this species because plan components for the Desert Communities PNVT would contribute to the maintenance of habitat components needed to maintain Arizona cliffrose habitat and protect its population in the Verde Valley. These plan components are largely absent in alternative A.

A biological assessment will be done and final determination of effects will be determined at that time.

Interior Chaparral PNVT

Coarse Filter

Affected Environment

Amount and Distribution: The Interior Chaparral PNVT occurs at lower elevations, mostly in the Verde River Basin, between the Semidesert Grassland and Piñon-Juniper Evergreen Shrub PNVTs and covers approximately 50,471 acres (approximately 3 percent of the forest). Its location varies from widely scattered pockets within grasslands and woodlands to more extensive areas on steep slopes.

Habitat Quality: The vegetative departure of the Interior Chaparral PNVT is currently low (26 percent) and the trend is static, which means that the habitat generally meets desired conditions and is similar to reference conditions. It is a fire-adapted PNVT and naturally has high-severity fires.

Risk Factors: For Interior Chaparral, the main consequence of the threat of uncharacteristic fire is that fire regimes are altered such that there are more frequent high-intensity fires or uncharacteristically large fires. Twenty percent of this PNVT is in the wildland-urban interface and, as a result, the risk of uncharacteristic fire has social consequences as well as ecological ones.

Associated Species: Three species are associated with Interior Chaparral (see Table 43and table 44). Their threats are equivalent to threats to their habitat and all are adequately addressed at the coarse filter level. The three species are all Forest Service sensitive species: plains harvest mouse, reticulate Gila monster, and Mt. Dellenbaugh sandwort. There are no federally listed or other forest planning species associated with this habitat.

Environmental Consequences – Interior Chaparral PNVT

Habitat Quality and Uncharacteristic Fire

All Alternatives

All alternatives include language that would improve habitat conditions for Southwestern Region sensitive species and would support and provide habitat for viable, self-sustaining populations (FW-WFP-DC-1, 2, 5; new p. 22-1, par 1).

Alternative A

Under alternative A, the structure and composition of Interior Chaparral would remain similar to reference conditions (low departure). Consequently, the associated species would generally exist in an environment similar to one they evolved with. At year 50, this PNVT moves into a moderate departure and continues to slowly trend away from desired conditions in the absence of disturbance.

While alternative A contains guidance to manage fire in this and other PNVTs, it lacks desired conditions and treatment objectives that would change the trend in the majority of this PNVT. This alternative has the highest vulnerability to uncharacteristic fire compared to alternatives B, C, and D. There are few plan components that provide desired conditions specifically for the PNVT outside the wildland-urban interface, however.

Alternative A directs the use of prescribed fire and wildfire with resource objectives (p. 94, par 2) which would help reduce the risk of uncharacteristic fire. However, there are about 39,082 acres (approximately 76 percent) of Interior Chaparral PNVT in wilderness. Overall direction for wilderness supports fire playing a natural role on the landscape, but additional guidelines that direct managers to suppress fires under specific circumstances essentially restrict the use of wildfires with resource objectives (pp. 93–95; p. 95, par 9; p. 111, par 8, 9; p. 112 in its entirety). As a result of this contradictory direction, fire has not been allowed to play its natural role in wilderness.

Guidelines in alternative A would also restrict managing wildfires with resource objectives in the wildland-urban interface, and this could further increase departures in these areas (replacement

pg. 165, par 5; new p. 206-9, no. 6; new p. 206-40, no. 3; new p. 206-47, no. 1). In the Oak Creek Canyon Management Area, where most of the wildland-urban interface in this PNVT is located, the suppression objective is 10 acres and there is a general guideline to "use prescribed fire and mechanical methods to achieve fire management goals" (p. 93, no. 6; replacement p. 184, no. 5).

Despite plan direction that would provide few vegetative desired conditions and both promote and hinder the flexibility to reintroduce fire in this PNVT, this vegetation type would be expected to remain at a low vegetative departure, but move to a moderate fire departure under alternative A.

Alternatives B and C

There are 1,707 acres of Interior Chaparral PNVT in the Walker Mountain recommended wilderness (about 3 percent of the PNVT). Alternatives B and C (and D) do not have the language that restricts burning in wilderness as in alternative A; thus, plan language would not inhibit the use of wildfire with resource objectives. However, there is a high likelihood that wildfire would be suppressed in this wilderness (see "Vegetation and Fire" section) due to factors other than plan language. There would be a low likelihood that vegetative treatments would be conducted due to expense and limited access. Consequently, this localized portion of the PNVT would be more departed and have older age classes of vegetation and higher canopy cover than areas outside of recommended wilderness. Interior Chaparral in Walker Mountain recommended wilderness is about 0.16 percent of the habitat for Mt. Dellenbaugh sandwort and 0.36 percent of the habitat for the reticulate Gila monster, both coarse filter species. Consequently, there is little difference between alternatives for the reticulate Gila monster and plains harvest mouse. There is also no overlap between habitat for Mt. Dellenbaugh sandwort and the additional special area designations and wildlife habitat management areas in alternative C and, therefore, there would be no difference in effects between alternatives B and C to this plant species.

Alternatives B, C, and D

Vegetative departure would remain at a low departure with a trend away from desired conditions under all three alternatives during the 10 years following plan approval. Fire departure would remain moderately departed with a trend away from desired conditions primarily due to missed fire return intervals.

Alternatives B, C, and D do a better job of maintaining species viability than alternative A because they have desired conditions and clearer language regarding the use of fire in both wilderness and wildland-urban interface.

Plan components that provide for viability at the coarse filter/habitat level: Because alternatives B, C, and D provide desired conditions for the structural, compositional, and functional ecology of this PNVT, these alternatives would more likely move this PNVT closer to desired conditions than alternative A, which offers very little guidance for projects outside of the wildland-urban interface (FW-Veg-IC-DC-1-6, FW-Veg-IC-G-1). Desired conditions also include managing for fire (FW-Veg-All-DC-2; FW-Fire-DC-1, 2; FW-Veg-IC-DC-3, 5); native vegetative diversity and structural composition (FW-Veg-All-DC-3; FW-Veg-IC-DC-1, 2, 3); and sustained soil function and reduced accelerated soil erosion (FW-Veg-IC-DC-1, 3, 6). Vegetative trends are similar to alternative A because of the lack of treatment objectives for this PNVT in the forest plan. Treatments that occur in the 20 percent of Interior Chaparral that is located in the wildland-

urban interface would result in more open conditions that would carry lower intensity fire than what is characteristic of this vegetation type (FW-Veg-IC-DC-5). Wildland-urban interface areas in this PNVT, therefore, would not likely provide the density and mosaic of shrubs in different age classes that are characteristic of reference conditions; however, species composition, younger shrubs, and a diverse understory would reflect early stages of succession. Treatments in the remaining 80 percent of the PNVT would result in conditions similar to desired conditions.

In contrast to alternative A, under alternatives B, C, and D, there would be no restriction on where wildfires can be managed for resource objectives. It is unknown how many acres would be treated in this manner under the plan because of the unpredictability of where lightning-caused ignitions will occur and under what conditions. In all cases, these fires would help move Interior Chaparral PNVT toward desired conditions. Although based on a lack of specified treatment objectives, estimated departure and trend for alternatives B, C, and D are not expected to differ from alternative A, however direction in alternatives B, C, and D would better support the tradeoffs necessary for managing this PNVT to better balance ecological and social desired conditions than alternative A.

Plan components that provide for species viability at a finer scale: Additional habitat language in B, C, and D would provide microsites and refugia for species with restricted ranges (FW-WFP-DC-5) and provide the resiliency and redundancy necessary to maintain species diversity and metapopulations (FW-WFP-DC-3). Habitats include the microclimate or smaller scale elements needed for rare plants and animals and elements, and structure and function of the PNVTs exist in sufficient quantities to provide habitat and refugia for the associated species (FW-WFP-DC-5) which will maintain habitat, including shrubby and grassy areas; seeds; and prey for the associated species. Finally, desired conditions in alternatives B, C, and D would promote connectivity between habitats, which would facilitate access to the variety of habitat and topography needed by reticulate Gila monsters (FW-WFP-DC-6, 7, 8).

Summary of Species Effects

All alternatives would maintain the viability of the Plains harvest mouse, Mt. Dellenbaugh sandwort, and reticulate Gila monster and not cause a trend toward listing. All alternatives would maintain Interior Chaparral similar to reference conditions during the life of the plan, and there has been little change in the location of Interior Chaparral relative to where it occurred historically. Alternatives B, C, and D are better because they provide updated plan components. Consequently, there is a low likelihood that associated species would be limited by habitat.

Grassland PNVTs

Coarse Filter

Affected Environment

Amount and Distribution: There are three grassland PNVTs on the Coconino NF: Semidesert Grassland, Great Basin Grassland, and Montane Subalpine Grassland.

The Semidesert Grassland PNVT occurs in the Verde Valley and covers about 89,563 acres (approximately 4.9 percent of the forest). It is bounded by the Desert Communities PNVT at lower elevations and Piñon-Juniper Evergreen Shrub or Interior Chaparral PNVTs at upper elevations. Current vegetation is dominated by perennial bunchgrasses; shrubs such as crucifixion

thorn, velvet mesquite, cat claw mimosa, agaves, and turbinella oak; forbs which may include various buckwheat species; and trees such as Utah juniper and red-berried juniper.

Great Basin Grassland PNVT occurs at elevations between 4,800 and 7,500 feet and covers approximately 92,913 acres (approximately 5 percent of the forest). Great Basin Grasslands are more arid than Montane Subalpine Grasslands, and typical locations include Anderson Mesa and near Wupatki National Monument. Dominant species in this PNVT are mostly grasses such as: western wheatgrass, spike muhly, black grama, Indian ricegrass, threeawn, blue grama, James' galleta, and Sandberg bluegrass. Shrubs, and to a lesser extent trees, are also present and may include: sagebrush, salt brush, Ephedra, snakeweed, winterfat, rabbitbrush, sparse one-seeded juniper, and Colorado piñon pine.

Montane Subalpine Grassland PNVT occurs at elevations between 6,550 and 9,200 feet, with some small, unmapped patches existing at higher elevations. This PNVT covers approximately 23,429 acres (approximately 0.8 percent of the forest), and consists of two subtypes: Montane Grasslands and Subalpine Grasslands. Montane Grasslands occur above the Mogollon Rim and extend upward to about 7,800 feet in elevation and include locations such as Kendrick Park, Antelope Park, and Mule Park. Species in this subtype include: mutton grass, mountain muhly, spike muhly, Arizona fescue, blue grama, red threeawn, squirreltail, yarrow, and pine dropseed. Subalpine Grasslands typically occur above 7,800 feet in areas such as Freidlein Prairie on the San Francisco Peaks. Species in this subtype include: pine dropseed, nodding brome, various sedges, Arizona fescue, mountain junegrass, mountain muhly, muttongrass, and squirreltail. In both subtypes, trees may be present in trace amounts within the grasslands and along their periphery.

Habitat Quality: Semidesert Grasslands are currently highly departed and continue to trend away from reference condition. The Montane Subalpine Grassland and Great Basin Grassland PNVTs have low departures and trend away from reference conditions. There has been a shift from grass to trees, especially trees encroaching at the perimeter of the PNVTs. Fire entered these grassland types from adjacent fire-adapted PNVTs.

Risk Factors: The risk of uncharacteristic fire and introduction of invasive plants are the two main risks to these grassland PNVTs. Frequent low-intensity fires were the principal driving force that maintained the open structure of Semidesert Grasslands; however, current conditions are departed from reference conditions because fire frequency has decreased. The increased interface with developed private land in the Verde Valley has increased the difficulty of maintaining frequent, low-intensity fire in this PNVT. Montane Subalpine Grasslands typically burned as fire from adjacent fire-adapted forest types trickled in along the edges. Departure from fire regimes in these adjacent PNVTs has led to tree encroachment in these grasslands and increased risk of soil damage from fires that could alter species composition by allowing for introduction of invasive plants.

The threat of invasive plants is a concern for Semidesert and Montane Subalpine Grasslands. Invasive plants can compete with native plants, affect available moisture and nutrients, and alter ecological processes, resulting in reduced vigor and abundance of native plant species in localized areas or increased risk of uncharacteristic fire in Semidesert Grasslands. Great Basin Grassland has very few invasive plants present. In Semidesert Grassland, there are a few, widely distributed invasive exotic plant species present, including red brome. In Montane Subalpine Grassland, there are a few invasive exotic species that are ranked high for invasiveness, such as leafy spurge.

Private land development nearby and travel through the area for recreation and land management are possible sources for the introduction and spread of invasive plants in these PNVTs.

Associated Species: Thirty-five species are associated with these habitats (see table 42, table 43, and table 44). The 35 species associated with grassland PNVTs are as follows:

- One is a federally listed species: Black-footed ferret (endangered);
- Eighteen are Forest Service sensitive species: Western Burrowing owl, Ferruginous hawk, dwarf shrew, long-tailed vole, Merriam's shrew, plains harvest mouse, Wupatki Arizona pocket mouse, reticulate Gila monster, Arizona sneezeweed, Arizona sunflower, disturbed (Tusayan) rabbitbrush, Grand Canyon agave, Heath-leaf wild buckwheat, Mt. Dellenbaugh sandwort, Tonto Basin agave, Rusby milkwort, Ripley's wild buckwheat, and Verde Valley sage; and
- Sixteen are other forest planning species: Alberta arctic, Gunnison's prairie dog, pronghorn antelope, Apache beardtongue, Arizona phlox, basin bladderpod, black dropseed, Bigelow's onion, bristlecone pine, common moonwort, grassy slope sedge, Jones' spider flower, Mearn's lotus, Rothrock's hedge-nettle, skunk-top scurfpea, and timberland blue-eye-grass.

The coarse filter is inadequate to address all threats to pronghorn antelope. Pronghorn are discussed further in the fine filter analysis and in the section on management indicator species. Black-footed ferret, Gunnison's prairie dog, and western burrowing owl are also evaluated below.

Environmental Consequences – Grassland PNVTs

Habitat Quality

All Alternatives

All alternatives promote a strategy to address establishment, containment, control, and eradication of invasive plants (p. 23, par 8; FW-Invas-G-1) and have forestwide standards and guidelines to incorporate control measures into projects (p. 69, par 9; FW-Invas-G1). All alternatives point to "Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures: in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests" (USDA Forest Service 2005) as part of the strategy to prioritize and treat invasive plants while still protecting native species from the treatments (p. 69, par 10; FW-Invas-G-2).

Alternative A

Plan language for grasslands in alternative A is outdated. It does not include current science about vegetative condition and natural disturbances and lacks comprehensive desired conditions for composition, structure, and function of grassland systems.

Alternative A would address departure and maintain Montane Subalpine grasslands by restricting off-road driving, avoiding new road construction, relocating existing roads to protect meadows, constructing fences or managing livestock to protect key meadows from grazing, and by piping water from developed springs to adjacent less sensitive areas (replacement p. 159, par 3, 4, 5; replacement p. 160, par 3). Grasslands would also be maintained by removing invading overstory, stabilizing gullies, and seeding with appropriate grass and forage species (replacement p. 160, par 3). For Montane Subalpine and Semidesert Grasslands, lack of treatment objectives in alternative

A would maintain their current departure, and both would have a static or away trend from desired conditions because of a lack of fire and continued tree and shrub encroachment.

In particular, restrictions on the use of wildfires in the wildland-urban interface have a detrimental effect on reintroducing fire in Montane/Subalpine and Semidesert Grassland PNVTs because their landownership pattern is intermixed between public and private ownerships. As a result, the risk of uncharacteristic fire would be higher for this alternative and departures would be maintained in these grasslands when compared to alternatives B, C, and D which allow burning in the wildland-urban interface.

Great Basin Grassland PNVT would be expected to remain at low departure, but trend away under alternative A. Fire suppression objectives in wildland-urban interface would have some effect on maintaining open conditions but enough of the PNVT is found outside of wildland-urban interface that it is unlikely to affect the vegetation departure as much as it would in the other grassland types. Prescribed burning is proposed to control invasion of undesirable plant species.

Alternatives B, C, and D

Effects relative to invasive species, mechanical vegetation treatments, and restrictions on wildfires with resource objectives for Great Basin Grasslands and Montane Subalpine Grasslands would be the same for alternatives B, C, and D.

In contrast to alternative A, alternatives B, C, and D would move Semidesert Grassland and Montane Subalpine Grassland PNVTs slightly closer to desired conditions than alternative A primarily because of their objectives to treat approximately 3,500 acres of Semidesert Grassland and 7,600 to11,400 acres of Montane Subalpine Grasslands during every 10-year period. In Great Basin Grasslands, plan objectives to treat approximately 10,800 to 12,400 acres every10-year period following plan approval would maintain a low departure under all alternatives. The trend would remain static for alternatives B, C, and D and would trend away from desired conditions under alternative A. This would result in improved habitat quality for the species associated with the specific grasslands (table 48).

Under alternatives B, C, and D there would be no restriction on where wildfires can be managed for resource objectives, so the portions of fire-adapted ecosystems in wilderness and wildland-urban interface would be able to use wildfire more effectively. It is unknown how many acres would be treated in this manner under the plan because of the unpredictability of where the lightning-caused ignitions will occur and under what conditions. In all cases, these fires would help move terrestrial vegetation toward desired conditions and would reduce the risk of uncharacteristic fire across the landscape which, in turn, would reduce the risk of uncharacteristic fire to adjacent grassland PNVTs.

In addition to the invasive species strategy common to all alternatives, alternatives B, C, and D have forestwide desired conditions that manage invasive species at a level that does not affect the sustainability of native species or disrupt ecological functioning. These desired conditions recognize the presence of invasive species, and call for prioritizing treatment of plants that rate highest for invasiveness, such as leafy spurge or those that alter ecosystem function, such as cheatgrass. This would allow these alternatives to address the threat of invasive plants in grassland settings better than alternative A because almost all grasslands have small populations

of nonnative plants, but it is the scale and aggressiveness of the spread of nonnative plants that accelerates departure in terms of composition.

Table 48. Acres of improved habitat quality for grassland associated species

Species	Semidesert Grassland Improvement	Great Basin Grassland Improvement	Montane/Subalpine Grassland Improvement
Basin bladderpod, Bigelow's onion, Jones' spider flower, Mearn's lotus, pronghorn antelope, skunk-top scurfpea, Ferruginous hawk, Mt. Dellenbaugh sandwort, plain's harvest mouse, reticulate Gila monster	3,500 acres every 10 years		
Apache beardtongue, black dropseed, grassy slope sedge, Gunnison's prairie dog, pronghorn antelope, Rothrock's hedge-nettle, timberland blue-eye grass, Arizona sneezeweed, Ferruginous hawk, long-tailed vole, western burrowing owl, black-footed ferret			7,600 to 11,400 acres every 10 years
Gunnison's prairie dog, pronghorn antelope, Rothrock's hedge-nettle, Arizona sunflower, disturbed (Tusayan) rabbitbrush, Ferruginous hawk, western burrowing owl, black-footed ferret		10,800 to 12,400 acres every 10 years	

Additional plan components that would benefit species associated with grasslands are shown in table 49. Alternatives B, C, and D do a better job of maintaining species viability than alternative A because desired conditions have been updated and clearer language regarding the use of fire in both wilderness and wildland-urban interface. Additional habitat language in B, C, and D would provide microsites and refugia for species with restricted ranges, and provide the resiliency and redundancy necessary to maintain species diversity and metapopulations. Habitats include the microclimate or smaller scale elements needed for rare plants and animals and elements, and structure and function of the PNVTs exist in sufficient quantities to provide habitat and refugia for the associated species which will maintain habitat, including shrubby and grassy areas; seeds; and prey for the associated species. Finally, desired conditions in alternatives B, C, and D would promote connectivity between habitats, which would facilitate access to the variety of habitat and topography needed by reticulate Gila monsters.

In addition, these three alternatives would have two management approaches that emphasize collaboration with partners and stakeholders on grassland restoration, grassland connectivity, and education; as well as coordination with the Arizona Game and Fish Department on objectives for wildlife conservation, education, habitat restoration, and improvements, particularly regarding pronghorn and prairie dogs.

Finally, Semidesert Grassland, Great Basin Grassland, and Montane Subalpine Grassland PNVTs have better descriptions of desired conditions under alternatives B and D and, consequently, projects would move more consistently toward the structural, compositional, and functional ecology of the PNVT than projects implemented under alternative A.

Mechanical treatments that reduce the risk of uncharacteristic fire would have some restrictions under recommended wilderness direction in alternative C. However, this restriction would apply to very small areas of Great Basin and Montane Subalpine Grasslands (2,327 acres and 6 acres, respectively) and, therefore, it would not result in different departures or risk of uncharacteristic fire in these PNVTs.

There are 2,327 acres of Great Basin Grassland PNVT in the Strawberry Crater recommended wilderness (about 2.5 percent of the PNVT); 132 acres of Semidesert Grassland PNVT in Davey's, and no acres of Montane Subalpine Grassland in recommended wilderness in alternative B. Alternatives B and C (and D) do not have the plan language that restricts burning in wilderness as in alternative A; thus, plan language would not inhibit managing wildfire with resource objectives. There is a low likelihood that wildfires would be suppressed in this wilderness (see "Vegetation and Fire" section) due to factors other than plan language. There would be a low likelihood that vegetative treatments would be conducted due to expense and limited access. Consequently, these small and localized portions of the PNVT could be more departed and have higher proportions of trees and shrubs compared to areas outside of recommended wilderness and compared to alternatives A and D. Because the extent is so small, this would not impact overall departure or trends of the PNVTs, nor would it impact the viability of the associated species.

Alternative C

Under alternative C, the Cottonwood Basin Fumeroles Geological Area would be expanded to better protect plant populations and diversity in the Semidesert Grassland PNVT.

Under alternative C, fewer acres would be available for mechanical treatments to prevent tree encroachment because 12,000 acres of Semidesert Grassland (11 percent of the PNVT) would be recommended for wilderness and access would be limited. Thus, tree encroachment would either be maintained or progress most rapidly in wilderness in wildland-urban interface and wilderness due to lack of mechanical treatments. This would increase the vulnerability of wildlife habitat already impacted by human development to uncharacteristic fire and decrease the naturalness of designated wilderness. Nearly 5,700 acres (6.3 percent of the PNVT) would have a moderate to very high likelihood of wildfires being suppressed which means that these localized areas would be more departed than areas outside of wilderness with a higher canopy, higher tree and shrub cover, and higher risk of uncharacteristic fire. Additionally, there would be less understory and herbaceous cover in these areas. The effect to species would be minimized because these acres are scattered in four recommended wilderness areas: Black Mountain, Cedar Bench, Walker Mountain, and Deadwood Draw.

Nearly 6,500 acres of Semidesert Grassland (about 7.2 percent of the PNVT) would occur in recommended wilderness areas where there is a low likelihood of wildfires being suppressed; thus, the PNVT departure could be lowered using wildfire in site-specific instances. This would occur in three recommended wilderness areas: Davey's, Cimmaron-Boulder, and Hackberry. This would be beneficial for the species preferring more open habitat and would improve habitat quality.

Table 49. Additional plan components under alternatives B, C, and D which would provide for the viability of grassland-associated species at the coarse filter/habitat level

Location Code in Proposed Revised Plan	Intent of Plan Components	Benefiting Species
FW-WFP-DC-3,5; FW-Veg-Grass-SDG-DC-1,2,3,4,5,6; FW-Veg-Grass-GB&MSG-DC-1,2,3,4,5,6,7; FW-Veg-All-DC-14; FW-SpecUse-G-13	Habitat provides resiliency and redundancy necessary to maintain species diversity and metapopulations. PNVT structure and function exists in sufficient quantities to provide habitat and microsites for associated species and those with restricted ranges; promotes diversity of regenerating native understory vegetation in terms of species, heights, seral stages, density, cover; unique plant community habitats maintain self-sustaining populations of associated native plant species; outfitter-guide motor vehicle use and camping activities should be excluded from areas with sensitive resource issues, such as a high density of archaeological sites or areas with sensitive or rare plants.	All associated species
FW-WFP-DC-6,7,8; FW-Veg-Grass-All-DC-1, FW-Veg-Grass-GB&MSG-DC-3	Promotes access to and connectivity between habitats.	Reticulate Gila monster
FW-Veg-Grass-GB&MSG-DC-4	Leafy spurge does not compete with rare plant species such as Arizona sneezeweed.	Arizona sneezeweed, Apache beardtongue
FW-Veg-Grass-GB&MSG-DC-6	Fine scale features such as wet areas and rock piles are present within Montane Grasslands to support rare plant species.	Apache beardtongue, Arizona phlox, Basin bladder pod, Black dropseed, Jones' spider flower, Mearn's lotus, Rothrock's hedgenettle
FW-Veg-Grass-GB&MSG-DC-7	Within site capability, a mosaic of vegetation density exists across the landscape… that provides cover for ground-nesting birds and pronghorn fawns to bare areas from natural activities such as prairie dog burrowing.	American pronghorn antelope, Black-footed ferret, Western burrowing owl, Gunnison's prairie dog
FW-Veg-All-DC-9,10, FW-WFP-DC-14	Rare and culturally important plant species are valued, and their habitats are enhanced and protected. Permits for cutting stalks off of agaves should not be issued, in order to protect stalks used as nesting and overwintering habitat for key pollinators of desert ecosystems, such as carpenter bees. Exceptions may be made for limited research purposes.	Grand Canyon agave, Tonto Basin agave

Location Code in Proposed Revised Plan	Intent of Plan Components	Benefiting Species
FW-Veg-All-DC-13	Endemic rare plant communities are intact and functioning.	Arizona cliffrose, Apache beardtongue, Arizona phlox, Basin bladderpod, Grand Canyon agave, Heath-leaf wild buckwheat, grassy slope sedge, Jones' spider flower, Jones' wild buckwheat, Mearn's lotus, Bigelow's onion, black dropseed, common moonwort, Arizona sneezeweed, Arizona sunflower, Mt. Dellenbaugh sandwort, Tonto Basin agave, Rusby milkwort, Ripley's wild buckwheat, and Verde Valley sage, Rothrock's hedge-nettle, timberland blue-eye-grass, Yavapai wild buckwheat, skunk-top scurfpea.
FW-Hrtg-DC-1	Historic and prehistoric sites are preserved and protected for their cultural importance and are generally free from adverse impacts or impacts are minimized through tribal consultation. Site integrity and stability is protected and maintained on sites that are susceptible to imminent risks or threats, or where values are rare or unique.	Grand Canyon agave, Tonto Basin agave
FW-Rec-Disp-DC-1, 2, 3	Recreation activities are balanced with the ability of the land to support them and create minimal user conflicts. Recreation demand is balanced with other forest desired conditions unless increasing capacity results in unacceptable negative effects on natural resources. Managed recreation stays within this capacity with the exception of holiday weekend use levels that may exceed capacity on a short-term basis. Recreation activities do not significantly impact resources such as soils, vegetation and wildlife.	Arizona sneezeweed, Arizona sunflower, disturbed (Tusayan) rabbitbrush, Grand Canyon agave, Heath-leaf wild buckwheat, Mt. Dellenbaugh sandwort, Tonto Basin agave, Rusby milkwort, Ripley's wild buckwheat, Verde Valley sage, Apache beardtongue, Arizona phlox, Basin bladderpod, black dropseed, Bigelow's onion, Jones' spider flower, Mearn's lotus, Rothrock's hedge-nettle, skunk-top scurfpea, timberland blue-eye grass
FW-Rec-Disp-DC-7	Resource damage from unauthorized motorized trails is minimal. Unauthorized trails are rehabilitated and mitigate long-term soil and water impacts. Motorized trails are located with minimal impacts to cultural sites, highly erodible soils, wildlife, and botanical resources.	Arizona sneezeweed, Arizona sunflower, disturbed (Tusayan) rabbitbrush, Grand Canyon agave, Heath-leaf wild buckwheat, Mt. Dellenbaugh sandwort, Tonto Basin agave, Rusby milkwort, Ripley's wild buckwheat, Verde Valley sage, Apache beardtongue, Arizona phlox, Basin bladderpod, black dropseed, Bigelow's onion, Jones' spider flower, Mearn's lotus, Rothrock's hedge-nettle
FW-Veg-Grass-SDG-O-1; FW-Veg-Grass-MSG-O-1, FW-Veg-GBG-O-1	Vegetation treatment objectives increase movement toward desired conditions.	All associated species

Location Code in Proposed Revised Plan	Intent of Plan Components	Benefiting Species
FW-Fire-DC-1,2; SA-Wild-All-DC-9	Wildfires with resource objectives would be managed more effectively.	All associated species
FW-Invas-DC-1, FW-Veg-All-DC-3	Management of invasive species at levels that do not affect the sustainability of native species allows for prioritization of species with highest rate of invasiveness.	Arizona cliffrose, Apache beardtongue, Arizona phlox, basin bladderpod, Grand Canyon Agave, Heath-leaf wild buckwheat, grassy slope sedge, Jones' spider flower, Jones' wild buckwheat, Mearn's lotus, Bigelow's onion, black dropseed, common moonwort, Arizona sneezeweed, Arizona sunflower, Mt. Dellenbaugh sandwort, Tonto Basin agave, Rusby milkwort, Ripley's wild buckwheat, and Verde Valley sage, Rothrock's hedge-nettle, timberland blue-eye-grass, Yavapai wild buckwheat, skunk-top scurfpea.

Summary of Species Effects

Considering the coarse filter analysis, plan components in all alternatives maintain the viability and do not cause a trend toward listing for: black-footed ferret, western burrowing owl, Gunnison's prairie dog, Ferruginous hawk, dwarf shrew, long-tailed vole, Merriam's shrew, plains harvest mouse, Wupatki Arizona pocket mouse, reticulate Gila monster, Arizona sneezeweed, Arizona sunflower, disturbed (Tusayan) rabbitbrush, Grand Canyon agave, Heath-leaf wild buckwheat, Mt. Dellenbaugh sandwort, Tonto Basin agave, Rusby milkwort, Ripley's wild buckwheat, and Verde Valley sage, Alberta arctic, Apache beardtongue, Arizona phlox, Basin bladderpod, black dropseed, Bigelow's onion, bristlecone pine, common moonwort, grassy slope sedge, Jones' spider flower, Mearn's lotus, Rothrock's hedge-nettle, skunk-top scurfpea, and timberland blue-eye-grass.

All alternatives would maintain the viability and persistence of associated species because plan components address threats to the habitat and allow for treatment of invading overstory and invasive plants. Language in alternative A, however, is outdated from the standpoint of including current science and has not kept pace with the Forest Service shift in perspective to more ecologically based management. Guidance for the grasslands PNVTs is better in alternatives B and D than in alternative A because:

- desired conditions are more clearly articulated for the different grassland types, incorporate natural disturbances and an ecological foundation so the composition, structure, and processes of these habitats better provide for the needs of the species;
- plan objectives slow or reverse the trend of the habitats;
- remove restrictions for burning in the wildland-urban interface; and
- guidelines more specifically address invasive plants.

Alternative C would have viability consequences similar to alternatives B and D, except in the Semidesert Grasslands PNVT where plan direction would not maintain the quality of habitat as

well in approximately 11,000 acres of recommended wilderness. Vegetative treatments that require motorized equipment would not be permitted and, therefore, these areas could remain at higher overall departure than nonwilderness areas over the long term.

Fine Filter – Black-Footed Ferret, Western Burrowing Owl, Gunnison's Prairie Dog

Threatened and Endangered Species (Table 42), Southwestern Region Sensitive Species (Table 43), Other Forest Planning Species (Table 44)

Affected Environment

Distribution and Habitat: There are no existing ferrets or records of ferrets on the Coconino NF. There are historical records fairly close to the boundary of the forest. Ferrets have been reintroduced as an experimental nonessential population in the Aubrey Valley near Seligman, Arizona, since 1996 (USFWS 1998a). The U.S. Fish and Wildlife Service believes that undiscovered wild populations of black-footed ferrets may still exist where prairie dogs persist (USFWS 2006). Black-footed ferrets occupy prairie dog burrows and feed on them.

Gunnison's prairie dogs are the species found on the forest. Gunnison's prairie dogs are associated with Great Basin Grassland, Montane Subalpine Grassland, and Piñon-Juniper with Grass PNVTs. They feed on grasses, sedges, forbs, and seeds. Total ground cover within colonies documented in several studies ranged from 39 to 74 percent (Underwood 2007). There are about between 2,900 acres (Underwood 2007) and 7,294 acres (Forest GIS data) of Gunnison prairie dog colonies on the forest.

Prairie dogs are considered to be a keystone or "strongly interactive" species (Soulé in Underwood 2007). They alter grasslands by modifying vegetation structure and composition, soil structure, nitrogen concentration in plant shoots; by creating a mosaic of different patch structures within the grassland matrix and maintain grassland ecosystems by preventing encroachment of woody species. Prairie dogs are food for black-footed ferrets, western burrowing owls, golden eagles, and ferruginous hawks. Their burrows are used for shelter by ferrets and burrowing owls (also nesting cavities), as well as by a variety of reptiles and insects.

There are no known western burrowing owls on the forest, but there is potential habitat associated with Gunnison's prairie dogs. There is one confirmed sighting of this species near the forest at about 6,600 feet elevation in a prairie dog colony near Flagstaff (Corman and Wise-Gervais 2005). Western burrowing owls are found in flat, open, low-stature grasslands, sparsely vegetated desert shrub, and edges of human-disturbed land. They take over burrows of prairie dogs and ground squirrels and dens of coyote, fox, and badger. They are associated with the same PNVTs as prairie dogs.

Risk Factors: There are no species-specific threats to black-footed ferrets on the forest because none occur here, although the potential for reintroduction exists.

The primary threat to Gunnison's prairie dogs is sylvatic plague, a nonnative pathogen transmitted by fleas. This is outside Forest Service authority to control. Shooting of prairie dogs is authorized by the Arizona Game and Fish Department, and there is a seasonal shooting closure to protect pregnant and lactating females and young. However, poorly managed livestock grazing

can have negative effects on prairie dogs, but well-managed grazing has been found to benefit black-tailed prairie dogs (Underwood 2007).

There are no species-specific threats to western burrowing owls because none occur here.

Environmental Consequences - Black-Footed Ferret, Western Burrowing Owl, and Gunnison's Prairie Dog

Alternative A

Alternative A indirectly affects habitat for prairie dogs that could potentially support western burrowing owls and the reintroduction of ferrets. According to the "Soil" section of the DEIS, soil conditions would slowly improve in Great Basin Grassland but not change in Montane Subalpine Grassland and would continue to decline in Piñon-Juniper with Grass. Trees and shrubs would continue to increase in Great Basin Grassland and Montane Subalpine Grassland, resulting in decreased amounts of open grassland states. Similarly for Piñon-Juniper with Grass under alternative A, this PNVT would be managed as woodland with a predominantly closed canopy, restricting restoration of the grassland component. The understory vegetation needed to maintain the fire regime would not be present, in turn negatively impacting understory composition and structure. Vegetation modeling results (see "Fire and Vegetation" section) indicate that although alternative A would reduce the overall departure of Piñon-Juniper with Grass, the amount of acres treated would not be enough to maintain or continue to move toward desired conditions over the long term.

Alternative A supports reintroduction of listed species and has guidance for habitat that supports prairie dogs (replacement p. 64 par 2, 6; new p. 64-1 par 1, 2; new p. 65-12 thru replacement p. 66). Plan components address prevention, control and eradication of invasive plants, and would result in habitats dominated by native species (see "Grasslands" under the coarse filter section above). Range management direction would improve unsatisfactory range conditions and would maintain seral grasslands where type conversions have occurred in the past (replacement p. 150 par 7; replacement p. 164 par 5; replacement p. 168 par 5).

Under alternative A, there are about 251,902 acres of habitat in more primitive recreation opportunity spectrum (ROS) classes. This would reduce noise disturbance; limit the ability of managers to build roads in this area in the future; and encourage closure and decommissioning of existing roads.[48]

Alternatives B, C, and D

These alternatives indirectly affect habitat for prairie dogs that could support the reintroduction of ferrets and potential habitat for western burrowing owls.

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[48] ROS class calculations for species analysis were done at a finer scale than the forestwide ROS calculations. Forestwide ROS calculations used in other parts of this DEIS included all the land within the administrative boundaries of the forest, regardless of whether the forest manages those lands. The forestwide approach recognizes differences between ROS classes identified for alternative A (which contains a unique ROS class called nonmanaged forest (NON-F) and alternatives B, C, and D (which only include established ROS classes). In the species ROS analysis, only Forest Service managed lands were analyzed. Nonetheless, under alternative A, the NON-F ROS class still exists. Where it does exist under Alternative A, it is considered to be a more developed recreation setting.

Compared to alternative A and as described in the coarse filter section above and table 50, alternatives B, C, and D update and provide more direction for habitat for these three species including: native vegetation of a structure and composition that provide food and cover for prairie dogs, restoration of natural fire regimes, and maintenance of long-term soil productivity . Plan components address prevention, control and eradication of invasive plants, and would result in habitat dominated by native species. Vegetation, soil, and wildlife objectives would improve ferret, Western burrowing owl, and prairie dog habitat. These would include: restoring or enhancing 10,800 to 12,400 acres of Great Basin Grassland and 7,600 to 11,400 acres of Montane Subalpine Grassland during each 10-year period during the life of the plan, and for Piñon-Juniper with Grass, mechanically treat between 1,000 to 10,000 acres and use naturally ignited fires to treat 3,750 acres with low- to mixed-severity fire every 10 years.

Other objectives that would potentially support the understory habitat needed as food for prairie dogs include treating 100,000 to 350,000 acres of impaired and unsatisfactory soil conditions every 10 years, restoring or enhancing at least 60,000 acres of terrestrial wildlife habitat each 10 years, and implementing recovery actions for federally listed and sensitive species, if some of these treatments occur within grassland habitats. The distribution of mollisol soils will guide restoration efforts in historic grasslands, to reduce fragmentation and provide for better habitat continuity across the landscape. Other plan components that are beneficial to habitat for these grassland species include desired conditions that promote grazed areas with stable soils and functional hydrology; and guidelines that would give sufficient rest after burning or mechanical treatment to ensure plant recovery and that would manage the intensity, timing, duration, distribution, and frequency of livestock grazing to provide for growth, reproduction, and retention of adequate residual cover of desired plant species.

Table 50. Plan components under alternatives B, C, and D that would provide for viability of black-footed ferret, Gunnison's prairie dog, and western burrowing owl in grassland PNVTs and associated habitat types at the coarse filter/habitat level

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Veg-Grass-GB&MSG-DC-1, 3, 7; FW-Veg-Grass-All-DC-0-1; FW-Veg-Grass-GBG-O-1; FW-Veg-Grass-MSG-O-1; FW-Veg-PJ-PJG-O-1	Provide a range of ground cover conditions that would support ground-nesting birds, pronghorn fawning, and prairie dog burrowing; Grasslands are open, grassy areas with functional and productive soils and watersheds, and provide habitat for wildlife and support the natural fire regime. Grasslands are connected based on the distribution of Mollisol soils and not fragmented. Restore or enhance 7,600 to 11,400 acres of Montane/Subalpine Grassland and 10,800 to 12,400 acres of Great Basin Grassland during each 10-year period during the life of the plan. Mechanically treat between 1,000 and 10,000 acres and use naturally ignited fires to treat 3,750 acres of Piñon-Juniper with Grass PNVT with low to mixed severity fires every 10 years.
FW-Invas-DC-0-1; FW-Invas-G-1	Invasive species are absent or exist at levels where they do not disrupt ecological functioning or affect the sustainability of native and desirable nonnative species. Project designs incorporate measures to prevent, control, contain, and eradicate priority infestations or populations of invasive species.
FW-Soil-DC-2; FW-Soil-O-1, FW-WFP-O-1, 2,3	Improve soil conditions, overall wildlife habitat, and in some grasslands within treated areas, implement recovery actions for federally listed and sensitive species.

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Graz-DC1, 2; FW-Graz-G3, 4, 7).	Rangelands provide large areas of unfragmented open space. These open spaces sustain biological diversity and ecological processes; grazing management maintains the desired composition, structure, and conditions of plant communities. Forage, browse, and cover needs of wildlife and authorized livestock should be managed in balance with available forage. Areas that are grazed have satisfactory soils, functional hydrology, and biotic integrity.

Alternative C

Alternative C indirectly affects potential habitat for prairie dogs that could support the reintroduction of ferrets and potential habitat for western burrowing owls. This alternative has similar consequences as alternative B in addition to the following items.

Of the 13 recommended wilderness areas, only 2 contain grassland habitat that could support these grassland species. Railroad Draw contains 6 acres of Montane Subalpine Grassland and Strawberry Crater. Since Strawberry Crater is recommended in alternative B as well, alternative C differs only in proposing 6 acres of Montane Subalpine Grassland, which is a negligible difference.

Alternative C proposes eight wildlife habitat management areas (WHMAs). Five of these include grassland habitat (see table 51) that may be able to support prairie dog colonies. Desired conditions for WHMAs would focus on protecting wildlife and their habitats. Guidelines for WHMAs would restrict or limit public motorized access, and in the Anderson Mesa WHMA, they would restrict road density to no more than an average of 1 mile of road per square mile. Another guideline specifies that roads in WHMAs not open for public motorized access are managed for administrative use or decommissioned. An additional guideline would limit some recreational activities such as nonresearch related large group events and commercial tours within wildlife habitat management areas. Overall, this direction could reduce human disturbance to grassland species and their habitat; however, project-specific NEPA would need to occur to determine the exact locations of restricted public motorized access within these WHMAs.

Table 51. Acres of PNVTs that would support prairie dogs in wildlife habitat management areas

WHMA	Great Basin Grassland	Montane/Subalpine Grassland	Piñon-Juniper with Grass	Total
Anderson Mesa	54,873	1,132	128,195	184,200
East Clear Creek	0	254	0	254
Hospital Ridge	0	13	0	13
Jack's Canyon	4,389	0	2,279	6,668
Pine Grove	370	346	0	716
Total	59,632	1,745	130,474	191,851

Anderson Mesa and Jack's Canyon Wildlife Habitat Management Areas would benefit these species the most because grassland restoration is emphasized (nearly 191,000 acres) along with Gunnison's prairie dogs in Anderson Mesa and pronghorn, another grassland species, in Jack's Canyon.

There is an overall shift of 1,806 acres to more primitive recreation opportunity spectrum (ROS) classes in alternative C compared to alternative A. This would result in an overall negligible impact (about 0.5 percent of potential habitat) to ferret habitat from the ROS objectives and the impacts would differ by PNVT. There would be more positive impacts in the Great Basin Grassland and Montane Subalpine Grassland portions of the habitat due to shifts to more primitive ROS classes (about 11,587 acres) which would result in reduced disturbance. However, about 9,781 acres of Piñon-Juniper with Grass habitat would shift to less primitive ROS classes resulting in potentially more disturbance.

Alternative D

Alternative D differs from alternative B only in not recommending any new wilderness areas and allowing mechanized recreation in botanical and geological areas on designated trails. Not adding any new wilderness areas makes this aspect of alternative D the same as alternative A. Recreation opportunity spectrum objectives for the three grassland PNVTs are the same as alternative B, and the remainder of effects of this alternative are similar to alternative B.

Summary of Species Effects

For the black-footed ferret, implementation of any alternative would result in a finding of "may affect" primarily through indirect effects of management of potential habitat that could support the reintroduction of ferrets as described above. Collectively, the guidance in all alternatives would support reintroduction of listed species and have plan components that would support maintenance and improvement of prairie dog habitat. A biological assessment will be done for the selected alternative and final determination of effects will be determined at that time. From the landscape perspective, black-footed ferrets have a low likelihood of limitation (i.e., being limited by their habitat) for Great Basin Grassland Montane Subalpine Grassland and medium likelihood of limitation for Piñon-Juniper with Grass. All alternatives address the threat of invasive plants to their habitat and have objectives that would encourage healthy resilient systems supported by intact soils, natural fire regimes, and a properly functioning watershed. Collectively, these conditions would result in habitats dominated by native species. As described in the introduction of the "Wildlife, Fish, and Plants" section, plan components in all alternatives support managing for viable self-sustaining populations of special status species, contributing to the survival and recovery of listed species, and allowing for the repatriation of extirpated species, and that direction for species listed as threatened, endangered, proposed, or candidate take precedence over direction for species not listed by the U.S. Fish and Wildlife Service as well as direction to comply with approved recovery plans.

Alternatives B, C, and D would maintain the viability of Gunnison prairie dogs and western burrowing owls and not cause a trend toward listing because of plan components that update desired conditions for their habitats providing vegetative structure and composition that provide habitat for the species; emphasize native species and restoration of natural disturbance patterns and address their habitat threats.

Natural fire regimes would be restored to reduce invasion of woody species, addresses invasive plants, habitat fragmentation/barriers, avoid excessive grazing, and minimize habitat degradation.

Fine Filter – Pronghorn Antelope

Other Forest Planning Species (Table 44)

Affected Environment

Pronghorn are a species of high socioeconomic interest and are identified as a management indicator species for MA 9 – Mountain Grassland, MA 10 – Grassland and Sparse Piñon-Juniper Above the Rim, MA 11 – Verde Valley, and in grassland habitats within the Flagstaff/Lake Mary Ecosystem Analysis Area in the 1987 plan. Almost all of Anderson Mesa, which is important pronghorn habitat, is within MA 10. The management emphases in these management areas are on livestock grazing, visual quality, and wildlife habitat, specifically, to emphasize management of pronghorn. The corresponding PNVTs are Great Basin Grasslands and Montane Subalpine Grasslands where pronghorn primarily occur, and Semidesert Grasslands where they occur in small numbers in the Verde Valley. There are approximately 206,026 acres of suitable pronghorn habitat currently on the forest (table 44).

Risk Factors: Causes of decline in pronghorn herds across Arizona are numerous, but generally consistent. Suboptimal habitat quality is a significant factor. Continued urban sprawl and associated highway construction has fragmented and damaged quality pronghorn habitat (the latter continues to cause direct mortality via collision with vehicles). Grasslands historically dependent upon regular fire return intervals have been reduced in size by invasion of juniper and shrub species resulting from decades of fire suppression. Past livestock grazing and historic fencing practices have reduced habitat quality and created barriers that pronghorn cannot maneuver. Finally, persistent drought and predation has impacted pronghorn populations to varying degrees statewide. The combination of these factors has led to a reduction in habitat availability and quality, a substantial decline in fawn recruitment, and a correlated increase in efficiency of pronghorn predators (AZGFD 2009).

The primary fine filter threats to pronghorn under Forest Service control are: disturbance during the fawning season from activities such as motorized use, off-highway vehicles, and management activities such as fence construction (table 44). Alternative A also addresses that vegetative treatments and fire can be used to maintain antelope habitat, when limited to avoid the fawning season.

Environmental Consequences – Pronghorn Antelope

Alternative A

Standards and guidelines that implement the direction to manage for pronghorn in the MAs listed above call for maintaining and improving mountain meadows and grasslands by removing invading overstory, controlling invasive plant species, prescribed burning, and other methods. Restrictions on off-road driving if resource damage is occurring and a guideline to avoid construction of new roads in MA 9 are beneficial to maintaining and improving grassland habitat. Range management direction is to improve unsatisfactory range conditions and to maintain seral grasslands where type conversions have occurred in the past. Prescribed fire is used to accomplish resource objectives outside of the urban interface. In MA 11 Verde Valley, a standard

and guideline specific to pronghorn is "Determine the need to control invasion of undesirable plant species in antelope range to improve and protect wildlife habitat values. Where necessary, implement the control measures, such as prescribed burning to improve antelope habitat." Plan direction for these three management areas that call for vegetation treatments, avoidance of new road construction, and restrictions on off-road driving habitat improvement would improve grassland habitats for pronghorn and reduce disturbance from motorized vehicles.

In 1998, the forest plan was amended to include guidance specific to the Red Rock Area on the Red Rock Ranger District (amendment 12). This included MA 27 – Savannah, which contains most of the Semidesert Grassland on the forest. In 2002, the forest plan was amended to include guidance specific to the Flagstaff/Lake Mary Ecosystem Analysis Area on the Flagstaff Ranger District (amendment 17). Amendment 17 provided management emphasis for all MIS species based on the habitats contained in the new management areas, including grasslands. Additional emphasis was provided to restore and maintain grasslands to benefit pronghorn and other grassland species in MA 32, Deadman Mesa, which contains Great Basin Grassland habitat.

Management Area 27, Savannah, is within the Sedona-Oak Creek Planning Area and contains Semidesert Grassland habitat interspersed with Piñon-Juniper Evergreen Shrub. One of the management emphases is that high-quality grassland supports a diversity of wildlife. Guidance is very strong in this management area for pronghorn and its habitat. (See 1987 plan pp. 206-50 to 206-53). Objectives, standards, and guidelines specific to pronghorn are:

- Acquire certain private parcels to reduce habitat fragmentation and otherwise improve antelope and grassland species habitat.
- This management area is characterized by an open vegetation structure. Use prescribed fire and other mechanical treatments to improve forage conditions for wildlife, particularly birds and antelope. Increase the area occupied by grasses and forbs while decreasing the area occupied by shrubs and trees in comparison to recent historic levels.
- Develop conditions that:
    - provide high-quality habitat for upland game birds and deer;
    - improve and expand antelope and grassland bird habitat through such means as fence, road, fire, and human access management;
    - provide adequate cover/security for animal shelter and foraging; and
    - improve forage conditions for wildlife, particularly quail.
- Identify and protect antelope fawning areas.
- Work together with the Arizona Game and Fish Department to develop hunting regulations for antelope below the rim in Game Management Unit 6B to protect and enhance the antelope population there.
- To minimize restriction of antelope movement, locate fences one-eighth mile from roads if road right-of-way fencing is required. Remove fences that are no longer needed; use smooth bottom wires and meet the wildlife standards as stated in FSH 2670 and 2240 for all existing or new fences.
- Locate roads to maintain adequate cover for animal shelter and foraging between roads, especially in locations with high road densities.

- Use commercial and personal use firewood sales and Christmas tree cutting areas to reduce encroachment of invasive tree species and maintain open grassland habitat for antelope.
- Acquire large blocks of undeveloped private property to improve antelope habitat and to prevent impacts on National Forest System (NFS) lands from residential and associated infrastructure development. Acquire the Bradshaw Ranch property.
- Road and trail locations must consider antelope protection goals. Recreation goals are subordinate to antelope protection.
- If the demand can be demonstrated, allow commercial tours to provide opportunities for scenic viewing, natural history education, wildlife viewing, and other activities that are compatible with antelope protection and Savannah Management Area goals.

Management Area 32, Deadman Wash, is within the Flagstaff/Lake Mary Ecosystem Area. It contains Great Basin Grassland adjacent to Piñon-Juniper Grassland and abuts Wupatki National Monument. Management emphasis is to restore and maintain grasslands and grassland-adapted wildlife species, especially antelope.

In addition to management area standards and guidelines for grasslands, there are numerous other standards and guidelines throughout the 1987 plan for pronghorn and big game species that provide emphases for management of pronghorn, and to minimize impacts from roads and fences. They include guidance for fence specifications to allow wildlife passage, forage habitat improvement, off-road driving restrictions in fawning areas and other sensitive habitats, installation of gates or barriers to limit or restrict motorized access into key winter ranges, cooperation with the Arizona Game and Fish Department to meet their management goals and objectives, and involving interested groups or individuals in achieving objectives. Additionally, a forestwide standard and guideline that specifically mentions pronghorn antelope is: interior fences in an allotment are generally three-wire fences with the bottom wire smooth and conform to the above height restrictions. Install antelope passes, let-down fences, electric fences, or elk jumps wherever necessary to improve wildlife travelways (p. 69).

Implementation of these standards and guidelines for improvement of grasslands habitats will be beneficial for pronghorn and will help to maintain their viability. However, the current forest plan identifies quantitative objectives for timber, roads, and recreation developments, but not for grassland improvement. Therefore, the expected amount of treatments to improve grasslands is not known, nor the expected timeframe.

Under alternative A, there are about 129,650 acres of habitat in more primitive, less developed recreation opportunity spectrum (ROS) classes. This would reduce noise disturbance; limit the ability of managers to build roads in this area in the future; and encourage closure and decommissioning of existing roads.

Alternatives B, C, and D

Table 52 highlights plan components that address the fine-filter threats mentioned above and specifically address pronghorn viability. In addition, many of the plan components listed in table 49 and in the section after “Environmental Consequences for All Species Common to All Alternatives” would also provide for pronghorn viability. Desired conditions and objectives that target grassland restoration would improve overall vegetation composition and structure and reduce fragmentation; this, in turn, should improve fawning habitat by providing better forage

and protection from predators. As historic grasslands are restored, connectivity would also be improved, allowing for better genetic flow across populations and the ability to be more responsive to climate change, which could shift habitat use patterns. Specific standards and guidelines focus on reduced disturbance and improved reproduction. Desired conditions for livestock management specify grazing is balanced with wildlife needs and forage capacity while several guidelines ensure that fence design, construction, modification, and removal will consider pronghorn needs. Finally, specific desired conditions for the Anderson Mesa Management Area should ensure that herds have a sustainable, healthy population capable of accessing all vital components of its habitat including winter range.

Table 52. Plan components under alternatives B, C, and D that would provide viability for American pronghorn at the fine filter level

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Veg-Grass-GB&MSG-DC-1, 3, 7	Vegetation height, density, and cover provide food and cover for wildlife species, including pronghorn. Grasslands are connected based on the distribution of Mollisol soils and not fragmented.
FW-Veg-PJ-All-DC-2	There is connectivity of openings between trees that provide for sufficient sighting distance to facilitate pronghorn movement.
FW-Veg-Grass-SDG-S-1	Recreation goals are subordinate to antelope protection.
FW-Veg-Grass-All-G-1, 2	To maximize reproductive success: disturbance from management activities in key pronghorn fawning areas during fawning season should be minimized and natural waters within ¼ mile of fawning habitat should be maintained and available to pronghorn during the fawning season.
FW-Veg-Grass-SDG-G-2	Road and trail locations should consider antelope protection goals.
Semi-desert Grasslands (FW-Veg-Grass-SDG-O-1)	Mechanically restore/enhance 3,500 acres of Semidesert Grassland every 10-year period during the life of the plan.
Great Basin grasslands (FW-Veg-Grass-GBG-O-1)	Mechanically restore/enhance 10,800 to 12,400 acres of Great Basin Grassland every 10-year period during the life of the plan.
Montane/Subalpine grasslands (Veg-Grass-MSG-O-1)	Mechanically restore/enhance 7,600 to 11,400 acres of Montane Subalpine Grassland every 10-year period during the life of the plan.
FW-WFP-G-10, 11	Fences minimize restriction to pronghorn movement, are maintained and removed as necessary. New fencing is minimal. Fence design, removal, modification, and construction consider pronghorn needs.
FW-Graz-DC1, 2; FW-Graz-G-3, 4, 7	Livestock grazing is in balance with wildlife needs and forage capacity.
FW-Soil-DC-2; FW-Soil-O-1	Improve soil conditions, overall wildlife habitat.
FW-Invas-DC-0-1; FW-Invas-G-1	Invasive species are absent or exist at levels where they do not disrupt ecological functioning or affect the sustainability of native and desirable nonnative species; project designs incorporate measures to prevent, control, contain, and eradicate priority infestations or populations of invasive species.
MA-AMesa-DC-5	The Anderson Mesa pronghorn herd has a sustainable population, is able to move freely across the grasslands and open areas of the forest and woodlands, and can easily access winter range.

Alternative B

The plan sets the desired recreation opportunity spectrum (ROS), also called ROS objectives, which are used to determine if projects are compatible with forest recreation goals. ROS classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no development and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

There is an overall shift of 1,284 acres to more primitive ROS classes in alternative B compared to alternative A. This would result in an overall negligible impact (about 0.6 percent of potential habitat) to pronghorn habitat from the ROS objectives and the impacts differ by PNVT. There would be more positive impacts in the Great Basin Grassland and Montane Subalpine Grassland portions of the habitat due to shifts to more primitive ROS classes (about 11,152 acres) which would reduce disturbance, limit the ability of managers to build roads in these areas in the future, and encourage closure and decommissioning of existing roads. This is slightly lower than alternative C and the same as alternative D. However, about 9,868 acres of Semidesert Grassland habitat would shift to less primitive ROS classes resulting in potentially more disturbance. This is higher than alternative C and lower than alternative D.

Alternative C

Recommendation of 13 wilderness areas would provide pronghorn with some extra protections for Great Basin and Montane Subalpine Grasslands, but only a small percentage (2.8 percent and 0.01 percent, respectively) of these PNVTs would be managed to protect wilderness character, including native species and maintenance of natural processes. Within this limited area, recreation use would be managed to protect wilderness character and public motorized vehicle use would no longer be allowed. Forest Service and permitted motor vehicle use would be limited and would not result in the expansion of impacts to wilderness character (SA-RWild-G-1 and 3).

Semidesert Grasslands, which are the most affected by alternative C's wilderness recommendations (11.2 percent), are highly departed from historical conditions, and management activities may be needed to help restore them. Since almost 88.8 percent of Semidesert Grasslands would be outside of wilderness, this will not have a large negative effect on pronghorn.

Desired conditions for wildlife habitat management areas focus on protection of wildlife and habitat restoration using establishment of natural fire regimes. Overall, guidelines for wildlife habitat management areas would reduce disturbance from recreation and motorized vehicles (see grasslands coarse filter for more details). About 30 percent of Montane Subalpine Grassland and 18.6 percent of Great Basin Grassland are located in WHMAs. Current levels of motorized dispersed camping would be maintained because a guideline in alternative C states, "There should be no net increase in the area of motorized dispersed camping corridors designated within each WHMA." This guideline would not increase the level of disturbance to pronghorn habitat compared to alternatives A, B, and D which could increase disturbance to pronghorn and their habitat. The restrictions on public motorized access may positively impact pronghorn.

Within Montane Subalpine and Great Basin Grasslands, disturbance to pronghorn would be reduced compared to alternatives A, B, and D due to less human use as outlined in the following guidelines:

- Public road density throughout the Anderson Mesa WHMA should not exceed an average of 1 mile of road per square mile.
- Large group recreation events and large commercial tours within WHMAs should not be permitted except in developed sites and in support of research.
- In the East Clear Creek and Jacks Canyon WHMAs, public access should be provided on roads that access developed sites, trailheads, and interpretive sites, and improved and maintained roads providing connectivity from State Highway 87 to Rim Road (FR 300). In the Pine Grove WHMA, public motor vehicle access should not be provided.
- All roads within WHMAs that are not open for public access are managed for administrative use or decommissioned.

Under alternative C, there would be an overall shift of 3,489 acres to more primitive ROS classes compared to alternative A. This would result in an overall low impact (about 1.6 percent of potential habitat) to pronghorn habitat from the ROS objectives and the impacts would differ by PNVT. There would be more positive impacts in the Great Basin Grassland and Montane Subalpine Grassland portions of the habitat due to shifts to more primitive ROS classes (about 11,587 acres) which would result in reduced disturbance, limit the ability of managers to build roads in these areas in the future, and encourage closure and decommissioning of existing roads. This is slightly higher than any other alternative. However, about 8,098 acres of Semidesert Grassland habitat would shift to less primitive ROS classes. This would result in potentially more disturbance though a lower amount of acres than any other alternative.

Alternative D

Alternative D would recommend no new wilderness area and would allow mechanized recreation (e.g., bikes) on designated trails in botanical and geological areas.

Not adding any new wilderness areas makes this aspect of alternative D the same as alternative A, and would avoid the small negative impact that adding new wildernesses would have on Semidesert Grasslands habitats analyzed in alternative C.

The amount of grassland habitat in botanical and geological areas is extremely small (approximately 338 acres for Montane Subalpine Grassland and 217 acres of Semidesert Grassland), therefore, the likelihood of disturbance to pronghorn is negligible. Allowing bicycles on designated trails in botanical and geological areas will have no appreciable effects on pronghorn. Overall, alternative D's effects are not appreciably different that alternative B.

Under alternative D, there would be an overall shift of 1,153 acres to more primitive ROS classes compared to alternative A. This would result in an overall negligible impact (about 0.5 percent of potential habitat) to pronghorn habitat from the ROS objectives and the impacts would differ by PNVT. There would be more positive impacts in the Great Basin Grassland and Montane Subalpine Grassland portions of the habitat due to shifts to more primitive ROS classes (about 11,153 acres) compared to alternative A which would result in reduced disturbance, limit the ability of managers to build roads in these areas in the future, and encourage closure and decommissioning of existing roads. This is the same as alternative B and lower than alternative C. However, about 10,000 acres of Semidesert Grassland habitat would shift to less primitive ROS classes resulting in potentially more disturbance which is a higher amount than alternatives B or C.

Summary of Species Effects

All alternatives would maintain viability for pronghorn by providing good quality grassland habitat for grazing and fawning, minimizing disturbance, invasive species, and providing fence designs and road placement that promote healthy movement of pronghorn herds. Pronghorn in both Great Basin Grassland and Montane Subalpine Grassland would have a low likelihood of being limited by its habitat, while they would have a medium likelihood of limitation for Semidesert Grasslands (see appendix C).

Alternative A lacks specific objectives for addressing grassland restoration and habitat fragmentation. However, overall, guidance contained in the proposed revised plan is not as explicit for management of pronghorn and their habitat as alternative A. Alternative B does have some similar guidance that would protect and enhance pronghorn and their habitats in the PNVT desired conditions and guidelines such as fawning season restrictions to reduce disturbance, fence standards and guidelines, and maintenance of habitat connectivity. However, alternative B lacks guidance that alternative A has, such as more comprehensive guidance for grassland habitats where management emphasis is provided for pronghorn, addressing vegetation management, range management, land acquisition, off-road driving, road construction, and other activities in standards and guidelines. Within alternative A's MA 27, objectives, standards, and guidelines are particularly strong for pronghorn in Semidesert Grassland, which is the grassland habitat in poorest condition. Alternative B's desired conditions for the Anderson Mesa Management Area call for stable pronghorn populations, but because populations are currently stable, this does not emphasize improving trends. Objectives for grassland habitats indicate that little active habitat improvement or restoration will be done in those habitats. A small proportion of Great Basin Grasslands would be designated as wilderness, providing some extra protections.

Alternatives B, C, and D are less prescriptive than alternative A, as a result, they should allow management to be more responsive to site-specific needs and changing conditions over time. This will better allow the forest to practice adaptive management and to more effectively cope with a changing climate.

Wetland Cienega PNVT

Coarse Filter

Affected Environment

Amount and Distribution: There are approximately 78 identified wetlands (9,859 acres) on the forest. There are several wetland types: semipermanent, seasonal, ephemeral, and reservoir/lakes. Many of the wetlands have been modified by dams and stock tanks to increase water permanency and provide water for livestock and wildlife. The forest contains 20 acres of cienega, linear streams associated with groundwater/spring recharge that is primarily herbaceous and does not have woody vegetation (as the riparian forest types do).

Habitat Quality: Wetland Cienega currently has a low departure in terms of acres for wetland functional condition and is trending toward reference conditions because most of the wetlands are fenced or otherwise protected. Smaller wetlands, mostly ephemeral, distributed across the landscape are also important ecologically and when departure is calculated using number of wetlands the overall departure is moderate and the trend is static because not all of these smaller ephemeral wetlands have been protected or fenced. Wetland Cienega soil has a high departure (96 percent impaired or unsatisfactory) with a static trend.

A portion of Stoneman Lake, one of the larger wetlands on the forest, is managed by the Forest Service. Its water quality is departed from reference conditions primarily due to high nutrients, high pH, and low dissolved oxygen. An increase in nutrients can result in rapid growth of algae and other plants in the lake, which may result in a drop in dissolved oxygen that can be detrimental to aquatic life and sometimes leads to fish kills. In addition, there are six impaired reservoir lakes on the forest due to mercury exceedances in fish tissue. Mercury from surrounding soils is naturally deposited in reservoir lakes with a consequent increase in mercury concentrations found in fish. The at-risk lakes are Long Lake, Soldier and Soldier Annex in the Jack's Canyon 5th HUC, and Upper Lake Mary and Lower Lake Mary in the Walnut Creek 5th HUC. See the "Aquatic Systems" section for more information. There are no fish on the forest planning list associated with reservoir lakes.

Risk Factors: High levels of dispersed recreation in easily accessed and localized areas may cause ground disturbance, soil compaction, and vegetation removal and could lead to accelerated erosion and sedimentation into connected waters in Wetland Cienega.

When poorly managed, livestock grazing also poses a risk to Wetland Cienega in localized areas. Excessive or poorly timed livestock grazing can cause soil compaction, change the structure and composition of vegetation to the extent it influences ecosystem processes, and cause soil disturbance that results in accelerated erosion and sedimentation. Because of water rights associated with livestock grazing, it is not feasible to preclude this activity from all wetlands. It is also not feasible to preclude elk grazing from all wetlands because elk management is outside the jurisdiction of the Forest Service. Additional risks are invasive and nonnative animal species and in localized areas and natural deposition of mercury in reservoir lakes, and sedimentation from high density of roads and high levels of motorized use within watersheds.

The introduction, presence, and spread of invasive animal species such as bullfrogs and crayfish, and nonnative fish can have significant impacts because they eat, compete with, and can hybridize with native species. This can result in the loss of the genetic uniqueness of a species, low recruitment, poor maintenance, growth, or dispersal of populations, and even extirpation. Further, invasive species are vectors for introduction of disease and parasites which infect native fish species and nonnative fish can transfer parasites to native fish. Other invasive species, such as aquatic zebra mussels, would pose a significant threat to species and ecosystems if they became established on the forest. According to the "Ecological Sustainability Report," one of the factors characteristic of reference conditions for aquatic systems was the presence of native fish assemblages and the absence of nonnative aquatic species (USDA Forest Service 2009). Aquatic habitat was assumed to have had all necessary components that native aquatic species needed for continued persistence. Forest Service activities such as fire suppression, stock tank cleaning, research projects, roads, recreation special uses, developed recreation, and dispersed recreation may cause the spread of invasive animal species. The forest is constrained because in general, introduction, control, and management of species is under control of the Arizona Game and Fish Department, and native species often lack defense mechanisms for nonnative organisms.

Associated Species: There are a total of 13 species associated with Wetland Cienega:

- Two are federally listed: Yuma clapper rail (endangered) and Chiricahua leopard frog (threatened);

- Eight are Forest Service sensitive species: Four-spotted skipperling, Nokomis fritillary, Nitocris fritillary, Arizona sneezeweed, Clark's grebe, lowland leopard frog, northern leopard frog; and northern Mexican gartersnake; and
- Three are other forest planning species: Bollander's quillwort, Oak Creek triteleia, and pond lily.

The coarse filter is inadequate to address all threats to Chiricahua leopard frog, lowland leopard frog, northern leopard frog, and Clark's grebe. They are discussed further in the fine filter analysis.

Environmental Consequences – Wetland Cienega PNVT

Habitat quality

All Alternatives

For all alternatives, the contribution of sediment to water quality resulting from vegetation management, trail maintenance, and construction and from human and livestock disturbances to riparian areas is expected to be similar because the best management practices used for implementation of these activities are the same across alternatives. Best management practices are expected to reduce or mitigate sedimentation.

Alternative A

Plan language for Wetland Cienega is outdated and does not include current science about vegetative condition and natural disturbances. It lacks comprehensive desired conditions for composition, structure, and function of Wetland Cienega.

Projected and Improved Habitat: Alternative A lacks treatment objectives, thus forest plan objectives would not result in additional acres of improvements to species habitats or changes to the number of acres of projected habitat for any species. Implementation of plan components other than objectives could result in improvements to habitat quality, however, amount of improvement would be unknown because this would be decided at the project level.

Alternative A would address departure and maintain Wetland Cienega by minimizing the effects of livestock grazing through fencing, seeding, and management of livestock (p. 175 par 1; replacement p. 69, par 6 and 7; replacement p. 176 par 1; p. 174 par 2). The number and acres of wetlands would retain their current departures and move slowly toward desired conditions. Soil would remain highly departed. However, it would allow salting in riparian areas to improve livestock management by concentrating cattle in certain areas, a practice which could be detrimental to associated species and their habitat (p. 68 par 8 and p. 175 par 9). This is offset by a standard that requires that forage use be maintained at a level that assures recovery and continued existence of listed species (new p. 66-1 par 1 and p. 174 par 1) and specific objectives to protect riparian areas and allow them to recover in the first 20 years of the plan (p. 175 par 1).

Plan components in alternative A would address departure, maintain water quality, and reduce sedimentation by meeting State water quality standards and promoting the use of best management practices which would reduce sedimentation of mercury carrying soil. Treatment objectives that would improve impaired water quality and riparian soil function in this alternative exceed the capacity of the forest to implement them and do not focus on priority areas, however.

Continuing implementation of alternative A would improve impaired water quality, maintain riparian, soil, and watershed function. However, alternative A has treatment objectives that exceed the capacity of the forest to implement them for watersheds, water quality, riparian recovery, and soil improvements. Alternative A does not holistically consider the effect that uplands within the watershed have on the health and stability of aquatic systems and does not have objectives that focus treatments on priority waters or watersheds. As a result, aquatic systems would continue to trend away from desired conditions because larger landscape-scale relationships would not be considered in designing and implementing projects. Alternative A would address departure due to invasive animal species and maintain Wetland Cienega by managing habitat to maintain viable populations of wildlife and fish species, improving habitat for selected species, and not supporting the introduction of unapproved species (new p. 22-1, par 1 and 2). In the Sedona-Oak Creek area and Flagstaff Lake Mary Ecosystem Area, alternative A would control the impacts from nonnative species and discourage the introduction of new nonnatives or maintenance of existing ones (p. 206-9, par 7; p. 206-72, par 7) while promoting habitats that support healthy populations of native animals and emphasizing cooperation on the introduction, prevention, and removal of unapproved species (p. 65-5 par 6, new p. 206-9, par 2). The forest is constrained in the extent to which it can control nonnative and invasive species because it is Arizona Game and Fish Department's authority to do so and nonnative species are well established in many areas.

Alternatives B, C, and D

Under alternatives B, C, and D, departure and trend would improve to low departure with trend toward desired conditions for both wetland acres and the number of wetlands. For Cienegas, the departure would remain unchanged, however, the trend would improve toward desired conditions compared to a static trend under alternative A. This is primarily because alternatives B, C, and D would improve 5 to 10 wetlands during 10 years following plan approval or 22 percent more wetlands than alternative A.

Projected and Improved Habitat: If these improvements would occur in a specific species habitat, then that habitat would be improved or enhanced. No improvements or changes in projected habitat are predicted for any associated species because the location of improved wetlands would be a project-level decision. There would be more acres where soil and wetland function are sustained that supports diverse vegetation for native and desirable nonnative, riparian, and aquatic species habitat and riparian soil moisture characteristics are maintained.

Table 53 shows the intent of plan components that were put in place to update plan language and to address the identified risks to Wetland Cienega. Alternatives B, C, and D would address departure and maintain Wetland Cienega by specifying that motor vehicle use and dispersed camping with recreational vehicles and campers occurs in designated motorized camping corridors or designated spur roads that are identified on the motor vehicle use map, except as authorized by permit or for administrative uses. This would reduce the risk of sedimentation from high levels of motor vehicle use or high density of roads in watersheds. Desired conditions in alternatives B, C, and D would protect riparian resources, soil conditions, and water quality by managing dispersed recreation to avoid resource damage and expanding direction to rehabilitate negatively impacted sites beyond the Sedona-Oak Creek Management Area. In addition, guidelines would specify that special use permits should generally not be given for activities proposed to occur within 200 feet of perennial streams, springs, or sensitive waters to protect

riparian vegetation. Exceptions will be for hardened or slickrock sites, for activities in support of approved research, to improve safety, or to provide for site rehabilitation.

Alternatives B, C, and D would maintain water quality in Wetland Cienega, improve the trend, and provide higher quality habitat than under alternative A. Water quality trends for alternatives B, C, and D would be toward desired condition (i.e., meeting State water quality standards) based on proposed revised plan direction that emphasizes total maximum daily load implementation and a focused, priority watershed treatment strategy. This direction is in addition to mandatory and voluntary requirements, including best management practices, imposed by the Arizona Department of Environmental Quality. The road system and new road construction and reconstruction would be managed to minimize erosion and sedimentation into connected waters, wetlands, and to maintain proper functioning watershed and riparian condition and water quality.

In addition, these alternatives address the localized impacts from livestock grazing and improve the trend by maintaining available forage in balance with desired conditions for plant communities while providing growth, reproduction, and adequate residual cover of desired plant species. In addition, guidelines specific to range improvements should be located to protect riparian function, rare species, and habitat for rare and Forest Service sensitive plants.

Invasive Species: The threat of invasive animal cannot be effectively addressed by any alternative because nonnative fish are already established in these habitats and, consequently, represent a significant threat. Furthermore, the management of these nonnative fish falls outside of the authority of the Forest Service and under the purview of the Arizona Game and Fish Department. That said, alternatives B, C, and D better address the threats of invasive animal species. Habitat quality is maintained by plan components that clarify on a forestwide basis that invasive species do not disrupt ecological functioning; affect the sustainability of native and desirable nonnative species; or have negative impacts on native species. Diversity of native species and integrity of rare species populations and habitats would be maintained because invasive species would not be transported or established by activities associated with developed recreation sites, large group activities, or dispersed recreation. Unlike alternative A, the proposed revised plan has prevention measures to minimize accidental and incidental introductions, including to downstream habitats and between 6th-code watersheds. It also specifies that research projects should not introduce new invasive plants or animals. Implementing the language within the proposed revised plan would result in reduced impacts to native species populations from invasive animals in regards to those activities under Forest Service control and would do a better job than alternative A in maintaining the viability and persistence of the species populations associated with this threat.

Table 53. Plan components under alternatives B, C, and D which would promote the viability of all Wetland Cienega associated species at the coarse filter/habitat level

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Aq-Wtlnds-O-1,	Establish more realistic objectives by restoring 5-10 wetlands.
FW-Aq-Wtlnds-DC-4; FW-Soil-DC-1, 2, 3	Soil improvement: Soils ability to infiltrate water, recycle nutrients, and resist erosion is sustained on most wetland acres. Soil functions properly. Herbaceous vegetation contributes to suitable hydrologic function, soil stability, and nutrient cycling. Vegetative ground cover prevents erosion from exceeding natural rates of soil formation.

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Aq-Wtlnds-DC-1, 2, 3, 5; FW-Veg-All-DC-2; FW-Soil- DC-1, 2, 3, 4; FW-WtrShed-DC-1, 2, 3	Updated desired conditions: Functional soil and water resources support diverse vegetation for species habitat. Individual wetland types support diverse composition and age distribution of and habitat for native species and provide abundant food, cover, nesting, and spawning habitat within their capability. All wetlands except reservoirs are maintained in or trend toward proper functioning condition. Vegetative conditions are resilient to disturbances and climate variability. Functioning ecosystems retain their components, processes, and functions. Natural and human disturbances provide desired species composition, structure, nutrient cycling, and plant density. Desired disturbance regimes are restored where practical. Functional watersheds: are resilient to natural and human disturbances, have high integrity relative to potential natural condition, recharge aquifers, maintain riparian communities, moderate climate variability and change, and provide habitats that support adaptive animal and plant communities that reflect natural processes.
FW-Aq-Wtlnds-DC-6; FW-Aq-Wat-G-1; FW-Aq-Wat-DC-5; FW-RdsFac-DC 1, 2, 4; FW-RdsFac-G-3, 5, 7, 8, 9; FW-Aq-Wat-DC- 3, 4; FW-Aq-Wat-G-1, 3; FW-Rec-Disp-G- 4, 8, 10 (except for the Long Valley Management Area), 11.	Water quality fully supports identified designated special uses or State quality standards. Consider and implement as appropriate total maximum daily load recommendations or implementation plans to maintain or improve water quality. Quality sustained at level that retains integrity of aquatic systems and benefits native aquatic and riparian species. Sedimentation that results in elevated mercury levels is reduced
FW-Veg-Rip-All-G-1, 6; FW-Rec-Disp-DC-2, 3, 8, 19; FW-Rec-Disp-G-2, 4, 8, 10, 11; FW-Rec-Disp-S-1.	Recreation activities, permitted uses, and management activities should not significantly impact soil function, riparian vegetation, and water quality; do not impact resources such as soils, vegetation, or wildlife. Resource damage from unauthorized motorized trails is minimal and unauthorized trails are rehabilitated. Effective vegetative cover should be maintained within riparian areas to stabilize banks, soil, and riparian function. Impacts to understory vegetation and soil erosion are minimal in nonmotorized and motorized dispersed camping areas.
FW-Rec-Disp-DC-4; FW-Rds-FAC-DC-1, 4, 5; FW-Rds-Fac-G-2, 3, 5.	Motorized use occurs as identified on the motor vehicle use map except as authorized by permit or for administrative uses . The forest transportation system balances public access with potential for ecological impacts and minimizes impacts to watershed conditions, rare plants, fisheries, and wildlife habitat and movement. Temporary roads are rehabilitated promptly and unneeded roads are closed and naturalized to reduce soil erosion and human disturbance to wildlife. The minimum road system necessary is managed within areas that affect municipal water sources, such as Upper and Lower Lake Mary, to prevent impacts to water quantity and quality from sedimentation and runoff. Best management practices for watershed and water quality in road construction should be used. Permanent and temporary road construction and relocation should avoid wetlands. Factors in prioritizing the naturalization of decommissioned and unauthorized roads should include watershed condition, impaired riparian areas, springs, and wetlands.
FW-Graz-DC-1, 2, 3. FW-Graz-G-1, 2, 5, 7	Localized livestock impacts: rangelands sustain biological diversity and ecological landscapes. Grazing maintains desired conditions of plant communities with biotic and geophysical integrity; is in balance with available forage; and should provide for growth, reproduction, adequate residual cover of desired plant species. Salt, fences, troughs, pipelines, and other improvements should be located to protect riparian function, rare species, and known locations of Southwestern Region sensitive plants. Sensitive plant habitat should not be adversely affected by water developments and handling or loading facilities.

Location Code in Proposed Revised Plan	Intent of Plan Components
FW-Invas-DC-1, 2; FW-Rec-Disp-DC-13; FW-Veg-All-DC-3; FW-SpecUse-DC-11; FW-Rec-Dev-DC-3; SA-Wild-All-DC-9; FW-WFP-DC 1, 4. Also in: FW-AQ-Str-DC-8; FW-AQ-Spr-DC-11; FW-Invas-DC-1-2; FW-WFP-DC 1, 2, 6, 8; FW-Spec-Use-S-12; FW-Rec-Disp-DC-13; FW-Rec-Dev-DC-3; SA-Wild-All-DC-9; SA-Wild-SecretMtn-DC-2; SA-Wild-Fossil-DC-3; SA-Wild-Verde-DC-6.	Invasive species do not disrupt ecological functioning or affect the sustainability of native and desirable nonnative species. They are not introduced or spread by activities associated with dispersed recreation. Desirable nonnative species are not having negative impacts on native species. Sites used by large group activities do not have long-term evidence of invasive activities. Developed recreation sites near riparian areas do not establish or transport invasive species.
FW-Invas-G-1, 2, 3, 4, 5; FW-RdsFac-G-4-6; FW-SpecUse-G-11; FW-WFP-G-6, 8, 9; FW-WtrShed-G-3-4; FW-SpecUse-G-11, 14.	Invasive species spread: Measures should be incorporated into projects and monitoring to prevent, control, contain, and eradicate priority populations or infestations. Integrated pest management approaches and other control treatments should be used to improve watershed condition and maintain ecosystem function while minimizing project impacts on native species. All equipment should be decontaminated so organisms are not transported among waterbodies and healthy forest habitats. Noninvasive weed-free plant material should be used in seeding and mulching projects to restore natural composition and ecosystem function. Hay, straw, and mulch used by Forest Service personnel or their contractors should be certified as being weed free and weed-seed-free to prevent unintentional introduction of invasive species. Road closures or other methods should be used to reduce spread. Research projects do not introduce new invasive species. Emphasizes that drainage structures should be designed consistent with the resource protection needs of native aquatic organisms

Coarse Filter – Yuma Clapper Rail

Threatened and Endangered Species (table 42)

Affected Environment

Yuma clapper rails are included here in more detail because they are a federally listed species addressed under the coarse filter.

Distribution: There are no known Yuma clapper rails nesting on NFS land. They were detected on private land at Peck's Lake and Tavasci Marsh during the winter and late summer.

Habitat: They are associated with Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Wetland Cienega PNVTs along the Verde River and Fossil Creek. Rails require large patches (at least 1 acre) of cattails.

Riparian condition in Cottonwood Willow Riparian is moderately departed from reference, with high departures in soil condition and productivity and invasive plants. Mixed Broadleaf Deciduous Riparian is similar to reference conditions. At the landscape level, riparian and soil condition are predicted to slowly improve or remain low for both PNVTs. Wetland Cienega

departure and trend is described in the "Aquatic Systems" section. Invasive plants are predicted to spread further under current management, except for treated areas along the Verde River.

Risk Factors: There are no species-specific threats to the Yuma clapper rail. Invasive plants, dispersed recreation in localized areas, and uncharacteristic fire in the watershed or in the PNVT are the primary habitat threats. These habitat threats are adequately covered above in the coarse filter sections in all alternatives that relate to the Yuma clapper rail's associated PNVTs.

Environmental Consequences – Yuma Clapper Rail

Summary of Determinations

The implementation of all alternatives would result in a "may affect" determination for Yuma clapper rail. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

All Alternatives

All alternatives incorporate the "Verde Wild and Scenic River Comprehensive River Management Plan," including its standards (replacement p. 113, par 4; SA-WSR-Verde-S-1). Wildlife and fish are among the outstandingly remarkable values that are protected and enhanced (replacement p. 113, par 5; new p. 115-1, par 2; FW-WSR-Verde-DC-5) and the range of flows in the free-flowing Verde River would provide optimum conditions for native fish and wildlife, and health and diverse stands of riparian vegetation on the banks and flood plain (replacement p. 114, par 3; replacement p. 115, par 2, 3; FW-WSR-Verde-DC-6). The original designation allows for some water diversion. Specifically, designation shall not prevent water users receiving Central Arizona Project water allocations from diverting that water through an exchange agreement with downstream water users in accordance with Arizona water law (new p. 115-1, par 8), thus streamflows could be reduced in the future.

Alternative A

Management of wildlife habitat is a key emphasis in Management Area 12 (Riparian Habitat). There are multiple standards for maintaining overstory, three age classes of woody vegetation, and stream shading which would maintain good habitat (p. 174, bullets 1-3). Yuma clapper rail habitat would be further maintained by plan components that recommend utilizing filter strips between streams and ground-disturbing activities and roads (p. 174, bullet 4; replacement p. 176, p. 5).

The goal to recover 80 percent of riparian habitats by year 2030 with the remaining 20 percent significantly improved would benefit rails (replacement p. 172, par 9); however, this implementation rate has proven to be too ambitious and not realistic. Other goals of constructing 10 miles of fence per decade to protect riparian regeneration and installing stream habitat improvement projects in the first decade would also have potential benefits to Yuma clapper rail habitat (p. 175, par 1, 7).

Other beneficial guidelines would minimize the negative effects of grazing on riparian habitat by: not placing salt within ¼ mile of riparian habitats to avoid concentration of livestock; establishing and protecting woody riparian vegetation through livestock management and/or fencing to allow for establishment and eliminate overuse; and setting allowable use standards on woody vegetation (p.175, par 9).

Under alternative A, there are about 5,808 acres of Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Wetland/Cienega PNVT habitat in more primitive, less developed recreation opportunity spectrum classes. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads.

Alternative B, C, and D

Desired conditions for the Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Wetland Cienega PNVTs describe conditions that would provide good habitat for Yuma clapper rail, that is, diverse native vegetation in multiple age classes, uncompacted soils and ecosystems functioning within their natural potential that are rarely negatively impacted by livestock (FW-Veg-All-DC-1 through DC-11).

An objective to restore 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas within 10 years following plan approval would benefit these PNVTs (FW-Veg-Rip-All-O-1) but only future site specific NEPA analysis would determine if these benefits would occur in Yuma clapper rail habitat. Other beneficial plan components include guidelines for streamside management zones to provide protections from management activities (FW-Veg-Rip-All-G2) and for minimal impact to PNVTs from recreation and management activities (FW-Veg-Rip-All-G1).

Alternative B

Alternative B recommends three wildernesses. Of the three recommended wilderness areas, Davey's has 30 acres of Mixed Broadleaf habitat and Walker Mountain has 19 acres of Mixed Broadleaf and 7 acres of Cottonwood Willow. Strawberry Crater does not contain any riparian habitat and there is no Wetland Cienega in these areas. Designation of this small amount of wilderness that contains potential Yuma clapper rail habitat will be a small benefit by limiting roads, recreation, and development in these riparian PNVTs in managing for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character (see "Designated Wilderness Areas" section of the proposed revised plan: SA-Wild-All).

The plan sets the desired recreation opportunity spectrum (ROS), also called ROS objectives, which are used to determine if projects are compatible with forest recreation goals. ROS classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no development and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

For the Mixed Broadleaf Riparian Forest PNVT, about 170 acres would shift from the ROS classes that allow more development to ones that allow less in alternative B. The most notable ROS is in the Wetland Cienega PNVT, where about 5,678 acres would shift from less to more primitive primarily due to a large increase in semiprimitive nonmotorized acres. This would limit

the ability of managers to build roads in these areas in the future and encourage closure and decommissioning of existing roads. In total, alternative B would shift ROS objectives to reduce noise disturbance and potential for future road construction in about 5,828 acres for these PNVTs, which would reduce potential habitat impacts to potential rail habitat and shift only 21 acres from more primitive to less primitive in Cottonwood Willow Riparian Forest PNVT.

Alternative C

Alternative C would potentially protect or improve an additional 367 acres of Mixed Broadleaf Deciduous Riparian Forest, 452 acres of Cottonwood Willow Riparian Forest, and 0 acres of Wetland Cienega because of 13 recommended wildernesses in this alternative (table 54). Designation as wilderness would provide extra protections for Yuma clapper rail potential habitat, since these habitats would be managed for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character. However, treatments in this habitat that would require motorized equipment may occur but would be designed to minimize the impacts of motor vehicles in these areas. In addition, these areas are not suitable for new permanent or temporary road construction. So treatments in this habitat, such as stream renovation or watershed improvement projects, would be possible but may be completed with lower impact tools or be smaller in scale than in other parts of Yuma clapper rail habitat.

Alternative C also would propose eight wildlife habitat management areas and portions of other management areas as not suitable for recreational (non-hunting) shooting; however, none of this occurs in Yuma clapper rail habitat.

For the Mixed Broadleaf Riparian Forest PNVT, about 198 acres would shift from the ROS classes that allow more development to ones that allow less in alternative C. The most notable change would be in the Wetland Cienega PNVT, where about 5,753 acres would shift from less to more primitive primarily due to a large increase in semiprimitive nonmotorized acres. This is substantially more acres compared to alternative A and nearly 100 acres more than alternative B. This would limit the ability of managers to build roads in these areas in the future and encourage closure and decommissioning of existing roads. In total, alternative C would shift ROS objectives to reduce noise disturbance and potential for future road construction in about 5,951 acres for these PNVTs, which would reduce potential habitat impacts to potential rail habitat and shift only 10 acres from more primitive to less primitive in Cottonwood Willow Riparian Forest PNVT. This is a net improvement of 5,951 acres in potential habitat for this species which is the same as alternative B and slightly more than alternative D.

Table 54. Potential Yuma clapper rail habitat within alternatives B and C recommended wilderness

PNVT	Alt. B Acres in Recommended Wilderness	Alt. C Acres in Recommended Wilderness	Total PNVT Acres	Percentage of Total PNVT Acres in Alt. C
Cottonwood Willow Riparian Forest	7	452	2,507	18%
Mixed Broadleaf Deciduous Riparian Forest	49	328	3,612	9%
Wetland Cienega	0	0	9,879	0%

Alternative D

Alternative D does not protect or affect any additional Yuma clapper rail habitat when compared to alternative B. It is responsive to public recommendations for no new wilderness areas and to allow mechanized recreation (biking) on designated trails in botanical and geological areas. Alternative D also differs from the proposed revised plan in that it would provide for expansion and/or increased access for future energy corridor needs, as well as modification of scenic integrity objectives along existing energy corridors for energy infrastructure. However, the plan still directs for the utility line that crosses the Verde River and Fossil Creek to be rerouted and so the impacts to Yuma clapper rail habitat are likely to be the same as alternatives B and D.

The effects from shifts in ROS would be the same as in alternative B for the Wetland/Cienega and Cottonwood Willow Riparian Forest PNVTs. Thirty fewer acres shift from less primitive to more primitive in the Mixed Broadleaf Deciduous Riparian Forest PNVT compared to alternative B and 58 fewer acres compared to alternative C. In total, alternative D would shift ROS objectives to reduce noise disturbance and potential for future road construction in about 5,893 acres for these PNVTs, which would reduce potential habitat impacts to potential rail habitat and shifts only 21 acres from more primitive to less primitive in Cottonwood Willow Riparian Forest PNVT. This is a net improvement of 5,872 acres in potential habitat for this species which is more than alternative A and slightly less than alternatives C and D.

Summary of Species Effects

Considering the coarse filter analysis, plan components in all alternatives maintain the viability and do not cause a trend toward listing for: Yuma clapper rail, four-spotted skipperling, Nokomis fritillary, Nitocris fritillary, and Arizona sneezeweed.

From the landscape perspective, Wetland Cienega is generally similar to reference conditions under alternatives B, C, and D and, therefore, species associated with them would have a low likelihood of being limited by habitat quality. Primarily due to outdated plan components, Wetland Cienega would be moderately departed from reference conditions under alternative A and associated species would have a moderate likelihood of being limited by habitat quality.

However, all alternatives would maintain the viability and persistence of associated species because plan components address the threats to the habitat. Alternatives B, C, and D better address threats from different kinds of recreation and provide plan components that better balance biotic, physical, and social factors than alternative A. These alternatives better address the threat of invasive animals because language better reflects current science, addresses spread and transport, and is applicable forestwide rather than specific geographic areas, as in alternative A.

Special Feature – Ephemeral and Intermittent Watercourses

Affected Environment

Ephemeral and intermittent watercourses are a special feature used by fine filter species associated with Wetland Cienega species. These watercourses are used as corridors for dispersal by a variety of wildlife including northern leopard frogs, lowland leopard frogs, and Chiricahua leopard frogs, and are connections between patches of suitable habitat. Ephemeral watercourses flow short term in response to storm events. Intermittent watercourses flow seasonally usually in response to snowmelt and may contain perennial pools. Watercourses include their associated drainages and flood plains.

Amount and Distribution: The vegetation in ephemeral drainages is not as diverse as perennial systems, but ephemeral drainages support different vegetative species than in the adjacent uplands. Seventy-five percent of forest stream courses are ephemeral (3,743 miles), 19 percent are intermittent (944 miles), and 6 percent are perennial (279 miles).

Habitat Quality: The types of riparian vegetation types associated with intermittent drainages are Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Montane Willow Riparian Forest. Their condition is the same as the proper functioning condition described for the different riparian forests that these features are associated with (see "Riparian Resources" in the "Aquatic Systems" section).

Risk Factors: Watercourses are vulnerable to sedimentation and excessive flooding as an indirect effect of uncharacteristic fire in their watersheds. Conversely, they are also vulnerable to drying as a possible consequence of increased temperatures and decreased precipitation that is predicted under some climate change models. Under this drying scenario, perennial streams would convert to intermittent drainages; and intermittent streams would convert to ephemeral watercourses. Roads and constructed features that change waterflow or water can result in fragmentation of these corridors and impede the movements of amphibians, reptiles, and other wildlife.

Environmental Consequences – Ephemeral and Intermittent Watercourses

Common to All Alternatives

There are no objectives for this special feature, so the amount of habitat for the associated species provided by ephemeral and intermittent watercourses does not change by alternative.

The effects of sedimentation resulting from uncharacteristic fire are discussed in vegetation and fire.

Alternative A

Departure and trend are discussed in the "Aquatic Systems" section.

Alternative A lacks treatment objectives, thus, forest plan objectives would not result in additional acres of improvements to species habitats or changes to the number of acres of projected habitat for any associated species. Implementation of plan components other than objectives could result in improvements to habitat quality, however, amount of improvement would be unknown because this would be decided at the project level.

Language in alternative A would not be as effective as the other alternatives at acknowledging ephemeral and intermittent stream courses as important habitat or movement corridors for some species, but it does have language that limits activities and protects stream courses from excessive runoff or high sedimentation from ground-disturbing activities (replacement p. 72, nos.1-9; new p. 72-1, par 1; replacement p. 176, par 5). Other forestwide standards and guidelines have areas within watercourses, including intermittently wet as a criteria for road closures or restrictions and this is repeated in direction for the Flagstaff Lake Mary Ecosystem Area (new p. 206-71, bullet 2). These plan components would minimize the effects from ground-disturbing activities on ephemeral and intermittent stream courses and set criteria for closing roads in these areas, which can serve as barriers or mortality hazards to species using ephemeral and stream courses for movements, especially the amphibians and reptiles.

The management emphasis in Riparian and Open Water (Management Area 12) (replacement p. 172, par 1) would set the framework for managing intermittent and ephemeral stream courses as habitat for the associated species.

Alternatives B, C, and D

Departure and trend are discussed in the section on aquatic systems.

Alternatives B, C, and D include a variety of plan components that would protect ephemeral and intermittent streams by fostering habitat connectivity. Desired conditions and guidelines state the importance of ephemeral and intermittent stream courses as nesting habitat and movement corridors and foster habitat connectivity. These alternatives would also reduce the impacts from human structures. These plan components are shown in table 55 and are beneficial for and help maintain the viability of species such as northern Mexican gartersnake, lowland leopard frog, northern leopard frog, and Chiricahua leopard frog. In addition, alternative C protects more miles of ephemeral and intermittent stream courses of its additional wilderness recommendations. There is more complete analysis for Chiricahua leopard frogs following the fine filter section for Clark's grebe below.

Table 55. Plan components under alternatives B, C, and D that provide for viability of species associated with ephemeral and intermittent watercourses at the special feature level

Location Code in Proposed Revised Plan	Plan Components
FW-WFP-DC-6	Vegetation and stream connectivity provide for wildlife, fish, and plant species movements and genetic exchange consistent with landforms and topography. Species are able to access adjoining habitat, disperse, migrate, and meet their life history requirements.
FW-WFP-DC-7	Ephemeral and intermittent stream courses function as nesting habitat and movement corridors for species.
FW-WFP-DC-8	Human-caused physical barriers or habitat alterations (e.g., temperature changes, loss of streamflow) do not exclude species from their historic habitat or exclude them from using stream courses. Barriers to movement are located where necessary to protect native fish from nonnative species until watershed restoration allows connectivity to be restored.
FW-RdsFac-DC-2	Permanent and temporary roads systems minimize stream crossings. Bridges and culverts allow for safe passage for aquatic organisms.
FW-RdsFac-G-5	To maintain an efficient and sustainable road system, unneeded roads should be decommissioned. Factors in prioritizing the naturalization of decommissioned and unauthorized roads should include the following: • Habitats for threatened, endangered, or sensitive species that are susceptible to roads as barriers or roads as mortality hazards.
FW-Veg-All-DC-4	Vegetation and stream connectivity provides for upland and aquatic species movements and genetic exchange consistent with landforms and topography.
FW-Veg-Grass-GB&MSG-DC-3	Grasslands are connected based on the distribution of mollisol soils and not fragmented. Natural surface drainages and subsurface flow patterns are not altered by manmade or ungulate disturbance, and they are maintained to assure waterflow into connected waterbodies or streams returns water quantity expected from an unaltered condition.

Location Code in Proposed Revised Plan	Plan Components
FW-Aq-Strm-DC-4	Stream ecosystems, including ephemeral watercourses, are not fragmented by infrastructure or development, consistent with existing water rights and claims. Physical barriers or habitat alterations like temperature changes or loss of streamflow do not exclude native fish or other aquatic species from their historic habitat. Human-made physical barriers do not exclude wildlife species such as reptiles, amphibians, and birds from using ephemeral watercourses as movement corridors or as nesting habitat. Ephemeral watercourses are important for dispersal, access to new habitats, perpetuation of genetic diversity, as well as nesting and foraging for special status species.
FW-Aq-Strm-DC-7	Links between aquatic and upland components are maintained, providing access to food, water, cover, nesting areas, and protected pathways for aquatic and upland species. Native fish and other aquatic organisms have unobstructed passage upstream and downstream at all bridges, culverts, and diversion structures, unless there is a specific need to provide a passage barrier such as to physically separate native and nonnative fish.
FW-Aq-Strm-DC-10	Stream and spring ecosystems are not fragmented by infrastructure or development, consistent with existing water rights and claims. Springs are undeveloped and unaltered by manmade structures such as head boxes, cisterns, and pipelines, consistent with existing water rights and claims.

Fine Filter – Chiricahua Leopard Frog

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Chiricahua leopard frog populations are known to be in only a portion of their former range on the forest. They historically occupied various locations in the Fossil Creek-Lower Verde River, West Clear Creek, and Upper Clear Creek 5th code watersheds. Since 2008, the Fish and Wildlife Service and Arizona Game and Fish Department have been reintroducing Chiricahua leopard frogs to the Buckskin Hills area. As of August 2012, frogs occur in eight stock tanks: Antelope, Black, Buckskin, Doren's Defeat, Middle, Needed, Sycamore Basin, and Walts. All are within Piñon-Juniper Evergreen Shrub and Piñon-Juniper Woodland (Persistent) PNVTs.

Habitat: These frogs breed in slack waters in a variety of natural and manmade aquatic systems. Habitat includes perennial streams and springs and the following riparian PNVTs: Cottonwood Willow, Mixed Broadleaf Deciduous, Montane Willow, and Wetland Cienega. In Cottonwood Willow Riparian Forest, the projected trend for noxious and/or invasive weeds is away from reference conditions under current management. Plants such as tamarisk, giant reed, and tree of Heaven will limit and eventually cause a decline in quality of existing vegetation by reducing native cottonwood and willow regeneration potential. Instream flows may be reduced as a result since these nonnative, woody plants draw more water out of the water table than native trees (USDA Forest Service 2009). In addition, there have been significant increases in fire intensity and severity in this PNVT in the southwest due to invasive species, primarily tamarisk and Russian olive. Severe fires remove cottonwoods from burn areas and convert these sites to a nonnative species mix.

Critical Habitat: The U.S. Fish and Wildlife Service proposed critical habitat for the Chiricahua leopard frog in March 2011, and final critical habitat became effective on April 19, 2012 (USFWS 2012). The 232 acres of critical habitat on the forest are within Piñon-Juniper Evergreen Shrub and Piñon-Juniper Woodland PNVTs.

Primary constituent elements for critical habitat include breeding and dispersal habitat:

- perennial water or pools with specific pH and salinity;
- no to low pollutants;
- emergent vegetation and other substrates that do not completely cover water surface;
- nonnative introduced predators are absent or do not preclude this species;
- absence of disease (chytridiomycosis); and
- adjacent uplands for foraging and basking.

Dispersal habitat consists of ephemeral, intermittent, or perennial drainages that provide overland movement corridors between breeding sites that have some vegetative hiding cover, aquatic sites, and are free of movement barriers. Movement barriers include urban, industrial, or agricultural development, reservoirs less than 50 acres stocked with predatory species; highways that do not include frog passageways, walls, dams, and other structures.

All historical and current Chiricahua leopard frog sites are within Recovery Unit 5 (USFWS 2007a). There are 566,548 acres of Recovery Unit 5 on the forest. Within recovery units, the U.S. Fish and Wildlife Service delineated management areas around extant populations and high potential recovery sites, based on watershed boundaries. There are two management areas delineated on the forest (USFWS 2007a). The West Mogollon Management Area includes currently occupied sites and critical habitat in the Buckskin Hills area. The East Clear Creek Management Area has the potential to support a metapopulation and contains historically occupied habitat.

Risk Factors: The final listing rule (USFWS 2002a) describes primary threats to the species and habitat. Primary species threats are diseases that can kill frogs, and invasive animal species which prey on the Chiricahua leopard frog.

Primary habitat threats under Forest Service control include degradation and loss of habitat, disruption of metapopulation dynamics, and environmental contamination. Habitat degradation includes:

- livestock grazing;
- dams and reservoirs;
- mining;
- altered fire regimes and the increased likelihood of crown fires; and
- other factors such as control of tamarisk.

Managed livestock grazing could remove vegetation on which egg masses are attached and that provide cover to tadpoles and frogs from predators in any of their riparian and aquatic habitats including stock tanks and ephemeral drainages. Range improvements such as fences, troughs, pipelines, or new water developments can modify riparian function or alter the hydrology of streams. Supplements used for livestock management, such as salt and minerals, can concentrate

cattle in riparian or other areas that would increase sediment discharge into connected waters during a precipitation event. Livestock could also step on eggs, tadpoles, or frogs. In the southeastern portion of Recovery Unit 5 on the forest, 24,120 acres in the Buck Springs allotment were closed to grazing in 2003. This area contains shallow drainages and headwater meadows that could be Chiricahua leopard frog habitat.

There are potentially three different kinds of mineral resources on the forest—locatable (manganese and flagstone), common variety mineral materials (cinders, river rock), and leasable (geothermal) all of which are subject to Federal, State, and local laws and regulations. The only current mineral withdrawal in Chiricahua leopard frog habitat is the Fossil Springs Wilderness.

Disruption of metapopulation dynamics includes introduction of chytrid fungus that moves between individual sites, and factors that alter the suitability of dispersal habitat. Nonmining-related contaminants include: variety of chemicals, pesticides, herbicides, insecticides, piscicides, metals, fire retardants, and suppressants. There is also an increased chance of extirpation by virtue of this species' small population size and the precipitation dependent nature of their habitats.

Environmental Consequences – Chiricahua Leopard Frog

All Alternatives

Pesticides and herbicides can negatively impact frogs and their habitat, including treatments to control tamarisk. All alternatives point to guidelines using the "Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures" in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott" (USDA Forest Service 2005). This section contains required protection measures from Section 7 consultation on Integrated Treatments of Noxious or Invasive Weeds (Endangered Species Act, replacement p. 69, par 9; FW-Invas-G-2) which must be followed for use of pesticide applications that would reduce potential impacts to the Chiricahua leopard frog. With respect to the use of regulated chemicals, all alternatives are equally guided by laws above and beyond the forest plan.

All activities in and around water sources are regulated by the Clean Water Act and associated regulations and are monitored by Arizona Department of Environmental Quality.

Alternative A

Invasive Animals: Although some of the language in alternative A is dated and not as comprehensive as in alternatives B, C, and D, plan components in alternative A would result in the maintenance of native species populations, functioning habitat to support these native populations, control of impacts from nonnative species, and discouraging the introduction of new nonnatives and would continue to maintain the viability and the persistence of the species populations associated with this threat. This is described in more detail in the coarse filter section under "Aquatic Systems." The forest is constrained in the extent to which it can control nonnative and invasive species, because it is within the Arizona Game and Fish Department's authority to do so, and nonnative species are well established in many areas.

Disease: Guidance in alternative A for disease is outdated and doesn't directly deal with this threat although it provides sufficient latitude to address the threat of disease and helps maintain

the viability and persistence of the species affected by disease, within the authority of the Forest Service. Applicable plan components are described in table 56.

Table 56. Summary of plan components in alternative A that address disease and help maintain the viability of the associated species

Species	Location in 1987 Plan (Page and Paragraph)	Plan Component
All species affected by this threat in table 42, Table 43, and table 44.	Page 22-1, paragraph 1	Manage habitat to maintain viable populations of wildlife and fish species and improve habitat for selected species
	Page 23, paragraphs 1 and 2	Threatened, endangered, and sensitive species are maintained, protected, or recovering in the majority of the habitat.
Longfin dace, desert sucker, Sonora sucker, Gila chub, roundtail chub, Gila trout, spikedace, loach minnow, Gila topminnow, razorback sucker, Colorado pikeminnow, narrow-headed gartersnake.	Page 206-9, paragraph 2 and page 206-72, paragraph 6	The Sedona/Oak Creek and Flagstaff Lake Mary Ecosystems have areawide goals for healthy populations of native plants and animals.
	Page 184, paragraph 4 and page 206-38, paragraph 2	Emphasize healthy stream environment along Oak Creek.
Northern leopard frog.	New p. 206-71, paragraph 17	Roads which cause the introduction or spread of diseases may be considered for closure or obliteration in the Lake Mary Ecosystem.

Alternative A lacks specific forestwide direction for disease but addresses disease via a guideline in the Flagstaff Lake Mary Ecosystem area where roads which cause the introduction or spread of diseases may be considered for closure or obliteration (new p. 206-71, par 17); areawide goals in the Sedona/Oak Creek and Flagstaff Lake Mary Ecosystem for healthy populations of native plants and animals (new p. 206-9, par 2; new p. 206-72, par 6); threatened, endangered, and sensitive species are maintained or recovering in the majority of the habitat (new p. 206-72, par 8) and management emphasis along Oak Creek for healthy stream environments (replacement p. 184, par 4; new p. 206-38, par 2). There are forestwide goals to manage habitat for the maintenance of viable populations of wildlife and fish species and improve habitat for selected species (p. 22-1, par 1).

Tamarisk Control: Tamarisk and other invasive plant species are widespread in portions of Chiricahua leopard frog habitat and treatment efforts are ongoing. Treatments to control tamarisk, a nonnative plant species, can impact Chiricahua leopard frogs and other species like southwestern willow flycatchers which share the same habitat. Removal of tamarisk can open up the habitat, which can cause heat stress or increase Chiricahua leopard frog susceptibility to predators. In alternative A, southwestern willow flycatcher habitat and, by default, Chiricahua leopard frog habitat, would be maintained or enhanced (p. 206-10, par 3; p. 206-12, par 2). Alternative A states that activities in southwestern willow flycatcher potential habitat would not slow or prevent potential habitat from progressing toward suitable habitat conditions (p. 206-14,

par 4). In addition, treatments need to comply with approved recovery plans which would mitigate the effects of these treatments and contribute to the persistence of species habitat. Treatments have a positive long-term impact on this species because it hastens restoration of native communities to which the species are adapted and removes plant species that use more water than native species do. Treatments are ongoing along the Verde River and project managers coordinate with local biologists to reduce impacts to threatened and endangered species.

Livestock Grazing: Plan components in alternative A protect and minimize impacts to riparian areas through management and fencing but also manage impacts through seeding (replacement p. 69, par 6; replacement p. 69, par 7; replacement p. 176, par 1; p. 174, par 2). However, it also allows salting in riparian areas to improve livestock management by concentrating cattle in certain areas, a practice which could be detrimental to Chiricahua leopard frogs and their habitat (p. 68, par 8; p. 175, par 9). This is offset by a standard that requires that forage use be maintained at a level that assures recovery and continued existence of listed species (new p. 66-1, par 1; p. 174, par 1) and specific objectives that protect riparian areas and allow them to recover in the first 20 years of the plan (p. 175, par 1).

Pollutants: In addition to that described in all alternatives, alternative A has standards and guidelines to ensure that the use of pesticides and herbicides does not cause surface water or groundwater contamination, including during site preparation for new timber stands or insect suppression projects (p. 73, par 9; replacement p. 121, par 12; replacement p. 70, par 4).

Fire Suppression: Forest Service response to wildfires is considered an emergency action and is guided by law, regulation, and policy. Chemicals used in fire suppression and prescribed fires (such as fire retardant and foam) can harm this species. Although alternative A lacks language that specifically addresses the use of such chemicals in threatened, endangered, and sensitive species habitat during fire suppression, it does have the following plan direction to address species needs: goals (or desired conditions) to maintain the viability of wildlife species on the forest (new p. 22-1 par 1); to follow existing recovery plans (replacement p. 64, par 2); and to provide appropriate protection or enhancement for threatened, endangered, and sensitive species (new p. 64-1 par 1), which would be applicable when using the Wildland Fire Decision Support System process during wildfires with resource objectives. Fire suppression has a positive impact by preventing or reducing catastrophic loss of habitat in riparian areas or in the associated watersheds. Uncharacteristic fire can result in uncharacteristic waterflows or increases in sedimentation that degrade or remove primary constituent elements in habitat (such as perennial water with specific pH and salinity and water with no to low pollutants) and can kill species. Fire retardant used as a tool in fire suppression can harm aquatic wildlife. Existing policies and guidance reduce or remove the impacts from fire retardant to affected species (USDA Forest Service 2011b, USFWS 2011b).

Mining: There is low potential for leasing activities in Chiricahua leopard frog habitat. Many of the standards and guidelines in alternative A describe the administrative processes for geology and minerals program management, and would not have an on-the-ground effect to resources. “No surface occupancy” stipulations would protect wildlife and soils at site-specific locations such as where there are federally listed species and slopes greater than 40 percent (p. 76, par 60). Alternative A identified research natural areas and other special areas to be withdrawn from locatable mineral entry in the first decade (p. 196, par 1). Standards and guidelines manage the adverse effects of leasing in areas of high resource sensitivity (p. 77, par 8). Also, mineral material excavation within the riparian zone may be allowed after environmental analysis, and

authorized mineral activities would maintain or improve riparian conditions (p. 177, par 2). These plan components would protect or mitigate effects to Chiricahua leopard frog habitat.

Connectivity: Alternative A partially addresses frog movements and basic needs. It promotes connectivity in piñon-juniper types (which contains critical habitat) and specific management areas across the forest such as Sedona/Oak Creek, however, it lacks guidance about connecting other areas, such as portions of Recovery Unit 5, and focuses on big game species (deer, elk, pronghorn, and bear) primarily in forest and woodland vegetation. The "Ephemeral and Intermittent Stream Course" section under "Coarse Filter – Special Features" describes how alternative A protects these stream courses that are also used for dispersal.

Under alternative A, there is about 6.9 miles of critical habitat, 70,211 acres of habitat in the West Mogollon Management Area, and 14,809 acres of habitat in the East Clear Creek Management Area in more primitive ROS classes. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads.

Alternatives B, C, and D

Invasive Animals: Invasive animals are also addressed in the coarse filter section above. Alternatives B, C, and D contain updated and more comprehensive plan direction regarding invasive species than alternative A. The proposed revised plan specifies forestwide desired conditions for ecosystems, habitats, and species that are free of, or minimally impacted by, invasive species (FW-AQ-Str-DC-8; FW-AQ-Spr-DC-11; FW-Invas-DC-1-2; FW-WFP-DC 1, 2, 6, 8; FW-WFP-G-6; FW-Spec-Use-S-12; FW-Rec-Disp-DC-13; FW-Rec-Dev-DC-3; SA-Wild-All-DC-9; SA-Wild-SecretMtn-DC-2; SA-Wild-Fossil-DC-3; SA-Wild-Verde-DC-6) and like the current plan, alternatives B, C, and D have management approaches that emphasize coordination with State and Federal wildlife agencies. Unlike alternative A, alternatives B, C, and D have prevention measures to minimize accidental and incidental introductions, including introductions to downstream habitats and between 6th code watersheds (FW-Invas-G-1-2; FW-RdsFac-G-6; FW-WFP-G-6, 8, 9; FW-WtrShed-G-3, 4). Implementing the language within the proposed revised plan would reduce impacts to native species populations from invasive animals with regards to those activities under Forest Service control and would do a better job than alternative A in maintaining the viability and persistence of the species populations associated with invasive animals.

Disease: Disease is better addressed in alternatives B, C, and D because disease is directly addressed and is applicable forestwide (table 57). All three alternatives would maintain the viability and persistence of the species populations associated with this threat, within the authority of the Forest Service, through plan components that would prevent or reduce the introduction and spread of disease within various habitats, including streams and springs. Native species populations would be maintained through measures designed to prevent the spread of diseases, including the use of established protocols to prevent the introduction and spread of a chytrid fungus where native toads and frogs occur. In addition, a management approach would ensure that public awareness/education tied to wildlife disease is increased. Other management approaches include coordinating with the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service regarding threatened and endangered species, including reintroductions of listed species into suitable habitat, and the management of sport and native fishes, including the identification of refugia for native fish.

Table 57. Plan components in alternatives B, C, and D that provide for the viability of species threatened by disease at the fine filter level

Species	Location Code in Proposed Revised Plan	Intent of Plan Component
Chiricahua leopard frogs and all aquatic and riparian associated species in table 42, Table 43, and table 44 that have disease as a threat.	FW-WtrShed-G-3 and G-4; FW-WFP-G-6, 7, 8, 9; FW-Invas-G1-2	Reduce the transfer or accidental introduction of disease between 6th code watersheds and between water bodies. Native species populations would be maintained through measures designed to prevent the spread of diseases.
Chiricahua leopard frog, Gila topminnow, lowland leopard frog, northern leopard frog	FW-Rec-Disp-G2	Accidental introduction of diseases would be limited at springs by having limited trail access.
All associated species	FW-RdFac-G-6	Road closures or other restrictions should be used to reduce invasive species dispersal.

Treatments to Control Tamarisk: Tamarisk and other invasive plant species are widespread in portions of Chiricahua leopard frog habitat and treatment efforts are ongoing. Alternatives B, C, and D are more explicit than alternative A: native species would be free or minimally impacted by treatments to control nonnative vegetation (FW-Aq-Strm-DC-8) and also promote removal of nonnative species and restoration of native communities. Treatments have a positive long-term impact on this species because it hastens restoration of native communities to which the species are adapted and removes plant species that use more water than native species do. Treatments are ongoing along the Verde River and project managers would coordinate with local biologists to reduce impacts to threatened and endangered species.

Livestock Grazing: Plan components in alternatives B, C, and D specify that livestock grazing maintains desired conditions of plant communities (FW-Graz-DC-2). They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season; specifying utilization levels on woody vegetation; maintaining adequate vegetative cover to protect streambanks; and stating that riparian areas are rarely negatively impacted by livestock (FW–Veg-Rip-All–DC-1; FW-Veg-Rip-All-G-3; FW-Graz-DC-2). This would provide sufficient cover for frogs and reduce potential impacts to egg masses or frogs from trampling, as well as maintain their habitat. A guideline reduces cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-1; FW-Graz-G-6).

Pollutants: Alternatives B, C, and D specify that chemicals, herbicides, and pesticides should be avoided near bat watering areas (which can also be frog habitat) to avoid contamination (FW-WFP-G-12). Native species would be free or minimally impacted by treatments (which includes pesticides and herbicides) to control nonnative vegetation (FW-Aq-Strm-DC-8).

Fire Suppression: Alternatives B, C, and D have a guideline that specifically states that fire suppression techniques that minimize disturbance impacts should be used where there are listed and Southwestern Region sensitive species (FW-WFP-G-3). Similar to alternative A, plan

components support viable self-sustaining populations in addition to the survival and recovery of listed species and provide habitat for federally listed species (FW-WFP-DC-2). Fire suppression has a positive impact by preventing or reducing catastrophic loss of habitat in riparian areas or in the associated watersheds. Uncharacteristic fire can result in uncharacteristic waterflows or increases in sedimentation that degrade or remove primary constituent elements in habitat (such as perennial water with specific pH and salinity and water with no to low pollutants) and can kill species. Fire retardant used as tool in fire suppression can harm aquatic wildlife. Existing policies and guidance reduce or remove the impacts from fire retardant to affected species (USDA Forest Service 2011b, USFWS 2011b).

Connectivity: Alternatives B, C, and D have plan components that would provide connectivity for an array of species. These components would provide for movement corridors and links between aquatic and upland habitats and watersheds which would facilitate establishment or maintenance of metapopulations, provide habitat and access to food, water, and cover, and provide for genetic exchange (FW-Aq-Strm-DC-1,4, 5, 7; FW-WFP-DC-7; FW-Veg-All-DC-4). These alternatives would also minimize fragmentation in streams and springs as well as barriers to movement and habitat in Chiricahua leopard frog habitat including roads and associated infrastructure (FW-Aq-Spr-DC-10; FW-WFP-DC-9; FW-RdsFac-DC-1, 2, 4; FW-RdsFac-G-5). The “Ephemeral and Intermittent Stream Course” section under “Coarse Filter – Special Features” describes how alternatives B, C, and D protect these stream courses that are also used for dispersal.

Mining: There is very little foreseeable development of minerals in the portion of the forest currently occupied by Chiricahua leopard frog (see “Minerals” section). Some plan language would apply to Chiricahua leopard frog in the event that Chiricahua leopard frog populations expand or mining or minerals becomes more economically feasible.

Desired condition statements in alternatives B, C, and D protect important cultural sites, habitats, and scenery, and guidelines require that these areas would be considered by future locatable and leasable mineral projects (FW-EngyMin-G-1, 4). Additional guidelines would direct the forest to consider withdrawal or no leasing for threatened and endangered species habitat (FW-EngyMin-G-1, 2). While the exact effect cannot be estimated in advance, these resources would provide more protection to the Chiricahua leopard frog than under alternative A. In further comparison with alternative A, reclamation of mine areas would be a higher priority for the minerals program under alternative B, which would reduce erosion and sedimentation from recent and past mining activities (FW-EngyMin-DC-1).

Areas with very high scenic integrity objectives can be considered for no leasing or no surface occupancy, or other less constraining stipulations, resulting in potential protection to Chiricahua leopard frog habitat that overlaps these areas (FW-EngyMin-DC-4).

Areas of very high cultural site density, high density of threatened, endangered, or sensitive species, or sensitive plant species would be protected by stipulations at the site-specific level to minimize ground and noise disturbance (FW-SpecUse-G-13). However, this guideline is not likely to benefit Chiricahua leopard frog, since they do not occur in high densities on the forest.

Another guideline in alternatives B, C, and D calls for considering for withdrawal for locatable minerals the “habitat of species having a very limited range and specific habitat requirements not found elsewhere where law and regulation alone do not adequately protect the resource” (FW-

EngyMin-G-1). This guideline could provide benefits during subsequent NEPA analysis and consultation with the U.S. Fish and Wildlife Service by ensuring that habitat and existing populations are not impacted by development of locatable minerals.

Mineral withdrawals and mitigations for threatened and endangered species are addressed through the Bureau of Land Management's leasing and sales process, but the proposed revised plan recognizes that proactive withdrawal is an important option to retain for species with "very limited range and specific habitat requirements not found elsewhere where law and regulation alone do not adequately protect the resource." This language would guide the forest to work with the Bureau of Land Management and U.S. Fish and Wildlife Service to identify locations where withdrawal for species such as Chiricahua leopard frog needs further protection.

Habitat: The coarse filter section on riparian resources, aquatic systems, and forest and woodland types provides additional information regarding how different alternatives address PNVT level threats to Chiricahua leopard frog habitat.

Collectively, the guidance in these alternatives would contribute positively to Chiricahua leopard frog riparian habitat as projects are implemented under alternatives B, C, or D. Extrapolating out to 2030, guidance and objectives in alternative B would improve 9 to 23 percent of riparian acres, but the remaining acres would stay in at-risk or nonfunctioning conditions (FW-Veg-Rip-All-O-1). These alternatives would have minimal positive impacts on Piñon-Juniper Evergreen Shrub and Piñon-Juniper Woodland habitats that surround existing Chiricahua leopard frog sites.

Desired conditions for stream ecosystems describe conditions supportive of native aquatic species. Emphasis is given to resilient streams and associated flood plains, natural hydrographs, self-sustaining aquatic species, habitat connectivity, minimal impact of nonnative species, and recovery of listed species (FW-Aq-Strm-DC-1-7). Implementing projects to meet these desired conditions would benefit the Chiricahua leopard frog.

The one desired condition that could negatively impact the Chiricahua leopard frog is "physical barriers or habitat alterations like temperature changes or loss of streamflow do not exclude native fish or other aquatic species from their historic habitat" (FW-WFP-DC-8). This can be detrimental to the Chiricahua leopard frog, since nonnative fish prey upon and compete with the frog. Fish barriers are sometimes needed to prevent the invasion of habitat by nonnative fish. This desired condition is countered by forestwide desired conditions for wildlife, fish, and plants that state "barriers to movement are located where necessary to protect native fish from nonnative species until watershed restoration allows connectivity to be restored" (FW-WFP-DC-8). This should ensure that barriers could be placed, if needed, to protect Chiricahua leopard frog populations, protecting them from nonnative fish predation.

Desired conditions describe watersheds with high geomorphic, hydrologic, and biotic integrity where natural processes maintain physical and biologic processes (FW-WtrShd-DC-1). Desired conditions for water quality and quantity emphasize native aquatic species (FW-Aq-Wat-DC-6). In addition, as the condition of the watersheds where the frogs currently occur is functioning at risk, an objective to improve impaired and functioning-at-risk watersheds could benefit Chiricahua leopard frogs (FW-Veg-Rip-All-O-1).

Following the guidelines in alternatives B, C, and D for water quality and quantity at the project level should benefit the Chiricahua leopard frog by management of instream flows, meeting water quality standards, and limiting the risk of transport of organisms among watersheds (FW-Aq-Wat-

G-1-5). These guidelines will help ensure frogs have: water that is sufficient for survival and reproduction; water that is clean enough to support aquatic food sources; and reduced impacts from disease (e.g., Chytridiomycosis). Guidance in alternatives B, C, and D for water quality is similar to alternative A, but is more protective in order to minimize transport of disease and nonorganisms among waterbodies.

Although all known populations of the Chiricahua leopard frog are in constructed stock tanks, the guidance in alternatives B, C, and D would be beneficial to the Chiricahua leopard frog because it will improve natural wetland habitats for the potential reintroduction of frogs within their historic range on the forest (FW-Aq-Wtlnds-G-1).

Alternative B

Wilderness: Alternative B proposes three new wilderness areas: Strawberry, Walker Mountain, and Davey's. Davey and Walker Mountain are within the Mogollon Rim-Verde Recovery Unit (RU-5), specifically, the Mogollon Rim Management Area. There is a very small amount of riparian habitat within these areas (56 acres). There are no occupied sites or critical habitat within the recommended wilderness areas, therefore, the recommended wilderness areas will have no effect on occupied Chiricahua leopard frog habitat or its critical habitat, and a negligible effect on other riparian habitat.

Recreation Opportunity Spectrum: The forest plan sets the desired recreation opportunity spectrum, also called recreation opportunity spectrum objectives, used to determine if projects are compatible with forest recreation goals. At the project level, the desired recreation opportunity spectrum is used to determine if a project is moving toward or away from the desired recreation opportunity spectrum. Recreation opportunity spectrum classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive, semiprimitive nonmotorized, and semiprimitive motorized and are characterized by relatively little or no developments and roads. The less primitive classes are roaded natural, rural, and urban.

Under alternative B, there would be about 6.9 miles of critical habitat (same as alternatives A, C, and D), 6,469 more acres of habitat in the West Mogollon Management Area, and 73,821 more acres of habitat in the East Clear Creek Management Area in more primitive ROS classes compared to alternative A. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. Overall this would be a net improvement of 80,290 in more management area acres than alternative A and a slightly higher net improvement than alternative D but less than alternative C.

Alternative C

Mining: Alternative C has the same overall environmental consequences as alternative B with respect to minerals and energy desired conditions and guidelines.

Wilderness: Alternative C proposes an additional 10 wilderness areas, of which all or part of 8 are within Chiricahua leopard frog Recovery Unit 5 (in addition to the Davey's and Walker Mountain recommended wilderness areas previously discussed under alternative B). The recommended wilderness areas contained in Recovery Unit 5 include: Barbershop, Black Mountain, Cedar Bench, Cimmaron-Boulder, Davey's, Deadwood Draw, East Clear Creek, Hackberry, Tin Can, and Walker Mountain. Four of the sites currently occupied by Chiricahua leopard frog are within or straddle the boundary of the Cimmaron-Boulder recommended

wilderness area. The remaining sites are not within any recommended wilderness area. Only three historic locations for the Chiricahua leopard frog are within recommended wilderness areas: one in the Black Mountain recommended wilderness area and two within East Clear Creek recommended wilderness area.

Wilderness recommendation could affect Chiricahua leopard frog in both positive and negative ways. Limitation on roads and access could reduce the potential for disturbance, habitat impacts, and spread of disease among sites. However, where riparian habitats and occupied or potential sites exist, there is often a need to conduct restoration activities such as thinning to improve adjacent watershed condition and waterflow, removing nonnative species, or fencing to exclude ungulate grazing. Guidelines for recommended wilderness could make it more difficult to implement some of these activities because of limitations on use of motor vehicles and direction to avoid construction of new facilities that cannot be made consistent with the area's wilderness character. For fencing and other facilities supporting reintroduction at new sites, the cost could be increased by the need to mitigate visual impacts and projects may be harder to implement because of the potential difficulty of maintaining these structures if the area is designated by Congress.

Wildlife Habitat Management Areas: Eight wildlife habitat management areas are proposed to emphasize wildlife habitat and all occur in Recovery Unit 5. Four wildlife habitat management areas contain potential or historic habitat for Chiricahua leopard frog (East Clear Creek, Hospital Ridge, Knoll Lake, and Limestone Pasture). These four are within the East Clear Creek Management Area and contain 30 percent of the Montane Willow Riparian Forest habitat on the forest. The proposed Second Chance Wildlife Habitat Management Area is within historic range, but does not contain any riparian habitat.

Guidelines for WHMAs would reduce disturbance from motorized dispersed camping and motor vehicle use in 30 percent of the Montane Willow Riparian Forest compared to alternatives A, B, and D. This could positively affect Chiricahua leopard frog by reducing riparian vegetation impacts (i.e., loss of hiding cover and habitat to which egg masses could be attached) from disturbance to the frog from recreational and motorized uses of the area.

None of the WHMAs are within occupied Chiricahua leopard frog critical habitat or the West Mogollon Management Area, so there would be no anticipated difference between alternatives B, C, and D on occupied habitat because of the delineation of wildlife habitat management areas.

Under alternative C, there would be about 6.9 miles of critical habitat (same as alternatives A, C, and D), 6,890 more acres of habitat in the West Mogollon Management Area and 75,484 more acres of habitat in the East Clear Creek Management Area in more primitive ROS classes compared to alternative A. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. Overall, this would be a net improvement of 82,374 more management area acres than alternative A and a higher net improvement than alternatives B and D.

Alternative D

Alternative D recommends no new wilderness areas, but otherwise is the same as alternative B. Because no new wilderness areas are proposed, alternative D would leave the most area on the forest open to mineral entry for locatable, leasable, and mineral materials, however, this is likely to have little impact on Chiricahua leopard frogs because of low mineral potential in its habitat (see "Minerals and Energy" section for more details). As alternative D does not propose any new

wilderness, it is the same as alternative A in that it would avoid both the positive effects of proposing wilderness (reducing the likelihood of disturbance, habitat destruction, and spread of disease) and the negative effects of proposing wilderness (reduced ability to actively restore habitat). However, because the Strawberry, Davey's, and Walker Mountain recommended wilderness areas will have no effect on occupied Chiricahua leopard frog habitat and critical habitat, and a negligible effect on other riparian habitat, the net effects from this alternative would be similar to alternative B.

Alternative D would allow mechanized use on designated trails within botanical and geological areas. Only the Mogollon Rim Botanical Area is within potential, but unoccupied, Chiricahua leopard frog habitat and no botanical or geological areas are within critical habitat. As a result, allowing bicycles on designated trails in botanical and geological areas will have no appreciable effects on the Chiricahua leopard frog or critical habitat.

Under alternative D, there would be about 6.9 miles of critical habitat (same as alternatives A, C, and D), 6,268 more acres of habitat in the West Mogollon Management Area, and 73,821 more acres of habitat in the East Clear Creek Management Area in more primitive ROS classes compared to alternative A. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. Overall, this would be a net improvement of 80,089 more management area acres than alternative A and a lower net improvement than alternatives C and D.

Summary of Species Effects

The implementation of all alternatives would result in a "may Affect" determination for Chiricahua leopard frog and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

For landscape-level habitat threats, the coarse filter section of this document summarizes how landscape threats to the primary habitats, including uncharacteristic fire and overall water quality, are addressed in the alternatives. Additional details are in the "Vegetation," "Soil," and "Aquatic Systems" sections of this document.

Chiricahua leopard frogs are rare on the forest, occupying a very small portion of potential habitat. As a result, it is vulnerable to perturbations in the environment. Some habitats have relatively higher departures from reference conditions, e.g., the Cottonwood Willow Riparian Forest, Piñon-Juniper Evergreen Shrub PNVTs, and springs. This species has threats associated with disease and invasive animals and sublandscape threats (which were listing factors): treatments to control tamarisk; livestock grazing; barriers to movements between suitable and upland habitats; and contaminants associated with pesticide and herbicide treatments, fire suppression, and mining.

Although all alternatives maintain the viability and persistence of this species, alternatives B, C, and D share the following characteristics that better maintain the viability and persistence of the Chiricahua leopard frog:

- desired conditions are more clearly articulated for all habitats including the Wetland Cienega and Springs PNVTs, so that the composition, structure, and processes of these habitats better provide for the needs of this species;
- guidelines specifically address disease and invasive animals more comprehensively, resulting in reductions of these threats within the authority of the Forest Service;
- threats to habitats are better defined and plan components would improve habitat conditions as projects are implemented; and
- language regarding movement corridors and connectivity between habitats is updated so that links between breeding and upland habitats, and between suitable habitats would be maintained.

Fine Filter - Amphibians

Southwestern Region Sensitive Species and Other Forest Planning Species (Table 43and table 44)

Affected Environment

Distribution: There are no known **Arizona toads** on the forest. Historically they were found on West Clear Creek and the Verde River (Sullivan 1991 and Sullivan and Richardson (1993)). The Arizona Game and Fish Department's Natural Heritage Program (HDMS) reported that Arizona toads could potentially occur along the Verde River from West Clear Creek to the East Verde confluences. Other authors state that the Arizona toad has been replaced by the native Woodhouse's toad at Alamo Lake, Lake Pleasant, the Verde Valley, and Fort Mohave (lower Colorado River) (AZGFD 2011).

Fossil Creek supports the only known population of **lowland leopard frogs** on the Coconino NF. Currently, lowland leopard frogs are known to occur in Spring Creek but only on the private land parcel, Josephine Tunnel (private land), Page Springs Fish Hatchery (State land), possibly in Oak Creek Canyon (only tadpoles observed), and Soda Springs (private land). Historic records for lowland leopard frogs are from Spring Creek, Verde River, Josephine Tunnel (private land), Oak Creek including the Canyon, and Fossil Creek. Unsurveyed, but suitable locations below the rim are numerous and include perennial streams (Walker Creek, Red Tank Draw), various springs (Russell, Holly), and numerous earthen livestock tanks below the rim.

In Arizona, **northern leopard frogs** are absent from most historical locations; other than the livestock tanks at and near Stoneman Lake, this species is rare in the State. The Arizona Game and Fish Department considers this species to be at the margins of the species populations, to have declining (30 to 70 percent) and small populations with either low birth rates or high death rates (AZGFD 2012). Following metamorphoses, northern leopard frogs disperse away from their natal wetlands, and can move up to 800 meters in 2 to 3 days and have a tendency to move to the edges of permanent bodies of water. Mass emigrations can follow heavy rains.

Habitat: Arizona toads are associated with streams, Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, Montane Willow Riparian Forest, and the Wetland Cienega PNVTs. Ephemeral and intermittent riparian watercourses with perennial pools are important special features used for movements between suitable habitats. The Arizona toad occurs in rocky streams, canyons, and flood plains with dense riparian vegetation in elevations between 2,000 and 6,000 feet. They breed in gently flowing waters generally with well developed riparian vegetation and feed on insects and snails.

Lowland leopard frogs are associated with streams, springs, and the Cottonwood Willow Riparian Forest, Mixed Broadleaf Riparian Forest, and Wetland Cienega PNVTs. Ephemeral and intermittent riparian watercourses are important for movement between suitable habitats.

Northern leopard frogs are associated with streams, springs, and the Mixed Broadleaf Riparian Forest, Montane Willow Riparian Forest, and the Wetland Cienega PNVTs. Ephemeral and intermittent riparian watercourses are important for movement between suitable habitats.

Risk Factors: Primary threats to **Arizona toads** under the control and authority of the Forest Service are disease, invasive exotic aquatic species, and water impoundments. Arizona Game and Fish Department states that fragmentation has isolated populations from each other. Water impoundments provide habitat for Woodhouse's toads which hybridize with Arizona toads, resulting in genetic swamping. All age classes are susceptible to predation by nonnative and invasive species.

Primary threats to **lowland leopard frogs** under the control and authority of the Forest Service are disease, invasive and nonnative aquatic species, and their overall rarity. Leopard frogs are seldom found in association with nonnatives including fish, bullfrogs, and crayfish. Arizona Game and Fish Department considers this an endemic subspecies because greater than 90 percent of the global species' breeding range is within Arizona. They are moderately threatened by fragmentation because within Arizona, populations are large but fragmentation has isolated them from one another (Arizona Game and Fish Department 2006a).

Primary threats to **northern leopard frogs** under the control and authority of the Forest Service are disease, invasive exotic aquatic species, and their overall rarity (described above).

Human activities such as dispersed recreation, fire and grazing management, and research can spread infected soil, water, and organisms from one occupied site to another. This can result in the spread of disease, which can affect survival and reproduction of Arizona toad and the two frog species. Chytridmycosis is a potentially fatal infectious disease of amphibians caused by the chytrid fungus *Batrachochytrium dendrobatidis* (Bd). This disease can be spread by moving contaminated soil, water, or organisms to uncontaminated areas. Chytrid fungus has been found on the forest. Arizona toad, Chiricahua leopard frog, northern leopard frog, and the lowland leopard frog are susceptible to chytrid fungus.

Forest Service management, permitted activities, or activities on Forest Service land associated with fire suppression, stock tank cleaning, research projects, roads, recreation special uses, developed recreation, and dispersed recreation may facilitate the spread of diseases.

Environmental Consequences – Amphibians

The coarse filter section of this document summarizes how landscape threats to these species primary habitats, for example, nonnative invasive species and overall water quality, are addressed in the alternatives. Additional threats and the details of how they are addressed are found in the Vegetation, Soil, Aquatic Systems, Riparian Resources and Watersheds sections of this document.

Fine Filter – Clark's Grebe

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Clark's grebe is threatened by human activities that result in disturbance that can disrupt sensitive life stages which can reduce reproduction or cause injury or death. The Forest Service has authority and control over human activities including: recreation and water-related projects. Forest Service has approval or enforcement authority for these activities on the forest except for other jurisdictions, laws, and regulations.

Environmental Consequences – Clark's Grebe

Alternative A

Specific plan components would reduce or remove disturbance during the breeding season for Clark's grebe, a Forest Service sensitive species. In alternative A, these include maintaining viable populations of wildlife species and protecting Forest Service sensitive species and habitats; limiting disturbance to rare species; and minimizing human disturbance to wildlife during critical times (page 184, par 10; new p. 206-116, par 9; new p. 206-98, par 3).

Alternatives B, C, and D

Alternatives B, C, and D also have specific plan components designed to reduce disturbance during the breeding season, facilitating reproductive success. These are summarized in table 58.

Table 58. Plan components under alternatives B, C, and D which reduce disturbance to and provide for viability of Clark's grebe

Species	Location Code in Proposed Revised Plan	Plan Component
Clark's grebe	FW–WFP-G-4, 7; FW-Rec-Disp-DC-1, DC-14; FW-Rec-Disp-G-4, 10.	Reduce or remove disturbance during breeding season.
Threatened, endangered, sensitive species	FW-WFP-G-3, 4	Fire suppression techniques that minimize disturbance impacts should be used where there are listed and Forest Service sensitive species.
All wildlife species	FW-Rec-Disp-DC- 17	Off-trail nonmotorized use is discouraged forestwide in ecologically sensitive areas.

The plan sets the desired recreation opportunity spectrum (ROS), also called ROS objectives, which are used to determine if projects are compatible with forest recreation goals. ROS classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no development and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

Alternatives B, C, and D would shift a similar amount of acres between 5,658 and 5,753 acres from the ROS classes that allow more development to ones that allow less. This is substantially more acres compared to alternative A. This would reduce disturbance, limit the ability of

managers to build roads in this PNVT in the future, and encourage closure and decommissioning of existing roads. This would be a net improvement in habitat for this species.

Considering this analysis, plan components in all alternatives maintain the viability and do not cause a trend toward listing for Clark's grebe. These alternatives address disturbance during the breeding season and would promote successful reproduction under favorable environmental conditions.

Riparian Forest PNVTs

Coarse Filter

These PNVTs include Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, Montane Willow Riparian Forest, and Gallery Coniferous Riparian Forest.

Affected Environment

Amount and Distribution: On the forest, Cottonwood Willow makes up 2, 507 acres (0.1 percent of the forest), Mixed Broadleaf Deciduous makes up 3,612 acres (0.1 percent), Montane Willow Riparian makes up 3,829 acres (0.2 percent), and there are only about 200 acres of Gallery Coniferous Riparian Forest. These PNVTs occur within the areas they did historically.

Habitat Quality: Table 59 shows the departures in riparian functional condition and soil in the riparian PNVTs. Cottonwood Willow has a moderate departure in riparian condition compared to reference reflecting a higher proportion of functioning-at-risk and nonfunctioning conditions. It is moving slowly toward reference conditions. This PNVT has a higher proportion of impaired soils, compared to reference conditions resulting in an overall high departure with a slow trend toward reference conditions. The landscape-level conditions of the other riparian PNVTs are similar to reference with overall trends either static or trending toward reference.

Table 59. Existing soil and riparian function departures and threats

Habitat	Existing Percent Riparian Departure, Trend Relative to Reference	Existing Soil Departure, Trend (Percent Unsatisfactory, Impaired)	Coarse-Filter Threats
Cottonwood Willow Riparian Forest	Moderate (49%) slowly toward	High, slowly toward (98%)	Uncharacteristic fire in watershed or PNVT, invasive plants, increased demand for water, dispersed recreation in localized areas.
Mixed Broadleaf Deciduous Riparian Forest	Low (26%) slowly toward	Low, static (4%)	Uncharacteristic fire in watershed or PNVT, increased demand for water, dispersed recreation in localized areas.
Montane WillowRiparian Forest	Low (28%), slowly toward to static	Low, static (7%)	Uncharacteristic fire in watershed or PNVT, increased demand for water, dispersed recreation in localized areas.

Habitat	Existing Percent Riparian Departure, Trend Relative to Reference	Existing Soil Departure, Trend (Percent Unsatisfactory, Impaired)	Coarse-Filter Threats
Gallery Coniferous Riparian Forest	Low, static	Low, static	Uncharacteristic fire in watershed or PNVT, increased demand for water.

Risk Factors: The main risk factor to all four riparian forest PNVTs is uncharacteristic fire, that is, fire burning at a severity or frequency outside its natural range. It is primarily a consequence of missed fire return intervals in fire-adapted PNVTs. Missed fire return intervals can result in higher proportions of trees and closed canopy forest structure than occurred during reference conditions, as well as larger and more severe fires that have negative consequences to soils, watersheds, and aquatic habitats. Uncharacteristic wildfire from adjacent PNVTs can spread into riparian PNVTs, killing riparian species, altering the moisture levels, and facilitating the spread of invasive species. Invasive plants such as tamarisk may also facilitate uncharacteristic fire behavior in riparian PNVTs. All riparian forest PNVTs and streams are at risk from increased sedimentation and increased flows. This can result from uncharacteristic fire because most 5th code watersheds contain relatively high proportions of fire-adapted PNVTs. All the forest and woodland PNVTs on the forest are moderately departed from reference except for Piñon-Juniper Woodland which is similar to reference and Ponderosa Pine which is highly departed. Subsequent fires as a result of increased tree densities can be larger and more severe, leading to higher vegetation mortality and resulting negative soil and watershed effects. The post-fire sediment load to streams and lakes can result in loss of suitable habitat for associated species, fish mortality, and in some cases long-term alteration of water chemistry and turbidity. Wildfires also pose a threat to the remaining fish populations by causing water quality changes that can kill fish and macroinvertebrates (Rinne 2004, USFWS 2005b, Rhodes 2007), negatively altering the food base for fishes (Earl and Blinn 2003), and resulting in stream and riparian vegetation alteration that negatively affects fish habitat (USFWS 2005b). High road densities and high levels of motorized use within a watershed can also increase sedimentation into waterbodies and the transport of chemicals associated with roads, resulting in water quality impacts and diminished soil conditions. Even though high road densities are a threat to watershed condition in some parts of the forest, there are no impairments of water quality attributed to this threat at this time.

In addition, there is a presumed reduced water yield and streamflow in these PNVTs compared to reference, due to higher than normal rates of evapotranspiration in watersheds with stand densities higher than would occur under more natural fire regimes (Springer and Kolb 2000, Brewer 2008). Water quantity is also at risk due to increased demand for water from the State's growing population and commercial sector. As a result, many of the risks to water quality and quantity and watershed condition are outside the administrative control of the Forest Service either because their source is on lands of other ownership or because the State of Arizona has the authority to regulate them (such as water rights and diversions). See the "Aquatic Systems" section for more information.

Another risk is high levels of dispersed recreation in easily accessed areas which is causing ground disturbance, soil compaction, and vegetation removal and could lead to accelerated erosion and sedimentation into connected waters in Cottonwood Willow Riparian, Mixed Broadleaf Deciduous Riparian, and Montane Willow Riparian. Invasive plants are an additional

threat to Cottonwood Willow Riparian Forest. In the majority of the PNVT, there is a higher proportion of invasive plant species, compared to reference conditions, with a trend away from reference. The exception is along about 23 miles of the Verde River (from Camp Verde on down) and 7 miles along Fossil Creek where the PNVT is trending toward reference conditions due to invasive weed treatments. In untreated areas, plants such as tamarisk, giant reed, and tree of Heaven will limit and eventually cause a decline in quality of existing vegetation by reducing native cottonwood and willow regeneration potential. Instream flows may be reduced as a result since these exotic, woody plants draw more water from the water table than native trees (USDA Forest Service 2009).

When poorly managed, livestock grazing also poses a risk to riparian forest PNVTs, in localized areas. Excessive or poorly timed livestock grazing can cause soil compaction, change the structure and composition of vegetation to the extent it influences ecosystem processes, and cause soil disturbance that results in erosion and sedimentation.

The introduction, presence, and spread of invasive animal species such as bullfrogs and crayfish, and nonnative fish can have significant impacts because they eat, compete with, and can hybridize with native species. This threat is analyzed in the "Wildlife, Fish, and Plants" section under "Wetland Cienega."

Associated Species: Fifty-one species are associated with these habitats (see table 42, Table 43, and table 44). The 51 species associated with riparian forest PNVTs are as follows:

- Ten are federally listed: Chiricahua leopard frog (threatened), Colorado pikeminnow (experimental), Gila chub (endangered), Gila topminnow (endangered), Gila trout (threatened), Little Colorado spinedace (threatened), loach minnow (endangered), razorback sucker (endangered), spikedace (endangered), and southwestern willow flycatcher (endangered).
- Thirty-two are Forest Service sensitive species: northern Mexican gartersnake (candidate), A Mayfly, Abert's towhee, California floater, fossil springsnail, Page springsnail (candidate), four-spotted skipperling, southwestern river otter, western red bat, Metcalfe's tick trefoil, narrow-headed gartersnake, Arizona toad, bald eagle, Clark's grebe, common black hawk, western yellow-billed cuckoo, headwater chub (candidate), bluehead sucker, desert sucker, Little Colorado River sucker, longfin dace, roundtail chub (candidate), Sonora sucker, Blumer's dock, Bebb's willow, Cochise sedge, alcove bog orchid, Arizona bugbane, lowland leopard frog, northern leopard frog, and reticulate Gila monster.
- Nine are other forest planning species: MacGillivray's warbler, Arizona snaketail, Persephone's darner, redrock stonefly, beaver, grassy slope sedge, Jones' spider flower, New Mexico alum-root, and rough Whitlow-grass (var. asprella).
- Northern Mexican gartersnake, four-spotted skipperling, Nokomis fritillary, and Nitocris fritillary are discussed in the "Wildlife, Fish, and Plants" section under "Wetland Cienega." Arizona sneezeweed is discussed in the "Wildlife, Fish, and Plants" section under "Wetland Cienega" and "Grassland PNVTs." Reticulate Gila monster is also discussed in the "Wildlife, Fish, and Plants" section under "Interior Chaparral." MacGillivray's warbler is also discussed in the "Wildlife, Fish, and Plants" section on "Migratory Birds." Habitat for grassy-slope sedge is also discussed in the "Wildlife, Fish, and Plants" section under "Grassland PNVTs." Habitat for Jones' spider flower is also discussed in the "Wildlife, Fish, and Plants" section under "Desert Communities."

The coarse filter is inadequate to address the threats to 28 species. These 28 species are discussed further in the fine filter analysis.

- Ten are federally listed species: Southwestern willow flycatcher (endangered), Colorado pikeminnow (experimental), Gila chub (endangered), Gila topminnow (endangered), Gila trout (threatened), Little Colorado spinedace (threatened), loach minnow (endangered), razorback sucker (endangered), spikedace (endangered), and the Chiricahua leopard frog.
- Eighteen are Forest Service sensitive species: Arizona toad, bald eagle, Clark's grebe, common black hawk, western yellow-billed cuckoo, headwater chub (candidate), bluehead sucker, Desert sucker, Little Colorado River sucker, longfin dace, roundtail chub (candidate), Sonora sucker, Blumer's dock, Bebb's willow, alcove bog orchid, Arizona bugbane, lowland leopard frog, and northern leopard frog.
- Chiricahua leopard frog, Clark's grebe, lowland leopard frog, and northern leopard frog are discussed in the "Wildlife, Fish, and Plants" section under the "Wetland Cienega PNVT." Bald eagles are discussed in the "Wildlife, Fish, and Plants" section under golden and bald eagles and under forest PNVTs.

Environmental Consequences – Riparian Forest PNVTs

Habitat Quality

Common to All Alternatives

For all alternatives, the contribution of sediment to water quality resulting from vegetation management, trail maintenance and construction, and from human and livestock disturbances to riparian areas is expected to be similar because the best management practices used for implementation of these activities are the same across alternatives and are expected to reduce or mitigate sedimentation.

Table 60 compares soil and riparian departure and trend by alternative for the riparian forests. Under all alternatives, riparian and soil departure in Cottonwood Willow Riparian Forests do not change and all improve by moving slowly toward desired conditions.

Under all alternatives, the forest would continue to pursue instream flow rights at similar levels (alt A: new pg. 206-116, par 9; pg. 74, par 5; alts B, C, and D: FW-Aq-Wat-DC 3, 4 and 5 and FW-Aq-Wat-G 4 and 5) which, if obtained, would ensure that new requests for water rights would not negatively impact water quantity for wildlife habitat and riparian vegetation.

All alternatives address the threat of invasive plants by pointing to the "Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds" (USDA Forest Service 2005). This direction includes best management practices, among other guidance, which would help prevent, mitigate, and reduce the threat of invasive plants. All alternatives prioritize treatments, call for incorporating control measures in project planning and implementation, and emphasize coordination with partners.

Alternative A

Plan language is generally outdated. It does not include current science about vegetative condition and natural disturbances and lacks comprehensive desired conditions for composition, structure, and function of riparian forests.

Under alternative A, riparian and soil departure and trend scarcely change from existing for Mixed Broadleaf Deciduous Riparian Forest and Montane Willow Riparian Forest. In Gallery

Coniferous Forest, there is no change in riparian departure between existing condition and alternative A and a slow improvement in trend for soil departure.

Table 60. Comparison of soil and riparian departure by alternative in riparian forests

Habitat	Riparian Departure			Soil Departure		
	Existing	Alt. A	Alts. B, C, D	Existing	Alt. A	Alts. B, C, D
Cottonwood Willow Riparian Forest	Moderate (49%), slowly toward	Moderate (46%)/Slowly Toward		High, slowly toward (98%)	Slowly toward	
Mixed Broadleaf Deciduous Riparian Forest	Low (26%), slowly toward	Low (23%)/Slowly Toward	Low, static (4%)		No change	Slowly toward
Montane WillowRiparian Forest	Low (28%), slowly toward to static	Low (25%)/Static to Slowly Toward.	Low (25%)/Static to Slowly Toward. Alt. C is toward.	Low, static (7%)	No change	Slowly toward.
Gallery Coniferous Riparian Forest	Low, static	No change		Low, static	Slowly toward	

Improved Habitat: Alternative A has treatment objectives that exceed the capacity of the forest to implement them for watersheds, water quality, riparian recovery, and soil improvements. Forest plan objectives would result in improving the habitat of associated species should projects occur in their habitat but the amount of improvement is unknown because the scale, magnitude, and location of treatments would be decided at the project level. Implementation of plan components other than objectives could result in improvements to habitat quality, however, amount of improvement would be unknown because this would be decided at the project level.

There would be little impact to the species associated with Mixed Broadleaf Deciduous, Riparian Montane Willow Riparian, and Gallery Coniferous Riparian Forests under alternative A because the composition and structure of these three PNVTs are assumed to be similar to reference and the species would have evolved under similar conditions.

Continuing implementation of alternative A would improve impaired water quality, maintain instream flows or riparian, soil, and watershed function and would move water resources toward desired conditions. The rate of improvement would not be as quickly as alternatives B, C, and D because alternative A does not holistically consider the effect that uplands within the watershed have on the health and stability of aquatic systems and lacks objectives that focus treatments on priority waters or watersheds.

Alternatives B, C, and D

Alternatives B, C, and D would improve desired conditions for these PNVTs by updated direction for fire management, native vegetation diversity, soil condition and function, and riparian function.

Improved Habitat: The departure and trend of riparian forest PNVTs would improve under these alternatives or remain in functioning condition. Alternatives B, C, and D have treatment objectives that would restore the structure of at least 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas during the 10 years following plan approval, with emphasis on priority 6th code watersheds, so that they are in or moving toward proper functioning condition. These objectives are more realistic than those in alternative A and, like alternative A, would result in improving the habitat of associated species should projects occur in their habitat but the amount of improvement is unknown because the scale, magnitude, and location of treatments would be decided at the project level. Implementation of plan components other than objectives could result in improvements to habitat quality, however, amount of improvement would be unknown because this would be decided at the project level.

Alternative C

Cochise sedge would be found in the East Clear Creek recommended wilderness area under alternative C. Recommendation of this area would not result in different impacts from hiking and dispersed camping than would occur under alternatives A, B, and D.

Bollander's quillwort and Cochise sedge would be found in the East Clear Creek Wildlife Habitat Management Area under alternative C. Guidelines for this WHMA include:

- Large group recreation events and large commercial tours should not be permitted except in developed sites and in support of research.
- Public access should be provided on roads that access developed sites, trailheads, and interpretive sites, and improved and maintained roads providing connectivity from State Highway 87 to the Rim Road (FR 300).
- All roads that are not open for public access are managed for administrative use or decommissioned.

These guidelines would potentially result in greater protection and more habitat for these plant species in riparian areas within the wildlife management area, such as springs, wetlands, or ponds.

Uncharacteristic Fire

Alternative A

Implementation of alternative A would not be sufficient to address threats that affect the PNVTs on a landscape scale because it lacks forestwide desired conditions or objectives that specify restoration of natural fire regimes to address the threat of uncharacteristic fire, except in certain management areas. Even when fire restoration is specifically addressed in a management area, alternative A's suppression objectives and guidelines may limit the Agency's ability to implement practices that would allow fire restoration to be reached. Fire exclusion in PNVTs that adjoin these riparian forest types, however, would continue to facilitate conifer encroachment (in Mixed Broadleaf and Montane Willow Riparian Forests), which is shading out riparian deciduous trees and shrubs and, thereby, increasing the risk for uncharacteristic fire in these PNVTs. Uncharacteristic wildfire would kill riparian vegetation, facilitate establishment of invasive and exotic plants, and dry riparian areas.

Although overall direction for wilderness supports fire playing a natural role on the landscape, guidelines that direct managers to suppress fires under several circumstances set a band of

opportunity that is so narrow as to essentially prevent the use of wildfires with resource objectives (pgs. 93–95; pg. 95, par 9; pg. 111, par 8, 9; pg. 112 in its entirety). As a result of this contradictory direction, fire has not been allowed to play its natural role in wilderness and departure from desired conditions has increased along with the risk of uncharacteristic fire under alternative A. These trends would be expected to continue and would result in increased risk of uncharacteristic fire to riparian areas in and around existing wilderness.

Low fire suppression objectives and guidelines in alternative A that restrict managing wildfires with resource objectives in wildland-urban interface would further increases departure in these areas from desired conditions (replacement p.137, par 7; p.144, par 6; p.147, par 9; p.155, par 5; replacement p.157, par 7; replacement p.161, par 2; replacement p. 165, par 5; p. 170, par 2; replacement p. 182, par 10; replacement p. 204, par 6). Approximately 26 percent of the fire-adapted PNVTs would be restricted from managing wildfires with resource objectives because they are located in the wildland-urban interface. Even though some riparian areas and the fire-adapted PNVTs that surround them may be able to decrease their departure and reduce the risk of uncharacteristic fire, this effect would not occur forestwide because riparian areas in watersheds that overlap the wildland-urban interface would not move toward desired conditions without fire from planned ignitions and mechanical treatments, which would achieve desired conditions more slowly than if fire were allowed to play its natural role on the landscape. Therefore, these areas would not move toward desired conditions or have a decreased risk of uncharacteristic fire under alternative A as they would under alternatives B, C, and D.

Alternatives B, C, and D

Desired conditions in alternatives B, C, and D would reduce the threat of uncharacteristic wildfires to all ecosystems, promote natural disturbance regimes in riparian habitats, and maintain or improve composition, structure and processes characteristic of these PNVTs (table 62). The desired condition for all vegetation types (FW-Veg-All-DC-5) emphasize the spatial and temporal distribution and condition of transition zones between riparian and terrestrial ecosystems, and desired conditions throughout the “Vegetation” section emphasize overall reduction in the risk of uncharacteristic fire across the landscape due to treatments and management in terrestrial PNVTs. Objectives for terrestrial PNVTs would also decrease the risk of uncharacteristic wildfires in riparian PNVTs. Under alternatives B, C, and D, there is no restriction on where wildfires can be managed for resource objectives and so the portions of fire-adapted ecosystems in wilderness and wildland-urban interface would be able to use wildfires with resource objectives more effectively. It is unknown how many acres would be treated in this manner under the plan because of the unpredictability of where lightning-caused ignitions will occur and under what conditions. In all cases, these fires would help move terrestrial vegetation toward desired conditions and would reduce the risk of uncharacteristic fire across the landscape which, in turn, would reduce the risk of uncharacteristic fire to adjacent riparian PNVTs. This would reduce the mortality associated with uncharacteristic fire in riparian areas and the indirect effect of creating conditions favorable for invasive plants postfire. When uncharacteristic fire occurs in their habitat, the population of associated species can decline because of decreased suitable habitat and food sources. Large trees and snags needed as roosts, perches, and nest trees by bald eagles, black hawks, and western red bats would also be better maintained as the risk of uncharacteristic fire is reduced and so would dense midstory and shrubs used by southwestern willow flycatchers and yellow-billed cuckoos. Woody species that provide food and dam material for beavers would be better protected from this threat. The coarse woody material provided by overstory species would be essential to a properly functioning riparian stream, helping to reduce the energy of floodwaters, and providing

cover for fish and other aquatic species which are prey for southwestern river otters. As the habitat for native fish is maintained or improved, then habitat conditions for California floaters, a native clam that requires native fish for one of its life stages, are likely to be maintained.

Alternative C

Alternative C would propose recommended wilderness that would limit the use of mechanized and motorized equipment for fuels reduction to maintain wilderness character in 9 percent of Cottonwood Willow Riparian Forest, 14.4 percent of the Montane Willow Riparian Forest, and 7.2 percent of Mixed Broadleaf Deciduous Riparian Forest. These areas would also not be suitable for new permanent and temporary road construction and would allow administrative and permitted motor vehicle access in a manner that allows for maintenance of facilities without expanding the evidence of motor vehicle use. This would somewhat reduce the ability of managers to conduct mechanized treatments in recommended wilderness and, as a result, it could have the negative effect of increasing the risk of uncharacteristic fire and resulting sediment deposition in watersheds emptying into the lower Verde River and Upper Clear Creek watershed, where the largest concentration of these designations are recommended.

Another way that recommended wilderness can affect the risk of uncharacteristic fire is by changing the ability of the Forest Service to manage wildfires with resource objectives in nearby PNVTs. Although prescribed fire and wildfires with resource objectives would continue to be permissible when an area is recommended for wilderness, the operational decision on whether or not to suppress a fire in an inaccessible area versus letting fire play a natural role on the landscape considers other factors.[49] The recommended wilderness in alternative C would be unlikely to change the likelihood that wildfire with resource objectives would be used in nearby PNVTs compared to alternative B, because it affects a very small percentage of riparian areas forestwide (table 61).

Table 61. Acres of recommended wilderness by alternative with a moderate to very high likelihood fire suppression ranking

PNVT	Alt. B	Alt. C	Percent of PNVT Forestwide for Alt. C
Cottonwood Willow Riparian Forest	7	24	0.53%
Mixed Broadleaf Deciduous Riparian Forest	19	199	4.38%
Montane Willow Riparian Forest	0	9	0.22%
Gallery Coniferous Riparian Forest	0	0	0%

[49] Per "Vegetation and Fire" section, these factors are the continuity and availability of fuels, adjacency to and comparative size of existing wilderness, size of the recommended wilderness area, existing condition of topography and roads affecting accessibility for equipment or foot travel, and proximity to values at risk (e.g., infrastructure such as buildings, water developments, power lines).

Table 62. Plan components in alternatives B, C, and D that provide for the viability of species associated with Riparian Forest PNVTs

Habitat Characteristics and Threat	Location Code in Proposed Revised Plan	Intent of Plan Component
Overall habitat quality	FW-Soil-Obj-1; FW-WtrShed-Obj-1; FW-Veg-Rip-All-O-1; FW-WtrShed-DC-2; FW-WtrShed-O-2	Provide more realistic objectives. Restore 200 to 500 acres of poorly functioning riparian areas. Reduce uncharacteristic fire and subsequent sedimentation and uncharacteristic flows in watersheds. Improve water yield in associated watersheds and springs. Improve ground cover, soil, clean water, and provide for healthy riparian communities that are resilient and recover rapidly from human and natural disturbances.
Uncharacteristic fire	FW-Veg-Rip-All-DC-10; FW-Veg-Rip-CWRF-DC-2; FW- Veg-Rip-MBDRF-DC-2; FW- Veg-Rip-MW&GCRF-DC-2; FW-Veg-Grass-SDG-O; FW-Veg-Grass-GBG-O; FW-Veg-PJ-PJG-O-1; FW-Veg-PJ-PJG-O-2; FW-Veg-PJ-PJES-O-1; FW-Veg-PP-O-1; FW-Veg-PP-O-2; FW-Veg-PP-O-3; FW-Veg-MC-MCFF-O-1; FW-Veg-MC-MCFF-O-2; FW-Veg-MC-MCFF-O-3	Promote natural disturbance regimes in riparian habitats, and maintains or improves composition, structure, and processes characteristic of these PNVT which would reduce the threat of uncharacteristic wildfires.
Invasive animal species		See “Wildlife, Fish, and Plants” section under Wetland Cienega.
Dispersed recreation in localized areas in Cottonwood Willow Riparian, Wetland Cienega, Springs	FW-Veg-Rip-All-G-1; FW-Rec-Disp-DC-2, 3, 12, 13,15, 19; FW-Rec-Disp-G- 2, 4, 8, 10; FW-SpecUse-G-14; MA-LongV-DC-3; MA-LongV-G-1; MA-SedOak-DC-10; MA-SedOak-DC-11; MA-OakCrk-S-1	Forestwide guidelines would reduce the impacts of dispersed recreation, such as camping, trails, and special use permits on riparian areas, meadows, wetlands, and flood plains. Management area guidelines provide protections to reduce the impacts of dispersed recreation in areas that have already experienced high intensity recreation uses and concflicts with natural resources.
Livestock grazing in localized areas	FW–Veg-Rip-All –DC-1; FW-Veg-Rip-All-G-3; FW-Graz-DC-2; FW-Graz-G-1, 5, 6	Grazed areas have satisfactory soils, functional hydrology, and biotic integrity. Improvements and water developments should be located away from riparian areas.
Water quantity	FW-Aq-Wat-DC 2	Expand the area where maintenance of already acquired water rights is emphasized from the Flagstaff/Lake Mary Management Areas and Sedona-Oak Creek Management Area to forestwide.

Habitat Characteristics and Threat	Location Code in Proposed Revised Plan	Intent of Plan Component
Sedimentation and water quality	FW-AQ-Wat-G-2-3; FW-Aq-Wat-DC1, 2, 3, and 7; FW-RdsFac-G-3; FW-Aq-Wat-DC-2; FW-Soil-O-1; FW-Aq-Spr-O-1; FW-RdsFac-O-1; FW-RdsFac-G-5; FW-Soil-DC-1, 2, 3; FW-WtrShd-DC-2; FW-WtrShd-O-2; FW-Spec-Use-G-9	More flexible widths would protect water quality and would be more responsive to site specific conditions. Minimizes road construction in streamside management zones. Decommission roads resulting in improved riparian, reduced fragmentation, erosion and sediment delivery in streams. Reduces mercury deposition.
Invasive plants	FW-WtrShd-G2 and FW-WtrShd-O-1; FW-Invas-DC-1, 2, 3; FW-Invas-G-4 and 5; FW-Rec-Dev-DC3; FW-Rec-Disp-G-2, 9; FW-RdsFac-DC-2; FW-RdsFac-G- 5, 6, 7, 8; FW-SpecUse-G-11, 23	Reduces mortality associated with uncharacteristic fire in riparian areas and the indirect effect of creating conditions favorable for invasive plants postfire.
High road densities near aquatic systems	FW-RdsFac-DC1, 2, 5; FW-RdsFac-O; FW-RdsFac-G-5, 7, 8, 9	Address decommission and naturalization of roads, road condition, and mitigation of impacts to aquatic systems through design and location of roads.

Sedimentation and Water Quality

Alternative A

Uncharacteristic fire leads to the potential for increased sedimentation. Fire exclusion, restrictions in wilderness and wildland-urban interface, and low fire suppression objectives in alternative A have collectively resulted in an increased risk of uncharacteristic fire across the landscape. As a result, watershed conditions have moved away from desired conditions and would continue to do so under this alternative.

Alternative A directs the use of prescribed fire and wildfires with resource objectives to accomplish resource objectives (p. 94, par 2) which would help reduce the risk of uncharacteristic fire. Overall direction for wilderness supports fire playing a natural role on the landscape, but additional guidelines that direct managers to suppress fires under specific circumstances essentially restrict the use of wildfire (pp. 93–95; p. 95, par 9; p. 111, par 8, 9; p. 112 in its entirety). As a result of this contradictory direction, fire has not been allowed to play its natural role in wilderness, and wilderness areas generally would have higher vulnerability to uncharacteristic fire than nonwilderness areas.

Guidelines in alternative A would also restrict managing wildfires with resource objectives in the wildland-urban interface and this could further increase departures in these areas (replacement p. 165, par 5; new p. 206-9, no. 6; new p. 206-40, no. 3; new p. 206-47, no. 1).

Within a watershed, following a fire that removes protective ground cover, high amounts of water, soil, and sediments can be rapidly transported into connected drainages and waters during a rain. Watersheds with wilderness areas and near communities in the wildland-urban interface would have a greater likelihood than alternatives B, C, and D of seeing increases in sedimentation postfire that would negatively alter aquatic habitat, possibly leading to mortality of aquatic species.

Alternatives B, C, and D

Plan components in the forestwide watershed section would maintain and improve effective ground cover, soil condition and productivity, clean water, and provide healthy riparian communities that are resilient and recover rapidly from human and natural disturbances. These plan components would reduce excessive sedimentation into connected drainages and perennial waters and would maintain clean water, functional riparian areas, intact streambanks, and reduce excessive flooding. In addition to addressing the threat of uncharacteristic fire at the watershed scale, the plan components that would promote functioning resilient watersheds that would also reduce the effects of sedimentation on, and maintain water quality of, the habitat of associated species.

Improved plan language would result in the focused emphasis on treating impaired waters requiring improvement and emphasizing total maximum daily load (TMDL) implementation to better support the identified beneficial uses and native aquatic species. This would result in improved water quality trend in these alternatives compared to a static trend under alternative A. These alternatives provide a strategy for improving watershed condition in priority functioning-at-risk and impaired watershed on the forest where the greatest improvements can be made and represent an integrated approach to managing watersheds so that aquatic systems can function and provide habitat conditions suitable for associated species. Because of the focus on priority watersheds, alternatives B, C, and D would reduce departure and move toward desired conditions in Cottonwood Willow Riparian Forest at a faster rate than alternative A in Middle Fossil Creek and Lower Oak Creek 5th code watersheds because of the focus on priority watersheds. This would benefit and help maintain the viability of western yellow-billed cuckoos, Gila topminnow, Gila chub, headwater chub, roundtail chub, loach minnow, longfin dace, Sonora sucker, desert sucker, Gila trout, spikedace, lowland leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake.

While instream flow water rights would be maintained and procured at similar levels under all alternatives, the plan language under these alternatives are improved and more focused on riparian ecological function relative to alternative A and would support improvement of ecological function as they relate to water quantity and watershed function. Alternatives B, C, and D expand the area where maintenance of already acquired water rights is emphasized from the Flagstaff/Lake Mary Management Areas and Sedona-Oak Creek Management Area to forestwide (alt. A: replacement p. 184, no. 6; new p. 206-116, par 9). Expanding the geographic range of this plan component, recognizes the growing demand for water across the forest and would better address the need for maintaining water quantity on a forestwide level than alternative A.

Diversion ditches permitted across NFS lands should be maintained in a way that minimizes disturbance of vegetation and hydrologic conditions (FW-Spec-Use-G-9).

Sediment would be reduced by guidelines that prioritize decommissioning roads that would result in improved riparian, reduced fragmentation of riparian areas, and reduced erosion and sediment delivery in streams improving habitat for associated species.

Desired conditions in alternatives B, C, and D would reduce the threat of uncharacteristic wildfires to all ecosystems, promote natural disturbance regimes in riparian habitats, and maintain or improve composition, structure, and processes characteristic of these PNVTs. The desired conditions for all vegetation types emphasize the spatial and temporal distribution and condition of transition zones between riparian and terrestrial ecosystems, and desired conditions throughout

the vegetation section emphasize overall reduction in the risk of uncharacteristic fire across the landscape due to treatments and management in terrestrial ecosystems. Objectives for terrestrial PNVTs would also decrease the risk of uncharacteristic wildfires in riparian PNVTs. Under alternatives B, C, and D, there is no restriction on where wildfires with resource objectives could occur, and so the portions of fire-adapted ecosystems in wilderness and wildland-urban interface would be able to use wildfire more effectively. It is unknown how many acres would be treated in this manner under the plan because of the unpredictability of where lightning-caused ignitions will occur and under what conditions. In all cases, these fires would help move terrestrial vegetation toward desired conditions and would reduce the risk of uncharacteristic fire across the landscape which, in turn, would reduce the risk of uncharacteristic fire to adjacent riparian PNVTs. This would reduce the mortality associated with uncharacteristic fire in riparian areas and the indirect effect of creating conditions favorable for invasive plants postfire. When uncharacteristic fire occurs in their habitat, the population of associated species can decline because of decreased suitable habitat and food sources. Large trees and snags needed as roosts, perches, and nest trees by bald eagles, black hawks, and western red bats would also be better maintained as the risk of uncharacteristic fire is reduced and so would dense midstory and shrubs used by southwestern willow flycatchers and yellow-billed cuckoos. Woody species that provide food and dam material for beavers would be better protected from this threat. The coarse woody material provided by overstory species would be essential to a properly functioning riparian stream, helping to reduce the energy of floodwaters, and providing cover for fish and other aquatic species, which are prey for southwestern river otters. As the habitat for native fish is maintained or improved, then habitat conditions for California floaters, a native clam that requires native fish for one of its life stages, are likely to be maintained. The watershed-scale improvements would also reduce sedimentation and debris from fire-adapted ecosystems that enter streams after fire events and, therefore, would protect the water quality on which aquatic species rely.

Plan components in the forestwide watershed section maintain and improve effective ground cover, soil condition and productivity, clean water, and healthy riparian communities that are resilient and recover rapidly from human and natural disturbances. Within a watershed, following a fire, high amounts of water, soil, and sediments can be rapidly transported into connected drainages and waters during a rain. These plan components would reduce excessive sedimentation into connected drainages and perennial waters and would maintain clean water, functional riparian areas, intact streambanks, and reduce excessive flooding. In addition to addressing the threat of uncharacteristic fire at the watershed scale, the plan components that would promote functioning resilient watersheds would reduce the effects of sedimentation on, and maintain water quality of, the habitat of species like the Page springsnail that occurs off the forest but within a forest 5th code watershed.

Invasive Animal Species

A comparison of the consequences of plan language on the threat of invasive animal species is discussed in the “Wildlife, Fish, and Plants” section under “Wetland Cienega.” The impacts of invasive animal species include: predation on all species; hybridization and loss of genetic integrity, as with some of the trout species; maintaining a native fish prey base, which would benefit the two gartersnakes; and maintaining native species that potentially could serve as host species for California floaters, a clam that relies on native fish for one of its life stages.

Alternatives A, B, C, and D

Alternatives B, C, and D provide more protection and guidance that alternative A.

Alternative B

In alternative B, there are all or portions of several proposed special area designations that increase restrictions on human activities, such as motor vehicle use and vegetation treatments, within the habitat of several Region 3 sensitive species. These restrictions result in slightly less disturbance for these species. There are 18 acres of Mixed Broadleaf Deciduous Riparian in the proposed West Clear Creek Research Natural Area; 15 acres of Montane Willow Riparian Forest in the Mogollon Rim Botanical Area, and 35 acres in the Fern Mountain Botanical Area.

A guideline in the "Roads" section emphasizes that drainage structures should be designed consistent with the resource protection needs of native aquatic organisms. In some cases, this may mean that drainages are designed to act as barriers and, in other instances, they may be designed to allow for safe passage of aquatic organisms. This is an improvement over alternative A, which does not address this issue in a balanced way.

Wilderness designation under alternative B would not substantially increase the costs or time needed to treat invasive animal species because the perennial streams recommended as wilderness in this alternative (in Davey's) are all under wild and scenic river or roadless area management, same as under the other alternatives.

Alternative C

Although alternative C proposes several wildlife habitat management areas in addition to recommended wilderness, the effects from desired conditions are not expected to result in a difference between alternatives B and C, because they would not result in habitat protections stronger than those already available in alternative B for these PNVTs. Potential restrictions on motor vehicle use would affect public motorized access to 3.8 percent of Montane Willow Riparian Forest.

Wilderness designation under alternative C would not substantially increase the costs or time needed to treat invasive animal species because the perennial streams recommended as wilderness in this alternative are all under wild and scenic river or roadless area management, same as under the other alternatives. The establishment of wildlife habitat management areas would not affect the ability of the Forest Service to treat invasive animal species because there are no restrictions on motorized administrative use.

Dispersed Recreation in Riparian Areas

Alternative A

The threat of dispersed recreation to riparian resources is not addressed forestwide in alternative A. Special areas such as the Verde Wild and Scenic River and wilderness, and the management areas within Flagstaff Lake Mary Ecosystem Area and the Sedona-Oak Creek Planning Area most specifically address the conflicts and strategies to resolve resource damage in riparian areas (replacement p. 105 par 3; new page 115-4 par 2-7; new page 115-4 par 8; replacement p. 187-1 par 9; new p. 196-2 par; new p. 206-9 par 4 and 5; new p. 206-10 par 1 and 4; new p. 206-11 par 3; new p. 206-15 par 2-4; new p. 206-22 par 7; new p. 206-39 par 7; new p. 206-62 par 2 and 3; new p. 206-63 par 4 and 5; new p. 206-64 par 1 and 3; new p. 206-66 par 4; new p. 206-68 par 5

and 6; new p. 206-78 par 8, 9, and 10; new p. 206-78 par 12-14; new p. 206-79 par 1-3, etc.). All of these goals and guidelines are similar in that they set general expectations that recreation impacts should not destabilize ecosystems and specifically that certain activities known to result in resource-recreation conflicts should be limited in a way that reduces their footprint or that they are not allowed in these areas. Overall, this direction addresses dispersed recreations impact to riparian areas in some areas where there have been past conflicts and resource damage but provides very limited direction when previously low use areas are "discovered" and see increases in recreation that are unexpected, such as the Fossil Creek Wild and Scenic River. As a result, alternative A addresses this threat sporadically compared with alternatives B, C, and D, but does mitigate some of the areas where the conflict is most pronounced.

Alternative B, C, and D

Alternatives B, C, and D have desired conditions that protect riparian resources including soil conditions and water quality while recognizing the demand for and need to properly manage the public's dispersed recreation opportunities. The appeal of the Coconino NF's riparian areas for recreation from visitors throughout Arizona has contributed economically to the tourism sector of local communities but has also resulted in high recreation use that, when unmanaged, can increase soil disturbance and erosion into streams, soil compaction, and trample plants needed for food and cover by wildlife and for a properly functioning riparian ecosystem. Forestwide desired conditions for dispersed recreation support managing dispersed recreation to avoid resource damage and expands direction to rehabilitate negatively impacted sites beyond the Sedona-Oak Creek Management Area to apply forestwide. Several guidelines about dispersed recreation would manage trails, camping, and recreation types to prevent further resource damage to riparian resources. One guideline sets thresholds for managers for closure, rehabilitation, and mitigation of dispersed sites, which results in managers having comparable ways of evaluating effects to riparian areas across the forest and allows managers to prioritize the needs for restoration activities. These desired conditions better direct management of dispersed recreation in riparian areas and prevent resource damage than alternative A, which only provides management in specific management areas and is silent on the tradeoffs between ecological and social demands on riparian habitats forestwide. Explicit desired conditions for recreation which balance the demand for opportunities in these areas with the stability of the habitat along streambanks and shorelines, and water quality, also improves the quality of habitat for associated wildlife.

Alternatives B, C, and D also have area-specific direction where resource-recreation conflicts have been successfully managed or where the need to manage the conflict explicitly has been recognized. In management areas with the most intense dispersed recreation use, camping is generally limited near riparian areas which prevent longer stays that result in social trails and increased bank erosion, and day-use activities are prevented with controlled access to riparian areas. Even though these desired conditions, standards, and guidelines are applied to particular management areas, these strategies support the forestwide desired conditions for riparian areas and dispersed recreation and support addressing the threat to this PNVT forestwide. Other watersheds that have been impacted by dispersed recreation (identified in the "Riparian Resources" section) are covered by the forestwide riparian resource and dispersed recreation plan components. As a result, alternatives B, C, and D address the threat of dispersed recreation in riparian areas more comprehensively than alternative A and better support the habitat quality of this PNVT for wildlife. Overall, projects implemented under alternatives B, C, and D would reduce the threat of dispersed recreation to riparian areas, springs, and wetlands better than

alternative A because they are more comprehensive and provide for a broader range of management options that can be tailored to the site-specific vulnerabilities, access, and demands.

Invasive Plants in Cottonwood Willow Riparian Forest

Common to All Alternatives

All alternatives prioritize eradicating species that are most invasive and pose the greatest threat to biological diversity and watershed condition as well as address prevention, containment, and control and utilize integrated pest management (replacement p. 23, par 8; replacement . 70, par 2, 3, 4, 5, 6; new p. 206-72, par 8; new p. 206-75, par 9; new p. 206-76, par 7, 8, 9; new p. 206-79, par 7). Invasive plant control is incorporated in project planning, implementation, and monitoring and invasive treatment impacts are reduced by using the following document design features, best management practices, required protection measures, and mitigation measures found in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona" (replacement p. 69, par 8, 9).

Alternative A

Alternative A only manages Forest Service administrative or permitted activities and uses to minimize the risk of introducing and spreading invasive species and does not provide direction on managing how public forest user activities contribute to this threat.

Alternatives B, C, and D

Alternatives B, C, and D have more explicitly stated desired conditions that invasive plants are absent or in low abundance, do not occur at levels that disrupt ecological functioning, and that maintain the sustainability of native and desirable nonnative species. These alternatives also have forestwide guidelines to prevent and control spread, and to restore natural species composition and ecosystem function. There would also be management approaches for prioritizing areas for controlling invasive species and maintaining an inventory of invasive species on the forest. In riparian areas and aquatic ecosystems, these alternatives would better manage public forest user impacts that create bare soil, thus creating substrate for invasive plant introduction and those activities transport invasive species across the landscape. Under these alternatives, direction for use of weed-free hay, mulch, and animal feed would be expanded to apply to more than just Forest Service administered activities and include use by the public and research projects would not introduce new invasive plants or animals. Also desired conditions guidelines for roads would reduce the density of unneeded roads on the forest and manage roads to reduce their risk of providing a vector for invasive plants. Alternative A discusses the use of native seed mixes in revegetation efforts but not for special use permits or recreation. Overall, alternatives B, C, and D address the vectors by which invasive plants are spread more comprehensively than alternative A, and better incorporate the coordination required to manage this threat across landownerships.

Livestock Grazing

Alternative A

Plan components in alternative A (Forestwide Range and Forestwide Riparian) protect and minimize impacts to riparian areas through management and fencing, but also manage impacts through seeding (replacement p. 69, par 6; replacement p. 69, par 7; replacement p. 176, par 1; p. 174, par 2). However, it also allows salting in riparian areas to improve livestock management by

concentrating cattle in certain areas, a practice which could be detrimental to associated species and their habitat (p. 68, par 8 and p. 175, par 9). This is offset by a standard that requires that forage use be maintained at a level that assures recovery and continued existence of listed species (new p. 66-1, par 1 and p. 174, par 1) and specific objectives to protect riparian areas and allow them to recover in the first 20 years of the plan (p. 175, par 1).

Alternative B, C, and D

Plan components in alternatives B, C, and D specify that livestock grazing maintains desired conditions of plant communities. They also protect and minimize impacts to riparian areas by recommending that livestock use be restricted to the dormant season, recommending utilization levels on woody vegetation, maintenance of adequate vegetative cover to protect streambanks, and state that riparian areas are rarely negatively impacted by livestock. This would maintain riparian structure, composition, and promote proper functioning. A guideline reduces cattle concentrations and sedimentation into connected waters by specifying that range improvements should not interfere with riparian function and rare species, and further specifies a minimum distance of salts and supplements from riparian areas (FW-Graz-G-1 and FW-Graz-G-6). Objectives would improve the riparian condition on 5 to 10 wetlands during the life of the plan (FW-Aq-Wtlnds-O-1).

High Road Densities from Aquatic Systems

Common to All Alternatives

All alternatives have similar road densities across the forest and so have similar effects to watershed condition. The recent travel management decision closed 4,387 miles of road to public access. This decision has narrowed the density of roads that are being traveled on regularly, since public use is a greater portion of traffic volume than administrative uses. Over time, some of these roads may be closed to all use or decommissioned, if they are not being used for permit administration or other administrative uses. As a result, the threat of high road densities would be reduced forestwide over time under all alternatives.

Alternative A

Direction in alternative A encourages the closure or obliteration of roads not needed for industry, public, and/or administrative use and also addresses the relocation or mitigation of roads causing impacts to watersheds, streams, and soils (replacement p. 72, no. 8; p. 88, par 6; replacement p. 184, no. 2; replacement p. 198, no. 3; new p. 206-10, par 4; new p. 206-23, par 3; new p. 206-77, par 5; new p. 206-78, par 12). It provides enough guidance to reduce the threat of higher road density on a landscape scale as evidence by the fact that there are currently several road decommissioning projects proposed on the forest following the travel management decision.

Alternatives B, C, and D

Under these alternatives, desired conditions and objectives for roads would encourage naturalization or decommissioning of roads that impact watershed condition. In addition, these alternatives would prioritize roads that threaten watershed condition and guidelines for roads identify impacts to watercourses and watersheds that should be mitigated through appropriate design features. These plan components address the need to manage the road system in order to reduce its impact to watersheds and, thus, address this threat similarly to alternative A. As a result, the social need for roads would be balanced with the ecological impacts of poorly located roads that are contributing toward watershed impacts.

Alternative C

Alternative C would result in effects similar to alternatives B and D concerning road density. For example, guidance for the Anderson Mesa WHMA would recommend a maximum public road density of 1 mile per square which is slightly lower than the current estimated road density of 1.1 mile per square mile. About 4 miles of road anywhere in this WHMA need to be closed to reach this road density. This change would have localized effects and would not change the overall condition of the watersheds or affect water quality because the reduced amount of sediment delivery following storm events would not be measureable. As a result, the difference in effects of this alternative and the other alternatives to watershed condition would be negligible at the coarse-filter level.

Summary of Species Effects

All alternatives maintain the viability of associated species by improving impaired water quality, maintaining instream flows, and improving riparian, soil, and watershed function. All alternatives also address habitat risks of uncharacteristic fires, sedimentation and water quality impacts, water diversions that reduce instream water quantity, dispersed recreation, livestock grazing, invasive plants, high road density, and invasive animals. Alternative A, however, would not improve conditions toward desired conditions as rapidly as alternatives B, C, and D.

Alternative A would maintain the viability of associated species because plan components support the maintenance of native species populations and address risks to aquatic habitats. Objectives to improve aquatic conditions, however, are less realistic given existing budgets and capacity than the other alternatives, therefore, improvements to species habitats would be less than plan components state. It addresses the threat of uncharacteristic fire in watersheds, except that wildfires with resource objectives would not be allowed in the wildland-urban interface. Although wilderness language would support the role of natural fire, there are so many restrictions that fire can seldom be applied and still meet plan guidance. Consequently, this alternative would result in a higher risk of uncharacteristic fire than alternatives B, C, and D. The increased risk of uncharacteristic fire would be relative higher in the Lower Verde River and Upper Clear Creek watersheds which support habitat for 12 native fish species on the forest planning list: Razorback sucker, headwater chub, roundtail chub, Sonora sucker, desert sucker, longfin dace, Colorado pikeminnow, loach minnow, spikedace, Little Colorado spinedace, bluehead sucker, and Little Colorado River sucker.

Alternatives B, C, and D would better maintain the viability of the species associated with aquatic systems than alternative A because plan components maintain or improve water quality and quantity using updated information from the Arizona Department of Environmental Quality, and improve conditions in priority at-risk watersheds which prevent further loss or degradation of habitat. Also, they better address the threat of uncharacteristic fire, which increases sedimentation postfire into aquatic systems and can alter the chemical and physical conditions upon which species depend. More resilient watersheds and upland conditions would also support the viability of these species. These alternatives have more comprehensive and updated language for invasive animals, the primary threat to many aquatic species. Other threats to water quality and quantity are addressed within the Agency's authority to do so and residual influences to habitat quality from past management would be rehabilitated and reduced over time under alternatives B, C, and D which better provides for viability of species associated with aquatic systems.

As detailed above, the viability of the associated species would be maintained relative to these PNVTs because plan components in all alternatives would maintain the structure, composition, and processes in riparian PNVTs and associated watersheds, as well as address the threat of uncharacteristic fire, dispersed recreation, livestock grazing, and invasive plants. Alternatives B, C, and D, however, would address the threats of uncharacteristic fire and dispersed recreation through more comprehensive plan direction. All riparian PNVTs are predicted to either maintain low departures or move toward desired conditions under all alternatives. Even though a portion of the riparian PNVTs are classified as functioning-at-risk, by definition, this portion still has ecological attributes that maintain the structure, function, and processes of the habitat although it is vulnerable to degradation. Alternatives B, C, and D also would provide updated and better articulated desired conditions particularly for springs and Wetland Cienega.

Twenty-nine species associated with these habitats have threats in addition to the coarse filter's habitat threats. These following 10 federally listed species and 19 sensitive species are further analyzed in the fine filter section below with respect to their other threats:

- Ten are federally listed species: Chiricahua leopard frog (threatened), Colorado pikeminnow (experimental), Gila chub (endangered), Gila topminnow (endangered), Gila trout (threatened), Little Colorado spinedace (threatened), loach minnow (endangered), razorback sucker (endangered), spikedace (endangered), and southwestern willow flycatcher (endangered); and
- Nineteen are Forest Service sensitive species: Arizona toad, bald eagle, Clark's grebe, common black hawk, western yellow-billed cuckoo, headwater chub (candidate), bluehead sucker, desert sucker, Little Colorado River sucker, longfin dace, roundtail chub (candidate), Sonora sucker, Blumer's dock, Bebb's willow, Mogollon thistle, alcove bog orchid, Arizona bugbane, lowland leopard frog, and northern leopard frog.

Special Features – Ephemeral and Intermittent Watercourses

Ephemeral and intermittent watercourses are an important aspect of the habitat for species associated with riparian forests. A comparison of plan consequences by alternative for ephemeral and intermittent watercourses is located in the "Wildlife, Fish, and Plants" section under Wetland Cienega PNVT and additional information is located in the section on "Riparian Resources." In addition to the species listed in Wetland Cienega PNVT, ephemeral and intermittent watercourses are used as corridors for dispersal by a variety of wildlife including the Arizona toad and narrow-headed gartersnake and are connections between patches of suitable habitat. Because of their biological diversity and microclimate, they can also be important nesting and foraging sites for birds such as Abert's towhee.

Fine Filter – Chiricahua Leopard Frog

Threatened and Endangered Species (table 42)

The Chiricahua leopard frog is addressed in the "Wildlife, Fish, and Plants" section under Wetland Cienega PNVT.

Fine Filter – Southwestern Willow Flycatcher

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: These endangered neotropical migrants nest in the southwestern United States and winter in Mexico and central and south America. There are known populations of nesting willow flycatchers at various sites on private land along the Verde River. Migrating individuals and floater males (single singing males during the breeding season) have been detected on Forest Service land in four areas: Dry Beaver Creek at Stagestop, Sheepshead Spring, Wet Beaver Creek, and West Clear Creek Campground).

Habitat: Suitable and potential habitat for southwestern willow flycatchers mainly occurs below the Mogollon Rim along various perennial streams in the Verde Valley. Some potentially suitable habitat occurs above the Mogollon Rim. They generally nest in areas where quiet water is present from April through September in riparian thickets with dense understory and midstory vegetation. In the Verde Valley, nesting willow flycatchers occur in tamarisk and mixed riparian habitats in patches varying from 460 feet to 1,640 feet in width (Sferra et al. 1995) and 5 to 121 acres in size (Spencer et al. 1996). They are associated with Cottonwood Willow, Mixed Broadleaf Deciduous, and Montane Willow Riparian Forests and springs. Much of their habitat is located in the Verde Wild and Scenic River corridor.

Critical Habitat: The final rule to designate critical habitat for the southwestern willow flycatcher was published on October 19, 2005 (USFWS 2011d). There are about 435 acres of designated critical habitat on the forest.

A proposed rule to revise critical habitat was published on August 15, 2011 (USFWS 2011c). There are about 549 acres of proposed critical habitat on the forest. The current designation remains in effect throughout the rulemaking process for revised designation.

Critical habitat on the forest occurs in the U.S. Fish and Wildlife Service's Verde Management Unit under both rules. Within the upper Verde segment, the proposed rule designates 12.9 miles more than the existing rule. Primary constituent elements for existing critical habitat and proposed critical habitat are listed below. Both rules list riparian vegetation and insect prey as the two primary constituent elements. The main difference is that riparian habitat in the proposed rule is expanded from riverine systems to include lakeside, natural or manmade habitat.

Existing Critical Habitat Primary Constituent Elements: Riparian habitat in a dynamic successional riverine environment (for nesting, foraging, migration, dispersal, and shelter) that comprises:

- Trees and shrubs that include a diverse overstory, midstory, and understory component including a variety of willows and seep willows, boxelder (*Acer negundo*), tamarisk (*Tamarix ramosissima*), Russian olive (*Eleagnus angustifolia*), cottonwood (*Populus fremontii*), stinging nettle (*Urtica dioica*), a variety of alders, velvet ash (*Fraxinus velutina*), poison hemlock (*Conium maculatum*), blackberry (*Rubus ursinus*), sycamore (*Platinus wrightii*), Pacific poison ivy (*Toxicodendron diversilobum*), grape (*Vitus arizonica*), Virginia creeper (*Parthenocissus quinquefolia*), Siberian elm (*Ulmus pumila*), and walnut (*Juglans hindsii*);

- Dense riparian vegetation with thickets of trees and shrubs ranging in height from 6 to 98 feet. Lower-stature thickets (6 to 13 feet tall) are found at higher elevation riparian forests, and tall stature thickets are found at middle and lower elevation riparian forests;
- Areas of dense riparian foliage at least from the ground level up to approximately 13 feet above ground or dense foliage only at the shrub level, or as a low, dense tree canopy;
- Sites for nesting that contain a dense tree and/or shrub canopy (the amount of cover provided by tree and shrub branches measured from the ground) (i.e., a tree or shrub canopy with densities ranging from 50 percent to 100 percent); or
- Dense patches of riparian forests that are interspersed with small openings of open water or marsh, or shorter/sparser vegetation that creates a mosaic that is not uniformly dense. Patch size may be as small as 0.25 acre or as large as 175 acres; and
- A variety of insect prey populations found within or adjacent to riparian flood plains or moist environments, including: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies/moths and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

Proposed Critical Habitat Primary Constituent Elements: These are the same as existing except riparian habitat also includes lakeside, natural or manmade habitats in addition to river environments.

Risk Factors: According to the U.S. Fish and Wildlife Service (2011d), risk factors to southwestern willow flycatchers are: disturbance, water diversions, treatments to control tamarisk, and livestock grazing.

Species Threats: Managed grazing was identified as a threat by the Fish and Wildlife Service because it can facilitate cowbird parasitism on southwestern willow flycatcher nests. Cowbirds generally lay eggs in nests of birds nesting in riparian habitats; can forage up to 4 miles from riparian habitat; and few cows can attract cowbirds. Cowbirds can substantially reduce the reproductive success of parasitized nests. Managed grazing can facilitate cowbird parasitism on Southwestern willow flycatcher nests in Cottonwood Willow Riparian Forest which contains suitable but unoccupied nesting habitat. Cowbirds generally lay eggs in nests of birds nesting in riparian habitats; can forage up to 4 miles from riparian habitat; and few cows can attract cowbirds. Cowbirds can substantially reduce the reproductive success of parasitized nests.

Environmental Consequences – Southwestern Willow Flycatcher

Summary of Determinations

The implementation of all alternatives would result in a “may affect” determination for southwestern willow flycatcher (SWFF) and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

Alternative A

Alternative A addresses cowbird parasitism through plan components that would implement cowbird control programs based on Fish and Wildlife Service consultation requirements and site-specific determination of need (page 206-14, par 1) and adaptively manage southwestern willow flycatchers and their habitat and cowbirds based on new information and work with other agencies (page 206-10, par 2).

Alternatives B, C, and D

In alternatives B, C, and D, a guideline to apply habitat management objectives and species protection measures from approved recovery plans would address this threat (FW-WFP-G-1) potentially enhancing the potential reproductive success of parasitized Southwestern willow flycatchers. The current recovery plan has an entire appendix devoted to cowbird parasitism (USDI Fish and Wildlife Service 2002b).

Human Activities

All Alternatives

Disturbance during the breeding season can reduce or eliminate the breeding success of any southwestern willow flycatchers that might nest on NFS land. The section on fine filter threats above compares the different alternatives as they relate to disturbance. All alternatives have plan components that reduce disturbance to southwestern willow flycatchers and, thus, would promote recruitment and survival should any breeding or nesting occur.

All alternatives incorporate the "Verde Wild and Scenic River Comprehensive River Management Plan," including its standards (replacement p. 113, par 4; SA-WSR-Verde-S-1). Wildlife and fish are among the outstandingly remarkable values that are protected and enhanced (replacement p. 113, par 5; new p. 115-1, par 2; FW-WSR-Verde-DC-5) and the range of flows in the free-flowing Verde River would provide optimum conditions for native fish and wildlife and health and diverse stands of riparian vegetation on the banks and flood plain (replacement p. 114, par 3; replacement p. 115, par 2, 3; FW-WSR-Verde-DC-6).

Designated and Proposed Critical Habitat

All Alternatives

The original designation of the Verde as a wild and scenic river allows for some water diversion. Specifically, designation shall not prevent water users receiving Central Arizona Project water allocations from diverting that water through an exchange agreement with downstream water users in accordance with Arizona water law, thus, streamflows could be reduced in the future.

Treatments to control tamarisk, a nonnative plant species, can impact southwestern willow flycatchers because tamarisk provides dense midstory habitat used by this species. Removal of tamarisk can open up the habitat which can cause heat stress or increase flycatcher susceptibility to predators or to cowbirds. Treatments to control tamarisk, a nonnative plant species, can impact southwestern willow flycatchers because tamarisk provides dense midstory habitat used by this species. Removal of tamarisk can open up the habitat which can cause heat stress or increase flycatcher susceptibility to predators or to cowbirds. In alternative A, southwestern willow flycatcher habitat would be maintained or enhanced (p. 206-10, par 3 and p. 206-12 par 2) and activities in southwestern willow flycatcher potential habitat would not slow or prevent potential habitat from progressing toward suitable habitat conditions (p. 206-14, par 4). In alternatives B,

C, and D, native species (such as the flycatcher) would be free or minimally impacted by treatments to control nonnative vegetation (FW-Aq-Strm-DC-8). Because there are no nesting flycatchers on the forest, activities to restore native riparian vegetation will not harm, and will likely improve habitat for southwestern willow flycatchers. All alternatives promote a strategy to address establishment, containment, control, and eradication of invasive plants (p. 23, par 8; FW-Invas-G-1) and they have forestwide standards and guidelines to incorporate control measures into projects (p. 69, par 9; FW-Invas-G1). All alternatives point to "Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures" in the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests" (USDA Forest Service 2005) as part of the strategy to prioritize and treat invasive plants while protecting native species (p. 69, par 10; FW-Invas-G-2).

Alternative A

Outside of the Central Arizona Project water allocations, plan components in this alternative would provide sufficient water for southwestern willow flycatchers. A forestwide goal would maintain high quality sustained water yield for forest users and others as well and protect wetlands and flood plains (replacement p. 24, par 1). Guidelines promote adequate instream flows and adequate instream flow water rights to maintain riparian and aquatic communities (new p. 206-116, par 9); and taking action to legally protect forest use of needed waters (p. 74, par 5).

Under alternative A, there are about 129 acres of proposed and designated SWWF critical habitat in more primitive ROS classes. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads.

Alternatives B, C, and D

Desired conditions for these alternatives would provide good habitat for southwestern willow flycatchers and their critical habitat. This includes:

- Diverse native vegetation in multiple age classes, uncompacted soils, and ecosystems that would function within their natural potential (FW-Veg-Rip-All-DC2);
- Resilient functioning watersheds which would maintain or improve riparian condition (FW-Veg-Rip-All-DC1);
- Healthy and resilient stream ecosystems that would be connected with their flood plains and riparian habitat with flooding as the primary disturbance ((FW-Veg-Rip-All-DC-1, 10); and
- The threat of uncharacteristic fire in the associated watersheds is described in the coarse filter section.

Wildlife, fish, and plant desired conditions describe sustainable populations of special status species (FW-WFP-DC1), viable populations of native riparian-dependent species (FW-WFP-DC4) which would include the southwestern willow flycatcher, and habitats that contribute to the survival and recovery of federally listed species (FW-WFP-DC2).

Plan objectives would:

- Restore at least 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas within 10 years following plan approval (FW-Veg-Rip-All-O1);

- Move 5 to 7 impaired and functioning-at-risk 6th code watersheds toward functioning conditions within 10 years of plan approval (all of the watersheds in the Verde Valley where southwestern willow flycatchers have been detected or potential habitat exists are impaired or functioning-at-risk) (FW-WtrShd-Obj1);
- Implement 20 actions for federally listed species that contribute to recovery or implement recovery plan actions during each 10-year period of the life of the plan (FW-WFP-O1);
- Would restore or enhance at least 60,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan (FW-WFP-O3);
- Restore/enhance at least 70 miles of stream habitat during each 10-year period of the life of the plan (FW-WFP-O4); and
- Naturalize or decommission 200 to 800 miles of unauthorized roads (FW-RdsFac-O1).

Projects and actions to meet these objectives would improve or maintain conditions for southwestern willow flycatchers and would likely occur within some portions of the Cottonwood Willow, Mixed Broadleaf Riparian, and Montane Willow Riparian PNVTs or watersheds that could provide southwestern willow flycatcher habitat, however, the amount of improvement is unknown.

Plan components in these alternatives would also provide sufficient water for southwestern willow flycatchers outside Central Arizona Project allocations. For example, desired conditions and best management practices under "Water Quality and Quantity" would maintain adequate quantity, quality, and timing of water to retain or enhance riparian vegetation consistent with existing water rights and claims (FW-Aq-Wat-DC-2; FW-AQ-Wat-G-3).

Other beneficial plan components would reduce impacts from livestock and dispersed recreation in riparian habitat, and minimize habitat fragmentation. These include:

- Riparian habitat is rarely negatively impacted by livestock (FW-Veg-Rip-All-DC-1);
- Place salt more than ¼ mile from riparian habitat (FW-Graz-G-1);
- Locate range improvements so they don't conflict with rare species or riparian habitat (FW-Graz-G-5); and
- Reduce fragmentation in mesquite bosques (FW-Veg-Rip-All-G-4).

Land and recreation special uses desired conditions incorporate general resource and environmental protections in most sections. Specific to wildlife, desired conditions state that location of new large, linear infrastructure has minimal effects to wildlife and minimizes habitat fragmentation; existing communication sites and utility corridors are used if environmentally acceptable before using new sites, and alternative energy developments such as wind energy are designed to minimize impacts to wildlife. If any of these developments are proposed in southwestern willow flycatcher habitat, these guidelines will ensure due consideration for the flycatchers.

Desired conditions for dispersed recreation call for balancing recreation activities with the ability of the land to support them and with other forest desired conditions, and that recreation activities don't impact resources such as wildlife. Resource damage from unauthorized motored trails is minimal and motorized trails are located to have minimal impacts on wildlife resources. Interpretation and education includes wildlife and fish resources. Resource damage from camping

is minimal and sites are rehabilitated as needed. Impacts to meadows and riparian areas are limited to road and trail crossings and access points. Trails in riparian areas that are causing impacts are prioritized for closure, rehabilitation, or mitigation. These desired conditions, while not excluding impacts from recreational activities to the southwestern willow flycatchers and their habitat, clearly have the intent to minimize habitat and disturbance impacts.

Guidelines for new dispersed recreational activities and motorized dispersed camping access routes call for protection of the natural environment and avoidance of environmentally sensitive areas, which would include southwestern willow flycatcher habitat. Additionally, dispersed sites should be closed, rehabilitated, or mitigated when unacceptable environmental damage is occurring; therefore, if southwestern willow flycatcher sites are being negatively impacted by dispersed recreation, the modified proposed revised plan would support protection of these sites.

A protective guideline for the southwestern willow flycatcher and their habitat is to generally not give recreation special use permits for activities proposed to occur within 200 feet of perennial streams, springs, or sensitive waters. However, permits for outfitter-guides allowed under the "Verde Wild and Scenic River Comprehensive River Management Plan" would continue. This will help protect current and potential southwestern willow flycatcher sites and habitat from disturbance and habitat alternation from intense recreation use.

Alternative B

Alternative B recommends three new wildernesses. Only Davey's and Walker Mountain have riparian habitat (56 acres total). There are no occupied sites or critical habitat within the recommended wilderness areas and the small amount of habitat present makes it unlikely to provide potential habitat.

Recreation Opportunity Spectrum: The forest plan sets the desired recreation opportunity spectrum (also called recreation opportunity spectrum objectives) used to determine if projects are compatible with forest recreation goals. At the project level, the desired recreation opportunity spectrum is used to determine if a project is moving toward or away from the desired recreation opportunity spectrum. Recreation opportunity spectrum classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The less developed classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM), and are characterized by relatively little or no development and roads. The more developed classes are roaded natural (RN), rural (R), and urban (U).

Under alternative B, there would be about 44 acres of proposed and designated SWWF critical habitat in more primitive ROS classes. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads on 85 fewer acres than alternative A. SWFF critical habitat on the forest has limited ROS to the Verde River. Changes in ROS class along the river would not have an appreciable effect on the habitat of this species because the amount of access, level of development, frequency of encounters with other people, and other ROS characteristics would not change on the ground. This is because the level of development is already very low on the majority of the habitat due to ROS, roadless area management, and wild and scenic river designation.

Alternative C

Alternative C recommends 13 new wilderness areas which contain 1,230 acres of Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Montane Willow Riparian Forest. It would protect or improve 367 acres of Mixed Broadleaf Deciduous Riparian Forest, 411 acres of Cottonwood Willow Riparian Forest, and 452 acres of Montane Willow Riparian Forest. None of the recommended wildernesses include designated or proposed critical habitat. Designation would provide extra protections for southwestern willow flycatcher potential habitat because motorized use (and associated disturbances) would be more restricted than under current conditions, and the potential for development of recreation and administrative facilities would be reduced. These areas would be managed for the suite of wilderness characteristics including native species and maintenance of natural process. Recreation use would be managed to protect wilderness character; however, dispersed nonmotorized recreation could increase following designation. Changes to recreation opportunity spectrum for alternative C reflect the recommendation of additional wilderness. Walker Mountain, Deadwood Draw, Black Mountain, and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability to manage wildfires with resource objectives (see "Vegetation and Fire" for more details).

Alternative C proposes eight wildlife habitat management areas which focus on improving habitat quality by reducing disturbances. This would improve 21 acres of Mixed Broadleaf Deciduous Riparian Forest, 1,148 acres of Montane Willow Riparian Forest, and 0 acres of Cottonwood Willow Riparian Forest, making impacts to southwestern willow flycatchers and their habitat negligible.

Alternative C also designates Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas; parts of the Flagstaff Neighborwoods Management Area; some special areas; and wildlife habitat management areas as nonsuitable for recreational (nonhunting) shooting. This would reduce disturbance in 1,162 acres in wildlife habitat management areas and 1,051 acres in the Long Valley, Sedona Neighborwoods, Sedona-Oak Creek, Verde Valley, and Walnut Canyon Management Areas for a total of 2,213 acres. In addition, this alternative restricts grazing in research natural areas, which reduces disturbance in 18 acres of Mixed Broadleaf Deciduous Riparian Forest and 117 acres of Montane Willow Riparian.

The effects from shifts in ROS classes would be the same as alternative B.

Alternative D

Alternative D does not recommend new wilderness areas and is similar to alternative A in this aspect. It is similar to alternative B for other consequences to flycatchers.

This alternative also allows mechanized travel on designated trails in botanical and geological areas. This would have little effects on southwestern willow flycatchers because these special areas lack Cottonwood Willow habitat and there is only 10 acres of Mixed Broadleaf Deciduous in the Fossil Creek Botanical Area and 30 acres in the West Clear Creek Research Natural Area. The recreation opportunity class distribution is similar to alternative B.

Fine Filter – Colorado Pikeminnow

Threatened and Endangered Species (Table 42)

Affected Environment

Distribution: Colorado pikeminnow is believed to have ranged in the Verde River up to Perkinsville, Arizona. This belief is based on bone samples taken from an archaeological site near Perkinsville (Minckley and Alger 1968). They were introduced under Section 10(j) of the Endangered Species Act as an experimental nonessential population. This means that this population is not essential to the continued existence of the species. The species is currently present on the Coconino NF in the Verde River within the Grindstone Wash-Verde River, Cherry Creek-Verde River, and Fossil Creek-Verde River 5th HUC watersheds (42.7 potential perennial stream miles) as a result of stocking efforts by the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service. Dams and the associated creation of the reservoir systems behind them limit the possibility of recovery for this species in the Verde River. Upstream migration is blocked by dams, and long-distance larval drift is hindered. Although outside the control of the Forest Service, the impacts of dams (e.g., Horseshoe, Bartlett) on the lower Verde River are one of the primary reasons for disappearance of the Colorado pikeminnow in the system.

Habitat: Colorado pikeminnow is characterized as a "Big River" generalist species, occurring in turbid, deep, and strongly flowing water. The fish has adapted to rivers with high seasonally variable flows, high silt loads, and turbulence (USFWS 1991a). Native fish found in Colorado pikeminnow habitat include Sonora sucker, desert sucker, roundtail chub, longfin dace, and speckled dace (USDA Forest Service 2011k). The species is associated with perennial streams and with Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest PNVTs.

Risk Factors: Threats to the Colorado pikeminnow that can be influenced by the Forest Service include predation by, and competition with, nonnative fish (invasive animals) and diseases that were introduced by nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education and work. Disease is a primary threat to fish and can result in death, reduced populations, weakened populations, and greater susceptibility to predation. Nonnative fish can transfer diseases to native fish. Forest Service management, permitted activities, or activities on Forest Service land associated with fire suppression, stock tank cleaning, research projects, roads, recreation special uses, developed recreation, and dispersed recreation may facilitate the spread of diseases.

Environmental Consequences – Colorado Pikeminnow

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species, complying with approved recovery plans, and a standard that says that federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed; restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat would be improved if these actions would occur in this species habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on nonnative and invasive species by alternative. The section on Chiricahua leopard frog in Wetland Cienega describes the consequences of plan components in all alternatives on the threat of disease to aquatic and riparian associated species.

Summary of Species Effects

Reintroduced Colorado pikeminnow populations in the Verde River have been designated as experimental nonessential populations. By definition, an experimental, nonessential population is not essential to the continued existence of the species (see 50 CFR § 17.80 Definitions). Therefore, no proposed action impacting an experimental, nonessential population, so designated under ESA §10(j), could lead to a jeopardy determination for the entire species. Therefore, all the alternatives are "not likely to jeopardize" the continued existence of the experimental nonessential populations of the Colorado pikeminnow. A biological assessment will be done and final determination of effects will be determined at that time.

Colorado pikeminnow is rare (F2 species) on the forest and is vulnerable to perturbations in the environment. Some of its habitats have higher departures from reference conditions (e.g., the Fossil Creek-Lower Verde 5th code HUC watershed within the Cottonwood Willow Riparian Forest PNVT). The Colorado pikeminnow is limited by conditions in its habitat including predation by, and competition with, nonnative fishes and the species threat of diseases introduced via nonnative fishes.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources" and "Watersheds" sections of this document.

All alternatives maintain the viability and persistence of the Colorado pikeminnow within the authority of the Forest Service with regard to disease and invasive animals as well as coarse filter threats. Alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the Colorado pikeminnow;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats are reduced within the authority of the Forest Service;
- Threats to the habitats of the Colorado pikeminnow are better defined and plan components are put into place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Razorback Sucker

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Razorback sucker is believed to have ranged in the Verde River up to Perkinsville, Arizona. This belief is based on bone samples taken from an archaeological site near Perkinsville (Minckley and Alger 1968). The razorback sucker is currently present on the Coconino NF in the Verde River within the Grindstone Wash-Verde River, Cherry Creek-Verde River, and Fossil Creek-Verde River 5th HUC watersheds (42.7 potential perennial stream miles) as a result of stocking efforts by the Arizona Game and Fish Department and U.S. Fish and Wildlife Service. Dams and the associated creation of the reservoir systems behind them limit the possibility of recovery for this species in the Verde River. Upstream migration is blocked by dams, and long-distance larval drift is hindered. Although outside the control of the Forest Service, the impacts of dams (e.g., Horseshoe, Bartlett) on the lower Verde River are one of the primary reasons for disappearance of the razorback sucker in the system.

Habitat: Razorback sucker is considered a "Big River" fish that evolved in warm-water reaches of larger rivers in the Colorado River basin. It uses a variety of habitats during the year depending on behavioral, reproductive, and physiological requirements. During spring, adult suckers utilize deep runs, eddies, backwaters, and flooded off-channel environments, shallow runs and pools often associated with submerged sandbars in summer, and low-velocity runs, eddies, and pools in winter (USDI 2002b). The species is associated with perennial streams and with the Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest PNVTs.

Designated Critical Habitat: Razorback sucker was listed as endangered in 1991 (USFWS 1991c) and critical habitat was designated in 1994 (USFWS 1994c). Critical habitat on the Coconino NF exists in the Verde River from the confluence with Fossil Creek upstream to the confluence with Sycamore Creek (only 11.9 miles of the Verde River are located on the forest).

Primary constituent elements for razorback sucker are:

- Water –This includes a quantity of water of sufficient quality.
- Physical Habitat – This includes areas of the Colorado River system that are inhabited or potentially habitable by fish for use in spawning, nursery, feeding, and rearing, or corridors between these areas.
- Biological Environment – Food supply, predation, and competition.

The Cherry Creek-Verde River, Fossil Creek-Lower Verde River, and Grindstone Wash-Verde River 5th code HUC watersheds include critical habitat for the razorback sucker. The condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT in these watersheds is at a low level of departure and similar to reference conditions at the landscape level (see the "Wildlife, Fish, and Plants" section under riparian forests and the "Aquatic Systems" section). Cottonwood Willow Riparian Forest PNVT is moderately departed from reference condition and slowly improving in two out of the three 5th code HUC watersheds associated with razorback suckers. The Fossil Creek-Lower Verde River 5th code HUC watershed is also moderately departed but its trend is static. This is due to system and nonsystem roads which have resulted in accelerated erosion and runoff. The recent decision on the Travel Management Rule (USDA Forest Service 2011m)

addressed off-highway vehicle use. Consequently, sedimentation into connected watercourses and the soil and vegetation issues should gradually decrease as the affected areas heal.

Thirty-two percent of the Cherry Creek-Verde River, Fossil Creek-Lower Verde River, and Grindstone Wash-Verde River 5th code HUC watersheds consist of designated wilderness or inventoried roadless areas that result in low to no motorized use (table 63). This would maintain sedimentation or nonpoint source pollution at approximately its current level. The existing Fossil Springs Wilderness and Mazatzal Wilderness protect Fossil Creek and a portion of the Verde River from motorized impacts. The existing Sycamore Canyon Wilderness protects Sycamore Creek from motorized impacts which, in turn, results in less sedimentation to the Verde River. Three inventoried roadless areas (Boulder Canyon, Cimarron Hills, Hackberry) preclude future road construction and indirectly benefit the Verde River because of reduced sedimentation from lack of motorized use. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas so proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Table 63. Existing roadless or minimally roaded areas in the Cherry Creek-Verde River, Fossil Creek-Lower Verde River, and Grindstone Wash-Verde River 5th-code HUC watersheds

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Cherry Creek-Verde River	21,807	none	0
Fossil Creek-Lower Verde River	104,923	Fossil Springs Wilderness	10,431
		Mazatzal Wilderness	2,639
		Boulder Canyon IRA	4,550
		Cimarron Hills IRA	5,295
		Hackberry IRA	17,905
Grindstone Wash-Verde River	8,080	Sycamore Canyon Wilderness	2,383
Total watershed acres	**134,810**	**Total acres (% of watershed)**	**43,203 (32%)**

Risk Factors: Threats to the razorback sucker that can be influenced by the Forest Service include predation by, and competition with, invasive animal species and nonnative fish and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Razorback Sucker and Its Critical Habitat

Common to All Alternatives

As described in the introduction to the “Wildlife, Fish, and Plants” section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species; complying with approved recovery plans; and a standard that says that direction federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives

to restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat for the species would improve should these objectives be implemented in this species habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on nonnative and invasive species by alternative. The section on Chiricahua leopard frog in Wetland Cienega describes the consequences of plan components in all alternatives on the threat of disease to aquatic and riparian associated species.

There are portions of five existing or eligible wild and scenic river segments in the Cherry Creek-Verde River, Fossil Creek-Lower Verde River, and Grindstone Wash-Verde River 5th code HUC watersheds. As designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. For the Verde Wild and Scenic River, the comprehensive river management plan sets a capacity and limits on recreation that protect the species habitat. However, until the comprehensive river management plan is finalized for the Fossil Creek Wild and Scenic River, the level of human use is unknown because the capacity of the area has not been determined. Therefore, it is not possible to estimate resource impacts to the watersheds from recreation use associated with Fossil Creek. Eligible rivers are managed to protect the outstandingly remarkable values in accordance with the Forest Service Handbook, but the amount of recreation occurring in these areas is not restricted.

All but one identified primary constituent element for razorback sucker is addressed by all alternatives, and more effectively so by alternatives B, C, and D, and would provide for the continued viability and persistence of the species on the Coconino NF. The exception is the primary constituent element for protection of the biological environment from inadequate food supply, predation, and competition. This primary constituent element cannot be effectively addressed by any alternative because nonnative fish are already established in these habitats, and consequently represent a significant threat. Furthermore, management of these nonnative fish falls outside of the authority of the Forest Service and under the purview of the Arizona Game and Fish Department. Alternatives B, C, and D better address the threats of invasive animal species and disease than alternative A (see "Wildlife, Fish, and Plants" section under Wetland Cienega). Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Alternative A

Recreation Opportunity Spectrum: Within the Cherry Creek-Verde River and Grindstone Wash-Verde River 5th code HUC watersheds, alternative A would retain existing recreation opportunity spectrum designations. Additionally, alternative A retains large areas of land presently designated as semiprimitive motorized, which would allow for future road construction in these areas. Furthermore, some land along Fossil Creek is designated as roaded natural and as a consequence, some segments of Fossil Creek could experience future road construction. This alternative has a higher potential contribution of sedimentation to connected waters compared to the other alternatives.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Changes in the ROS spectrum designations in the Cherry Creek-Verde River and the Grindstone Wash-Verde River 5th code HUC watersheds from less motorized access to more motorized access would accommodate the growing human populations adjacent to the forest but would not provide any protection from additional road construction and associated sedimentation in the future. Nor would these changes encourage closure and decommissioning of existing roads. Within the Fossil Creek-Lower Verde River 5th code HUC watershed, changes in ROS designations range from 9,462 to 13,612 acres across alternatives B, C, and D, with alternative C being the highest and alternative D being the lowest. These areas of land would be changed to allow less motorized access, resulting in beneficial change because some segments of Fossil Creek would limit the ability of managers to build roads in this watershed and would encourage closure and decommissioning of existing roads. These alternatives would not determine ROS for the Fossil Creek Wild and Scenic River because these are being determined by the comprehensive river management plan, which is currently under development.

Alternatives B and C

Special Area Designations: Alternatives B and C would add the recommended Davey's Wilderness, which is adjacent to the Fossil Springs Wilderness and would add wilderness to the north side of Fossil Creek.

This wilderness would preclude future road construction or development of new range improvements in this area and indirectly benefit Fossil Creek, the Verde River, and the razorback sucker because of reduced sedimentation from lack of motorized use. However, any vegetation treatments in the recommended wilderness that would require motorized equipment would not occur, resulting in proportionally less of the watershed being available for beneficial treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Alternative C

Special Area Designations: In alternative C, 67 percent of the watersheds that support razorback sucker would have designations such as existing wilderness, recommended wilderness, or inventoried roadless areas that would result in low to no motorized use (table 64). This would help reduce sedimentation and/or nonpoint source pollution into razorback sucker habitat and critical habitat. The recommended Hackberry, Cimarron-Boulder, Tin Can, and Black Mountain recommended wilderness areas would add 45,135 acres of protected areas. However, treatments in the watersheds that would require motorized equipment would be less likely to occur in these areas, resulting in proportionally less of the watershed being available for treatments that modify the natural setting such as fuels reduction, stream renovation, or watershed improvement projects. Black Mountain and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the forest's ability to manage wildfires with resource objectives. This could result in increased sedimentation as the result of fire within the watershed.

There is no overlap between habitat for the razorback sucker and the wildlife habitat management areas proposed in alternative C.

Table 64. Acres of Cherry Creek-Verde River, Fossil Creek-Lower Verde River, and Grindstone Wash-Verde River 5th-code watersheds within existing and recommended wilderness and inventoried roadless areas (IRA) by alternative

5th Code HUC watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Cherry Creek–Verde River	21,807	none	0	0	0	0
Fossil Creek–Lower Verde River	104,923	Fossil Springs Wilderness	10,431	10,431	10,431	10,431
		Mazatzal Wilderness	2,639	2,639	2,639	2,639
		Boulder Canyon IRA	4,550	4,550	4,550	4,550
		Cimarron Hills IRA	5,295	5,295	5,295	5,295
		Hackberry IRA	17,905	17,905	17,905	17,905
		Davey's recommended wilderness	0	1,779	1,779	0
		Hackberry recommended wilderness	0	0	25,171	0
		Cimarron-Boulder recommended wilderness	0	0	15,300	0
		Tin Can recommended wilderness	0	0	3,972	0
		Black Mountain recommended wilderness (portion)	0	0	692	0
Grindstone Wash–Verde River	8,080	Sycamore Canyon Wilderness	2,383	2,383	2,383	2,383
Total watershed acres	**134,810**	**Total acres (percentage of watershed)**	**43,203 (32%)**	**44,982 (33%)**	**90,117 (67%)**	**43,203 (32%)**

Summary of Species Effects

The implementation of any alternative would result in a "may affect" determination for razorback sucker and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments; recreation management; watershed management; wildlife, fish, or rare plant management; or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits toward maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

Viability Summary: The razorback sucker is rare (F2 species) on the forest and is vulnerable to perturbations in the environment. Some portions of its habitats have higher departures from reference conditions (e.g., Cottonwood Willow Riparian Forest within the Fossil Creek-Lower Verde 5th code HUC watershed). The razorback sucker is limited by conditions in its habitat including predation by, and competition with, nonnative fishes and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources" and "Watersheds" sections of this document.

Although all alternatives maintain the viability and persistence of the razorback sucker within the authority of the Forest Service with regard to disease and invasive animals as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the razorback sucker and its critical habitat;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the razorback sucker are reduced within the authority of the Forest Service;
- Threats to the habitats of the razorback sucker are better defined and plan components are put into place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Gila Chub

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Throughout its range (Arizona and New Mexico), the populations of Gila chub currently appear to be stable. Gila chub remains within the watersheds where they historically occurred. Three populations of Gila chub are present on land managed by the Coconino NF: Red Tank Draw, Walker Creek (both within the Beaver Creek 5th code watershed) and Spring Creek (within the Oak Creek 5th code watershed). In 2005, two Gila chub populations on the forest were considered in a "stable to threatened" condition (Spring Creek and Walker Creek) and one population was considered in an "unstable to threatened" condition (Red Tank Draw) (USFWS, 2005b).

Habitat: The Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in small artificial impoundments. Gila chub are highly secretive, preferring quiet, deeper waters, especially pools, or remaining near cover including terrestrial vegetation, boulders, undercut banks, and fallen logs. Native fish found in Gila chub habitat include Sonora sucker, longfin dace, desert sucker, and speckled dace. The species is associated with perennial streams and the Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest PNVTs.

Designated Critical Habitat: Critical habitat was designated for the Gila chub in 2005 (USFWS 2005b). There are 11.8 miles on the Coconino NF along Walker Creek, Red Tank Draw, and Spring Creek.

Primary constituent elements are:

- Space for individual and population growth and for normal behavior;
- Food, water, air, light, minerals, or other nutritional or physiological requirements;
- Cover or shelter;
- Sites for breeding, reproduction, and rearing or development of offspring; and
- Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The Beaver Creek 5th code HUC watershed includes critical habitat for Gila chub. See the section on "Aquatic Systems" for more information on condition of the riparian forests. The condition of the Mixed Broadleaf Deciduous Riparian Forest where the Gila chub is found is more departed (moderate level) than the overall PNVT-level departure (low level). The higher rate of departure is due in part to high amounts of dispersed recreation in accessible areas and roads; however it is slowly improving. Impacts include soil compaction and damage to vegetation, and sedimentation in the water which could have some impacts on the Gila chub. The comparatively higher departure is also due to past actions: road maintenance, off-highway vehicle use, and grazing practices which resulted in vegetation removal, soil compaction, soil loss, and erosion.

The Cottonwood Willow Riparian Forest PNVT in the Oak Creek 5th code HUC watershed is moderately departed from reference condition and its trend is static. This is due to dispersed recreation in accessible areas, which has resulted in vegetation removal, accelerated erosion, and runoff. The departure and trend is also affected by past actions related to road locations, off-highway vehicle use, and grazing that contributed to vegetation removal, soil compaction and loss, and erosion. The recent decision on the Travel Management Rule (USDA Forest Service 2011m) addressed off-highway vehicle use. Consequently, the sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas heal.

An instream flow water rights application for Red Tank Draw was approved and the assessment was submitted to Arizona Department of Water Resources, pending approval. Spring Creek and Walker Creek have certified water rights for instream flow. It is expected that Arizona Department of Water Resources will award certified water rights for all perennial streams following protest resolution.

Fifteen percent of the Oak Creek and Beaver Creek 5th code HUC watersheds consist of designated wilderness or inventoried roadless areas that result in low to no motorized use (table 65). This would maintain sedimentation or nonpoint source pollution at approximately current levels. The existing Wet Beaver Creek Wilderness protects Wet Beaver Creek from motorized impacts. The Walker Mountain Inventoried Roadless Area precludes future road construction within the inventoried roadless area and benefits the headwaters and downstream areas of Walker Creek and, consequently, the Gila chub because of reduced sedimentation from lack of motorized use. The existing Red Rock-Secret Mountain Wilderness protects most of the perennial West Fork of Oak Creek and several miles of Oak Creek from motorized impacts. Any treatments in the watersheds that would require motorized equipment would not occur in these areas so proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Table 65. Existing roadless or minimally roaded areas in habitat occupied by Gila chub

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294
		Munds Mountain Wilderness (portion)	12,311
		Walker Mountain IRA	4,448
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158
		Munds Mountain Wilderness	5,783
Total watershed acres	**518,393**	**Total acres (% of watershed)**	**76,994 (15%)**

Risk Factors: Threats to the Gila chub that can be influenced by the Forest Service include predation by, and competition with, invasive animals including bull frogs and virile crayfish and nonnative fish and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Gila Chub and its Critical Habitat

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species; complying with approved recovery plans and a standard that says that direction federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives to restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat for the species would improve should these objectives be implemented in this species habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on nonnative and invasive species by alternative. The section on Chiricahua leopard frog in Wetland Cienega describes the consequences of plan components in all alternatives on the threat of disease to aquatic and riparian associated species.

Special Area Designations: There are portions of four eligible wild and scenic river segments in the Beaver Creek and Oak Creek 5th code HUC watersheds. As eligible wild and scenic river segments should retain their outstandingly remarkable values per Forest Service Handbook direction, there should be low net impact in these areas. However, the amount of recreation occurring in these areas is not restricted.

Recreation Opportunity Spectrum: There are some inconsistencies between recreation opportunity spectrum class in alternative A and number of open roads on the ground in the Oak

Creek watershed. Alternatives B, C, and D would be updated to better reflect the existing conditions in this watershed.

Alternatives B and C

Recreation Opportunity Spectrum: Changes in the ROS designations in the Beaver Creek and the Oak Creek 5th code HUC watersheds from less motorized access to more motorized access would accommodate the growing human populations adjacent to the forest but would not provide any protection from additional road construction and associated sedimentation in the future. Nor would these changes encourage closure and decommissioning of existing roads. These changes represent about 17,143 acres or 3.3 percent of the acres within of the two watersheds.

Special Area Designations: Alternatives B and C would add the recommended Walker Mountain Wilderness. It would have no additional benefit to perennial streams because it is colocated with the Walker Mountain Inventoried Roadless Area, which already precludes future road construction within this boundary and benefits the headwaters and downstream areas of Walker Creek, and Gila chub because of reduced sedimentation from lack of motorized use. The boundary of the recommended wilderness varies slightly from the roadless area in order to allow for creation of a fish barrier if needed to protect the Gila chub population. The recommendation of Walker Mountain alone would not be enough to alter the risk of uncharacteristic fire in its watershed in this alternative.

Alternative C

Special Area Designations: In alternative C, 17 percent of the watersheds that support Gila chub would have designations such as existing wilderness, recommended wilderness or inventoried roadless areas that result in low to no motorized use (table 66). This would help reduce sedimentation or nonpoint source pollution into Gila chub habitat and critical habitat. The alternative C Deadwood Draw recommended wilderness benefits the watershed by increasing the areas of low disturbance by 11,257 acres. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas so proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects. The recommendation of Deadwood Draw would have a very high likelihood of reducing the ability of the Forest Service to manage wildfires with resource objectives. Therefore, the risk of uncharacteristic fire in this area would be increased compared to alternatives A, B, and D. As a result, the risk of increased sediment delivery after a fire would be increased slightly in this watershed under alternative C. There is no overlap between habitat for the Gila chub and the wildlife habitat management areas proposed in alternative C.

Recreation Opportunity Spectrum: Changes in the ROS designations in the Beaver Creek and the Oak Creek 5th code HUC watersheds from less motorized access to more motorized access would accommodate the growing human populations adjacent to the forest but would not provide any protection from additional road construction and associated sedimentation in the future. Nor would these changes encourage closure and decommissioning of existing roads. For alternative C, these changes represent about 15,794 acres or 3 percent of the acres within of the 2 watersheds which is slightly lower than alternatives B and D and lower than A.

Table 66. Acres of Beaver Creek and Oak Creek 5th code watersheds within existing and recommended wilderness and inventoried roadless areas by alternative

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294	6,294	6,294	6,294
		Munds Mtn. Wilderness (portion)	12,311	12,311	12,311	12,311
		Walker Mtn. IRA	4,448	4,448	4,448	4,448
		Walker Mtn. recommended wilderness	0	4,448[1]	4,448[1]	0
		Deadwood Draw recommended wilderness	0	0	11,257	0
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158	48,158	48,158	48,158
		Munds Mtn. Wilderness	5,783	5,783	5,783	5,783
Total water-shed acres	**518,393**	**Total acres (percentage of watershed)**	**76,994 (15%)**	**76,994 (15%)**	**88,251 (17%)**	**76,994 (15%)**

[1] Walker Mountain recommended wilderness overlaps with the existing Walker Mountain Inventoried Roadless Area, so these acres are not counted twice.

Summary of Species Effects

The implementation of any alternative would result in a "may affect" determination for Gila chub and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All but one of the identified primary constituent elements for Gila chub is addressed by each alternative, and more effectively so by alternatives B, C, and D, and would provide for the continued viability and persistence of the species on the Coconino NF. The exception to this is the primary constituent element for habitat protected from disturbance or habitat that is representative of the historic geographical and ecological distribution of the species. This primary constituent element cannot be effectively addressed by any alternative because nonnative fish are already established in these habitats and consequently represent a significant threat. Furthermore, management of these nonnative fish falls under the purview of the Arizona Game and Fish Department. Though largely outside of the authority of the Forest Service, the forest can work with wildlife agencies to remove nonnative fish or install fish barriers to improve habitat for native fish. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Gila chub is very rare (F1 species) on the forest in its habitat but occupies its historic habitat and is vulnerable to perturbations in the environment. Some of its habitats have higher departures from reference conditions (e.g., Mixed Broadleaf Deciduous Riparian Forest within the Beaver Creek 5th code HUC watershed). The Gila chub is limited by conditions in its habitat including predation by, and competition with, nonnative fish (invasive animals) as well as bullfrogs and virile crayfish, and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of the species portion of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources" and "Watersheds" sections of this document.

Although all alternatives maintain the viability and persistence of the Gila chub within the authority of the Forest Service with regard to disease and invasive animals as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for perennial streams so that the composition, structure, and processes of these habitats better provide for the needs of the Gila chub and its critical habitat;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the Gila chub are reduced within the authority of the Forest Service;
- Threats to the habitats of the Gila chub are better defined and plan components put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter - Gila Topminnow and Headwater Chub

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Gila topminnow once occupied aquatic habitats in the Gila River drainage in New Mexico, Arizona, and Mexico below 1,524 meters (5,000 feet) in elevation and at one time was the most common fish found in the Gila River Basin. The species has recently been reintroduced into Fossil Creek on the Coconino NF and is present in that system. This creek is within the Fossil Creek-Lower Verde River 5th code HUC watershed.

Headwater chub was historically restricted in overall range to the headwater reaches of major tributaries to the Verde River. At present, headwater chub is only known from the Fossil Creek-Lower Verde River 5th code HUC watershed (10.7 potential perennial stream miles within Fossil Creek).

Habitat: Gila topminnow occupies headwater springs and vegetated margins and backwater areas of intermittent and perennial streams and rivers. This species prefers shallow warm water in a moderate current with dense aquatic vegetation and algal mats. The species is associated with

perennial springs, perennial streams, and the Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest PNVTs.

Headwater chub occupy headwater reaches of cool water, mid-elevation streams, and rivers where typical adult microhabitat consists of pools adjacent to swifter riffles and runs. Cover is usually present and consists of large boulders, tree rootwads, submerged large trees and branches, undercut cliff walls, or deep water. Headwater chub are associated with perennial streams and the Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest PNVTs.

Thirty-nine percent of the Fossil Creek–Lower Verde River 5th code HUC watershed consists of designated wilderness and inventoried roadless areas (table 67). The condition of the riparian forests is further discussed in the section on "Aquatic Systems." Mixed Broadleaf Deciduous Riparian Forest PNVT in these watersheds is at a low level of departure and similar to reference conditions at the landscape level. The Cottonwood Willow Riparian Forest PNVT in the Fossil Creek–Lower Verde 5th code HUC watershed is moderately departed from reference condition and its trend is static. This is due to system and nonsystem roads which have resulted in accelerated erosion and runoff. The recent decision on the Travel Management Rule (USDA Forest Service 2011m) addressed off-highway vehicle use. Consequently, the sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas heal.

The low to no motorized use in these areas contributes little sediment to perennial waters. The existing Fossil Springs Wilderness and Mazatzal Wilderness protect most of Fossil Creek from motorized impacts. There are also three inventoried roadless areas in this watershed: Hackberry, Boulder Canyon, and Cimarron Hills. Because there is no motorized use in the wildernesses and little motorized use in the IRAs, there is low net impact on the watershed. The inventoried roadless areas should preclude future road construction in these areas. This could benefit upland vegetation and soils in the Fossil Creek-Lower Verde River watershed, but wilderness and inventoried roadless area designations would also be a hindrance to management activities (fuels reduction, stream renovation) that would otherwise be beneficial to the watershed.

Table 67. Existing roadless or minimally roaded areas in the Fossil Creek–Lower Verde River 5th code HUC watershed

Special Area Designation	Acres in All Alternatives
Fossil Springs Wilderness	10,431
Mazatzal Wilderness	2,639
Boulder Canyon IRA	4,550
Cimarron Hills IRA	5,295
Hackberry IRA	17,905
Total acres (percentage of watershed)	**40,820 (39%)**

Risk Factors: Threats to the Gila topminnow and Headwater chub that can be influenced by the Forest Service include predation by, and competition with, nonnative species (invasive animals) to include mosquitofish and virile crayfish, and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona

Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Gila Topminnow and Headwater Chub

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species; complying with approved recovery plans and a standard that says that direction federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives to restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat for the species would improve should these objectives be implemented in this species habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on disease and nonnative and invasive species by alternative.

Special Area Designations: There are portions of four existing and eligible wild and scenic river segments in the watershed: an existing designation is along the Verde River (scenic), two existing designations are along Fossil Creek (wild, recreation), and one eligible river segment is along West Clear Creek (scenic). Because designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. For the Verde Wild and Scenic River, the comprehensive river management plan sets a capacity and limits on recreation that protect the species habitat. However, until the comprehensive river management plan is finalized for the Fossil Creek Wild and Scenic River, the level of human use is unknown because the capacity of the area has not been determined. Therefore, it is not possible to estimate resource impacts to the watersheds from recreation use associated with Fossil Creek. Eligible rivers are managed to protect the outstandingly remarkable values in accordance with the Forest Service Handbook but the amount of recreation occurring in these areas is not restricted.

Alternative A

Recreation Opportunity Spectrum: This alternative has a higher potential contribution of sedimentation to connected waters compared to the other alternatives. Alternative A differs from alternatives B, C, and D in having large areas of land presently designated by the recreation opportunity spectrum as semiprimitive motorized which would allow future road construction in these areas. In addition, some land along Fossil Creek is designated as roaded natural and consequently some segments of Fossil Creek could have additional road construction.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Within the Fossil Creek–Lower Verde River 5th code HUC watershed, changes in ROS designations would range from 9,462 to 13,612 acres across alternatives B, C, and D, with alternative C being the highest and alternative D being the lowest. These areas of land would be changed to allow less motorized access than alternative A, resulting

in beneficial change because some segments of Fossil Creek would limit the ability of managers to build roads in this watershed and encourage closure and decommissioning of existing roads. These alternatives would not determine ROS for the Fossil Creek Wild and Scenic River because these are being determined by the comprehensive river management plan, which is currently under development.

Alternative B

Special Area Designations: The recommended Davey's wilderness would add additional protection of Fossil Creek from motorized impacts. However, the beneficial impacts of designating wilderness is diminished by the fact that designation limits motorized access and can, thus, be a hindrance to management activities (fuels reduction, stream renovation) that would otherwise be beneficial to the watershed condition. Davey's is not expected to alter the ability to manage wildfires with resource objectives in the watershed. See table 68.

Table 68. Acres of Fossil Creek 5th code HUC watershed within existing and recommended wilderness and inventoried roadless areas by alternative

Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Fossil Springs Wilderness	10,431	10,431	10,431	10,431
Mazatzal Wilderness	2,639	2,639	2,639	2,639
Boulder Canyon IRA	4,550	4,550	4,550	4,550
Cimarron Hills IRA	5,295	5,295	5,295	5,295
Hackberry IRA	17,905	17,905	17,905	17,905
Davey's recommended wilderness	0	1,779	1,779	0
Hackberry recommended wilderness	0	0	25,171	0
Cimarron-Boulder recommended wilderness	0	0	15,300	0
Tin Can recommended wilderness	0	0	3,972	0
Black Mountain recommended wilderness (portion)	0	0	692	0
Total acres (percentage of watershed)	40,820 (38.9)	42,599 (40.6)	87,734 (83.6)	40,820 (38.9)

Alternative C

Special area designations: The effects for Davey's recommended wilderness would be the same as alternative B. The recommended Tin Can wilderness would extend the Fossil Springs Wilderness, but would not have any effect on perennial waters in the watershed. The recommended Hackberry, Cimarron-Boulder, and Black Mountain wildernesses would be located in areas that do not have any existing roads, so their impact to perennial stream habitats would not be measurable. Again, the beneficial impacts of designating wilderness is diminished by the fact that they limit motorized access and can, thus, be a hindrance to management activities (fuels reduction, stream renovation) that would otherwise be beneficial to the watershed. Black Mountain and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability

to manage wildfires with resource objectives. This could result in increased sedimentation as the result of fire within the watershed.

There is no overlap between habitat for the Gila topminnow and headwater chub and the wildlife habitat management areas proposed in alternative C.

Summary of Species Effects

The implementation of all alternatives would result in a "may affect" determination for the Gila topminnow and headwater chub and their habitats. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All alternatives would provide for the continued viability and persistence of the Gila topminnow and headwater chub on the Coconino NF. Additional threats and the details of how they are addressed are found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Gila topminnow is very rare (F1 species) and headwater chub is rare (F2 species) on the forest in their habitats and both occupy a small portion of their historic habitat, which is comprised of only one location and one watershed and are vulnerable to perturbations in the environment. Some of their habitats have higher departures from reference conditions (e.g., Cottonwood Willow Riparian Forest within the Fossil Creek-Lower Verde 5th code HUC watershed). The Gila topminnow and headwater chub are limited by conditions in their habitats including include predation by, and competition with, nonnative species (invasive animals), including mosquitofish and virile crayfish, and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, for example, uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Although all alternatives maintain the viability and persistence of the Gila topminnow and the headwater chub within the authority of the Forest Service with regard to disease and invasive animals as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including springs, so that the composition, structure, and processes of these habitats better provide for the needs of the Gila topminnow and headwater chub;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the Gila topminnow and headwater chub are reduced within the authority of the Forest Service;

- Threats to the habitats of the Gila topminnow and headwater chub are better defined and plan components are put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Gila Trout

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Gila trout is not currently extant on the Coconino NF. The species was found historically in the higher elevations of the Oak Creek and West Clear Creek 5th code HUC watersheds on the Coconino NF (Miller 1972). This represents 23.2 potential perennial stream miles.

Habitat: Gila trout are found in small mountain headwater streams, which are generally narrow and shallow, and rarely exceed 21 degrees Celsius (70 degrees Fahrenheit). Siltation is usually low and cobble is the predominate substrate. During drought years, the fish tend to be confined to pools with sufficient depth and cover. The Gila trout is associated with perennial streams and the Mixed Broadleaf Deciduous, Montane Willow, and Gallery Coniferous Riparian Forest PNVTs.

The condition of riparian forests is described in the section on "Aquatic Systems." The condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT in these watersheds is at a low level of departure and similar to reference conditions at the landscape level. In all of the 5th code HUC watersheds associated with the Gila trout, the condition of the Montane Willow Riparian Forest PNVT is at a low level of departure and similar to reference conditions at the landscape level. The Gallery Coniferous Riparian Forest PNVT is at a low level of departure from reference condition and has a static trend in all of the 5th code HUC watersheds associated with Gila trout.

Sixteen percent of the Oak Creek and West Clear Creek 5th code HUC watersheds consist of designated wilderness or inventoried roadless areas that result in low to no motorized use (table 69). This would maintain sedimentation or nonpoint source pollution at approximately its current level. The existing Red Rock-Secret Mountain Wilderness protects most of the perennial West Fork of Oak Creek and several miles of Oak Creek from motorized impacts, and the existing West Clear Creek Wilderness protects most of the perennial miles of West Clear Creek from motorized impacts. The Munds Mountain Wilderness and Walker Mountain Inventoried Roadless Area are located in upland areas of the Oak Creek and West Clear Creek 5th code HUC watersheds, respectively, and preclude future road construction. Gila trout habitat is, thus, benefited because of reduced sedimentation from lack of motorized use. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas so proportionally less of the watershed would be available for otherwise beneficial treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Table 69. Existing roadless or minimally roaded areas in Gila trout habitat

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158
		Munds Mountain Wilderness	5,783
West Clear Creek	187,280	West Clear Creek Wilderness	15,545
		Walker Mountain IRA	1,930
Total watershed acres	**442,708**	**Total acres (% of watershed)**	**71,416 (16%)**

Risk Factors: Threats to the Gila trout that can be influenced by the Forest Service include predation by, and competition and hybridization with, nonnative fish (invasive animals) and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Gila Trout

Summary of Determinations

The implementation of any alternative would result in a "may affect" determination for Gila trout and its habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

Coarse Filter Summary

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All alternatives would provide for the continued viability and persistence of Gila trout on the Coconino NF. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species; complying with approved recovery plans; and a standard that says that federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives to restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat for the species would improve should these objectives be implemented in this species habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on disease and nonnative and invasive species by alternative.

Special Area Designations: There are portions of four eligible wild and scenic river segments in the Oak Creek and West Clear Creek watersheds: one eligible designation is along Oak Creek (recreational), one eligible designation is along West Fork Oak Creek (wild), and two eligible designations are along West Clear Creek (wild, scenic). Because designated wild and scenic rivers promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. Eligible rivers are managed to protect the outstandingly remarkable values in accordance with the Forest Service Handbook, but the amount of recreation occurring in these areas is not restricted.

Alternative A

Recreation Opportunity Spectrum: Alternative A would retain some inconsistencies between recreation opportunity spectrum class and number of open roads on the ground in the Oak Creek 5th code HUC watershed.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Overall, ROS classes designated in each alternative would not differ in their effects to lands near or that encompass the perennial stream habitat in these watersheds. There are some inconsistencies between ROS class in alternative A and number of open roads on the ground in the Oak Creek watershed. This discrepancy would be remedied in alternatives B, C, and D by placing areas in more appropriate ROS classes. In alternatives B, C, and D, changes to ROS designations in the Oak Creek 5th code HUC watershed would result in a shift from less developed to more developed designations in about 12,702 acres (about 5 percent of the watershed). Within the West Clear Creek 5th code HUC watershed, changes in ROS designations would range from 31,192 to 32,088 acres (about 17 percent of the watershed) across alternatives B, C, and D. These areas of land would be changed to allow less motorized access, resulting in beneficial change because the ability of managers to build roads in this watershed would be limited, and it would encourage closure and decommissioning of existing roads.

Alternatives B and C

Special Area Designations: Alternatives B and C would add the recommended Walker Mountain wilderness, but it would add no additional benefit to perennial streams because it is colocated with the Walker Mountain Inventoried Roadless Area, which already precludes future road construction within this boundary.

Alternative C

Special Area Designations: In alternative C, 20 percent of the watersheds that support Gila trout would have designations such as existing wilderness, recommended wilderness, or inventoried roadless areas that result in low to no motorized use (table 70). This would help reduce sedimentation or nonpoint source pollution into Gila trout habitat. The existing Red Rock-Secret Mountain Wilderness protects most of the perennial West Fork of Oak Creek and several miles of Oak Creek from motorized impacts, and the existing West Clear Creek Wilderness protects most of the perennial miles of West Clear Creek from motorized impacts. The Black Mountain recommended wilderness would also protect several miles of West Clear Creek. Together, the Black Mountain, Cedar Bench, Deadwood Draw and Walker Mountain recommended

wildernesses increase the area of low disturbance by 17,322 acres. However, treatments in the watersheds that would require motorized equipment would be less likely to occur in these areas so proportionally less of the watershed would be available for treatments that modify the natural setting such as fuels reduction, stream renovation, or watershed improvement projects. There is no overlap between habitat for the Gila trout and the wildlife habitat management areas proposed in alternative C.

Table 70. Acres of Oak Creek and West Clear Creek 5th code HUC watershed within existing and recommended wilderness and inventoried roadless areas, by alternative

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Oak Creek	255,428	Red Rock-Secret Mtn. Wilderness	48,158	48,158	48,158	48,158
		Munds Mtn. Wilderness	5,783	5,783	5,783	5,783
West Clear Creek	187,280	West Clear Creek Wilderness	15,545	15,545	15,545	15,545
		Walker Mtn. IRA	1,930	1,930	1,930	1,930
		Walker Mtn. recommended wilderness	0	1,930[1]	1,930[1]	0
		Black Mtn. recommended wilderness	0	0	9,054	0
		Cedar Bench recommended wilderness	0	0	5,809	0
		Deadwood Draw recommended wilderness	0	0	529	0
Total watershed acres	**442,708**	**Total acres (percentage of watershed)**	**71,416 (16%)**	**71,416 (16%)**	**86,808 (20%)**	**76,994 (16%)**

[1] Walker Mountain recommended wilderness overlaps with the existing Walker Mountain IRA, so these acres are not counted twice.

Summary of Species Effects

Gila trout occurred historically on the forest, but there are no known extant populations (FH species). The PNVTs included in the habitat of this species are at a low level of departure and in all but one PNVT (Gallery Coniferous Riparian Forest, which has a static trend), are similar to reference conditions at the landscape level. The Gila trout is limited by conditions in its habitat including predation by, and competition and hybridization with, nonnative fishes and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components would address landscape threats to the primary habitats such as uncharacteristic fire and overall water quality, in the alternatives. Although all alternatives maintain the viability and persistence of the Gila trout within the authority of the Forest Service with regard to disease and invasive animals, as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the Gila trout;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the Gila trout are reduced within the authority of the Forest Service;

- Threats to the habitats of the Gila trout are better defined and plan components put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Little Colorado Spinedace

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: The Upper Clear Creek 5th code HUC watershed (East Clear Creek) from Leonard Canyon upstream to Blue Ridge Reservoir and upstream from the reservoir to Potato Lake is considered critical habitat for Little Colorado spinedace. This watershed contains 124.1 potential perennial stream miles on the forest.

Habitat: Little Colorado spinedace habitat is characterized by clear, flowing pools with slow to moderate velocities, moderate depths, and gravel substrates, with cover from undercut banks or large rocks often present (USDA Forest Service 1999b). Residual pools and springs are important refuges during periods of low water and drought. The species is associated with perennial streams and Montane Willow and Gallery Coniferous Riparian Forest PNVTs.

Designated Critical Habitat: Critical habitat was designated for the Little Colorado spinedace in 1987 (USDI 1987a). There are approximately 18 miles of critical habitat on the forest extending from the confluence of Leonard Canyon with East Clear Creek upstream to CC Cragin Reservoir dam and approximately 13 miles of stream extending from the upper end of CC Cragin Reservoir upstream to Potato Lake.

Primary constituent elements for this species are:

- Aquatic systems with perennial flow
- Free of nonnative fishes
- Natural hydrographs
- Good water quality, free of pollutants

The Upper Clear Creek 5th code HUC watershed includes critical habitat for Little Colorado spinedace.

See “Aquatic Systems” for condition of riparian forests. In the Upper Clear Creek 5th code HUC watersheds associated with the Little Colorado spinedace, the condition of the Montane Willow Riparian Forest PNVT in the Upper Clear Creek 5th code HUC watershed is more departed (high level) than the overall PNVT-level departure. This is due to dispersed recreation in accessible areas as well as past actions associated with improperly located and poorly maintained roads, off-highway vehicle use, and elk herbivory which is under the purview of the Arizona Game and Fish Department. The Gallery Coniferous Riparian Forest PNVT is at a low level of departure from reference condition and has a static trend in all of the 5th code HUC watersheds associated with Little Colorado spinedace.

Risk Factors: Threats to the Little Colorado spinedace that can be influenced by the Forest Service include predation by, and competition with, nonnative fish (invasive animals) and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Little Colorado Spinedace and its Critical Habitat

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species; complying with approved recovery plans and a standard that says that direction federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives to restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat for the species would improve should these objectives be implemented in this species habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on disease and nonnative and invasive species by alternative.

There are portions of three eligible wild and scenic river segments in the Upper Clear Creek watershed. As designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in this watershed. Eligible rivers are managed to protect the outstandingly remarkable values in accordance with the Forest Service Handbook, but the amount of recreation occurring in these areas is not restricted.

Three percent of the Upper Clear Creek 5th code HUC watersheds consist of existing inventoried roadless areas that result in low to no motorized use (table 71). This would maintain sedimentation or nonpoint source pollution at approximately its current level because there are no existing roads in the inventoried roadless areas, that designation would preclude future road construction. This would benefits portions of East Clear Creek, Barbershop Canyon, and Merritt Draw directly, but would also be a hindrance to motorized management activities (fuels reduction, stream renovation) that would otherwise be beneficial to the watershed.

Table 71. Existing roadless or minimally roaded areas in habitat occupied by Little Colorado spinedace

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Upper Clear Creek	112,362	Barbershop Canyon IRA	1,310
		East Clear Creek IRA	2,036
Total watershed acres	**112,362**	**Total acres (% of watershed)**	**3,346 (3%)**

Alternatives B, C, and D

Recreation Opportunity Spectrum: Within the Upper Clear Creek 5th code HUC watershed, changes in ROS designations would range from 74,744 acres in alternatives B and D to 76,408 acres in alternative C (about 66 to 68 percent of the watershed). These areas of land would be changed to allow less motorized access, resulting in beneficial change because the ability of managers to build roads in this watershed would be limited, and it would encourage closure and decommissioning of existing roads. This could reduce sedimentation to connected waters and improve habitat for this species.

Alternative C

Special area designations: In alternative C, about 3 percent of the Upper Clear Creek watershed would have designations of inventoried roadless areas or recommended wilderness that would result in low to no motorized use (table 72). This would help reduce sedimentation or nonpoint source pollution into Little Colorado spinedace habitat following storm events due to nonuse of existing roads. Barbershop and East clear Creek recommended wilderness areas overlap with the existing Barbershop and East Clear Creek IRAs, so these acres are not counted twice.

Table 72. Upper Clear Creek 5th code HUC watershed, inventoried roadless areas, recommended wilderness areas, and proposed wildlife habitat management areas by alternative

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Upper Clear Creek	112,362	Barbershop Canyon IRA	1,310	1,310	1,310	1,310
		East Clear Creek IRA	2,036	2,036	2,036	2,036
		Barbershop recommended wilderness	0	0	1,310[1]	0
		East Clear Creek recommended wilderness	0	0	2,036*	0
		Anderson Mesa proposed WHMA	0	0	1,372	0
		East Clear Creek proposed WHMA	00	0	35,797	0
		Hospital Ridge proposed WHMA	0	0	4,945	0
		Knoll Lake proposed WHMA	0	0	2,423	0
		Limestone Pasture proposed WHMA (no motorized use)	0	0	2,418	0
		Second Chance proposed WHMA	0	0	1,444	0
Total watershed acres	**112,362**	**Total acres (percentage of watershed)**	**3,346 (3%)**	**3,346 (3%)**	**51,815 (46%)**	**3,346 (3%)**

[1] Barbershop and East Clear Creek recommended wildernesses overlap with the existing Barbershop and East Clear Creek IRAs, so these acres are not counted twice.

The proposed East Clear Creek, Hospital Ridge, Knoll Lake, Limestone Pasture, and Second Chance wildlife habitat management areas overlap the Upper Clear Creek 5th HUC watershed. It is highly unlikely that closing roads in the proposed wildlife habitat management areas in this

watershed would result in a measureable reduction of sediment delivery or water quality improvement in any perennial waters due to the low extent and magnitude of road closures that connect to perennial waters (See "Aquatic Systems" – Water Quality for more information). This would not affect sedimentation or nonpoint source pollution into Little Colorado spinedace habitat and its critical habitat. The Barbershop and East Clear Creek recommended wilderness areas overlap with the existing Barbershop and East Clear Creek IRAs and, thus, do not provide added benefit with regard to roadless area or reduced sedimentation in the watershed. Protection and restoration of the watersheds that support Leonard Canyon and East Clear Creek, including the headwaters, are a priority for East Clear Creek, Hospital Ridge, Knoll Lake, Limestone Pasture, and Second Chance wildlife habitat management areas. The Little Colorado spinedace is an emphasis species in the East Clear Creek, Hospital Ridge, and Knoll Lake WHMA. This means that management activities that occur in these WHMAs would utilize practices that protect or improve the habitat of this species.

Summary of Species Effects

The implementation of any alternative would result in a "may affect" determination for Little Colorado spinedace and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

Coarse Filter Summary

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All but one identified primary constituent element for Little Colorado spinedace is addressed by all alternatives, and more effectively so by alternatives B, C, and D, and would provide for the continued viability and persistence of the species on the Coconino NF. The exception is the primary constituent element for a biological environment free of nonnative fishes. This primary constituent element cannot be effectively addressed by any alternative because nonnative fish are already established in these habitats and, consequently, represent a significant threat. Furthermore, management of these nonnative fish falls under the purview of the Arizona Game and Fish Department. Though largely outside of the authority of the Forest Service, the forest can work with wildlife agencies to remove nonnative fish or install fish barriers to improve habitat for native fish. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

The Little Colorado spinedace is very rare (F1 species) on the forest, and its historic habitat has been drastically reduced; therefore, it is vulnerable to perturbations in the environment. Some of its habitats have high departures from reference conditions (e.g., the Montane Willow Riparian Forest PNVT within the Upper Clear Creek 5th code HUC watershed). The Little Colorado spinedace is limited by conditions in its habitat including predation by, and competition with, nonnative fishes and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document. Although all alternatives maintain the viability and persistence of the Little Colorado spinedace within the authority of the Forest Service with regard to disease and invasive animals, as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the Little Colorado spinedace;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the Little Colorado spinedace are reduced within the authority of the Forest Service;
- Threats to the habitats of the Little Colorado spinedace are better defined and plan components are put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Loach Minnow

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Loach minnow is historic to the Verde River, and on the Coconino NF, the loach minnow historically occurred in the Beaver Creek, Oak Creek, Grindstone Wash-Verde River, Cherry Creek-Verde River, and Fossil Creek-Lower Verde River 5th code HUC watersheds (totaling approximately 79.8 potential perennial stream miles). Loach minnow now occurs in Fossil Creek as a result of recent repatriation efforts.

Habitat: Loach minnow is found in turbulent, rocky riffles of rivers and tributaries up to about 2,200 meters (7,200 feet) in elevation. It is a bottom-dwelling inhabitant of shallow, swift waters flowing over gravel, cobble, and rubble substrates in mainstream rivers and tributaries (USFWS 1994b). Loach minnow is associated with perennial streams and riparian forest PNVTs.

Designated Critical Habitat: Loach minnow was listed as endangered with critical habitat in 2012 (USDI 2012b). There are a total of approximately 79.8 miles of critical habitat on the Coconino NF.

The primary constituent elements for this species are:

- Habitat to support all egg, larval, juvenile, and adult loach minnow;
- An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies;
- Streams with no or no more than low levels of pollutants;

- Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted;
- No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low to allow persistence of loach minnow; and
- Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments

See the section on "Aquatic Systems" for information on the condition of riparian forest PNVTs. The condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT in four out of the five watersheds associated with loach minnow is at a low level of departure and similar to reference conditions at the landscape level. The condition of the Mixed Broadleaf Deciduous Riparian Forest within the Beaver Creek 5th code HUC watershed, however, is more departed (moderate level) than the overall low PNVT-level departure. The higher rate of departure is due in part to high amounts of dispersed recreation in accessible areas and roads that result in soil compaction, damage to vegetation, and sedimentation into the water which could affect loach minnow. The comparatively higher departure is also due to past actions: road maintenance, off-highway vehicle use, and grazing practices which resulted in vegetation removal, soil compaction, soil loss, and erosion. Conditions, however, have been slowly improving.

The Cottonwood Willow Riparian Forest PNVT is moderately departed from reference condition and slowly improving in three out of the five 5th code HUC watersheds associated with loach minnow. The Oak Creek and Fossil Creek-Lower Verde River 5th code HUC watersheds are also moderately departed, but their trend is static. This is due to dispersed recreation, which has resulted in vegetation removal, accelerated erosion and runoff. Past actions related to road locations, off-highway vehicle use, and grazing also contributed to vegetation removal, soil compaction and loss, and erosion. The recent decision on the Travel Management Rule (USDA Forest Service 2011m) addressed off-highway vehicle use. Consequently, sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas recover.

In all of the 5th code HUC watersheds associated with the loach minnow, the condition of the Montane Willow and Gallery Coniferous Riparian Forest PNVTs are at a low level of departure and similar to reference conditions at the landscape level.

Nineteen percent of the Beaver Creek, Oak Creek, Cherry Creek-Verde River, Fossil Creek-Verde River, Grindstone Wash-Verde River 5th code watersheds consist of existing designated wilderness or inventoried roadless areas that result in low to no motorized use (table 73). This would maintain sedimentation or nonpoint source pollution at approximately its current level. The existing wildernesses directly protect perennial portions of Wet Beaver Creek, Fossil Creek, Oak Creek, and the Verde River from motorized impacts. Four inventoried roadless areas (Boulder Canyon, Cimarron Hills, Hackberry, and Walker Mountain) preclude future road construction in their respective areas and indirectly benefit Beaver Creek, Fossil Creek, and the Verde River because of reduced sedimentation from lack of motorized use. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas, so proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Risk Factors: Threats to loach minnow that can be influenced by the Forest Service include predation by, and competition with, nonnative fish (invasive animals), including piscivorous catfish and the red shiner, and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Table 73. Existing roadless or minimally roaded areas in habitat occupied by loach minnow

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294
		Munds Mountain Wilderness	12,311
		Walker Mountain IRA	4,448
Cherry Creek-Verde River	21,807	None	0
Fossil Creek-Verde River	104,923	Fossil Springs Wilderness	10,431
		Mazatzal Wilderness	2,639
		Boulder Canyon IRA	4,550
		Cimarron Hills IRA	5,295
		Hackberry IRA	17,905
Grindstone Wash-Verde River	10,462	Sycamore Canyon Wilderness	2,383
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158
		Munds Mountain Wilderness	5,783
		Kachina Peaks Wilderness	1,770
		Walker Mountain IRA	1,930
Total watershed acres	**655,585**	**Total acres (% of watershed)**	**123,897 (19%)**

Environmental Consequences – Loach Minnow and Its Critical Habitat

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species; complying with approved recovery plans and a standard that says that management direction for federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives to restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat for the species would improve should these objectives be implemented in this species' habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on disease and nonnative and invasive species by alternative.

Special Area Designations: There are portions of several existing or eligible wild and scenic river segments in each of the five watersheds where loach minnow is found. The Fossil Creek-

Verde River 5th code HUC watershed has existing wild and scenic river designations, and the Beaver Creek, Cherry Creek–Verde River, Grindstone Wash–Verde River, and Oak Creek 5th code HUC watersheds all have eligible wild and scenic river designations. Because designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. For the Verde Wild and Scenic River, the comprehensive river management plan sets a capacity and limits on recreation that protect the species habitat. However, until the comprehensive river management plan is finalized for the Fossil Creek Wild and Scenic River, the level of human use is unknown because the capacity of the area has not been determined. Therefore, it is not possible to estimate resource impacts to the watersheds from recreation use associated with Fossil Creek. Eligible rivers are managed to protect the outstandingly remarkable values in accordance with the Forest Service Handbook but the amount of recreation occurring in these areas is not restricted.

Alternative A

Recreation Opportunity Spectrum: Within the Cherry Creek–Verde River and Grindstone Wash–Verde River 5th code HUC watersheds, alternative A would retain large areas of land presently designated as semiprimitive motorized, which would allow for future road construction in these areas. Furthermore, some land along Fossil Creek is designated as roaded natural and as a consequence, some segments of Fossil Creek could experience future road construction. This alternative would have a higher potential contribution of sedimentation to connected waters compared to the other alternatives. Additionally, alternative A would retain some inconsistencies between recreation opportunity spectrum class and number of open roads on the ground in the Oak Creek 5th code HUC watershed.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Within the Fossil Creek–Lower Verde River 5th code HUC watershed, changes in ROS designations range from 9,462 to 13,612 acres across alternatives B, C, and D, with alternative C being the highest and alternative D being the lowest. These areas of land would be changed to allow less motorized access than alternative A. This would limit the ability of managers to build roads in this watershed and would encourage closure and decommissioning of existing roads which would be a beneficial effect. These alternatives would not determine ROS for the Fossil Creek Wild and Scenic River because these are being determined by the comprehensive river management plan, which is currently under development.

Recreation opportunity spectrum classes designated in the remaining watersheds would be changed to allowing more motorized access which would be beneficial to nearby communities but not confer additional protections to this species habitat. The changed acres total about 34,500 which represent about 6.2 percent of the remaining watersheds. Not all of these changes would affect habitat for this species because not all changes would occur in areas that connect to perennial waters.

Alternatives B and C

Special Area Designations: Alternatives B and C would add the recommended Walker Mountain recommended wilderness in the Beaver Creek watershed and the recommended Davey's recommended wilderness in the Fossil Creek–Verde River watershed (table 74). The Walker Mountain recommended wilderness would add no additional benefit to perennial streams because it is colocated with the Walker Mountain Inventoried Roadless Area which already precludes future road construction within this boundary, benefiting the headwaters and downstream areas of

Walker Creek and Wet Beaver Creek from reduced sedimentation due to lack of motorized use. The recommended Davey's wilderness, which is adjacent to the Fossil Springs Wilderness, would add wilderness to the north side of Fossil Creek and further protect this system from motorized use and sedimentation. Davey's recommended wilderness is not expected to alter the ability to manage wildfire with resource objectives in the watershed. Walker Mountain wilderness designation alone would not be enough to alter the risk of uncharacteristic fire in this watershed in alternative B and C.

Alternative C

Special Area Designations: In alternative C, 18 percent of the watersheds that support loach minnow would have designations such as existing wilderness, recommended wilderness, or inventoried roadless areas that result in low to no motorized use (table 74). This would help reduce sedimentation or nonpoint source pollution into loach minnow habitat and critical habitat. The recommended Deadwood Draw wilderness would provide an additional buffer for both Wet Beaver and Walker Creeks because it is adjacent to the existing Wet Beaver Creek Wilderness and the recommended Walker Mountain wilderness. The recommended Davey's wilderness would add additional protection of Fossil Creek from motorized impacts because it is adjacent to the existing Fossil Springs and Mazatzal Wilderness areas. The recommended Tin Can wilderness would extend the Fossil Springs Wilderness, but would not have any effect on perennial waters in the watershed. Finally, the recommended Hackberry, Cimarron-Boulder, and Black Mountain wildernesses would be located in areas that do not have any existing roads, so their impact to perennial stream habitats would not be measureable. Of the latter, only the recommended Hackberry wilderness would be located near and/or encompasses perennial water (Verde River). Walker Mountain, Black Mountain, and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability to manage wildfires with resource objectives. This could result in increased sedimentation as the result of fire within the watershed.

There is no overlap between habitat for loach minnow and the wildlife habitat management areas proposed in alternative C, so no additional benefits would be conferred from these areas.

Table 74. Existing and recommended wilderness and inventoried roadless areas by watershed and alternative

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294	6,294	6,294	6,294
		Munds Mtn. Wilderness (portion)	12,311	12,311	12,311	12,311
		Walker Mtn. IRA	4,448	4,448	4,448	4,448
		Walker Mtn. recommended wilderness	0	4,448[a]	4,448[1]	0
		Deadwood Draw recommended wilderness	0	0	11,257	0
Cherry Creek-Verde River	21,807	none	0	0	0	0
Fossil Creek-	104,923	Fossil Springs Wilderness	10,431	10,431	10,431	10,431

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Verde River		Mazatzal Wilderness	2,639	2,639	2,639	2,639
		Boulder Canyon IRA	4,550	4,550	4,550[2]	4,550
		Cimarron Hills IRA	5,295	5,295	5,295[2]	5,295
		Hackberry IRA	17,905	17,905	17,905[2]	17,905
		Davey's recommended wilderness	0	1,779	1,779	0
		Hackberry recommended wilderness	0	0	25,171[2]	0
		Cimarron-Boulder recommended wilderness	0	0	15,300[2]	0
Fossil Creek-Verde River Continued	104,923	Tin Can recommended wilderness	0	0	3,972	0
		Black Mountain recommended wilderness (portion)	0	0	692	0
Grindstone Wash-Verde River	10,462	Sycamore Canyon Wilderness	2,383	2,383	2,383	2,383
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158	48,158	48,158	48,158
		Munds Mtn. Wilderness	5,783	5,783	5,783	5,783
		Walker Mountain IRA	1,930	1,930	1,930	1,930
Total watershed acres	**655,585**	**Total acres (percentage of watershed)**	**99,074 (15%)**	**100,853 (15%)**	**118,238 (18%)**	**99,074 (15%)**

[1] Walker Mountain recommended wilderness overlaps with the existing Walker Mountain IRA, so these acres are not counted twice.
[2] Some of the acreages in the existing inventoried roadless areas and the recommended wildernesses overlap, and are not counted twice in the total acreage.

Summary of Species Effects

The implementation of any alternative would result in a "may affect" determination for loach minnow and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

Coarse Filter Summary

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All but one of the identified primary constituent elements for loach minnow are addressed by each alternative, and more effectively so by alternatives B, C, and D, and would provide for the continued viability and persistence of the species on the Coconino NF. The

exception to this is the primary constituent element for a habitat free from nonnative aquatic species or that has low densities of nonnative aquatic species. This primary constituent element cannot be effectively addressed by any alternative because nonnative fish are already established in these habitats and, consequently, represent a significant threat. Furthermore, the management of these nonnative fish falls under the purview of the Arizona Game and Fish Department. Though largely outside of the authority of the Forest Service, the forest can work with wildlife agencies to remove nonnative fish or install fish barriers to improve habitat for native fish. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Loach minnow is very rare (F1 species) on the forest in its habitat and has been extirpated from most of its historic habitat; therefore, it is vulnerable to perturbations in the environment. Some of its habitats have higher departures from reference conditions (e.g., Cottonwood Willow Riparian Forest within the Fossil Creek–Lower Verde 5th code HUC watershed). Loach minnow is limited by conditions in its habitat including predation by, and competition with, nonnative species (invasive animals), including piscivorous catfish and the red shiner, and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Although all alternatives maintain the viability and persistence of loach minnow within the authority of the Forest Service with regard to disease and invasive animals as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of loach minnow and its critical habitat;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to loach minnow are reduced within the authority of the Forest Service;
- Threats to the habitats of loach minnow are better defined and plan components are put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Spikedace

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Historically, spikedace was common and locally abundant throughout the upper Gila River Basin of Arizona and New Mexico. Its distribution was widespread in large and moderate size rivers and streams in Arizona, including the Gila, Salt, and Verde Rivers and their major tributaries. Spikedace was present in the Beaver Creek, Oak Creek, Cherry Creek–Verde

River, Fossil Creek–Lower Verde River, Grindstone Wash–Verde River, and West Clear Creek 5th code HUC watersheds (totaling approximately 117.7 potential perennial stream miles). Spikedace now occurs in Fossil Creek as a result of recent repatriation efforts.

Habitat: Spikedace occupy mid-water habitats usually less than 1 meter deep, with slow to moderate water velocities over sand, gravel, or cobble substrates (USDI 2007b). Adults often aggregate in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars (USDI 2007b). The species is associated with perennial streams and with Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest PNVTs.

Designated Critical Habitat: Spikedace was listed as endangered with critical habitat in 2012 (USDI 2012c). There are a total of approximately 117.7 miles of critical habitat on the Coconino NF (42.7 miles of Verde River; 33.7 miles of lower Oak Creek; 20.7 miles of lower Beaver–Wet Beaver Creeks; 6.8 miles of lower West Clear Creek; 13.8 miles of lower Fossil Creek).

The primary constituent elements for this species are:

- Habitat to support all egg, larval, juvenile, and adult spikedace.
- An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies.
- Streams with no or no more than low levels of pollutants.
- Perennial flows or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted.
- No nonnative aquatic species or levels of nonnative aquatic species that are sufficiently low to allow persistence of spikedace.
- Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

The condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT in five out of the six watersheds associated with spikedace is at a low level of departure and similar to reference conditions at the landscape level (see section on “Aquatic Systems”). The condition of the Mixed Broadleaf Deciduous Riparian Forest within the Beaver Creek 5th code HUC watershed is more departed (moderate level) than the overall PNVT-level departure (low level) described in the coarse filter section for riparian resources (see section on “Aquatic Systems”). The higher rate of departure is due in part to high amounts of dispersed recreation in accessible areas and roads that result in soil compaction, damage to vegetation, and sedimentation into the water which could affect the spikedace. The comparatively higher departure is also due to past actions: road maintenance, off-highway vehicle use, and grazing practices which resulted in vegetation removal, soil compaction, soil loss, and erosion. Conditions, however, have been slowly improving.

As described in the coarse filter riparian resources section, the Cottonwood Willow Riparian Forest PNVT is moderately departed from reference condition and slowly improving in four out of the six 5th code HUC watersheds associated with the spikedace. The Oak Creek and Fossil Creek–Lower Verde River 5th code HUC watersheds are also moderately departed but their trend

is static (see section on "Aquatic Systems"). This is due to dispersed recreation, which has resulted in vegetation removal, accelerated erosion, and runoff. Past actions related to road locations, off-highway vehicle use, and grazing also contributed to vegetation removal, soil compaction and loss, and erosion. The recent decision on the Travel Management Rule (USDA Forest Service 2011m) addressed off-highway vehicle use. Consequently, the sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas heal.

In all of the 5th code HUC watersheds associated with the spikedace, the condition of the Montane Willow Riparian Forest PNVT is at a low level of departure and similar to reference conditions at the landscape level.

As described in the coarse filter riparian resources section, the Gallery Coniferous Riparian Forest PNVT is at a low level of departure from reference condition and has a static trend in all of the 5th code HUC watersheds associated with spikedace (see section on "Aquatic Systems").

Sixteen percent of the Beaver Creek, Oak Creek, Cherry Creek–Verde River, Fossil Creek–Verde River, Grindstone Wash–Verde River, and West Clear Creek 5th code watersheds consist of designated wilderness or inventoried roadless areas that result in low to no motorized use (table 75). This would maintain sedimentation or nonpoint source pollution at approximately its current level. The existing wildernesses directly protect perennial portions of Wet Beaver Creek, Fossil Creek, Oak Creek, the Verde River, and West Clear Creek from motorized impacts. Four inventoried roadless areas (Boulder Canyon, Cimarron Hills, Hackberry, and Walker Mountain) preclude future road construction in their respective areas and indirectly benefit Beaver Creek, Fossil Creek, the Verde River, and West Clear Creek because of reduced sedimentation from lack of motorized use. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas so proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Table 75. Existing roadless or minimally roaded areas in habitat occupied by spikedace

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294
		Munds Mountain Wilderness	12,311
		Walker Mountain IRA	4,448
Cherry Creek-Verde River	21,807	none	0
Fossil Creek-Verde River	104,923	Fossil Springs Wilderness	10,431
		Mazatzal Wilderness	2,639
		Boulder Canyon IRA	4,550
		Cimarron Hills IRA	5,295
		Hackberry IRA	17,905
Grindstone Wash-Verde River	10,462	Sycamore Canyon Wilderness	2,383
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158
		Munds Mountain Wilderness	5,783

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
		Kachina Peaks Wilderness	1,770
West Clear Creek	187,280	West Clear Creek Wilderness	15,545
		Walker Mountain IRA	1,930
Total watershed acres	**842,865**	**Total acres (% of watershed)**	**139,442 (16%)**

Risk Factors: Threats to spikedace that can be influenced by the Forest Service include predation by, and competition with, nonnative fish (invasive animals), to include virile crayfish and the red shiner, and the parasites and diseases that were introduced via nonnative fish. Although the management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Spikedace and its Critical Habitat

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by: managing for viable self-sustaining populations of special status species; contributing to recovery of listed species; allowing for repatriation of extirpated species; complying with approved recovery plans and a standard that says that management direction for federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives to restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat, and implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions. Habitat for the species would improve should these objectives be implemented in this species habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on disease and nonnative and invasive species by alternative.

Special Area Designations: There are portions of several existing or eligible wild and scenic river segments in each of the six watersheds where spikedace is found. The Fossil Creek–Lower Verde River watershed has existing wild and scenic river designations, and the Beaver Creek, Cherry Creek–Verde River, Grindstone Wash–Verde River, Oak Creek, and West Clear Creek watersheds all have eligible wild and scenic river designations. Because designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. However, until the comprehensive river management plan is finalized for the Fossil Creek Wild and Scenic River, the level of human use is unknown because the capacity of the area has not been determined. Therefore, it is not possible to estimate resource impacts to the watersheds from recreation use associated with Fossil Creek. Eligible rivers are managed to protect the outstandingly remarkable values in accordance with the Forest Service Handbook, but the amount of recreation occurring in these areas is not restricted.

Alternative A

Recreation Opportunity Spectrum: Within the Cherry Creek–Verde River and Grindstone Wash–Verde River 5th code HUC watersheds, alternative A would retain large areas of land presently designated as semiprimitive motorized, which would allow for future road construction in these areas. Furthermore, some land along Fossil Creek is designated as roaded natural and as a consequence, some segments of Fossil Creek could experience future road construction. This alternative has a higher potential contribution of sedimentation to connected waters compared to the other alternatives. Additionally, alternative A would retain some inconsistencies between recreation opportunity spectrum class and number of open roads on the ground in the Oak Creek 5th code HUC watershed.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Within the Fossil Creek–Lower Verde River and West Clear Creek 5th code HUC watersheds, changes in ROS designations would range from 40,654 to 45,700 acres across alternatives B, C, and D, with alternative C being the highest and alternative D being the lowest. These areas of land would be changed to allow less motorized access than alternative A. This would limit the ability of managers to build roads in this watershed and encourage closure and decommissioning of existing roads resulting in a potentially beneficial effect. These alternatives would not determine ROS for the Fossil Creek Wild and Scenic River because these are being determined by the comprehensive river management plan, which is currently under development.

ROS classes designated in the remaining watersheds would be changed to allow more motorized access which would benefit nearby communities but not confer additional protections to this species habitat. The changed acres total would range between 33,180 to 34,529 acres which represents about 6 percent of the remaining watersheds. Not all of these changes would affect habitat for this species because not all changes would occur in areas that connect to perennial waters.

Alternatives B and C

Special Area Designations: Alternatives B and C would recommend adding the Walker Mountain Wilderness to the Beaver Creek watershed and the Davey's recommended wilderness area to the Fossil Creek–Verde River watershed (table 76). The Walker Mountain recommended wilderness would have no additional benefit to perennial streams because it is colocated with the Walker Mountain Inventoried Roadless Area which already precludes future road construction within this boundary and benefits the headwaters and downstream areas of Walker Creek, and Wet Beaver Creek because of reduced sedimentation from lack of motorized use. The recommended Davey's wilderness, which is adjacent to the Fossil Springs Wilderness, would add wilderness to the north side of Fossil Creek, and further protects this system from motorized use and sedimentation. Davey's recommended wilderness is not expected to alter the ability to manage wildfire with resource objectives in the watershed. Walker Mountain alone would not be enough to alter the risk of uncharacteristic fire in its watershed in this alternative.

Alternative C

In alternative C, 20 percent of the watersheds that support spikedace would have designations such as existing wilderness, recommended wilderness or inventoried roadless areas that result in low to no motorized use (table 76). This would help reduce sedimentation or nonpoint source pollution into spikedace habitat and critical habitat. The recommended Deadwood Draw

wilderness would provide an additional buffer for both Wet Beaver and Walker Creeks because it is adjacent to the existing Wet Beaver Creek Wilderness and the recommended Walker Mountain wilderness.

The recommended Davey's wilderness would add additional protection to Fossil Creek from motorized impacts because it is adjacent to the existing Fossil Springs and Mazatzal Wilderness areas. The recommended Tin Can wilderness would extend the Fossil Springs Wilderness, but would not have any effect on perennial waters in the watershed. Finally, the recommended Hackberry, Cimarron-Boulder, and Black Mountain wildernesses would be located in areas that do not have any existing roads, so their impact to perennial stream habitats would not be measureable. Of the latter, only the recommended Hackberry wilderness would be located near and/or encompasses perennial water (Verde River).

Table 76. Existing and recommended wilderness and inventoried roadless areas by watershed and alternative

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294	6,294	6,294	6,294
		Munds Mtn. Wilderness (portion)	12,311	12,311	12,311	12,311
		Walker Mtn. IRA	4,448	4,448	4,448	4,448
		Walker Mtn. recommended wilderness	0	4,448[a]	4,448[1]	0
		Deadwood Draw recommended wilderness	0	0	11,257	0
Cherry Creek–Verde River	21,807	None	0	0	0	0
Fossil Creek–Verde River	104,923	Fossil Springs Wilderness	10,431	10,431	10,431	10,431
		Mazatzal Wilderness	2,639	2,639	2,639	2,639
		Boulder Canyon IRA	4,550	4,550	4,550[2]	4,550
		Cimarron Hills IRA	5,295	5,295	5,295[2]	5,295
		Hackberry IRA	17,905	17,905	17,905[2]	17,905
		Davey's recommended wilderness	0	1,779	1,779	0
		Hackberry recommended wilderness	0	0	25,171[2]	0
		Cimarron-Boulder recommended wilderness	0	0	15,300[2]	0
		Tin Can recommended wilderness	0	0	3,972	0
		Black Mountain recommended wilderness (portion)	0	0	692	0
Grindstone Wash–Verde River	10,462	Sycamore Canyon Wilderness	2,383	2,383	2,383	2,383
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158	48,158	48,158	48,158
		Munds Mtn. Wilderness	5,783	5,783	5,783	5,783
		Kachina Peaks Wilderness	1,770	1,770	1,770	1,770
West Clear Creek	187,280	West Clear Creek Wilderness	15,545	15,545	15,545	15,545
		Walker Mountain IRA	1,930	1,930	1,930	1,930

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Total watershed acres	**842,865**	**Total acres (percentage of watershed)**	**161,019 (16%)**	**162,798 (17%)**	**206,706 (20%)**	**161,019 (16%)**

[1] Walker Mountain recommended wilderness overlaps with the existing Walker Mountain IRA, so these acres are not counted twice.
[2] Some of the acreages in the existing inventoried roadless areas and the recommended wildernesses overlap, and are not counted twice in the total acreage.

Most of the recommended Black Mountain wilderness and a portion of the recommended Deadwood Draw wilderness would not further protect the West Clear Creek watershed from motorized impacts because the existing West Clear Creek Wilderness already encompasses most of the perennial West Clear Creek. Of these wilderness areas, only the existing West Clear Creek Wilderness and the recommended Black Mountain wildernesses encompass portions of perennial West Clear Creek. Walker Mountain, Black Mountain and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability to manage wildfire with resource objectives. This could result in increased sedimentation as the result of fire within the watershed.

There is no overlap between habitat for the spikedace and the wildlife habitat management areas proposed in alternative C, so no additional benefits would be conferred from these areas.

Summary of Species Effects

The implementation of any alternative would result in a "may affect" determination for spikedace and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

Coarse Filter Summary

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All but one identified primary constituent element for spikedace is addressed by all alternatives, and more effectively so by alternatives B, C, and D, and would provide for the continued viability and persistence of the species on the Coconino NF. The exception is the primary constituent element for habitat free from nonnative aquatic species or that has low densities of nonnative aquatic species. This primary constituent element cannot be effectively addressed by any alternative because nonnative fish are already established in these habitats and, consequently, represent a significant threat. Furthermore, the management of these nonnative fish falls under the purview of the Arizona Game and Fish Department. Though largely outside of the authority of the Forest Service, the forest can work with wildlife agencies to remove nonnative fish or install fish barriers to improve habitat for native fish. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

The spikedace is very rare (F1 species) on the forest in its habitat and has been extirpated from most of its historic habitat; therefore, it is vulnerable to perturbations in the environment. Some of its habitats have higher departures from reference conditions (e.g., Cottonwood Willow Riparian Forest within the Fossil Creek–Lower Verde 5th code HUC watershed). The spikedace is limited by conditions in its habitat including predation by, and competition with, nonnative species (invasive animals) including virile crayfish and the red shiner, and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Although all alternatives maintain the viability and persistence of the spikedace within the authority of the Forest Service with regard to disease and invasive animals as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the spikedace and its critical habitat;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the spikedace are reduced within the authority of the Forest Service;
- Threats to the habitats of the spikedace are better defined and plan components are put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter - Bald Eagle

Southwestern Region Sensitive Species (Table 43)

This species is evaluated in the "Wildlife, Fish, and Plants" section under forest PNVTs and in the section on golden and bald eagles.

Fine Filter – Common Black Hawk

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: On the Coconino NF, the common black hawk has been observed nesting along all main perennial streams and a few minor perennial streams below the rim. Streams where nesting has been observed include Verde River, Sycamore Creek, Oak Creek, Spring Creek, Dry Beaver Creek, Red Tank Draw, Wet Beaver Creek, Walker Creek, West Clear Creek, and Fossil Creek. There are about 31 known nest occupied nest sites on the forest.

Habitat: Common black hawks nest in low elevation cottonwood/sycamore riparian zones that are supported by a permanent flowing stream. Tall trees must be present along the streamcourse

for nesting. Groves are preferred to single trees. Shallow streams of low to moderate gradient provide ideal hunting conditions. Food items include crayfish, amphibians, reptiles, and fish. Some human disturbance can disrupt breeding and raising young that could result in failed reproduction or fewer young. The Forest Service has authority and control over human activities including: construction, maintenance, mineral activities, recreation, water related projects, mechanical thinning/removal and burning treatments, and off-trail hiking. Forest Service has approval or enforcement authority for these activities on the forest except for other jurisdictions, laws, and regulations. The Forest Service does not have authority over activities such as locatable minerals and some road work. Forest Service authority is subject to the limitations under the General Mining Act of 1872. Some road work may be under other jurisdictions such as the Federal Highway Administration or the Arizona Department of Transportation.

Nesting success is lower in areas where there are crayfish and a lack of native prey. They are associated with Cottonwood Willow Riparian PNVT.

Risk Factors: Alteration and elimination of riparian habitat through clearing, water diversion, damming, and lowering of water table by underground pumping (which is outside the control of the Forest Service). They are vulnerable to disturbance, such as recreation, during the nesting season. Human activities can disrupt breeding which can reduce reproduction. Nesting success may be lower in areas where there are crayfish and a lack of native prey.

Environmental Consequences – Common Black Hawk

Common to All Alternatives

All alternatives would promote procuring instream water rights to protect sensitive species (p. 74, par 5; FW-Aq-Wat-DC-4) and would manage botanical areas to protect their unique qualities (replacement p. 25, par 4; p. 79, par 10; replacement p. 195, par 9; SA-RNABotGeo-DC-7) and visitor use is limited (replacement p. 195, par 6; SA-RNABotGeo-G-1); allotment management plans protect the uniqueness and ecological condition of special areas (replacement p. 195, par 10; SA-RNABotGeo-G-4) and have minimal damage from fire suppression tactics (replacement p. 196, par 5; SA-RNABotGeo-G2). The use of fire retardant in riparian areas can be harmful to riparian and aquatic species. It is governed by national policy.

Alternative A

Plan components in this alternative would provide sufficient water for these species. A forestwide goal would maintain high quality sustained water yield for forest users and others as well and protect wetlands and flood plains (replacement p. 24, par 1). Guidelines promote adequate instream flows and adequate instream flow water rights to maintain riparian and aquatic communities (new p. 206-116, par 9); and taking action to legally protect forest use of needed waters (p. 74, par 5).

Table 77 summarizes the plan components in alternative A that address the fine filter threat of disturbance.

Table 77. Summary of plan components in alternative A that address disturbance from human activities and provide for the viability of common black hawk at the fine filter level

Species	Location in 1987 Plan (Page and Paragraph)	Plan Component
Southwestern willow flycatchers, bald eagles, western yellow-billed cuckoos, common black hawk	p. 22-1, par 1; p. 64-1, par 1	Reduce or remove disturbance during breeding season.
Bats, birds, other wildlife and threatened, endangered, and sensitive species	Page 184, par 10	Maintain viable populations of wildlife species, protect threatened, endangered, and sensitive species and habitats.
Threatened, endangered, and sensitive species	New p. 206-11, par 8	Restrict aircraft activities related to commercial filming to protect threatened, endangered, and sensitive species.
Active raptor nests, including golden eagles, prairie falcon, Mexican spotted owl, and zone-tailed hawks.	p. 206-67, par 6	Restrict human activities where active raptor nests are located.
Bats, birds, wildlife	Page 206-12, no. 6	Explore the need for and feasibility of reducing campfire smoke in Oak Creek Canyon from April to November to improve habitat conditions for bats, birds, and other wildlife species.
Rare species, American peregrine falcon	New p. 206-116, par 9	Avoid or limit human disturbance to rare species such as peregrine falcon.
Wildlife	New p. 206-98, par 3	Minimize human disturbance to wildlife during critical times.

Alternatives B, C, D

Plan components in these alternatives would provide sufficient water and provide for the species at the coarse filter/habitat level. For example, desired conditions and best management practices under “Water Quality and Quantity” would maintain adequate quantity, quality, and timing of water to retain or enhance riparian vegetation consistent with existing water rights and claims (FW-Aq-Wat-DC-2, FW-AQ-Wat-G-3). Other plan language would promote resilient riparian areas that allow a variety of plant species to thrive, especially those unique to these habitats, and that are rarely impacted negatively by livestock (FW-Veg-Rip-All-DC-1). To avoid negative impacts to accessible riparian areas, livestock use should be restricted to time when vegetation is dormant and utilization would not exceed 20 percent on woody vegetation such as willows (FW-Veg-Rip-All-G-3).

Table 78 shows plan components in alternatives B, C, and D that reduce disturbance.

Table 78. Summary of plan components in alternatives B, C, and D that address disturbance from human activities and provide for viability of common black hawks at the fine filter level

Species	Location Code in Proposed Revised Plan	Plan Component
Mexican spotted owls, southwestern willow flycatchers, western yellow-billed cuckoos, American peregrine falcon, bald eagles, Clark's grebe, common black hawk, northern goshawk, golden eagle, pronghorn antelope	FW –WFP-G-4, 7; FW-Rec-Disp-DC-1, DC-14.	Reduce or remove disturbance during breeding season.
Bats, birds, other wildlife species	MA-OakCrk-DC-6	Campfire smoke in Oak Creek Canyon is minimal to protect habitat conditions for bats, birds, and other wildlife species and to improve air quality.
Southwestern willow flycatchers, bald eagles, western yellow-billed cuckoos, common black hawk	MA-SedOak-G-10	Commercial filming using aircraft is discouraged in the Sedona-Oak Creek MA except within the House Mtn-Lowlands MA and along paved highways.
Occupied common black hawk nest sites	SA-Wild-Fossil-DC-2	Protected from disturbance during breeding season
Threatened, endangered, sensitive species	FW-WFP-G-3, 4	Fire suppression techniques that minimize disturbance impacts should be used where there are listed and Forest Service sensitive species.
All wildlife species	FW-RdsFac-DC-4	Unneeded roads are closed and naturalized to reduce human disturbance to wildlife and to reduce soil erosion.
All wildlife species	FW-SpecUse-DC-3	The location of new, large linear infrastructure such as power lines has minimal effects to wildlife and minimizes habitat fragmentation.
American peregrine falcon, other raptor species, rare, or threatened species	FW-BioPhys-Geo-DC-7; FW-SpecUse-G-20	Rock climbing and related recreational activities do not disrupt life processes of rare or threatened species. Air tour companies and rock-climbing activities should not disturb occupied eyries between March 1 and August 31, to protect the area during the peregrine falcon breeding season and to protect other raptor species sensitive to noise disturbance.
All wildlife species	FW-Rec-Disp-DC-14, 17	Trailheads avoid impacts to ecological resources, off-trail nonmotorized use is discouraged forestwide in ecologically sensitive areas.

In addition, desired conditions for designated wilderness areas would ensure Fossil Springs remains a special refuge for sensitive species, and occupied black hawk nesting sites in Fossil Springs (SA-Wild-Fossil-DC-2).

The plan sets the desired recreation opportunity spectrum (ROS), also called ROS objectives, which are used to determine if projects are compatible with forest recreation goals. ROS classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no development and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

Between 10 and 21 acres of Cottonwood Willow Riparian Forest PNVT would shift from the ROS classes that allow less development to ones that allow more. This level of effect on the habitat or the species would be hard to detect and likely negligible because this acreage represents between 0.3 and 0.8 percent of the habitat.

Invasive animals can replace native prey species for common black hawks. This threat is discussed in the "Wildlife, Fish, and Plants" section under Wetland Cienega.

Alternative C

Alternative C designates Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas; parts of the Flagstaff Neighborwoods Management Area; some special areas; and wildlife habitat management areas as nonsuitable for recreational (nonhunting) shooting. This would reduce disturbance in 1,162 acres in wildlife habitat management areas and 1,051 acres in the Long Valley, Sedona Neighborwoods, Sedona-Oak Creek, Verde Valley, and Walnut Canyon Management Areas for a total of 2,213 acres.

Summary of Species Effects

Considering the coarse filter/habitat, plan components in all alternatives maintain the viability and do not cause a trend toward listing for the common black hawk.

All alternatives would maintain the viability of this species because plan components address threats to the habitat and allow for treatment of invasive plants and address the risk of uncharacteristic fire. Language in alternative A is outdated from the standpoint of including current science and has not kept pace with the Forest Service shift in perspective to more ecologically based management. Guidance for the riparian forest PNVTs is better in alternatives B and D than in alternative A because:

- Desired conditions are more clearly articulated for the different riparian types, incorporate natural disturbances and an ecological foundation so the composition, structure, and processes of these habitats better provide for the needs of the species;
- Plan objectives slow or reverse the trend of departed PNVTs in the watersheds;
- Guidelines more specifically address invasive animals; and
- Some disturbance related guidelines have been expanded to include more of the habitat.

Fine Filter – Western Yellow-billed Cuckoo

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: Although numbers of cuckoos are substantially less, Arizona probably contains the largest remaining yellow-billed cuckoo population in any of the western states (FWS 2001). Surveys have been conducted since 1998 along about 16 miles (1,790 acres of habitat) along the Verde River and its tributaries. So far, nearly 50 sites have been surveyed and 18 are occupied in the following areas: Verde River, Sycamore Canyon, Oak Creek, Dry Beaver Creek, Red Tank Draw, Walker Creek, Beaver Creek, and West Clear Creek.

Habitat: Yellow-billed cuckoos are associated with large tracts of undisturbed riparian deciduous forests, particularly those with cottonwoods and willows (FWS 2001). On the forest, they utilize Cottonwood Willow and Mixed Broadleaf Deciduous Riparian PNVTs adjacent to mesquite bosques, which persist on upland terraces with high water tables. Cuckoos favor mesquite stands at least 12.5 acres in size. The combination of these two PNVTs with mesquite bosques creates a unique vegetation community.

Risk Factors: Disturbance during the breeding season can reduce or eliminate the breeding success of yellow-billed cuckoos that might nest on NFS land.

The coarse filter section describes landscape-level habitat conditions and threats.

Sublandscape Habitat: Mesquite bosques are dissected by roads which reduce the effective patch size of habitat for cuckoos.

Environmental Consequences – Western Yellow-billed Cuckoo

All Alternatives

All alternatives incorporate the "Verde Wild and Scenic River Comprehensive River Management Plan," including its standards (replacement p. 113, par 4; SA-WSR-Verde-S-1). Wildlife and fish are among the outstandingly remarkable values that are protected and enhanced (replacement p. 113, par 5; new p. 115-1, par 2; FW-WSR-Verde-DC-5) and the range of flows in the free-flowing Verde River would provide optimum conditions for native fish and wildlife and health and diverse stands of riparian vegetation on the banks and flood plain (replacement p. 114, par 3; replacement p. 115, par 2, 3; FW-WSR-Verde-DC-6). The original designation allows for some water diversion. Specifically, designation shall not prevent water users receiving Central Arizona Project water allocations from diverting that water through an exchange agreement with downstream water users in accordance with Arizona water law (new p. 115-1, par 8) thus streamflows could be reduced in the future.

Cottonwood gallery forests, riparian willows, and mesquite bosques are part of the outstandingly remarkable scenic values of the Verde Wild and Scenic River (replacement p. 114, par 2 and SA-WSR-Verde-DC-1) and by law, the wild and scenic river must be managed to protect and enhance the river's values. By default, yellow-billed cuckoo habitat would be protected and enhanced.

Verde Wild and Scenic River river-related nonmotorized recreation is emphasized but outstandingly remarkable values, including Cottonwood Willow Riparian Forest, are protected and enhanced. Camping and day use is balanced with maintenance of outstanding opportunities

for primitive recreation and solitude, in a predominantly undeveloped river setting (p. 114, par 2; SA-WSR-Verde-DC-2). This would have the indirect effect of protecting and enhancing yellow-billed cuckoo habitat.

The loss of substantial amounts of low-elevation riparian habitats in Arizona has likely resulted in concurrent declines in cuckoos (FWS 2001). Lands that contain threatened and endangered species habitat is a criterion for acquisition in all alternatives. This can, and has in the past, resulted in the forest gaining habitat for federally listed species. Guidance for landownership adjustments does not differ among alternatives (see "Lands and Special Uses" section); therefore, the consequences for threatened and endangered species will not differ either.

All alternatives have plan components that would reduce disturbance to yellow-billed cuckoos and would have the indirect effects of promoting population recruitment and survival.

Alternative A

Management of wildlife habitat is a key emphasis in Management Area 12 (Riparian Habitat). There are multiple standards for maintaining overstory, three age classes of woody vegetation, and stream shading which would maintain good habitat for cuckoos (p. 174, bullets 1-3). Yellow-billed cuckoo habitat would be further maintained by plan components that maintain at least 80 percent of the potential shrub cover in high elevation habitats and standards and utilizing filter strips between streams and ground-disturbing activities and roads (p. 174, bullet 4, replacement p. 176, par 5).

The goal to recover 80 percent of riparian habitats by year 2030 with the remaining 20 percent significantly improved would benefit cuckoos (replacement p. 172, par 9); however, this implementation rate has proven to be too ambitious and not realistic. Other goals of constructing 10 miles of fence per decade to protect riparian regeneration and installing stream habitat improvement projects in the first decade would also have potential benefits to yellow-billed cuckoo habitat (p. 175, par1, 7).

Other beneficial guidelines would minimize the negative effects of grazing on riparian habitat by: not placing salt within ¼ mile of riparian habitats to avoid concentration of livestock; establishing and protecting woody riparian vegetation through livestock management and/or fencing to allow for establishment and eliminate overuse; and setting allowable use standards on woody vegetation (p.175, par 9).

Alternatives B, C, and D

Desired conditions for all riparian types and for these two PNVTs describe conditions that would provide good habitat for cuckoos, that is, diverse native vegetation in multiple age classes, uncompacted soils, and ecosystems functioning within their natural potential that are rarely negatively impacted by livestock (p. 174, par 1; FW-Veg-Rip-All-DC-1). An objective to restore 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas within 10 years following plan approval would benefit these PNVTs (FW-Rip-All-O-1), but only future site specific NEPA analysis would determine if these benefits would occur in yellow-billed cuckoo habitat. Other beneficial plan components include guidelines for streamside management zones to provide protections from management activities (Veg-Rip-All-G-2, 3); and for minimal impact to PNVTs from recreation, permitted uses, and management activities (Veg-Rip-All-G-1). Plan components describe high water tables that allow mesquite bosques to persist and bosques unfragmented by roads or infrastructure (Veg-Rip-All-DC-4).

Alternatives B, C, and D improve the direction pertaining to road operation and maintenance in yellow-billed cuckoo habitat compared to alternative A. There are specific guidelines to minimize disturbance to wildlife from road maintenance, impacts of new permanent and temporary roads to streams and streamside management zones, and broadens direction on using filter strips to include a broader set of tools for intercepting nonpoint source pollution (FW-RdsFac-G-1, 2, 7), Alternative B, C, and D also have objectives for naturalizing or decommissioning 200 to 800 miles of roads in the 10 years following plan approval, but only site-specific NEPA would determine if this would occur in yellow-billed cuckoo habitat (FW-RdsFac-O-1).

Fossil Creek Wild and Scenic River: Designated river and its adjacent areas contain yellow-billed cuckoo habitat and the designated river and adjacent areas would retain their free-flowing character and outstandingly remarkable values and classifications implying protection and enhancement for this species habitat (SA-WSR-FossilCrk-DC-1).

Alternative B

Three wilderness areas are being proposed in alternative B: Davey's, Strawberry, and Walker Mountain. Less than 2 percent of the Cottonwood Willow and Mixed Broadleaf PNVTs will be within recommended wilderness areas. This would provide minor extra protections for yellow-billed cuckoo potential habitat, since these habitats would be managed for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character.

The plan sets the desired recreation opportunity spectrum (ROS), also called ROS objectives, which are used to determine if projects are compatible with forest recreation goals. ROS classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no development and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

In alternative B, about 170 acres of Mixed Broadleaf Deciduous Riparian Forest PNVT would shift from the ROS classes that allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This alternative would shift only 21 acres from more primitive to less primitive in Cottonwood Willow Riparian Forest PNVT. This slight net improvement would be higher than alternatives A and D and less than alternative C.

Alternative C

Alternative C has the same consequences as alternative B except for the following: Alternative C recommends 13 wilderness areas which contain 780 acres of Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest. While much of this habitat is already protected as designated and eligible wild and scenic rivers and inventoried roadless areas, recommendation as wilderness would provide extra protections from motorized disturbances for yellow-billed cuckoo potential habitat, since these habitats would be managed for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character, but if the area is designated, nonmotorized recreation could increase because of these areas being "discovered" and the premium on recreation in riparian areas in Arizona.

Walker Mountain, Cedar Bench, Deadwood Draw, Black Mountain and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability to manage wildfires with resource objectives. This could result in increased sedimentation as the result of fire within the watershed and an increased risk of uncharacteristic fire in nearby riparian areas.

Alternative C proposes eight wildlife habitat management areas which focus on improving habitat quality by reducing disturbances. This would improve 21 acres of Mixed Broadleaf Deciduous Riparian Forest and 0 acres of Cottonwood Willow Riparian Forest within yellow-billed cuckoo habitat.

Alternative C would also designate Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas; parts of the Flagstaff Neighborwoods Management Area; some special areas; and wildlife habitat management areas as nonsuitable for recreational (nonhunting) shooting. This would reduce disturbance in 21 acres of Mixed Broadleaf Deciduous Riparian Forest in wildlife habitat management areas and 389 acres of Mixed Broadleaf Deciduous Riparian Forest in the Long Valley, Sedona Neighborwoods, and Verde Valley Management Areas for a total of 410 acres. Cottonwood Willow Riparian Forest did not occur in these areas.

In alternative C, about 198 acres of Mixed Broadleaf Deciduous Riparian Forest PNVT would shift from the ROS classes that allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This alternative would shift only 10 acres from more primitive to less primitive in Cottonwood Willow Riparian Forest PNVT. This slight net improvement would be higher than alternatives A, B, and D. Designation of the Walnut Canyon Management Area and areas with a ROS objective of semiprimitive nonmotorized as not suitable for snowmobile use would not have an impact because this species is migratory and would not occur here in the winter.

Cuckoos would not be impacted by other aspects of alternative C. Expanding the Cottonwood Basin Fumeroles Geological Area will have no impact on the yellow-billed cuckoo since this area lacks riparian habitat. Retention of the alternative A standards and guidelines for old growth would have no impact because this direction is for areas that are not cuckoo habitat.

Table 79. Potential western yellow-billed cuckoo habitat within alternatives B and C recommended wilderness

PNVT	Alt. B Acres in Recommended Wilderness (% of Total PNVT Acres)	Alt. C Acres in Recommended Wilderness (% of Total PNVT Acres)	Total PNVT Acres
Cottonwood Willow Riparian Forest	7 (<1%)	452 (18%)	2,507
Mixed Broadleaf Deciduous Riparian Forest	49 (1%)	328 (9%)	3,612

Alternative D

By not adding any new wilderness areas, alternative D would be the same as alternative A in this aspect. The effects are also similar to alternative B, since there is no Cottonwood Willow Riparian

Forest habitat in botanical or geological areas, only 10 acres of Mixed Broadleaf Deciduous Riparian Forest in the Fossil Creek Botanical Area and 30 acres in the West Clear Creek Research Natural Area. Therefore, allowing bicycles on designated trails would have little to no impacts on cuckoos or their habitat.

In alternative D, about 140 acres of Mixed Broadleaf Deciduous Riparian Forest PNVT would shift from ROS classes that allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This alternative would shift only 21 acres from more primitive to less primitive in Cottonwood Willow Riparian Forest PNVT. This slight net improvement would be higher than alternative A and lower than alternatives B and C. Designation of the Walnut Canyon Management Area and areas with a ROS objective of semiprimitive nonmotorized as not suitable for snowmobile use would not have an impact because this species is migratory and would not occur here in the winter.

Summary of Species Effects

Viability of the western yellow-billed cuckoo would be maintained under all alternatives. All alternatives contain plan direction that would maintain or improve riparian habitats, as well as reduce their species specific threat of human disturbance during their breeding season. Alternative C would do the most to reduce the potential for human disturbance.

Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF.

Fine Filter – Bluehead Sucker, Little Colorado River Sucker

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: Bluehead sucker and Little Colorado River sucker are found in East Clear Creek and associated perennial tributaries in the Upper and Lower Clear Creek 5th HUC watersheds on the forest (a total of approximately 124.1 potential perennial stream miles).

Habitat: Bluehead sucker occupies a variety of habitats from headwater streams to large rivers, usually in moderate to fast-flowing water over a cobble-dominated substrate. Young fish are more likely to be encountered in shallow areas near the streambank. Gravelly or rocky pools of creeks and rivers are characteristic of Little Colorado River sucker habitat. Adults tend to remain near cover in daylight, but move to runs and deeper riffles at night. Individuals are sedentary, exhibiting little seasonal movement and resisting downstream displacement during floods. Both species are associated with perennial streams and all riparian forest PNVTs.

See the section on “Aquatic Systems” for more information on the condition of riparian forest PNVTs. The condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT in both watersheds associated with the bluehead sucker and Little Colorado River sucker are at a low level of departure and similar to reference conditions at the landscape level.

The Cottonwood Willow Riparian Forest PNVT is moderately departed from reference condition and slowly improving in both 5th code HUC watersheds associated with these species.

In the Lower Clear Creek 5th code HUC watershed, the condition of the Montane Willow Riparian Forest PNVT is at a low level of departure and similar to reference conditions at the landscape level. However, the condition of the Montane Willow Riparian Forest PNVT in the Upper Clear Creek 5th code HUC watershed is more highly departed than the overall PNVT-level departure described in the coarse filter section and has a static trend. This is due to dispersed recreation in accessible areas as well as past actions associated with improperly located and poorly maintained roads, off-highway vehicle use, and elk herbivory, which is under the purview of the Arizona Game and Fish Department.

The Gallery Coniferous Riparian Forest PNVT is at a low level of departure from reference condition and has a static trend in all of the 5th code HUC watersheds associated with the Bluehead sucker and the Little Colorado River sucker.

Three percent of the Upper Clear Creek and Lower Clear Creek 5th code HUC watersheds consist of existing inventoried roadless areas (table 80) that maintain sedimentation or nonpoint source pollution at approximately its current level. There are no existing roads in the inventoried roadless areas, and the inventoried roadless areas would preclude future road construction. This benefits portions of East Clear Creek, Barbershop Canyon, and Merritt Draw directly, but would also be a hindrance to motorized management activities (fuels reduction, stream renovation) that would otherwise be beneficial to the watershed.

Table 80. Existing roadless or minimally roaded areas in habitat occupied by bluehead sucker and Little Colorado River sucker

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Lower Clear Creek	10,258	None	0
Upper Clear Creek	112,362	Barbershop Canyon IRA	1,310
		East Clear Creek IRA	2,036
Total watershed acres	**122,620**	**Total acres (% of watershed)**	**3,346 (3%)**

Risk Factors: Threats to the bluehead sucker and the Little Colorado River sucker that can be influenced by the Forest Service include predation by, and competition with, nonnative fish (invasive animals), and the parasites and diseases that were introduced via nonnative fish. Although the management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Bluehead Sucker and Little Colorado River Sucker

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would help provide for the viability of this species by managing for viable self-sustaining populations of special status species and allowing for repatriation of extirpated species.

In addition, there are objectives to implement actions to benefit sensitive species, restore/enhance at least 60,000 acres of terrestrial wildlife habitat, and at least 70 miles of stream habitat. Habitat for this species would be improved if any of these treatments occur in its habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on disease and nonnative and invasive species by alternative.

Special Area Designations: There are portions of four eligible wild and scenic river segments in the Upper Clear Creek and Lower Clear Creek watersheds. In the Upper Clear Creek 5th code HUC watershed, one eligible wild and scenic river designation is along Barbershop Canyon (Wild), one eligible designation is along East Clear Creek (scenic), and one eligible river segment is along Leonard Canyon (recreational). In the Lower Clear Creek 5th code HUC watershed, the eligible wild and scenic river designation is along East Clear Creek (scenic). Because designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. However, until the comprehensive river management plans are finalized for each eligible or existing segment, the level of human use is unknown, so it is not possible to estimate resource impacts to the watersheds.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Within the Upper Clear Creek 5th code HUC watersheds, changes in ROS designations range from 74,744 acres to 76,408 acres across alternatives B, C, and D, with alternative C being the highest and alternatives B and D being the lowest. These areas of land would be changed to allow less motorized access than alternative A. This would limit the ability of managers to build roads in this watershed and encourage closure and decommissioning of existing roads, resulting in a potentially beneficial effect.

ROS classes designated in the Lower Clear Creek watersheds would be changed to allow more motorized access which would benefit nearby communities but not confer additional protections to this species habitat. The number of changed acres range between 8,579 and 8,668 acres which represents about 8 percent of the watershed. Not all of these changes would affect habitat for this species because not all changes would occur in areas that connect to perennial waters.

Alternative C

In alternative C, less than 3 percent of the Lower Clear Creek and Upper Clear Creek watershed would have designations of inventoried roadless areas or recommended wilderness that would result in reduced motorized use (table 81). This would help reduce sedimentation or nonpoint source pollution into bluehead sucker and Little Colorado River sucker habitat following storm events due to nonuse of existing roads. The Barbershop and East Clear Creek recommended wildernesses overlap with the existing Barbershop and East Clear Creek Inventoried Roadless Areas and, thus, do not provide added benefit with regard to roadless area or reduced sedimentation in the watershed. The proposed East Clear Creek, Hospital Ridge, Knoll Lake, Limestone Pasture, and Second Chance wildlife habitat management areas overlap the Upper Clear Creek 5th HUC watershed. It is highly unlikely that closing roads in the proposed wildlife habitat management areas in this watershed would result in a measureable reduction of sediment delivery or water quality improvement in any perennial waters due to the low extent and magnitude of road closures that connect to perennial waters (See "Aquatic Systems," Water Quality for more information).

Table 81. Inventoried roadless areas, recommended wilderness areas, and proposed wildlife habitat management areas within Lower Clear Creek and Upper Clear Creek watersheds, by alternative

5th Code HUC	Acres	Designation	Alt. A	Alt. B	Alt. C	Alt. D
Lower Clear Creek	10,258	Anderson Mesa proposed WHMA	0	0	10,234	0
Upper Clear Creek	112,362	Barbershop Canyon IRA	1,310	1,310	1,310	1,310
		East Clear Creek IRA	2,036	2,036	2,036	2,036
		Barbershop recommended wilderness	0	0	1,310[1]	0
		East Clear Creek recommended wilderness	0	0	2,036*	0
		Anderson Mesa proposed WHMA	0	0	1,372	0
		East Clear Creek proposed WHMA	0	0	35,797	0
		Hospital Ridge proposed WHMA	0	0	4,945	0
		Knoll Lake proposed WHMA	0	0	2,488	0
		Limestone Pasture proposed WHMA	0	0	2,423	0
		Second Chance proposed WHMA	0	0	1,444	0
Total watershed acres	**122,620**	**Total acres (percentage of watershed)**	**3,346 (3%)**	**3,346 (3%)**	**58,703 (48%)**	**3,346 (3%)**

[1] Barbershop and East Clear Creek recommended wildernesses overlap with the existing Barbershop and East Clear Creek IRAs, so these acres are not counted twice.

Protection and restoration of the watersheds that support Leonard Canyon and East Clear Creek, including the headwaters, are desired conditions for the East Clear Creek, Hospital Ridge, Knoll Lake, Limestone Pasture, and Second Chance wildlife habitat management areas. This would provide indirect positive benefits to 112,362 acres of species habitat.

Summary of Species Effects

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All alternatives would provide for the continued viability and persistence of the bluehead sucker and the Little Colorado River sucker on the Coconino NF. Additional information can be found in the “Vegetation,” “Soil,” “Aquatic Systems,” “Riparian Resources,” and “Watersheds” sections of this document.

The bluehead sucker and Little Colorado River sucker are uncommon in their habitats on the forest (F3 species) and in addition, have habitats that are geographically separated. As such, they are vulnerable to perturbations in the environment. The bluehead sucker and the Little Colorado River sucker are limited by conditions in their habitat including predation by, and competition with, nonnative fishes and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the “Vegetation,” “Soil,” “Aquatic Systems,” “Riparian Resources,” and “Watersheds” sections of this document. Implementation of plan components related to vegetation treatments; recreation management; watershed management; wildlife, fish, or rare plant management; or land

acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF.

Although all alternatives would maintain the viability and persistence of the bluehead sucker and Little Colorado River sucker within the authority of the Forest Service with regard to disease and invasive animals, as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the bluehead sucker and Little Colorado River sucker;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the bluehead sucker and Little Colorado River sucker are reduced within the authority of the Forest Service;
- Threats to the habitats of the bluehead sucker and Little Colorado River sucker are better defined and plan components are put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Desert Sucker, Sonora Sucker, and Longfin Dace

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: On the Coconino NF, desert sucker, Sonora sucker, and longfin dace are present in the Beaver Creek, Oak Creek, Sycamore Creek, Grindstone Wash–Verde River, Cherry Creek–Verde River, Fossil Creek–Lower Verde River, and West Clear Creek 5th code HUC watersheds (totaling approximately 193.9 potential perennial stream miles).

Habitat: Desert sucker is found in rapids and flowing pools of streams, primarily over bottoms of gravel-rubble with sandy silt in the interstices (AZGFD 2002a). Adults live in pools, moving at night to swift riffles and runs, where they feed on encrusting algae scraped from stones. Gravelly or rocky pools of creeks and rivers are characteristic of Sonora sucker habitat (AZGFD 2002b). It can be found in a variety of habitats from warm water rivers to trout streams. The desert sucker and Sonora sucker are associated with perennial streams and all riparian PNVTs.

Longfin dace ranges from low, hot, sandy-bottomed desert streams to clear, cooler brooks in the lower reaches of the conifer zones. It is rarely abundant in larger streams, or at elevations above 5,000 feet (Arizona Game and Fish Department 2006). The species is associated with perennial streams and with the Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forest PNVTs.

See the section on “Aquatic Systems” for information on condition of riparian forests in the habitat for these species. The condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT in six out of the seven watersheds associated with the desert sucker, Sonora sucker, and longfin dace is at a low level of departure and similar to reference conditions at the landscape level. The condition of the Mixed Broadleaf Deciduous Riparian Forest within the Beaver Creek 5th code

HUC watershed is more departed (moderate level) than the overall PNVT-level departure (low level). The higher rate of departure is due in part to high amounts of dispersed recreation in accessible areas and roads that result in soil compaction, damage to vegetation, and sedimentation into the water which could affect these species. The comparatively higher departure is also due to past actions: road maintenance, off-highway vehicle use, and grazing practices which resulted in vegetation removal, soil compaction, soil loss and erosion. Conditions, however, have been slowly improving.

The Cottonwood Willow Riparian Forest PNVT is moderately departed from reference condition and slowly improving in five out of the seven 5th code HUC watersheds associated with the desert sucker, Sonora sucker, and longfin dace. The Oak Creek and Fossil Creek–Lower Verde River 5th code HUC watersheds are also moderately departed but their trend is static. This is due to dispersed recreation, which has resulted in vegetation removal, accelerated erosion and runoff. Past actions related to road locations, off-highway vehicle use, and grazing also contributed to vegetation removal, soil compaction and loss, and erosion. The recent decision on the Travel Management Rule (USDA Forest Service 2011m) addressed off-highway vehicle use. Consequently, the sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas recover.

In all of the 5th code HUC watersheds associated with the desert sucker and Sonora sucker, the condition of the Montane Willow Riparian Forest PNVT is at a low level of departure and similar to reference conditions at the landscape level. The Gallery Coniferous Riparian Forest PNVT is at a low level of departure from reference condition and has a static trend in all of the 5th code HUC watersheds associated with the desert sucker and Sonora sucker

Seventeen percent of the Beaver Creek, Oak Creek, Sycamore Creek, Cherry Creek–Verde River, Fossil Creek–Lower Verde River, Grindstone Wash–Verde River, and West Clear Creek 5th code HUC watersheds consist of designated wilderness or existing inventoried roadless areas that result in low to no motorized use (table 82). This would maintain sedimentation or nonpoint source pollution at approximately its current level. The existing wildernesses would directly protect perennial portions of Wet Beaver Creek, Fossil Creek, Oak Creek, Sycamore Creek, the Verde River, and West Clear Creek from motorized impacts. Four inventoried roadless areas (Boulder Canyon, Cimarron Hills, Hackberry, and Walker Mountain) preclude future road construction in their respective areas and indirectly benefit Beaver Creek, Fossil Creek, the Verde River, and West Clear Creek because of reduced sedimentation from lack of motorized use. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas so proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Table 82. Existing roadless or minimally roaded areas in habitat occupied by desert sucker, Sonora sucker, and longfin dace

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294
		Munds Mountain Wilderness	12,311
		Walker Mountain IRA	4,448
Cherry Creek-Verde River	21,807	none	0

5th Code HUC Watershed	Acres	Special Area Designation	Alts. A, B, C, D
Fossil Creek-Verde River	104,923	Fossil Springs Wilderness	10,431
		Mazatzal Wilderness	2,639
		Boulder Canyon IRA	4,550
		Cimarron Hills IRA	5,295
		Hackberry IRA	17,905
Grindstone Wash-Verde River	10,462	Sycamore Canyon Wilderness	2,383
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158
		Munds Mountain Wilderness	5,783
Sycamore Creek	83,219	Kachina Peaks Wilderness	1,770
		Sycamore Canyon Wilderness	21,577
West Clear Creek	187,280	West Clear Creek Wilderness	15,545
		Walker Mountain IRA	1,930
Total watershed acres	**926,084**	**Total acres (% of watershed)**	**161,019 (17%)**

Risk Factors: Threats to the desert sucker, Sonora sucker, and the longfin dace that can be influenced by the Forest Service include predation by, and competition with, nonnative fish (invasive animals), and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Desert Sucker, Sonora Sucker, and Longfin Dace

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would provide for the viability of this species by managing for viable self-sustaining populations of special status species and allowing for repatriation of extirpated species. In addition there are objectives to implement actions to benefit sensitive species, restore/enhance at least 60,000 acres of terrestrial wildlife habitat and at least 70 miles of stream habitat. Habitat for this species would be improved if any of these treatments occur in its habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on disease and nonnative and invasive species by alternative.

Special Area Designations: There are portions of several existing or eligible wild and scenic river segments in each of the seven watersheds where the desert sucker, Sonora sucker, and longfin dace are found. The Fossil Creek–Lower Verde River watershed has existing wild and scenic river designations, and the Beaver Creek, Cherry Creek–Verde River, Grindstone Wash–Verde River, Oak Creek, Sycamore Creek, and West Clear Creek watersheds all have eligible wild

and scenic river designations. Because designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. For the Verde Wild and Scenic River, the comprehensive river management plan sets a capacity and limits on recreation that protect the species habitat. However, until the comprehensive river management plan is finalized for the Fossil Creek Wild and Scenic River, the level of human use is unknown because the capacity of the area has not been determined. Therefore, it is not possible to estimate resource impacts to the watersheds from recreation use associated with Fossil Creek. Eligible rivers are managed to protect the outstandingly remarkable values in accordance with the Forest Service Handbook, but the amount of recreation occurring in these areas is not restricted.

Alternative A

Recreation Opportunity Spectrum: Alternative A would retain some inconsistencies between recreation opportunity spectrum class and number of open roads on the ground in the Oak Creek 5th code HUC watershed and would retain all the existing classifications.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Within the Fossil Creek–Lower Verde River and West Clear Creek 5th code HUC watersheds, changes in ROS designations range from 40,654 acres to 45,700 acres across alternatives B, C, and D, with alternative C being the highest and alternative D being the lowest. These areas of land would be changed to allow less motorized access than alternative A. This would limit the ability of managers to build roads in this watershed and encourage closure and decommissioning of existing roads resulting in a potentially beneficial effect. These alternatives would not determine ROS for the Fossil Creek Wild and Scenic River because these are being determined by the comprehensive river management plan, which is currently under development.

ROS classes designated in the remaining watersheds would be changed to allow more motorized access which would benefit nearby communities but not confer additional protections to this species habitat. The changed acres range between 33,189 and 34,538 acres which represents about 6 percent of the remaining watersheds. Not all of these changes would affect habitat for this species because not all changes would occur in areas that connect to perennial waters.

Alternatives B and C

Special Area Designations: Alternatives B and C would recommend the Walker Mountain wilderness to the Beaver Creek watershed and the Davey's wilderness to the Fossil Creek-Lower Verde River watershed (table 83). The Walker Mountain recommended wilderness has no additional benefit to perennial streams because it is colocated with the Walker Mountain Inventoried Roadless Area which precludes future road construction within this boundary and benefits the headwaters and downstream areas of Walker Creek, and Wet Beaver Creek because of reduced sedimentation from lack of motorized use. The recommended Davey's wilderness, which is adjacent to the Fossil Springs Wilderness, adds wilderness to the north side of Fossil Creek, and further protects this system from motorized use and sedimentation. Davey's recommended wilderness is not expected to alter the ability to manage wildfires with resource objectives in the watershed. Walker Mountain alone would not be enough to alter the risk of uncharacteristic fire in its watershed in this alternative.

Table 83. Existing and recommended wilderness and inventoried roadless areas, by watershed and alternative

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294	6,294	6,294	6,294
		Munds Mtn. Wilderness (portion)	12,311	12,311	12,311	12,311
		Walker Mtn. IRA	4,448	4,448	4,448	4,448
		Walker Mtn. recommended wilderness	0	4,448a	4,448[1]	0
		Deadwood Draw recommended wilderness	0	0	11,257	0
Cherry Creek–Verde River	21,807	none	0	0	0	0
Fossil Creek-Lower Verde River	104,923	Fossil Springs Wilderness	10,431	10,431	10,431	10,431
		Mazatzal Wilderness	2,639	2,639	2,639	2,639
		Boulder Canyon IRA	4,550	4,550	4,550[2]	4,550
		Cimarron Hills IRA	5,295	5,295	5,295[2]	5,295
		Hackberry IRA	17,905	17,905	17,905[2]	17,905
		Davey's recommended wilderness	0	1,779	1,779	0
		Hackberry recommended wilderness	0	0	25,171	0
		Cimarron-Boulder recommended wilderness	0	0	15,300	0
		Tin Can recommended wilderness	0	0	3,972	0
		Black Mountain recommended wilderness (portion)	0	0	692	0
Grindstone Wash-Verde River	10,462	Sycamore Canyon Wilderness	2,383	2,383	2,383	2,383
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158	48,158	48,158	48,158
		Munds Mtn. Wilderness	5,783	5,783	5,783	5,783
Sycamore Creek	83,219	Kachina Peaks Wilderness	1,770	1,770	1,770	1,770
		Sycamore Canyon Wilderness	21,577	21,577	21,577	21,577
West Clear Creek	187,280	West Clear Creek Wilderness	15,545	15,545	15,545	15,545
		Walker Mountain IRA	1,930	1,930	1,930	1,930
Total watershed acres	**926,084**	**Total acres (percentage of watershed)**	**161,019 (17%)**	**162,798 (18%)**	**191,440 (21%)**	**161,019 (17%)**

[1] Walker Mountain recommended wilderness overlaps with the existing Walker Mountain IRA, so these acres are not counted twice.

[2] Some of the acreages in the existing inventoried roadless areas and the recommended wildernesses overlap, and are not counted twice in the total acreage.

Alternative C

In alternative C, 21 percent of the watersheds that support desert sucker, Sonora sucker, and longfin dace would have designations such as existing wilderness, recommended wilderness, or

inventoried roadless areas that result in low to no motorized use (table 83). This would help reduce sedimentation or nonpoint source pollution into desert sucker, Sonora sucker, and longfin dace habitat.

The recommended Deadwood Draw wilderness would provide an additional buffer for both Wet Beaver and Walker Creeks because it is adjacent to the existing Wet Beaver Creek Wilderness and the recommended Walker Mountain wilderness.

The recommended Davey's wilderness would add additional protection of Fossil Creek from motorized impacts because it is adjacent to the existing Fossil Springs and Mazatzal Wilderness areas. The recommended Tin Can wilderness would extend the Fossil Springs Wilderness, but would not have any effect on perennial waters in the watershed. Finally, the recommended Hackberry, Cimarron-Boulder, and Black Mountain wildernesses would be located in areas that do not have any existing roads, so their impact to perennial stream habitats would not be measureable. Of the latter, only the recommended Hackberry wilderness is located near, or encompasses, perennial water (Verde River).

Most of the recommended Black Mountain wilderness and a portion of the recommended Deadwood Draw wilderness would further protect the West Clear Creek watershed from motorized impacts because the existing West Clear Creek Wilderness already encompasses most of the perennial West Clear Creek. Of these wilderness areas, only the existing West Clear Creek Wilderness and the recommended Black Mountain wilderness encompass portions of perennial West Clear Creek. Walker Mountain, Black Mountain and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability to manage wildfires with resource objectives. This could result in increased sedimentation as the result of fire within the watershed.

There is no overlap between habitat for the desert sucker, Sonora sucker, and longfin dace and the wildlife habitat management areas proposed in alternative C.

Summary of Species Effects

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All alternatives would provide for the continued viability and persistence of the species on the Coconino NF. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Desert sucker, Sonora sucker, and longfin dace are uncommon on the forest (F3 species) and their range has been somewhat diminished, leaving them vulnerable to perturbations in the environment. Some of their habitats have higher departures from reference conditions (e.g., the Cottonwood Willow Riparian Forest PNVT within the Oak Creek 5th code HUC watershed).The desert sucker, Sonora sucker, and longfin dace are limited by conditions in their habitat including predation by, and competition with, nonnative fishes and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Implementation of plan components related to vegetation treatments; recreation management; watershed management; wildlife, fish, or rare

plant management; or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document.

Although all alternatives maintain the viability and persistence of the desert sucker, Sonora sucker, and longfin dace within the authority of the Forest Service with regard to disease and invasive animals, as well as coarse filter threats, alternatives B, C, and D do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the desert sucker, Sonora sucker, and longfin dace;
- Guidelines specifically desert sucker, Sonora sucker, and longfin dace address disease and invasive animals more comprehensively so these threats to the roundtail chub are reduced within the authority of the Forest Service;
- Threats to the habitats of the desert sucker, Sonora sucker, and longfin dace are better defined and plan components are put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Roundtail Chub

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: Roundtail chub is widespread in moderate to large rivers of the Colorado River Basin. In Arizona, it still occurs in the mainstem and tributaries (Fossil Creek) to the Verde and Salt Rivers. On the Coconino NF, roundtail chub is present in the Beaver Creek, Oak Creek, Sycamore Creek, Grindstone Wash–Verde River, Cherry Creek–Verde River, and Fossil Creek–Lower Verde River, Upper Clear Creek, Lower Clear Creek, and West Clear Creek 5th code HUC watersheds (296.4 potential perennial stream miles).

Habitat: Roundtail chub occupy cool to warm water, mid-elevation streams, and rivers where typical adult microhabitat consists of pools up to 8 feet deep adjacent to swifter riffles and runs. Cover is usually present and consists of large boulders, tree rootwads, submerged large trees and branches, undercut cliff walls, or deep water. The species is associated with perennial streams and all of the Riparian Forest PNVTs.

More information on the condition of the riparian forest PNVTs is in the section on "Aquatic Systems." In eight out of the nine 5th code HUC watersheds associated with the roundtail chub, the condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT is at a low level of departure and similar to reference conditions at the landscape level. However, the condition of the Mixed Broadleaf Deciduous Riparian Forest PNVT in the Beaver Creek 5th code HUC watershed is more departed (moderate level) than the overall PNVT-level departure. The higher rate of departure is due in part to high amounts of dispersed recreation in accessible areas and roads;

however, it is slowly improving. Impacts include soil compaction and damage to vegetation, and sedimentation in the water which could have some impacts on associated species. The comparatively higher departure is also due to past actions: road maintenance, off-highway vehicle use, and grazing practices which resulted in vegetation removal, soil compaction, soil loss, and erosion.

The Cottonwood Willow Riparian Forest PNVT is moderately departed from reference condition and slowly improving in seven out of the nine 5th code HUC watersheds associated with roundtail chubs. The Oak Creek and Fossil Creek–Lower Verde River 5th code HUC watersheds are also moderately departed but their trend is static. This is due to dispersed recreation, which has resulted in vegetation removal, accelerated erosion, and runoff. Past actions related to road locations, off-highway vehicle use, and grazing also contributed to vegetation removal, soil compaction and loss, and erosion. The recent decision on the Travel Management Rule (USDA Forest Service 2011m) addressed off-highway vehicle use. Consequently, the sedimentation into connected watercourses, and the soil and vegetation issues should gradually decrease as the affected areas heal.

In eight out of the nine 5th code HUC watersheds associated with the roundtail chub, the condition of the Montane Willow Riparian Forest PNVT is at a low level of departure and similar to reference conditions at the landscape level. However, the condition of the Montane Willow Riparian Forest PNVT in the Upper Clear Creek 5th code HUC watershed is more departed (high level) than the overall PNVT-level departure. This is due to dispersed recreation in accessible areas as well as past actions associated with improperly located and poorly maintained roads, off-highway vehicle use, and elk herbivory, which is under the purview of the Arizona Game and Fish Department.

The Gallery Coniferous Riparian Forest PNVT is at a low level of departure from reference condition and has a static trend in all of the 5th code HUC watersheds associated with roundtail chubs.

Sixteen percent of the Beaver Creek, Oak Creek, Sycamore Creek, Grindstone Wash–Verde River, Cherry Creek–Verde River, Fossil Creek–Lower Verde River, Upper Clear Creek, Lower Clear Creek, and West Clear Creek 5th code HUC watersheds consist of designated wilderness or inventoried roadless areas that result in low to no motorized use (Table 84). This would maintain sedimentation or nonpoint source pollution at approximately its current level. The existing wildernesses would directly protect perennial portions of Wet Beaver Creek, Fossil Creek, Oak Creek, Sycamore Creek, the Verde River, East Clear Creek, and West Clear Creek from motorized impacts. Six inventoried roadless areas (Barbershop Canyon, Boulder Canyon, Cimarron Hills, East Clear Creek, Hackberry, and Walker Mountain) preclude future road construction in their respective areas and indirectly benefit Beaver Creek, East Clear Creek, Fossil Creek, the Verde River, and West Clear Creek because of reduced sedimentation from lack of motorized use. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas so proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects.

Table 84. Existing roadless or minimally roaded areas in habitat occupied by roundtail chub

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294	6,294	6,294	6,294
		Munds Mtn. Wilderness (portion)	12,311	12,311	12,311	12,311
		Walker Mtn. IRA	4,448	4,448	4,448	4,448
		Walker Mtn. recommended wilderness	0	4,448[a]	4,448[1]	0
		Deadwood Draw recommended wilderness	0	0	11,257	0
Cherry Creek–Verde River	21,807	None	0	0	0	0
Fossil Creek–Verde River	104,923	Fossil Springs Wilderness	10,431	10,431	10,431	10,431
		Mazatzal Wilderness	2,639	2,639	2,639	2,639
		Boulder Canyon IRA	4,550	4,550	4,550[2]	4,550
		Cimarron Hills IRA	5,295	5,295	5,295[2]	5,295
		Hackberry IRA	17,905	17,905	17,905[2]	17,905
		Davey's recommended wilderness	0	1,779	1,779	0
		Hackberry recommended wilderness	0	0	25,171	0
		Cimarron-Boulder recommended wilderness	0	0	15,300	0
		Tin Can recommended wilderness	0	0	3,972	0
		Black Mountain recommended wilderness (portion)	0	0	692	0
Grindstone Wash–Verde River	10,462	Sycamore Canyon Wilderness	2,383	2,383	2,383	2,383
Lower Clear Creek	10,258	Anderson Mesa proposed WHMA	0	0	10,234	0
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158	48,158	48,158	48,158
		Munds Mtn. Wilderness	5,783	5,783	5,783	5,783
Sycamore Creek	83,219	Kachina Peaks Wilderness	1,770	1,770	1,770	1,770
		Sycamore Canyon Wilderness	21,577	21,577	21,577	21,577
		Railroad Draw recommended wilderness	0	0	1,220	0
Upper Clear Creek	112,362	Barbershop Canyon IRA	1,310	1,310	1,310	1,310
		East Clear Creek IRA	2,036	2,036	2,036	2,036
		Barbershop recommended wilderness	0	0	1,310[2]	0
		East Clear Creek recommended wilderness	0	0	2,036[2]	0

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
		Anderson Mesa proposed WHMA	0	0	1,372	0
		East Clear Creek proposed WHMA	0	0	35,797	0
		Hospital Ridge proposed WHMA (admin motorized only)	0	0	4,945	0
		Knoll Lake proposed WHMA	0	0	2,488	0
		Limestone Pasture proposed WHMA	0	0	2,423	0
		Second Chance proposed WHMA	0	0	1,444	0
West Clear Creek	187,280	West Clear Creek Wilderness	15,545	15,545	15,545	15,545
		Walker Mountain IRA	1,930	1,930	1,930	1,930
Total watershed acres	**1,048,704**	**Total acres (percentage of watershed)**	**164,365 (16%)**	**166,144 (16%)**	**282,459 (27%)**	**164,365 (16%)**

[1] Walker Mountain recommended wilderness overlaps with the existing Walker Mountain IRA, so these acres are not counted twice.
[2] Some of the acreages in the existing inventoried roadless areas and the recommended wildernesses overlap, and are not counted twice in the total acreage.

Risk Factors: Threats to the roundtail chub that can be influenced by the Forest Service include predation by, and competition with, nonnative fish (invasive animals) and the parasites and diseases that were introduced via nonnative fish. Although management of nonnative fish falls under the purview of the Arizona Game and Fish Department, the Forest Service can influence the introduction of invasive animals through public education.

Environmental Consequences – Roundtail Chub

Common to All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, there is language in all alternatives that would provide for the viability of this species by: managing for viable self-sustaining populations of special status species; allowing for repatriation of extirpated species and a standard that says that direction federally listed and proposed and candidate species takes precedence over direction for species that are not federally listed. In addition there are objectives to implement actions to benefit sensitive species, restore/enhance at least 60,000 acres of terrestrial wildlife habitat, and at least 70 miles of stream habitat. Habitat for this species would be improved if any of these treatments occur in its habitat.

Disease and Invasive Nonnative Species: The section on Wetland Cienega in the "Wildlife, Fish, and Plants" section describes the consequences of plan components on nonnative and invasive species by alternative. The section on Chiricahua leopard frog in Wetland Cienega describes the consequences of plan components in all alternatives on the threat of disease to aquatic and riparian associated species.

Special Area Designations: There are portions of several existing or eligible wild and scenic river segments in the Beaver Creek, Oak Creek, Cherry Creek–Verde River, Fossil Creek–Lower Verde River, Grindstone Wash–Verde River, Sycamore Creek, Upper Clear Creek, Lower Clear

Creek, and West Clear Creek 5th code HUC watersheds. Because designated wild and scenic river segments promote protecting outstandingly remarkable values and low motorized use, there should be low net impact in these areas. However, until the comprehensive river management plans are finalized for each eligible or existing segment, the level of human use is unknown, so it is not possible to estimate resource impacts to the watersheds.

Alternative A

Recreation Opportunity Spectrum: Within the Cherry Creek–Verde River and Grindstone Wash–Verde River 5th code HUC watersheds, alternative A would retain large areas of land presently designated as semiprimitive motorized, which would allow for future road construction in these areas. Furthermore, some land along Fossil Creek is designated as roaded natural and as a consequence, some segments of Fossil Creek could experience future road construction. This alternative has a higher potential contribution of sedimentation to connected waters compared to the other alternatives. Additionally, alternative A would retain some inconsistencies between recreation opportunity spectrum class and number of open roads on the ground in the Oak Creek 5th code HUC watershed.

Alternatives B, C, and D

Recreation Opportunity Spectrum: Within the Fossil Creek–Lower Verde River, Upper Clear Creek and West Clear Creek 5th code HUC watersheds, changes in ROS designations range from 115,398 to 122,108 acres across alternatives B, C, and D, with alternative C being the highest and alternative D being the lowest. These areas of land would be changed to allow less motorized access than alternative A. This would limit the ability of managers to build roads in this watershed and would encourage closure and decommissioning of existing roads, resulting in a potentially beneficial effect. These alternatives would not determine ROS for the Fossil Creek Wild and Scenic River because these are being determined by the comprehensive river management plan, which is currently under development.

ROS classes designated in the remaining watersheds would be changed to allow more motorized access which would benefit to nearby communities but not confer additional protections to this species habitat. The changed acres range between 41,857 and 43,117 acres which represents about 7.5 percent of the remaining watersheds. Not all of these changes would affect habitat for this species because not all changes would occur in areas that connect to perennial waters.

Alternatives B and C

Special Area Designations: Alternatives B and C would add the recommended Walker Mountain wilderness to the Beaver Creek watershed and the recommended Davey's wilderness to the Fossil Creek–Lower Verde River watershed (table 85). The Walker Mountain recommended wilderness has no additional benefit to perennial streams because it is colocated with the Walker Mountain Inventoried Roadless Area which precludes future road construction within this boundary and benefits the headwaters and downstream areas of Walker Creek and Wet Beaver Creek because of reduced sedimentation from lack of motorized use. Davey's wilderness, which is adjacent to the Fossil Springs Wilderness, adds wilderness to the north side of Fossil Creek and further protects this system from motorized use and sedimentation. Davey's recommended wilderness is not expected to alter the ability to manage wildfires with resource objectives in the watershed. Walker Mountain alone would not be enough to alter the risk of uncharacteristic fire in its watershed in this alternative.

Table 85. Existing and recommended wilderness areas, inventoried roadless areas, and wildlife habitat management areas by watershed and alternative

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
Beaver Creek	262,965	Wet Beaver Wilderness	6,294	6,294	6,294	6,294
		Munds Mtn. Wilderness (portion)	12,311	12,311	12,311	12,311
		Walker Mtn. IRA	4,448	4,448	4,448	4,448
		Walker Mtn. recommended wilderness	0	4,448[a]	4,448[1]	0
		Deadwood Draw recommended wilderness	0	0	11,257	0
Cherry Creek–Verde River	21,807	None	0	0	0	0
Fossil Creek–Verde River	104,923	Fossil Springs Wilderness	10,431	10,431	10,431	10,431
		Mazatzal Wilderness	2,639	2,639	2,639	2,639
		Boulder Canyon IRA	4,550	4,550	4,550[2]	4,550
		Cimarron Hills IRA	5,295	5,295	5,295[2]	5,295
		Hackberry IRA	17,905	17,905	17,905[2]	17,905
		Davey's recommended wilderness	0	1,779	1,779	0
		Hackberry recommended wilderness	0	0	25,171	0
		Cimarron-Boulder recommended wilderness	0	0	15,300	0
		Tin Can recommended wilderness	0	0	3,972	0
		Black Mountain recommended wilderness (portion)	0	0	692	0
Grindstone Wash–Verde River	10,462	Sycamore Canyon Wilderness	2,383	2,383	2,383	2,383
Lower Clear Creek	10,258	Anderson Mesa proposed WHMA	0	0	10,234	0
Oak Creek	255,428	Red Rock-Secret Mountain Wilderness	48,158	48,158	48,158	48,158
		Munds Mtn. Wilderness	5,783	5,783	5,783	5,783
Sycamore Creek	83,219	Kachina Peaks Wilderness	1,770	1,770	1,770	1,770
		Sycamore Canyon Wilderness	21,577	21,577	21,577	21,577
		Railroad Draw recommended wilderness	0	0	1,220	0
Upper Clear Creek	112,362	Barbershop Canyon IRA	1,310	1,310	1,310	1,310
		East Clear Creek IRA	2,036	2,036	2,036	2,036
		Barbershop recommended wilderness	0	0	1,310[2]	0
		East Clear Creek recommended wilderness	0	0	2,036[2]	0

5th Code HUC Watershed	Acres	Special Area Designation	Alt. A	Alt. B	Alt. C	Alt. D
		Anderson Mesa proposed WHMA	0	0	1,372	0
		East Clear Creek proposed WHMA	0	0	35,797	0
		Hospital Ridge proposed WHMA	0	0	4,945	0
		Knoll Lake proposed WHMA	0	0	2,488	0
		Limestone Pasture proposed WHMA	0	0	2,423	0
		Second Chance proposed WHMA	0	0	1,444	0
West Clear Creek	187,280	West Clear Creek Wilderness	15,545	15,545	15,545	15,545
		Walker Mountain IRA	1,930	1,930	1,930	1,930
Total watershed acres	**1,048,704**	**Total acres (percentage of watershed)**	**164,365 (16%)**	**166,144 (16%)**	**282,459 (27%)**	**164,365 (16%)**

[1] Walker Mountain recommended wilderness overlaps with the existing Walker Mountain IRA, so these acres are not counted twice.
[2] Some of the acreages in the existing IRAs and the recommended wildernesses overlap, and are not counted twice in the total acreage.

Alternative C

Special Area Designations: In alternative C, 27 percent of the watersheds that support roundtail chub would have designations such as existing wilderness, recommended wilderness, or inventoried roadless areas that would result in reduced public motorized use (table 85). This would help reduce sedimentation or nonpoint source pollution into roundtail chub habitat during storm events. The recommended Deadwood Draw wilderness would provide an additional buffer for both Wet Beaver and Walker Creeks because it is adjacent to the existing Wet Beaver Creek Wilderness and the recommended Walker Mountain wilderness.

The recommended Davey's wilderness would add additional protection of Fossil Creek from motorized impacts because it is adjacent to the existing Fossil Springs Wilderness and Mazatzal Wilderness. The recommended Tin Can wilderness would extend the Fossil Springs Wilderness, but would not have any effect on perennial waters in the watershed. Finally, the recommended Hackberry, Cimarron-Boulder, and Black Mountain wildernesses would be located in areas that do not have any existing roads, so their impact to perennial stream habitats would not be measureable. Of these latter three, only Hackberry wilderness is located near, or encompasses, perennial water (Verde River).

The recommended Cedar Bench wilderness, most of the recommended Black Mountain wilderness, and a portion of the recommended Deadwood Draw wilderness would further protect the West Clear Creek watershed from motorized impacts because the existing West Clear Creek Wilderness already encompasses most of the perennial West Clear Creek. Of these wilderness areas, only the West Clear Creek Wilderness and recommened Black Mountain wilderness encompass portions of perennial West Clear Creek. The Barbershop and East Clear Creek recommended wildernesses overlap with the existing Barbershop and East Clear Creek Inventoried Roadless Areas and, thus, do not provide added benefit with regard to inventoried roadless area or reduced sedimentation in the watershed. However, any treatments in the watersheds that would require motorized equipment would not occur in these areas so

proportionally less of the watershed would be available for treatments such as fuels reduction, stream renovation, or watershed improvement projects. Walker Mountain, Black Mountain and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability to manage wildfires with resource objectives. This could result in increased sedimentation as the result of fire within the watershed.

Alternative C proposes to close forest roads in wildlife habitat management areas to minimize disturbance and impacts from motorized vehicular traffic to wildlife species and their associated habitat. The majority of sediment delivered to streams comes from road and stream intersections following storm events. Sediment delivery can degrade water quality, so closing roads could potentially result in improvements. Road closures are proposed in the Upper Clear Creek 5th HUC and Lower Clear Creek 5th HUC watersheds which contain perennial streams that are habitat for these species. It is highly unlikely that closing roads in the Upper Clear Creek 5th HUC watershed would result in a measurable reduction of sediment delivery or water quality improvement in any perennial waters within this watershed due to the low extent and magnitude of road closures that connect to perennial waters.

About 2.5 miles of roads that connect to perennial streams in Lower Clear Creek 5th HUC watershed could potentially be closed under separate project level decisions. These are in the Anderson Mesa WHMA. Because the location of the closed roads is unknown, it cannot be determined whether alternative C would result in reduced sediment delivery in this watershed or not. Alternative C also recommends a 1 mile per square mile road density in this WHMA. Unlike the other alternatives, the density of roads designated as open could increase only slightly in the future due to this recommended density. The current density is approximately 1.1 mile per square mile. Because of the recommended road density and the motor vehicle use map is updated annually, sediment delivery would remain approximately the same in this alternative whereas sediment delivery could potentially increase in alternatives A, B, and D depending on what roads might be redesignated as open.

The Barbershop and East Clear Creek recommended wilderness areas overlap with the existing Barbershop and East Clear Creek Inventoried Roadless Areas and, thus, do not provide added benefit with regard to roadless area or reduced sedimentation in the watershed. Protection and restoration of the watersheds that support Leonard Canyon and East Clear Creek, including the headwaters, are desired conditions for East Clear Creek, Hospital Ridge, Knoll Lake, Limestone Pasture and Second Chance Wildlife Habitat Management Areas.

Summary of Species Effects

The coarse filter section on riparian resources and aquatic systems compares the alternatives in regards to landscape-scale threats to riparian PNVTs, water quality and quantity, and the threat of invasive animals. All alternatives would provide for the continued viability and persistence of the roundtail chub on the Coconino NF.

Roundtail chub is rare (F2 species) on the forest in its habitat and its range has been reduced somewhat from historic conditions, with habitats becoming further separated from one another. As such it is vulnerable to perturbations in the environment. Some of its habitats have higher departures from reference conditions (e.g., the Montane Willow Riparian Forest PNVT within the Upper Clear Creek 5th code HUC watershed).The roundtail chub is limited by conditions in its

habitat including predation by, and competition with, nonnative fishes and the species threat of diseases introduced via nonnative fish.

Landscape-Level Habitat Threats: The coarse filter section of the species portion of this document summarizes how plan components address landscape threats to the primary habitats, such as uncharacteristic fire and overall water quality, in the alternatives. Additional information can be found in the "Vegetation," "Soil," "Aquatic Systems," "Riparian Resources," and "Watersheds" sections of this document. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF.

Although all alternatives would maintain the viability and persistence of the roundtail chub within the authority of the Forest Service with regard to disease and invasive animals, as well as coarse filter threats, alternatives B, C, and D would do a better job because:

- Desired conditions are updated and more clearly articulated for all habitats, including perennial streams, so that the composition, structure, and processes of these habitats better provide for the needs of the roundtail chub;
- Guidelines specifically address disease and invasive animals more comprehensively so these threats to the roundtail chub are reduced within the authority of the Forest Service;
- Threats to the habitats of the roundtail chub are better defined and plan components are put in place that would improve habitat conditions as projects are implemented; and
- A management approach would emphasize coordination and education with stakeholders and the public regarding impacts and mitigations associated with nonnative invasive species.

Fine Filter – Northern Mexican Gartersnake

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: This species occurs within the forest boundaries at the Page Springs and Bubbling Ponds fish hatcheries which are owned and managed by the Arizona Game and Fish Department and along Oak Creek in the vicinity of the two hatcheries.

Habitat: The northern Mexican gartersnake is associated with Cottonwood Willow and Mixed Broadleaf Deciduous Riparian Forests. They are closely linked to shallow slow moving or impounded waters where it feeds on leopard frogs, toads, tadpoles, various native fishes, and lizards and small rodents which are taken during occasional terrestrial forays.

Risk Factors: The northern Mexican gartersnake is threatened by invasive animal species which prey on them and can impact their prey species.

Environmental Consequences – Northern Mexican Gartersnake

Alternatives B, C, and D

Desired conditions for all riparian types and for these two PNVTs describe conditions that would provide good habitat for northern Mexican gartersnakes, that is, diverse native vegetation in multiple age classes, uncompacted soils, and ecosystems functioning within their natural potential that are rarely negatively impacted by livestock (FW-Veg-Rip-All-DC-1, 2, 3, 7). Objectives to restore 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas within 10 years following plan approval would benefit these PNVTs (FW-Veg-Rip-All-O-1) but only future site-specific NEPA analysis would determine if these benefits would occur in northern Mexican gartersnake habitat. Other beneficial plan components include guidelines for streamside management zones to provide protections from management activities (Veg-Rip-All-2); and for minimal impact to PNVTs from recreation and management activities (Veg-Rip-All-G-1).

Fossil Creek Wild and Scenic River: Designated river segments and its adjacent areas may contain potential habitat for northern Mexican gartersnakes. The designated river and adjacent areas would retain their free-flowing character and outstandingly remarkable values and classifications implying protection and enhancement for this species habitat (SA-WSR-FossilCrk-DC-1).

Alternative B

Three wilderness areas are being proposed in alternative B: Davey's, Strawberry, and Walker Mountain. Less than 2 percent of the cottonwood willow and mixed broadleaf PNVTs will be within recommended wilderness areas. This would provide minor extra protections for northern Mexican gartersnake potential habitat, since these habitats would be managed for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character. Davey's recommended wilderness is not expected to alter the ability to manage wildfires with resource objectives in the watershed. Walker Mountain alone would not be enough to alter the risk of uncharacteristic fire in its watershed in this alternative.

Alternative C

Alternative C would the same consequences as alternative B, except for the following: Alternative C recommends 13 wilderness areas which contain 780 acres of Cottonwood Willow Riparian Forest and Mixed Broadleaf Deciduous Riparian Forest. While much of this habitat is protected as designated wild and scenic rivers and inventoried roadless areas, recommendation as wilderness would provide extra protections from motorized disturbance for northern Mexican gartersnake potential habitat, since these habitats would be managed for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character, but if designated, nonmotorized recreation could increase because of these areas being "discovered" and the premium on recreation in riparian areas in Arizona. However, any treatments in this habitat that would require motorized equipment would not occur in these areas so proportionally less of the habitat would be available for treatments such as stream renovation, or watershed improvement projects. Combined, Walker Mountain, Cedar Bench, Deadwood Draw, Black Mountain and Tin Can have a moderate to high likelihood of increasing the risk of uncharacteristic fire in the watershed because their designation would inhibit the Agency's ability to manage wildfires with resource objectives. This could result in increased sedimentation as the result of fire and loss of habitat for northern Mexican gartersnake within these watersheds.

Alternative C proposes eight wildlife habitat management areas which focus on improving habitat quality by reducing disturbances. This would improve 21 acres of Mixed Broadleaf Deciduous Riparian Forest and 0 acres of Cottonwood Willow Riparian Forest.

Alternative C would also designate Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas; parts of the Flagstaff Neighborwoods Management Area; some special areas; and wildlife habitat management areas as nonsuitable for recreational (nonhunting) shooting. This would reduce disturbance in 21 acres of Mixed Broadleaf Deciduous Riparian Forest in wildlife habitat management areas; 389 acres of Mixed Broadleaf Deciduous Riparian Forest in the Long Valley, Sedona Neighborwoods, and Verde Valley Management Areas; and 4 acres of Wetland/Cienega in the Long Valley Management Area for a total of 414 acres. Cottonwood Willow Riparian Forest did not occur in these areas.

Summary of Species Effects

All alternatives would result in maintaining the viability and persistence of the populations of these two species and not contribute to listing because both habitat and threat of invasive animals would be addressed. The coarse filter section of this document summarizes how landscape threats to these species primary habitats, for example, nonnative invasive species and overall water quality, are addressed in the alternatives. Additional threats and the details of how they are addressed are found in the “Vegetation,” “Soil,” “Aquatic Systems,” “Riparian Resources,” and “Watersheds” sections of this document.

Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF.

Fine Filter – Alcove Bog Orchid, Arizona Bugbane

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: Alcove bog orchid and Arizona bugbane are Forest Service Southwestern Region sensitive species. Both species occupy a very small portion of their habitat on the forest. Arizona bugbane occurs only in northern and central Arizona. These species are vulnerable to perturbations in the environment because of limited distribution and rarity.

Habitat: These species both occur in the eligible portions of the West Fork Wild and Scenic River (wild) and Oak Creek Wild and Scenic River (recreational). The West Fork of Oak Creek is within the Red Rock Secret Mountain Wilderness, a very high use recreation area for hiking, especially within the first 3 miles.

Arizona bugbane occurs in the Mixed Broadleaf Deciduous Forest, Gallery Coniferous Forest PNVTs, and in canyons. It grows along canyon bottoms and lower canyon slopes in association with Douglas-fir, white fir, big tooth maple, Rocky Mountain maple, and sometimes aspen. Some populations occur on mountains at seeps and springs, in drainages and on shaded north slopes, growing in moist, loamy soil of the ecotone between the coniferous forest and riparian habitat. Arizona bugbane requires deep shade from forest or riparian overstory at elevations from 4,800 to

8,600 feet. Locations of this species include the tributaries of Oak Creek, including West Fork, Pumphouse, and James Canyons and in West Clear Creek. Alcove bog orchid is associated with Mixed Broadleaf Deciduous Riparian Forest.

At the landscape level, all of their habitats are similar to reference conditions, and there is a low likelihood that these species are limited by conditions in their habitat. Arizona bugbane is found in other riparian forest areas besides the West Fork of Oak Creek; however, impacts to Arizona bugbane in these other areas are lower.

Risk Factors: These plants and their habitat are vulnerable to soil compaction, loss, and trampling. The primary threat to the alcove bog orchid and the Arizona bugbane is ground-disturbing activities, specifically, dispersed recreation located in the West Fork of Oak Creek. The West Fork of Oak Creek receives high levels of dispersed recreation, mainly hiking and day use along a main trail that generally follows the creek. There are multiple trails in some places associated with accessing the water or avoiding obstacles on the main trail. Most of the use is in the first few miles. High levels of use has resulted in soil compaction and loss and the trampling and crushing of vegetation especially in riparian areas near the creek.

The coarse filter section of this document summarizes how landscape threats to the alcove bog orchid and Arizona bugbane primary habitats, for example, uncharacteristic fire and overall water quality are addressed in the alternatives.

The coarse filter section describes threats and consequences to riparian habitats.

Environmental Consequences – Alcove Bog Orchid, Arizona Bugbane

Human Disturbance

Common to All Alternatives

Although there are differences between the alternatives, all alternative address the threat of disturbance and maintain the viability and persistence of these two plant species on the forest. As described in the coarse filter section and “Riparian Resources,” all alternatives address the primary threats to the habitats of these two species and would result in maintaining or improving its habitats. All alternatives address dispersed recreation impacts to individuals by prohibiting horse and pack stock use (p. 90, par 4; FW-Rec-Disp-S-3), consolidating multiple trails (new p. 108-2, no. 7; FW-Rec-Disp-DC-7), limiting commercial activities (SA-Wild-All-S-2), and emphasize maintaining and improving habitat for sensitive species (see beginning of section on sensitive species).

In addition, all alternatives refer to conservation strategies and assessments (Arizona bugbane has one) (new p. 206-10, no. 6; FW-WFP-G2) which would result in mitigations designed to protect this species, monitoring designed to inform current status and trends and future projects.

Alternative A

Alternative A prohibits horse and pack stock use in the West Fork of Oak Creek which would avoid this threat to both species. In addition, alternative A would protect these two species by keeping creek crossings to a minimum when designating the trail route (new p. 108-2, no. 7) which would reduce the area of recreational impact in the species habitats; designate camp areas in West Fork consistent with the protection of threatened, endangered, and sensitive species (new p. 108-2, no. 8), evaluating the need for additional limitation on visitor use at the West Fork of

Oak Creek (new p. 108-2, no. 6), and taking management action where needed to protect visitor experience and resources (new p. 108-2, par 1).

Alternative A would specifically protect Arizona bugbane by restricting ground-disturbing activities within the habitat, providing shade needed by this species, relocating trails to protect occupied habitat (new p. 65-12, par 3; new p. 206-10, no. 6; new p. 206-116, par 10). Management emphasis for the Flagstaff Lake Mary Ecosystem Area would maintain or enhance rare plants populations where they occur, including Arizona bugbane (new p. 206-98, par 11).

Alternatives B, C, and D

These alternatives prohibit horse and pack stock use on the West Fork of Oak Creek trail but in contrast to alternative A, allow administrative use of horse and pack stock. This which would reduce, but not eliminate, potential trampling of vegetation and soil compaction from horses or mules to individuals within the populations (FW-Rec-Disp-S-3). These alternatives also protect the species and their habitat in the West Fork of Oak Creek through a more strategic approach via desired conditions compared to a more tactical approach in alternative A. The desired conditions would result in dispersed recreation activities and dispersed camping having low impact to vegetation and soil and damage to riparian areas would be minimized (FW-Rec-Disp-DC-3, 7, 13-15, 17). Trails that impact resources like rare plants and riparian would be prioritized for rehabilitation, closure, or mitigation (FW-Rec-Disp-DC-3, 13, 15-16). These plan components would also protect these species if they were found in other canyons coming off the rim whereas the alternative A language is more location specific and would not provide for similar protections elsewhere. Wilderness direction allows for more developed infrastructure in order to protect resources (SA-Wild-All-DC-5), promotes proper functioning habitat conditions for native species (SA-Wild-All-DC-9), and limits some groups sizes (SA-Wild-All-S-1).

Also see the “Primary Threats,” Human Activities section of this document for discussion of how human activities affect other species.

Summary of Species Effects

Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in maintaining the viability and persistence of the populations of these two species and not contribute to listing because:

- Desired conditions and plan language provide for the composition, structure, and processes of these habitats to maintain alcove bog orchid and Arizona bugbane habitat;
- Standards and guidelines support the use of conservation strategies and assessments to protect the alcove bog orchid and the Arizona bugbane and prevent listing;
- Guidelines and desired conditions promote managing the habitat of sensitive species and those with restricted ranges, like these two species, for viable, healthy, and self-sustaining populations; and
- Threats to the habitats and species are addressed through guidelines in alternative A and desired conditions, standards, and guidelines in alternatives B, C, and D.

Fine Filter – Bebb's Willow and Blumer's Dock

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution and Habitat: These species occur within the Fern Mountain Botanical Area, a unique high-elevation riparian area. Bebb's willow is found in other locations on the forest that support Montane Willow Riparian Forest vegetation and springs.

Risk Factors: Risk factors to these species include water diversions or stock tanks, which can result in reduced water quantity for riparian plant species. Diversions or stock tanks, however, are regulated primarily through water rights and claims.

Water Diversion: Water diversions or stock tanks can result in reduced water quantity for riparian plant species. Diversions or stock tanks are regulated primarily through water rights and claims.

Environmental Consequences – Bebb's Willow and Blumer's Dock

All Alternatives

All alternatives would promote procuring instream water rights to protect sensitive species (p. 74, par 5; FW-Aq-Wat-DC-4) and would manage botanical areas to protect their unique qualities (replacement p. 25, par 4; p. 79, par 10; replacement p. 195, par 9; SA-RNABotGeo-DC-7). The Fern Mountain Botanical Area is managed to preserve a high elevation riparian community dominated by Bebb's willow (replacement p. 193, par 9; SA-RNABotGeo-DC-10). Visitor use is limited (replacement p. 195, par 6; SA-RNABotGeo-G-1); allotment management plans protect the uniqueness and ecological condition of special areas (replacement p. 195, par 10; SA-RNABotGeo-G-4) and have minimal damage from fire suppression tactics (replacement p. 196, par 5; SA-RNABotGeo-G2).

Alternative A

Plan components in this alternative would provide sufficient water for these species. A forestwide goal would maintain high quality sustained water yield for forest users and others as well and protect wetlands and flood plains (replacement p. 24, par 1). Guidelines promote adequate instream flows and adequate instream flow water rights to maintain riparian and aquatic communities (new p. 206-116, par 9); and taking action to legally protect forest use of needed waters (p. 74, par 5).

There are other plan components that would benefit these species. For example, botanical areas are managed to maintain existing conditions and natural processes for research and public enjoyment (replacement p. 194, par 2). There is no assigned grazing capacity (replacement p. 195, par 7), and timber harvest and firewood cutting is prohibited (replacement p. 195, par 11). These areas should be withdrawn from locatable mineral entry, should not be affected by special use authorizations and vehicular intrusions (replacement p. 196, par 1, 2, 3, 5).

These provisions would protect these species and improve habitat conditions, including water quantity, except for the prohibition for timber harvest. Due to fire suppression, tree density has increased in this botanical area, which has resulted in increased competition for water and a decline in Bebb's willow regeneration. Although prescribed fire is permitted (replacement p. 196,

par 4), it is generally ineffective as a thinning tool because the trees are too large to be killed by the fire intensity appropriate for the area.

Alternatives B, C, and D

Plan components in these alternatives would also provide sufficient water for these species. For example, desired conditions and best management practices under "Water Quality and Quantity" would maintain adequate quantity, quality, and timing of water to retain or enhance riparian vegetation consistent with existing water rights and claims (FW-Aq-Wat-DC-2, FW-AQ-Wat-G-3).

Unlike alternative A, these alternatives have language for springs that would avoid or modify structures to allow some flow to maintain habitat while still providing for established water rights (FW-Aq-Spr-G-3). Also unlike alternative A, these alternatives do not specifically exclude timber harvest in botanical areas but describe resilient plant communities not impacted from human activities (SA-RNABotGeo-DC-7), thus allowing for tree removal if approved under site-specific NEPA process.

Other plan language would promote resilient riparian areas that allow a variety of plant species to thrive, especially those unique to these habitats and that are rarely impacted negatively by livestock (FW-Veg-Rip-All-DC-1). To avoid negative impacts to accessible riparian areas, livestock use should be restricted to time when vegetation is dormant and utilization would not exceed 20 percent on woody vegetation such as willows (FW-Veg-Rip-All-G-3). Regeneration of Bebb's willow would be enhanced by plan components that would maintain open vegetative conditions in the watershed surrounding springs to raise the water table (FW-AQ-Spr-G-4) and desired conditions that promote high water tables in Montane Willow Riparian and spongy moist surfaces in wet meadows (FW-Veg-Rip-MW&GCRF-DC-1).

Summary of Species Effects

All alternatives would maintain the viability of associated species by including plan components that support the necessary water quantity and riparian habitats needed for these species.

At the landscape level, Montane Willow has a low departure and is considered similar to reference conditions. Springs are considered to be moderately departed especially if they are accessible, unfenced, and developed with infrastructure such as pipes or troughs. Montane willow is considered to be as abundant as it was historically, and springs are considered to be somewhat less abundant than they were historically primarily due to having been developed and some have dried up. Consequently there is low to moderate likelihood that Bebb's willow would be limited by conditions in its habitat. Blumer's dock, however, would not be limited because it is protected within a botanical area.

Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in maintain the viability and persistence of the populations of these two species and not contribute to listing because they would:

- Promote procuring water rights and maintaining sufficient water for riparian dependent species and in addition to law regulation and policy;
- Promote the management of Forest Service sensitive species to maintain and improve their habitat to preclude listing; and

- Maintain the unique qualities of the Fern Mountain Botanical Area which has the only known population of Blumer's dock on the forest and a large population of Bebb's willow.

Alternatives B, C, and D do a better job of maintaining the viability of these species because they would:

- Include desired conditions and plan language that better provide for the composition, structure, and functioning of springs to maintain the habitat of both of these species compared to alternative A;
- Maintain high water tables and moist spongy soil in Bebb's willow habitat which would be beneficial for regeneration and recruitment; and
- Not preclude timber harvest in botanical areas. Removal of some trees that have encroached into this community as a result of fire suppression may be beneficial because ponderosa pine trees compete with Bebb's willow for water and negatively impact willow seed germination and seedling establishment.

Springs

Coarse Filter

Affected Environment

Amount and Distribution: There are approximately 340 springs on the forest.

Habitat Quality: According to the section in "Aquatic Systems," springs that are assumed accessible, modified with stock tanks or pipelines, and unfenced are highly departed from reference conditions and classified as either nonfunctioning or functioning-at-risk. Springs that are fenced and/or are not very accessible are assumed to have a low departure from reference conditions and are assumed to be in functional condition.

Risk Factors: Unfenced accessible springs are at risk because of the increased potential for excessive use from recreationists, livestock, and wildlife. High levels of dispersed recreation in easily accessed areas can cause ground disturbance, soil compaction, and vegetation removal and could lead to accelerated erosion and sedimentation into connected waters. Excessive or poorly timed livestock grazing can cause soil compaction, change the structure and composition of vegetation to the extent it influences ecosystem processes, and cause soil disturbance that results in erosion and sedimentation.

Water quantity is also at risk due to increased demand for water from the State's growing population and commercial sector. As a result, many of the risks to water quality and quantity and watershed condition are outside the administrative control of the Forest Service either because their source is on non-Federal lands or because the State of Arizona has the authority to regulate them (such as water rights and diversions). See "Aquatic Systems" section for more information.

Associated Species: Nineteen species are associated with these habitats (see table 42, Table 43, and table 44). The 19 species associated with springs are as follows:

- Three are federally listed: Chiricahua leopard frog (threatened), Gila topminnow (endangered), and southwestern willow flycatcher (endangered);

- Twelve are Forest Service sensitive species: California floater, fossil springsnail, Page springsnail (candidate), four-spotted skipperling, Nokomis fritillary, Nitocris fritillary, Arizona toad, Blumer's dock, Bebb's Willow, lowland leopard frog, northern leopard frog, and Mogollon thistle; and
- Four are other forest planning species: Alberta arctic, Arizona snaketail, Persephone's darner, redrock stonefly.

The coarse filter is inadequate to address the threats to eight species. These eight species are discussed further in the fine filter analysis.

- Three are federally listed species: Southwestern willow flycatcher (endangered), Gila topminnow (endangered), and the Chiricahua leopard frog (threatened).
- Five are Forest Service sensitive species: Arizona toad, Blumer's dock, Bebb's willow, lowland leopard frog, northern leopard frog.
- The Chiricahua leopard frog, lowland leopard frog, and northern leopard frog are further discussed in the "Wildlife, Fish, and Plants" section under the Wetland Cienega PNVT. Southwestern willow flycatcher, Gila topminnow, Arizona toad, Blumer's dock, and Bebb's willow are also discussed in the "Wildlife, Fish, and Plants" section under Riparian Forest PNVTs.

Environmental Consequences – Springs

Common to All Alternatives

Habitat Quality: The contribution of sediment to water quality resulting from vegetation management, trail maintenance and construction, and from human and livestock disturbances to springs is expected to be similar because the best management practices used for implementation of these activities are the same across alternatives. Best management practices are expected to reduce or mitigate sedimentation.

Alternative A

Plan language for springs is outdated because it does not include current science about vegetative condition and natural disturbances and lacks comprehensive desired conditions for composition, structure, and function.

Projected and Improved Habitat: Alternative A lacks treatment objectives, thus forest plan objectives would not result in additional acres of improvements to species habitats or changes to the number of acres of projected habitat for any associated species. Implementation of plan components other than objectives could result in improvements to habitat quality, however, amount of improvement would be unknown because this would be decided at the project level. Alternative A does not address recreation impacts to springs.

Alternative A would address departure and maintain springs by minimizing the effects of livestock grazing through fencing, seeding, and management of livestock (p. 175, par 1, replacement p. 69, par 6 and 7; replacement p. 176, par 1; p. 174, par 2). The number and acres of wetlands would retain their current departures and remain static relative to desired conditions. This alternative would allow salting in riparian areas to improve livestock management by concentrating cattle in certain areas, a practice which could be detrimental to associated species and their habitat (p. 68, par 8 and p. 175, par 9). This is offset by a standard that requires that forage use be maintained at a level that assures recovery and continued existence of listed species

(new p. 66-1, par 1 and p. 174, par 1) and specific objectives to protect riparian areas and allow them to recover in the first 20 years of the plan (p. 175, par 1).

Alternatives B, C, and D

Projected and Improved Habitat: Under alternatives B, C, and D, conditions would improve for about 10 percent of springs (see "Aquatic Systems" for more information). This is primarily because alternatives B, C, and D would reconstruct or restore riparian function to at least 25 springs identified as not in proper functioning condition to provide water quantity and aquatic habitat for the recovery of plan and animal species during the 10 years following plan approval (FW-Aq-Spr-O-1). If these improvements would occur in a specific species habitat, then that habitat would be improved or enhanced. No improvements or changes in projected habitat are predicted for any associated species because the location of improved wetlands would be a project-level decision.

Recreation: Table 86 shows the intent of plan components that were put in place to update plan language and to address the identified risks to springs. Alternatives B, C, and D would address departure and maintain springs by specifying that motor vehicle use and dispersed camping with recreational vehicles and campers occurs in designated motorized camping corridors or designated spur roads that are identified on the motor vehicle use map, except as authorized by permit or for administrative uses. This would reduce the risk of sedimentation from high levels of motor vehicle use or high density of roads in watersheds. Desired conditions in alternatives B, C and D would protect riparian resources by managing dispersed recreation to avoid resource damage and expanding direction to rehabilitate negatively impacted sites beyond the Sedona-Oak Creek Management Area. In addition, guidelines would specify that special use permits should generally not be given for activities proposed to occur within 200 feet of perennial springs, to protect riparian vegetation. Exceptions will be for hardened or slickrock sites, for activities in support of approved research, to improve safety, or to provide for site rehabilitation. There is also a forestwide guideline to manage trails that access springs so that they do not result in social trails and support wildlife access to the sites. This would reduce sedimentation to springs and would improve vegetative cover for associated species.

Livestock Grazing: In addition, these alternatives address the localized impacts from livestock grazing area and improve the trend by maintaining available forage in balance with desired conditions for plant communities while providing growth, reproduction, and adequate residual cover of desired plant species. In addition, guidelines specific that range improvements should be located to protect riparian function, rare species, and habitat for rare and Forest Service sensitive plants.

Table 86. Plan components in alternatives B, C, and D that help provide for the viability of species associated with springs

Activities	Location Code in Proposed Revised Plan
Recreation activities, permitted uses, and management activities should not significantly impact soil function, riparian vegetation, and water quality; do not impact resources such as soils, vegetation, or wildlife. Resource damage from unauthorized motorized trails is minimal and unauthorized trails are rehabilitated. Effective vegetative cover should be maintained within riparian areas to stabilize banks, soil, and riparian function. Impacts to understory vegetation and soil erosion are minimal in nonmotorized and motorized dispersed camping areas. Manage dispersed recreation to avoid resource damage and rehabilitate impacted sites. Special use permits should generally not be given for activities proposed to occur within 200 feet of springs. Manage trails that access springs so they don't result in social trails and support wildlife access.	FW-Veg-Rip-All-G-1, 6; FW-Rec-Disp-DC-2, 3, 8, 19; FW-Rec-Disp-G-2, 4, 8, 10, 11; FW-SpecUse-G-14; FW-Rec-Disp-G-2.
Motorized use occurs as identified on the motor vehicle use map except as authorized by permit or for administrative uses. The forest transportation system balances public access with potential for ecological impacts and minimizes impacts to watershed conditions, rare plants, fisheries, and wildlife habitat and movement. Temporary roads are rehabilitated promptly and unneeded roads are closed and naturalized to reduce soil erosion and human disturbance to wildlife. The minimum road system necessary is managed within areas that affect municipal water sources, such as Upper and Lower Lake Mary, to prevent impacts to water quantity and quality from sedimentation and runoff. Best management practices for watershed and water quality in road construction should be used. Permanent and temporary road construction and relocation should avoid wetlands. Factors in prioritizing the naturalization of decommissioned and unauthorized roads should include watershed condition, impaired riparian areas, springs, and wetlands.	FW-Rec-Disp-DC-4; FW-Rds-FAC-DC-1, 4, 5; FW-Rec-Disp-S-1; FW-Rds-Fac-G-2, 3, 5.
Localized livestock impacts: Rangelands sustain biological diversity and ecological landscapes. Grazing maintains desired conditions of plant communities with biotic and geophysical integrity; is in balance with available forage; and should provide for growth, reproduction, adequate residual cover of desired plant species. Salt, fences, troughs, pipelines, and other improvements should be located to protect riparian function, rare species, and known locations of Southwestern Region sensitive plants. Sensitive plant habitat should not be adversely affected by water developments and handling or loading facilities.	FW-Graz-DC-1, 2, 3; FW-Graz-G-1, 2, 5, 7.

Fine Filter – Species Associated with Springs

Affected Environment

Species Threats: Disease and invasive or nonnative species are a threat in addition to coarse filter threats to Gila topminnow, Chiricahua leopard frog, Arizona toad, lowland leopard frog, and northern leopard frog. Reduced water quantity as a result of water diversions is an additional threat to Blumer's dock and Bebb's willow. The Wetland Cienega PNVT section in the "Species Analyzed by PNVT" section describes the consequences of plan components on nonnative and invasive species by alternative. The section on Chiricahua leopard frog in the Wetland Cienega PNVT section describes the consequences of plan components in all alternatives on the threat of disease to aquatic and riparian associated species.

Environmental Consequences – Species Associated with Springs

Alternatives B, C, and D

While instream flow water rights would be maintained and procured at similar levels under all alternatives, the plan language under these alternatives is improved and more focused on riparian ecological function relative to alternative A and would support improvement of ecological function as they relate to water quantity and watershed function. Alternatives B, C, and D expand the area where maintenance of already acquired water rights is emphasized from the Flagstaff/Lake Mary Management Areas and Sedona-Oak Creek Management Area to Forestwide (alt. A: replacement p. 184, no. 6; new pp. 206-116, par 9). Expanding the geographic range of this plan component, recognizes the growing demand for water across the forest and would better address the need for maintaining water quantity on a forestwide level than alternative A. In addition, plan components in alternatives B, C, and D would maintain water quantity and riparian function by guidelines that specify that diversion ditches permitted across NFS lands should be maintained in a way that minimizes disturbance of vegetation and hydrologic conditions (FW-Spec-Use-G-9).

Piñon-Juniper Woodland PNVTs

Coarse Filter

These PNVTs include Piñon-Juniper with Grass, Piñon-Juniper Evergreen Shrub, and Piñon-Juniper Woodland.

Affected Environment

Amount and Distribution: There are three PNVTs dominated by piñon and juniper: Piñon-Juniper with Grass, Piñon-Juniper Evergreen Shrub, and Piñon-Juniper Woodland. Piñon-Juniper with Grass covers approximately 261,432 acres (14.2 percent of the forest) and is distributed in upland and valley settings or where local conditions are inherently favorable for grasses. It is often found on moderately deep soils and gentle topography. Its understory is mainly forbs and grasses, and shrubs are minor components.

Piñon-Juniper Evergreen Shrub covers approximately 263,835 acres (approximately 14 percent of the forest) and usually occupies hills, plains, mountains, and escarpments below the Mogollon Rim. It is dominated by open to closed shrub canopy of evergreen oaks, cliffrose, and tree forms of some evergreen oaks. Its herbaceous ground cover is dominated by warm season grasses.

Piñon-Juniper Woodland (also called Persistent Piñon-Juniper Woodland) covers approximately 75, 393 acres (approximately 4 percent of the forest) and is located mainly in the north and east portions of the forest on the lower slopes of mountains and upland rolling hills. This PNVT ranges from sparse stands of scattered, small trees growing on poor substrates to relatively dense stands of large trees on more productive sites. However, tree density and cover may fluctuate in response to disturbance and climatic variability. The understory consists of grasses and shrubs.

Habitat Quality: The Piñon-Juniper with Grass PNVT is moderately departed because there are currently more trees per acre and greater cover than under reference conditions due to fire exclusion and weather patterns which have favored tree germination and establishment. As a result, understory abundance and diversity has decreased. In severe cases of tree encroachment, former grasslands and savannas have undergone a vegetation type conversion, including a change in fire regime to juniper or Piñon-Juniper Woodland. In Piñon-Juniper Evergreen Shrub, current

conditions are moderately departed as mid-scale vegetation analysis indicates a shift to more closed tree canopies and a loss of herbaceous understory. As tree canopies continue to move toward a more closed state the departure would trend away from desired condition. (See table 87.)

Even though the overall departure for Piñon-Juniper Woodland is low and expected to remain static, areas that are overstocked with trees are expected to trend away because of the overall shift toward small and medium size trees with loss of herbaceous understory and large trees with open canopy.

Table 87. Condition and trend of woodland PNVTs

PNVT	Vegetation Departure, (Percent), Trend	Soil Condition Departure, Trend (Percent Unsatisfactory, Impaired)	Threats
Piñon-Juniper with Grass	Moderate (55%), away	Low, away (28%)	Uncharacteristic fire
Piñon-Juniper Evergreen Shrub	Moderate (50%), away	Moderate, away (57%)	Uncharacteristic fire
Piñon-Juniper Woodland	Low (25%), static	Moderate, away (60%)	Uncharacteristic fire

Snags: Table 88 shows that the existing number of snags meet or exceed desired conditions, based on Forest Inventory Assessment data in Piñon-Juniper with Grass PNVTs in the 18 inches d.b.h. size class. Comparisons cannot be made for Piñon-Juniper Evergreen Shrub or Piñon-Juniper Woodland or the different snag requirement subsets because PNVT-wide or subset existing condition data is lacking.

Table 88. Existing snags in Piñon-Juniper Grasslands by size

PNVT	Size of Snags (d.b.h.)	Existing Snags
Piñon-Juniper Grasslands	8 to 12 inches	5
	12 to 18 inches	3.8
	18+ inches	1.8

Coarse Woody Debris: Coarse woody debris is woody material on the ground greater than 3 inches in diameter, and includes downed logs. It is found throughout the landscape and is a specific attribute of late seral portion of the landscape. It is critical for nutrient cycling and maintaining a productive forest. It is used by small mammals, reptiles, and invertebrates for habitat, and these species, in turn, are prey for a variety of species.

Old-Growth Attributes: Currently, it is estimated that at least 20 percent or more of the piñon-juniper PNVTs on the forest have older structural stages and old-growth attributes, like coarse woody debris. For piñon-juniper grasslands, it is assumed that increased amount of area occupied by states or combinations of the medium and very large tree states, is also movement toward desired old-growth conditions. Because of their slower growth rates, the majority of trees in medium trees would qualify as old growth forest components.

In addition to operable forested areas that are actively managed for desired conditions, areas designated as wilderness, as well as areas outside of wilderness with slopes greater than 40 percent may also be assumed to qualify as having existing or developing old growth forest components for piñon-juniper PNVTs because these areas have evolved naturally, except for fire exclusion.

Risk Factors: The primary risk factor is to these PNVTs is uncharacteristic fire.

Uncharacteristic Fire: In fire-adapted PNVTs, vegetative conditions and fire ecology are interrelated because of the coevolution of these habitat characteristics. When vegetation and fire regimes are highly departed from desired conditions, uncharacteristically severe fires could occur. Uncharacteristic fire refers to fires that burn at a severity or frequency outside its natural range. It is primarily a consequence of missed fire return intervals in fire adapted PNVTs. Missed fire return intervals can result in higher proportions of trees and closed canopy forest structure than occurred during reference conditions, as well as larger and more severe fires that have negative consequences to soils, watersheds, vegetation, and species.

In the three piñon-juniper PNVTs, the resulting shifts in tree density and structure has reduced understory species cover and diversity which can impact food sources and cover for wildlife species such as Merriam's shrew, Navajo Mogollon vole, Gunnison's prairie dogs, reticulate Gila monster, and western burrowing owl. In Piñon-Juniper with Grass PNVT, the increasing tree cover would shade out the fine fuels such as grasses and other understory vegetation and reduce the ability of understory vegetation to carry frequent, lower intensity fire. The increasing fuel loads associated with tree cover, on the other hand, would contribute to increased risk of uncharacteristic fire effects which could threaten retention of large trees.

Associated species: Twenty-seven species are associated with Piñon-Juniper Woodland, Piñon-Juniper with Grass, and/or Piñon-Juniper Evergreen Shrub. These species are:

- One federally listed species: Black-footed ferret (endangered),
- Eleven are Forest Service sensitive species: western burrowing owl, Merriam's shrew, Navajo Mogollon vole, reticulate Gila monster, Grand Canyon agave, Flagstaff beardtongue, Metcalfe's tick trefoil, Mt. Dellenbaugh sandwort, Rusby's milkwort, Tonto Basin agave, Verde Valley sage; and
- Fifteen are other forest planning species: Piñon jay, Gunnison's prairie dog, Arizona phlox, Basin bladderpod, black dropseed, creeping milkvetch, James rubberweed, Jones' spider flower, Jones' wild buckwheat, Rothrock hedge-nettle, silver milkvetch, skunk-top scurfpea, western mouse-tail, Mearns lotus, and Yavapai wild buckwheat.

All 27 species associated with Piñon-Juniper PNVTs had threats which were completely addressed at the habitat level (coarse filter).

The black-footed ferret (endangered) and western burrowing owl (Forest Service sensitive species) were previously analyzed in detail under the Grasslands PNVT and additional information on those species and how plan components provide for viability can also be found in that section.

Environmental Consequences – Piñon-Juniper Woodland PNVTs

Habitat Quality

Common to All Alternatives

From a fire standpoint, vegetative condition class (VCC) in Piñon-Juniper with Grass would remain at VCC II to VCC III, a moderate to high departure with a trend toward desired conditions. Likewise, the predicted fire severity would remain moderate to high with a trend toward desired conditions. Fire return intervals would remain highly departed and would trend away from desired conditions because there are no prescribed fire treatment objectives. Even though Piñon-Juniper with Grass has an objective to treat 3,750 acres every 10 years with low to mixed severity naturally ignited wildfire (FW-Veg-PJ-PJG-O -2), tree density and cover would continue to increase. If conditions are suitable for more acres to be treated with naturally ignited fire than the objective, the trend could become static, but this would require considerably higher levels of treatment.

Piñon-Juniper Evergreen Shrub would remain moderately departed and trend away from desired conditions because there are no specific plan objectives for mechanical treatments to manage this PNVT. Tree density and cover would continue to increase, shading out understory species, and maintain smaller to medium sized trees than desired. These factors would exacerbate the lack of fire disturbance and would modify the shrub and tree age class distribution, increasing the potential for severe fires. These vegetation structural trends tend to increase vulnerability to insect and disease outbreaks. From a fire standpoint, vegetative condition class would remain at VCC II, a moderate departure with a trend away from desired conditions. Likewise, the predicted fire severity would remain moderate with a trend away from desired conditions. Fire return intervals would remain at a low departure and would trend away from desired conditions because there are no prescribed fire treatment objectives. Even though Piñon-Juniper Evergreen Shrub[50] has an objective to treat 3,750 acres every 10 years with low to mixed severity naturally ignited wildfire (FW-Veg-PJ-PJES-O -1), tree density and cover would continue to increase. If conditions are suitable for more acres to be treated with naturally ignited fire than the objective, the trend could become static, but this would require more than 10 times the current objective level of treatment.

In Piñon-Juniper Woodland PNVT, vegetative departure would be anticipated to remain at a low departure with a static trend. The current vegetative structure would be maintained. From a fire standpoint, vegetative condition class would remain at VCC II, a moderate departure. Likewise, the predicted fire severity would remain moderate with a static trend relative to desired conditions. Fire return intervals would retain a low departure and trend away from desired conditions because there are no fire treatment objectives.

The Piñon-Juniper PNVTs contain all or portions of several proposed or existing special areas' designations that increase restrictions on human activities, such as motor vehicle use and vegetation treatments within the habitat of several species.

[50] This PNVT would have over 50,000 acres in recommended wilderness, which is almost one-fifth of the entire PNVT across the forest. Because naturally ignited fires may be managed in wilderness areas, movement toward desired conditions and level of departure are expected to be the same as alternative B.

There are currently more than 101,408 acres of Piñon-Juniper Woodland that occur in wilderness or on slopes greater than 40 percent that have not had any timber harvesting activity and, therefore, contain and would likely continue to sustain old-growth components under all alternatives.

Alternative A

Alternative A combines the three piñon-juniper types into one type. The three types differ from each other in terms of species composition and fire regime.

Piñon-Juniper with Grass would remain moderately departed and trend toward desired conditions. After about 50 years, growth would outpace the benefits from the treatments and the PNVT would trend away from desired conditions. Over time, treated acres would not keep pace with tree growth and increased canopy cover and, thus, understory vegetation would decline. Increased competition from seedlings, saplings, and small trees that historically would have been thinned by fire would be expected to continue to hamper the development of very large trees in this PNVT. At this point, tree density and cover would increase, shading out understory species, and maintaining smaller to medium sized trees than desired. The risk of uncharacteristic fire would increase.

Improved Habitat Quality: Alternative A lacks treatment objectives, thus forest plan objectives would not result in additional acres of improvements to species habitats or changes to the number of acres of projected habitat for any associated species. Implementation of plan components other than objectives could result in improvements to habitat quality, however, amount of improvement would be unknown because this would be decided at the project level.

Under the 1987 plan, all piñon-juniper types were lumped together under Management Areas 7, 8, and 10 and not split out by differences in ecological characteristics and overlapped numerous other management areas. This resulted in conflicting direction when managing the PNVT as a whole. Plan direction in the 1987 plan emphasizes shelterwood, clear-cutting, and uneven-aged silvicultural systems, and it specifies to manage for at least 30 percent cover in MA 7 (pp. 152-153). Modeling suggests that conditions would improve within this PNVT after 15 years, but it would begin to trend away from desired conditions after 50 years. Under the 1987 plan, all Piñon-Juniper Woodlands were lumped together under Management Areas (MA) 7 and 8, and not split out by differences in ecological characteristics except for Grassland and Sparse Piñon-Juniper above the Mogollon Rim (MA 10), which overlaps 17 of the 18 PNVTs across the forest.

Piñon-Juniper Woodland (Persistent) falls primarily under MA 7 – Piñon-Juniper Woodlands less than 40 percent Slope, MA 11 – Verde Valley, and MA 8 – Piñon-Juniper Woodlands greater than 40 percent Slope. MA 7 is the only one with mechanical vegetation management guidelines, emphasizing management on a sustained-yield basis for firewood and miscellaneous convertible products (p. 152, par 14; p. 153, par 1).

Piñon-Juniper Evergreen Shrub is primarily covered under Piñon-Juniper Woodlands with Less Than 40 Percent Slope (MA 7), which is the only one with a mechanical vegetation management guideline, emphasizing management on a sustained-yield basis for firewood and miscellaneous convertible products, on 0 to 15 percent slopes. Old growth, cover, and snags would generally be provided on slopes greater than 15 percent. However, exceptions would occur if dispersion requirements for wildlife habitat components are not met on these steep slopes.

Alternatives B, C, and D

In contrast to alternative A, these three alternatives provide updated desired conditions and other plan components for three types of piñon-juniper vegetation. These types differ from each other in terms of species composition and fire regime.

The larger proposed treatment objective under these alternatives for Piñon-Juniper with Grass would lead to greater progress toward desired conditions than alternative A. Alternatives B, C, and D would move this PNVT closer to desired conditions after 15 years and would maintain a lower departure level than alternative A, after 50 years, by moving large and medium-sized tree states with open canopy conditions closer to reference conditions (FW-Veg-PJ-PJW-O-1). Seedlings, saplings, small, and very large trees in open canopy conditions would trend away as overall cover becomes more closed.

Improved Habitat: Table 89 shows the amount of habitat that is improved for the associated species as a consequence of plan objectives in alternatives B, C, and D. There would no improved habitat in Piñon-Juniper Woodland because there are no treatment objectives associated with PNVT. Some species occupy only a portion of their respective PNVTs. They would benefit from plan objectives if treatments occurred in their habitat, however, the amount of improvement is unknown because this would be a project level decision. These species are: Arizona phlox, Flagstaff beardtongue, Grand Canyon agave, Metcalfe's tick trefoil, Mt. Dellenbaugh sandwort, Rusby's milkwort, Tonto Basin agave, Verde Valley sage, basin bladderpod, black dropseed, creeping milkvetch, James rubberweed, Jones' spider flower, Jones' wild buckwheat, Mearn's lotus, Rothrock's hedge-nettle, silver milkvetch, skunk-top scurfpea, western mouse-tail, and Yavapai wild buckwheat. Habitat for Chiricahua leopard frog would improve if the habitat treatments occur near occupied sites.

Unlike alternative A, which split the piñon-juniper PNVTs among many management areas, alternatives B, C, and D would provide specific guidance, including desired conditions, objectives, and guidelines, for managing each of the piñon-juniper forestwide. Alternatives B, C, and D better provide for the viability of the associated species and would be somewhat less restrictive than alternative A in terms of vegetation management by focusing more on the desired conditions rather than prescribing how to achieve them (table 90).

Table 89. Acres of improved habitat for species associated with Piñon-Juniper Evergreen Shrub and Piñon-Juniper with Grass

Species	Piñon-Juniper Evergreen Shrub Improvement (3,750 Acres Naturally Ignited Fires)	Piñon-Juniper with Grass Improvement (1,000 to 10,000 Acres Mechanical Treatment, 3,750 Acres Naturally Ignited Fire)
Reticulate Gila monster, piñon jay	X	X
Black-footed ferret, Merriam's shrew, western burrowing owl, Gunnison's prairie dog		X

Table 90. Plan components under alternatives B, C, and D that provide for species viability in the Piñon-Juniper PNVTs

Location Code in Proposed Revised Plan	Intent of Plan Components	Benefiting Species
FW-Veg-PJ-All-DC-1 through 6	Piñon-juniper types have a mosaic of trees and open areas that provide wildlife habitat, contribute to functional soils, and are resilient to natural disturbances and climate change, large snags and old trees with dead limbs and tops are persistent and scattered across the landscape.	All associated species
FW-Veg-PJ-All-G-2, 3	Grassland soil inclusions (also called mollisol soils) with tree encroachment within the piñon-juniper types should be restored to grassland desired conditions. Use proposed, slash treatments (e.g., lop and scatter and mastication) to improve herbaceous vegetation growth, soil and watershed condition, and soil productivity in areas with poor understory.	All associated species
FW-Veg-PJ-PJG-DC-1, 2, 3; FW-Veg-PJ-PJG-O –1 and 2	Piñon-Juniper with Grass is generally uneven-aged and open in appearance; vegetation supports the natural fire regime and provides food and cover for wildlife. Old-growth components (old trees, dead trees, and downed wood) are present and shift across the landscape over time. Mechanically treat between 1,000 and 10,000 acres of Piñon-Juniper with Grass; use naturally ignited fires (i.e., lightning-caused fires) to treat 3,750 acres with low to mixed severity fire satisfactory conditions.	Black-footed ferret, western burrowing owl, piñon jay, Gunnison's prairie dog, Merriam's shrew, Navajo Mogollon vole, Arizona phlox, black dropseed, Jones' wild buckwheat, Yavapai wild buckwheat
FW-Veg-PJ-PJES-DC-1, 2, 3; FW-Veg-PJ-PJES-O -1	Piñon-Juniper Evergreen Shrub is a mix of trees and shrubs that occurs as a series of vegetation states that move over time from herbaceous-dominated to shrub-dominated to tree-dominated. Soil stability and productivity is maintained. Old-growth components are present and shift across the landscape over time. Vegetation is resilient to natural disturbance and climate. Using naturally ignited fires (i.e., lightning-caused fires), treat 3,750 acres with low to mixed severity fire during the 10 years following plan approval.	Piñon jay, reticulate Gila monster, Flagstaff beardtongue, Grand Canyon agave, Metcalfe's tick trefoil, Mt. Dellenbaugh sandwort, Rusby's milkwort, Tonto Basin agave, Verde Valley sage, Basin bladderpod, black dropseed, creeping milkvetch, James rubberweed, Jones' spider flower, Mearns lotus, Rothrock hedge-nettle, silver milkvetch, skunk-top scurfpea, western mouse-tail
FW-Veg-PJ-PJW-DC-1, 2, 3	Piñon-Juniper Woodlands (or Persistent Piñon Juniper) is characterized by even-aged patches of piñons and junipers that at the landscape level form multiaged woodlands. Old-growth components are present; vegetation is resilent to disturbance over time.	Navajo Mogollon vole, piñon jay

Even though alternatives B and C recommend over 3,000 acres of Piñon-Juniper with Grass PNVT as wilderness, decisions concerning fire suppression of natural ignitions would not differ

between alternatives B, C, and D due to general inaccessibility of these areas or the nature of their vegetative structure. As a result, the effects of the recommended wilderness would be insignificant, the fire departure and trend under alternative C is the same as alternatives B and D.

Alternative B

Alternative B does not have language that restricts burning in wilderness as in alternative A; thus, plan language would not inhibit using wildfire with resource objectives. There is a low likelihood that mechanical vegetative treatments would be conducted due to expense and limited access. Wilderness recommendations for alternative B would not affect the departure and trend of piñon-juniper PNVTs. For Piñon-Juniper with Grass PNVT, 3,648 acres (1.4 percent of the PNVT) lie within the Strawberry Crater recommended wilderness. The recommendation of wilderness would have a low likelihood that wildfires would be suppressed and, therefore, could be managed for resource objectives. The risk of uncharacteristic fire could be slightly higher due to the limited ability to conduct vegetative treatments, and this could be offset to an unknown extent by wildfires.

Piñon-Juniper Evergreen Shrub PNVT has over 4,000 acres of recommended wilderness in alternative B. Most of this acreage occurs in Walker Mountain recommend wilderness; its recommendation has a high likelihood of wildfires being suppressed which means this localized area would tend to have higher canopy, tree and shrub cover, and risk of uncharacteristic fire than areas outside of the recommended wilderness. The threat of uncharacteristic fire within the Walker Mountain recommended wilderness would not be addressed as well as under alternatives A and D. However, this accounts for only about 1.5 percent of the PNVT and would, therefore, not affect departure and trend toward desired conditions at the PNVT scale. For Piñon-Juniper Woodland (Persistent), about 2,148 acres (2.8 percent of the PNVT) are included in recommended wildernesses. About 1,483 acres (1.9 percent of the PNVT) would have a low likelihood that wildfires would be suppressed in the Strawberry Crater and Davey's recommended wilderness areas, and these could be managed for resource objectives. Less than 1 percent of the PNVT (665 acres) in Walker Mountain recommended wilderness would have a high likelihood of being suppressed. Combined with the low likelihood of mechanical treatments, this localized portion of the PNVT could have older age classes of vegetation and higher canopy cover than areas outside of wilderness. The risk of uncharacteristic fire would not be expected to change because high severity fire is characteristic.

Alternative C

Alternative C does not have language that would restrict burning in wilderness like alternative A; thus, plan language would not inhibit using wildfire with resource objectives. There would be a low likelihood that mechanical vegetative treatments would be conducted due to expense and limited access. For the Piñon-Juniper with Grass PNVT, the effects of wilderness recommendation would be the same as alternative B.

For Piñon-Juniper Evergreen Shrub, which is anticipated to remain moderately departed and continue to move away from desired conditions, alternative C would result in a slightly more departed landscape than alternatives A, B, and D. About 50,635 acres (18.6 percent of the PNVT) would be in recommended wildernesses. Of this, 24,150 acres (9.1 percent of the PNVT) would have a moderate to high likelihood that wildfires would be suppressed. Combined with the low likelihood of mechanical treatments, these localized portions of the PNVT could have older age classes of vegetation, higher canopy cover, less understory, and a higher risk of uncharacteristic

fire than areas outside of wilderness. The remaining 26, 488 acres (10 percent of the PNVT) would have a low likelihood that wildfires would be suppressed; thus, wildfires could be managed for resource objectives and help move the PNVT toward desired conditions.

For Piñon-Juniper Woodland (Persistent), about 13,665 acres (18 percent of the PNVT) are included in recommended wildernesses. About 9,670 acres (12.8 percent of the PNVT) would have a low likelihood that wildfires would be suppressed and would these could be managed for resource objectives. Wildfires in about 5.2 percent of the PNVT (3,995 acres) would have a high likelihood of being suppressed. Combined with the low likelihood of mechanical treatments, these localized portions of the PNVT could have older age classes of vegetation and higher canopy cover than areas outside of wilderness. The risk of uncharacteristic fire would not be expected to change because high severity fire is characteristic. See Ponderosa Pine in the "Vegetation and Fire" section for more discussion about how wilderness and likelihood of fire suppression was evaluated.

Old-Growth Attributes, Large Trees, Snags, and Coarse Woody Debris

Alternative A

In the 1987 plan, piñon-juniper old growth is managed as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area (new p. 70-1, par 1). This standard is applied on a 10,000-acre block basis rather than a project basis. Ten-thousand-acre blocks are an outdated concept. Plan direction and a table under forestwide direction describes minimum levels for old-growth attributes such as large trees, snags, and logs scales (new p. 70-1; par 5; replacement p. 118, no. 1; replacement p. 127, par 4; replacement p. 151, par 5; p. 152, par 1; replacement p. 157, par 5). This plan direction would support the development and maintenance of old growth forest components, although some areas may tend toward even-aged structure, rather than the desired uneven-aged structure. This table does not account for the differences in fire regimes and, therefore, vegetative structure between the piñon-juniper PNVT types. Accounting for canopy and rooting zones and natural between-group interspaces, this minimum level of trees would provide less ability than alternatives B and D to promote vertical structure and age class diversity because the available growing space is occupied by the minimum required trees. This density of trees would tend to maintain a more continuous canopy than alternatives B and D and would be more conducive to crown fire. Consequently, alternative A would result in more closed canopy, even-aged conditions than alternatives B and D. This structure and age class diversity does not reflect frequent low-severity fires that are characteristic of these PNVTs. There would be fewer openings and less understory.

Compared to alternative B and D, old-growth stands in Piñon-Juniper with Grass PNVT are at higher risk for uncharacteristic fire, and when they do burn, there would likely be more area in mixed severity with 25 percent to 75 percent loss of dominant overstory, compared to loss of 25 percent or less which is characteristic of low-severity fires. Fires would tend to burn from tree to tree instead of from grass to tree. Old-growth stands would be less resilient to endemic levels of disturbances. Old-growth stands in Piñon-Juniper Evergreen Shrub would tend to burn a higher proportion of the area at the high end of mixed severity fire. There would likely be little additional risk in Piñon-Juniper Woodland (Persistent) because it characteristically burns at high severity.

Alternative C is similar to alternative A. In the piñon-juniper vegetation types, direction from the 1987 plan also identifies slopes greater than 15 percent as having the majority of old growth. It

also would limit mechanical treatment of piñon-juniper PNVTs to slopes of 15 percent or less only. This would limit treatments on steeper slopes that could be designed to adjust composition and structure and improve ecosystem function and resilience to disturbance.

Overall, alternative A makes less progress toward creation of very large tree states and overall uneven-aged (desired) conditions than alternatives B, C, and D because fewer acres would be treated. Under alternative A, Piñon-Juniper with Grass PNVT modeling demonstrated that after 15 years, the total area occupied by medium and very large tree states would remain static at about 37 percent and then declines to about 32 percent. However, the level of departure for this PNVT would drop from near high to moderate as cover is reduced, growth is increased, and stand structure becomes more uneven-aged.

In alternative A, plan direction would emphasize the retention and protection of snags, a key habitat component for many wildlife species. The 1987 plan provides direction that snags would be protected from prescribed fire, would not be available for firewood, and would be retained on the landscape unless specific thresholds are exceeded (new p. 65-2, nos. 2, 7, 9; new p. 65-3, no. 2; new p. 65-5, par 5 & no. 1; new p. 65-7, par 4; p. 95, par 8; replacement p. 126, nos. 4-7; replacement p. 127, nos. 1-3). Additionally, the plan has guidance to educate the public about the utility of snags to wildlife, primarily during the timeframe before firewood permits are issued (replacement p. 127, par 3). To better provide for wildlife, this alternative dictates that where possible, snags would be located more densely in areas adjacent to meadows, riparian areas, and key water sources (new p. 70-3, par 1).

The 1987 plan specifies snag sizes and distributions for Piñon-Juniper. In areas with slopes less than 40 percent (MA-7) standards and guidelines specify at least 100 snags/100 acres greater than 9 inches diameter at root collar and 10 feet or greater in height in old growth and in 10,000-acre blocks. There are also specific standards and guidelines focused on maintaining snag distributions as a function of wildlife habitat: “Manage for at least an average of 1 snag per acre on 40 percent of the Piñon-Juniper Woodland acres in each 10K Block. Snags are at least 9-inch diameter at root collar and at least 10 feet high (p. 152-153, par 1). In areas with slopes greater that 40 percent (MA-8) most of the area is old growth because it has not been cut and fire has been excluded. The specifications for snag guidance are the same as for MA 7.

Alternative A would provide for coarse wood debris consistent with the needs for associated wildlife. In addition to general forestwide plan direction, guidance for coarse woody debris is provided for specific wildlife habitats and management areas such as: in the piñon-juniper management areas 7 and 8, there should be a minimum of 2 logs per acre of downed woody material at least 9 inches in diameter and 10 feet long (p. 152, no. 3; replacement p. 157, no. 3) in old growth.

For the Oak Creek Canyon and the Sedona/Oak Creek ecosystem-wide management areas: retain dead and down woody materials, such as logs, limbs, and flood debris, in riparian communities for prey base habitat (replacement p. 185, par 4).

In addition, alternative A states that snags and downed logs important to wildlife should be identified and protected during prescribed burning (p. 95, par 8).

Alternatives B, C, and D

In Piñon-Juniper with Grass, modeling based on plan objectives shows that alternatives B, C, and D would increase the amount of old growth in this PNVT by approximately 5 percent more than alternative A. In Piñon-Juniper Evergreen Shrub and Piñon-Juniper Woodland PNVTs, old growth and large tree retention are expected to remain static or increase in the absence of major disturbances. Plan objectives that relate to using naturally occurring fires in Piñon-Juniper Evergreen Shrub would not be expected to alter the amount of old growth or large trees but could protect these characteristics from uncharacteristic fire.

Language in alternatives B, C, and D would provide for a landscape that is a functioning ecosystem, containing snags in quantities sufficient to provide habitat for associated wildlife (FW-Veg-All-DC-16; FW-WFP-DC-9). Alternatives B, C, and D provide definitions of snag size and distribution for the piñon-juniper PNVTs. Snags within these vegetative types would be scattered across the landscape and included as an old-growth component. Alternatives B, C, and D have general desired conditions for old growth and associated habitat components (e.g., coarse woody debris, large trees, snags). Plan components ensure snags would be scattered across the landscape over time. This would provide a variety of size and condition classes for various wildlife species (FW-Veg-PJ-All-DC-2; FW-Veg-PJ-PJG-DC-2; FW-Veg-PJ-PJES-DC-2; FW-Veg-PJ-PJW-DC-2).

Alternatives B, C, and D would also provide for coarse woody debris consistent with the needs of associated wildlife. In comparison with alternative A, these alternatives have more detailed desired conditions for a wider variety of habitat quality and consequently may support more species needs than alternative A. Forestwide desired conditions in alternatives B, C, and D would provide for coarse woody debris across the landscape (FW-Veg-All-DC-2); however, levels of coarse woody debris levels could be lower in wildland-urban interface areas than in other areas to reduce the risk of wildfires (Veg-All-DC-11, Veg-All-G-1). Within the piñon-juniper PNVTs, coarse woody debris would be maintained as a component part of functioning ecosystem and would provide vegetative and wildlife habitat (FW-Veg-PJ-All-DC-6). As an old growth forest component, downed wood would occur throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth (FW-Veg-PJ-PJG-DC-2; FW-Veg-PJ-PJES-DC-2; FW-Veg-PJ-PJW-DC-2).

Specifically, desired conditions for the piñon-juniper types would provide for coarse woody debris sufficient to resist accelerated soil erosion and promote nutrient cycling, water retention, and the microclimate conditions necessary for piñon seed germination (FW-Veg-PJ-All-DC-4). In addition, desired conditions state vegetative ground cover is present and sufficient to maintain soil stability and soil productivity (FW-Veg-PJ-PJG-DC-1).

Alternatives B and D

Plan components under alternatives B and D would promote old-growth components throughout the landscape within an uneven-aged matrix of tree groups and individual components (FW-Veg-PJ-PJG-DC-2; FW-Veg-PJ-PJES-DC-1, 2) rather than just on 20 percent, and would be more consistent with desired conditions than alternative A. Old growth would not be distributed primarily on 15 percent or greater slopes but would be distributed throughout the PNVTs. Old growth would have greater resiliency to changing conditions and characteristic disturbances and reflect the characteristic fire regime.

Alternative C

Alternative C would retain some of the language from the 1987 plan, in particular old-growth management (see appendix F). Plan components would manage old growth in 100- to 300-acre stands over 20 percent of the landscape following the minimum attribute table in forestwide direction in alternative A and would have similar effects. In the 80 percent area outside of these old-growth stands, management would largely follow the plan components for desired conditions in alternatives B and D and would have similar effects. Twenty percent of the landscape managed in old-growth stands would have a higher likelihood of uncharacteristic fire in Piñon-Juniper with Grass and Piñon-Juniper Evergreen Shrub PNVTs similar to alternative A. The 80 percent would be more resilient and have a greater likelihood of characteristic fire.

In contrast to alternative A, old growth that can be provided and maintained would be evaluated at the 6th level HUC rather than the 10,000-acre block basis. This would not result in any differences in the quality or distribution of old growth between these two alternatives; however, 6th level HUCs are a more ecologically based feature on the ground compared to 10,000-acre blocks. Alternatives B and D do not specify at what level old growth would be evaluated.

Alternative C also would have a guideline for 20 percent of the area within a 1,320-foot zone adjacent to pine stringers to be managed for dense mature or overmature stands of piñon-juniper. This would be compatible with desired vegetative states in Piñon-Juniper with Grass and Piñon-Juniper Woodland (Persistent) PNVTs but not with Piñon-Juniper Evergreen Shrub which has more open conditions in medium to very large vegetative states with closed canopy. The proximity of dense vegetation adjacent to pine stringers (which are valuable as movement corridors and the diversity they provide) could enhance habitat quality for species that favor dense vegetation for movement and for big game cover. This proximity could also increase the risk of uncharacteristic fire to the pine stringer by having a half-mile swath of dense vegetation adjacent to it. Alternative A has similar language and effects (p. 152, par. 2, bullet 5). Alternatives B and D have desired conditions that promote the persistence of pine stringers into piñon and juniper (FW-Veg-PJ-All-DC-3) but do not describe the condition of the adjacent vegetation, allowing for more flexibility at the site specific level.

Uncharacteristic Fire

Alternative A

Alternative A does not have forestwide desired conditions or objectives that specify restoration of natural fire regimes to address the threat of uncharacteristic fire, except in certain management areas. Forestwide activities to decrease the risk of uncharacteristic fire would follow national policy under this alternative. Even when fire restoration is specifically addressed in a management area under alternative A, suppression objectives and guidelines may limit the Agency's ability to implement practices that would allow those desired conditions to be reached.

Although overall direction for wilderness supports fire playing a natural role on the landscape, guidelines that direct managers to suppress fires under several circumstances set a band of opportunity that is so narrow as to essentially prevent the use of wildfires with resource objectives (pp. 93–95; p. 95, par 9; p. 111, par 8, 9; p. 112 in its entirety). As a result of this contradictory direction, fire has not been allowed to play its natural role in wilderness, and departure from desired conditions has increased along with the risk of uncharacteristic fire under alternative A. These trends would be expected to continue and would result in increased risk of uncharacteristic fire to riparian areas in and around existing wilderness.

Low fire suppression objectives and guidelines in alternative A that restrict managing wildfires with resource objectives in wildland-urban interface would further increase departure in these areas from desired conditions (p.147, par 9; p.155, par 5; replacement p.157, par 7; replacement p.161, par 2; replacement p. 165, par 5). Approximately 26 percent of the fire-adapted PNVTs would be restricted from managing wildfires with resource objectives because they are located in the wildland-urban interface.

Although alternative A would follow national agency fire policy and have guidance related to fire, management, it would offer the least opportunity relative to other alternatives to implementing treatments to reduce the risk of uncharacteristic fire, because it has constraints on utilizing wildfires to meet resource objectives and a general lack of emphasis on the ecological need of frequent fire. Alternative A explicitly prohibits wildfires to meet resource objectives in the wildland-urban interface. As a result, parts of the forest could be managed to allow fire to maintain ecosystems which other areas of the forest would remain susceptible to uncharacteristic fire.

Alternative B, C, and D

While predicted fire departure and trends do not differ substantially between all alternatives, alternatives B, C, and D differs substantially from alternative A with respect to management direction and flexibility to use wildfire with resource objectives. Desired conditions in alternatives B, C, and D would reduce the threat of uncharacteristic wildfires to all ecosystems, including forest and woodland PNVTs (FW-Veg-All-DC-2, 11; FW-Veg-PJ-PJW-DC-3). Objectives for these PNVTs (FW-Veg-PJ-PJG-O-1, 2; FW-Veg-PJ-PJES-O-1) and would also decrease the risk of uncharacteristic fire within and adjacent to these PNVTs. See table 42 for piñon- juniper associated species that would benefit from these plan components.

Under alternatives B, C, and D, there would also be no restriction on where wildfires with resource objectives can be managed, and so the portions of fire-adapted ecosystems in wilderness and wildland-urban interface would be able to use wildfires more effectively (SA-Wild-All-DC-9, FW-Fire-DC-1-3). It is unknown how many acres would be treated in this manner under the plan because of the unpredictability of where the lightning-caused ignitions will occur and under what conditions. In all cases, these fires would help move terrestrial vegetation toward desired conditions and would reduce the risk of uncharacteristic fire across the landscape which, in turn, would reduce the risk of uncharacteristic fire to adjacent riparian PNVTs.

Alternatives B, C, and D provide plan components that both (1) restore habitats that are currently departed to reduce the risk of uncharacteristic fire and (2) allow increased flexibility to allow fire to be managed on the landscape in a way that more closely mimics its natural role by not putting constraints on the use of prescribed fire and wildfires with resource objectives. As a result, fire-adapted PNVTs would be managed in a manner more consistent with their desired conditions on a landscape scale and would not have constraints to moving toward fire return intervals and conditions that support the appropriate fire intensity and postfire conditions that result in higher quality habitat for associated species.

Summary of Species Effects

Considering the coarse filter analysis, plan components in all alternatives maintain the viability and do not cause a trend toward listing for: Black-footed ferret, western burrowing owl, Merriam's Shrew, Navajo Mogollon Vole, reticulate Gila monster, Grand Canyon Agave,

Flagstaff beardtongue, Metcalfe's tick trefoil, Mt. Dellenbaugh Sandwort, Rusby's milkwort, Tonto Basin agave, Verde Valley sage; piñon jay, Gunnison's prairie dog, Arizona phlox, Basin bladderpod, black dropseed, creeping milkvetch, James rubberweed, Jones' spider flower, Jones' wild buckwheat, Rothrock hedge-nettle, silver milkvetch, skunk-top scurfpea, western mouse-tail, Mearns lotus, and Yavapai wild buckwheat.

From the landscape perspective, the likelihood of species being limited by their habitat ranges from low to high depending on the PNVT type with which they are associated. For PJES, there are 12 species with a medium high likelihood of being limited by their habitat, and 8 species with a medium low risk. For Piñon-Juniper with Grass, there are two species with a medium to high likelihood and five with a medium to low. Piñon-Juniper Woodland had two species with a low likelihood and one with a medium likelihood of being limited by their habitat. This PNVT has been primarily affected by a legacy of past management including off-highway vehicles and livestock grazing from which it is slowly recovering, however, the threat of invasive plants causes it to have a trend away from reference conditions. All alternatives incorporate plan direction for invasive plants and maintain the Verde Valley Botanical Area, which provides additional protection to rare and endemic plant populations, as well as to reticulate Gila monster. In addition, the PNVT is slowly recovering from legacy impacts from off-road driving and past livestock grazing.

Alternatives B, C, and D better address threats from different types of recreation and provide updated plan components that better balance biotic, physical, and social factors than alternative A. Plants in the Verde Valley Botanical Area are most protected by alternatives B and C which does not allow mechanized dispersed recreation, then by alternatives B and D which allow mechanized use on designated trails. Rare and endemic plants in the Verde Valley Botanical Area are least protected by alternative A which has no restrictions on mechanized use in this special area.

Course Filter Viability Summary

For the 27 species associated with Piñon-Juniper Woodland PNVT, all threats are adequately addressed by the coarse filter. Their viability is upheld in this PNVT because plan components maintain or improve the structure, composition, and processes within the authority of the Forest Service to do so. For Piñon-Juniper Evergreen Shrub and Piñon-Juniper with Grass, treatment objectives in alternatives B, C, and D address the need for the return of fire to prevent tree encroachment and restore understory conditions that support the spread of fire at intensities closer to reference conditions. Implementation of these objectives and removal of restrictions on use of wildfires in wildland-urban interface and wilderness would also reduce the risk of uncharacteristic fire on the landscape. As a result, species that persist in this PNVT currently would see improved habitat quality and, therefore, these alternatives would adequately provide for their viability.

All Forest PNVTs

Coarse Filter

Forest PNVTs include Ponderosa Pine, Mixed Conifer with Frequent Fire, Mixed Conifer with Aspen, and Spruce-Fir.

Affected Environment

Amount and Distribution: Ponderosa Pine is the largest PNVT on the forest covering approximately 807,424 acres (or approximately 48 percent) of the forest. There are two subtypes: Ponderosa Pine/Gambel oak and Ponderosa Pine Bunchgrass. There is typically an understory of grasses, forbs, and sometimes shrubs.

Mixed Conifer with Frequent Fire PNVT (also called Dry Mixed Conifer) covers approximately 79,060 acres (4.3 percent of the forest) and is located between lower elevation Ponderosa Pine and Mixed Conifer with Aspen PNVTs and the higher elevation Spruce-Fir PNVT. It is dominated by mainly shade-intolerant trees such as ponderosa pine with a lesser presence of species more tolerant of shade such as white fir and Douglas-fir. Aspen may occur as single trees or small groups. Maple is generally found in wetter sites, canyons, and draws. The understory consists of various grasses, forbs, and shrubs.

The Mixed Conifer with Aspen PNVT (also called Wet or Infrequent-Fire Mixed Conifer) covers approximately 37,083 acres (2 percent of the forest) and occurs on mountain slopes such as the San Francisco Peaks and may also occur in canyons and north-facing slopes such as on Hutch Mountain and Mormon Mountain. About one-sixth of the PNVT is within the Kachina Peaks Wilderness. Dominant and codominant species include Douglas-fir, southwestern white pine, and limber pine and late seral species such as maple, white fir, and blue spruce. The diverse understory consists of native herbaceous and shrub species.

Spruce-Fir PNVT covers approximately 13,946 acres (less than 1 percent of the forest) and is primarily located within the Kachina Peaks Wilderness. The remainder is within the permit area for the Snowbowl Ski Area and Inner Basin, which is a designated municipal watershed. It represents some of the coldest, wettest, and highest elevation sites on the forest. It is dominated by Engelmann spruce and can contain a variety of understory species depending on the elevation.

Habitat Quality: Current conditions within Ponderosa Pine differ from desired conditions in that the amount of cover is higher, trees are denser and more continuous, fuel loads are higher, and there are more even-aged stands of trees exist due to the exclusion of fire. The departure in this PNVT is high and trending away from reference conditions (table 91). Open canopy stands are extremely deficit although in some areas, Ponderosa Pine occurs as savannah with extensive grasslands interspersed between widely spaced clumps or individual trees. There is more even-aged structure than desired. Stands growing under these conditions are less resilient and sustainable over time, because they are under greater competitive stress and are more susceptible to threats including: uncharacteristic wildfire; invasive plant species; and widespread infestations of disease. Another consequence of fire exclusion and the interruption of the frequent fire regime is the decline in understory species diversity and abundance which exists because tree density is higher and less sunlight reaches the forest floor. Secondary threats include uncharacteristically intense wildfire and increased susceptibility to insect and disease from increased plant competition for water during times of drought.

Current conditions in Mixed Conifer with Frequent Fire and Mixed Conifer with Aspen are moderately departed and trending away from desired conditions (table 91). In both PNVTs, closed canopy conditions are greater than desired conditions and as a result, shade-tolerant species, such as white fir, are increasing in the understory. Consequently, tree density is high in most places, and conditions for fire tolerant early succession species are not being maintained or created. The current fire frequency is far outside the historic range of variability and is trending

away due to fire exclusion. Aspen populations are declining in these PNVTs due to insect defoliators, drought, and heavy ungulate browsing.

The Spruce-Fir PNVT is moderately departed from desired conditions because past wildfires have increased the proportion of early successional stands (table 91). The trend for this PNVT is unknown because it is mostly in a designated wilderness and other areas with restricted potential for vegetation management. Therefore, its movement toward desired conditions is largely unrelated to management actions and dependent on climate, disturbance and other naturally occurring processes. There is a surplus of younger age classes and fewer old age classes due to extensive wildfires that occurred in the early 1900s.

Table 91. Condition and trend of Forest PNVTs

PNVT	Vegetation Departure (Percent), Trend	Soil Condition Departure, Trend (Percent Unsatisfactory, Impaired)	Threats
Ponderosa pine	High (79%), away	Low, static (1%)	Uncharacteristic fire, Invasive plants
Mixed Conifer with Frequent Fire	Moderate (64%), away	Low, static (0%)	Uncharacteristic fire
Mixed Conifer with Aspen	Moderate (62%), away	Low, static (0%)	Uncharacteristic fire
Spruce-Fir	Moderate (49%), unknown	Low, static (0%)	Uncharacteristic fire, invasive animals

Old-Growth Attributes: Currently, it is estimated that at least 20 percent or more of the forested PNVTs on the forest have older structural stages and old-growth attributes, like coarse woody debris snags. Under the current plan, this approach manages Ponderosa Pine and Mixed Conifer stands (mid-scale) primarily for large trees, high stocking levels (70 to 100 square feet of basal area per acre), and high canopy cover (50 to 60 percent), which tend to promote even-aged structure, which is contrary to desired conditions. Current science, however, points to old growth in frequent, low-severity fire regimes as being characterized by uneven-aged structure comprised of groups of trees and single trees interspersed in open grass-forb-shrub interspaces where old growth tree components typically occur at the fine scale and structural features of old growth are distributed throughout the uneven-aged forest. In addition to operable forested areas that are actively managed for desired conditions, areas designated as wilderness, as well as areas outside of wilderness with slopes greater than 40 percent may also be assumed to qualify as having existing or developing old growth forest components for forested PNVTs because these areas have evolved naturally, except for fire exclusion.

There are currently more than 88,638 acres of forest that occur in wilderness or on slopes greater than 40 percent that have not had any timber harvesting activity (table 92).

Table 92. Acres of Forest PNVTs that occur in wilderness or on slopes greater than 40 percent

PNVT	Acres
Mixed Conifer with Aspen	13,352
Mixed Conifer with Frequent Fire	7,595
Ponderosa Pine	55,841
Spruce-Fir Forest	11,850
Grand Total	88,638

Snags: Table 93 shows that the existing number of snags, as based on Forest Inventory Assessment data, in Mixed Conifer with Frequent Fire and Ponderosa Pine PNVT in the 18 inches d.b.h. size class meet or exceed desired conditions. Comparisons cannot be made for Mixed Conifer with Aspen and Spruce-Fir PNVTs or the different snag requirement subsets because PNVT-wide or subset existing condition data is lacking.

Table 93. Existing snags per acre by potential natural vegetation type

PNVT	Size of Snags (d.b.h.)	Existing Snags
Ponderosa Pine	8 to 12 inches	2.8
	12 to 18 inches	1.2
	18+ inches	1.3
Mixed Conifer with Frequent Fire	8 to 12 inches	8.0
	12 to 18 inches	4.5
	18+ inches	3.3

Coarse Woody Debris: Coarse woody debris is woody material on the ground greater than 3 inches in diameter and includes downed logs. It is found throughout the landscape and is a specific attribute of late seral portion of the landscape. It is critical for nutrient cycling and maintaining a productive forest. It is used by small mammals, reptiles, and invertebrates for habitat, and these species in turn are prey for a variety of species including raptors like northern goshawks, golden eagles, and Mexican spotted owls.

Risk Factors: The primary risk factor is to these PNVTs is uncharacteristic fire. Ponderosa pine has an additional risk factor of invasive plants and Spruce-Fir PNVT is additionally threatened by an introduced insect called the exotic spruce aphid. These threats are described in detail below.

Uncharacteristic Fire: In fire-adapted PNVTs, vegetative conditions and fire ecology are interrelated because of the coevolution of these habitat characteristics. When vegetation and fire regimes are highly departed from desired conditions, uncharacteristically severe fires could occur. Uncharacteristic fire refers to fires that burn at a severity or frequency outside its natural range. It is primarily a consequence of missed fire return intervals in fire adapted PNVTs. Missed fire

return intervals can result in higher proportions of trees and closed canopy forest structure than occurred during reference conditions, as well as larger and more severe fires that have negative consequences to soils, watersheds, and aquatic habitats.

In Spruce-Fir and Mixed Conifer with Aspen PNVTs, fire exclusion has resulted in increased tree density and shifts in species composition to more shade-tolerant species, increased fuel loading and continuity. In Mixed Conifer with Frequent Fire and Ponderosa Pine PNVTs, the resulting shifts in tree density and structure has reduced understory species cover and diversity which can impact food sources and cover for wildlife species such as Long-tailed vole, Merriam's shrew, Navajo Mogollon vole, and Alberta arctic. Mixed Conifer with Frequent Fire and Ponderosa Pine also are experiencing increased fuel loading and more continuous fuels that would facilitate higher intensity fires than would have naturally occurred. The increasing fuel loads associated with tree cover, on the other hand, would contribute to increased risk of uncharacteristic fire effects which could threaten retention of large trees.

Invasive Plants (Ponderosa Pine): The Ponderosa Pine PNVT is highly departed from reference conditions, partially because thousands of acres are infested with invasive plants that are dispersed throughout the PNVT and some of these species, such as leafy spurge and three varieties of knapweed, are highly invasive. These invasive plants compete with native plants and populate the seed bank with nonnative seeds, reducing the food and cover supplied by native species. Invasive plants have the potential to reduce native species biodiversity, can alter fire regimes, reduce available forage, and can increase erosion in localized areas.

Invasive Animals (Spruce-Fir): The Spruce-Fir PNVT is potentially at risk from the exotic spruce aphid which damages Engelmann spruce and Colorado blue spruce of all size classes. The number of acres of the Spruce-Fir PNVT on the forest that is affected by spruce aphid is unknown. In the White Mountains of Arizona, however, spruce aphids have killed 25 to 40 percent of severely damaged Englemann spruce after a single defoliation episode. The likelihood of mortality after spruce aphid feeding is increased by the severity of the pre-existing spruce dwarf mistletoe infection (USDA Forest Service 2009).

Associated Species: There are a total of 47 species associated with these habitats (table 42, Table 43, and table 44). These species are:

- One is a federally listed species: Mexican spotted owl (threatened);
- Fifteen are Forest Service sensitive species: northern goshawk, long-tailed vole, Merriam's shrew, Navajo Mogollon vole, western red bat, Allen's lappet browed bat, bald eagle, dwarf shrew, Flagstaff pennyroyal, hairy clematis, Sunset Crater beardtongue, Arizona sneezeweed, Flagstaff beardtongue, Rusby's milkvetch, and Mt. Dellenbaugh sandwort; and
- Thirty-one are other forest planning species: Alberta Arctic, Arizona phlox, aspen, bearded cinquefoil, black dropseed, bristlecone pine, Colorado blue columbine, common moonwort, corkbark fir, creeping milkvetch, graceful buttercup, Hall's milkweed, James rubberweed, Jones' wild buckwheat, Macdougal's aletes, reflected moonwort, Rothrock hedge-nettle, rough Whitlow-grass, Thurber's cinquefoil, timberland blue-eye-grass, western mouse-tail, Mearns lotus, Oak Creek triteleia, Serrate phacelia, McGillivray's warbler, golden-crowned kinglet, evening grosbeak, Swainson's thrush, three-toed woodpecker, golden eagle, and southwestern myotis.

Of these species, there are 40 species whose threats in these PNVTs are completely addressed at the habitat level (coarse filter). The seven species associated with these habitats that have additional species-specific (fine filter) threats are addressed in the fine filter section further below and are as follows:

- One federally listed species: Mexican spotted owl (threatened);
- Five are Forest Service sensitive species: bald eagle, northern goshawk, Flagstaff pennyroyal, hairy clematis, and Sunset Crater beardtongue; and
- One is another forest planning species: golden eagle.

Threats to Allen's lappet-browed bat and southwestern myotis in their cave habitat are discussed in the section on species not associated with PNVTs under Caves.

Environmental Consequences – All Forest PNVTs

Common to All Alternatives

Improved Habitat Quality: For Spruce-Fir and Mixed Conifer with Aspen, all alternatives lack treatment objectives, thus forest plan objectives would not result in changes in habitat quality for any species. Implementation of plan components other than objectives could result in improvements to habitat quality however amount of improvement would be unknown because this would be decided at the project level.

Existing or eligible wild and scenic river corridors contain habitat for plant species associated with forest and woodland PNVTs that would be maintained under all alternatives. Because eligible and designated wild and scenic river segments are managed to protect outstandingly remarkable values and low motorized use, there should be low net impact in these areas, although higher impacts could occur in segments with a recreational emphasis. Creeping milkvetch, Metcalf's tick trefoil, Basin bladderpod and Jones' spider flower are found in the eligible Oak Creek Wild and Scenic River (recreational) corridor, and Rough whitlow grass (var. asprella) is in the eligible West Fork of Oak Creek Wild and Scenic River (wild) corridor. Jones' spider flower is in the eligible Sycamore Creek Wild and Scenic River (wild) corridor. The eligible Barbershop Wild and Scenic River (wild) corridor contains occurrences of Timberland blue-eye grass. The eligible East Clear Creek Wild and Scenic River (scenic) corridor contains occurrences of black dropseed. Basin bladderpod is also in the designated Verde Wild and Scenic River. Because these segments have management that is protective in nature for outstandingly remarkable values which include riparian habitat, these plants would be protected as well by all alternatives and existing law, regulation, and policy (replacement p. 114, par 1; SA-WSR-Verde-DC-6; SA-WSR-Verde-S-1).

Environmental Consequences – Ponderosa Pine PNVT

Habitat Quality

Common to All Alternatives

From a fire standpoint, vegetative structure would trend toward desired conditions in all alternatives. Although the fire regime is highly departed, prescribed fire objectives would move fire return intervals slowly toward their characteristic frequency. This would improve the resiliency and lower the risk of ponderosa pine to uncharacteristic disturbances such as fire, insects, and disease.

Alternative A

Ponderosa Pine would trend toward desired conditions under alternative A, shift to more open canopy conditions over the long term, and increase uneven-aged multistoried stand structure particularly in medium and very large trees, but not as quickly as alternatives B, C, and D.

Improved Habitat Quality: Table 94 shows an estimated amount of improved habitat quality by species under alternative A. Some species occupy only a portion of their respective PNVTs. They would be benefit from plan objectives in ponderosa pine if treatments occurred in their habitat, however, the amount of improvement in unknown because this would be a project level decision. These species are: Jones' wild buckwheat, Mearn's lotus, Serrate phacelia, Flagstaff pennyroyal, hairy clematis, and Sunset Crater beardtongue. There would be no projected improvement for golden eagles because they are primarily cliff nesters and only occasionally nest in pine.

There would be projected increases in the amount of habitat for three mammals primarily due to increases in the proportion of open states for the small mammals. Based on a range of objectives, there would be between 13,801 and 14,115 acres improved for long-tailed voles; between 23,944 and 24,881 acres improved for Merriam's shrews; and between 31,104 and 32,041 acres improved for Navajo Mogollon voles.

Allen's lappet-browed bat uses large snags with exfoliating bark for roosting. Based on language in the 1987 plan, large snags would be distributed across the landscape and would tend to be more abundant in areas with a higher proportion of medium to very large trees. Based on modeling of Allen's lappet-browed bat habitat (Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen PNVTs), the proportion of the landscape occupied by medium to very large states (open, closed, even-aged, and uneven-aged) would be 529,842 acres, a 22 percent decrease compared to existing. Although there is substantial habitat (680,767 acres) under existing conditions, there is little recruitment of seedlings, saplings, and small trees. This would imply a future decline in or lack of large snags in this bat's habitat. Treatments under alternative A would result in an increase in seedlings, saplings, and some small trees in Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs. This would result in improved age class diversity and could reduce the impact of future declines in roosting habitat for this species.

There would be no changes in projected habitat from existing for other species.

Table 94. Acres of improved habitat quality for Ponderosa Pine PNVT associated species by alternative

Species	Alt. A Ponderosa Pine Improvement	Alts. B, C, and D Ponderosa Pine Improvement
Arizona phlox, bearded cinquefoil, black dropseed, creeping milkvetch, James rubberweed, Oak Creek triteleia, Rothrock's hedge-nettle, rough Whitlow-grass, Thurber's cinquefoil, timberland blue-eye grass, western mouse-tail, Arizona sneezeweed, Flagstaff beardtongue, Mt. Dellenbaugh sandwort, Rusby milkvetch	100,000 acres over 10 years of mechanical treatment, 150,000 acres prescribed fire over 10 years, and 135,000 acres treated with low severity fire over 10 years[1]	50,000 to 260,050 acres over 10 years of mechanical treatment, 150,000 to 300,000 acres prescribed fire over 10 years, and 135,000 acres treated with low severity fire over 10 years[1]

[1] Habitat improvement is overestimated because an unknown number of treatment acres will overlap each other.

Alternative A would provide mostly general desired conditions in regard to the composition, structure, and function of Ponderosa Pine compared to alternatives B, C, and D, but it is more prescriptive in terms of desired density and has direction to minimize natural disturbances in some management areas (p. 70, par 4; replacement p. 117, no. 1; replacement p. 122-1, par 1; replacement p. 127, no. 3; replacement p. 121, par 6; replacement p. 129, par 3; replacement p. 137, pars. 4, 6, 7; replacement p. 140, par 8). Although fire suppression is broadly addressed, restoration of ecosystems is not addressed as a critical element of forest management under this alternative. Constraints to managing wildfire for resource objectives in the wildland-urban interface and wilderness areas reduce fire treatment forestwide and result in areas with increased fire departure (p. 93, no. 6; p. 94, no. 3; replacement p. 137, par 6; replacement p. 140, par 8). Also, the lack of desired conditions regarding ecological function and standards and guidelines that unintentionally reduce fire treatment opportunities would inhibit the forest's ability to carry out fire restoration activities. Despite these restrictions, direction for Ponderosa Pine in alternative A is projected to shift to more open canopy conditions and increases in uneven-aged multistoried stand structure particularly in medium and very large trees. Fire departure would also move toward desired conditions, mirroring the shifts in stand structure. This means that fire return intervals are expected to shorten; and with improvement in vegetation structure, the risk of uncharacteristic fire would also decrease. Predicted fire severity would remain high and trend toward desired conditions.

In the 1987 plan, ponderosa pine old growth is managed as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area (new p. 70-1, par 1). This standard is applied on a 10,000-acre block basis rather than a project basis. Ten-thousand-acre blocks are an outdated concept. Plan direction and a table under forestwide direction describes minimum levels for old-growth attributes such as large trees, snags, and logs scales (new p. 70-1, par 5; replacement p. 118, no. 1; replacement p. 127, par 4; replacement p. 151, par 5; p. 152, par 1; replacement p. 157, par 5). This plan direction would support the development and maintenance of old growth forest components, although some areas may tend toward even-aged structure, rather than the desired uneven-aged structure. Accounting for canopy and rooting zones, and natural between-group interspaces, the minimum level of trees in the table would provide less ability than alternatives B and D to promote vertical structure and age class diversity because the available growing space is occupied by the minimum required trees. This density of trees would tend to maintain a more continuous canopy than B and D that would be more conducive to crown fire. Consequently, alternative A would result in more closed canopy, even-aged conditions than alternatives B and D. This structure and age class diversity is not reflective of frequent low severity fires characteristic of this PNVT. There would be fewer openings and less understory.

Compared to alternatives B and D, old-growth stands in Ponderosa Pine PNVT are at higher risk for uncharacteristic fire and when they do burn, there is likely to be more area in mixed severity with 25 percent to 75 percent loss of dominant overstory, compared to loss of 25 percent or less which is characteristic of low-severity fires. Fires would tend to burn from tree to tree instead of from grass to tree. Old-growth stands would be less resilient to endemic levels of disturbances.

Alternatives B, C, and D

Alternative B would be less prescriptive than alternative A in terms of desired conditions. The proposed treatment of additional acres (FW-Veg-PP-O- 1, 2, and 3) under alternative B would provide for closer achievement of desired conditions than alternative A, primarily resulting from more acres treated, conversion from even to uneven-aged structure, and additional dense, closed

canopy converted to open canopy conditions. Overall departure from desired conditions for open canopy conditions within this PNVT would decrease after 15 years, dropping an additional 7 percent beyond that predicted for alternative A. The level of departure would remain static after 50 years. The large disparity between closed and open canopy conditions would decrease more under alternative B compared to alternative A, and the amount of area with uneven-aged structure would start to occupy a large majority within medium and very large trees. Alternative B would put this PNVT on a trend toward desired conditions by improving stand structure, opening up the canopy, and reducing the overall departure. Understory vegetation is expected to respond favorably to treatment under alternatives B and D.

Improved and Projected Habitat: Table 94 shows an estimated amount of improved habitat by species under alternatives B, C, and D. Some species occupy only a portion of their respective PNVTs. They would be benefit from plan objectives in ponderosa pine if treatments occurred in their habitat, however, the amount of improvement is unknown because this would be a project level decision. These species are: Jones' wild buckwheat, Mearn's lotus, Serrate phacelia, Flagstaff pennyroyal, hairy clematis, and Sunset Crater beardtongue. There would be no projected improvement for golden eagles because they are primarily cliff nesters and only occasionally nest in pine. There would be projected increases in the amount of habitat for three mammals primarily due to increases in the proportion of open states for the small mammals. Based on modeling, there would be 7,841 acres improved for long-tailed voles over 15 years; between 23,944 and 24,881 acres improved for Merriam's shrews; and between 31,104 and 32,041 acres improved for Navajo Mogollon voles.

Allen's lappet-browed bat uses large snags with exfoliating bark for roosting. Based on language in the 1987 plan, large snags would be distributed across the landscape and would tend to be more abundant in areas with a higher proportion of medium to very large trees. Based on modeling of Allen's lappet-browed bat habitat (Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen PNVTs), the proportion of the landscape occupied by medium to very large states (open, closed, even-aged, and uneven-aged) would be 542,063 acres, a 20 percent decrease compared to existing. Although there is substantial habitat (680,767 acres) under existing conditions, there is little recruitment of seedlings, saplings, and small trees. This would imply a future decline in or lack of large snags in this bat's habitat. Treatments under alternatives B, C, and D would result in an increase in seedlings, saplings, and some small trees in Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs. This would result in improved age class diversity and could reduce the impact of future declines in roosting habitat for this species. Compared to A, these alternatives would result in higher proportions of the habitat in seedlings, saplings, and small trees (for roost recruitment) and would have a higher proportion of the habitat in medium to very large trees.

There would be no changes in projected habitat from existing for other species.

Alternatives B and D

Plan components under alternatives B and D would promote old-growth components throughout the landscape within an uneven-aged matrix of tree groups and individual components (FW-Veg-PJ-PJG-DC-2; FW-Veg-PJ-PJES-DC-1, 2) rather than just on 20 percent and would be more consistent with desired conditions than alternative A. Old growth would have greater resiliency to changing conditions and uncharacteristic disturbances and reflect the characteristic fire regime.

Alternative B

Alternative B does not have language that restricts burning in wilderness as in alternative A; thus, plan language would not inhibit managing wildfires with resource objectives. There is a low likelihood that mechanical vegetative treatments would be conducted in recommended wilderness due to expense and limited access. For Ponderosa Pine PNVT, there are only 29 acres (less than 1 percent of the PNVT) in the Strawberry Crater recommended wilderness. There is a low likelihood that wildfires would be suppressed; thus, wildfires could be managed for resource objectives which could help restore the characteristic fire return interval. Due to the probable lack of active management in these areas, canopy cover, tree density, and departure are probably higher than in some areas outside of recommended wilderness and there may be a higher proportion of late seral stages. This could be beneficial for species that prefer large trees and snags. The risk of uncharacteristic fire in this localized area would not increase because it is likely naturally limited by cinder soils. Wilderness recommendation in alternative B would not affect departure or trends of this PNVT at the landscape level due to the low extent.

Alternative C

Alternative C would retain some of the language from the 1987 plan, in particular old-growth management (see appendix F). Plan components would manage old growth in 100- to 300-acre stands over 20 percent of the landscape following the minimum attribute table in forestwide direction as in alternative A and would have similar effects. In the 80 percent area outside of these old-growth stands, management would largely follow the plan components for desired conditions in alternatives B and D and would have similar effects. Twenty percent of the landscape managed in old-growth stands would have a higher likelihood of uncharacteristic fire in Ponderosa Pine PNVT similar to alternative A. The 80 percent would be more resilient and have a greater likelihood of characteristic fire.

In contrast to alternative A, old growth that can be provided and maintained should be evaluated at the 6th code watershed level rather than the 10,000-acre block basis. This would not result in any differences in the quality or distribution of old growth between these two alternatives; however, 6th code watersheds are a more ecologically-based feature on the ground compared to 10,000-acre blocks. Alternatives B and D do not specify at what level old growth is evaluated.

Alternative C would do slightly less than alternative B to promote and maintain old growth components due to potential reductions in fire treatment from recommended wilderness designations. Alternative C incorporates similar plan language as alternative A for old growth and has similar consequences. The 100- to 300-acre old-growth stands would support more area in mixed severity fires than the frequent, low-severity surface fires that are more characteristic of this PNVT.

Alternative C also would have a guideline for 20 percent of the area within a 1,320-foot zone adjacent to pine stringers to be managed for dense mature or overmature stands of piñon juniper. The proximity of dense vegetation adjacent to pine stringers (which are valuable as movement corridors and the diversity they provide) could enhance habitat quality for species that favor dense vegetation for movement and for big game cover. This proximity could also increase the risk of uncharacteristic fire to the pine stringer by having a half-mile swath of dense vegetation adjacent to it. Alternative A has similar language and effects (p. 152, par 2, bullet 5). Alternatives B and D have desired conditions that promote the persistence of pine stringers into piñon and

juniper (FW-Veg-PJ-All-DC-3) but do not describe the condition of the adjacent vegetation, allowing for more flexibility at the site specific level.

Alternative C does not have language that restricts burning in wilderness as in alternative A; thus, plan language would not inhibit managing wildfires with resource objectives. There is a low likelihood that mechanical vegetative treatments would be conducted in recommended wilderness due to expense and limited access. For Ponderosa Pine PNVT, there are 4,470 acres (less than 1 percent of the PNVT) in 7 recommended wilderness areas: Abineau, Barbershop, East Clear Creek, Railroad Draw, Strawberry Crater, Tin Can, and Deadwood Draw. There is a low likelihood that wildfires would be suppressed in 3,394 of these acres; thus, wildfires could be managed for resource objectives which could help restore the characteristic fire return interval. Due to the probable lack of active management in these areas, canopy cover, tree density, and departure are probably higher than in some areas outside of recommended wilderness, and there may be a higher proportion of late seral stage conditions but this could be reduced using wildfire with resource objectives. This could be beneficial for species that prefer large trees and snags and late seral stages such as bears, Mexican spotted owls, northern goshawks, and primary cavity nesters like flickers. The risk of uncharacteristic fire in these localized areas could increase due to lack of vegetative treatments. There is a moderate to high likelihood that wildfires in 1,076 acres (less than 1 percent of the PNVT) would be suppressed rather than managed for resource objectives. This would result in higher departures, later seral stage conditions, and a higher risk of uncharacteristic fire in these localized areas. This could also be beneficial for species that prefer late seral stages. Wilderness recommendations in alternative C would not affect departure or trends of this PNVT at the landscape level due to the low extent.

Environmental Consequences – Mixed Conifer PNVTs

Habitat Quality

Common to All Alternatives

Old-growth characteristics including closed canopy forest dominated by medium to very large trees are expected to remain static or increase in about 70 percent of Mixed Conifer with Aspen PNVT. Aspen in these areas would mature and become increasingly overtopped by conifers and would not experience much growth of new saplings.

A portion of the white fir/big tooth maple vegetation community would be protected within the existing Mogollon Rim Botanical Area (replacement p. 193, no. 5; SA-RNABotGeo-DC-9).

Plan direction under all alternatives (replacement pp. 141-143, 144; FW-Veg PP-DC-7; FW-Veg-MC-MCFF-DC-13; FW-Veg-MC-MCA-DC-1, 7) would benefit species that are closely associated with deciduous tree species, such as evening grosbeaks, golden-crowned kinglets, and MacGillivray's warbler.

Alternative A

Alternative A combines the two mixed conifer types which differ in terms composition and fire regime.

All Mixed Conifer under alternative A is considered to be Mexican spotted owl restricted and protected habitat (replacement p. 65, pars. 5, 6), and the Mexican spotted owl recovery plan provides primary guidance for desired density and structure within this PNVT. Because of this, there are more areas with higher stocking densities than is desired.

Alternative A would move Mixed Conifer with Frequent Fire toward desired conditions by reducing the overall departure. Although improved, modeling results predict that after 15 years this PNVT would still remain moderately departed under this alternative because too few acres would be treated to develop more open conditions. As a result, seedlings, saplings, and small trees would increase. Because of the increased competition, the smaller trees would not grow at a rate sufficient to replace medium and large trees. These conditions also would favor shade-tolerant species recruitment over species such as juniper, oak species, ponderosa pine, and Douglas-fir, which under desired conditions would be codominant over this vegetation type.

Improved Habitat Quality: Table 95 shows an estimated amount of improved habitat by species under alternative A for Mixed Conifer with Frequent Fire. There are no improvements associated with Mixed Conifer with Aspen or with Spruce-Fir PNVTs as a result of plan objectives because there are none. The evening grosbeak occupies only a portion of its respective PNVTs. They would be benefit from plan objectives in this PNVT if treatments occurred in their habitat, however, the amount of improvement in unknown because this would be a project level decision. For bald eagles, Mexican spotted owls, and Allen's lappet-browed bat, there would be a decrease of 397 acres over existing. There would be 10,837 acres, 82,515 acres, and 19,677 acres improvement for long-tailed voles, Merriam's shrews, and Navajo Mogollon voles respectively. Projected habitat for these three species would be 26 percent higher than existing and 9.2 percent lower than alternatives B, C, and D. There would be no changes in projected habitat from existing for other species.

Table 95. Acres of improved habitat quality for Mixed Conifer with Frequent Fire PNVT associated species by alternative

Species	Alt. A Mixed Conifer with Frequent Fire Improvement	Alts B, C, and D Mixed Conifer with Frequent Fire Improvement
Golden-crowned kinglet, Macdougal's aletes, McGillivray's warbler, timberland blue-eye grass	2,870 acres mechanical treatment every 10 years and 8,000 acres prescribed fire every 10 years[1]	14,000 acres mechanical treatment over 10 years, 8,000 acres prescribed fire over 10 years, and 7,500 acres naturally ignited wildfire over 10 years[1]

[1] Habitat improvement is overestimated because an unknown number of treatment acres will overlap each other.

Existing maple would be maintained and emphasized where it exists (replacement p. 132, par 3; replacement p. 203, par 7). Aspen and oak would also persist in increasingly older seral stages. A portion of the white fir/big tooth maple vegetation community would be protected within the existing Mogollon Rim Botanical Area. Alternative A, however, would not result in as much maple regeneration in Mixed Conifer with Frequent Fire and Mixed Conifer with Aspen as alternatives B, C, and D because the current direction to maintain 120 square feet of basal area per acre (replacement p. 132, par 3) could inhibit growth and establishment of maple. The focus on fire suppression and trend to shade-tolerant species in alternative A would not promote improved conditions for aspen, a fire adapted early seral species, oak or maple (p. 95, par 9; replacement p. 137, par 4).

Large trees and medium-sized trees in both open and closed conditions would be maintained at nearly 80 percent of the PNVT during the 15 years following plan approval. About half of this PNVT would be maintained in uneven-aged.

Seventy percent of Mixed Conifer with Aspen on the forest would be managed for Mexican spotted owls or is in wilderness. Old-growth attributes would persist in these areas with a predominantly closed canopy condition. The remaining 30 percent could move toward more uneven-aged and open desired conditions. However, the focus on commodity production, dwarf mistletoe eradication, and fire suppression may hinder the rate of progress toward desired conditions (replacement p. 117, no. 1; replacement p. 118, nos. 1-3; replacement p. 122-1, par 1; replacement p. 137, pars 1, 2, 4-8). This PNVT would be predicted to trend away from desired conditions during the 15 years following plan approval and become highly departed in the long term.

Alternative A includes an objective to recruit aspen on 254 acres per decade (replacement p. 130, no. 6). However, the management area to which this objective applies would not incorporate all of the potential sites that are within this PNVT and, therefore, would not support aspen recruitment across the landscape as well as the plan objective in alternative B (FW-Veg-All-O-1).

In the 1987 plan, old growth is managed as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area (new p. 70-1, par 1). This standard is applied on a 10,000-acre-block basis. Ten-thousand-acre blocks are an outdated concept. Plan direction and a table under forestwide direction describes minimum levels for old-growth attributes such as large trees, snags, and logs (new p. 70-1; par 5; replacement p. 118, no. 1; replacement p. 127, par 4; replacement p. 151, par 5; p. 152, par 1; replacement p. 157, par 5). This plan direction would support the development and maintenance of old growth forest components, although some areas may tend toward even-aged structure, rather than the desired uneven-aged structure. Accounting for canopy and rooting zones, and natural between-group interspaces, the minimum level of trees in the table would provide less ability than alternatives B and D to promote vertical structure and age class diversity because the available growing space is occupied by the minimum required trees. This density of trees would tend to maintain a more continuous canopy than B and D that would be more conducive to crown fire. Consequently, alternative A would result in more closed canopy even-aged conditions than alternatives B and D. This structure and age class diversity is not reflective of frequent, low-severity fires characteristic of Mixed Conifer with Frequent Fire. In addition, there would be fewer openings and less understory.

Compared to alternative B and D, old-growth stands in Mixed Conifer with Frequent Fire are at higher risk for uncharacteristic fire, and when they do burn, there is likely to be more area in mixed severity with 25 percent to 75 percent loss of dominant overstory, compared to loss of 25 percent or less which is characteristic of low severity fires. Fires would tend to burn from tree to tree instead of from grass to tree. Old-growth stands in Mixed Conifer with Aspen would tend to have a higher proportion of habitat burn at the upper end of mixed severity rather than the more characteristic mixed severity. In other words, more area would burn hotter. In both PNVTs, old-growth stands would be less resilient to endemic levels of disturbances.

Where mixed conifer stringers extend into ponderosa pine, alternative A would emphasize wildlife habitat needs by emphasizing big game cover except where environmental analysis indicates otherwise (p. 133, par 2). This would be beneficial for a wide variety of wildlife that uses stringers and associated drainages as movement corridors and habitat. Stringers also provide vegetative and structural diversity and microclimates facilitating a wider variety of species in localized areas. Alternatives B, C, and D lack specific plan components about mixed conifer stringers, but they do not preclude managing for them.

Alternatives B, C, and D

For Mixed Conifer Frequent Fire, alternative B would be similar to alternative A in terms of vegetation management for this PNVT, because activities are largely guided by direction provided in the Mexican spotted owl recovery plan (FW-WFP-DC-2). The proposed treatment of additional acres (FW-Veg-MC-MCFF-O-1, 2, and 3) would provide for closer achievement of desired conditions than alternative A, primarily by converting more acres from closed canopy to open canopy conditions. These conditions would allow for increased growth and vigor, and it would make stands more resilient to uncharacteristic disturbances such as insects, disease, and drought. Understory vegetation is predicted to improve in both distribution and species diversity as cover is reduced. Modeling results predict that after 15 years Mixed Conifer with Frequent Fire would improve to a low departure under these alternatives. The consequences of alternatives B, C, and D on associated species of Mixed Conifer with Frequent Fire are similar to alternative A; however, there is a greater proportion of the PNVT in open conditions, about 35 percent, compared to about 24 percent in alternative A and a slightly higher proportion in uneven-aged conditions. Consequently, there would be improved environment for the small mammals, kinglet, warbler, and grosbeak and northern goshawk prey because of the increase in open areas that provide food and cover. Seedlings and saplings would increase. The proportion of medium to very large trees would be about 4 percent less than alternative A; however, the proportion of medium to very large trees in uneven-aged open condition would improve and move closer to desired conditions by over 11 percent. More open areas would also create improved conditions for aspen and maple and plan components would provide for all age classes of aspen and maple in regenerating and vigorous groups or patches where they naturally occur (FW-Veg-MC-MCFF-DC-13).

The consequences of alternatives B, C, and D on associated species of Mixed Conifer with Frequent Fire are parallel to alternative A; however, there is a greater proportion of the PNVT in open conditions, about 44 percent compared to about 35 percent, a greater proportion in uneven-aged conditions, and about the same proportion in medium to very large trees, both open and closed conditions. Consequently, there would be improved environment for the small mammals, kinglet, warbler, and grosbeak and northern goshawk prey because of the increase in open areas that provide food and cover. More open areas would also create improved conditions for aspen, oak, and maple. Dense areas needed by kinglets would also be provided. Conditions would likely be improved for northern goshawks because of the increase in uneven-aged conditions, and there would be the same consequences relative to medium to very large trees as alternative A.

Under alternatives B, C, and D, an objective to promote and maintain aspen (FW-Veg-All-O-1) would benefit species that are closely associated with deciduous tree species, such as evening grosbeaks, golden-crowned kinglets, and MacGillivray's warbler.

Acres Improved Habitat Quality: Table 95 shows an estimated amount of improved habitat by species under alternatives B, C, and D for Mixed Conifer with Frequent Fire. There are no improvements associated with Mixed Conifer with Aspen or with Spruce-Fir PNVTs due to a lack of plan objectives. The evening grosbeak occupies only a portion of its respective PNVTs. They would be benefit from plan objectives in this PNVT if treatments occurred in their habitat, however, the amount of improvement in unknown because this would be a project level decision. The effects of the alternatives on Allen's lappet-browed bat, long-tailed voles, Merriam's shrews, and Navajo Mogollon voles are discussed under the Ponderosa Pine PNVT.

Under alternatives B, C, and D, management in Mixed Conifer with Aspen would not be expected to change from current levels, thus maintaining the current level of moderate departure and trend

of static movement from desired conditions. In the approximately 30 percent of this PNVT outside of Mexican spotted owl habitat and wilderness, alternatives B, C, and D would be expected to move closer to desired conditions than alternative A because of better defined desired conditions and because fire would be allowed to play a more natural role in these areas (FW-Veg-MC-MCA-DC-O1-12). Alternative B would better promote more aspen in PNVTs where aspen occurs because of the plan objective that would promote more aspen than in alternative A (FW-Veg-O-All-1; FW-Veg-PP-O1-3; FW-Veg-MC-MCFF-O1-3). This objective (FW-Veg-All-O-1) would also be more effective because it can be applied anywhere on the landscape where appropriate or needed, and not just in a particular management area or PNVT. Promoting and maintaining aspen would be beneficial for species that are closely associated with deciduous tree species.

In Mixed Conifer with Frequent Fire, alternatives B, C, and D would manage forest structure, snags, logs, and coarse woody debris at the lower range of desired conditions for these features in wildland-urban interface (FW-Veg-MC-MCFF-DC-11). This would result in greater ability to reduce fire intensity, control fire, and greater retention and more fire-proofing of these features in the wildland-urban interface during a fire. It would also result in lower levels of these features in this proportion of the PNVT and a possible lower abundance of associated species. For example, the abundance of pygmy nuthatches, a management indicator species, is positively correlated with snag density.

Alternatives B and D

Plan components in the proposed revised plan for alternatives B and D promote Mixed Conifer old-growth components landscape wide rather than just on 20 percent and would be more consistent with desired conditions than alternative A. Plan components would result in sufficient groups and patches of old growth to be representative of the forest type in historical times (FW-Veg-MC-MCFF-DC 1) or in arrangements similar to historic patterns (FW-Veg-MC-MCA-DC-1) allowing for flexibility at the project level depending on site specific conditions. Plan components for Mixed Conifer with Frequent Fire would promote old-growth components throughout the landscape as clumps, groups, patches, and individual components within a generally open uneven-aged matrix in sufficient amounts to be representative of historical times. The location of old-growth components would shift in time and space in response to succession, disturbance, tree growth, and mortality (FW-Veg-MC-MCFF-DC 1, 2). Reflecting the longer fire return interval, plan components in Mixed Conifer with Aspen would provide old-growth structure over large areas as stands or patches where old-growth attributes are concentrated, including old trees, snags, coarse woody debris, and structural diversity. The locations of old-growth components would shift in time and place in response to disturbance. Declining trees would be well distributed throughout the landscape and would provide for snags and coarse woody debris (FW-Veg-MC-MCFF-DC-4; FW-Veg-MC-MCA-DC-3). In both types, old growth would have greater resiliency to changing conditions and uncharacteristic disturbances (FW-Veg-MC-MCFF-DC-5; FW-Veg-MC-MCA-DC-4) and reflect the characteristic fire regimes.

Alternative B

Alternative B does not have language that restricts burning in wilderness or in the wildland-urban interface as in alternative A, thus, plan language would not inhibit managing wildfires with resource objectives. There is a low likelihood that mechanical vegetative treatments would be conducted in wilderness due to expense and limited access. Wildfires with resource objectives could move mixed conifer in existing wilderness closer to desired conditions, however, because

these areas have not been actively managed for many years, fuel conditions could result in higher than desired fire severity. Consequently, most fires would like be suppressed. Mixed conifer does not occur in any of the wildernesses recommended in alternative B.

Alternative C

Alternative C would retain some of the language from the 1987 plan, in particular old-growth management in both mixed conifer PNVTs (see appendix F). Plan components would manage old growth in 100- to 300-acre stands and greater than or equal to 330-feet wide or are in closely over 20 percent of the landscape following the minimum attribute table in forestwide direction as in alternative A and would have similar effects. In the 80 percent area outside of these old-growth stands, management would largely follow the plan components for desired conditions in alternatives B and D and would have similar effects. Twenty percent of the landscape managed in old-growth stands would have a higher likelihood of uncharacteristic fire similar to alternative A. The 80 percent would be more resilient and have a greater likelihood of characteristic fire.

In contrast to alternative A, old growth that can be provided and maintained should be evaluated at the 6th code watershed level rather than the 10,000-acre-block basis. This would not result in any differences in the quality or distribution of old growth between these two alternatives, however, 6th code watersheds are a more ecologically-based feature on the ground compared to 10,000-acre blocks. Alternatives B and D do not specify at what scale old growth is evaluated.

Alternative C also would have a guideline for 20 percent of the area within a 1,320-foot zone adjacent to pine stringers to be managed for dense mature or overmature stands of piñon juniper. The proximity of dense vegetation adjacent to pine stringers (which are valuable as movement corridors and the diversity they provide) could enhance habitat quality for species that favor dense vegetation for movement and big game cover. This proximity could also increase the risk of uncharacteristic fire to the pine stringer by having a half-mile swath of dense vegetation adjacent to it. Alternative A has similar language and effects (p. 152, par. 2, bullet 5). Alternatives B and D have desired conditions that promote the persistence of pine stringers into piñon and juniper (FW-Veg-PJ-All-DC-3) but do not describe the condition of the adjacent vegetation allowing for more flexibility at the site specific level.

Alternative C does not have language that restricts burning in wilderness as in alternative A, thus plan language would not inhibit managing wildfires with resource objectives. There is a low likelihood that mechanical vegetative treatments would be conducted in recommended wilderness due to expense and limited access. For Mixed Conifer with Frequent Fire PNVT, there are 283 acres (less than 1 percent of the PNVT) in the Barbershop recommended wilderness. For Mixed Conifer with Aspen, there are 347 acres (less than 1 percent of the PNVT) in the Abineau recommended wilderness. In both of these recommended wilderness areas, there is a lower likelihood that wildfires would be suppressed; thus, wildfires could be managed for resource objectives which could help restore the characteristic fire return interval. Due to the probable lack of active management in these areas, canopy cover, tree density, and departure are probably higher than in some areas outside of recommended wilderness. This would confer a higher risk for uncharacteristic disturbances in these localized areas, yet would be beneficial for species that prefer higher canopy and tree densities such as bears and Mexican spotted owls. Wilderness recommendation in alternative C would not affect departure or trends of these two PNVTs at the landscape level due to the low extent.

Anderson Mesa Wildlife Habitat Management Area contains occurrences and habitat for Rothrock's hedge-nettle. Overall, the desired conditions and guidelines for WHMAs would not significantly affect the viability or habitat for these species because they would not address any species threat better than alternative B. All threats for this species are addressed through the coarse filter analysis for the PNVT.

East Clear Creek Wildlife Habitat Management Area contains occurrences of timberland blue-eye grass; however, their occurrence in this area comprises a small and insignificant portion of the total area. Thus, the effects from the desired conditions and guidelines are not expected to result in a meaningful difference between alternatives B and C.

MacDougal's aletes occurs in an area where existing and proposed special areas would overlap. According to available data, it likely occurs in the existing Red Rock-Secret Mountain Wilderness and possibly within the Oak Creek Canyon Research Natural Area. These areas of occurrence also overlap with the eligible West Fork (wild) and the Oak Creek (recreational) wild and scenic river corridors. Given the protections from existing special areas, there would be few impacts to the habitat of this species.

Environmental Consequences – Spruce-Fir PNVT

Habitat Quality

Common to All Alternatives

Under all alternatives, the Spruce-Fir PNVT is expected to remain moderately departed with a static trend because it occurs mainly in wilderness, and there are few management activities and no plan objectives. In addition, wilderness, special areas, permitted uses, and the Inner Basin municipal watershed have similar effects from plan restrictions under all alternatives (p. 191, pars 1-5, nos. 1, 2; replacement p. 192, pars 1-8; SA-Wild-All-DC-9; FW-Veg-SF-DC-5; FW-Rec-Disp-G-11). Although alternative C proposes a number special area designations and wildlife habitat management areas, there is no difference in effects between that and other alternatives with respect to species occurring in this PNVT, because none of the designations unique to alternative C occur in the Spruce-Fir PNVT.

Under all alternatives, maintenance of existing conditions in Spruce-Fir would maintain habitat for the insectivorous golden-crowned kinglet that reach their highest densities in the White Mountains and San Francisco Peaks areas. They occur at the edge of clearings and benefit from cool conditions provided by mature Spruce-Fir with closed canopies and dense old-growth trees. Existing openings would likely be maintained in Spruce-Fir, but they may get overtopped by conifers over time. Small gaps that provide habitat for insects would be created from natural events (e.g., blow-down, weakened trees from mistletoe or insect and disease mortality, or avalanches). These openings would maintain habitat for long-tailed voles that rely on the herbaceous understory for food and cover. An abundance of logs and coarse woody debris that have accumulated due to a lack of disturbance would also provide cover for this species.

Barring a major disturbance, aspen would be retained in the ecosystem most often as mature trees that are gradually overtopped by mature conifers and would regenerate in the scattered small openings. Aspen is an important component in the habitat for golden-crowned kinglet and Swainson's thrush.

Swainson's thrush occurs in corkbark fir forests on the San Francisco Peaks. Spruce-Fir structure would maintain the dense clumps of trees needed by the species. Edge habitat with dense understory and ground vegetation would be provided by existing openings and small gaps created from natural disturbances.

As the PNVT progresses toward old-growth conditions, snags would be recruited and existing ones would provide nest sites for three-toed woodpeckers, a primary cavity nester, then become logs. Plan components that provide for the viability of species associated with the forest PNVTs are shown in table 96. Snag information is listed separately in table 97.

Table 96. Plan components under alternatives B, C, and D that provide for viability of the species associated with the forest PNVTs

Location Code in Proposed Revised Plan	Intent of Plan Components
Ponderosa Pine (FW-Veg PP-DC-1, 2, 3, 4, 7-9, 12-19)	Ponderosa pine forest is characterized by vertical and horizontal heterogeneity with all structural age classes present, including robust understory and this will vary by scale (landscape, mid, fine). Fire is encouraged to play its natural role in the system. Aspen and Gambel-oak subtypes provide additional habitat for wildlife and increase biodiversity. At the mid-scale the forest is uneven-aged with all structural classes present. Forest conditions in goshawk post-fledgling areas (PFAs) are similar to general forest conditions except these forests contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in goshawk foraging areas and the general forest. Goshawk nest areas have forest conditions that are multiaged but are dominated by large trees with relatively denser canopies than other areas in the ponderosa pine type. At the fine scale, dwarf mistletoe is an element of the forest landscape and witches brooms may provide habitat for wildlife species. Large oak trees and pine-oak groups in the Ponderosa Pine-Gambel Oak subtype provide cooler, moister microsites and higher overstory diversity than surrounding Ponderosa Pine-Bunchgrass subtypes. Gambel oak acorns provide food for wildlife species.
Ponderosa Pine (FW-Veg-PP-O-1, 2, 3)	A combination of mechanical and fire vegetative treatments are used to restore the natural fire regime and provide a more resilient ecosystem with an intact functioning watershed.
Ponderosa Pine (MA-PineBelt-DC, 2, 3, 6; MA-PineBelt-G, 1)	This area is valued for its continuous stands of uneven-aged ponderosa pine, old-growth "yellow-belly" ponderosa pine stands; small lakes are scattered throughout the area and provide ecological diversity. Trails and recreation use are located and managed to reduce impacts to woody riparian vegetation and riparian habitat in Pumphouse Wash.
Ponderosa Pine (MA-PineBelt-G, 1)	In Pumphouse Wash, road and trail rehabilitation work helps to improve and maintain watershed conditions and fragile and rare plant communities.
All Mixed Conifer Types (FW-Veg-MC-All-DC-1)	Mixed Conifer types have a mosaic of trees with varying age classes and understory vegetation which provide habitat for wildlife species, including Mexican spotted owls and northern goshawks; ground cover for healthy watersheds; and fuel for fire to occur according to historic ranges of frequency and severity.
FW-Veg-MC-MCFF-DC-1, 3, 5-8, 10, 12-14, 16, 17)	Mixed conifer forest is characterized by vertical and horizontal heterogeneity with all structural age classes present, including robust understory, and this will vary by scale (landscape, mid, fine). Fire is encouraged to play its natural role in the system. Forest is variable but generally uneven-aged. At the mid-scale, frequent low-severity fires (generally less than 25 percent mortality or topkill) occurring every 1 to 35 years are characteristic including throughout the range of Mexican spotted owls and northern goshawks. Fires burn primarily on the forest floor but may result in single to group tree torching. At the fine scale, trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking. Dwarf mistletoe is an element of the forest landscape and witches brooms provide habitat for wildlife species. Fine scale features such as rock piles and wet areas, which are necessary to support rare plant species, are well distributed.
Mixed Conifer Frequent Fire (FW-Veg-MC-MCFF-O-1, 2, 3	A combination of mechanical and fire vegetative treatments are used to restore the natural fire regime and provide a more resilient ecosystem with an intact functioning watershed.

Location Code in Proposed Revised Plan	Intent of Plan Components
Mixed Conifer with Aspen (FW-Veg-MC-MCA-DC-1, 4, 5, 7, 8, 9, 10-12)	Mixed Conifer with Aspen is a mosaic of structural and seral stages ranging from young trees to old. The landscape arrangement is an assemblage of variably sized and aged groups of trees and other vegetation similar to historic patterns. An approximate balance of seral stages is present across the landscape; each seral stage is generally characterized by distinct dominant species composition and biophysical conditions. An understory consisting of native graminoids, forbs, and/or shrubs is present. The system is resilient to natural disturbance and climatic variation. At the mid-scale, the size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Basal area per mid-aged to old tree group in northern goshawk PFAs is 10 to 20 percent higher than northern goshawk foraging areas and the general forest. Nest areas have forest conditions that are multiaged but are dominated by large trees with relatively denser canopies than other areas in the wet mixed conifer type. At the fine scale, openings that support grasses, forbs, and shrubs are periodically created by disturbance, natural openings and meadows are well distributed and maintained by natural processes, providing habitat for rare species such as Colorado blue columbine, Rusby milkvetch, Oregon willow herb, and timberland blue-eye grass. Fine scale features, such as rock piles and wet areas, which are necessary to support these rare plant species, are well distributed within the capacity of this PNVT.
Spruce-Fir (FW-Veg-SF-DC-1, 2, 5-8, 10, 12-15).	At the landscape scale, Spruce-Fir has a mosaic of trees with varying age classes and understory vegetation, which provide for an intact healthy watershed, resilient to the frequency, extent, and severity of disturbances and climate variability. Natural openings and subalpine meadows are present throughout and provide habitat for rare species such as Colorado blue columbine, graceful buttercup, spider saxifrage, and timberland blue-eye grass. At the mid-scale, the size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity, generally unevenaged. Grass, forb, and shrub openings created by disturbance may comprise 10 to 100 percent of the mid-scale area following major disturbance and depending on time since disturbance. Aspen is occasionally present in large patches providing habitat for plants such as Colorado blue columbine and Rusby milkvetch, and native animals such as woodpeckers, and a variety of fungi and microorganisms. Forest conditions in goshawk PFAs are similar to general forest conditions except PFAs contain 10 to 20 percent greater tree density (basal area) than goshawk foraging areas and the general forest. Nest areas in Spruce-Fir have forest conditions that are multiaged but are dominated by large trees with relatively denser canopies than other areas. Soil and vegetation disturbance is minimal. Mid-aged to old trees grow tightly together with interlocking crowns. Small openings (gaps) are present as a result of disturbances. Invasive species are minimal.
Spruce-Fir (FW-Veg-SF-G-1)	Soil and vegetation disturbance from management activities should be minimized to maintain long-term soil productivity and a healthy, functioning watershed.

Environmental Consequences – Old growth Attributes in Forest PNVTs

All Alternatives

There are currently more than 88,638 acres of forest that occur in wilderness or on slopes greater than 40 percent that have not had any timber harvesting activity and, therefore, contain and would likely continue to contain old growth components under all alternatives.

Alternative A

The 1987 plan, as amended, requires that at least 20 percent of each forested ecosystem management area be developed or maintained for old-growth function (new p. 70-1, par 1) and be managed as 100- to 300-acre stands. This approach manages Ponderosa Pine and Mixed Conifer

stands (mid-scale) primarily for large trees, high stocking levels (70 to 100 square feet of basal area per acre), and high canopy cover (50 to 60 percent) which tend to promote even-aged structure which is not consistent with desired conditions. In terms of old-growth attributes within the forest and woodland PNVTs, alternative A's plan components would emphasize old-growth attributes and large trees (with snags and downed logs) distributed through at least 20 percent of the landscape at multiple scales (new p. 70-1, par 5; replacement p. 118, no. 1; replacement p. 127, par 4; replacement p. 151, par 5; p. 152, par 1; replacement p. 157, par 5). There are several examples of direction from alternative A that supports this effect. For instance, northern goshawk guidelines (Reynolds et al. 1992) state the goal of maintaining 40 percent of the forested area outside of Mexican spotted owl habitat as predominantly trees of 18- to 24-inch d.b.h. and 24+ inch d.b.h. As described in the "Vegetation and Fire" section, alternative A would provide less ability than alternatives B and D to promote vertical structure and age class diversity because the available growing space would be occupied by old growth sized trees. This structure and age class diversity does not reflect frequent low-severity fires characteristic of Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs. There would be fewer openings and less understory. Compared to alternatives B and D, old-growth stands would have a higher risk for uncharacteristic fire, and when they do burn, there would likely be more area burned at mixed severity. In addition, old-growth stands would be less resilient to disturbances. Nonetheless, alternative A would support the development and maintenance of old growth forest components, although some areas may tend toward even-aged structure and not be consistent with desired conditions.

Alternatives B, C, D

In terms of maintaining old growth forest components, the fire regime is very important because it removes competition from saplings, which allows the vegetation type to reach its climax state more quickly and maintains understory conditions. In addition, maintaining the fire regime condition class in adjacent stands helps reduce the risk of uncharacteristic wildfire that can damage or destroy old-growth components.

Plan components under alternatives B through D would further promote old-growth components within an uneven-aged matrix of tree groups and forest at the mid-scale and aggregated across the landscape in frequent fire forest types (FW-Veg PP-DC-4, 6, 10; FW-Veg-PP-G-2, 3; FW-Veg-MC-MCFF-DC-2, 3, 8), rather than just on 20 percent and would be more consistent with desired conditions than alternative A.

Alternative C

From an old-growth standpoint, alternative C would retain some of the language from the 987 plan for old growth (see appendix F). Plan components would result in 100- to 300-acre stands over 20 percent of each forested ecosystem management areas to be managed for old growth. These stands would have the same effects as described in alternative A. The areas outside of this 20 percent would largely follow the plan components for desired conditions in alternative B. See the "Vegetation and Fire" section for more detail. This alternative is more consistent with desired conditions than alternative A and less consistent than alternatives B and D.

Environmental Consequences – Large Trees in Forest PNVTs

Common to All Alternatives

Most of Spruce-Fir is approaching old-growth conditions because of wilderness management and undisturbed recovery from early 1900s fires. Barring a major natural disturbance, the trend toward increasing old-growth characteristics and large tree retention is expected to continue.

Alternative A

Alternative A's plan components would emphasize old growth and large trees (with snags and downed logs) distributed through at least 20 percent of the landscape at multiple scales (replacement p. 70-1, pars 1, 5). Modeling demonstrated that under alternative A, after 15 years, the total area occupied by medium and very large tree states would remain static at about 37 percent and then declines to about 32 percent. However, the level of departure for this PNVT would drop from near high to moderate as cover is reduced, growth is increased, and stand structure becomes more uneven-aged. Overall, alternative A makes less progress toward creation of very large tree states and overall uneven-aged (desired) conditions than alternatives B, C, and D because of fewer acres would be treated under alternative A based on past performance.

In both Mixed Conifer PNVTs, direction to provide for old growth to maintain and promote development of owl habitat in this PNVT should result in increasing acres of existing old growth mixed conifer as developing old growth matures (new page 65-3, pars 4, 5; new page 70-1, pars 1-10; replacement p. 118, no. 1; replacement p. 139, no. 5). Modeling shows that amounts of medium trees (10 to 20 inches d.b.h.) would decrease, while very large trees (20+inches d.b.h.) would increase (see section on "Vegetation and Fire," Mixed Conifer with Frequent Fire).

Alternatives B, C, and D

For Mixed Conifer PNVTs, alternatives B, C, and D would do the most to promote and maintain old-growth components across the landscape. Uneven-aged structure, including promotion of mature and old age classes, would be managed for across the landscape rather than just over 20 percent of the forest as directed in alternative A (FW-Veg-MC-MCFF-DC-1, 2, 4, 8; FW-Veg-MC-MCA-DC-1, 2, 3, 5). In addition, these alternatives would be more effective at maintaining and enhancing the current distribution after 50 years.

Based on plan objectives for Ponderosa Pine (FW-Veg-PP-O-1, 2, 3), modeling shows that after 15 years, the total area occupied by medium and very large tree states would remain static at about 34 percent, and then slightly decline to about 32 percent. In 50 years, closed-canopy states would decrease substantially from current levels. The amount of area in uneven-aged condition would nearly double. Stands dominated by very large trees would increase in all states over the next 50 years except single storied, closed canopy.

Environmental Consequences – Snags in Forest PNVTs

Common to All Alternatives

A majority of Spruce-Fir is approaching old-growth conditions because of wilderness management and undisturbed recovery from early 1900s fires. Barring a major natural disturbance, the trend toward increasing old-growth characteristics including large trees of multiple species, snags, coarse woody debris, and logs is expected to continue. Spruce-Fir would not move toward desired conditions under any alternative.

Table 97. Distribution of snags in forest PNVTs by alternative

PNVT	Size of Snags	Existing snags	Average Number or Trend of Snags per Acre							
			Alt. A		Alt. B		Alt. C		Alt. D	
			15 Year	50 Year	15 Year	50 Year	15 Year	50 Year	15 Year	50 Year
Ponderosa Pine	8-12"	2.8	3.1	2.8	Similar to alternative A					
	12-18"	1.2	1.8	1.6						
	18"+	1.3	1.4	1.4						
Mixed Conifer with Frequent Fire	8-12"	8.0	9.1	8.8	Same across alternatives B, C, and D					
					15 yr.		50 yr.			
	12-18"	4.5	5.1	4.6	8.9		8.6			
					5.2		4.9			
	18"+	3.3	6.8	6.4	7.1		7.0			
Mixed Conifer with Aspen	8-12"	N/A	Will increase due to less treatment and fire suppression, resulting in competition-induced mortality and higher susceptibility to insect and disease		Will increase due to more treatment of stands and susceptibility to insect and disease, but not increase as much as alternative A					
	12-18"	N/A								
	18"+	N/A								

Alternative A

In alternative A, plan direction would emphasize the retention and protection of snags, a key habitat component for many wildlife species, particularly Mexican spotted owl and northern goshawk (both within and outside of post-fledgling areas). The 1987 plan provides direction that snags would be protected from prescribed fire, would not be available for firewood, and would be retained on the landscape unless specific thresholds are exceeded (new p. 65-2, nos. 2, 7, 9; new p. 65-3, no. 2; new p. 65-5, par 5 & no. 1; new p. 65-7, par 4; p. 95, par 8; replacement p. 126, nos. 4-7; replacement p. 127, nos. 1-3). Additionally, the plan has guidance to educate the public about the utility of snags to wildlife, primarily during the timeframe before firewood permits are issued (replacement p. 127, par 3). To better provide for wildlife, this alternative dictates that where possible, snags would be located more densely in areas adjacent to meadows, riparian areas, and key water sources (new p. 70-3, par 1).

The 1987 plan specifies snag sizes and distributions for many vegetation types, such as Ponderosa Pine, Mixed Conifer, Spruce-Fir, Riparian, Aspen, Big tooth Maple, Oak, and White fir. However,

alternative A contains sometimes contradictory snag retention direction for Ponderosa Pine (p. 65-3, no. 3; p. 65-5, no. 1; p. 65-9, par 7). Depending on the location and whether or not the area is designated old growth or northern goshawk or Mexican spotted owl habitat, the minimum size for snags may be 12, 14, or 18 inches. Overall, objectives in alternative A would not increase the snags above 18 inches in size that are important for Mexican spotted owl and northern goshawks, but it would slightly increase the 12- to 18-inch category of snags which still have some utility to wildlife.

Alternatives B, C, and D

Language in alternatives B, C, and D would provide for a landscape that is a functioning ecosystem, containing snags in quantities sufficient to provide habitat for associated wildlife including golden eagle, bald eagle, Allen's lappet-browed bat, southwestern myotis, northern goshawk, and Mexican spotted owl (FW-Veg-All-DC-16) (table 97). Alternatives B, C, and D provide definitions of snag size and distribution for the Ponderosa Pine, Mixed Conifer, and Spruce-Fir PNVTs. Snags within these vegetative types would be scattered across the landscape, included as an old-growth component. These alternatives would also provide direction for snags within PNVT subtypes, such as Aspen and Gambel oak, as well as in the Pine Belt Management Area (MA-PineBelt-DC-2). These alternatives would emphasize placement of snags along edges of openings and within groups/clumps of trees to provide habitat and roost sites for wildlife species such as small mammals, cavity nesting birds, and tree-dwelling bats (FW-Veg-All-DC-16; FW-WFP-DC-1).

For the Ponderosa Pine type, snags are expected to increase similarly to alternative A.

According to modeling results, smaller sized snags in the Mixed Conifer with Frequent Fire vegetation type will decrease in comparison with alternative A, but will increase in the larger size classes important for wildlife in comparison with alternative A. Within the Mixed Conifer with Aspen PNVT, it is expected that the amount of snags will increase due to treatment of stands and susceptibility to insect and disease, but will not increase as much as alternative A. In these alternatives, snags are expected to remain static or increase in the Spruce-Fir PNVT resulting in wildlife habitat, but a slightly slower rate than in alternative A.

Alternative C

Plan language regarding the minimum size and distribution of snags varies by alternative in Mixed Conifer with Frequent Fire old growth. Alternative C (and alternative A) would have at least 1 snag per acre in old-growth stands (minimum diameter of 14 to 16 inches d.b.h.) and, thus, snags would be more evenly distributed in old growth with a smaller minimum diameter than the other alternatives. This is similar to alternative A. In contrast, alternatives B and D would average 3 snags per acre with a minimum diameter of greater than 18 inches d.b.h., and there could be some areas without snags and others with groups or clumps of snags. Snag density and distribution under alternative C would be less representative of the frequent, low-severity fires characteristic of this PNVT.

Plan language regarding the minimum size and distribution of snags in Mixed Conifer with Aspen old growth varies by alternative. Alternative C (and alternative A) would have at least 2.5 snags per acre in old-growth stands (minimum diameter of 14 to16 inches d.b.h.) and, thus, snags would be more evenly distributed in old growth with a smaller minimum diameter than the other alternatives. The overall density of snags would be substantially lower in old-growth stands

compared to alternatives B and D. Alternatives B and D would average 1 to 5 snags per acre for snags with a minimum diameter of greater than 18 inches d.b.h., and for snags greater than 8 inches d.b.h., there would be an average of 20 per acre. In alternatives B and D, there could be some areas without snags and others with groups or clumps of snags. The distribution and density of snags in old-growth stands would be less representative of a mixed severity fire system than alternatives B and D.

Environmental Consequences – Coarse Woody Debris in Forest PNVTs

Common to All Alternatives:

A majority of Spruce-Fir is approaching old-growth conditions because of wilderness management and undisturbed recovery from early 1900s fires. Barring a major natural disturbance, the trend toward increasing old-growth characteristics, such as coarse woody debris, is expected to continue.

Alternative A

Alternative A would provide for coarse wood debris consistent with the needs for associated wildlife, including Mexican spotted owl and northern goshawk. It defines coarse woody debris as downed logs larger than 12 inches in diameter and 8 feet long or 3 inches or larger on the forest floor (new p. 65-3, no. 2). In addition to general forestwide plan direction, guidance for coarse woody debris is provided for specific wildlife habitats and management areas include:

- For Mexican spotted owl habitat: retain woody debris/downed logs larger than 12 inches in diameter (new p. 65-2, no. 7; new p. 65-3, par 2; new p. 65-6, par 7)
- For northern goshawk habitat forest cover types:
    - within Ponderosa Pine: minimum 3 downed logs per acre and 5-7 tons of woody debris per acre (new p. 65-10, par 2).
    - within Mixed Conifer: minimum 5 downed logs and 10-15 tons of woody debris per acre (new p. 65-10, par 1).
    - within Spruce-Fir: minimum 5 downed logs and 10-15 tons of woody debris per acre (new p. 65-9, par 10).

In addition, alternative A states that downed logs should be identified and protected during prescribed burning and that oak showing obvious wildlife use would be retained within the Gambel Oak subtype of the Ponderosa Pine Management Area (p. 95, par 8; replacement p. 131, par 1).

Alternatives B, C, and D

Alternatives B, C, and D would also provide for coarse woody debris consistent with the needs of associated wildlife, including Mexican spotted owl and northern goshawk (table 98). In comparison with alternative A, these alternatives have more detailed desired conditions for a wider variety of habitat quality and consequently may support more species needs than alternative A. Forestwide desired conditions in alternatives B, C, and D would provide for coarse woody debris across the landscape (FW-Veg-All-DC-2); however, coarse woody debris levels could be lower in wildland-urban interface areas than in other areas to reduce the risk of wildfires (Veg-All-DC-11, Veg-All-G-1). Within Ponderosa Pine, the Mixed Conifer types, and Spruce-Fir PNVTs, coarse woody debris would be maintained as a component part of functioning ecosystem

and would provide vegetative and wildlife habitat (FW-Veg PP-DC-3, 5; FW-Veg-MC-MCFF-DC-4, 6; FW-Veg-MC-MCA-DC-3, 4, 8; FW-Veg-SF-DC-4, 5, 9). As an old growth forest component, downed wood would occur throughout the landscape, generally in small areas as individual old-growth components or as clumps of old growth (FW-Veg PP-DC-6; FW-Veg-MC-MCFF-DC-2; FW-Veg-MC-MCA-DC-2; FW-Veg-SF-DC-3).

Within subtypes of the Ponderosa Pine PNVT (Gambel oak and Aspen), coarse woody debris provides habitat for wildlife species. Within this PNVT, downed logs would be emphasized along edges of openings and within groups/clumps of trees to provide habitat and roost sites for wildlife species such as small mammals (FW-Veg PP-DC-11).

Table 98. Plan components containing old growth attributes that would provide for species viability in the forest PNVTs

Location Code in Proposed Revised Plan	Intent of Plan Component	Benefiting Species
All vegetation types (FW-Veg-All-DC-2, 16; FW-WFP-DC-1).	Natural and human disturbances provide desired coarse woody debris; snags along edges of openings and within groups/clumps of trees provide habitat and roost sites for wildlife species such as small mammals, cavity nesting birds, and tree-dwelling bats	Golden eagle, bald eagle, Allen's lappet-browed bat, southwestern myotis, northern goshawk, and Mexican spotted owl, and three-toed woodpecker
Ponderosa Pine (FW-Veg PP-DC-3, 5, 6, 11; FW-Veg-PP-G-1, 2, 3, 5, 7)	Unevenly distributed across the landscape; may not exist in some patches. Downed logs (greater than 12 inch diameter at mid-point and greater than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris, including large downed logs, is sufficient to maintain or improve long term soil productivity, provides important wildlife habitat, is generally well distributed and averages from 3 to 10 tons per acre. Declining trees are well distributed across the landscape and may occur as clumps or individual trees. They provide for coarse woody debris (greater than 3-inch diameter, including large logs). Downed logs retained along edges of openings and within groups/clumps of trees to provide habitat and roost sites for wildlife. Existing old growth forest attributes should be protected from uncharacteristic natural disturbances and are promoted across the landscape; preference for retention should be given to presettlement trees, often the largest, oldest, and tallest trees on site. Slash piles may be retained across the landscape for several years, rather than immediately being burned, to improve small mammal occupancy as needed.	Golden eagle, bald eagle, Allen's lappet-browed bat, southwestern myotis, northern goshawk, and Mexican spotted owl, long-tailed vole, Merriam's shrew, and Navajo Mogollon vole.
Ponderosa Pine (MA-PineBelt-DC-2)	Old-growth ponderosa pine as groups or as individual specimens provide a valued landscape feature that adds to the sense of diversity and discovery in this zone. Snags, top-killed trees, down logs, and other evidence of fire and wind disturbance occur individually and in patches of varying sizes. They provide an intriguing feature whose distribution on the landscape varies over time. Standing dead trees provide character and wildlife habitat and some are retained.	Golden eagle, bald eagle, Allen's lappet-browed bat, southwestern myotis, northern goshawk, and Mexican spotted owl, long-tailed vole, and Navajo Mogollon vole.

Location Code in Proposed Revised Plan	Intent of Plan Component	Benefiting Species
Mixed Conifer with Frequent Fire (FW-Veg-MC-MCFF-DC- 2, 4, 6; FW-Veg-MC-MCFF-G-1, 2)	Course woody debris ranges from 5-15 tons/acre; declining trees are well distributed throughout the landscape and provide coarse woody debris (greater than 3 inch diameter); a variety of coarse woody debris is well distributed throughout the landscape. To retain structural diversity, existing and developing old-growth forest structures should be protected from uncharacteristic disturbances through use of thinning and wildland fire. To promote structural diversity, the development of old growth structural components should be encouraged in areas where lacking. Vegetation treatments should be designed such that replacement structural stages and age classes are proportionally present to assure continuous representation of old-growth characteristics across the landscape over time.	Mexican spotted owl, northern goshawk, Allen's lappet-browed bat, three-toed woodpecker, long-tailed vole, and Navajo Mogollon vole.
Mixed Conifer with Aspen (FW-Veg-MC-MCA-DC-2, 3, 4, 8)	Course woody debris varies by seral stage: ranges from 5-20 tons/acre for early-seral stages; 20-40 tons/acre for mid-seral stages; 35 tons/acre or greater for late-seral stages; declining trees are well distributed throughout the landscape and provide for coarse woody debris; the amount of downed logs (greater than 12 inch diameter at mid-point and greater than 8 feet long) and coarse woody debris (greater than 3 inch diameter) vary by seral stage.	Northern goshawk, Allen's lappet-browed bat, three-toed woodpecker, long-tailed vole, and Navajo Mogollon vole.
Spruce-Fir (FW-Veg-SF-DC-3, 4,5, 9).	The amount of coarse woody debris (greater than 3-inch diameter) varies by seral stage: ranges from 5-30 tons/acre for early-seral stages; 30-40 tons/acre for mid-seral stages; 40 tons/acre or greater for late-seral stages; declining trees are well distributed throughout the landscape and provide for coarse woody debris.	Northern goshawk, three-toed woodpecker, and long-tailed vole.

Environmental Consequences – Uncharacteristic Fire in Forest PNVTs

Alternative A

Alternative A does not have forestwide desired conditions or objectives that specify restoration of natural fire regimes to address the threat of uncharacteristic fire, except in certain management areas. Forestwide activities to decrease the risk of uncharacteristic fire would follow national policy under this alternative. Even when fire restoration is specifically addressed in a management area under alternative A, suppression objectives and guidelines may limit the Agency's ability to implement practices that would allow those desired conditions to be reached.

Although overall direction for wilderness supports fire playing a natural role on the landscape, guidelines that direct managers to suppress fires under several circumstances set a band of opportunity that is so narrow as to essentially prevent the use of wildfires with resource objectives (pp. 93–95; p. 95, par 9; p. 111, par 8, 9; p. 112 in its entirety). As a result of this contradictory direction, fire has not been allowed to play its natural role in wilderness, and departure from desired conditions has increased along with the risk of uncharacteristic fire under alternative A. These trends would be expected to continue and would result in increased risk of uncharacteristic fire to riparian areas in and around existing wilderness.

Low fire suppression objectives and guidelines in alternative A that restrict managing wildfires with resource objectives in wildland-urban interface would further increase departure in these areas from desired conditions (replacement p. 137, par 7; p. 144, par 6; p. 147, par 9; p. 155, par 5; replacement p. 157, par 7; replacement p. 161, par 2; replacement p. 165, par 5; p. 170, par 2; replacement p. 182, par 10; replacement p. 204, par 6). Approximately 26 percent of the fire-adapted PNVTs would be restricted from managing wildfires with resource objectives because they are located in the wildland-urban interface.

Alternative A would follow national Agency fire policy and have guidance related to fire management. Compared to the other alternatives, it would offer the least opportunity to implement treatments that reduce the risk of uncharacteristic fire because it has constraints on utilizing wildfires to meet resource objectives and has a general lack of emphasis on the ecological need for frequent fire. Alternative A explicitly prohibits wildfires to meet resource objectives in the wildland-urban interface. As a result, parts of the forest could be managed to allow fire to maintain ecosystems while other areas of the forest would remain susceptible to uncharacteristic fire.

Alternative B, C, and D

While predicted fire departure and trends do not differ substantially between all alternatives, alternatives B, C, and D differs substantially from alternative A with respect to management direction and flexibility to use wildfire with resource objectives. Desired conditions in alternatives B, C, and D would reduce the threat of uncharacteristic wildfires to all ecosystems, including forest and woodland PNVTs (FW-Veg-All-DC-2, 11; FW-Veg PP-DC-3; FW-Veg-MC-MCFF-DC-6). Objectives for these PNVTs (FW-Veg-PP-O-1-3, FW-Veg-MC-MCFF-O-1-3,) would also decrease the risk of uncharacteristic fire within and adjacent to these PNVTs.

Under alternatives B, C, and D, there would also be no restriction on where wildfires with resource objectives, and so the portions of fire-adapted ecosystems in wilderness and wildland-urban interface would be able to use wildfires more effectively (SA-Wild-All-DC-9, FW-Fire-DC-1-3). It is unknown how many acres would be treated in this manner under the plan because of the unpredictability of where the lightning-caused ignitions will occur and under what conditions. In all cases, these fires would help move terrestrial vegetation toward desired conditions and would reduce the risk of uncharacteristic fire across the landscape which, in turn, would reduce the risk of uncharacteristic fire to adjacent riparian PNVTs.

Alternatives B, C, and D provide plan components that both (1) restore habitats that are currently departed to reduce the risk of uncharacteristic fire and (2) allow increased flexibility to allow fire to be managed on the landscape in a way that more closely mimics its natural role by not putting constraints on the use of prescribed fire and wildfire with resource objectives. As a result, fire-adapted PNVTs would be managed in a manner more consistent with their desired conditions on a landscape scale and would not have artificial social constraints to moving toward fire return intervals and conditions that support the appropriate fire intensity and postfire conditions that result in higher quality habitat for associated species.

Alternatives B and C

The proposed expansion of the Strawberry Wilderness under alternatives B and C would contain some occurrences of Sunset Crater beardtongue. The area included in this expansion would be subject to the guidance currently regulating the adjacent Strawberry Wilderness and other existing

wilderness areas on the forest. As a result, motorized and mechanized vehicle travel in the area would occur infrequently. The ability to implement vegetation treatments to reduce fire risk in this area would be slightly reduced, but there has been little of this activity in the area in the past. The added restrictions of the wilderness designation would not significantly affect the threat of uncharacteristic fire, but would slightly increase the complexity of initiating vegetation and fuels treatments and wildfire suppression.

Environmental Consequences – Invasive Plants in Ponderosa Pine PNVT

Common to All Alternatives

Management of invasive plant species would not vary between alternatives. Under alternative A, amendment 20 of the 1987 plan incorporates the "Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds" (USDA Forest Service, 2005; replacement p. 23, par 8; new p. 206-76, par 8). Under alternatives B, C, and D the same direction is incorporated by reference per the following guideline: "Measures should be incorporated into project planning, implementation, and monitoring to: prevent, control, and eradicate priority infestations of invasive, exotic species using an integrated pest management approach; minimize project impacts on native species; and improve watershed condition." (FW-Invas-G-2) The associated footnote specifically points to the "Final Environmental Impact Statement for the Treatment of Noxious or Invasive Weeds" or more current direction. Both methods of incorporation would allow the forest to address the threat of invasive, exotic species for all vegetation types.

Alternatives B, C, and D

Alternatives B, C, and D also include desired conditions that "[i]nvasive species are absent or exist at levels where they do not disrupt ecological functioning or affect the sustainability of native and desirable nonnative species. Invasive species includes plants, animals, diseases, and insects. Examples include diffuse knapweed, bullfrogs, white pine blister rust, and the exotic spruce aphid" (FW-Invas-DC-1).

Environmental Consequences – Invasive Animals in Spruce-Fir PNVT

Alternative A

Alternative A would address the risk of exotic spruce aphid in the Spruce-Fir PNVT through its inclusion of plan goals to "[m]anage resources to prevent a buildup of insects and diseases to prevent or reduce serious, long-lasting hazards through integrated pest management" (replacement p. 23). Standards and guidelines for insect and disease management also stipulate monitoring of insect and disease activities on all land, and evaluation of the extent control measures are needed to protect suitable or unsuitable areas (p. 70, par 2). Alternative A also includes language to not allow the introduction of exotic species outside of those managed by Arizona Game and Fish (new p. 22-1, par 2). This plan component would support efforts to manage invasive animal introductions with partners and provides support for controls that can prevent departure to spruce-fir from aphids.

Alternatives B, C, and D

In contrast to alternative A, desired conditions for Spruce-Fir in alternatives B, C, and D seek levels of disturbance by invasive animals that are comparable to the outcomes of more characteristic insect disturbance (FW-Veg-SF-DC-2, 4, and 5). Rather than focusing on the cause of the disturbance, the desired conditions focus on acceptable levels of declining trees, snags and

resilience to disturbance within the PNVT. As a result, these alternatives would better provide for the viability of species associated with this PNVT because they characterize that the disturbance may change over time, but set desired conditions for what outcomes provide for habitat conditions conducive to supporting associated species.

Alternatives B, C, and D also include desired conditions that "[i]nvasive species are absent or exist at levels where they do not disrupt ecological functioning or affect the sustainability of native and desirable nonnative species. Invasive species includes plants, animals, diseases, and insects. Examples include diffuse knapweed, bullfrogs, white pine blister rust, and the exotic spruce aphid" (FW-Invas-DC-1). Alternatives B, C, and D would better address the threat of exotic spruce aphid and the resulting loss of spruce that would alter vegetative composition and structure and increase the risk of fire in Spruce-Fir.

Environmental Consequences – Coarse Filter Viability Summary for Forest PNVTs

All Alternatives

All alternatives contain plan direction to reduce the risks of uncharacteristic fire to all forest and woodland PNVTs, invasive plants in Ponderosa Pine, and invasive animals in Spruce-Fir. Alternatives B, C, and D would reduce the risks of uncharacteristic fire more than alternative A, however, due to greater flexibility to use wildfire with resource objectives in wildland-urban interface and wilderness areas, as well as more comprehensive desired conditions for PNVTs.

Habitat amount and distribution would not change under any alternative. The overall predicted vegetative trend of Ponderosa Pine and Mixed Conifer with Frequent Fire, is expected to move toward desired conditions over the expected life of the plan under all alternatives and would support the viability of species associated with these PNVTs. Spruce-Fir has a low departure and is expected to have a static trend under all alternatives. Mixed Conifer with Aspen would trend away under alternatives A and C, but would maintain a static trend for alternatives B and D.

Besides overall habitat quality, all alternatives would provide for snags, coarse woody debris, and large, old trees; fine-scale habitat components important to many wildlife species. In comparison to alternative A, alternatives B, C, and D generally have more detailed desired conditions for a wider variety of habitat quality and consequently may support more species needs than alternative A. The expected outcomes relative to the structure, composition, and function of these PNVTs that provide for species habitats are detailed below.

A portion of the white fir/big tooth maple vegetation community would be protected within the existing Mogollon Rim Botanical Area. This would maintain habitat for golden-crowned kinglet, MacGillivray's warbler, and evening grosbeaks under all alternatives.

Ponderosa Pine Forest PNVT

All Alternatives

Of the 34 species associated with ponderosa pine, there are 22 species for which all threats are adequately addressed by the coarse filter. These species are as follows:

- Eight are Forest Service sensitive species: long-tailed vole, Merriam's shrew, Navajo Mogollon vole, western red bat, Arizona sneezeweed, Flagstaff beardtongue, Mt. Dellenbaugh sandwort, and Rusby's milkvetch; and

- Sixteen are other forest planning species: Arizona phlox, aspen, bearded cinquefoil, black dropseed, creeping milkvetch, James rubberweed, Jones' wild buckwheat, Mearns lotus, Oak Creek triteleia, Rothrock's hedge-nettle, rough Whitlow-grass (*Draba asprella* var. *asprella*), Thurber's cinquefoil, timberland blue-eye grass, and western mouse-tail.

Their viability would be maintained in this PNVT because plan components maintain or improve the structure, composition, and processes within the authority of the Forest Service to do so.

The shift to more open canopy under all alternatives would improve the abundance and vigor of understory vegetation which provides food and cover for small mammals such as long-tailed voles and Navajo Mogollon vole. It would improve conditions for Gambel oak and aspen, and would maintain habitat for Western red bat, which roosts, in deciduous trees in the Ponderosa Pine PNVT.

The increases in uneven-aged multistoried stand structure, particularly in medium and very large trees, over the long term would maintain favorable conditions for northern goshawks and their prey.

Alternative A

Alternative A (and alternative C) follows the 1987 plan for managing old growth as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area. Consequences of this plan direction are described in detail in the "Vegetation and Fire" section. This strategy would provide less ability than alternatives B and D to promote vertical structure and age class diversity; would tend to maintain a more continuous canopy than B and D that would be more conducive to crown fires; and would result in more even-aged conditions. This structure and age class diversity is not reflective of frequent low-severity fires characteristic of this PNVT. During wildfires, there is likely to be more area in mixed severity condition with 25 percent to 75 percent loss of dominant overstory, compared to loss of 25 percent or less which is characteristic of low-severity fires. Old-growth stands would be less resilient to endemic levels of disturbances. There would be fewer openings and less understory.

Alternatives B, C, and D

For Ponderosa Pine, in particular, increased treatment objectives in alternatives B, C, and D address the need for ecological restoration that addresses both the shift in canopy conditions away from desired conditions that has facilitated the spread of nonnative species in the understory. Implementation of these objectives and removal of restrictions on use of wildfires with resource objectives in wildland-urban interface and wilderness would also reduce the risk of uncharacteristic fire on the landscape.

Alternative C

Under alternative C, Anderson Mesa Wildlife Habitat Management Area would contain occurrences and habitat for Forest Service sensitive species Flagstaff beardtongue and three other forest planning species: Arizona phlox, black dropseed, and Rothrock's hedge-nettle. Public road density in this WHMA would be reduced to an average of 1 mile of road per square mile through future site-specific NEPA. Because the existing road density is slightly more, only 4 miles of road need to be closed to achieve this goal. This reduction would result in more continuous blocks of habitat and fewer impacts to these species from motor vehicles where the road closures intersect with species occurrences and habitat. East Clear Creek WHMA would contain occurrences of

timberland blue-eye grass. More open stand conditions in alternatives B, C, and D would be more beneficial to all understory species by increasing sunlight and water through the reduction of stand density and canopy.

Mixed Conifer and Spruce-Fir Forest PNVTs

All Alternatives

Of the 25 species associated with these habitats, there are 21 species whose primary threats are adequately addressed by the coarse filter.

- Four are Forest Service sensitive species: Dwarf shrew, long-tailed vole, Navajo Mogollon vole, and Rusby's milkvetch; and
- Seventeen are other forest planning species: Evening grosbeak, holden-crowned kinglet, MacGillivray's warbler, Swainson's thrush, three-toed woodpecker, Alberta arctic, aspen, bristlecone pine, Colorado blue columbine, common moonwort, corkbark (subalpine) fir, Graceful buttercup, Hall's milkweed, Macdougal's aletes, Reflected moonwort, Rothrock's hedge-nettle, and timberland blue-eye grass.

Their viability is maintained in these PNVTs because plan components maintain or improve the structure, composition, and processes in Spruce-Fir and Mixed Conifer PNVTs within the authority of the Forest Service to do so.

All alternatives address the risk of uncharacteristic fire in these PNVTs, even though they do so at different rates. As a result, all of the species associated with these PNVTs are provided for by the plan alternatives. The species with fine filter threats are discussed below.

The plan components that maintain the persistence of aspen would maintain habitat in Mixed Conifer with Frequent Fire and Mixed Conifer with Aspen for evening grosbeak, golden-crowned kinglets, and MacGillivray's warblers.

Alternative A

Under alternative A, about a third of Mixed Conifer with Frequent Fire would be maintained in open conditions that provide herbaceous cover and food for small mammals, birds, and insects including long-tailed and Navajo Mogollon voles, evening grosbeaks, golden-crowned kinglets, and MacGillivray's warbler. It would also maintain conditions for other northern goshawk prey such as rabbits. These would be best conditions to maintain oak, aspen, and maple.

Large trees and medium-sized trees in both open and closed conditions would be maintained at nearly 80 percent of Mixed Conifer with Frequent Fire PNVT during the 15 years following plan approval, which would maintain habitat for northern goshawks and prey species. About half of this PNVT would be maintained in uneven-aged conditions which would provide habitat for northern goshawks and its prey. Dense clumps of trees would maintain suitable habitat for golden-crowned kinglets.

Seventy percent of Mixed Conifer with Aspen on the forest would be managed for Mexican spotted owl or is in wilderness. Old-growth attributes would persist in these areas with a predominantly closed canopy condition. Dense clumps of trees and old-growth conditions would maintain habitat for Golden-crowned kinglets and Swainson's thrush in Mixed Conifer with Aspen. The remaining 30 percent of this PNVT could move toward more uneven-aged and open

desired conditions which maintains habitat for small mammals such as voles, and would maintain small meadows used by Alberta arctic, an endemic butterfly.

Alternatives B, C, and D

The consequences of alternatives B, C, and D on associated species of Mixed Conifer with Frequent Fire are similar to alternative A. In alternatives B, C, and D, there would be a greater proportion of the PNVT in open conditions, a greater proportion in uneven-aged conditions, and about the same proportion in medium to very large trees (both open and closed conditions). Consequently, there would be improved environment for the small mammals, kinglet, warbler, and grosbeak and northern goshawk prey because of the increase in open areas that provide food and cover. More open areas would also create improved conditions for aspen, oak, and maple. Dense areas needed by kinglets would also be provided. Conditions would likely be improved for northern goshawks because of the increase in uneven-aged conditions, and there would be the same consequences relative to medium to very large trees as alternative A.

Plan direction under all alternatives (replacement p. 141-143, 144; FW-Veg PP-DC-7; FW-Veg-MC-MCFF-DC-13; FW-Veg-MC-MCA-DC-1, 7) and an objective under alternatives B, C, and D to promote and maintain aspen (FW-Veg-All-O-1) would benefit species that are closely associated with deciduous tree species, such as evening grosbeaks, golden-crowned kinglets, and MacGillivray's warbler.

Fine Filter – Mexican Spotted Owl

Threatened and Endangered Species (table 42)
(Mexican spotted owls are also discussed under "Management Indicator Species.")

Affected Environment

Distribution: Mexican spotted owls throughout their range are declining (FWS 2011a). On the forest, they are stable to declining (Gutierrez 2003, Seamens et al. 1999, FWS 2011a). As of February 2012, there were 190 Mexican spotted owl protected activity centers that are completely or partially on the Coconino NF. Of these, 182 are completely within Coconino NF boundaries and the remainder overlap with Walnut Canyon National Monument, State lands, Kaibab NF, the Navajo Army Depot, the Naval Observatory, and Apache-Sitgreaves NFs. The Coconino NF lies within the Upper Gila Mountain Recovery Unit.

Habitat: Mexican spotted owls occupy the Mixed Conifer with Frequent Fire, Mixed Conifer with Aspen, and the Ponderosa Pine (ponderosa pine/Gambel oak subtype) PNVTs, as well as cliffs and canyons. Currently, 118,314 acres of the forest are within Mexican spotted owl protected activity centers. Habitat is characterized by high canopy cover, high stem density, multilayer canopies within the stand, large trees, numerous snags, and downed woody material.

Critical Habitat: Critical habitat was most recently designated for this subspecies in 2004. All or a portion of 6 critical habitat units occur within the Coconino NF, totaling 575,100 acres. Within critical habitat, physical and biological features that are essential to conservation of the species and may require special management considerations are identified. These are called primary constituent elements and are described in more detail in the Federal Register (69 FR 53182).

Primary constituent elements related to forest structure are:

- range of tree species – 30 to 45 percent of which are greater than 12 inches in diameter at breast height;
- shade canopy covering greater than 40 percent; and
- snags greater than 12 inches in diameter at breast height.

Primary constituent elements related to maintenance of adequate prey species are:

- high volume of fallen trees and woody debris;
- a wide range of tree and plant species; and
- adequate levels of residual plant cover.

Primary constituent elements related to canyon habitat are:

- presence of water;
- clumps or stringers of forest, woodland, or riparian vegetation;
- canyon walls with crevices, ledges, or caves; and
- high percent of ground litter and woody debris.

Risk Factors: The primary threat cited when the Mexican spotted owl was listed was historical habitat alteration as a result of timber management practices and the threat of those practices continuing. With newer information, the main risk to the Mexican spotted owl is stand-replacing wildfire (FWS 2012b). The revised recovery plan also lists a number of other stressors to the Mexican spotted owl including: fire suppression activities, domestic and wild ungulate grazing, land development, and recreation. While there are other factors and potential threats, these are the ones with the most potential to impact owls.

Environmental Consequences – Mexican Spotted Owl

Summary of Determinations: The implementation of all alternatives would result in a "may affect," determination for Mexican spotted owl and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish, or rare plants management, or land acquisition in any of the alternatives may have short-term effects on aquatic and riparian habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

Landscape-Level Habitat Threats: The coarse filter section (Forest and Woodland types above) compares how each alternative addresses the primary habitat threat of uncharacteristic fire in Mexican spotted owl habitat. Additional details are in the "Vegetation and Fire" and "Soil" sections of this document.

All Alternatives

All alternatives have plan components that would reduce disturbance to Mexican spotted owls at nest and roost sites and would have the indirect effects of promoting population recruitment and survival.

In addition, there is forestwide direction to use fire suppression techniques that minimize disturbance impacts to owls (FW-WFP-G-3) or limit human activity in protected activity centers during the breeding season (replacement p. 65, par 12) resulting in similar consequences to the Mexican spotted owl.

All alternatives support following approved recovery plans.

Alternative A

Alternative A contains language from the original recovery plan, which has since been updated. Consequently, alternative A contains outdated language and does not reflect the most current science for this subspecies.

Fire Suppression Activities: Fire suppression can protect Mexican spotted owl habitat from uncharacteristic fire, but site-specific activities can impact habitat as well. The 1987 plan has a standard and guideline to suppress fires that threaten habitat of threatened, endangered, or sensitive species (p. 95, par 9). Additional guidance is to use suppression objectives to guide the use of suppression methods, to use methods that will have the least impact on resources, and to give top priority for suppression action to protect resources (p. 93, par. 6; p. 93, par 7; p. 94, par 1). This direction would protect Mexican spotted owl habitat and minimize impacts from suppression activities. Alternative A would limit or restrict the use of wildfires with resource objectives in the wildland-urban interface and wilderness. The portion of owl habitat affected by these restrictions would be at higher risk from uncharacteristic fire.

Grazing: Insufficiently managed grazing by livestock and wild ungulates can affect cover and food for prey species, can limit regeneration and recruitment of nest and roost habitat, and can affect the ability to support natural fire regimes. The Arizona Game and Fish Department regulates ungulate populations through their hunt permit system. The forest provides input into hunt guidelines and recommendations, but does not have regulatory control.

Alternative A has specific guidance to minimize impacts from grazing on the Mexican spotted owl and its habitat. Within Mexican spotted owl restricted habitat, forage utilization levels are to maintain prey, the potential for beneficial fire, and riparian ecosystems, as well as to promote the development of Mexican spotted owl habitat (new p. 65-5, par 3). Alternative A also has a standard to ensure that forage use by ungulates will be maintained at or above levels that assure recovery and continued existence of threatened and endangered species (new p. 66-1, par 1), and a guideline to consult with the FWS to develop site-specific forage use levels (new p. 66-1, par 3). Although the term “restricted” does not reflect current science, this plan language would promote adequate levels of understory vegetation to support Mexican spotted owl prey.

Recreation: Alternative A has specific forestwide guidance that minimizes the potential for disturbance impacts to the Mexican spotted owl and its habitat by limiting human activity in protected activity centers during the breeding season (p. 65, par 12). Given that recreational use on the forest is increasing, guidelines to avoid road and trail building in protected activity centers (new p. 65-1, par 10) and allow the level of recreation that was occurring prior to listing in 1993 (new p. 65-1, par 11), keeps recreational activities in protected activity centers at a relatively low level. Additionally, permits are required for bird guides (new p. 65-1, par 12). Combined, these standards and guidelines would minimize disturbance in protected activity centers.

Range of Tree and Plant Species, 30 to 45 percent of which are trees greater than12 inches (critical habitat): Alternative A has a number of standards and guidelines that emphasize maintaining a range of tree species within Mexican spotted owl habitat. Timber harvest is not allowed in protected activity centers except precommercial thinning for firewood and fire risk abatement (p. 65, par 10). Firewood harvest retains key forest species such as oak (new p. 65-2, par 2). When thinning and prescribed fire occurs to abate fire risk in protected activity centers and on steep slopes, clumps of broad-leafed woody vegetation and large hardwood trees are retained (new p. 65-2, par 9; new p. 65-3, par 4).

Within restricted Mexican spotted owl habitat, guidelines call for maintaining all species of native trees (p. 65-4, par 3). Specifically, in pine-oak habitat, large oaks are to be retained and promoted (p. 65-4, par 8). Substantive amounts of hardwoods are to be retained in restricted habitat (new p. 65-5, par 1).

Several standards and guidelines support maintaining and developing the large tree component. Within protected activity centers and on steep slopes, only trees less than 9 inches d.b.h. can be harvested, except for the Clark Protected Activity Center (new p. 65-2, pars 4, 8; new p. 65-3, par 3). Within restricted habitat where nest/roost habitat is being managed for, stand averages are to provide 20 trees greater than 18 inches d.b.h. per acre and to maintain 30 percent stand density index in trees greater than 12 inches d.b.h. in mixed conifer and greater than 45 percent in pine-oak (new p. 65-4, table under par 1). Also in restricted habitat, trees greater than 24 inches d.b.h. are to be retained as well as large oaks (new p. 65-4, pars. 7, 8).

The 1987 plan calls for managing at least 20 percent, or as much of the landscape as possible, as old growth. Also, old growth in alternative A is in 100- to 300-acre stands over 20 percent of a forest ecosystem management area; while alternative B group size averages 0.5 acre in size, with 2 to 40 trees per group across the landscape. See “Vegetation and Fire” for a comparison of old-growth guidance amongst alternatives. For the Mexican spotted owl, which uses mature forests and old growth, alternative A specifically identifies a minimum amount of old growth to maintain, and provides for 100- to 300-acre stands in old-growth conditions. Mexican spotted owls also use more open areas for foraging.

Together, these standards and guidelines ensure that this primary constituent element will be maintained in critical habitat for Mexican spotted owls.

Snags Greater than 12 Inches in Diameter (Critical Habitat): Timber harvest is not allowed in protected activity centers except for precommercial thinning for firewood and fire risk abatement, but when those activities occur, snags must be retained (new p. 65-2, nos. 2, 7). Within restricted habitat, substantive amounts of snags greater than18 inches in diameter are to be retained (new p. 65-5, no. 1). In other forest and woodland types, guidance is to manage for landscape diversity, including snags (new p. 65-5, par 5). In Ponderosa Pine and Mixed Conifer, snags are retained at an average of 200 snags per 100 acres (replacement p. 126, no. 4; replacement p.143, par 8) and in other forest and woodland types, at least 100 snags per 100 acres are retained (p. 152, no. 2; replacement p. 157, no. 2). Minimum recommended snag densities (1 per acre in Ponderosa Pine and 2.5 per acre in Mixed Conifer), diameters (14 inches d.b.h. in Ponderosa Pine and 14 to 16 inches in Mixed Conifer), and heights (15 to 25 feet) for old growth are provided on new page 70-2). Standing dead Gambel oak greater than 10 inches d.b.h. containing one or more cavities are retained regardless of vigor at a density of at least two cavity bearing trees per acre (replacement p. 131, par 5, no. 9). Although language like “restricted” habitat does not reflect the

current recovery plan, collectively this language would ensure this primary constituent element would be maintained in Mexican spotted owl critical habitat.

Logs and Coarse Woody Debris (Critical Habitat): Within protected activity centers, large downed logs are to be retained when firewood is harvested to minimize impacts on owls, and large woody debris should be retained when prescribed burns occur (new p. 65-2, nos. 2, 7, 9). Woody debris larger than 12 inches in diameter should be retained when treatments to abate fire risk are conducted on steep slopes in owl habitat outside of protected activity centers (new p. 65-3, par 2, no. 2). In restricted habitat, substantive amounts of downed logs over 12 inches midpoint diameter are to be retained (new p. 65-3, par 2; new p. 65-5, par 1; new p. 65-6, par 7). There are also standards and guidelines to retain downed logs and woody debris throughout Ponderosa Pine and Mixed Conifer types in addition to Woodland and Spruce-Fir (new p. 65-7, par 4; new p. 65-10, pars 1-3) and to have a minimum amount in old-growth stands (new p. 70-2, item 3).

A potentially detrimental standard and guideline is found in Management Area 3 guidance for Ponderosa Pine Less than 40 Percent Slope for Gambel oak silvicultural prescriptions. While emphasis is placed on maintaining Gambel oak for wildlife habitat, salvaging of dead and downed oak is encouraged (replacement p. 131, par 1) which could be a detriment to prey species cover, depending on how much coarse woody debris is salvaged. However, firewood policy may be adjusted if it is causing damage to sensitive resources (new p. 206-89, par 5). Although language like “restricted” habitat does not reflect the current recovery plan, collectively this language would ensure this primary constituent element would be maintained in Mexican spotted owl critical habitat.

Under alternative A, there are about 54,361 acres of protected activity centers and 201,480 acres of designated critical habitat in more primitive recreation opportunity spectrum classes. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads.

Alternatives B, C, and D

Desired conditions for the Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs describe a landscape with a variety of age and structural classes, generally uneven-aged and open, with well-distributed old growth (FW-Veg PP-DC-1, 4, 6; FW-Veg-MC-MCFF-DC-1-3). It would be structurally diverse with individual trees, small clumps, and groups interspersed with openings that range from 10 to 70 percent of the landscape (FW-Veg PP-DC-4). Size of tree groups averages 0.5 acre and the forest specifically added “and may be larger in areas managed for bald eagles and Mexican spotted owls” (FW-Veg PP-DC-17). The Mixed Conifer with Aspen PNVT would have higher canopy cover and fewer openings than the Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs, providing cool moist microhabitat conditions favorable for nesting and roosting (FW-Veg-MC-MCA-DC-1, 2, 5, 10).

Desired conditions and other plan components for the primary vegetation types used by the Mexican spotted owl would provide the habitat conditions they need, including the primary constituent elements for critical habitat. Some plan components specifically support Mexican spotted owls and listed species. For example, desired conditions in ponderosa pine PNVT allows for tree groups that are larger than 1 acre in areas managed for owls (FW-Veg PP-DC-17). As detailed in the beginning of the listed “Wildlife, Fish, and Plants” section, these alternatives point to direction within approved recovery plans, and other plan direction that support survival and recovery of all federally listed species.

Objectives in the Mixed Conifer with Frequent Fire and Ponderosa Pine PNVTs for prescribed cutting and burning within 10 years of plan approval should reduce the threat of uncharacteristic fire in Mexican spotted owl habitat (MSO), and improve the diversity of understory conditions. During this 10-year period, up to 260,050 acres of Ponderosa Pine PNVT (not all MSO habitat) and up to 14,000 acres of Mixed Conifer with Frequent Fire PNVT could be cut (FW-Veg-PPO-1; FW-Veg-MC-MCFF-O-1). Up to 300,000 acres of Ponderosa Pine PNVT (not all MSO habitat) and at least 8,000 acres of Mixed Conifer with Frequent Fire could be prescribed burned (FW-Veg-PP-O-2; FW-Veg-MC-MCFF-O-2). Naturally ignited fires could be utilized to treat up to 135,000 acres in Ponderosa Pine PNVT and at least 7,500 acres in Mixed Conifer with Frequent Fire PNVT with low severity fire (FW-Veg-PP-O-3; FW-Veg-MC-MCFF-O-3). Locations and extent of these treatments would be decided at a separate time under site-specific NEPA; thus, the impacts to MSO and their habitat are not known.

In contrast to alternative A, alternatives B, C, and D lack plan components emphasizing the salvaging of dead and downed oak, which is more beneficial for prey cover. Alternatives B, C, and D lack reference to the original recovery plan and by inference includes more current science.

Fire Suppression Activities: A guideline in alternatives B, C, and D addresses disturbance to special-status species by stating that fire suppression techniques that minimize disturbance impacts should be used where there are listed and Southwestern Region sensitive species (FW-WFP-G-3). Unlike alternative A, alternatives B, C, and D guidance does not address the use of suppression techniques to protect Mexican spotted owl habitat specifically; however, occupied habitat would be included by inference in the guideline above.

These alternatives would not promote fire suppression in listed species habitat like alternative A; instead, they would promote the use of wildfire. These alternatives would not limit or restrict the use of wildfires with resource objectives in the wildland-urban interface and wilderness. The portion of owl habitat affected by these restrictions would be at a potentially lower risk from uncharacteristic fire depending on site-specific conditions and fire behavior.

Grazing: Alternatives B, C, and D have desired conditions to support biodiversity (FW-Graz-1) and to manage forage, browse, and cover needs of wildlife and authorized livestock in balance with available forage (FW-Graz-2). No specific guidance applies to the Mexican spotted owl or federally listed species, although desired conditions for the ponderosa pine and mixed conifer types describe good habitat for Mexican spotted owl prey (FW-Veg PP-DC-4, 6, 8, 11; FW-Veg-MC-MCFF-DC-3, 6, 9, 10). Overall, alternative A is more explicit in managing livestock and forage to ensure Mexican spotted owl prey availability, providing for beneficial fire, and leading to recovery of the Mexican spotted owl.

Recreation: Unlike alternative A, alternatives B, C, and D do not have specific guidance relative to the Mexican spotted owl. Desired conditions are that dispersed recreational activities do not significantly impact wildlife resources (FW-Rec-Disp-DC-3) and that motorized trails are located to have minimal impact to sensitive wildlife resources (FW-Rec-Disp-DC-7). Other guidance for dispersed and developed recreation generally calls for minimizing impacts to resources (FW-WFP-G-4).

Range of Tree and Plant Species, 30 to 45 percent of which are trees greater than 12 inches (critical habitat): In the Gambel oak subtype of the Ponderosa Pine PNVT (habitat for the Mexican spotted owl), desired conditions describe all sizes, structures, and ages of oak trees are

present, and this subtype is reproducing and maintaining its presence on suitable acres across the landscape (FW-Veg PP-DC-8). In MCFF, desired conditions describe vigorous and regenerating aspen (as does MCA) and maple (FW-Veg-MC-MCFF-DC-12; FW-Veg-MC-MCA-DC-7). In Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen, desired conditions describe a diverse understory comprised of native herbaceous and shrub species that has a variety of seral and age classes and is vigorous and regenerating (FW-Veg PP-DC-11; FW-Veg-MC-MCFF-DC-12; FW-Veg-MC-MCA-DC-7).

Desired conditions for ponderosa pine describe a landscape with well-distributed old growth (FW-Veg PP-DC-6), large oak trees and pine-oak groups provide cool, moist microsites (FW-Veg PP-DC-19) which would benefit this species because it is adapted to cooler, moister conditions. Four guidelines emphasize protection of existing old growth, development of future old growth, and protection of old trees, including Gambel oaks (FW-Veg-PP-G-1, 2, 3, 4). Desired conditions for Mixed Conifer with Frequent Fire has well-distributed old growth representative of historical times. Compared to alternative A, guidance in alternatives B, C, and D is less specific and quantitative for maintaining a range of tree species and large trees than alternative A. Nonetheless, desired conditions within the Mixed Conifer and Ponderosa Pine PNVTs are consistent with maintaining these elements within Mexican spotted owl critical habitat.

For both mixed conifer types, desired conditions call for a range of structural and seral stages ranging from young to old trees (FW-Veg-MC-MCFF-DC-1, FW-Veg-MC-MCA-DC-1), but tree diameters are not specified. Two guidelines in Mixed Conifer with Frequent Fire encourage the development of old growth in areas where it is lacking and protect existing old growth from uncharacteristic disturbances (cite). This would protect and maintain old growth and old-growth attributes which can be used as prey habitat, prey foraging substrate, and nest and roost sites for this species.

Within the Ponderosa Pine PNVT, desired conditions aim to have 95.8 percent in mid-age to mature/old seral stages. All alternatives move toward desired conditions by favoring both medium and very large trees growing in more open, uneven-aged conditions. But over the long term, alternatives B, C, and D have the greatest effect on creation of very large trees, increasing their area to almost 14 percent, while alternative A reaches almost 12 percent (see “Management Indicator Species” analysis for Mexican spotted owl old growth for more information). This should ensure that at least 30 to 45 percent of critical habitat has trees greater than 12 inches d.b.h.

Desired conditions within the Mixed Conifer and Ponderosa Pine PNVTs are consistent with maintaining these elements within Mexican spotted owl critical habitat, although alternatives B, C, and D are less specific and quantitative for maintaining a range of tree species and large trees than alternative A.

Shade Canopy Greater than 40 Percent: Desired conditions at the midscale for Ponderosa Pine and Mixed Conifer with Frequent Fire include… “denser tree conditions occur in some locations such as north-facing slopes and canyon bottoms” which would be habitat for this species, however, within the wildland-urban interface, habitat may be more open with groups of trees more widely spaced apart (FW-Veg PP-DC-13; FW-Veg-MC-MCFF-DC-10; FW-Veg-MC-MCA-DC-8) – this would provide for a more vigorous and abundant understory which would be beneficial for Mexican spotted owl prey but also Mexican spotted owl predators such as great horned owls. This would not provide nesting and roosting habitat for owls, but because this is

intended to protect communities from wildfires, it would also serve to protect Mexican spotted owl habitat not in the wildland-urban interface from wildland fires starting near these communities. Tree density would be higher in Mixed Conifer with Aspen compared to Mixed Conifer with Frequent Fire and Ponderosa Pine. At the fine scale in Mixed Conifer with Aspen, mid-aged and older forests have variably-spaced groups and clumps of trees with interlocking crowns which would provide cooler microclimate conditions for Mexican spotted owl and prey. Small openings likewise would provide for an herbaceous understory that provides food and cover for voles and other small mammals eaten by Mexican spotted owl.

Snags Greater than 12 Inches d.b.h. (Critical Habitat): Alternatives B, C, and D address this critical habitat component through desired conditions in Ponderosa Pine and Mixed Conifer PNVTs that provide for declining trees well distributed throughout the landscape, including large snags 18 inches or greater d.b.h. that average 1-2 per acre (FW-Veg PP-DC-11), large snags that average 3 per acre (FW-Veg-MC-MCFF-DC-4), and 1-5 snags 18 inches in diameter or greater per acre in Mixed Conifer with Aspen PNVT (FW-Veg-MC-MCA-DC-3). Large to moderately sized oak snags are scattered across the landscape, as are moderate to large live oak trees with dead limbs, hollow boles, and cavities which can provide nest or roost sites for a variety of species, including Mexican spotted owls (FW-Veg PP-DC-8). A guideline emphasizes snags and downed logs along edges of openings and within groups and clumps of trees (FW-Veg PP-G-5).

Logs and Coarse Woody Debris (Critical Habitat): Alternatives B, C, and D address this critical habitat component through desired conditions in Ponderosa Pine and Mixed Conifer PNVTs that provide for coarse woody debris and logs well distributed throughout the landscape. Three logs per acre are specified in Ponderosa Pine and Mixed Conifer with Frequent Fire (FW-Veg PP-DC-11, FW-Veg-MC-MCFF-DC-4) with provisions for coarse woody debris ranging from 5 to 15 tons per acre that would maintain nutrient cycling and provide prey cover. Desired conditions in the Mixed Conifer with Aspen PNVT would provide a range of 5 to 35 tons per acre of coarse woody debris depending on seral stage (FW-Veg-MC-MCA-DC-3). Additionally, a guideline manages slash to minimize impacts from Ips beetles (which would protect Mexican spotted owl habitat) and to provide habitat for small mammals which Mexican spotted owl feed on (FW-Veg PP-G-6).

In addition, two guidelines in Mixed Conifer with Frequent Fire encourage the development of old growth in areas where it is lacking and protect existing old growth from uncharacteristic disturbances (FW-Veg-MC-MCFF-G-1, 2). This would protect and maintain old growth, and old-growth attributes, which can be used as prey habitat, prey foraging substrate, and nest and roost sites for this species. A guideline in both mixed conifer types protects red squirrel caches, which would help maintain food sourcesw for one of the prey species.

Alternative B

Alternative B guidance for the PNVTs that support Mexican spotted owls is incorporated into vegetation desired conditions at various scales. One desired condition for Ponderosa Pine is specific to the Mexican spotted owl and allows for tree groups that are larger than 1 acre in areas managed for owls (FW-Veg PP-DC-17). Alternative B points to direction within approved recovery plans, and has other plan direction common to all federally listed species (see that section at the beginning of the listed “Wildlife, Fish, and Plants” section) as the primary guidance applicable to Mexican spotted owl. Desired conditions and other plan components for the primary vegetation types used by the Mexican spotted owl encompass habitat conditions they need, including the primary constituent elements for critical habitat.

Alternative B proposes three wilderness areas none of which contain any Mexican spotted owl protected activity centers or any Ponderosa Pine or Mixed Conifer habitat that might be used by Mexican spotted owl, so this would not have an effect on viability.

Recreation Opportunity Spectrum: The forest plan sets the desired recreation opportunity spectrum (also called recreation opportunity spectrum objectives) used to determine if projects are compatible with forest recreation goals. At the project level, the desired recreation opportunity spectrum is used to determine if a project is moving toward or away from the desired recreation opportunity spectrum. Recreation opportunity spectrum classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no developments and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

In alternative B, about 19,628 acres of protected activity centers and 107,271 acres of designated critical habitat would shift from the recreation opportunity spectrum classes that allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This improvement would be higher than alternative A, lower than alternative C, and the same as alternative D.

Alternative C

Alternative C has the same consequences as B and D except for the following differences.

Of the 13 recommended wilderness areas, there are portions of 13 protected activity centers totaling 2,702 acres within 4 of the recommended wilderness areas (Barbershop, East Clear Creek, Railroad Draw, and Tin Can). This represents 2.3 percent of the known protected activity center acreage. The portion of protected activity centers within the Barbershop and East Clear Creek PWAs are already within the Barbershop and East Clear Creek Inventoried Roadless Areas so there would be little additional benefit to designation as wilderness. Recommendation of wilderness would reduce motorized and mechanized use but still allow motorized big game retrieval until designation of wilderness by Congress. Designation of wilderness would reduce disturbance to Mexican spotted owl from management activities that rely on motorized and mechanized equipment, and motorized recreation would not be allowed. Dispersed recreation such as hiking and horseback riding would be managed to preserve wilderness character, however, recreation may increase once areas have been designated. Therefore, East Clear Creek and Barbershop may see increased disturbance from dispersed recreation under alternative C but it is less likely to be true for Tin Can and Railroad Draw (see the “Special Areas” section for more information). Mechanical thinning treatments would be limited by the lack of permanents and temporary roads, so some areas within the recommended wilderness areas that might benefit from pretreatment to reduce the effects of subsequent prescribed fire or wildfire with resource objectives may remain vulnerable to uncharacteristic fire. Fire could still be used to improve habitat conditions.

From a mining standpoint, East Clear Creek (2,017 acres) has manganese minerals but no economic potential for development. Even if the economic potential were to change, there would be no development if the area is designated as wilderness or withdrawn while it is recommended, so there would be no impact to Mexican spotted owl and its habitat. Overall this would result in a small positive impact from reduced disturbance compared to alternatives A and B.

Direction for wildlife habitat management areas would focus on habitat restoration by reestablishing natural fire regimes and reducing road densities for public motorized access. Of the 8 proposed wildlife habitat management areas, 6 have all or part of 33 protected activity centers (PACs) within their boundaries, with East Clear WHMA having the most (table 99). Mexican spotted owls are an emphasis species in five WHMAs: Anderson Mesa, East Clear Creek, Jack's Canyon, Knoll Lake, and Pine Grove. About 3.2 miles of road could potentially be closed to public motorized use in PACs, in the East Clear Creek and Jack's Canyon WHMAs. If all of these were closed through site-specific NEPA, this would result in 12 PACs with reduced disturbance which represents 6.3 percent of the PACs on the forest. A total of 54.2 miles could potentially be closed in critical habitat within the East Clear Creek, Jack's Canyon, Knoll Lake, and Limestone Pasture WHMAs, with about 50 miles in the East Clear Creek and Jack's Canyon WHMAs.

Table 99. Wildlife habitat management areas and Mexican spotted owl habitat and potential road closures

WHMA	PAC Acres (No. of PACs Affected)	PACs Acres with Reduced Disturbance (Percent of PAC Acres Forestwide)	Miles of Road That Could Potentially Close in PACs	Miles of Road That Could Potentially Close in Critical Habitat Outside of PACs
Anderson Mesa[1]	67 (4)	0	0	0
East Clear Creek[1]	9,903 (20)	8 (4.2%)	2.4	29.9
Jack's Canyon[1]	2,416 (4)	4 (2.1%)	0.8	20.3
Knoll Lake[1]	91 (2)	0	0	2.5
Limestone Pasture	24 (1)	0	0	1.4
Pine Grove[1]	36 (2)	0	0	0
Totals:	12,537 (33)	12 (6.3%)	3.2	54.2

[1] Indicates that Mexican spotted owls are emphasized in the WHMA

Other plan components that reduce disturbance include guidelines that: specify that roads in WHMAs not open for public motorized access are managed for administrative use or decommissioned; and direct that there should be no net increase in the area of motorized dispersed camping corridors within each WHMA (alternatives A, B, and D would allow a net increase in motorized dispersed camping corridors). An additional guideline would limit some recreational activities such as nonresearch-related large group events and large commercial tours within WHMAs. Collectively, these reduce disturbance to Mexican spotted owl.

There is no Mexican spotted owl habitat within the proposed expansion of the Cottonwood Fumeroles Geological Area.

Alternative C would also designate Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas; parts of the Flagstaff Neighborwoods Management Area; some special areas; and wildlife habitat management areas as nonsuitable for recreational (nonhunting) shooting. This would reduce disturbance in 41,945 acres of protected activity centers with 12,632 acres in wildlife habitat management areas and 29,313 acres in a combination of species areas and management areas. Designating these areas as not suitable for recreational shooting will benefit

the Mexican spotted owl by reducing disturbance to roosting and nesting owls within daylight hours.

Alternative C designates the Walnut Canyon Management Area and areas with a recreation opportunity spectrum objective of "semiprimitive nonmotorized" as not suitable for snowmobile use, except to provide ingress/egress for private inholdings. This will have a positive impact on the five protected activity centers within these boundaries by reducing disturbance during the winter to roosting owls.

Alternative C would retain some old-growth language from the 1987 plan (see appendix F) and would have similar effects to alternative A. Outside of these specific stands that are managed for old growth, alternative C follows direction in the proposed revised plan for old-growth components across the landscape and has the same consequences as alternative B. The 80 percent of habitat outside of areas managed for old growth would be more resilient and have a greater likelihood of characteristic fire. (See "Vegetation and Fire" for more information.)

There are portions of 5 protected activity centers totaling 1,245 acres within the Oak Creek Research Natural Area and portions of 2 protected activity centers totaling 175 acres in the Rocky Gulch Research Natural Area. Restricting grazing will have a small positive impact on Mexican spotted owl by improving cover and food production and availability for prey species.

Recreation Opportunity Spectrum: In alternative C, about 20,223 acres of protected activity centers and 112,836 acres of designated critical habitat would shift from the ROS classes that allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This improvement would be higher than alternatives A, B, and D.

Alternative D

This alternative is responsive to public recommendations for no new wilderness areas and to allow mechanized recreation (biking) on designated trails in botanical and geological areas. Alternative D also differs from the proposed revised plan in that it would provide for expansion and/or increased access for future energy corridor needs, as well as modification of scenic integrity objectives along existing energy corridors for energy infrastructure. Alternative D plan language would provide fewer restrictions tied to recreation in special areas and energy infrastructure and, as a result, could result in slightly greater impacts on overall ecosystem health of the forest by increasing habitat fragmentation and creating breaks in tree cover.

Specifically, this alternative would change the scenic integrity objectives associated with the power line between Sycamore and Red Rock-Secret Mountain Wilderness to a low scenic integrity objective rating instead of a moderate rating and would change the Western Area Power Administration line between Fossil Creek and West Clear Creek to a low rating (note: Arizona Public Service, an electric company, would still need legislation to expand the corridor over the wilderness area). In addition, alternative D would consider using the Arizona Public Service Alternative Energy Corridor (along Highway 87) as an alternate route for expanding capacity on the Western Area Power Administration line, subsequently requiring consideration of lowering scenic integrity objectives along Highway 87 for alternative energy transmission. Additional plan language would be added to this alternative regarding scenic impacts to designated wild and scenic rivers and updates to scenic integrity objective maps (see appendix F). Mexican spotted

owl protected activity centers and critical habitat in these areas could be affected by the expansion and use of alternate routes, however, the scale and magnitude of the effects is unknown at this time.

Under alternative D, the effects from shifts in ROS classes would be the same as alternative B for protected activity centers and designated critical habitat.

There are 322 acres of the Immigrant Protected Activity Center and 340 acres of critical habitat in the Mogollon Rim Botanical Area. There are no other protected activity centers or critical habitat in botanical or geological areas. Allowing bicycles on designated trails in botanical and geological areas would slightly increase disturbance to the Immigrant Protected Activity Center owls. Overall consequences are the same as alternative B, with the exception of disturbance to the Immigrant Protected Activity Center.

Recreation Opportunity Spectrum

Summary of Species Effects

Although all alternatives maintain the viability and persistence of the Mexican spotted owl and follow approved recovery plans, alternatives B, C, and D do a better job because:

- Desired conditions are more clearly articulated for all habitats including the Ponderosa Pine/Gambel oak subtype and canyons and cliffs so that the composition, structure, and processes of these habitats better provide for the needs of Mexican spotted owl;
- Guidelines specifically address disturbance from human activities, so these species threats are reduced within the authority of the Forest Service;
- Prohibitions and restrictions on burning in wilderness and wildland-urban interface are lifted; and
- These alternatives reduce the risk of uncharacteristic fire in owl habitat at a faster rate than alternative A.

Fine Filter – Bald and Golden Eagles

Southwestern Region Sensitive Species and Other Forest Planning Species (Table 43and table 44)

Affected Environment

Distribution and Habitat: Both eagles could forage across the entire forest. They roost and nest in large trees, large snags, and the Ponderosa Pine, Cottonwood Willow Riparian Forest, and Mixed Broadleaf Deciduous Riparian Forest PNVTs. Golden eagles are primarily cliff nesters.

Nesting eagles are associated with cliffs and Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, Ponderosa Pine, and Montane Willow Riparian Forest PNVTs. Five of the six bald eagle breeding areas on the Coconino NF occur below the Mogollon Rim in the vicinity of the Verde River, and one occurs in Ponderosa Pine above the Mogollon Rim. There are currently 11 confirmed and 27 potential bald eagle roosts on the forest.

Risk Factors: Energy development related infrastructure such as communication towers and transmission lines, as well as associated corridors and alternative energy sites, pose species-specific risks. Communication towers are a collision hazard and transmission lines are an

electrocution risk for bald eagles (Southwestern Region sensitive species) and golden eagles (other forest planning species).

Another primary threat to eagles is disturbance during nesting or roosting from human activities. Human activities that result in disturbance can disrupt sensitive life stages such as breeding and can reduce reproduction and/or cause injury or death. With some exceptions on NFS lands, the Forest Service has authority and control over human activities including: rock climbing, caving, construction, maintenance, mineral activities, recreation, water related projects, vegetation and burning treatments, and off-trail hiking. Forest Service authority over locatable minerals, however, is subject to the limitations under the General Mining Act of 1872, and some road work that occurs on the forest may be under other jurisdictions such as the Federal Highway Administration or the Arizona Department of Transportation.

Primary habitat-level threats and environmental consequences of the alternatives on eagle habitat are described in the coarse filter/habitat sections for its PNVTs. The section on "Cliffs" in the section on "Species Not Associated with PNVTs" describes threats and consequences to cliffs.

Environmental Consequences – Bald and Golden Eagles

All Alternatives

Energy Development: All alternatives would reduce these hazards to eagles by promoting the use of existing transmission corridors to capacity with compatible utilities (where additions are environmentally and visually acceptable before evaluating new routes) (p. 79, par 9; FW-SpecUse-DC-1, 3) and specifying that power lines and towers would be constructed or reconstructed to specifications compatible with raptor use (p. 80, par 2; FW-SpecUse-DC-3). All alternatives would avoid research natural areas and geological and botanical areas, the Elden Environmental Study Area, wilderness, and the Verde Wild and Scenic River (p. 79, par 10; FW-SpecUse-DC-3; new p. 115-5, par 3; SA-WSR-Verde-S-1). Consequently new power lines and transmission corridors would not occur in these areas which could contain roosting, nesting, or foraging habitat for bald and golden eagles.

Human Activities: All alternatives incorporate the "Verde Wild and Scenic River Comprehensive River Management Plan," including its standards (replacement p. 113, par 4; SA-WSR-Verde-S-1). Wildlife and fish are among the outstandingly remarkable values that are protected and enhanced (replacement p. 113, par 5; new p. 115-1, par 2; FW-WSR-Verde-DC-5) and the range of flows in the free-flowing Verde River would provide optimum conditions for native fish and wildlife, and health and diverse stands of riparian vegetation on the banks and flood plain (replacement p. 114, par 3; replacement p. 115, par 2-3; FW-WSR-Verde-DC-6). The original designation allows for some water diversion. Specifically, designation shall not prevent water users receiving Central Arizona Project water allocations from diverting that water through an exchange agreement with downstream water users in accordance with Arizona water law (new p. 115-1, par 8). As a result, streamflows could be reduced in the future which could degrade riparian habitat used for bald eagle nesting.

All alternatives have timing restrictions to minimize disturbance during the breeding season (replacement p. 124, no. 9 for eagles in the osprey emphasis area; replacement p. 167, par 5 for bald eagle nesting in the Verde Valley; new page 206-67, par 6 for raptors nesting in the Flagstaff Lake Mary Ecosystem Area, new page 206-73, par 6 for bald eagle nests and roosts in the

Flagstaff Lake Mary Ecosystem Area; FW- WFP-G-4 for both golden and bald eagle nests and roosts).

Alternative A

Energy Development: This alternative would avoid transmission lines in certain PNVTs (the Ponderosa Pine and Mixed Conifer vegetation types) and would evaluate new corridors for their potential impacts on habitats for threatened and endangered species (p. 79, par 10). Avoidance of these PNVTs would be beneficial because large ponderosa pine trees and snags in these PNVTs can be used for roosting and nesting by both golden and bald eagles. Alternative A allows communication sites at a limited list of locations which would reduce the number of sites that would potentially impact the species (p. 82, pars 4-5). Alternative A is silent on alternative energy proposals such as wind and solar, so the guidelines in the forest plan would not be adequate to mitigate potential impacts to eagles and other wildlife species.

Human Activities: In alternative A, multiple plan components would address the threat of human-caused disturbance to bald and golden eagles, which would facilitate reproductive success. Forestwide management would restrict activities in threatened, endangered, and sensitive species habitat during the breeding season; manage roads and limit or restrict access into big game winter ranges and bald eagle roosting/wintering areas; and limit human activity in nest areas during breeding seasons (new p. 22-1, par 1; new p. 64-1, pars 1-2; replacement p. 65, par 7, 12; new p. 65-1, par 12; new p. 65-11, pars 4, 5; replacement p. 66, par 10;). Furthermore, there is direction to suppress fires that threaten the habitats of threatened, endangered, or sensitive species (p. 95, par 9). In addition there is monitoring of specific species and related consultation with other agencies (new p. 64-1, par 1; new p. 65-6, pars 2, 9; new p. 65-7, par 2; replacement p. 206-12, no. 2; new p. 206-67, par 5).

Alternative A has standards and guidelines in Management Area 3 (Ponderosa Pine and Mixed Conifer Less than 40 Percent Slope) to leave an uncut area around active nests for a 50-foot radius for other raptors such as golden eagles (replacement p. 123, par 6, no. 4) and for a 300-foot radius around bald eagles winter roosts (replacement p. 123, par 6, no. 5). This latter direction conflicts with a guideline for bald eagles in the Flagstaff Lake Mary Ecosystem Area that promotes silvicultural methods and prescribed fires near roost areas to encourage regeneration, growth of large diameter trees with open crowns in multilayered stands, and reduction of fire risk with protection of large trees and snags (new p. 206-73, par 5). Although probably intended to protect the microclimate and integrity of the stand, these uncut zones would increase the risk of uncharacteristic fire or increase vulnerability to drought, insects, and disease to roosts where stand density is high. The differences in the plan language in Management Area 3 and the Flagstaff Lake Mary Ecosystem create unnecessary conflict when implementing plan direction.

Guidelines increase bald eagle winter habitat to include potential habitat, minimize wildfire loss in key habitats, and require compliance with various recovery plans (replacement p. 64, par 1; new p. 206-10, par 1; replacement p. 206-12, no. 6; new p. 206-73, par 5). Standards and guidelines would develop a public education program for osprey/bald eagle (replacement p. 124, no. 9). Plan components would address the threat by minimizing smoke impacts to habitat, protecting habitat during breeding and wintering seasons, eliminating roads that negatively impact wildlife, and restoring habitats damaged by human activities (replacement p. 184, par 10; new p. 206-10, no. 4; new p. 206-11, par 8; new p. 206-12, no. 6; new p. 206-13, par 8; new p. 206-51, nos. 1, 3; new p. 206-53, nos. 5, 7; new p. 206-67, pars 5, 6; new p. 206-73, par 4; new p. 206-98, par 3; new p. 206-116, par 9). Another plan component would support research in

defining species habitat and subsequent action to protect and restore it (replacement p. 185, no. 2).

Alternative A has language to follow approved or more recent conservation strategies or assessments for bald eagles only in the Lake Mary Watershed Management Area – MA 35 (new p. 206-100, par 6); while alternatives B, C, and D expand this to a forestwide guideline to improve the status of species and prevent Federal listing (FW-WFP-G-2).

Alternatives B and C

Energy Development: These alternatives provide the least amount of risk to eagles from energy development. They would limit the number of sites that would potentially impact eagles by using existing communication sites and utility corridors to maximum capacity (FW-SpecUse-G-4), and by updating communication site plans to optimize use of existing sites and minimizing the number of towers (FW-SpecUse-G-6). Utility lines, such as pipelines, power lines, fiber optic lines, and telephones, would be buried (FW-SpecUse G-2). These alternatives would minimize the effects to wildlife and habitat fragmentation of new large linear infrastructure such as power lines (FW-SpecUse-DC-2) but would not specifically avoid certain PNVTs like alternative A does. Unlike alternative A, these alternatives would support alternative energy production and energy developments such as wind energy while mitigating or minimizing impacts to other resources, including wildlife (FW-SpecUse-DC-5), and would avoid transmission lines not just in the Mt. Elden Environmental Study Area, but all environmental study areas, some of which have foraging and nesting habitat for eagles (FW-SpecUse-DC-3).

Alternative D

Energy Development: This alternative has the highest potential for risk to eagles from transmission lines. This alternative has similar consequences as B and C except for language related to certain geographic areas on the forest. The scenic integrity objectives associated with the power line between Sycamore and Red Rock-Secret Mountain Wilderness would change from a moderate to low rating. The assumption is that the width of a power line corridor would not change under a moderate scenic integrity objective, but can double in size under a low scenic integrity objective before it would be lowered to a very low scenic integrity objective category. Therefore, under alternative D, this segment of the power line could substantially increase in size, including the clearing of trees to meet regulations, but it could get no larger than the distance between the Sycamore and Red Rock-Secret Mountain Wilderness boundaries. This could increase transmission line size or number of lines within the corridor, increasing localized risk to eagles. This risk could be reduced by location or design as described under alternatives B and C.

This alternative would consider an alternative route for the Western Area Power Administration line between Fossil Creek and West Clear Creek. The most likely location for this route would be the Arizona Public Service Alternative Energy Corridor along State Highway 87. The guideline allows for lowering scenic integrity objectives along the alternative energy transmission route (see appendix F). This could increase transmission line size or number of lines within the alternative corridor increasing localized risk to eagles while it would maintain or lower the risk between the Verde River and West Clear Creek Wilderness. Such impact could be reduced by location or design as described under alternatives B and C.

Alternatives B, C, and D

Alternatives B, C, and D also have specific plan components designed to reduce disturbance during the breeding season, facilitating reproductive success. These are summarized in table 100.

Human Activities: In addition, alternatives B, C and D provide multiple plan components that would further address the threats from human activities. Desired conditions related to recreation would ensure impacts to habitat from campfire smoke are minimized, trailheads avoid impacts to ecological resources, information about low-impact trail use is made available to recreationists, trails that access water do so without damaging habitat, and those trails that do cause erosion or loss of soil are prioritized for rehabilitation or closure (FW-Rec-Disp-DC-14; SA-Wild-All-DC-2; FW-Rec-Disp-DC-7-8,14,19).

A desired condition for the Red Rock-Secret Mountain Wilderness would address this threat by ensuring there was no disturbance to nests or roosts (SA-Wild-SecretMtn-DC-2). A wildlife guideline would restrict the use of pesticides where eagle species forage to minimize effects to species or habitat (FW-WFP-G-12). Guidelines for recreation include a special uses guideline that would restrict air tour companies or rock climbers from using habitat during the breeding season, and dispersed recreation guidelines that would curtail recreation activities to protect resources (FW-SpecUse-G-20; MA-SedOak-G-10; FW-Rec-Disp-G-2, 6, and 11). A wildlife guideline would require compliance with species conservation agreements and require assessments to avoid the need for Federal listing of nonlisted species (FW-WFP-G-2), not just in specific management areas as in alternative A.

Alternatives B, C, and D do not have plan language that calls for uncut zones around golden eagle or bald eagle nests. This eliminates the conflicting plan language that currently exists in alternative A. It also facilitates addressing long-term viability of eagle roosts where needed at the project level through site-specific NEPA decisions.

Table 100. Summary of plan components in alternatives B, C, and D that reduce disturbance and provide for the viability of bald eagles and golden eagles

Plan Component	Location Code in Proposed Revised Plan
Seasonal timing restrictions should be applied for threatened, endangered, and sensitive species; bats; and golden eagles to protect known nests, roosts, and other special features from habitat alteration and/or disturbance from management activities to avoid disruption of species or their habitats that could affect survival or successful reproduction. Reduce or remove disturbance during breeding season.	FW–WFP-G-4, 7; FW-Rec-Disp-DC-1, 14, FW-Rec-Disp-G-4, 10
Campfire smoke in Oak Creek Canyon is minimal to protect habitat conditions for bats, birds, and other wildlife species and to improve air quality.	MA-OakCrk-DC-6
Commercial filming using aircraft is discouraged in the Sedona-Oak Creek Management Area except within the House Mountain-Lowlands Management Area and along paved highways.	MA-SedOak-G-10
Fire suppression techniques that minimize disturbance impacts should be used where there are listed and Forest Service sensitive species.	FW-WFP-G-3, 4
Unneeded roads are closed and naturalized to reduce human disturbance to wildlife and to reduce soil erosion.	FW-RdsFac-DC-4

Plan Component	Location Code in Proposed Revised Plan
To increase chances of survival for young wildlife, active roosts, nests, and dens should not be disturbed.	FW-BioPhys-Geo-G-3
The location of new, large linear infrastructure such as power lines has minimal effects to wildlife and minimizes habitat fragmentation.	FW-SpecUse-DC-3
Off-trail nonmotorized use is discouraged forestwide in ecologically sensitive areas.	FW-Rec-Disp-DC- 17

In addition to plan components, a recreation special use management approach would encourage working with partners to minimize aircraft effects to threatened, endangered, or sensitive animal species. There are also areas identified under these alternatives as being "not suitable" for new motorized recreation areas which would reduce the amount of potential future human disturbances but it is not possible to quantify how much this would reduce future impacts.

Alternative B

Human Activities: In comparison, alternative B would provide more protections from disturbance than alternatives A and D, but less than alternative C. This is due to alternative B's special area plan components for the three newly recommended wilderness areas (Strawberry Crater, Davey's, and Walker Mountain) and the Cottonwood Fumeroles Geological Area. The associated plan components would reduce threats of disturbance to eagles in these special areas.

Recreation Opportunity Spectrum: The plan sets the desired recreation opportunity spectrum (ROS), also called ROS objectives, which are used to determine if projects are compatible with forest recreation goals. ROS classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no development and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

In alternative B, about 80,916 acres of Mixed Broadleaf Deciduous Riparian, Montane Willow Riparian, and Ponderosa Pine PNVTs would shift from ROS classes that would allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This alternative would shift only 21 acres from more primitive to less primitive in Cottonwood Willow Riparian PNVT. This overall net improvement of 80,895 acres would be higher than alternatives A and D and lower than alternative C.

Alternative C

Human Activities: Alternative C would be the best alternative for reducing threats associated with disturbance because of the high number of recommended wilderness areas, areas with very high scenic integrity objectives, areas with low disturbance recreation opportunity spectrum classes, changes in suitability for recreational shooting and snowmobiling in certain areas, the potential for reducing public motorized use in wildlife habitat management areas, and the expanded Cottonwood Fumaroles Geological Area. These designations would minimize or eliminate motor vehicle disturbance.

There are eight wildlife habitat management areas proposed by alternative C (Anderson Mesa, East Clear Creek, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, and Second Chance). Desired conditions for the wildlife habitat management areas articulate the species for which the area should be managed and include prey species for eagles. Guidelines also would limit public motorized access and would not permit nonresearch related large group events or commercial tours in wildlife habitat management areas. Compared to alternatives A, B, and D, the curtailment of human activities within these wildlife habitat management areas would reduce disturbances to the resources and species for which those areas are emphasized (see appendix F).

Alternative C would also recommended suitability changes which would reduce the amount of human disturbances. Botanical areas, geological areas, existing and recommended research natural areas, wildlife habitat management areas, and the Walnut Canyon, Sedona Neighborwoods, Long Valley, and parts of the Flagstaff Neighborwoods Management Areas would become "not suitable" for recreational (i.e., nonhunting) shooting.

In alternative C, about 89,095 acres of Mixed Broadleaf Deciduous Riparian, Montane Willow Riparian, and Ponderosa Pine PNVTs would shift from ROS classes that would allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This alternative would shift only 10 acres from more primitive to less primitive in the Cottonwood Willow Riparian PNVT. This overall net improvement of 89,085 acres would be higher than alternatives A, B, and D. The Walnut Canyon Management Area and areas with a ROS objective of semiprimitive nonmotorized would become not suitable for snowmobile use, except to provide ingress/egress for private inholdings. There would be reduced noise disturbance to eagles in these parts of the forest.

Alternative D

By not adding any new wilderness areas, alternative D would be the same as alternative A in this aspect. Allowing bicycles on designated trails in geological, botanical, and research natural areas would have little impact on bald eagles or their habitat due to the small amount of habitat affected and because these areas are not proximal to known nests and roosts. There is no Cottonwood Willow habitat in botanical, geological, or research natural areas; a total of 28 acres of Mixed Broadleaf Deciduous Riparian in the Fossil Springs Botanical Area and in the West Clear Creek Research Natural Area; 166 acres of Montane Willow Riparian in the Mogollon Rim Botanical Area and Oak Creek Research Natural Area; and 2,001 acres of Ponderosa Pine in the Oak Creek Research Natural Area, Red Mountain Geological Area, and the Rocky Gulch Research Natural Area.

Effects from shifts in ROS classes would be similar to alternative B.

Summary of Species Effects

These species are also addressed in the species section under "Golden and Bald Eagles" near "Management Indicator Species."

All alternatives, particularly alternatives B and C, would produce long-term benefits to the maintenance and improvement of bald and golden eagle populations and their habitats on the forest. The implementation of plan components related to energy development and other disturbance-causing activities under any of the alternatives may have localized negative effects on

eagle habitat or species populations, but these impacts would not result in a trend toward listing or a loss of viability of these species on the forest.

Fine Filter - Northern Goshawk

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: There are 83 goshawk post-fledgling family areas on the Coconino NF, including 3 areas that are shared with other forests. Current total acreage of post-fledgling areas managed by the Coconino NF is 54,686 acres. The goshawk preys on large to medium-sized birds and mammals which it captures on the ground.

Habitat: The northern goshawk occupies ponderosa pine, mixed conifer, and spruce-fir forest types in the Southwest. On the forest, ponderosa pine, and mixed conifer above the Mogollon Rim is considered to be prime goshawk habitat, with occasional use in the piñon-juniper. Habitat includes any associated pine or mixed conifer stringers that may extend below the rim. The northern goshawk occurs on the Flagstaff and Mogollon Ranger Districts, with approximately 878,899 acres of potential habitat available in these areas. The goshawk is a forest habitat generalist that uses a wide variety of forest stages. It prefers stands of intermediate canopy cover, typically comprised of mature and older forests for nesting, while more open areas are used for foraging, allowing them to more easily see and pursue their prey.

Large trees, snags, logs, downed woody material, and with a diverse herbaceous component, are important habitat attributes for northern goshawks and their prey.

Risk Factors: The main risk to goshawk habitat is uncharacteristic fire which would contribute to direct loss of habitat for goshawks and their prey species. Overly dense forest, with contiguous canopy cover and fire regimes that differ greatly from historic conditions further contribute to this risk. The primary fine-filter species threat under the control and authority of the Forest Service is nest disturbance during the breeding season. This may result in failed reproduction or fewer young.

Environmental Consequences – Northern Goshawk

Common to All Alternatives

Landscape-Level Habitat Threats: The coarse filter section above for the forest and woodland PNVTs compares how each alternative addresses the primary habitat threat of uncharacteristic fire in northern goshawk habitat. Additional details are in the “Vegetation and Fire” section of this document.

As described in the introductory fine filter section above, all alternatives have plan components that would reduce disturbance to northern goshawks in their post-fledgling areas and would have the indirect positive effects of promoting population recruitment and survival.

There are 2,659 acres of northern goshawk post-fledgling area in currently designated special areas. Acres in existing wilderness or inventoried roadless areas would have low disturbance due to the lack of motorized use or limited motorized use, respectively. Post-fledgling areas and northern goshawk habitat outside of post-fledgling areas lie within portions of four eligible wild

and scenic river segments. Because the forest would maintain the outstandingly remarkable values of eligible wild and scenic river segments (see the "Special Areas" section for more information), there is usually very limited motorized use in these areas and there should be low net disturbance. However, until eligible segments are designated by Congress, the level of human use is not limited to a certain capacity, so it is not possible to estimate resource impacts to northern goshawk habitat from nonmotorized dispersed recreation activities in these areas.

Alternative A

Post-Fledgling Activity Center (PFA) Habitat: In Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs, it was assumed that northern goshawks could nest in vegetative states that represent medium to very large trees, open and closed canopy, even-aged and uneven-aged. In Mixed Conifer with Aspen PNVT, it was assumed that northern goshawks could nest in vegetative states that represent very large trees with open and closed canopy. Collectively, these states occupy about 77 percent of these 3 PNVTs (680,767 acres). Based on VVDT modeling for alternative A, the amount of potential goshawk nesting habitat would shift to about 60 percent of these 3 PNVTs (529,842 acres).

The amount of PFA habitat in uneven-aged conditions, which is better northern goshawk habitat and consistent with desired conditions, would improve substantially over existing condition but not as quickly as in alternatives B, C, and D. The shift to uneven-aged structure would facilitate goshawk foraging and maintain favorable conditions for goshawks and their prey over the long term. At the fine scale, clumps of trees with higher canopy cover could be included in the open states, as well as in closed canopy states, and these would provide for PFA and nesting habitat.

There would also be a shift to more open conditions in Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs. The shift to more open canopy would improve the abundance and vigor of understory vegetation which provides food and cover for some northern goshawk prey species and would reduce the risk of uncharacteristic fire. These conditions would improve the forest's ability to maintain oak, aspen, and maple. Vegetation compositional diversity within forest stands can increase the diversity of passerine birds, some of which are important prey for northern goshawks.

There are no plan objectives for Mixed Conifer with Aspen PNVT, so potential goshawk habitat in this PNVT would remain about the same as current. Aspen would maintain but primarily as later seral stages except where actively managed or in early seral stages following a wildfire. Seventy percent of Mixed Conifer with Aspen on the forest would be managed for Mexican spotted owl or wilderness. Old-growth attributes would persist in these areas with a predominantly closed canopy condition. This could provide nesting habitat as well as habitat for prey species such as squirrels and woodpeckers. About 14 percent of this PNVT would provide for more open desired conditions which maintain habitat birds and mammals that goshawk prey on. It would provide favorable conditions for aspen and additional structural diversity required by northern goshawks and their prey.

Alternative A contains desired conditions for northern goshawk habitat (for composition, structure, and function) that are more general than alternatives B, C, and D, but it is more prescriptive in terms of desired density.

Approximately 48 percent of the post-fledgling areas overlap Mexican spotted owl habitat in the Ponderosa Pine and Mixed Conifer PNVTs and are managed with an emphasis on Mexican

spotted owl habitat because threatened species take priority over sensitive species. In these same vegetation types, approximately 19 percent of the landscape outside of post-fledgling areas is managed with an emphasis on Mexican spotted owl habitat as well. This means that these proportions of northern goshawk habitat are generally managed at higher canopy cover levels and with smaller openings than goshawk habitat outside of Mexican spotted owl habitat. Under alternative A, where northern goshawk habitat overlaps with Mexican spotted owl protected activity centers, only trees smaller than 9 inches in diameter at breast height may be cut. Consequently, dense areas are at higher risk of uncharacteristic fire, insects and disease, and density-related tree mortality than habitat that does not overlap with protected activity centers.

Alternatives A and C

Alternatives A and C follow the 1987 plan for managing old growth as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area and consequences are described in detail in the "Vegetation and Fire" section. This strategy would result in lower habitat quality for northern goshawks compared to alternatives B and D because it would result in less vertical structure and age class diversity; tend to maintain a more continuous canopy than alternatives B and D that would be more conducive to crown fires; and result in more even-aged conditions. This structure and age class diversity does not reflect frequent low-severity fires characteristic of this PNVT. During wildfires, there is likely to be more area in mixed severity condition with 25 percent to 75 percent loss of dominant overstory, compared to a loss of 25 percent or less which is characteristic of low-severity fires. Old-growth stands would be less resilient to endemic levels of disturbances. There would be fewer openings and less understory. Northern goshawk habitat would be maintained under this alternative; however, it would be at higher risk from uncharacteristic fire and susceptibility to insects and disease compared to alternatives B and D. Habitat quality would also be lower in these areas because of a greater proportion of even-aged conditions. These areas would not be consistent with desired conditions.

Recreation Opportunity Spectrum: The forest plan sets the desired recreation opportunity spectrum (also called recreation opportunity spectrum objectives) used to determine if projects are compatible with forest recreation goals. At the project level, the desired recreation opportunity spectrum is used to determine if a project is moving toward or away from the desired recreation opportunity spectrum. Recreation opportunity spectrum classes represent a continuum or spectrum from primitive and unmodified environments to highly urban and modified landscapes. The more primitive classes include primitive (P), semiprimitive nonmotorized (SPNM), and semiprimitive motorized (SPM) and are characterized by relatively little or no developments and roads. The less primitive classes are roaded natural (RN), rural (R), and urban (U).

Alternative A would have the highest amount of potential disturbance to northern goshawk post-fledgling areas resulting from recreation opportunity spectrum classifications compared to alternatives B, C, and D. It has the lowest amount of the classes that allow minimal facilities and highest amount of classes that permit development of roads and facilities.

Wilderness and Other Special Area Designations: Alternative A would not recommend or propose any new wilderness or other special area designations, so the amount of post-fledgling areas and northern goshawk habitat that would be protected from disturbance from special designations would not change from current management.

Under alternative A, northern goshawk viability would continue to be maintained through the 1996 plan amendment, which provides site specific (project-level) direction across the forest.

Specific plan components would reduce or remove disturbance during the breeding season (new p. 65-7, par 5; new p. 65-11, pars 4, 5; p. 206-67, par 6; new p. 206-73, par 4). Additional objectives that would benefit goshawk are also provided in the Oak Creek Canyon (MA 14) through objectives to maintain viability populations of wildlife species and standards that restrict aircraft activities related to commercial filming, as well as prohibitions on campfires in Oak Creek Canyon and other areas (p. 184, par 10; new p. 206-11, par 8; replacement p. 206-24, par 3).

Alternatives B, C, and D

Alternatives B, C, and D contains desired conditions for northern goshawk habitat (for composition, structure, and function) that are more specific and less prescriptive than alternative A. These alternatives also have separate desired conditions for the two mixed conifer types which would facilitate management better fitting these two different ecological systems.

Alternatives B, C, and D would provide for closer achievement of desired conditions than alternative A, primarily resulting from more acres treated and conversion from even-aged to uneven-aged structure. These alternatives would put northern goshawk habitat on a trend toward desired conditions by improving age class diversity and stand structure, opening up the canopy, and reducing overall departure. Understory vegetation is expected to respond favorably to treatment. The shift to more open canopy would improve the abundance and vigor of understory vegetation which provides food and cover for northern goshawk prey. It would also improve conditions for Gambel oak and aspen. The increases in uneven-aged, multistoried stand structure particularly in medium and very large trees over the long term would maintain favorable conditions for northern goshawks and their prey.

Post-Fledgling Activity Center (PFA) Habitat: In Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs, it was assumed that northern goshawks could nest in vegetative states that represent medium to very large trees, open and closed canopy, and even-aged and uneven-aged. In Mixed Conifer with Aspen PNVT, it was assumed that northern goshawks could nest in vegetative states that represent very large trees with open and closed canopy. Collectively, these states occupy about 77 percent of these 3 PNVTs (680,767 acres). Based on VVDT modeling for alternatives B, C, and D, the amount of potential goshawk nesting habitat would shift to about 62 percent of these 3 PNVTs (542,063 acres or about 12,000 acres more than alternative A).

The amount of PFA habitat in uneven-aged conditions, which is better northern goshawk habitat and consistent with desired conditions, would improve substantially over existing condition and at a faster rate than in alternative A. The shift to uneven-aged structure would facilitate goshawk foraging and maintain favorable conditions for northern goshawks and their prey over the long term. At the fine scale, clumps of trees with higher canopy cover could be included in the open states, as well as in closed canopy states, and these would provide for PFA and nesting habitat.

There would also be a shift to more open conditions in Ponderosa Pine and Mixed Conifer with Frequent Fire. The shift to more open canopy would improve the abundance and vigor of understory vegetation which provides food and cover for some northern goshawk prey species and would reduce the risk of uncharacteristic fire. These conditions would improve the forest's ability to maintain oak, aspen, and maple. Vegetation compositional diversity within forest stands can increase the diversity of passerine birds, some of which are important prey for northern goshawks.

There are no plan objectives for Mixed Conifer with Aspen PNVT, so potential goshawk habitat in this PNVT would remain about the same as current. Aspen would maintain but primarily as later seral stages, except where actively managed, or in early seral stages following a wildfire. Seventy percent of Mixed Conifer with Aspen on the forest would be managed for Mexican spotted owl or wilderness. Old-growth attributes would persist in these areas with a predominantly closed canopy condition. This could provide nesting habitat as well as habitat for prey species such as squirrels and woodpeckers. In the proportion of habitat outside of Mexican spotted owl habitat and wilderness, alternatives B, C, and D would be expected to move closer to desired conditions than alternative A because of better defined desired conditions and fire would be allowed to play a more natural role in these areas (FW-Veg-MC-MCA-DC-1 to 12).

About 14 percent of this PNVT would provide more open desired conditions which maintain habitat birds and mammals that goshawk prey on. It would provide favorable conditions for aspen and additional structural diversity required by northern goshawks and their prey.

These alternatives also have a variety of specific plan components designed to reduce the fine filter threat of disturbance during the breeding season, facilitating reproductive success. Desired conditions state that campfire smoke in Oak Creek Canyon is minimal and air quality is of sufficient quality to protect habitat and wildlife species (MA-OakCrk-DC-6), that unneeded roads are closed and naturalized to reduce human disturbance to wildlife (FW-RdsFac-DC-4), and the location of new, large linear infrastructure such as power lines has minimal effects to wildlife and minimizes habitat fragmentation (FW-SpecUse-DC-3). Guidelines further clarify that fire suppression techniques should minimize impacts to listed and Forest Service sensitive species (FW-WFP-G4).

Alternative B

Recreation Opportunity Spectrum: In alternative B, about 6,369 acres of post-fledgling areas would shift from the ROS classes that allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This improvement would be higher than alternative A, lower than alternative C, and the same as alternative D.

Wilderness: This alternative recommends 3 wildernesses, which would not affect any known post-fledgling areas and add 29 additional acres of northern goshawk habitat to areas that would be protected from disturbance by special area designations. These additional areas would have reduced disturbance, but would also be precluded from restoration treatments that would require motorized equipment.

Alternative C

Recreation Opportunity Spectrum: In alternative C, about 7,087 acres of post-fledgling areas would shift from ROS classes that allow more development to ones that allow less. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This improvement would be higher than alternatives A, B, and D.

Wilderness: Alternative C would recommend 13 additional wilderness areas and propose wildlife habitat management areas. The recommended wilderness areas would overlap 731 acres of post-fledgling areas (2.8 percent) and 2,571 acres of landscape of northern goshawk habitat to areas that would be protected from disturbance by special area designations.

Recreational Shooting: The designation of areas as nonsuitable for recreational shooting would result in reduced disturbance within post fledging areas in the following areas: 6,343 acres in wildlife habitat management areas; 2,433 acres in the Walnut Canyon Management Area; 2,286 acres in the Long Valley Management Area; 24 acres in special areas within the Flagstaff Neighborwoods Management Area, and 52 acres in special areas within the Pine Belt Management Area.

Direction for wildlife habitat management areas would focus on habitat restoration by reestablishing natural fire regimes and by reducing road densities for public motorized access. Of the 8 proposed WHMAs, 6 have all or part of 13 post-fledgling areas (PFAs) within their boundaries (Table 101). Northern goshawks are an emphasis species in seven WHMAs: East Clear Creek, Hospital Ridge, Jacks's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, and Second Chance. About 3.2 miles of road could potentially be closed to public motorized use in PFAs, in the East Clear Creek and Jack's Canyon WHMAs. If these were closed through site-specific NEPA, this would result in 2 PFAs with reduced disturbance which represents 3.2 percent of the PFAs on the forest. A total of 61 miles could potentially be closed to public motorized use in areas outside of PFAs within the East Clear Creek, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, and Pine Grove WHMAs, with about 54 miles in the East Clear Creek and Jack's Canyon WHMAs (table 101).

Table 101. Wildlife habitat management areas, northern goshawk habitat, and potential road closures

WHMA	PFA Acres (No. of PFAs Affected)	PFA Acres with Reduced Disturbance (Percent of PFA Acres Forestwide)	Miles of Road That Could Potentially Close in PFAs	Northern Goshawk Habitat Acres Outside of PFAs with Reduced Disturbance
Anderson Mesa	1,540 (4)	0	0	0
East Clear Creek	1,313 (3)	1 (1.6%)	1.2	32.9
Hospital Ridge	670 (1)	0	0	1.1
Jack's Canyon	1,267 (2)	1 (1.6%)	3.8	20.9
Knoll Lake	0	0	0	2.5
Limestone Pasture	0	0	0	1.4
Pine Grove	799 (2)	0	0	2.3
Second Chance	754 (1)	0	0	<0.1
Total	**6,343 (13)**	**2 (3.2%)**	**5.0**	**61.0**

Wildlife habitat management areas would serve to reduce human disturbance in those areas where the area isn't already protected by existing designations such as wild and scenic rivers or inventoried roadless areas.

Alternative D

Alternative D would have the same effects as alternative B except there would be no recommended wilderness. In alternative D, shifts from ROS classes that allow more development

to ones that allow less would be the same as in alternative B. This would reduce noise disturbance, limit the ability of managers to build roads in this area in the future, and encourage closure and decommissioning of existing roads. This improvement would be higher than alternative A and lower than alternative C.

Summary of Species Effects

Northern goshawks are widely distributed across the forest. In addition to the landscape-level threat of habitat loss through uncharacteristic fire, this species can be sensitive to human disturbance during the breeding season. Actions associated with vegetation management (e.g., prescribed fire and mechanical treatment), disturbance from recreation, and habitat fragmentation resulting from development can affect viability by decreasing reproductive output. Under all alternatives, individual birds could be impacted, and viability would be maintained but no alternatives would lead to Federal listing in the expected 15-year life of the plan.

Although all alternatives maintain the viability and persistence of this species, alternatives B, C, and D do a better job because:

- Desired conditions for northern goshawk habitat are updated and more clearly articulated;
- Language regarding movement corridors and connectivity between habitats is updated so that links between suitable habitats would be better maintained and habitat fragmentation is minimized; and
- Guidelines minimize disturbance to Southwestern Region sensitive species during the breeding season.

Relative to alternative A, alternatives B, C, and D would increase the amount of medium to very large tree and open vegetative conditions, as well as shift approximately 5,124 acres of post-fledgling area habitat from roaded natural, rural, and urban classifications to the more primitive classes, further decreasing human disturbance to goshawks. Fire management could still be performed in these areas, but any potential disturbance would be countered by plan guidelines to minimize that threat.

To varying extents under all alternatives, post-fledgling areas and northern goshawk habitat would be further protected from human disturbance with existing and recommended or proposed special area designations. Although human disturbance would be decreased in those areas, the ability to actively manage those areas would also be limited (table 102).

Alternative D would parallel alternative B, except that there would be no additional wilderness designations. Alternative D plan language would provide fewer restrictions tied to recreation in special areas and energy infrastructure and, as a result, could result in slightly greater impacts on overall ecosystem health of the forest.

Table 102. Acres of post-fledgling areas and northern goshawk habitat in existing and proposed special area designations by alternative

Special Designation	Alts. A, D		Alt. B		Alt. C	
	PFAs	Goshawk PNVTs	PFAs	Goshawk PNVTs	PFAs	Goshawk PNVTs
Existing wilderness	1,018	40,391	1,018	40,391	1,018	40,391

Special Designation	Alts. A, D		Alt. B		Alt. C	
	PFAs	Goshawk PNVTs	PFAs	Goshawk PNVTs	PFAs	Goshawk PNVTs
Inventoried roadless areas	1,037	2,989	1,037	2,989	1,037	2,989
Eligible wild and scenic river segments	604	11,304	604	11,304	604	11,304
Recommended wilderness	0	0	0	29	762	5,117
Wildlife habitat management area	0	0	0	0	7,608	112,482
Total in any special designation	2,659	52,684	2,659	52,713	11,029	172,283
Acres outside all special designations	39,478	826,215	39,478	826,186	31,108	706,616

Fine Filter – Flagstaff Pennyroyal, Hairy Clematis

Southwestern Region Sensitive Species (Table 43)

Affected Environment

Distribution: There are two major populations of Flagstaff pennyroyal on the forest; the first extends between Flagstaff, Marshall Lake, Fisher Point, and south to the vicinity of Mountainaire and Lower Lake Mary. A second population is near the rim of Oak Creek Canyon and its tributaries. The estimated amount of habitat on the forest for the hairy clematis is approximately 15 acres in ponderosa pine forests and on dolomitic limestone soils.

Habitat: Flagstaff pennyroyal occurs on limestone substrates such as dolomitic limestone cliffs, and rock pavement in ponderosa pine forest in a broad range of canopy cover (0 to 86 percent). Hairy clematis occurs on dolomitic limestone soils in ponderosa pine.

Risk Factors: Both of these plants are threatened from disturbance from activities such as road construction and maintenance, vegetative treatments, and burning which can crush or remove of plants.

Environmental Consequences – Flagstaff Pennyroyal, Hairy Clematis

Alternative A

Alternative A has direction that protects and improves habitat for these species (new p. 22-1, par 1). Area-specific direction would maintain or enhance rare plant populations and their habitat where they occur in the Flagstaff Lake Mary Ecosystem Analysis Area (new p. 206-98, par 11), balance recreation demands with sensitive resources such as species habitats (new p. 206-98, par 3; new p. 206-91, par 4), and mitigate potential effects from rock climbing (new p. 206-66, par 9; new p. 206-67, par 4).

Additional language protects, improves, or maintains habitat for Forest Service sensitive species (replacement p. 23, pars 1, 2; p. 206-70, par 8) and would specify the development of a rock climbing plan that would detail mitigation measures to protect sensitive species (new p. 206-67, pars 1-2). Forestwide plan standards and guidelines would manage Flagstaff pennyroyal through the direction in the management plan prepared for it (replacement p. 65, par 1). This 1984 plan

mainly addresses the effects of timber sales and related activities. Alternative A also protected hairy clematis through a standard that specified that management activities needed for the conservation of *Clematis hirsutissima arizonica* (now classified as *Clematis hirsutissima* var. *hirsutissima*) would be exempt from the conflicting northern goshawk standards and guidelines until conservation strategies or recovery plans (if listed) are developed (new p. 65-7, par 8) providing.

Although alternative A includes language that would benefit these species, guidance found in alternative A is based on outdated science and information about these plants. Additionally, it lacks desired conditions and objectives for rare and endemic plants, and is largely silent on direction and mitigation for many management actions.

Alternatives B, C, and D

Alternatives B, C, and D would address rare plant habitats and management more completely than alternative A. Unlike analyses under alternative A that generally rely on existing laws, regulations, and manual direction, alternatives B, C, and D would provide more integrated approaches. Since monitoring is needed that supports adaptive management, focusing on outcomes and progress toward desired conditions would provide positive benefits for forest planning plant species.

Desired conditions common to alternatives B, C, and D that benefit these two species include:

- Habitats throughout the forest include the microclimate or smaller scale elements needed for rare plants within each PNVT. The structure and function of the PNVTs and associated microclimate or smaller scale elements such as special features, rock piles, specific soil types, and wet areas exist in adequate quantities to provide habitat and refugia for narrow endemics, species with restricted distributions, and Region 3 sensitive species (FW-Veg-All-DC-14; FW-WFP-DC-5).
- Plant species are genetically diverse and able to disperse to suitable habitat, disperse, migrate, and meet their life history requirements (FW-WFP-DC-6).
- Habitats for special status species support viable, self-sustaining populations (FW-WFP-DC-2).
- Ecological conditions provide habitat for federally listed and other special status species. Habitat conditions contribute to the survival and recovery of listed species, contribute to the delisting of species under the Endangered Species Act, preclude the need for listing new species, improve conditions for Forest Service Southwestern Region Sensitive Species, and keep common native species common (FW-WFP-DC-2).
- Desired conditions for all vegetation types at the fine scale include ensuring that endemic rare plant communities are intact and functioning; unique plant community habitats (e.g., limestone cliffs, margins of springs, Verde Valley Formation, basalt-lava flows/cinders, calcareous soil/alkaline clay, canyons/cliffs and ledges, granitic soils/Igneous rocks, and sandstone rocks/soils) are present to maintain well-distributed populations of associated native plant species; and to promote pollinator success and survival. (FW-Veg-All-DC-14, FW-Veg-All-DC-15, FW-Veg-All-DC-13).

Modifying stand structure and density toward reference conditions and restoration of historic fire regimes would enhance habitats of rare plant species that exist in ponderosa pine. Studies of several forest plan analysis species, including Flagstaff pennyroyal and Hairy clematis, have

shown that these species respond favorably to treatments that open the ponderosa pine forests and restore more natural fire return intervals (Crisp, D. 1997, Laughlin et al. 2008, Machinski et al. 1997).

Other plan components would protect the habitat of species growing on cliffs and rocky outcrops (FW-BioPhys-Geo-DC-1, 4, 5, 6), balance impacts from dispersed recreation use with sensitive resources), minimize damage from motorized use, and encourage stewardship of botanical communities through interpretive messages (FW-Rec-Disp-DC-2, 3, 7, 8). These alternatives would have a management approach that refers to a plan implementation guidebook for plants for project level guidance. This guidebook is intended to be a living document that is periodically updated with new information.

Summary of Species Effects

All alternatives would maintain the viability of the Flagstaff pennyroyal and hairy clematis by providing plan components that address the threat of disturbance from human activities by protecting habitats for sensitive and rare and endemic species.

All alternatives, particularly alternatives B, C, and D, would also improve ponderosa pine forests for the Flagstaff pennyroyal and hairy clematis. The implementation of any alternative could result in negative impacts to individual Flagstaff pennyroyal and Hairy clematis plants and their habitat, but these impacts would not result in a trend toward listing or a loss of viability of these species on the forest. Implementation of plan components related to vegetation treatments, recreation management, watershed management, wildlife, fish or rare plants management, or land acquisition in any of the alternatives may have short-term effects on plant habitat or species populations, but would produce long-term benefits to the maintenance and improvement of habitats and associated species populations on the forest.

Fine Filter – Mogollon Thistle, Serrate Phacelia, and Sunset Crater Beardtongue

Southwestern Region Sensitive Species, Other Forest Planning Species (Table 43and Table 44)

Affected Environment

Distribution: Mogollon thistle is known from a few springs on the south end of the forest and is a Forest Service sensitive species. Serrate phacelia is fairly abundant in its cinder soil habitat which is mainly restricted to the north and northeastern portions of the forest on the Sunset Crater volcanic field. In previous years, however, thousands of plants have been observed in the Cinder Lake area of the Coconino NF. The range of the Sunset Crater beardtongue on the forest is limited to the Sunset Crater volcanic field near Flagstaff, including the Coconino NF and Sunset Crater National Monument.

Habitat: Mogollon thistle habitat includes springs. It grows in moist soils with riparian understory plants associated with springs in Mixed Conifer and Ponderosa Pine forest. Serrate phacelia and Sunset Crater beardtongue habitat includes Ponderosa Pine and cinder soils. The habitat of Sunset Crater beardtongue is flat or gently sloping cinder soil sites in open Ponderosa Pine forest between 6,500 and 8,500 feet.

Risk Factors: Risk factors for these plants include invasive plant species that can compete with these native species. Specifically, the invasive bull thistle can compete with the native Mogollon

thistle. The invasive diffuse knapweed can compete with Serrate phacelia that grows in cinder soils in the northeast portion of the forest, including the Cinder Hills Off-highway Vehicle Area.

Crushing of plants in cinder soils by dispersed recreation activities, especially motor vehicle use, also threatens Serrate phacelia and Sunset Crater beardtongue.

Environmental Consequences – Mogollon
Thistle, Serrate Phacelia, and Sunset Crater Beardtongue

All Alternatives

As described in the coarse filter section, all alternatives address the primary threats to the habitats of these species and would result in maintaining or improving their habitats.

Invasive Plants: All alternatives would promote a strategy to address establishment, containment, control, and eradication of invasive plants (p. 23, par 8; FW-Invas-G-1) and have forestwide standards and guidelines to incorporate control measures into projects (p. 69, par 9; FW-Invas-G1). All alternatives point to "Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures" in the "Final Environment al Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests" (USDA Forest Service 2005) as part of the strategy to prioritize and treat invasive plants while still protecting native species from the treatments (p. 69, par 10; FW-Invas-G-2).

Dispersed Recreation in Cinder Soils: Under all alternatives, the Cinder Hills Off-highway Vehicle Area would continue to be managed for off-road motor vehicle use (replacement p. 179, par 2; replacement p. 180, par 4; FW-Rec-Disp-DC-5). This results in a portion of habitat for these species being heavily impacted by dispersed recreation and being dominated by bare soil and frequent disturbance. Under alternative A, there is plan language that promotes monitoring, of plant communities and states that areas within the off-highway vehicle area may be closed for protection of ground vegetation and for sensitive plant locations (replacement p. 178, par 3; replacement p. 180, par 5; replacement p. 182, par 5). However, implementation of these plan components has been infeasible because of the extent of off-highway vehicle use within the area and the long recovery period of these soils once they are disturbed. There is a forestwide guideline under alternatives B, C, and D that also provides for closure of areas from recreation activities for rehabilitation of native plants (FW-Rec-Disp-G-6), but within the Cinder Hills Off-highway Vehicle Area, implementation of this guideline would conflict with the express purpose of this area being designated for off-highway recreation. Under all alternatives, however, there are plan components that promote maintenance of a well signed and distinguishable boundary for the off-highway vehicle area to prevent expansion of the area and disturbance of plants communities adjacent to it (replacement p. 181, par 7; FW-Rec-Disp-DC-5; MA-VolcanWd-DC-2).

Alternative A

Dispersed Recreation in Cinder Soils: Alternative A includes a forestwide goal to protect areas of threatened, endangered, and sensitive plants (new p. 206-32, par 2) (see table 103). Specific areas where conflicts with bicycles and resources occur have been identified (replacement p. 59, par 5). The motor vehicle use map limits recreational motor vehicle traffic to designated roads and trails, which will protect sensitive plant species from off-trail driving (replacement p. 58, pars 2 and 3). In the Sedona-Oak Creek Management Area (MA 21), trail placement should keep sensitive plants out of sight and that viewing native plants is an important part of maintaining the

recreation setting (scenery) (new p. 206-32, par 2; new p. 206-16, par 4). There are guidelines in the Cinder Hills Off-highway Vehicle Area (Management Area 13), which is habitat for Serrate phacelia, to locate camping to lessen use in sensitive areas and protecting and rehabilitating needs of impaired vegetation and soils (replacement p. 181, par 8).

Table 103. Alternative A plan components that would protect Mogollon thistle, Serrate phacelia, and Sunset Crater beardtongue from dispersed recreation impacts

Plan Section	Location in 1987 Plan (Page and Paragraph)	Plan Component
MA 21 Management Emphasis and Guidelines	New p. 206-32, par 2, new p. 206-16, par 4	Protect sensitive plant populations by site design and mitigation measures during construction. Develop native plant rehabilitation measures for disturbed areas.
Forestwide Wildlife and Fish Goals	Replacement p. 23, par 2	Identify and protect areas that contain threatened, endangered, and sensitive species of plants and animals.
Forestwide Standards and Guidelines – Bicycle Use	Replacement p. 59, par 5	Bicycle use of NFS roads/trails will be regulated if significant conflicts arise.
Forestwide Standards and Guidelines – Motor vehicle Management	Replacement p. 58, pars 2 and 3	Limits motor vehicle use to designated roads, trails, and areas.
Cinder Hills Off-Highway Vehicle Area – Management Area 13	Replacement p. 178, par 3 Replacement p. 180, par 5 Replacement p. 182, par 5	Monitor communities of plants such as Penstemon cluteii. Areas may be closed for protection of geologic features tied to Sunset Crater, maintenance of ground vegetation necessary for ecosystem function, sensitive plant locations.
Cinder Hills Off-Highway Vehicle Area – Management Area 13	Replacement p. 179, par 2 Replacement p. 180, par 4	This MA is designated for OHV use and is managed for 2- and 4-wheeled vehicles. This MA is open to unrestricted cross-country travel except where signed closed.
Cinder Hills Off-Highway Vehicle Area – Management Area 13	Replacement p. 181, par 7	Improve and maintain boundary of the OHV area and interior signing.

Alternatives B, C, and D

Forestwide desired conditions promote endemic rare plant communities that are intact and functioning (FW-Veg-All-DC-13) and invasive species at a level that where they do not affect the sustainability of native species or disrupt ecological functioning (FW-Invas-DC-1, FW-Veg-All-DC-3). These alternatives further protect Mogollon thistle by having additional guidelines to reduce the spread of invasive plants between waterbodies and healthy habitats through use of decontamination protocols (FW-Invas-G-3) and both species through the use of weed-free plant material for animal feed, bedding, soil stabilization, and land rehabilitation in disturbed areas (FW-Invas-G-4,5). Native species (such as Mogollon thistle) associated with springs would be free of, or minimally impacted by, invasive plant species (FW-Aq-Spr-DC-11).

Dispersed Recreation in Cinder Soils: For Serrate phacelia, management direction in the Volcanic Woodlands Management Area promotes cinder cones generally undisturbed by

management activities (MA-VolcanWd-DC-2) outside the OHV area. This would lessen the establishment of invasive plants like diffuse knapweed which rapidly infiltrate disturbed areas. There is no specific guidance related to sensitive resources in the Cinder Hills Off-highway Vehicle Area except to clearly delineate the boundary (FW-Disp-Rec-DC-5) and recommendation in management approaches to create a management plan.

Desired conditions under alternatives B, C, and D would recognize the relationship between unique native plant communities and retention of physical features that support them more effectively than alternative A (FW-Veg-All-DC-13 and 14, FW-Scenic-DC-5). Plan components would address the need for rehabilitation of social trails and sites where disturbance has removed native plants and increased erosion (FW-Rec-Disp-DC-1; FW-Rec-Disp-DC-7; FW-Rec-Disp-DC-8; FW-Rec-Disp-DC-14; FW-Rec-Disp-G-6; FW-Scenic-DC-5). These components also incorporate strategies to prevent off-trail and off-road recreation and to improve visitor understanding of resource stewardship. Cinder cones outside of the OHV area would also be protected from disturbance and motor vehicle intrusion into already protected areas would be limited, especially the Strawberry Crater Wilderness (SA-Wild-Straw-DC-3; MA-VolcanWd-DC-2). Alternatives B, C, and D would, therefore, better provide for the viability of plant species associated with cinder soils because it incorporates proactive approaches to resource protection, rehabilitation of already impacted sites, and better goals for management of the physical setting underlying unique plant communities (see table 104).

Sunset Crater beardtongue may occur in the proposed Strawberry Crater Wilderness addition that would afford this species some additional protection from human generated disturbances under alternatives B and C.

Table 104. Alternatives B, C, and D plan components that would protect Mogollon thistle, Serrate phacelia, and Sunset Crater beardtongue from dispersed recreation impacts

Plan Section	Location Code in Proposed Revised Plan	Plan Component
Vegetation	FW-Veg-All-DC-13; FW-Veg-All-DC-14	Endemic rare plant communities are intact and functioning and the unique physical habitats that support them.
Recreation – Dispersed	FW-Rec-Disp-DC-1; FW-Rec-Disp-DC-7; FW-Rec-Disp-DC-8; FW-Rec-Disp-DC-14	Recreation desired conditions support education on low impact recreation principles, a system of trails, trailheads, and signs that reduce conflicts between resources and visitors, and management to prevent creation of unauthorized trails.
Recreation – Dispersed	FW-Rec-Disp-DC-5	The boundaries of the Cinder Hills Off-Highway Vehicle (OHV) Area are clearly delineated and prevent off-road driving outside of the designated area. Clear signage and information are provided to off-highway vehicle drivers to make clear distinction between driving rules in the Cinder Hills OHV area and rules that apply to the cinder cones outside of the OHV area.
Recreation – Dispersed	FW-Rec-Disp-G-6	Where necessary to protect and promote soil and plant restoration, national forest visitor activities should be restricted from entry into soil and plant restoration sites.
Scenery	FW-Scenic-DC-5	Cultural and historic features, young cinder cones, and lava flows are recognized for their inherent scenic values. Native plant rehabilitation is carried out in disturbed areas to speed scenic quality recovery.

Plan Section	Location Code in Proposed Revised Plan	Plan Component
Strawberry Crater Wilderness	SA-Wild-Straw-DC-3	The construction of barriers and signage along the wilderness boundary prevent motor vehicle intrusion along the south and west boundaries of the wilderness. Educational materials about the sensitive soils and plants are provided to visitors.
Volcanic Woodlands MA	MA-VolcanWd-DC-2	Outside of the Cinder Hills OHV area, cinder cones are generally undisturbed by management activity and the volcanic features maintain their integrity, form, and process.

Summary of Species Effects

Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would maintain the viability and persistence of the populations of these two species and not contribute to listing because:

- All alternatives address the control, containment, and eradication of invasive plants;
- Reduce recreation impacts to threatened, endangered, and sensitive plants; and
- In addition to law regulation and policy, all alternatives promote the management of Forest Service sensitive species to maintain and improve their habitat to preclude listing.

Alternatives B, C, and D would further maintain the viability of these species by providing:

- Desired conditions and plan language to better provide for the composition, structure, and functioning of springs to maintain the habitat of Mogollon thistle, compared to alternative A; and
- Desired conditions that promote intact and functioning ecosystems for endemic species like Mogollon thistle and Serrate phacelia.

Alpine Tundra

Coarse Filter

Affected Environment

Abundance and Distribution: This PNVT makes up 941 acres or about 0.1 percent of the Coconino NF. This PNVT is as abundant now as it was in reference conditions.

Habitat Quality: Overall, it has low departures from reference conditions in terms of vegetation, invasive plants, and soil condition and productivity. This PNVT is trending away from reference and transitioning into more meadow subtypes. Soil condition and invasive plants both have a static trend.

Risk Factors: The main risk factor for this PNVT is climate change, which is outside the control of the Forest Service. The other habitat threat is off-trail hiking. Off-trail hiking has the potential to reduce the vigor, maintenance, and survival of rare plants, such as those found in the Alpine Tundra PNVT or in botanical special areas.

Associated Species: Fourteen species are associated with this habitat (table 42, Table 43, and table 44). These species are:

- One is federally listed: San Francisco Peaks ragwort (threatened);

- Three are Forest Service sensitive species: long-tailed vole, dwarf shrew, and crenulate moonwort; and
- Ten are other forest planning species: common moonwort, blackroot sedge, different-nerve sedge, Dane's dwarf gentian, bearded gentian, bristlecone pine, spider saxifrage, graceful buttercup, grassy slope sedge, and timberland blue-eye grass.

Habitat (coarse filter) plan components adequately address threats to all species except the one federally listed species, the San Francisco Peaks ragwort (threatened). Additional species-specific threats to San Francisco Peaks ragwort are addressed below in the "Listed Species" section in the fine filter analysis.

Environmental Consequences – Alpine Tundra

Habitat Quality

Common to All Alternatives

There would be no difference in departure for this PNVT among alternatives because all 939 acres of alpine tundra occur in wilderness and the Snowbowl Ski Area. None of the alternatives would vary in effects for the 40 acres of this PNVT within the Snowbowl Ski Area because none would lead to changes in the operating permit for the site. The departure of the PNVT could be negatively impacted by the predicted effects of climate change because treeline may move upward resulting in decreased abundance of the habitat. The Forest Service, however, does not have a mechanism within its authority to mitigate this effect.

Projected and Improved Habitat: All alternatives lack treatment objectives, thus forest plan objectives would not result in additional acres of improvements to species habitats or changes to the number of acres of projected habitat for any species. Implementation of plan components other than objectives could result in improvements to habitat quality, however, the amount of improvement would be unknown because this would be decided at the project level.

Off-Trail Hiking: Off-trail hiking would continue to be prohibited in the Kachina Peaks Wilderness above treeline under all alternatives (replacement p. 108 under Kachina Peaks heading bullets 5, 6, 7, and 9; SA-Wild-KPeaks-S-1; SA-Wild-KPeaks-S-2; SA-Wild-KPeaks-S-3). Therefore, the threat of trampling and increased soil instability because of off-trail hiking within this PNVT would be addressed under all alternatives.

Environmental Consequences – Coarse Filter Viability Summary for Alpine Tundra

The risks of off-trail hiking to Alpine Tundra are addressed through the inclusion of off-trail hiking prohibitions in that PNVT under all alternatives. Therefore, species viability associated with Alpine Tundra habitat within the control of the Forest Service would be addressed by the coarse filter plan components under all alternatives (see table 105). The remaining species associated with this habitat, San Francisco ragwort, has species specific risks and is further addressed in the "Threatened and Endangered Species" fine filter section that follows.

Table 105. Plan components under alternatives B, C, and D that would provide for species viability in Alpine Tundra PNVT

Location Code in Proposed Revised Plan	Intent of Plan Component	Benefiting Species
FW-Veg-AT-DC-1, 2,3,4	The plants, animals, and geological features which contribute to the ecological diversity and uniqueness of Alpine Tundra are maintained. Provides habitat for native biota, has a diverse composition of native species and vegetation communities (including boulder fields, talus slopes, and meadows). Invasive species are absent. Provides habitat for San Francisco Peaks ragwort; is able to support and sustain rare or endemic species; and continues to be resilient to natural and human-caused impacts. Tribal and recreational uses occur such that the uniqueness of the vegetation and ecological attributes are maintained.	All associated species
FW-Veg-AT-S-1	Recreation activities, including new route construction, shall avoid important habitat for the San Francisco Peaks ragwort and result in minimal disturbance to its habitat.	San Francisco Peaks ragwort
FW-WFP-DC-1-3, 5	Sustainable populations of native and desirable nonnative plant and animal species, including special status species, are supported by healthy ecosystems and ecologically responsible forest activities and reflect the diversity, quantity, quality, and capability of natural habitats on the forest. Habitats for special status species support viable, self-sustaining populations. Ecological conditions provide habitat for federally listed and other special status species, prevent from further listing, and keep common species common. Habitat conditions are resilient and have the soil characteristics and native vegetation to support the species that are dependent on them.	All associated species
FW-WFP-1, 2	Implement at least 20 actions for federally listed species that contribute to recovery or implement recovery plan actions during each 10-year period of the life of the plan and implement at least 10 actions to benefit sensitive species that contribute to positive trends to avoid the need for listing during each 10-year period of the life of the plan.	San Francisco Peak ragwort, long-tailed vole, Dwarf shrew, and Crenulate moonwort.
FW-WFP-G-1, 2	Habitat management objectives and species protection measures from approved recovery plans should be applied to activities occurring within federally listed species habitat to promote recovery of the species. To improve the status of species and prevent Federal listing, management activities should comply with species conservation agreements, assessments, and strategies.	San Francisco Peak ragwort, long-tailed vole, Dwarf shrew, and Crenulate moonwort.
FW-Rec-Disp-DC-1, 2,7	Growing demand for recreation is balanced with other forest desired conditions, unless increasing capacity results in unacceptable negative effects on natural resources. Recreation activities do not significantly detract from the natural character of the forest, impact resources such as aesthetics, soils, vegetation, and wildlife, or contribute to user conflicts. Motorized trails are located with minimal impact to sensitive resources such as cultural sites, highly erodible soils, water, and wildlife and botanical resources.	All associated species.

Location Code in Proposed Revised Plan	Intent of Plan Component	Benefiting Species
SA-Wild-KPeaks-DC-1, 2	There is a diverse composition of wildlife species and native vegetation. In this high elevation wilderness, there are Alpine Tundra, Mixed Conifer with Aspen, and Spruce-Fir Forests with Subalpine Grasslands and Ponderosa Pine interspersed (see the desired conditions for these vegetation types for more information). Provides habitat for San Francisco Peaks ragwort, is able to support and sustain rare or endemic species, and continues to be resilient to natural and human-caused impacts.	All associated species
SA-Wild-KPeaks-S-1, 2, 3	Off-trail hiking, overnight camping, and horse and pack stock in Alpine tundra are prohibited.	San Francisco Peak ragwort

Special Features – Talus Slopes

Affected Environment

Amount and Distribution: At the landscape level, talus slopes occur in the same locations and in the same amounts as they did historically and are little impacted by management activities. They are considered similar to reference conditions with a low departure.

Habitat Quality: Most talus slopes are inherently unstable, generally inaccessible, and little management occurs on them. Consequently, vegetation composition, structure, and slope processes are generally close to natural conditions over most of the landscape where talus slopes occur.

Associated Species: San Francisco Peaks ragwort (threatened) and the dwarf shrew, a Forest Service sensitive species.

Risk Factors: There are no activities that affect talus slopes forestwide. Localized disturbance from recreation or management activities, however, can destabilize the talus slopes and alter habitat in specific areas. Habitats that are located on talus slopes are vulnerable to damage or modification from ground-disturbing activities that could alter humidity levels, increase sedimentation, or destabilize slopes which could alter habitat for both species.

Environmental Consequences – Talus Slopes

All Alternatives

Many talus slopes are within wilderness which are managed to maintain wilderness quality and use within capacity, which would result in minimal modification to talus slopes. In all wilderness areas, biophysical features such as talus slopes would be at or moving toward desired conditions that provide properly functioning habitat conditions for native species.

All alternatives include language stopping motorized vehicle intrusions in the Kachina Peaks wilderness as well as no overnight camping, horse or pack stock use above timberline (which is where many of the talus slopes are), an area closure during snow-free periods to protect a federally listed plant (*Packera franciscanus*), and limiting access to designated trails.

Alternatives B, C, and D

Forestwide desired conditions in these alternatives would recognize talus slopes as generally undisturbed, unique habitats for plants and wildlife, including rare species, that are generally free from sedimentation and have near historic levels of moisture that are protected from damage or alteration from recreational uses. (See table 106.)

Some area specific language promotes the generally undisturbed nature of talus slopes and the maintenance of their integrity, form, and processes and their distinctive nature (MA – VolcanWood-DC-2, MA-Peaks-DC-4).

Table 106. Plan components in all alternatives that address talus slopes

Species	Alt. A Location in 1987 Plan (Page and Paragraph)	Alts. B, C, D Location Code in Proposed Revised Plan	Intent of Plan Component
All talus-dwelling species in wilderness	Replacement p. 105, par 5	FW-Wild-All-DC-2	Manage wilderness to maintain wilderness quality and to maintain use within capacity.
Dwarf shrew, San Francisco Peaks ragwort	Replacement p. 108, par 2, bullets 5, 6, 7, 9 and p. 110, par 1	FW-SA-Wild-KPeaks-S-1, 2-3	In Kachina Peaks Wilderness, no overnight camping, horse or pack stock use above timberline, and a 325-acre area is closed during snow-free periods.
All associated species	Replacement p. 108, par 1, bullet 3	SA-Wild-Straw-DC-2-3	No motorized vehicle intrusions in Strawberry Crater Wilderness or intrusions are rare.
Dwarf shrew, San Francisco Peaks ragwort	Replacement p. 108, par 2, bullet 8	FW-Rec-Disp-G-11	Limited to day-use foot traffic in the Inner Basin municipal watershed.
Dwarf shrew, San Francisco Peaks ragwort, and other talus slope dwelling species	None	FW-BioPhys-Geo-DC-1 and 9	Talus slopes are protected from damage or alteration from recreation uses. Talus slopes are natural, generally undisturbed features that provide habitat for a variety of species. They maintain near historic levels of moisture, and are free from excessive sedimentation. In areas where there are species of conservation concern, there is a near historic level of high quality rocky habitat

Alternative C

In addition to the desired conditions mentioned above, this alternative also recommends 13 wilderness areas. The addition of these new areas would provide additional habitat/protection for species inhabiting talus slopes but would not be an added benefit to the dwarf shrew or San Francisco Peaks ragwort because they are primarily known from the Kachina Peaks Wilderness.

Summary of Species Effects

Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in maintaining the viability and persistence of the populations of dwarf shrews and not contributing to listing because:

- They provide for the protection and management and viability for special status species, in addition to law, regulation, and policy; and
- Desired conditions for wilderness and specific guidelines for the Kachina Peaks Wilderness would result in lack of disturbance to most talus slopes.

Alternatives B, C, and D do a better job of maintaining viability because forestwide desired conditions are more clearly articulated for talus slopes so the geologic composition, structure, and processes of these habitats provide for the associated species, and this habitat remains largely undisturbed. All threats are addressed through the coarse filter for the dwarf shrew. Plan components that deal with coarse filter threats are insufficient to address the threats to the San Francisco Peaks ragwort, which is further analyzed under "Listed Species."

Considering the coarse filter analysis, plan components in all alternatives maintain the viability and do not cause a trend toward listing for: long-tailed vole, dwarf shrew, and crenulate moonwort; common moonwort, blackroot sedge, different-nerve sedge, Dane's dwarf gentian, bearded gentian, bristlecone pine, spider saxifrage, graceful buttercup, grassy slope sedge, and timberland blue-eye grass.

The Alpine Tundra PNVT is moderately departed from reference conditions. For all alternatives, most species associated with Alpine Tundra have a medium high likelihood of being limited by their habitat (appendix C). All alternatives would maintain the viability and persistence of associated species because plan components ensure disturbance to this fragile habitat is minimized.

Language in alternative A, however, is outdated from the standpoint of current science, particularly with regard to climate change, the primary threat to this PNVT. Guidance in alternatives B, C, and D does a better job of addressing climate change by managing for an ecosystem which will be resilient to change, and allowing for more site-specific management flexibility. This will allow the forest to better cope with, and adapt to, the changing needs of this unique system.

Alternative A also lacks specific direction for talus slopes, a special feature associated with Alpine Tundra. Alternatives B, C, and D have more specific desired conditions, standards, and guidelines that which will ensure for the viability of talus dwelling species.

There has been no new wilderness proposed for Alpine Tundra, and the viability consequences for alternatives C and D would be similar to alternative B.

All alternatives would expand the existing San Francisco Peaks Research Natural Area into the alpine tundra habitat. This would offer additional protections to this area because research natural areas are permanently protected and maintained in natural condition offering greater protection to this area than alternative A.

Fine Filter – San Francisco Peaks Ragwort

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: This threatened plant occurs only within the Alpine Tundra PNVT on the San Francisco Peaks. It has a recovery plan (1987b). It has a stable trend (USFWS 2010) and appears to be healthy and reproducing (Boucher and Goodwin 1984).

Habitat: There are about 325 acres[51] of habitat, all within the Kachina Peaks Wilderness (USFWS 1987b). The habitat is dissected by several heavily used trails, one of which leads to Humphrey's Peak, the highest point in Arizona. A portion of the habitat overlaps the Snowbowl Ski Area, one of the few ski resorts in the State. A portion of the population is within the San Francisco Peaks Research Natural Area. Alpine Tundra and upper Mixed Conifer and Spruce-Fir within the Kachina Peaks Wilderness are closed to grazing and not part of any grazing allotment (p. 110, par 2).

Critical Habitat: All 743 acres of critical habitat occur within the Alpine Tundra PNVT. It has a low departure and is trending away from reference. Primary constituent elements are the loose cinder talus slopes of the Alpine Tundra on the San Francisco Peaks and absence of disturbance and damage from hikers (Federal Register Vol. 48, No. 226, November 22, 1983).

Risk Factors: Off-trail hiking reduces the vigor, maintenance, and survival of sensitive plant species, such as those found in the Alpine Tundra PNVT or in botanical special areas. Avalanche abatement reduces slope stability and may result in loss of plants from slides. Avalanche abatement, however, would only affect approximately 12 percent of the species' habitat (Dexter 2007).

Environmental Consequences – San Francisco Peaks Ragwort

Summary of Determinations: The implementation of all alternatives would result in a "may affect" determination for the San Francisco Peaks ragwort and its critical habitat. The reasons for the may affect findings are described below. Implementation of plan components related to recreation management, watershed management, or wildlife, fish, or rare plants management in any of the alternatives may have short-term effects on this species or its habitat, but would produce long-term benefits to the maintenance and improvement of habitat and species populations on the Coconino NF. A biological assessment will be done and final determination of effects will be determined at that time.

All Alternatives

Under all alternatives, management and guidance for San Francisco Peaks ragwort would be subject to consultation with the U.S. Fish and Wildlife Service and continue to follow the recovery plan (replacement p. 64-1, par 1, FW-WFP-G-1). Off-trail hiking would be prohibited

[51] Habitat and critical habitat acres do not match because critical habitat is based on a legal description and the actual habitat is based on the fellfield within the talus slopes of the alpine tundra.

under all alternatives (replacement p. 108 under Kachina Peaks heading bullets 5, 6, 7 and 9; SA-Wild-KPeaks-S-1; SA-Wild-KPeaks-S-2; SA-Wild-KPeaks-S-3).

Avalanche abatement activities associated with the Snowbowl Ski Area occur on approximately 25 out of 939 acres of the Alpine Tundra PNVT. Snowmaking activities associated with the Snowbowl's special use permit would occur in accordance with the terms of their permit and consultation with the U.S. Fish and Wildlife Service. Avalanche abatement would also be limited through the Snowbowl Ski Area's special use permit.

Alternative A

Alternative A provides overarching plan direction for federally listed species to:

- Inventory, evaluate, and prepare recovery schedules for proposed, threatened, endangered, and sensitive plant species in the first decade or as species are proposed (replacement p. 64); and
- Provide appropriate law enforcement to protect habitat for listed species (replacement p. 65, par 2).

Specific direction that would protect the species and its critical habitat includes the following:

- *Senecio franciscanus* is managed by the direction present in its management plan and in accordance with the San Francisco Peaks Tundra Management Plan, which was adopted into the forest plan (replacement p. 65, par 1). While this document provides useful reference information, it was intended to provide management direction for the San Francisco ragwort prior to the recovery plan for the species being adopted in 1987.
- Protect *Senecio franciscanus* by an area closure. Protect 325 acres of alpine areas on the San Francisco Mountains to improve habitat for *Senecio franciscanus* by closing the area during snow-free periods, access is limited to designated trails (replacement p. 110, par 1).
- No overnight camping above timberline (replacement p. 108, par 2).
- Use in the city of Flagstaff watershed (draining into Inner Basin) is limited to day use foot traffic, and the area may be closed if unacceptable damage occurs as determined by a degradation of water quality (replacement p. 108, par 2).
- Implement corrective measures such as wilderness permit system if overuse causes unacceptable resource damage (replacement p. 107, par 1).
- Research natural areas and botanical areas are managed to protect and maintain their uniqueness and ecological condition (replacement p. 195, par 9).
- Inventory, evaluate, and prepare recovery schedules for proposed, threatened, endangered, and sensitive plant and animal species within the first decade or as species are proposed.
- Monitor approved schedules, reproductive success, and effects of management activities at occupied threatened, endangered, and sensitive species sites.
- Provide appropriate law enforcement to protect habitat for listed species (replacement p. 65, par 2)

Alternative A, however, would not direct new trail construction away from ragwort habitat, but all trails and trailheads listed in the current forest plan have been constructed, so development of new

trails is unlikely under this alternative, even though there is plan language promoting it (replacement p. 108, no. 4).

Alternative A would also not expand the research natural area but because there are no trails in this area and off-trail hiking is prohibited under all alternatives, all alternatives would have similar effects.

Alternatives B, C, and D

Alternatives B, C, and D would maintain the persistence and contribute to the viability of San Francisco Peaks ragwort by prohibiting off-trail hiking (SA-Wild-KPeaks-S2), directing new route construction and other recreation activities to avoid San Francisco Peaks ragwort habitat and to minimize disturbance to it (FW-Veg-AT-S-1) and do not encourage new trail development into the Kachina Peaks Wilderness (FW-Veg-AT-S-1). They also carry forward protections for the Inner Basin from horse and pack stock use and overnight camping (FW-Rec-Disp-S-3, FW-Rec-Disp-G-11).

Other beneficial wilderness plan components in alternatives B, C, and D would protect the resource and educate people about sensitive resources are located in "Special Areas Under Designated Wilderness Areas" are SA-Wild-All-DC-4, 5, and 8; SA-Wild-All-S-1, 2; and SA-Wild-All-G-3. These plan components may result in improved compliance with trail and recreation activity closures because the public would be better informed about the resources these restrictions are intended to protect.

Alternatives B, C, and D would expand the existing San Francisco Peaks Research Natural Area into the Alpine Tundra habitat, which would include a portion of the populations and designated critical habitat. This would offer additional protections to the plant and habitat because research natural areas are permanently protected and maintained in natural condition, so they may serve as experimental research controls and monitoring sites, and used for education. Associated plan components would result in little disturbance or evidence of human activities (SA-RNABotGeo-DC-1, SA-RNABotGeo-S1and S2, and SA-RNABotGeo-G1 and G2). Since alternatives B, C, and D all recommend expansion of the existing San Francisco Peaks Research Natural Area into the alpine tundra habitat, there would be no difference in effects between these alternatives from the expansion of the research natural area.

Summary of Species Effects

San Francisco Peaks ragwort is very rare on the forest in its habitat and occupies a small portion of its habitat. It is vulnerable to perturbations in the environment because of its small population size, rarity, and because it known from only one location. Alpine Tundra is similar to reference conditions but is trending away from reference conditions primarily due to climate change which is causing an increase in alpine meadow conditions. This ragwort is primarily found on the talus slope component of alpine tundra, rather than alpine meadow.

All alternatives maintain the viability and persistence of the San Francisco Peaks ragwort. Alternatives B, C, and D, however, do a better job because they better address the threat of avalanche abatement activities on San Francisco Peaks ragwort by containing a desired condition that Alpine Tundra is resilient to natural and human-caused impacts and can sustain rare and endemic species (FW-Veg-AT-DC-3).

Coarse Filter Viability: The coarse filter section for Alpine Tundra compares how the alternatives address off-trail hiking threats to the species and critical habitat within Forest Service control. Given prohibitions in off-trail hiking in the San Francisco Peaks ragwort's habitat, as well as other measure that reduce recreation impacts, trampling of plants and increased soil instability from off-trail hiking would be addressed in all alternatives.

Fine Filter Viability: Given elements shared by all alternatives, risks to San Francisco Peaks ragwort would be similar under all alternatives. Avalanche abatement occurs on about 25 out of 939 acres (3 percent) of the Alpine Tundra PNVT. Under all alternatives, avalanche abatement would be limited by special use permit. However, unlike alternative A, if it were to occur incidentally outside of the constraints of the permit under alternatives B, C, and D, the permittee would be required to rehabilitate the impacted area (FW-SpecUse-S2).

Species Not Associated with PNVTs

This section includes species that are wide ranging and not associated with a particular PNVT such as California condor and Mexican gray wolf. It also addresses special features that are key habitat elements that may occur in multiple PNVTs, but do not necessarily correspond to PNVTs. They include caves, cliffs, and human structures,

All Alternatives

As described in the introductory paragraphs in the "Coarse Filter – Habitat" section, plan components in all alternatives support managing for viable self-sustaining populations of special status species, including the survival and recovery of listed species, and the repatriation of extirpated species through following existing law and policy, approved recovery plans, conservation strategies or assessments, or management plans.

Mexican Gray Wolf

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: The last reported wolf from northern Arizona was trapped in 1942 either on the forest or nearby on the Apache-Sitgreaves National Forests. Mexican gray wolves have been reintroduced in Arizona and New Mexico, beginning in 1998. The final rule for establishment of a nonessential experimental population of the Mexican gray wolf in Arizona and New Mexico (FWS 1998b) designated primary recovery zones, secondary zones, and an experimental population area (EPA). All of the Coconino NF south of Interstate 40 is within the experimental population area, but outside the recovery zones. Under the final rule, wolves will only be reestablished in the recovery zones and will not be allowed to establish territories on public lands wholly outside the designated recovery areas. Wolves that occasionally make forays onto public lands outside the nonessential experimental population area are fully protected under the Endangered Species Act. Wolves have ventured on the forest at least twice, once in 2000 and once in 2001, but did not remain.

Habitat: Mexican gray wolves probably occupied forested habitats above the Mogollon Rim and around the San Francisco Peaks. They are not associated with desert habitats and do not have specific vegetative habitat requirements.

Risk Factors: Prey and water availability are probably the most important determinants in habitat use by wolves. They primarily feed on deer and elk which are managed by the Arizona Game and Fish Department. They are primarily influenced by reintroduction and management activities on the Apache-Sitgreaves and Gila National Forests in Arizona and New Mexico.

Environmental Consequences

Summary of Determinations: All alternatives are "not likely to jeopardize" the continued existence of Mexican gray wolves because all alternatives support reintroduction activities and provide diverse habitats that can support prey habitat. The final rule states that wolves are not allowed to establish territories outside of recovery zones. By definition, a nonessential experimental population is not essential to the continued existence of the species, therefore, none of the alternatives could lead to a jeopardy determination for the species.

Alternative A

Plan components in this alternative would support habitat for Mexican gray wolves and their prey. Plan components emphasize management and cooperation for recovery of listed species, the reintroduction of extirpated species in accordance with recovery plans (p. 22-1, par 2; p. 64, par 5), and the management of habitat to maintain viable populations of wildlife and fish (p. 22-1, par 1). Management for wolves is essentially management for the habitat of their prey, and ungulate populations are most productive in ecosystems that contain a variety of forest successional stages (Groebner et al. 1995). Management activities that may benefit prey include water development and vegetation management by using prescribed fire, managed wildfire, timber harvest, and seeding and planting of desired vegetation according to the recovery plan (USFWS 1982a). Alternative A has standards and guidelines to establish and maintain stand diversity through timber harvest to provide suitable habitat for wildlife while maintaining or enhancing timber production and age class distribution (p.70, par 6), to use prescribed fire to improve wildlife habitat (pp. 92-96). There are also forestwide standards and guidelines that provide direction for big game winter range management, management of forage for wildlife, and for improvements such as water developments (pp. 64-66).

Alternatives B, C, and D

All of the desired conditions for the forested PNVTs aspire to move habitats toward reference conditions (see the "Vegetation and Fire" section in chapter 2 of the proposed revised plan). Guidance under the section on "Wildlife, Fish, and Plants" emphasizes thriving wildlife populations supported by the diversity, quantity, quality, and capability of habitats; dispersal and migration of wildlife so they can meet their life history requirements (FW-WFP-DC1-9; FW-WFP-O1, 3; FW-WFP-S1; FW-WFP-G 1, 3, 4, 6, 10, 11); and guidance for road management also emphasizes habitat connectivity and minimization of disturbance impacts to wildlife (FW-RdsFac-DC1, 4; FW-RdsFac-G1, 2, 5).

Alternative B

Two of the three recommended wilderness areas (Walker Mountain and the Strawberry Crater addition) would provide additional habitat (12,988 acres) where disturbance from motorized

vehicles is minimized by limiting motorized use to administrative and permitted uses in order to maintain the area's wilderness character (SA-Rwild-G3).

Alternative C

This alternative proposes a total of 13 wilderness areas (including the ones discussed in alternative B. Of these, three would occur above the Mogollon Rim and contain forested habitat that would be used by wolves and their prey. This would provide 14,208 acres of habitat with reduced disturbance from motorized use and activities.

Alternative C proposes eight wildlife habitat management areas which would focus on emphasizing wildlife and restoring habitat using establishment of natural fire regimes and reduction of road densities. The Upper Clear Creek watershed along the Mogollon Rim is the closest forest habitat to the western edge of the Blue Range Recovery Area. There are five wildlife habitat management areas in the Upper Clear Creek watershed including East Clear, Hospital Ridge, Knoll Lake, Limestone Pasture, and Second Chance, and all eight are within the Mexican gray wolf EPA. Guidelines for wildlife habitat management areas would reduce disturbance associated with recreation and public motorized access compared to alternative A or B. This would positively impact wolves that wander outside of recovery zones by reducing disturbance impacts from recreational and motorized uses.

Special Feature – Caves

Affected Environment

Caves are any naturally occurring void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the Earth or within a cliff or ledge (including any cave resources but not including any mine, tunnel, aqueduct, or other manmade excavation). Caves are large enough to permit a person to enter and include any natural pit, sinkhole, or other feature which is an extension of the entrance. There are more than 50 caves on the forest; some are lava tube caves and others are caves found in karst or pseudokarst terrain.

Amount and Distribution: The number and location of caves have generally not changed over time in that they occur in the same locations and in the same amounts as they did historically.

Habitat Quality: Caves in pristine conditions are those with little human disturbance in their interior or immediately surrounding areas. Impacts to other caves on the forest have been vegetation removal at cave entrances, sedimentation from nearby roads from bar or relief ditches, refuse within caves, damage to cave features, and changes to cave microclimates.

At the landscape level, caves and cliffs occur in the same locations and in the same amounts as they did historically. They are considered similar to reference conditions with a low departure. Individual caves and cliffs, however, may be impacted by management or permitted activities.

Risk Factor: The primary risk factor for caves is human disturbance that could alter the cave habitat. Disturbance can result from caving, road construction and maintenance, well drilling, and vegetation treatments. In addition to modifying surface features, caving can also alter cave temperature and humidity levels that could affect roosting or hibernating bats, possibly making the cave unsuitable or less suitable for occupancy.

Associated Species: Four Forest Service Sensitive species are associated with caves: Allen's lappet-browed bat, pale Townsend's big-eared bat, and spotted bat plus the southwestern myotis, another planning species. No federally listed species are associated with caves. Plan components associated with the coarse filter do not adequately address all the threats to these species so they are addressed further in the fine filter analysis.

Environmental Consequences

Alternative A

Alternative A would limit impacts to cave habitats by allowing caves of high resource values to be recommended for withdrawal from mineral entry; in addition, drilling and seismic surveys that would use disruptive techniques would not be conducted over or close to known caves (replacement p. 51-2, pars 5-7). Major alterations from project activities would generally not be permitted; nor sedimentation from human-caused erosion; nor the disposal of slash, waste rock, fill materials or other refuse be permitted to enter caves (replacement p. 51-2, pars 2-4). These components include a 300-foot buffer to be evaluated for effects to caves at the project level. If an unknown cave is excavated, forestwide standards and guidelines stipulate that the condition of the original opening be mimicked so that that air flow and wildlife use is not altered and the surface visual resource is maintained (replacement p. 51-2, par 4). Alternative A encourages partnerships to protect cave resources from human impacts while preserving their scientific and aesthetic values and directs districts to prepare an implementation schedule for cave protection and to institute limits of acceptable change thresholds and monitoring (replacement p. 20, par 9; replacement p. 51-1, pars 4, 5). Bat colonies associated with caves are monitored and management tools to maintain or enhance them may be applied as needed under alternative A (replacement p. 51-1, par 7). Risk of introduction of disease into the cave environment and the archaeological values of caves are not addressed by alternative A.

Alternatives B, C, and D

Alternatives B, C, and D better describe the importance of talus slopes, cliffs, rocky outcrops, and caves for species and, subsequently, they are able to provide well crafted desired conditions that would specifically protect cave features and species habitat from damage or alteration from blasting, seismic surveys, and various management activities (FW-BioPhys-Geo-G-1, 2, 5) including a 200-foot buffer that can be used for restricting activities that could alter cave conditions. This guideline has a smaller radius but better describes the activities to be considered and the features to be protected. It also allows for adjustments that would allow inclusion of a larger area depending on the physical features of the surrounding landscape. This guideline would result in better protection and evaluation of known cave resources than alternative A. Other dispersed recreation activities, such as caving or rock climbing, are provided without diminishing the cave resource (FW-BioPhys-Geo-DC-1, 8). Management activities would also provide for continuation of natural processes (FW-BioPhys-Geo-DC-5) and protect the species from disturbance or introduction of diseases (FW-BioPhys-Geo-DC 3, 4). The specialized moisture and temperature conditions that provide suitable overwintering and roosting conditions for bats are provided and maintained at near historic conditions (FW-BioPhys-Geo-DC-3). Historic and prehistoric sites associated with caves would be preserved and protected for cultural importance, which would also maintain their suitability for bat roosts (FW-BioPhys-Geo-DC-4). Alternative A's existing plan components that protect and maintain the integrity of caves have been updated and incorporated in these alternatives. In addition, these alternatives also have specific desired conditions and guidelines for wildlife (FW-BioPhys-Geo-DC-6; FW-BioPhys-Geo-G-3, 6) that

more actively seek to maintain the proper functioning condition of the habitat for cave dwelling species.

Summary of Species Effects

Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in maintaining the viability and persistence of the populations of these bats in caves and not contributing to listing because:

- They provide for the protection, management, and viability for special status species, in addition to law, regulation, and policy; and
- Cave environments would be managed to maintain the cave features and microclimate conditions needed to support cave roosting bats.

Alternative A would use a broad brush approach to provide for species viability by limiting the impacts of forest activities around caves and maintaining their overall integrity; however, it lacks plan language for white nose syndrome, a deadly bat disease and is outdated.

Alternatives B, C, and D would better maintain suitable habitat for these populations than alternative A because forestwide desired conditions for caves also stipulate that the structure and processes of caves are maintained and provide the microclimatic conditions needed by healthy native cave dwelling species such as the Allen's lappet-browed bat, pale Townsend bat, spotted bat, and the Southwestern myotis. This habitat remains largely undisturbed, and there are guidelines to mitigate disturbance and impacts from nearby or aboveground activities and to maintain proper functioning conditions for cave dwelling species. However, the coarse filter alone was inadequate to address all the threats to these bats. The species-specific threats of disease and human disturbance are analyzed further in the fine filter section.

Fine Filter – Pale Townsend's Big-Eared Bats

Affected Environment

Threats: The primary threats to Pale Townsend's big-eared bats, Allen's lappet-browed bat, spotted bats, and Southwestern myotis in their cave roosts is disease and disturbance during critical time periods.

Primary habitat-level threats and environmental consequences of the alternatives on caves and cliffs are located in the "Biophysical Features" section and in the "Wildlife, Fish, and Plants" section under "Caves and Cliffs."

Disease: Human activities, such as dispersed recreation and research, can spread infected soil from one occupied cave to another resulting in the spread of disease which, in turn, can affect survival and reproduction of four bats found on the forest planning species list: Pale Townsend's big-eared bat, spotted bat, Allen's lappet-browed bat, and Southwestern myotis. White Nose Syndrome is a condition associated with the deaths of over a million bats in the U.S. and Canada since its discovery in the winter of 2006–2007 in New York. The fungus, *Geomyces destructans*, is the primary causal agent of White Nose Syndrome. This fungus thrives in cold and humid conditions of caves, which provide prime hibernating habitat for many bat species. It is not known from Arizona as of the writing of this plan, but has been spreading west. Forest Service

management, permitted activities, activities on Forest Service land associated research projects, or developed and dispersed recreation may facilitate the spread of diseases.

Disturbance: A primary threat to bats is disturbance during sensitive periods, such as overwintering or roosting, from human activities. This threat is mainly associated with caves and archaeological sites because these are generally closed environments with unique microclimates where people could potentially come in close proximity to bats. Human activities that result in disturbance can disrupt sensitive life stages such as breeding and can reduce reproduction and/or cause injury or death. With the exception of some activities on NFS lands, the Forest Service has approval or enforcement authority and control over human activities including: rock climbing, caving, construction, mineral activities, recreation, and off-trail hiking.

Common to All Alternatives

Although there are differences between the alternatives, all alternatives would address the threat of disease and maintain the viability and persistence of the species populations associated with disease on the forest, including Allen's lappet-browed bat, pale Townsend's big-eared bat, spotted bat, and southwestern myotis.

Disturbance from Human Activities: Although there are differences between the alternatives, all alternatives address the threat of disturbance during sensitive periods from human activities, and maintain the viability and persistence of the species populations associated with disturbance on the forest, including Allen's lappet-browed bat, pale Townsend's big-eared bat, spotted bat, and southwestern myotis.

Alternative A

Guidance in alternative A for disease is outdated although it provides sufficient latitude to address the threat of disease and maintain the viability and persistence of the bat species found on the forest. Caves would be managed to enhance bat populations and several plan components would address the threat of human-caused disturbance to bats during sensitive time periods (roosting, overwintering), which would facilitate reproductive success and successful overwintering.

Alternatives B, C, and D

In summary, disease as it relates to bats is directly addressed in alternatives B, C, and D through desired conditions, prevention guidelines, and a management approach for public awareness and education.

These alternatives have desired conditions that protect caves and cliffs from alteration, maintain the specialized conditions needed for roosting and overwintering bats, and reduce disturbance to sensitive species during sensitive time periods. The proposed revised plan would expand the campfire smoke reduction in Oak Creek from "exploring the feasibility of" to a desired condition (MA-OakCrk-DC-6).

Alternative B

In comparison, alternative B would provide more protections from disturbance than alternatives A and D, but less than alternative C. This is due to alternative B's special area plan components for the three newly recommended wilderness areas (Strawberry Crater, Davey's, and Walker Mountain). The associated plan components would reduce threats of disturbance to any bats occupying these areas.

Alternative C

Compared to alternatives A, B, and D, alternative C would provide the most area with low disturbance because of the high number of recommended wilderness areas, area closures, changes in suitability for recreational shooting and snowmobiling in certain areas, and wildlife habitat management areas.

Where bats occur in recommended wilderness, other proposed special areas, or wildlife habitat management areas, alternative C would provide additional protections from disturbance, particularly those plan components for special areas: the 13 newly recommended wilderness areas (Strawberry Crater, Abineau, Railroad Draw, Deadwood Draw, Walker Mountain, Cedar Bench, Black Mountain, Cimmaron-Boulder, Hackberry, Tin Can, Davey's, East Clear Creek, and Barbershop), and the 8 wildlife habitat management areas (Anderson Mesa, East Clear Creek, Hospital Ridge, Jack's Canyon, Knoll Lake, Limestone Pasture, Pine Grove, and Second Chance).

Human activities would be curtailed within these wildlife habitat management areas to protect the resources and species for which those areas were delineated. Guidelines for the wildlife habitat management areas restrict or limit public motorized access. They would limit some recreational activities such as nonresearch related large group events and commercial tours within wildlife habitat management areas. Overall, this could indirectly reduce disturbance to cave dependent species although caves are not targeted by this management direction.

Botanical areas, geological areas, existing and recommended research natural areas, wildlife habitat management areas, and the Walnut Canyon, Sedona Neighborwoods, Long Valley, and parts of the Flagstaff Neighborwoods Management Areas would become "not suitable" for recreational (i.e., nonhunting) shooting in alternative C. Suitability changes in these areas would reduce human disturbance and would indirectly benefit cave dependent species.

Summary of Species Effects

Although there are differences between the alternatives, all alternatives would address the threat of disease and disturbance during sensitive periods from human activities to maintain the viability and persistence of these species on the forest.

Special Features – Cliffs and Rocky Outcrops

Affected Environment

Cliffs and rock outcrops provide eyries for peregrine falcons, roosting habitat for bats, habitat for Rocky Mountain bighorn sheep, and habitat for rare plants such as Cliff fleabane, Senator Mine alumroot, and Flagstaff pennyroyal.

Amount and Distribution: At the landscape level, cliffs and rocky outcrops occur in the same locations and in the same amounts as they did historically and are little impacted by management activities. They are considered similar to reference conditions with a low departure.

Habitat Quality: Cliffs are inherently unstable and generally inaccessible, however, rocky outcrops may be accessible along the rims of canyons, in drainages, and where otherwise exposed. Structure and processes are generally close to natural conditions over most of the landscape where cliffs and rocky outcrops occur. At the landscape level, caves and cliffs occur in the same locations and in the same amounts as they did historically. They are considered similar

to reference conditions with a low departure. Individual caves and cliffs, however, may be impacted by management or permitted activities.

Risk Factors: There are no activities that affect cliffs and rocky outcrops landscapewide. The exceptions would be where people interface with these features such as near view points, along trails and roads, and at rock climbing areas and dispersed camping sites. Likely impacts are localized and include soil compaction, surface disturbance, vegetation trampling and removal, and disturbance of wildlife. Other localized impacts could include cliff removal and modification during road construction or maintenance, or during slope stabilization. These activities would affect individuals of certain species.

Associated Species: The 18 species associated with cliffs and rocky outcrops are:

- Two federally listed species: California condor (experimental) and Mexican spotted owl (threatened);
- Nine Forest Service sensitive species: American peregrine falcon, bald eagle, cliff fleabane, Flagstaff pennyroyal, greater western mastiff bat, Lyngholm's Cliffbrake, pale Townsend's big-eared bat, Senator Mine Alum-root, spotted bat; and
- Seven other forest planning species: Arizona whitefeather, black spleenwort, ebony spleenwort, Fossil Creek bedstraw, golden eagle, New Mexico alum-root, and Utah bladder fern.

However, plan components that deal with the coarse filter's habitat threats are inadequate to completely address all the threats associated with eight species associated with cliffs and rocky outcrops. These eight species are further analyzed in the fine filter analysis:

- Two federally listed species: California condor (endangered) and Mexican spotted owl (threatened);
- Five Forest Service sensitive species: American peregrine falcon, bald eagle, Flagstaff pennyroyal, pale Townsends's big-eared bat, spotted bat; and
- One other forest planning species: Golden eagle.

Bald eagles are discussed in the "Wildlife, Fish, and Plants" section under Riparian Forests, Forest PNVTs, and Golden and Bald Eagles. Flagstaff pennyroyal is discussed in the "Wildlife, Fish, and Plants" section under forest PNVTs. Pale Townsend's big-eared bat and spotted bats are also discussed under Caves. Golden eagles are also discussed under Golden and Bald Eagles.

Environmental Consequences

All Alternatives

As described in the introduction to the "Wildlife, Fish, and Plants" section, all alternatives would apply species and habitat protection measures from approved recovery plans, conservation agreements, assessments, and strategies. In addition, there will be specific consideration of effects to federally listed species (proposed, threatened, and endangered species) and Regional Forester's Sensitive Species, in biological assessments and evaluations conducted as part of all national forest management decisions. These assessments and evaluations identify where additional protective measures are warranted to provide for continued existence of the species on NFS land. In addition, the golden eagle falls under provision of the Bald and Golden Eagle Protection Act.

Alternative A

This alternative addresses area-specific impacts from dispersed recreation activities such as rock climbing in certain management areas of the forest, where impacts have been observed and the plan has been amended. Sensitive resources are considered in specific areas such as the Flagstaff Lake Mary Ecosystem Area, native plants are protected to the extent possible by site design and mitigation measures during construction and threatened, endangered, and sensitive species are protected by rock climbing closures if needed. Alternative A, however, does not directly recognize the function of cliffs and rocky outcrops as primary habitat for some associated species, and plan components that provide protective measures apply to site specific areas whereas threats such as rock climbing or construction could be forestwide. (See table 107.)

Alternatives B, C, and D

In contrast to alternative A, these alternatives recognize cliffs and rock outcrops as forestwide primary habitat features that maintain the viability of the associated species. (See Table 107.)

Table 107. Plan components in all alternatives that provide for the viability of species associated with cliffs and rocky outcrops

Species	Alt. A Location in 1987 Plan (Page and Paragraph)	Alts. B, C, D Location in Proposed Revised Plan	Plan Component
Wildlife and plants	New p. 206-66, par 8 and 9		Rock climbing areas are managed to protect sensitive resources from unacceptable impacts in the Flagstaff Lake Mary Ecosystem Area.
Native plants	New p. 206-16, bullet 4		In the Sedona-Oak Creek area, native plants are protected to the extent possible by site design and mitigation measures during construction to achieve scenic quality.
Associated native plant species		FW-Veg-All-DC-14.	Cliffs are present to maintain well-distributed populations.
All associated species above		FW-BioPhys-Geo-DC-1	Cliffs (and rocky outcrops) are protected from damage or alteration from recreation uses like rock climbing.
All associated species above		FW-BioPhys-Geo-DC-6	Cliffs and rock outcrops continue to support habitat.
Cliff vegetation, wildlife communities, rare and threatened species		FW-BioPhys-Geo-DC-7, 8	Dispersed recreation activities do not diminish the quantity or quality of species. Vandalism does not occur.
Common black hawks, peregrine falcons		SA-Wild-Fossil-DC-2; SA-Wild-SecretMtn-DC-2	Fossil Springs remains a special refuge for sensitive species, and occupied black hawk nesting sites in Fossil Springs and occupied peregrine nest area in Red Rock-Secret Mountain Wilderness are undisturbed.

Summary of Species Effects

Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in maintaining the viability and persistence of the populations of these species and not contributing to listing because:

- They provide for the protection, management, and viability for special status species, in addition to law, regulation, and policy; and
- They provide plan language that would protect populations from site-specific threats such as rock climbing.

Alternatives B, C, and D do a better job of maintaining viability because desired conditions are articulated for cliffs and rocky outcrops forestwide. Forestwide desired conditions help to insure that the geologic composition, structure, and processes of these habitats provide for the associated species. In addition, there is forestwide direction to protect cliff dwelling species, providing greater coverage than the area specific direction of alternative A.

California Condor

Threatened and Endangered Species (table 42)

Affected Environment

Distribution: Reintroduction of captive-bred condors in Arizona began in 1996 at the Vermilion Cliffs National Monument. They were introduced under Section 10(j) of the Endangered Species Act as an experimental nonessential population (USFWS 1996). This means that this population is not essential to the continued existence of the species. There are 74 condors in Arizona as of 2011.

There have been two sightings of condors on the forest since the introduction. Coconino NF north of I-40 is within the designated experimental population area, which was designated to accommodate future movements and expansions of reintroduced condors (USFWS, 1996). Condors outside of this are fully protected as endangered.

Habitat: Condors nest and roost on cliffs, caves, or tall conifers, forage in open terrain for carrion, and can travel 100 miles or more in a day.

Risk Factors: The main threat to the Arizona population of California condors is ingestion of lead shot, which is regulated by the Arizona Game and Fish Department. From 1996 to 2006, the mortality of 14 condors was linked to lead poisoning or suspected lead poisoning (Austin et al. 2007). The Arizona Game and Fish Department has a voluntary lead shot program, along with its partners the Arizona Deer Association, Arizona Elk Society, Arizona Antelope Foundation, Arizona Desert Bighorn Sheep Society, and the Arizona Chapter of the National Wild Turkey Federation. Their message to hunters is to “be part of the solution by using nonlead ammunition when hunting in condor country” which they identify as Game Management Units 9, 10, 12A/B, and 13A/B (none of these are on the forest).

Predation by coyotes and eagles was responsible for the death of eight condors, while shooting, starvation, blood poisoning, and a power line collision resulted in additional, but less common, deaths of condors (Austin et al. 2007).

Environmental Consequences – California Condor

Summary of Determinations

All alternatives contain plan components supporting recovery of listed species and following existing recovery plans. All alternatives specify that construction or reconstruction of power lines and towers will be compatible with raptor use (p. 80, par 2; FW-SpecUse-DC-3). In addition, alternatives B, C, and D have standards to minimize ecological impacts for new overhead lines and support tower and expansion of existing utility corridors (FW-SpecUse-S4 and S6). Furthermore, required protection measures from Section 7 consultation (Endangered Species Act) (replacement p. 69, par 9; FW-Invas-G-2) must be followed for pesticide applications. For California condors, there is a quarter-mile buffer from nests, roosts, and release sites for the chemicals listed (appendix 1, p. 374 in the FEIS for the current forest plan).

The reintroduced Arizona population has been designated as a nonessential, experimental population. No proposed action impacting an experimental, nonessential population that is designated under Endangered Species Act §10(j) could lead to a jeopardy determination for the entire species. This is because, by definition, this nonessential experimental population is not essential to the continued existence of the species.

Therefore, all the alternatives are "not likely to jeopardize" the continued existence of the nonessential, experimental population of the California condor. For the fully listed entity (endangered outside of 10(j) area) the Coconino NF LRMP "may affect, but is not likely to adversely affect" the endangered California condor.

All alternatives would continue to maintain viability for this species within the authority of the Forest Service. Alternatives B, C, and D, however, would provide even more protections, by imposing new standards for transmission lines and pesticide use. Although the forest has no regulatory authority over the primary threat to condors—ingestion of lead shot—under all alternatives, the forest would continue to work with the Arizona Game and Fish Department's highly effective hunter education program, emphasizing increased awareness of the detrimental effects of lead shot to condors and other wildlife. Alternatives B, C, and D have specific objectives for increasing wildlife awareness and education for the public throughout the life of the plan (FW-WFP-O-5).

Mexican spotted owls are analyzed in the "Wildlife, Fish, and Plants" section under forest PNVTs and in the section on "Management Indicator Species."

Special Features – Human Structures: Railroad Beds and Archaeological Sites

Affected Environment

Amount and Distribution: These features are scattered across the Coconino NF. It is predicted that the forest contains about 70,000 archaeological sites, of which about 10,000 have been formally recorded. The forest's archaeological site densities are among the highest known site densities in the Southwest, ranging from 1 to 99 sites per square mile, but averaging about 12 sites per square mile (see the "Heritage Resources" section for more information).

Railroad beds used by Macoun's false bindweed are primarily located in the Ponderosa Pine PNVT. The amount is unknown.

Archaeological sites used as bat roost sites are mainly located below the Mogollon Rim as are the old trade routes where some rare agaves are found.

Habitat Quality: The historic railroad beds on which Macoun's false bindweed occurs and prehistoric ruins used by roosting bats (such as Forest Service sensitive pale Townsend's big-eared bats) are protected under law, regulation, and policy. In addition, desired conditions in all alternatives preserve and protect these features for their cultural importance so they are generally free from adverse impacts (FW-Hrtg-DC-1). Some historic grades may be used for recreation trails (FW-Hrtg-DC-4), however, the consequences to Macoun's bindweed would be low because they are generally located on the slopes of the grade rather than the level portion used as a trail.

Risk Factor: The primary risk factor for human structures is human disturbance that alters its availability as habitat and/or disturbs the life processes of species. Habitats that are located on cliffs and rocky outcrops, talus slopes, caves, and human-made structures are vulnerable to damage from rock climbing, caving, road construction and maintenance, and demolition of buildings and facilities. In addition to modifying surface features, caving can also alter cave temperature and humidity levels that could affect roosting or hibernating bats, possibly making the cave unsuitable or less suitable for occupancy.

Associated Species: Tonto Basin Agave and Grand Canyon Agave are Region 3 sensitive species and remnants of ancient crops dispersed along trade routes by prehistoric people. These species occur in isolated pockets in various areas of the Desert Communities, Semidesert Grassland, and Piñon-Juniper Evergreen Shrub PNVTs. Protection for these species regulates the placement of trailheads (new p. 206-32, par 5; MA-SedOak-G-disp rec G-2) and addresses removal of stalks on agaves (FW-WFP-G-14). Additionally, FW-Hrtg DC-1 in alternatives B, C, and D broadly provides protection for these ancient crops.

Environmental Consequences – Human Structures: Railroad Beds and Archaeological Sites

All Alternatives

All alternatives follow national heritage resource policies and procedures, which would result in avoidance of negative impacts to heritage resource.

Alternative A

Tours and/or large group activities at ruins used as roosts would potentially disturb bats. Provisions in the monitoring section under alternative A allow for appropriate actions to minimize impacts on threatened, endangered, and sensitive species in high use recreation areas (new p. 242-30, par 8), including seasonal or area closures.

Alternatives B, C, and D

A guideline in alternatives B, C, and D would provide for seasonal timing restrictions for sensitive species like pale Townsend's big-eared bat to protect them from disturbance that could affect survival or successful reproduction (FW-WFP-G-4).

Coarse Filter Viability Summary

Although actions could be implemented under these alternatives that would result in impacts to individuals, all alternatives would result in maintaining the viability and persistence of the

populations of these species and not contribute to listing because they provide for the protection, management, and viability for special status species, in addition to law, regulation, and policy. All alternatives have provisions to reduce disturbance to pale Townsend's big-eared bat at archaeological sites and provide protection for Tonto Basin agave and Grand Canyon agave.

Management Indicator Species

Management indicator species (MIS) were selected based on the criteria that their population changes are believed to indicate the effects of management activities being emphasized in the plan alternatives, so that the effects of each alternative on fish and wildlife populations can be estimated (FSM 2605 and 2620). Ecological indicators were also considered for species whose population dynamics reflect significant changes in the conditions or productivity of an ecosystem.

The forest used the direction in the 1982 Planning Rule Provisions and Forest Service guidance documents to help identify categories of species to consider, monitoring and selection criteria, and a process to follow for selection and documentation.

From input received from forest staff and from external agencies and researchers, potential lists of management indicator species and ecological indicators were developed. From this list, the forest supervisor chose which species would be carried forward in analysis and the reasons for their selection. The forest supervisor chose pronghorn antelope, Mexican spotted owl, and pygmy nuthatch as management indicator species. These species are also management indicator species under the 1987 plan. Table 108 provides information about the habitats each management indicator species was selected for the existing acres of those habitats and the primary reason for selecting the management indicator species.

The decision for these species considered coverage of both terrestrial and aquatic species, primary PNVTs in which the forest expects to focus management activities, availability and ease of obtaining monitoring data, and responsiveness to management activities. Alternative A would continue to use its associated management indicator species list for the Coconino NF. However, only the species listed in table 108 were analyzed for the purposes of comparing the alternatives. For more details on the selection of management indicator species, see the project record.

Table 108. Management indicator species (MIS) for alternatives B, C, and D

Species	Indicator Habitat[1]	Existing Habitat Acres	Total Acres Indicator Habitat	Primary Reasons for Selection
Pronghorn antelope	Great Basin Grasslands	92,913	206,025	Good indicator for grassland habitat. Also selected by the Kaibab and Prescott NFs as MIS, so also good to evaluate habitat connectivity. Population monitoring data available from Arizona Game and Fish Department.
	Montane/ Subalpine Grasslands	23,429		
	Semidesert Grasslands	89,683		

Species	Indicator Habitat[1]	Existing Habitat Acres	Total Acres Indicator Habitat	Primary Reasons for Selection
Mexican spotted owl	Ponderosa Pine - Gambel oak subtype	316,759	403,461	Very strongly tied to these three PNVTs. The forest anticipates treatments in these PNVTs, particularly Ponderosa Pine over the life of the plan. It is a federally listed species, and population monitoring has been proposed as a requirement in the revised recovery plan for the species.
	Mixed Conifer with Aspen	37,083		
	Mixed Conifer with Frequent Fire	49,619		
Pygmy nuthatch	Ponderosa Pine (old growth and snags)	268,453 acres 3.3 snags/acre	268,453	Indicator for mature forest and snags. There is robust density and occupancy estimates for Pygmy nuthatch from the ongoing Rocky Mountain Bird Observatory monitoring.

[1] See the "Vegetation and Fire" section of this chapter for information on the current conditions and trends of these PNVTs.

Affected Environment

Pronghorn Antelope

The pronghorn was selected as an indicator for Semidesert, Great Basin, and Montane Subalpine Grassland PNVTs on the forest. This species was also an indicator species for the 1987 plan. Pronghorn prefer areas of grasses and scattered shrubs with rolling hills and mesas (Hoffmeister 1986). For additional information on the condition of Semidesert, Great Basin, and Montane/Subalpine Grassland PNVTs, please refer to the "Vegetation and Fire" section.

Existing Condition Habitat Trends: Existing information on grassland PNVTs comes from the "Vegetation" section of the DEIS. Summing the acres within the three grassland PNVTs on the forest, the current estimate of indicator habitat for the pronghorn is 203,563 acres (table 108). Current information shows that grassland PNVTs on the forest are either highly departed from reference (historical) conditions and/or are trending away from historical conditions (table 109). The current vegetation departure for both Great Basin and Montane/Subalpine grasslands is low, but Semidesert grasslands are highly departed, and all three PNVTs are trending away from reference conditions. All three PNVTs are highly departed from their natural fire regimes and soil conditions. Overall, the current trend for grassland indicator habitat for pronghorn is **declining**.

Table 109. Amount of pronghorn indicator habitat (PNVT acreage) and existing departure and trend relative to reference conditions for vegetation, fire, and soils for pronghorn indicator habitat PNVTs

Indicator Habitat	Existing Acres	Existing Departure[1] (Percent) and Trend		
		Vegetation	Fire[2]	Soils
Montane/Subalpine Grassland	23,429	Low (32), Away	High (VCC III)	High (69), Static
Great Basin Grassland	92,913	Low (10), Away	High (VCC III)	High (87), Toward

Indicator Habitat	Existing Acres	Existing Departure[1] (Percent) and Trend		
		Vegetation	Fire[2]	Soils
Semidesert Grassland	89,683	High (100), Away	Moderate (VCCII)	High (95), Slowly Toward
Total	**206,025**			

[1] Departure was assessed as low (0 to 33 percent), moderate (34 to 66 percent), or high (greater than 66 percent).
[2] Vegetation condition classes (VCC) II and III are moderately to highly altered from reference conditions. These classes are more likely to lose key ecosystem components following a disturbance and may have a higher likelihood of uncharacteristic fire. See the "Vegetation and Fire" section for more information.

Existing Condition Population Trend: Since the 1987 plan was signed, pronghorn population indicators have fluctuated since the late 1980s, with fawn:doe ratios showing greater fluctuation than number of pronghorn observed per hour (Coconino NF 2013). But within the range of fluctuations, the population trend appears to be **relatively stable**, with fawn:doe ratios **increasing** somewhat over approximately the last 10 years (Coconino NF 2013).

Mexican Spotted Owl

The Mexican spotted owl was selected as an indicator for Mixed Conifer with Aspen, Mixed Conifer with Frequent Fire, and Ponderosa Pine-Gambel Oak subtype (pine-oak) PNVTs on the forest. This species was also an indicator species for the 1987 plan where indicator habitat was identified as late seral mixed conifer and spruce-fir. Since then, the Mexican spotted owl has been found to use Ponderosa Pine-Gambel Oak, and has not been found using spruce-fir habitat. The Mexican spotted owl prefers areas of well-structured forests with high canopy cover, large trees, and other late seral characteristics for nesting and roosting habitat (U.S. Fish and Wildlife Service 2012). They also use steep and narrow rocky canyons formed by parallel cliffs with numerous caves and ledges (U.S. Fish and Wildlife Service 2012).

Most owl home ranges are quite a bit larger than the 600-acre + protected activity centers established around known nesting and roosting activity centers (U.S. Fish and Wildlife Service 2012). In the Mexican spotted owl recovery plan, Mixed Conifer and Ponderosa Pine-Gambel oak habitats outside of protected activity centers are considered to be recovery habitat, managed to provide a dynamic supply of future nesting and roosting habitat mixed with foraging and non-breeding habitat over time. Although the nesting and roosting habit used by owls is well structured, late seral habitat, all of the mixed conifer and pine-oak habitats are important to the owl as occupied or potential habitat, and will be considered as indicator habitat.

For additional information on the condition of Mixed Conifer with Aspen, Mixed Conifer with Frequent Fire, and Ponderosa Pine-Gambel Oak subtype (pine-oak) PNVTs, refer to the "Vegetation and Fire" section.

Existing Condition Habitat Trend: Summing the acres within the three indicator PNVTs on the forest, the current estimate of indicator habitat for the Mexican spotted owl is 403,461acres (table 110). Except for soils, current information shows that mixed conifer and pine-oak habitats on the forest are moderately to highly departed from reference (historical) conditions and vegetation is moving away from reference conditions (see "Vegetation and Fire" section for details). Overall, the current trend for Mexican spotted owl indicator habitat is **declining**.

Table 110. Amount of Mexican spotted owl indicator habitat (PNVT acreage), and existing departure and trend relative to reference conditions for vegetation, fire, and soils

Indicator Habitat	Existing Acres	Existing Departure[1] (Percent) and Trend		
		Vegetation	Fire[2]	Soils
Mixed Conifer with Aspen	37,083	Moderate (62), Away	High (VCC III)	Low (0), Static
Mixed Conifer with Frequent Fire	49,619	Moderate (64), Away	High (VCC III)	Low (0), Static
Ponderosa Pine-Gambel Oak[3]	316,759	High (79), Away	High (VCC III)	Low (1),Static
Total	**403,461**			

[1] Departure was assessed as low (0 to 33 percent), moderate (34 to 66 percent), or high (greater than 66 percent).
[2] Vegetation condition classes (VCC) II and III are moderately to highly altered from reference conditions. These classes are more likely to lose key ecosystem components following a disturbance and may have a higher likelihood of uncharacteristic fire. See the "Vegetation and Fire" section for more information.
[3] Departure and trends are from the PNVT as a whole.

Existing Condition Population Trend: Overall, the forestwide population trend for the Mexican spotted owl is not known for certain, but may be "stable to declining" (Coconino NF 2013). A few new protected activity centers are still being found on the forest, and occupancy rates are up and down. The only demography study done on the forest found that the owls within the study area were declining at a rate of greater than10 percent per year from 1991 to 1997 (Seamans et al. 1999). Implementation of the population monitoring plan called for in the 2012 recovery plan (U.S. Fish and Wildlife Service 2012) should help determine more accurate rangewide and forest trends.

Pygmy Nuthatch

The pygmy nuthatch was selected as an indicator for mature ponderosa pine that contains large live trees and large snags (18 inches d.b.h. and larger). This species was also an indicator species for the 1987 plan. There are 791,897 acres of Ponderosa Pine PNVT on the forest and about 268,453 acres (34 percent) are estimated to be indicator habitat.

The pygmy nuthatch shows a strong association with long-needled pines and their range is co-extensive with ponderosa pine, Jeffrey pine, and similar species (Kingery et al. 2001). Pygmy nuthatches nest in dead pines and live trees with dead sections and prefer old growth, mature, and undisturbed forests (Szaro and Balda 1982). The pygmy nuthatch also roosts in cavities, with up to 150 individuals being documented as roosting in one tree (Knorr 1957 and Sydeman and Güntert 1983 in Kingery et al. 2001).

In Arizona, their range closely follows the distribution of ponderosa pine (Corman and Wise-Gervais 2005). The majority of potential breeding records were in either pure pine or pine with Gambel oak. Although nests were found in other vegetation types, they all had a ponderosa pine component (Corman and Wise-Gervais 2005).

Two main factors affecting population density are availability of nest sites and sufficient numbers of large cone-producing trees for food (Kingery et al. 2001). Pygmy nuthatches and other cavity-nesting birds show a preference for large-diameter snags over 75 feet in height (Scott 1978). Snags greater than15 inches are used significantly more than smaller snags, and snags in the 27-

to 30-inch size class have more holes per snag that other size classes (Scott 1978). In Arizona, nest heights range from 7.2 to 62 feet, with a median of 24.6 feet (Corman and Wise-Gervais 2005).

Data on snags are often summarized in size classes of 12 to 18 inches and 18 inches and greater. Although pygmy nuthatches will use snags smaller than 18 inches d.b.h., larger snags are more valuable as habitat. Therefore, for the purposes of identifying and tracking snag indicator habitat, snags 18 inches and greater will be used.

The current amount of old growth on the forest is estimated to be approximately 268,453 acres or 34 percent of the PNVT acres (table 111). It is important to view these results in terms of not only the area occupied by stands of trees in the medium and large tree states but also the area occupied in the desired states within these size classes. About 96 percent of the entire Ponderosa Pine PNVT is desired to occur within medium and very large tree states.

Table 111. Existing ponderosa pine large tree and old growth distribution

Proportion of Ponderosa Pine PNVT States Dominated by	Existing	Acres
Medium Trees (10 to 20 inches d.b.h.)[1]	28.1%	222,523
Very Large Trees (20+ inches d.b.h.)[2]	5.9%	46,722
Totals	**34.0%**	**268,453**

[1] Adjusted by 40 percent to represent old-growth components. See explanation in "Vegetation and Fire" section.
[2] Adjusted by 60 percent to represent old-growth components. See explanation in "Vegetation and Fire" section.

Table 112 shows that the average number of existing ponderosa pine snags greater than 12 inches d.b.h. per acre in the Ponderosa Pine PNVT is 2.5. Snags 18 inches and greater average 1.3 per acre and represent indicator habitat for the pygmy nuthatch. Snags within existing old growth are estimated to currently be 7.0 snags per acre, with a higher proportion in the 12 to 18 inches size class compared to snags that are 18 inches and greater.

Table 112. Average number of existing ponderosa pine snags per acre

Snag Category	12 to 18 inches	18+ inches	Total Snags Per Acre
Snags in medium to very large tree states	4.4	2.6	7.0
Snags in entire PNVT	1.2	1.3	2.5

For additional information on the condition of Ponderosa Pine PNVTs, please refer to the "Vegetation and Fire" section.

Existing Condition Habitat Trends: The current estimate for ponderosa pine old growth indicator habitat for the pygmy nuthatch is 268,453 acres (table 108). A recent analysis of ponderosa pine habitat trend found that late seral ponderosa pine is increasing slightly and that the large snag component is **stable** (Coconino NF 2013). Overall, the current trend for ponderosa

pine old growth indicator habitat for the pygmy nuthatch is **increasing slightly** and large snag indicator habitat is **stable**.

Existing Condition Population Trend: The current forestwide population trend for pygmy nuthatch is **stable to slightly declining** (Coconino NF 2013). This is based on current data from the Breeding Bird Survey, Christmas Bird Count, on-forest surveys by the Rocky Mountain Bird Observatory, and a long-term research project on the Mogollon Rim Ranger District. State-level breeding bird survey data indicate a slight declining trend (Coconino NF 2013). Forest-specific Christmas Bird Count data do not indicate any discernible trend, but the Rocky Mountain Bird Observatory surveys and the research project along the Mogollon Rim indicate **declining** trends (Coconino NF 2013).

Environmental Consequences

Table 113 summarizes the expected habitat and population trends of management indicator species by alternative. Further details about how alternatives would likely affect these management indicator species are described further below.

Table 113. Summary of management indicator species habitat[1] and population trends by alternative

Alernative	Pronghorn Antelope[2]	Mexican Spotted Owl	Pygmy Nuthatch
Alternative A			
Habitat	Stable to declining except for soil which is stable to increasing (improvements in quality based on vegetative plan objectives = 0).	Increasing in Mixed Conifer with Frequent Fire and Ponderosa Pine. Decreasing in Mixed Conifer with Aspen. Soil will remain stable.	Stable to slightly increasing
Population	Stable	Stable	Stable
Alternative B			
Habitat	Stable to increasing (improvements in quality based on vegetative plan objectives = 21,900 to 27,300 acres).	Increasing (at a greater rate than alternative A). Mixed Conifer with Aspen would remain stable.	Stable to increasing
Population	Stable	Stable	Stable
Alternative C			
Habitat	Stable to increasing (improvements in quality based on vegetative plan objectives = 21,900 to 27,300 acres).	Increasing (at a greater rate than alternative A). Mixed Conifer with Aspen would remain stable.	Stable to increasing
Population	Stable	Stable to increasing	Stable

Alernative	Pronghorn Antelope[2]	Mexican Spotted Owl	Pygmy Nuthatch
Alternative D			
Habitat	Stable to increasing (improvements in habitat quality based on plan objectives – 21,900 to 27,300 acres).	Increasing (at a greater rate than alternative A). Mixed Conifer with Aspen would remain stable.	Stable to increasing
Population	Stable	Stable	Stable

[1] These PNVTs were modeled to predict changes in vegetation structure and composition by alternative; fire and soil were qualitatively assessed.
[2] For alternatives B, C, and D, improvements do not include soil objectives (FW-Soil-O-1: Maintain satisfactory soil conditions and improve impaired and unsatisfactory soil conditions on 100,000 to 350,000 acres during the 10 years following plan approval.) or wildlife objectives (FW-WFP-O-3: Restore/enhance at least 60,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan.). Habitat would be improved or maintained for pronghorn should these treatments occur in its habitat.

Pronghorn Antelope

Summary of Trends for All Alternatives

Vegetation, fire, and soils departure and trends do not differ among the action alternatives (alternatives B, C, and D). Compared to alternative A, the vegetation departures do not change among alternatives B, C, and D, but the trends improve in all three of the PNVTs or remain low (Great Basin Grassland). For fire, trends related to vegetation and fire severity improve among alternatives B, C, and D, compared to alternative A. For soils, none of the departures change in any of the alternatives, but alternatives B, C, and D would improve faster than alternative A in Semidesert Grassland and Great Basin Grassland. Overall, alternatives B, C, and D would result in slightly improved condition of grassland indicator habitats as compared to alternative A.

Table 114 summarizes the departure and trends for grassland PNVTs for existing conditions and all alternatives. This table will be referred to in the following effects analysis discussions for each alternative.

Alternative A

Pronghorn are identified as a management indicator species early and late seral grassland habitat. The 1987 plan gives management emphasis for pronghorn in these habitats within MA 9 – Mountain Grassland, MA 10 – Grassland and Sparse Piñon-Juniper Above the Rim, and MA 11 – Verde Valley. Almost all of Anderson Mesa, which is important Great Basin Grassland pronghorn habitat, is within MA 10. The management emphasis in these MAs is on livestock grazing, visual quality, and wildlife habitat, specifically, to emphasize management of pronghorn. The corresponding PNVTs are Great Basin Grasslands, Montane Subalpine Grassland, and Semidesert Grasslands.

Vegetation, fire, and soils departure and trends do not differ among the action alternatives (alternatives B, C, and D). Compared to alternative A, the vegetation departures do not change among alternatives B, C, and D, but the trends improve in all three of the PNVTs or remain low (Great Basin Grassland). For fire, trends related to vegetation and fire severity improve among alternatives B, C, and D, compared to alternative A. For soils, none of the departures change in any of the alternatives, but alternatives B, C, and D would improve faster than alternative A in

Semidesert Grassland and Great Basin Grassland. Overall, alternatives B, C, and D would result in slightly improved condition of grassland indicator habitats as compared to alternative A.

Table 114. Summary of existing grassland vegetation, fire regime, and soils departure[1] and trend relative to reference conditions and after 15 years of implementation of each alternative

Indicator Habitat	Departure (Percent) and Trend								
	Vegetation			Fire[1]			Soils		
	Existing	Alt. A	Alts. B, C, D	Existing	Alt. A (Veg. and Fire Severity)	Alts. B, C, D (Veg. and Fire Severity)	Existing	Alt. A	Alts. B, C, D
Semidesert Grassland[3]	High (100), Away	High, Static	High (94), Toward	High (VCC II)	Static	Toward	High (95), Slowly Toward	High, Slowly Toward	High, Toward
Great Basin Grassland[3]	Low (10), Away	Low, Away	Low (12), Static	High (VCC III)	High, Away	High, Static	High (87), Toward	High, Slowly Toward	High, Toward
Montane Subalpine Grassland	Low (32), Away	Low, Away	Low (14), Toward	High (VCC III)	Away	Toward	High, Static	High, Toward	High, Toward

[1] Departure was assessed as low (0 to 33 percent), moderate (34 to 66 percent), or high (greater than 66 percent). Vegetation was modeled and fire and soils were assessed qualitatively.

[2] Two fire indicators are vegetation (as it relates to fuel continuity) and fire severity. For departure and trend related to fire return interval (a third fire indicator), all alternatives are trending away from desired conditions because there are no plan objectives relating to fire. Montane/Subalpine Grasslands would retain a moderate departure and Great Basin and Semidesert Grassland would retain a high departure from fire return interval. See the "Vegetation and Fire" section for more information.

[3] These PNVTs were modeled to predict changes by alternative; other PNVTs were qualitatively assessed.

Standards and guidelines that implement the direction to manage for pronghorn in these three management areas call for maintaining and improving mountain meadows and grasslands by removing invading overstory, controlling invasive plant species, prescribed burning, and other methods. Restrictions on off-road driving if resource damage is occurring, and a guideline to avoid construction of new roads in MA 9 are beneficial to maintaining and improving grassland habitat. Range management direction is to improve unsatisfactory range conditions and to maintain seral grasslands where type conversions have occurred in the past. Prescribed fire is used to accomplish resource objectives outside of the urban interface. In MA 11, Verde Valley, a standard and guideline specific to pronghorn is "Determine the need to control invasion of undesirable plant species in antelope range to improve and protect wildlife habitat values. Where necessary, implement the control measures, such as prescribed burning to improve antelope habitat." Plan direction for these three management areas that call for vegetation treatments, avoidance of new road construction, and restrictions on off-road driving habitat improvement would improve grassland habitats for pronghorn and reduce disturbance from motorized vehicles.

In 1998, the plan was amended to include guidance specific to the Red Rock Area on the Red Rock Ranger District (amendment 12). This included MA 27 – Savannah, which contains most of the Semidesert Grassland on the forest. In 2002, the 1987 plan was amended to include guidance specific to the Flagstaff/Lake Mary Ecosystem Analysis Area on the Flagstaff Ranger District (amendment 17). Amendment 17 provided management emphasis for all MIS species based on the habitats contained in the new management areas, including grasslands. Additional emphasis was provided to restore and maintain grasslands to benefit pronghorn and other grassland species in MA 32, Deadman Mesa, which contains Great Basin Grassland habitat.

Management Area 27, Savannah, is within the Sedona-Oak Creek Planning Area and contains Semidesert Grassland habitat interspersed with Piñon-Juniper Evergreen Shrub. One of the management emphases is that high quality grassland supports a diversity of wildlife. Guidance is very strong in this management area for pronghorn and its habitat. Objectives, standards, and guidelines specific to pronghorn are:

- Acquire certain private parcels to reduce habitat fragmentation and otherwise improve antelope and grassland species habitat.
- This management area is characterized by an open vegetation structure. Use prescribed fire and other mechanical treatments to improve forage conditions for wildlife, particularly birds and antelope. Increase the area occupied by grasses and forbs while decreasing the area occupied by shrubs and trees in comparison to recent historic levels.
- Develop conditions that:
    - Provide high-quality habitat for upland game birds and deer;
    - Improve and expand antelope and grassland bird habitat through such means as fence, road, fire, and human access management;
    - Provide adequate cover/security for animal shelter and foraging; and
    - Improve forage conditions for wildlife, particularly quail.
- Identify and protect antelope fawning areas.
- Work together with the AG&FD to develop hunting regulations for antelope below the rim in Game Management Unit 6B to protect and enhance the antelope population there.

- To minimize restriction of antelope movement, locate fences one eighth mile from roads if road right-of-way fencing is required. Remove fences that are no longer needed; use smooth bottom wires and meet the wildlife standards as stated in FSH 2670 and 2240 for all existing or new fences.
- Locate roads to maintain adequate cover for animal shelter and foraging between roads, especially in locations with high road densities.
- Use commercial and personal use firewood sales and Christmas tree cutting areas to reduce encroachment of invasive tree species and maintain open grassland habitat for antelope.
- Acquire large blocks of undeveloped private property to improve antelope habitat and to prevent impacts on NFS lands from residential and associated infrastructure development. Acquire the Bradshaw Ranch property.
- Road and trail locations must consider antelope protection goals. Recreation goals are subordinate to antelope protection.
- If the demand can be demonstrated, allow commercial tours to provide opportunities for scenic viewing, natural history education, wildlife viewing, and other activities that are compatible with antelope protection and Savannah Management Area goals.

Management Area 32, Deadman Wash, is within the Flagstaff/Lake Mary Ecosystem Analysis Area. It contains Great Basin Grassland adjacent to Piñon-Juniper Grassland and abuts Wupatki National Monument. Management emphasis is to restore and maintain grasslands and grassland-adapted wildlife species, especially antelope.

In addition to management area standards and guidelines for grasslands, there are numerous other standards and guidelines throughout the 1987 plan for pronghorn and big game species that provide emphasis for management of pronghorn, and to minimize impacts from roads and fences. They include guidance for fence specifications to allow wildlife passage, forage habitat improvement, off-road driving restrictions in fawning areas and other sensitive habitats, installation of gates or barriers to limit or restrict motorized access into key winter ranges, cooperation with the Arizona Game and Fish Department to meet their management goals and objectives, and involving interested groups or individuals in achieving objectives. Additionally, a forestwide standard and guideline that specifically mentions pronghorn antelope is:

- Interior fences in an allotment are generally three-wire fences with the bottom wire smooth and conform to the above height restrictions. Install antelope passes, let-down fences, electric fences, or elk jumps wherever necessary to improve wildlife travelways.

Implementation of these standards and guidelines for improvement of grasslands habitats will be beneficial for pronghorn. However, the current forest plan identifies quantitative objectives for timber, roads, and recreation developments (see appendix H), but not for grassland improvement. Therefore, the expected amount of treatments to improve grasslands is not known, nor the expected timeframe.

Alternative A Projected Habitat Trend: The amount of indicator habitat is not expected to change, but the quality of habitat could improve with continued implementation of the existing plan. Plan guidance emphasizes habitat treatments to improve all three PNVTs, with particularly strong guidance for MA 27, containing 26 percent of Semidesert Grassland. Despite this guidance in alternative A, vegetation conditions are only expected to change in Semidesert Grasslands,

where the departure remains high, but the trend changes from away to static. Fire departure would not change in any of the three PNVTs; however, trend for vegetation as it relates to fuel continuity and fire severity changes from away to static for Semidesert Grassland and remains trending away from desired conditions for Great Basin Grassland and Montane/Subalpine Grassland PNVTs (table 114). Soil condition departures would remain essentially the same in all three PNVTs and improve slowly in Semidesert Grassland and Great Basin Grassland and would not change in Montane/Subalpine Grassland. Therefore, habitat is expected to **improve slightly** in two of the three PNVTs. Combined with strong plan direction that would apply to all projects, the projected habitat trend is expected to move from **declining** under existing conditions to **stable to declining** (table 114).

Alternative A Projected Population Trend: The current population trend for pronghorn on the forest is **stable** (Coconino NF 2013). As noted above, grassland habitat that supports populations is expected to improve slightly with continued implementation of alternative A. Direction in alternative A is strong for improvement of habitat and populations, so actions that occur in grassland habitat would be expected to improve conditions for pronghorn. Under implementation of alternative A, pronghorn population trend has improved from **declining** in 2002 (Coconino NF 2002) to **stable** in 2013 (Coconino NF 2013). The vegetation trend in Semidesert Grasslands is expected to improve, as is fire departure and trend for Montane/Subalpine Grasslands, but other vegetation, fire, and soil departures and trends are not expected to change (table 114). Therefore, the population trend for pronghorn after 15 years of implementing alternative A is expected to remain **stable**.

Alternatives B, C, and D

Pronghorn is identified as a management indicator species for the Great Basin Grassland, Montane Subalpine Grassland, and Semidesert Grassland PNVTs. The correlation between these PNVTs and management areas from the 1987 plan are described in the previous section such that comparisons can be made among all alternatives. Unless noted, all plan components listed below are common among alternatives B, C, and D.

The desired condition plan component that applies to all grassland types is consistent with good pronghorn habitat. The desired condition states:

- Grasslands are open, grassy areas with limited trees and shrubs and contribute to functional and productive soils and watershed, provide habitat for wildlife, and provide ground fuels conducive to low-severity fires.

This is a positive goal for pronghorn habitat, since they prefer open, rolling grasslands. Low-severity fire can help enhance a diversity of grasses and forbs that pronghorn eat.

Two guidelines common to all three grassland types provide protection to pronghorn fawning habitat, therefore, enhancing the likelihood of successful recruitment into the population.

- Disturbance from management activities in key pronghorn fawning areas during fawning season should be minimized to maximize reproductive success.
- Natural waters within ¼ mile of fawning habitat should be maintained and available to pronghorn during the fawning season to maximize reproductive success.

Alternative B

Montane/Subalpine and Great Basin Grasslands: The desired condition for Great Basin and Montane/Subalpine grassland PNVTs describes a landscape that would provide good habitat for pronghorn. The goal is to manage for a canopy cover of trees and shrubs that is less than 10 percent providing the open habitat favored by pronghorn. Soil erosion is minimal, and long-term soil productivity is maintained, increasing the likelihood of maintaining grass and forbs favored by pronghorn as forage. Grasslands are connected based on the natural distribution of grassland soils, which would help facilitate pronghorn daily and seasonal movements among habitat patches. Desired conditions that specifically mention pronghorn benefits are:

- The composition, structure, and distribution of native vegetation reflect a mix of early, mid, and late seral stages. Early seral stages will typically contain more forbs, and as stages get older, they are dominated by more grasses and fewer forbs. Vegetation height, density, and cover support the historic fire return interval, where fire played a role, while providing food and cover for wildlife species, including pronghorn. The historic fire regime is thought to be low-intensity fire with a 1- to 35-year fire return interval and is generally dependent on the fire regime in adjoining vegetation types (landscape scale).
- Within site capability, a mosaic of vegetation density exists across the landscape ranging from densely vegetated areas that provide cover for ground-nesting birds and pronghorn fawns to bare areas that result from natural activities such as freeze-thaw action or prairie dog burrowing (fine scale).

The treatment objectives for Great Basin and Montane Subalpine Grasslands are:

- Mechanically restore/enhance 10,800 to 12,400 acres of Great Basin Grassland every 10-year period during the life of the plan.
- Mechanically restore/enhance 7,600 and 11,400 acres of Montane Subalpine Grassland every 10-year period during the life of the plan.

Those acres equate to treatment of 16,200 to 18,600 acres over 15 years, or 17 to 20 percent of the Great Basin Grassland PNVT. Although the departure value increases 2 percent and still remains low, the trend would change from “away” (existing condition) to “static” (table 114). For the Montane Subalpine PNVT, objectives equate to 11,400 to 17,100 acres treated over 15 years, or 49 to 73 percent of the PNVT. As a result, the PNVT would improve as the departure value decreases 18 percent and the trend changes from “away” to “toward” desired conditions (table 114). While these treatments would not be creating new acres of PNVT habitat, using the desired conditions to develop projects should improve the quality of pronghorn habitat within these PNVTs.

Most of the Great Basin Grasslands are within the Anderson Mesa and Painted Desert Management Areas. There are no plan components relative to pronghorn in the Painted Desert Management Area. Desired conditions for pronghorn in the Anderson Mesa Management Area are:

- Wildlife viewing and hunting opportunities are emphasized in this area. The Anderson Mesa pronghorn herd has a sustainable population, is able to move freely across the grasslands and open areas of the forest and woodlands, and can easily access winter range. Functioning wetlands provide nesting and migratory habitat for waterfowl and shorebirds, foraging habitat for peregrine falcons, ferruginous hawks and other raptors, and water for a variety of species, consistent with type of wetland.

These desired conditions and guidelines for the Great Basin and Montane Subalpine Grassland PNVTs and the Anderson Mesa Management Area would support maintaining vegetation conditions that provide food, water and cover for pronghorn, and would minimize disturbance in key fawning areas that could improve fawn recruitment into the population.

Semidesert Grasslands: As for the Great Basin and Montane/Subalpine Grassland PNVTs, desired conditions for the Semidesert Grassland PNVT describe a landscape that would provide good habitat for pronghorn. The goals are similar, aiming for open and connected grasslands with the canopy cover of trees and shrubs that is less than 10 percent, providing the open habitat favored by pronghorn. There are no desired conditions that specifically mention pronghorn. Implementing projects that move toward these desired conditions would improve pronghorn habitat.

The treatment objective for Semidesert Grasslands is:

- Mechanically restore/enhance 3,500 acres of Semidesert Grassland every 10-year period during the life of the plan.

This equates to 5,250 acres over 15 years, which is 6 percent of the PNVT acreage.

There is only one standard for Semidesert Grasslands and it states that "Recreation goals are subordinate to antelope protection." This would help ensure that disturbance to pronghorn populations is minimized for recreation projects and activities that the Forest Service decides or controls.

Semidesert Grasslands are contained within the four management areas in alternative B (table 115).

Table 115. Semidesert Grassland acres within management areas in alternative B

Management Area	Semidesert Grassland PNVT Acres
House Mountain Lowlands/Sedona-Oak Creek	24,402
Sedona Neighborwoods/Sedona-Oak Creek	1,307
Sedona-Oak Creek	6,583
Verde Valley	57,391
Total:	**89,683**

The House Mountain Lowlands and Sedona Neighborwoods Management Areas are submanagement units of the Sedona-Oak Creek Management Area. The House Mountain Lowlands Management Area is the same as the Savannah Management Area in alternative A. Guidance in management areas in alternative B is primarily related to scenery and recreation. Although there are no pronghorn-specific plan components in the management areas listed in table 115, there is a beneficial desired condition for few roads in the House Mountain Management Area (MA-HouseMtn-DC-2) and a guideline to locate roads to maintain adequate cover for animal shelter and foraging between roads, especially in locations with high road densities (MA-HouseMtn-G-1), both of which would reduce disturbance to pronghorn.

Forestwide Wildlife, Fish, and Plants Direction: Forestwide desired conditions for wildlife, fish, and plants describe thriving populations and habitats that support viable, self-sustaining populations that are able to meet all of their life history requirements, including migration and dispersal.

A forestwide objective to restore/enhance at least 60,000 acres of terrestrial wildlife habitat could include some work within pronghorn habitat, but where or how much is unknown.

Forestwide guidelines for wildlife, fish, and plants include:

- Design, build, and modify fences to minimize impacts on wildlife movement. For example, locate road right-of-way fences 1/8 mile from roads, design lay-down fences, etc., to minimize restriction to pronghorn movement.
- Project-specific wildlife concerns may require modifying the standard specifications on new or existing fences. Construction of additional fences should be minimal. Maintenance of fences should occur as needed and be prioritized in threatened, endangered, and sensitive species habitat and in habitat for fence-sensitive big game species. Fences that are no longer needed should be removed.

These two guidelines ensure that fence design, construction, modification, and removal would consider pronghorn needs.

Wilderness: Recommendation of Davey's, Strawberry, and Walker Mountain wilderness areas will have a negligible effect on pronghorn, since very little habitat is within these boundaries (table 116). Alternative B would remove the restrictions or conflicting language for burning in the wildland-urban interface and in wilderness, which would be potentially beneficial because burning can reduce the risk of uncharacteristic fire to the its habitat and improve the nutritional quality of forage. This would have little effect to pronghorn in this alternative because the addition to Strawberry Crater is primarily in cinder soils and is generally not conducive to burning.

Table 116. Pronghorn Grassland PNVT acres within recommended wilderness areas in alternative B

Grassland PNVT	Wilderness Acres	Total PNVT Acres	Percent of Total
Great Basin Grassland	2,327	92,913	2.50
Montane/Subalpine Grassland	0	23,429	0.00
Semidesert Grassland	638	89,683	0.71

Recommendation as wilderness would provide pronghorn with minimal extra protections for the 2,327 acres of Great Basin Grasslands, since this PNVT has low departure from reference conditions, and the habitat would be managed for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character and motorized traffic would no longer be allowed.

Overall, guidance contained in the proposed revised plan is not as explicit for management of pronghorn and their habitat as alternative A. Alternative B distinguishes between the different grassland types and provides plan components that address each type. Alternative B would have

similar guidance to protect and enhance pronghorn and their habitats in the PNVT desired conditions and guidelines such as fawning season restrictions to reduce disturbance, fence standards/guidelines, and maintenance of habitat connectivity. However, alternative B lacks guidance that alternative A has, such as more comprehensive guidance for grassland habitats where management emphasis is provided for pronghorn, addressing vegetation management, range management, land acquisition, road construction, and other activities in standards and guidelines. Within alternative A's MA 27, objectives, standards, and guidelines specifically address pronghorn in Semidesert Grassland which is the grassland habitat in poorest condition. Alternative B's desired conditions for the Anderson Mesa Management Area call for sustainable pronghorn populations, but because populations are currently stable, this does not emphasize improving trends. A small proportion of Great Basin Grasslands would be recommended as wilderness, providing some extra protections from disturbance; however, access for vegetation treatments that might be needed would be limited.

Alternative B Projected Habitat Trend: The amount of indicator habitat is not expected to change, but the quality of habitat could improve with the implementation of alternative B. Forest plan guidance does not specifically emphasis pronghorn habitat and population enhancement as much as alternative A; however, plan objectives in alternative B are designed to reduce the overstory and increase the proportion of open state for herbaceous vegetation and open shrubs, which will improve the quality of pronghorn habitat. Vegetation departure would not change in any of the three PNVTs; however, vegetative trends are expected to improve in Semidesert and Montane/Subalpine Grasslands and essentially maintain the low departure (with a static trend) in Great Basin Grassland (table 114). Fire departure is not expected to change for the three PNVTs. The trends for vegetation (as it relates to fuel continuity) and fire severity would be expected to improve and move toward desired conditions in Semidesert and Montane/Subalpine Grasslands and remain static in Great Basin Grassland (in contrast to alternative A which trends away from desired conditions for this PNVT). Soil condition would be expected to improve in alternative B for all three PNVTs and improve faster than alternative A in Semidesert and Great Basin Grasslands. It is difficult to compare the amount of projected habitat improvement under alternative B to alternative A because alternative A's percentage of fire departure from reference conditions is unknown as well as how much indicator habitat has been improved under the 1987 plan. Altogether, the trend for grassland habitat is expected to improve from its current condition of **declining** to **stable to improving** due to the expected habitat improvement in some aspects, but not others.

Alternative B Projected Population Trend: The current population trend for pronghorn is **stable**. As noted above, some of the grassland habitat that supports populations is expected to improve with implementation of alternative B. Guidance includes guidelines for protection of fawning habitat and fence modifications to improve permeability for pronghorn. Desired conditions for the Anderson Mesa MA call for a sustainable pronghorn population that is able to move freely across the grasslands and open areas of the forest and woodlands and can easily access winter range; however, these desired conditions do not emphasize improving trends. Also, there is a lack of specific guidance for pronghorn within other programs such as lands and livestock grazing. However, the "Livestock Grazing" section of the proposed revised plan does have plan components favorable to pronghorn such as desired conditions that provide for large areas of unfragmented open space and plant communities with desired composition, structure, and conditions to balance available forage for permitted livestock is with forage, browse, and cover

needs for wildlife. Considering the strength of direction in the proposed revised plan combined with projected habitat, population trend is **stable**.

Alternative C

Alternative C is the same as alternative B except for the following differences:

- Grassland PNVTs acres in the 13 recommended wilderness areas (includes the 3 proposed in alternative B) is relatively minor, except for Semidesert Grassland PNVT (table 117).

Table 117. Pronghorn Grassland PNVT acres within recommended wilderness areas in alternative C

Grassland PNVT	Total Wilderness Acres	Total PNVT Acres	Percent of Total
Great Basin Grassland	2,327	92,913	2.50
Montane Subalpine Grassland	6	23,429	0.03
Semidesert Grassland	12,186	89,683	13.59

Recommendation as wilderness would provide pronghorn with some extra protections for Great Basin and Montane/Subalpine Grasslands, since these habitats would be managed for the suite of wilderness characteristics, including native species and maintenance of natural processes. Recreation use would be managed to protect wilderness character and motorized traffic would no longer be allowed. The inclusion of these grasslands in recommended wilderness would have negligible effect on Great Basin Grassland and Montane Subalpine Grassland habitat (2.5 percent) because these acres have a low likelihood of being suppressed in the event of a wildfire with a subsequent lower risk of uncharacteristic fire and fire severity. However, Semidesert Grasslands are highly departed from historical conditions, and management activities may be needed to help restore them. Increases in tree density and canopy cover would likely continue in these acres. Wildfire in about 5,687 of these acres would have a moderate to very high likelihood of being suppressed. Consequently, there could be a localized increased risk of uncharacteristic fire and higher than desired fire severity, along with a decreased likelihood of restoring the natural fire interval. The remaining Semidesert Grassland acres have a low likelihood of being suppressed in the event of a wildfire with a subsequent lower risk of uncharacteristic fire and fire severity. Since almost 82 percent[52] of Semidesert Grasslands would be outside of wilderness, this will not have a large negative effect on pronghorn.

Pronghorn would be an emphasis species in Anderson Mesa and Jack's Canyon WHMAs. Desired conditions for WHMAs would focus on protecting wildlife and their habitats. Guidelines for WHMAs would restrict or limit public motorized access and restrict road density to no more than an average of 1 mile of road per square mile (in the Anderson Mesa WHMA). Another guideline specifies that roads in WHMAs not open for public motorized access are managed for administrative use or decommissioned. In addition, there should be no net increase in the area of

[52] This number reflects 13.59 percent recommended wilderness and 4.04 percent designated wilderness.

motorized dispersed camping corridors within each WHMA. Alternatives A, B, and D would allow a net increase in motorized dispersed camping corridors (see table 118). An additional guideline would limit some recreational activities such as nonresearch related large group events and large commercial tours within wildlife habitat management areas. Overall, this direction could reduce human disturbance to pronghorn and to their habitat; however, project-specific NEPA would need to occur to determine the exact locations of restricted public motorized access within these WHMAs.

Table 118. Acres of pronghorn habitat and miles of road that potentially could close to public use within wildlife habitat management areas

WHMA	Great Basin Grassland	Montane/ Subalpine Grassland	Semidesert Grassland	Total Acres by WHMA	Road Miles That Potentially Could Close to Public Use
Anderson Mesa	54,873	1,132	0	56,005	4[1]
East Clear Creek	0	254	0	254	0.1
Hospital Ridge	0	13	0	13	0
Jack's Canyon	4,389	0	0	4,389	2.1
Pine Grove	370	346	0	716	0.1
Total Acres by Grassland PNVT	**59,632**	**1,745**	**0**	**61,377**	**-**
Percent of PNVT Acres	**64.2**	**7.5**	**0**		**-**

[1] This number is an estimate of the number of miles needed to meet the road density guideline for Anderson Mesa WHMA. Road locations would be determined at the project-specific level.

Other parts of alternative C, affect pronghorn habitat and population as follows:

1. Expanding the Cottonwood Basin Fumeroles Geological Area could have a positive impact on pronghorn. The expanded botanical/geological area would contain 1,324 acres of Semidesert Grassland and 499 acres of Desert Communities. Management emphasis is on protecting the plant communities and geology. Emphasizing protection and management of plant communities could improve Semidesert Grassland habitat for foraging.
2. Alternative C would also designate Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas; parts of the Flagstaff Neighborwoods Management Area; some special areas; and wildlife habitat management areas as nonsuitable for recreational (nonhunting) shooting. This would have positive impacts by reducing disturbance in 67,998 acres of pronghorn habitat with 61,374 acres in wildlife habitat management areas and 6,624 acres in a combination of special areas and management areas (Table 119).
3. Designating the Walnut Canyon Management Area and areas with a recreation opportunity spectrum objective of "semiprimitive nonmotorized" as not suitable for snowmobile use, except to provide ingress/egress for private inholdings will have no

impact on pronghorn that use habitats in this area, since they move to lower elevations in the winter to escape snow.

4. None of the research natural areas contain grasslands, so restricting grazing until grazing supports or would not affect the research purposes of research natural areas will have no impacts.
5. Retaining the old-growth standards and guidelines from the 1987 plan will have no impacts on pronghorn and their grassland habitats.

Table 119. Acres of pronghorn habitat designated as nonsuitable for recreational (nonhunting) shooting

Management Area	Great Basin Grassland Acres	Montane/Subalpine Grassland Acres	Semidesert Grassland Acres	Total Acres by WHMA
Anderson Mesa WHMA	54,874	1,132		56,006
East Clear Creek WHMA		250		250
Hospital Ridge WHMA		13		13
Jack's Canyon WHMA	4,389			4,389
Pine Grove WHMA	370	346		716
Long Valley MA	156	3,200	0	3,356
Special areas within San Francisco Peaks MA		150		150
Special areas within Sedona Neighborwoods MA	0		1,307	1,307
Special areas within Walnut Canyon MA	15	283	0	298
Special areas within Verde Valley MA			1,513	1,513
Total Acres by Grassland PNVT	**59,804**	**5,374**	**2,820**	**67,998**
Percent of PNVT Acres	**64**	**23**	**3**	

Alternative C Projected Habitat Trend: The amount of indicator habitat is not expected to change. However, the quality of habitat will change based on implementation of alternative C. Vegetation, fire, and soil departure and trends for all three PNVTs are the same as alternative B (table 114). Guidance for wildlife habitat management areas to specifically emphasize management to benefit pronghorn provides stronger direction for projects that occur in these wildlife habitat management areas. Despite some shifting trends among PNVTs, overall grassland habitat trends will remain **stable to increasing**.

Alternative C Projected Population Trend: The existing population trend for pronghorn is **stable**. Objectives call for the same amount of treatment within indicator habitat as alternatives B and D, resulting in a population trend of **stable**. The rationale for this trend is the same as alternative B.

Alternative D

The forest proposes alternative D to be responsive to public recommendations for no additional wilderness areas and to allow biking in botanical and geological areas. Alternative D differs from alternative B in the following ways:

- Recommends no new wilderness area;
- Allows mechanized recreation (e.g., bikes) on designated trails in botanical and geological areas.

Not adding any new wilderness areas makes this aspect of alternative D the same as alternative A, and would avoid the small negative impact that adding new wilderness areas would have on Semidesert Grassland habitats analyzed in alternative C.

The amount of grassland habitat in botanical and geological areas is extremely small (table 120), therefore, the likelihood of disturbance to pronghorn is negligible. Allowing bicycles on designated trails in botanical and geological areas will have no appreciable effects on pronghorn. Overall, effects from alternative D are not appreciably different that alternative B.

Table 120. Acres of pronghorn habitat within botanical and geological areas

Botanical or Geological Area	Great Basin Grassland Acres	Montane Subalpine Grassland Acres	Semidesert Grassland Acres
Cottonwood Basin Fumeroles Botanical/Geological Area	0	0	217
Fern Mountain Botanical Area	0	150	0
Mogollon Rim Botanical Area	0	26	0
Verde Valley Botanical Area	0	162	0
Total Acres	**0**	**338**	**217**

Alternative D Projected Habitat Trend: Since the effects from this alternative are not appreciably different from alternative B, the habitat trend under alternative D is **stable to increasing**.

Alternative D Projected Population Trend: Since the effects from this alternative are not appreciable different from alternative B, the projected population trend for alternative D is **stable**.

Summary of Trends by Alternative for Pronghorn

The amount of indicator habitat is not expected to change under any of the alternatives (table 121), but treatments within indicator PNVTs are expected to improve habitat quality by opening up denser stands and/or improving forage quality.

Table 121. Summary of pronghorn indicator habitat, population and habitat trends, and acres of expected treatment by alternative

Alternative	Acres of Indicator Habitat	Habitat Trend	Population Trend	Acres of Expected Habitat Improvement[1]
A	206,025	Stable to declining	Stable	Unknown
B	206,025	Stable to increasing	Stable	21,900 to 27,300
C	206,025	Stable to increasing	Stable	21,900 to 27,300
D	206,025	Stable to increasing	Stable	21,900 to 27,300

[1] Based on objectives; alternative A does not have quantitative objectives.

Mexican Spotted Owl

Summary of Trends and Treatments for All Alternatives

Table 122 summarizes the departure and trends for Mexican spotted owl indicator habitat PNVTs for existing conditions and all alternatives. This table will be referred to in the following effects analysis discussions for each alternative.

Table 122. Summary of existing vegetation, fire regime, and soils departure[1] and trend relative to reference conditions and after 15 years of implementation of each alternative

Indicator Habitat[2]	Departure (%)[3] and Trend								
	Vegetation			Fire[4]			Soils		
	Existing	Alt. A	Alts. B, C, D	Existing VCC	Alt A. (Veg. and Fire Severity)	Alts. B, C, D (Veg. and Fire Severity)	Existing	Alt. A	Alts. B, C, D
Ponderosa Pine – Gambel Oak[5,c]	High (79), Away	Moderate (58), Toward	Moderate (51), Toward	High (VCC III)	High, Toward	High, Toward	Low (1), Static	Low, Static	Low, Toward
Mixed Conifer with Frequent Fire[5]	Moderate (64), Away	Moderate (39), Toward	Moderate (34), Toward	High (VCC III)	High, Toward	High, Toward	Low (0), Static	Low, Static	Low, Slowly Toward
Mixed Conifer with Aspen	Moderate (62), Away	Moderate, Away	Moderate, Static	High (VCC III)	High, Away	High, Static	Low (0), Static	Low, Static	Low Slowly Toward

[1] Departure was assessed as low (0 to 33 percent), moderate (34 to 66 percent), or high (greater than 66 percent).

[2] These PNVTs serve as indicator habitat for the Mexican spotted owl.

[3] Departure and trend values are assumed to be the same as for the PNVT as a whole.

[4] The two indicators are vegetation (as it relates to fuel continuity) and fire severity trend. Fire departure and trend related to fire return interval (a third fire indicator), all alternatives have a high departure; however, Ponderosa Pine-Gambel Oak and Mixed Conifer with Frequent Fire PNVTs would move slowly toward desired conditions in all alternatives because of fire related objectives. Mixed Conifer with Aspen PNVT would trend away from desired fire return interval due to a lack of fire related objectives. In Ponderosa Pine-Gambel Oak, implementation of the higher end of the ranges specified in the plan objectives would result in a trend toward desired conditions; whereas implementation of the lower end of plan objectives would result in a trend away from desired conditions.

[5] These PNVTs were modeled to predict changes by alternative; other PNVTs were qualitatively assessed.

Alternative A would lessen the departures from, and move trends toward, desired conditions for Mixed Conifer with Frequent Fire and Ponderosa Pine-Gambel Oak; while Mixed Conifer with Aspen would trend away. Vegetative departures would not change for these three PNVTs in alternatives B, C, and D. Ponderosa Pine-Gambel Oak and Mixed Conifer with Frequent Fire would improve at a faster rate than under alternative A, and Mixed Conifer with Aspen would have a static trend rather than trending away from desired conditions. Alternatives B, C, and D would reduce vegetation departures for all three PNVTs more so than alternative A. Alternative C is similar to alternatives B and D, except for Mixed Conifer with Aspen in which vegetation trend would be away from reference conditions. For fire, departure and trends do not differ between alternative A and alternatives B, C, and D. Soils are in satisfactory condition in these PNVTs, with only Ponderosa Pine departed by 1 percent (table 122). Alternative A trends would remain static, and alternatives B, C, and D trends would move toward reference conditions (table 122). Overall, alternatives B, C, and D would result in slightly improved condition of in indicator habitats as compared to alternative A.

Table 123. Average acres expected to be treated per year by alternative over 10 years after plan approval[1]

Indicator Habitat	Mechanical Treatment Acres (Percent of PNVT)		Prescribed Fire Acres (Percent of PNVT)		Natural Ignitions Acres (Percent of PNVT)	
	Alt. A	Alts. B, C, D	Alt. A	Alts. B, C, D	Alt. A	Alts. B, C, D
Ponderosa Pine – Gambel Oak[2,3] (316,719 acres)	40,000 (13)	20,000 (6) – 104,020 (33)	60,000 (19)	60,000 (19) – 120,000 (38)	54,000 (17)	54,000 (17)
Mixed Conifer with Frequent Fire[2] (49,619 acres)	2,870 (6)	14,000 (28)	8,000 (16)	8,000 (16)	15,500 (31)	7,500 (15)
Mixed Conifer with Aspen (37,083 acres)	0	0	0	0	0	0
Total Treatment Acres (403,461 acres)	42,870 (11)	34,000 (5) – 118,020 (29)	68,000 (17)	68,000 (17) -128,000 (32)	69,500 (17)	61,500 (15)

[1] Percentages are rounded to the nearest whole number.

[2] These PNVTs were modeled to predict changes by alternative; other PNVTs were qualitatively assessed.

[3] Assumed treatments would be proportional to the proportion of the Ponderosa Pine PNVT estimated to be pine-oak, which is 40 percent.

Common to All Alternatives

Primary direction for the Mexican spotted owl in alternatives B, C, and D includes a guideline that specifies habitat management objectives and species protection measures from approved recovery plans should be applied to activities occurring within federally listed species habitat to promote recovery of the species. This guideline is similar to the standard from alternative A to follow approved recovery plans. Other plan components state that direction for species listed as

threatened, endangered, proposed, or candidate takes precedence over direction for species not listed by the U.S. Fish and Wildlife Service. All alternatives also have timing restrictions to minimize disturbance during the breeding season.

Alternative A

The Mexican spotted owl is identified as a management indicator species for MA 3 (Ponderosa Pine and Mixed Conifer on Slopes Less than 40 Percent) and MA 4 (Ponderosa Pine and Mixed Conifer Greater than 40 Percent Slopes) and for these habitat types within the Flagstaff/Lake Mary Ecosystem Analysis Area. The management emphasis for MA 3 is providing a sustained yield of timber and firewood, wildlife habitat, livestock grazing, high quality water, and dispersed recreation. The management emphasis for MA 4 is on wildlife habitat and dispersed recreation.

The 1987 plan has a standard to follow approved recovery plans. Specific standards and guidelines for the Mexican spotted owl tier to the 1995 recovery plan. Guidance is provided for protected, restricted, and other forest and woodland types. A guideline for managing restricted habitat includes a guideline to follow forest plan old-growth standards and guidelines to maintain and promote development of owl habitat. Similarly, a guideline for other forest and woodland types calls for retention of existing old growth in accordance with forest plan old-growth standards and guidelines. This would result in old growth areas with a higher risk of uncharacteristic fire than the surrounding landscapes (see “Vegetation and Fire” section for more information). In addition, alternative A includes language for the 1995 recovery plan in which treatments in protected activity centers can only be conducted for firewood and for reducing fire risk. This conflicts with the revised recovery plan which also allows treatments in protected activity centers to improve species habitat.

Under alternative A, the 20 percent of the landscape managed for old growth would have a higher likelihood of uncharacteristic fire and mixed severity fire. In forest and woodland vegetation types under the 1987 plan, old growth is managed as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area. A table under forestwide direction describes minimum levels for old-growth attributes such as large trees, snags, and logs. Accounting for canopy and rooting zones, and natural between-group interspaces, this minimum level of trees would provide less ability than alternatives B and D to promote vertical structure and age class diversity because the available growing space is occupied by the minimum required trees. This density of trees would tend to maintain a more continuous canopy than alternatives B and D, and it would be more conducive to crown fire. Consequently, alternative A would result in more closed canopy, even-aged conditions than alternatives B and D; this structure and age class diversity does not reflect the frequent, low-severity fires that are characteristic of Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs. Additionally, there would be fewer openings and less understory. Compared to alternatives B and D, old-growth stands in these PNVTs would be at higher risk for uncharacteristic fire, and when they burn, more area would likely burn as mixed severity fire (25 to 75 percent loss of dominant overstory) compared to low-severity fire (25 percent or less loss of dominant overstory). In Mixed Conifer with Aspen, more areas would likely burn at the upper end of mixed severity. Old-growth stands would be less resilient to endemic levels of disturbances.

The revised recovery plan was approved in 2012. The standard to follow approved recovery plans would apply, therefore, habitat should be managed to protect and improve Mexican spotted owl habitat. However, because the existing plan has standards and guidelines based on the 1995 recovery plan, both would have to be followed unless/until the plan is amended.

Alternative A is expected to result in Mexican spotted owl protected activity centers with a higher risk for uncharacteristic fire because plan language limits the diameter of trees that can be cut; however, the revised recovery plan supports a higher tree diameter limit that could potentially be removed.

Continued implementation of alternative A over the next 15 years is expected to improve vegetative conditions with respect to departure and trends for the Mixed Conifer with Frequent Fire and Ponderosa Pine PNVTs; for Mixed Conifer with Aspen, conditions would trend away from desired conditions (table 122). Fire departure would remain the same for all three PNVTs. The trends for vegetation (as it relates to fuel continuity) and fire severity would move toward desired condition in Ponderosa Pine and Mixed Conifer with Frequent Fire PNVTs, but it would move away from desired conditions in Mixed Conifer with Aspen (table 122). Soils remain at low departure with a static trend and in good condition for all three PNVTs.

Within Mexican spotted owl indicator habitat, there would be approximately 42,870 acres of mechanical treatment, 68,000 acres of prescribed fire, and 69,500 of naturally ignited fire completed within the first 10 years of plan approval. These treatments represent 11, 17, and 17 percent of indicator habitat, respectively. Treatments could overlap spatially to some degree. While the amount of indicator habitat will not change, treatments should contribute to improved habitat quality by reducing the threat of wildfire to owl habitat through projects designed and implemented under the recovery plan.

Alternative A Projected Habitat Trend: The amount of indicator habitat will not change. There will be some improvement in vegetative conditions and habitat quality within a portion of indicator habitat. This should change the **declining** habitat trend to **improving**, but within a relatively modest portion of the total indicator habitat.

Alternative A Projected Population Trend: The current forestwide population trend for the Mexican spotted owl is **stable to declining**. Under alternative A, the improvement in habitat, combined with implementation of other aspects of the recovery plan, the population trend for the Mexican spotted owl should improve from **stable to declining** to **stable**.

Alternatives B, C, D

As mentioned above, indicator habitats are Mixed Conifer with Aspen, Mixed Conifer with Frequent Fire, and the Gambel oak subtype (pine-oak) of the Ponderosa Pine PNVT. These alternatives have desired conditions that encompass Mexican spotted owl habitat needs and emphasize sustainable populations, provide habitat conditions that are resilient, and contribute to the survival and recovery of listed species. These alternatives also include a guideline to use fire suppression techniques to minimize disturbance impacts where listed species are located.

Like alternative A, no fire or vegetation treatments are expected in Mixed Conifer with Aspen. However, the amount of vegetation treatments in indicator habitat could be almost three times greater than alternative A, and the amount of prescribed fire treatment could be up to twice as much (table 123). The amount of treatment using naturally-ignited wildfire is expected to be slightly lower than alternative A (table 123). Treatments would overlap spatially to some degree. While the amount of indicator habitat will not change, treatments should contribute to improved habitat quality by reducing the threat of wildfire to owl habitat through projects designed and implemented under the recovery plan.

As a result of implementation of alternatives B, C, and D over 10 to 15 years, vegetation departure would lessen and trends would improve faster than alternative A in Ponderosa Pine-Gambel Oak and Mixed Conifer with Frequent Fire; while Mixed Conifer with Aspen would remain static (table 122).Trends would be the same for vegetation as it relates to fuel continuity and for fire severity. Fir departure as it relates to fire return intervals would remain high for indicator habitat, but it would trend slowly toward desired conditions for Mixed Conifer with Frequent Fire and Ponderosa Pine-Gambel Oak. The trend for Mixed Conifer with Aspen PNVT for fire return intervals would continue away from desired conditions because there are no objectives for prescribed fire in the proposed revised plan. Soil condition trend would move toward desired conditions and remain at a low departure (table 122).

Alternative C

Alternative C would have the same effects from allocated old growth on 20 percent of the landscape as alternative A and, consequently, it would have a greater potential for uncharacteristic fire in the allocated old-growth stands. This is a higher potential than in alternatives B and D.

Except for Limestone Pasture and Second Chance, WHMAs in alternative C emphasize management of the Mexican spotted owl. The primary difference between alternative C and alternatives B and D is that alternative C manages for a lower level of human disturbance. If alternative C is selected, several guidelines would help reduce disturbance. For example, one guideline specifies that roads in WHMAs not open for public motorized access are managed for administrative use or decommissioned. Another guideline specifies no net increase in the area of motorized dispersed camping corridors within each WHMA; whereas alternatives A, B, and D would allow a net increase in motorized dispersed camping corridors. An additional guideline would limit some recreational activities such as nonresearch related large group events and large commercial tours within WHMAs. About 64 miles of road could potentially be closed for public use in Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Aspen PNVTs (Table 124). Subsequent site-specific NEPA would need to be completed; however, this would limit public motorized access and, thus, reduce disturbance to Mexican spotted owls over more area of habitat than alternatives A, B, and D. Overall, this direction could reduce human disturbance to Mexican spotted owls and to their habitat; however, project-specific NEPA would need to occur to determine the exact locations of restricted public motorized access within these WHMAs.

Table 124. Acres of Mexican spotted owl habitat and road miles that potentially could close to public use within wildlife management habitat areas

WHMA	Ponderosa Pine-Gambel Oak[1]	Mixed Conifer with Frequent Fire	Mixed Conifer with Aspen	Total Acres by WHMA	Additional Road Miles with No Public Motorized Access[2]
Anderson Mesa	48,213 x 0.4 = 19,285	0	24	19,309	4
East Clear Creek	21,005 x 0.4 = 8,402	13,993	0	22,395	34.6
Hospital Ridge	861 x 0.4 = 344	4,042	0	4,386	1.1
Jack's Canyon	8,269 x 0.4 = 3,308	0	0	3,308	21.3
Knoll Lake	0	2,558	0	2,558	3.1
Limestone Pasture	2,158 x 0.4 = 863	236	0	1,099	
Pine Grove	12,722 x 0.4 = 5,089	0	0	5,089	0.3
Total Acres by PNVT	**37,291**	**20,829**	**24**	**58,144**	**-**
Percent of PNVT Acres	**9.2%**				**-**

[1] Assumption that Ponderosa Pine-Gambel Oak represents about 40 percent of Ponderosa Pine PNVT.

[2] In Anderson Mesa WHMA, closure of about 4 miles of road is needed to meet the 1 mile per square mile desired condition.

Alternatives B, C, and D Projected Habitat Trend: The amount of indicator habitat will not change. There will be some improvement in vegetative conditions and habitat quality within a portion of indicator habitat. This should change the **declining** habitat trend to **improving**, and with a greater improvement in indicator habitat quality than alternative A because of a higher proportion of indicator habitat treated.

Alternatives B, C, and D Projected Population Trend: The current forestwide population trend for the Mexican spotted owl is **stable to declining**. Under alternatives B, C, and D, the improvement in habitat, combined with implementation of other aspects of the recovery plan, the population trend for the Mexican spotted owl should improve from **stable to declining** to **stable**.

Summary of Trends by Alternative for the Mexican Spotted Owl

The amount of indicator habitat is not expected to change under any of the alternatives (table 125), but treatments within indicator PNVTs are expected to improve habitat quality by opening up denser stands and lessening the threat of wildfire to occupied and potential Mexican spotted owl habitat.

Table 125. Summary of Mexican spotted owl indicator habitat, population and habitat trends, and acres of expected treatment over 10 years by alternative

Alternative(s)	Acres of Indicator Habitat	Population Trend	Habitat Trend	Acres of Expected Habitat Improvement[1]
A	403,461	Stable	Improving	180,370
B, C, D	403,461	Stable	Improving (greater improvement in habitat quality)	171,500 to 307,520

[1] Summary of expected vegetation, prescribed fire, and naturally-ignited fires; acres could overlap.

Pygmy Nuthatch

Summary of Trends and Treatments for All Alternatives

Table 126 compares old growth and snags between existing condition and the plan alternatives for pygmy nuthatch indicator habitat. This table is the basis for the following effects analysis discussions for each alternative.

Table 126. Projected habitat changes by alternative for pygmy nuthatch

	Existing			Alt. A			Alts. B, C, D		
Acres in medium and very large trees (proportion of landscape)									
Medium trees (10-20” d.b.h.)	222,523 acres (28.2%)			181,344 acres (22.9%)			164,715 acres (20.8%)		
Very large trees (20”+ d.b.h.)	46,722 acres (5.9%)			85,525 acres (10.8%)			109,282 acres (13.8%)		
Distribution subtotal	270,487 acres (34%)			268,891 acres (33.7%)			276,072 acres (34.6%)		
Number of snags									
Snag category	12-18”	18+”	Total snags/ acre	12-18”	18+”	Total snags/ acre	12-18”	18+”	Total snags/ acre
Snags in medium to very large tree states	4.4	2.6	7.0	4.0	2.7	6.7	3.6	2.7	6.3
Snags in entire PNVT	1.2	1.3	2.5	1.8	1.4	3.2	1.7	1.4	3.1

Table 127. Summary of pygmy nuthatch indicator habitat, population and habitat trends, and acres of expected treatment by alternative[1]

Alt.	Acres of Old Growth Indicator Habitat	Large Snags[2] Per Acre in PNVT	Large Snags[2] Per Acre Within Old Growth	Population Trend	Habitat Trend – Old Growth	Habitat Trend – Snags
A	266,869	1.4	2.7	Stable	Slightly Increasing	Stable
B	273,204	1.4	2.7	Stable	Increasing	Stable
C	273,204	1.4	2.7	Stable	Increasing	Stable
D	273,204	1.4	2.7	Stable	Increasing	Stable

[1] All estimates are after 15 years of implementation.

[2] Based on objectives; alternative A does not have quantitative objectives.

Alternative A

The pygmy nuthatch is identified as a management indicator species for MA 3 – Ponderosa Pine and Mixed Conifer Less than 40 Percent Slope, MA 4 – Ponderosa Pine and Mixed Conifer Greater than 40 Percent Slope, MA 13 – Cinder Hills Off-highway Vehicle Area, and in ponderosa pine habitats within the Flagstaff/Lake Mary Ecosystem Analysis Area. The management emphasis in MA 3 is on providing a sustained yield of timber and firewood production, wildlife habitat, livestock grazing, high quality water, and dispersed recreation. MA 4 emphasizes wildlife habitat, watershed condition, and dispersed recreation. MA 13 emphasizes off-highway vehicle recreation.

Ponderosa Pine Old Growth - Large Trees and Old-Growth Attributes. Standards and guidelines that apply to old growth ponderosa pine are found primarily within forestwide direction of the 1987 plan.

- A guideline for managing Mexican spotted owl restricted habitat directs that forest plan old growth standards and guidelines be implemented to maintain and promote development of owl habitat.
- A standard to be applied in habitats outside of Mexican spotted owl protected and restricted habitat is to:
    - Manage for uneven-age stand conditions for live trees and retain live reserve trees, snags, downed logs, and woody debris levels throughout woodland, ponderosa pine, mixed conifer, and spruce-fir forest cover types. Manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape. Sustain a mosaic of vegetation densities (overstory and understory), age classes, and species composition across the landscape. Provide foods and cover for goshawk prey.
- Guidelines to apply outside of goshawk post-fledgling areas are to manage for 20 percent in mature (VSS 5) and 20 percent in old (VSS 6) forest conditions. In ponderosa pine, canopy cover should average greater than 40 percent in VSS 5 and 6. Within post-fledgling areas, canopy cover is slightly greater.
- Also in forestwide direction, a standard for old growth states:
    - Until the forest plan is revised, allocate no less than 20 percent of each forested ecosystem management area to old growth as depicted in the table in the forest plan.
- Several key forestwide guidelines for old growth include:
    - Strive to create or sustain as much old growth compositional, structural, and functional flow as possible over time at multiple area scales. Seek to develop or retain old growth function on at least 20 percent of the naturally forested area by forest type in any landscape.
    - Consider the effects of spatial arrangement on old growth function, from groups to landscapes, including de facto allocations to old growth such as goshawk nest sites, Mexican spotted owl protected activity centers, sites protected for species behavior associated with old growth, wilderness, research natural areas, and other forest structures managed for old growth function.
    - Forested sites should meet or exceed the structural attributes to be considered old growth in the five primary forest cover types in the Southwest as depicted in a table

titled "Minimum Criteria for the Structural Attributes Used to Determine Old-Growth."

- Minimum structural aspects of ponderosa pine old growth, depending on site, include 20 live trees per acre 14 or 18 inches in diameter, 70 to 90 basal area, and 40 to 50 percent canopy cover.
- Management Area 3 direction for ponderosa pine and mixed conifer less than 40 percent slopes includes: Guidance for Management Area 3 that refers to forestwide guidance for old growth, with the added standards and guidelines that old-growth stands are 100 to 300 acres in size. Management Area 4 follows the same direction for Management Area 3.

The 20 percent of the landscape managed for old growth would have a higher likelihood of uncharacteristic fire and more area in mixed severity fire. In the 1987 plan in the forest and woodland vegetation types, old growth is managed as 100- to 300-acre stands over no less than 20 percent of each forested ecosystem management area. A table under forestwide direction describes minimum levels for old growth attributes such as large trees, snags, and logs. Accounting for canopy and rooting zones, and natural between-group interspaces, this minimum level of trees would promote vertical structure and age class diversity less than alternatives B and D because the available growing space is occupied by the minimum required trees. This density of trees would tend to maintain a more continuous canopy than alternatives B and D, and it would be more conducive to crown fire. Consequently, alternative A would result in more closed canopy, even-aged conditions than alternatives B and D. This structure and age class diversity does not reflect the frequent, low-severity fires characteristic of Ponderosa Pine PNVT. Additionally, there would be fewer openings and less understory. Compared to alternatives B and D, old-growth stands in these PNVTs would be at higher risk for uncharacteristic fire, and when they burn, more area would likely burn in mixed severity fire (25 to 75 percent loss of dominant overstory) compared to low-severity fire (25 percent or less loss of dominant overstory). Old-growth stands would be less resilient to endemic levels of disturbances.

Overall guidance for old growth in alternative A would provide for the mature habitat and large snags needed by pygmy nuthatches.

Forestwide standards and guidelines for fuels treatment include:

- Limit the treatment of natural fuels to areas where fuel buildups are a threat to life, property, adjacent to old growth areas, or specifically identified high resource values. This would provide a higher level of protection to old growth. However, compared to alternatives B, C, and D, alternative A would reduce fire treatments forestwide due to constraints in managing wildfire for resource objectives in the wildland-urban interface and wilderness areas. This would result in a higher potential for uncharacteristic fire across the PNVT compared to alternatives B, C, and D, which support managing wildfire for resource objectives in wildland-urban interface and in wilderness (but without the alternative A constraints).

Ponderosa Pine Snags: Snag management is emphasized in the 1987 plan. Standards and guidelines that apply to ponderosa pine snags are found in many sections.

Forestwide guidance for snags includes:

- Mexican spotted owl guidance calls for retaining snags within protected activity centers and other protected habitat. In Mexican spotted owl restricted habitat, substantive amounts of snags 18 inches in diameter and larger are to be maintained. In habitats in other forest types that are not protected or restricted, snags are to be retained while applying ecosystem management approaches.
- Forestwide guidance for the northern goshawk calls for retaining snags throughout vegetation types, including ponderosa pine. Snags are defined for goshawk management as 18 inches in diameter or larger and 30 feet tall or taller. In ponderosa pine habitat both within and outside of post-fledgling areas, guidance is to leave at least 2 snags per acre.
- Forestwide timber guidance for 10,000-acre blocks allows for exceeding minimum requirements for snags where it is good multiple-use management to do so; however, the concept of 10,000-acre blocks is outdated.
- Forestwide direction for old growth, including snag management, is spelled out on pages 70-1 to 70-2 of the 1987 plan. Minimum size criteria for ponderosa pine snags within old growth are 14 inches in diameter and 15 feet tall on low sites, and 25 feet tall on high sites. Old growth ponderosa pine should contain at least one ponderosa pine snag per acre. As with 10,000-acre blocks, minimum requirements are exceeded where it is good multiple-use management to do so. This is a smaller minimum diameter than in alternatives B and D. It is also a smaller minimum diameter than in alternative C outside of allocated old growth and the same as alternative C within allocated old-growth stands.
- Forestwide direction for fuel treatments is to identify and fire-line snags that are necessary to meet wildlife management objectives. Monitoring during burning is to occur to ensure they are protected.

Management Area 3 direction for Ponderosa Pine and Mixed Conifer Less than 40 Percent Slopes includes:

- Guidance for osprey has several standards/guidelines for snags. Potential nest sites in preferred nesting habitat should have at least 2 snags per acre 20 inches or greater in diameter and should be as tall as the forest canopy or taller. Snags should be created if necessary to provide perch and nest sites.
- In the snag management section, a ponderosa pine snag is defined as a tree greater than 12 inches d.b.h. and 15 feet tall. An oak snag is defined as a tree greater than 10 inches d.b.h. and 10 feet tall. Within 10,000-acre blocks, at least 50 percent of the forested land, 2 snags per acre will be maintained, and in high priority areas, 2.8 snags per acre will be maintained. Snags are not available for firewood unless designated because of being surplus to wildlife needs. Snags and potential snags will be identified and tallied for each stand. Potential snags will be left where needed to meet snag requirements. Salvage sales must meet snag standards and sales will be delayed if numbers are too low to allow salvage. In order to be considered a road hazard, a snag must lean toward the road and must be tall enough to reach the road if the snag fell, and any snag not meeting both requirements will not be removed.
- Silvicultural prescriptions in MA 3 discuss snag management as well. For ponderosa pine shelterwood prescriptions, dead and poor risk trees in excess of planned snag densities can be harvested, but snags without red needles are retained for wildlife purposes except for wildfire killed trees. Prescriptions for Gambel oak call for retaining 2 cavity-bearing

snags greater than 10 inches in diameter and live trees containing 1 or more cavities. If snag density objectives are exceeded in 10,000-acre blocks, areas containing excessive mortality in Gambel oak may be harvested under the following criteria:

- Retain at least 2 snags per acre greater than 15 inches d.b.h. without signs of wildlife use.
- Retain trees showing obvious signs of wildlife use or rot.
- Retain trees with some live crown and less than 75 percent trunk girdling unless removal is necessary to meet overall objectives.

In MA 4, guidance is to follow standards and guidelines in MA 3.

- In Flagstaff/Lake Mary Ecosystem Analysis Area direction, protection of large trees and snags occurs when prescribed fires are used to improve and protect bald eagle winter roost areas.
- Collectively, guidance in the 1987 plan would maintain snags across the landscape. Different definitions for ponderosa pine snag size and height definitions are confusing, however, because they range from 12 to greater than 20 inches in diameter and 15 to greater than 30 feet tall. Because the standards and guidelines for Mexican spotted owl and goshawk apply to all forested areas, the more recent guidance for snags in those sections is generally what is applied at the site-specific level (S. Martin, personal communication). Therefore, at least 2 snags per acre, 18 inches in diameter and 30 feet or greater, are managed for in the ponderosa pine type, except in osprey habitat, where snag guidance is for 2 tall snags per acre, 20 inches or greater in diameter. Thus, implementation is more consistent although plan language is not. Additionally, standards and guidelines call for retaining 2 cavity-bearing Gambel oak snags greater than 10 inches in diameter per acre, plus live trees containing 1 or more cavities. Because pygmy nuthatches favor snags greater than 15 inches in diameter, and more cavities are found in trees greater than 20 inches, standards and guidelines in alternative A for large snags benefit pygmy nuthatches.
- Plan language regarding the distribution of snags varies by alternative. Alternative A (and C) would have at least one snag per acre in old growth and in the other areas mentioned; thus, snags would be more evenly distributed. Alternatives B and D would average 1 to 2 snags per acre with a minimum diameter of greater than 18 inches d.b.h., and there could be some areas without snags and other areas with groups or clumps of snags. In some areas, snag distribution under alternative A would be less representative of the frequent low severity fires characteristic of this PNVT.

Alternative A Projected Habitat Trend: Based on treatment objectives, the amount of old growth would be expected to slightly decrease by 0.3 percent (1,584 acres); however, the very large tree component will increase by 4.9 percent (38,803 acres) over 15 years (Table 126). These 38,803 acres represent a 14 percent increase. Based on Forest Vegetation Simulator modeling, the number of snags per acre is projected to increase slightly within the ponderosa pine PNVT and is projected to increase a negligible amount within old growth under alternative A (Table 127). The trend for ponderosa pine old-growth habitat for the pygmy nuthatch is **increasing slightly** and large snag indicator habitat is **stable**. Overall, the habitat trend for pygmy nuthatch is **stable to slightly increasing**.

Alternative A Projected Population Trend: The current forestwide population trend for pygmy nuthatch is **stable** to **slightly declining**. Given the projected habitat trends that would increase the amount of old growth in the largest size classes and keep large snags stable, implementation of alternative A should result in a halt to the **declining** population trend and improve the population trend for the pygmy nuthatch to **stable**.

Alternative B

The proposed revised plan specifically identifies the pygmy nuthatch as a management indicator species. The Ponderosa Pine PNVT, including the Gambel oak subtype, provides indicator habitat for this species.

Ponderosa Pine Old Growth – Large Trees and Old Growth Attributes: Almost all of the guidance for ponderosa pine old growth is described in desired conditions in several sections of the proposed revised plan: forestwide ponderosa pine; forestwide wildlife, fish and rare plants; desired landscape character for the Pine Belt Management Area; and the Rocky Gulch Research Natural Area. Desired conditions call for representation of all age classes including old growth occurs throughout the landscape, with locations shifting as a result of succession and disturbance. Also, old growth will occur in small areas as individual trees or clumps, and old-growth attributes required by old growth dependent species are present in necessary amounts and distributions to support viable populations.

In addition to the desired conditions for old growth, there are two guidelines in forestwide ponderosa pine direction. They are to develop old-growth conditions in areas where old growth is lacking, and to make every effort to retain old trees to promote a balanced, uneven-aged forest condition that maintains or contributes to the restoration of presettlement old-growth conditions.

Collectively the desired conditions and guidelines describe conditions that should provide good habitat for the pygmy nuthatch. Compared to alternative A, direction is not as explicit with respect to the amount of ponderosa pine to manage for and does not have canopy cover requirements. Under alternative B, desired conditions are to have more open conditions than alternative A would provide.

Although guidance is not as explicit as alternative A, the total amount of old growth is still expected to increase by 4,751 acres in 15 years over existing conditions. The very large tree component is expected to increase by 62,560 acres, 23,757 acres more than alternative A (Table 126).

Wilderness: Alternative B proposes three new wilderness areas: Strawberry Crater, Walker Mountain, and Davey's. The acreage of ponderosa pine within these recommended wilderness areas is only 0.1 percent (535 acres) of the total PNVT acres (791,897). Recommendation of these additional wildernesses will have a negligible effect on pygmy nuthatches and their habitat.

Ponderosa Pine Snags: Desired conditions frequently mention snags as a desirable part of the landscape. Forestwide desired conditions for all vegetation types includes:

- Snags are present in adequate numbers to provide habitat features such as cavities and loose bark, etc.

A guideline for all vegetation types allows for snags at the lower end of desired conditions in the wildland-urban interface as stated here:

- Forest and woodland vegetation within the wildland-urban interface may be composed of conditions at the lower end of desired conditions for the respective vegetation type such as younger age classes, and the lower end of coarse woody debris and snags in order to reduce the risk of wildfires in wildland-urban interface areas.

Specific to the ponderosa pine type, forestwide desired conditions for snags at multiple scales are described. At the landscape scale (10,000 acres or greater) desired conditions for snags are:

- The young to old large aspens, snags, and downed logs provide habitat for a variety of wildlife species.
- Ponderosa Pine is composed predominantly of vigorous trees, but declining trees are a component. Declining trees are well distributed across the landscape and provide for snags, top-killed, lightning-scarred and fire-scarred trees, and coarse woody debris (greater than3 inches in diameter). Ponderosa pine snags are typically 18 inches or greater at d.b.h. and average 1 to 2 snags per acre, but this can vary in space and time. There are varying sizes of snags greater than 18 inches at d.b.h.
- The landscape is a functioning ecosystem that contains its components, processes, and conditions that result from endemic levels of disturbances (e.g., insects, diseases, fire, and wind) including: snags, downed logs, and old trees.
- Large to moderate-sized oak snags are scattered across the landscape, as are moderate to large live oak trees with dead limbs, hollow boles, and cavities.

For ponderosa pine mid-scale (100 to 1,000 acres), snag desired conditions are:

- In order to reduce fire intensity and resistance to control in the wildland-urban interface, forest structure may be at the lower end of the range of desired conditions for levels of snags, logs, coarse woody debris, tree density, and groups of trees that are more widely spaced or have fewer trees per group (but still within desired condition) than in the nonwildland-urban interface areas. Crown base heights may also be higher.

And at the fine scale (1 to 10 acres) for ponderosa pine, desired conditions are described for old growth that address snags and the late successional stage that will provide for snag recruitment:

- Some openings contain individual trees. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Size of tree groups typically is less than 1 acre, but averages 0.5 acre. Old-growth groups contain trees having similar age characteristics and conditions. Such groups may include fairly similar tree ages and sizes or combinations of ages and sizes, limited amounts of dead and downed material, and dead trees and spike tops, but they are readily distinguished from adjacent groups having different characteristics. Groups at the mid-aged to old stages consist of 2 to approximately 40 trees per group.

The forestwide guidelines that address snags in the ponderosa pine PNVT are:

- Existing large Gambel oak trees and snags should be retained and the development of additional large trees and snags enhanced.

- To provide a necessary habitat component, snags and downed logs should be emphasized along edges of openings and within groups/clumps to provide habitat and roost sites for wildlife species, such as small mammals, cavity nesting birds, and tree-dwelling bats.

Forestwide desired conditions for wildlife discuss snags as an important attribute of old growth in all forest and woodland types:

- Desired Conditions – In all forest and woodland vegetation types, all of the attributes of old growth required by old growth dependent species are present in necessary amounts and distributions, and in patch sizes large enough to provide habitat to support viable populations. Attributes include: multistory structure; large, old trees; large trees with sloughing, exfoliating bark; snags; large downed logs; and other indicators of decadence. All age classes of the hardwood component (e.g., aspen, bigtooth maple, Gambel oak) within conifer dominated vegetation types are well represented and provide wildlife habitat.

A forestwide scenic guideline that includes snags is:

- Visually attractive live and dead trees, some large woody debris, and understory shrubs should be favored when leaving vegetation in the foreground (1/2 mile or less) of concern level 1 and 2 travel routes to enhance the desired landscape character.

Snags are also addressed in the Pine Belt Management Area desired conditions:

- Snags, top-killed trees, down logs, and other evidence of fire and wind disturbance occur individually and in patches of varying size. They provide an intriguing feature that moves throughout the landscape with time. Standing dead trees provide character and wildlife habitat and they are retained (see the desired conditions for the Ponderosa Pine vegetation type for more information).

Overall, compared to alternative A, the guidance in the proposed revised plan is not as strong for protection and maintenance of ponderosa pine snags that pygmy nuthatches need for nesting and roosting. Snags are often mentioned as a desired part of the landscape, but specifics of guidance for maintenance and development of snags is lacking. Alternative B's desired conditions define snags as 18 inches or greater in diameter, but it envisions average levels of 1 to 2 snags per acre that are irregularly distributed across the landscape. This density is less than alternative A, but it is probably more representative of frequent, low-severity fires. No minimum heights are mentioned. During Arizona breeding bird surveys, pygmy nuthatch nests were found in cavities that ranged from 7.2 to 62 feet off the ground with a median height of 24.6 feet (Corman and Wise-Gervais 2005). Unlike alternative A, alternative B does not describe protections for snags when doing management activities such as timber harvest, thinning, or fuels treatment; however, a guideline does provide for protection from uncharacteristic natural disturbances. Pygmy nuthatch abundance is strongly related to snag density (Szaro and Balda 1979 and Sydeman et al. 1988 in Corman and Wise-Gervais 2005), and they tend to be less common in intensively managed forests. Consequently, alternative B's desired condition that allows for lower levels of snags in the wildland-urban interface could result in lower abundance of pygmy nuthatches in the wildland-urban interface; however, more open conditions and a lowered risk of crown fires may reduce the loss of snags in these areas.

Alternative B would clarify some of the confusing snag language that is present in the 1987 plan, as described in alternative A.

Alternative B Projected Habitat Trend: With an emphasis on meeting desired conditions but no quantitative goals for the amount of old growth to manage for on the landscape, the amount of old growth is expected to increase by only 0.5 percent (4,751 acres) over 15 years, which is 3,167 acres more than under alternative A (table 127). The large tree component within old growth is expected to increase by 7.9 percent (62,560 acres), which is 3.0 percent (23,757 acres) more than alternative A (Table 126).

For snags, plan guidance is not as specific as alternative A, with desired conditions of an average of 1 to 2 snags 18 inches or greater per acre. The number of large snags per acre is not projected to increase slightly within the Ponderosa Pine PNVT and is projected to increase a negligible amount within old growth under alternative B (table 127). Projected large snag numbers are the same as for alternative A.

Overall, the trend for ponderosa pine old-growth habitat for the pygmy nuthatch is **increasing** and large snag indicator habitat is **stable**.

Alternative B Projected Population Trend: The current forestwide population trend for pygmy nuthatch is stable to **slightly declining**. Given the projected habitat trends that would increase the amount of old growth in the largest size classes and keep large snags stable, implementation of alternative B should result in a halt to the **declining** population trend and improve the population trend for the pygmy nuthatch to **stable**.

Alternative C

Alternative C is the same as alternative B, except the seven elements described in the "Summary of Alternatives" section earlier in this document. Therefore, the environmental consequences of this alternative are similar to alternative B, with the following analysis focused on the differences based on the seven elements:

1. The acreage of ponderosa pine within the 13 recommended wildernesses is only 0.6 percent (4,976 acres) of the total 791,897 PNVT acres. Recommendation of these additional wildernesses will have a negligible effect on pygmy nuthatches and their habitat.
2. Desired conditions for WHMAs focus on protection of wildlife and their habitats. Guidelines for WHMAs would reduce road densities and reduce human disturbances from public motorized access and recreation activities such as large group events and commercial tours compared to alternatives A, B, and D. Through projected WHMA road closures, public motorized access would potentially be reduced 5.8 percent forestwide in the Ponderosa Pine PNVT. These closures would occur through site-specific NEPA at a separate time.
3. Expanding the Cottonwood Basin Fumeroles Geological Area will have no impact on the pygmy nuthatch since there is no ponderosa pine habitat within the area.
4. Walnut Canyon, Sedona Neighborwoods, and Long Valley Management Areas; parts of the Flagstaff Neighborwoods Management Area; some special areas; and wildlife habitat management areas are designated as nonsuitable for recreational (nonhunting) shooting. There are 94,673 acres of Ponderosa Pine PNVT in the wildlife habitat management areas and 174,938 acres in a combination of management areas and specials areas for a total of 269,611 acres. Designating these areas as not suitable for recreational (nonhunting)

shooting will minimally impact pygmy nuthatches by reducing the amount of disturbance from shooting.

5. Designating the Walnut Canyon Management Area and areas with a recreation opportunity spectrum objective of "semiprimitive nonmotorized" as not suitable for snowmobile use, except to provide ingress/egress for private inholdings will have a very minor positive impact on pygmy nuthatches since they do not migrate in the winter.
6. Only 2,202 acres of ponderosa pine are in research natural areas. Restricting grazing will have no measurable impact on pygmy nuthatches or their habitats.
7. Because of the older, more decadent conditions found in old growth, it provides valuable snag and large tree habitat for pygmy nuthatches. As described in the analyses above, alternative A has more explicit guidance for the amount of old growth to manage for compared to alternative B because it requires at least 20 percent, and as much of the landscape as possible, to be in old growth. Alternative B does not identify the amount of old growth to maintain or develop although desired conditions describe "…having sufficient groups of old growth to be representative of the vegetation type prior to 1850 (prefire disruption), declining trees are generally well distributed across the landscape to meet the needs of species that use snags; the location of old-growth components shifts on the landscape over time as a result of succession and disturbance." It also has a guideline to encourage the development of old-growth conditions where it is lacking so there is continuous representation of old-growth characteristics across the landscape over time. Another guideline promotes the retention of presettlement trees to promote an uneven-aged forest condition that maintains or contributes to the restoration of old-growth conditions characteristic of Ponderosa Pine PNVT. Alternative B is projected to result in slightly more old growth in 15 years than alternative A (table 127). Alternative B also does not state snag sizes to manage for in old growth; instead it describes having an average of 1 to 2 snags per acre 18 inches or greater throughout the landscape which applies across the PNVT. Alternative A describes minimum snag attributes to meet or exceed in old growth, which are one 14-inch snag per acre that is 15 to 25 feet in height depending on site quality, but overarching guidelines of 2 snags per acre greater than 18 inches diameter are implemented at the project level (see alternative A analysis). Therefore, retaining the 1987 plan guidance for old growth and snags in ponderosa pine in alternative C would provide more specific guidance than alternative B; however, old-growth stands (see "Vegetation and Fire" section) would have a higher risk from uncharacteristic fire. But as analyzed above, the amount of old growth, particularly in the large tree component, is expected to be greater for alternatives B, C, and D than for alternative A.

Overall, alternative C provides more emphasis for pygmy nuthatch through managing for wildlife habitat in 12 percent of the Ponderosa Pine PNVT that is within wildlife habitat management areas. It would also provide very slight benefits through the recommendation of more wilderness and reducing the amount of disturbance from shooting and snowmobiles in several management areas, compared to alternative B. Retaining the old-growth guidance from the 1987 plan does not change the projected amount of old-growth habitat from that of alternative B (table 127).

Alternative C Projected Habitat Trend: Despite retaining the old-growth guidance from alternative A, the amount of old-growth habitat is expected to increase the same as alternative B (table 127). Additionally, the designation of wildlife habitat management areas would support

protection and improvement in wildlife habitat and would contribute positively to pygmy nuthatch habitat. The amount of large snags projected does not differ among any of the alternatives.

The combination of effects of alternative C differs slightly, but the habitat trend for old growth would be expected to be the same as alternative B, or **increasing**, and the trend for large snags is **stable**. Overall, the projected habitat trend for pygmy nuthatch is **stable to increasing**.

Alternative C Projected Population Trend: The current forestwide population trend for pygmy nuthatch is **stable to slightly declining**. Given the projected habitat trends that would increase the amount of old growth in the largest size classes and keep large snags stable, implementation of alternative C should result in a halt to the declining population trend and improve the population trend for the pygmy nuthatch to **stable**.

Alternative D

The forest proposes alternative D to be responsive to public recommendations for no additional wilderness areas and to allow biking in botanical and geological areas. Alternative D differs from the alternative B in the following ways:

- Recommends no new wilderness area;
- Allows mechanized recreation (e.g., bicycles) on designated trails in botanical and geological areas.

Not adding any new wilderness areas makes this aspect of this alternative D the same as alternative A. However, as analyzed above for both alternative B and C, the addition of wilderness has a negligible impact on pygmy nuthatches compared to alternative A.

Allowing bicycles on designated trails in botanical and geological areas will have no measurable effects on pygmy nuthatches. The only ponderosa pine within botanical or geological areas is 49 acres in the Red Mountain Geological Area.

Because these differences are minimal, the effects of alternative D are the same as alternative B.

Alternative D Projected Habitat Trend: The projected trends are the same as for alternative B: increasing slightly for old growth and stable for large snags or **stable to increasing**.

Alternative D Projected Population Trend: Like alternative B, the population trend for the pygmy nuthatch is **stable**.

Summary of Trends by Alternative for Pygmy Nuthatch

Despite explicit and more quantitative guidance for old growth and snags in alternatives A and C, the amount of ponderosa pine old growth and snag habitat varies little among alternatives. The only difference is that the amount of old-growth habitat is 6,335 acres less under alternative A than the other alternatives. Primarily because the amount of old growth in the large tree component increases almost 24,000 acres more than alternative A (see Table 126), the old growth habitat trend for alternatives B, C, and D improves to **increasing** versus **slightly increasing** (see Table 127).

Golden and Bald Eagles

Affected Environment

All golden and bald eagles are protected under the Bald and Golden Eagle Protection Act (Eagle Act). The purpose of the analysis in the following section is to determine if take is likely to occur with implementation of the alternatives. Take is defined in the Eagle Act as to "…pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest or disturb." Disturb is further defined as "…to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." Bald and golden eagles are also protected under the Migratory Bird Treaty Act, which also prohibits take. Each project implemented under the selected alternative would be evaluated at the site-specific level, and each would require a take permit from the U.S. Fish and Wildlife Service if take is likely.

The Fish and Wildlife Service recommends using the "Conservation Assessment and Strategy for Bald Eagles in Arizona" (Driscoll et al. 2006) in conjunction with the "Bald Eagle National Management Guidelines" (USFWS 2007c) to protect bald eagles in Arizona. For golden eagles, the FWS has issued a report titled, "Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance" (Pagel et al. 2010).

Surveys for nesting bald eagles are led by the Arizona Game and Fish Department, which conducts fixed-wing flights for nesting bald eagle activity early each breeding season. Based on their survey results, Arizona Game and Fish Department assigns bald eagle nest watchers to monitor sites with active nests. Nest watchers monitor occupied sites from the first week of February through fledging in June.

National bald eagle winter surveys have been ongoing since 1979. They were initiated and organized by the National Wildlife Federation from 1979 to 1991, and since then, they have been coordinated by the Raptor Research Technical Assistance Center (Bureau of Land Management). Arizona Game and Fish Department is the coordinating agency for the annual statewide survey. Golden eagles are also documented if they are encountered on survey routes.

Bald Eagles

Bald eagles are not only Southwestern Region sensitive species, but they also fall under the Eagle Act. There are both nesting and wintering bald eagles on the Coconino NF. On average, approximately 16 percent of all wintering eagles counted in Arizona during the statewide mid-winter survey are found within the Coconino NF's boundaries, and in some years, the percentage is as much as 26 percent (USDA Forest Service 2012). Small to moderately sized groups (2 to 48 eagles) night roost in clumps (less than 1 to 43 acres) of large trees in protected locations. Large trees are used for roosting, nesting, and perches. Eagles feed on carrion, fish, and waterbirds. Roosting eagles are associated with Ponderosa Pine PNVT.

There are currently 11 confirmed and 27 potential eagle roosts on the forest. Nesting eagles are associated with cliffs and Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and Montane Willow Riparian Forest PNVTs. Five of the six bald eagle breeding

areas on the Coconino NF occur below the Mogollon Rim in the vicinity of the Verde River, and one occurs in Ponderosa Pine above the Mogollon Rim. The primary species threat on the forest is disturbance from management activities and recreation. This can result in failed reproduction or fewer young to nesting eagles or increased winter stress for roosting eagles. (See "Other Species" for information on golden eagles.)

Nesting: Bald eagles in central Arizona prefer to nest on cliff ledges or pinnacles or in tall trees (USFWS 1982b). They mainly forage on waterfowl and fish found along major streams; however, they do hunt in the uplands and forage on various mammal species, especially in the winter. There are six nesting pairs of bald eagles on the Coconino NF.

Six breeding areas (Tower's, Beaver, Oak, Ladder's, Cold Water, and Lake Mary) occur on the forest. All but Lake Mary occur below the Mogollon Rim. The breeding areas below the Mogollon Rim are located along the Verde River or within one mile of the confluence of major tributaries to the Verde River.

Breeding bald eagles at Tower's and Ladder's are protected by a seasonal closure that restricts all entry during the breeding season (December 1 through June 30). In addition, these two breeding areas and the Oak Creek breeding area are monitored most years by nest watchers from February through fledging which occurs sometime in June. A recent riparian restoration project near the Oak Creek breeding area closed various roads accessing the riparian area to motorized vehicles. This action has reduced recreation, particularly vehicular based recreation, and has reduced disturbance to the bald eagles nesting there. The Beaver eagle breeding area also has issues with off-highway vehicle activities. A series of social roads extending from D.W. Lane across from the Camp Verde High School south and east to the country north of State Highway 260 near NFS Road 9207, allows motorcycles and ATVs to travel within close proximity to the Beaver nesting pair, causing adult eagles to flush, circle, and call.

Wintering: Bald eagles occupy northern Arizona primarily as a winter resident or migrant. From 1995 through 2010, an average of 299 individuals has been counted during the annual midwinter survey in Arizona (McCarty and Jacobson 2010). On the forest, wintering eagles occupy most habitat types and elevations, but they are most frequently seen within ponderosa pine, piñon-juniper, and grassland habitats, often near water.

The forest provides important wintering habitat for Arizona eagles. On average, approximately 16 percent of all wintering eagles counted in Arizona during the midwinter survey are found within the Coconino NF boundaries, and in some years, the percentage is as much as 26 percent (USDA Forest Service 2012). The highest numbers of wintering eagles are counted on routes that include Lake Mary, Mormon Lake, and Interstate 17. Wintering eagles arrive in the fall, usually late October or early November, and leave in early to mid-April. Numbers of eagles peak in February and March. They feed on fish, waterfowl, terrestrial vertebrates, and carrion. Eagles are often seen perched in trees or snags near water or next to roadways where they feed on road-killed animals. However, bald eagles are highly mobile in the winter, and they can fly great distances in search of aquatic or terrestrial prey and suitable nighttime roosting habitat.

On the forest, small to moderate-sized groups (typically 2 to 48) of bald eagles roost at night in clumps of large trees in protected locations such as drainages and hillsides (Grubb and Kennedy 1982, Dargan 1991). Eagles typically roost in the following locations: ponderosa pine stands that are variable in size (less than an acre to 43 acres), north or northeast-facing slopes, and areas

close to daytime foraging areas (Dargan 1991). Roost trees are large live or dead ponderosa pine trees averaging 28 inches d.b.h. that occur in groups and are much larger than other trees in roost stands (Dargan 1991).

In 1986, wintering bald eagles were trapped and fitted with radio transmitters on the forest (Grubb et al. 1989). Nighttime relocations were used to identify general roosting areas by plotting telemetry locations on maps. Approximately 30 roost areas were identified. Dargan (1991) was able to locate and ground verify 11 of those roosts for use in habitat analysis. Followup work by the Rocky Mountain Research Station resulted in at least one more roost being ground verified (Coconino NF files), and district biologists have delineated several potential roosts when evaluating project effects on bald eagles. There are currently 38 eagle roosts that have been spatially identified in GIS. They consist of the 11 confirmed roosts, plus 27 additional roosts.

Golden Eagles

For golden eagles, there are 10 confirmed nests representing 9 nesting areas (Red Mountain has 2 nests identified). There are an additional 10 sites that are potential golden eagle nesting areas, but have not been confirmed (table 128).

Table 128. Known and potential golden eagle nests on the Coconino NF

Name	Status	Comments
Black Mountain Canyon	Confirmed	
Boynton Canyon	Confirmed	Within Red Rock-Secret Mountain Wilderness.
Colton Crater	Confirmed	0.3 mile from forest boundary.
Mount Elden Sandy Seep	Confirmed	No data on this site.
North of Lost Mountain	Confirmed	Within Red Rock-Secret Mountain Wilderness.
Red Mountain	Confirmed	Cliff nest.
Red Mountain	Confirmed	Alternate nest site at Red Mountain.
Secret Mountain	Confirmed	At the edge of Munds Mountain Wilderness.
Upper Lake Mary South	Confirmed	Tree nest.
Walnut Canyon	Confirmed	Within Walnut Canyon National Monument.
Bear Sign Canyon	Potential	No data or information on this site.
Dry Lake	Potential	Not confirmed. Could be a roost site.
Indian Point, Oak Creek Canyon	Potential	Eagles seen often in area.
Lee Mountain	Potential	No data or information on this site. Within Munds Mountain Wilderness.
O'Leary	Potential	Golden eagles often seen in area.
Padre Canyon	Potential	Non-Forest Service land. 0.4 mile from forest boundary.
San Francisco Wash	Potential	No data or information on this site. Digitized point appears to be in bottom of wash, road on top.
Upper Lake Mary North	Potential	Tree nest. Record isn't clear if this is a confirmed nest or not.
Walker Creek	Potential	Reported to Forest Service, not confirmed.
Woody Mountain	Potential	No data or information on this site.

Environmental Consequences

Common to All Alternatives

Communication towers are a collision hazard and transmission lines are an electrocution risk for bald eagles and golden eagles. All alternatives would reduce these hazards to eagles by promoting the use of existing transmission corridors to capacity with compatible utilities (where additions are environmentally and visually acceptable before evaluating new routes) (p. 79, par 9; FW-SpecUse-DC-1, 3) and specifying that power lines and towers would be constructed or reconstructed to specifications compatible with raptor use (p. 80, par 2; FW-SpecUse-DC-3). All alternatives would avoid research natural areas, geological and botanical areas, the Mt. Elden Environmental Study Area, wilderness, and the Verde Wild and Scenic River (p. 79, par 10; FW-SpecUse-DC-3; new p. 115-5, par 3; SA-WSR-Verde-S-1). Consequently new power lines and transmission corridors would not occur in these areas which could contain roosting, nesting, or foraging habitat for bald and golden eagles.

Human Activities: All alternatives incorporate the "Verde Wild and Scenic River Comprehensive River Management Plan," including its standards (replacement p. 113, par 4; SA-WSR-Verde-S-1). Wildlife and fish are among the outstandingly remarkable values that are protected and enhanced (replacement p. 113, par 5; new p. 115-1, par 2; FW-WSR-Verde-DC-5) and the range of flows in the free-flowing Verde River would provide optimum conditions for native fish and wildlife and health and diverse stands of riparian vegetation on the banks and flood plain (replacement p. 114, par 3; replacement p. 115, par 2-3; FW-WSR-Verde-DC-6). The original designation allows for some water diversion. Specifically, designation shall not prevent water users receiving Central Arizona Project water allocations from diverting that water through an exchange agreement with downstream water users in accordance with Arizona water law (new p. 115-1, par 8). As a result, streamflows could be reduced in the future which could degrade riparian habitat used for bald eagle nesting.

All alternatives have timing restrictions to minimize disturbance during the breeding season (replacement p. 124, no. 9 for eagles in the osprey emphasis area; replacement p. 167, par 5 for bald eagle nesting in the Verde Valley; new page 206-67, par 6 for raptors nesting in the Flagstaff Lake Mary ecosystem area , new page 206-73, par 6 for bald eagle nests and roosts in the Flagstaff Lake Mary Ecosystem Area; FW- WFP-G-4 for both golden and bald eagles nests and roosts).

Most Forest Service authorized management activities would not meet the definition of take under the Eagle Act. However, some activities could result in disturbance to eagles during the breeding season, or disturbance in the vicinity of roost sites in the winter. Examples include: timber harvest or thinning activities; road, trail, and facility construction; prescribed burning; and special use permits in the vicinity of eagle nests or roost sites.

Alternative A

Alternative A is silent on allowing bicycles on designated trails in botanical and geological areas, thus, could have consequences on bald and golden eagles. Golden eagles nest in the Red Mountain Geological Area. Even though there are no mountain biking trails here at this time, they could be developed in the future. Although there are no known nests or roosts, bald and golden eagles could use portions of the other geological and botanical areas for nesting and roosting. In alternative A, standards for timber and habitat access would protect winter roosts for raptors and

close or restrict access to bald eagle nests during breeding seasons (replacement p. 124, no. 9; new p. 206-73, par 5). Wildlife objectives would address the threat by minimizing smoke impacts to habitat, protecting habitat during breeding and wintering seasons, eliminating roads that negatively impact wildlife, and restoring habitats damaged by human activities (replacement p. 184, par 10; new p. 206-10, no. 4; new p. 206-11, par 8; new p. 206-12, no. 6; new p. 206-13, par 8; new p. 206-51, nos. 1, 3; new p. 206-53, nos. 5, 7; new p. 206-67, pars 5, 6; new p. 206-73, par 4; new p. 206-98, par 3; new p. 206-116, par 9).

This alternative would avoid transmission lines in certain PNVTs (the Ponderosa Pine and Mixed Conifer vegetation types) and would evaluate new corridors for their potential impacts on habitats for threatened and endangered species (p. 79, par 10). Avoidance of these PNVTs would be beneficial because large ponderosa pine trees and snags in these PNVTs can be used for roosting and nesting by both golden and bald eagles. Alternative A allows communication sites at a limited list of locations which would reduce the number of sites that would potentially impact the species (p. 82, pars. 4-5). Alternative A is silent on alternative energy proposals such as wind and solar so the guidelines in the forest plan would not be adequate to mitigate potential impacts to eagles and other wildlife species.

Future management activities could result in unavoidable take of bald and golden eagles in alternative A, however, numerous plan components would reduce the likelihood of disturbance. Each project would be evaluated at the site-specific level, and each would require a take permit from the Fish and Wildlife Service if take is likely.

Considering all environmental and cumulative consequences, this alternative could result in take, as defined in the Eagle Act, for bald or golden eagles on the forest; however, its plan guidance to minimize disturbance effects emphasizes bald eagles more so than golden eagles in terms of timing restrictions, does not address wind and solar energy sites, and allows mountain biking in geological and botanical areas, so the likelihood of unavoidable take at the project level would be higher than the other alternatives.

Alternative B

Alternative B has seasonal timing restrictions to be applied at the project level for minimization of disturbance to protect known nests and roosts from habitat alteration and/or disturbance to avoid disruption that could affect survival or successful reproduction (FW-WFP-G-4).

This alternative provides the least amount of risk to eagles from energy development. It would limit the number of sites that would potentially impact eagles by using existing communication sites and utility corridors to maximum capacity (FW-SpecUse-G-4) and by updating communication site plans to optimize use of existing sites and minimizing the number of towers (FW-SpecUse-G-6). Utility lines, such as pipelines, power lines, fiber optic lines, and telephones, would be buried (FW-SpecUse G-2). These alternatives would minimize the effects to wildlife and habitat fragmentation of new large linear infrastructure such as power lines (FW-SpecUse-DC-2) but would not specifically avoid certain PNVTs like alternative A does. Unlike alternative A, these alternatives would support alternative energy production and energy developments such as wind energy while mitigating or minimizing impacts to other resources, including wildlife (FW-SpecUse-DC-5) and would avoid transmission lines not just in the Mt. Elden Environmental Study Area, but all environmental study areas, some of which have foraging and nesting habitat for eagles (FW-SpecUse-DC-3).

Although, alternative B has a guideline where recreation uses should be excluded from research natural areas and botanical and geological areas where they have a negative impact on the resource for which the area is designated (SA-RNABotGeo-G-1), this would not apply to eagles. Alternatives B, C, and D also have specific plan components designed to reduce disturbance during the breeding season, facilitating reproductive success. These are summarized in Table 129. Guidelines for recreation include a special uses guideline that would restrict air tour companies or rock climbers from using habitat during the breeding season and dispersed recreation guidelines that would curtail recreation activities to protect resources (FW-BioPhys-Geo-G-3; FW-SpecUse-G-20; MA-SedOak-G-10; FW-Rec-Disp-G-2, 4, 6, 10-11). A wildlife guideline would require compliance with species conservation agreements and require assessments to avoid the need for Federal listing of non-listed species (FW-WFP-G-2). In addition, a wildlife guideline would restrict the use of pesticides where eagle species forage to minimize effects to species or habitat (FW-WFP-G-12).

Considering all environmental and cumulative consequences, this alternative could result in take, as defined in the Eagle Act, for bald or golden eagles on the forest. Its plan guidance minimizes disturbance effects to both bald eagles and golden eagles in terms of timing restrictions, addresses wind and solar energy sites, has the least amount of risk associated with energy development yet would allow mountain biking in geological and botanical areas, so the likelihood of unavoidable take is lower than alternative A and higher than alternative C at the project level.

Table 129. Summary of plan components in alternatives B, C, and D that reduce disturbance to bald eagles and golden eagles

Plan Component	Location Code in the Proposed Revised Plan
Seasonal timing restrictions should be applied for threatened, endangered, and sensitive species; bats; and golden eagles to protect known nests, roosts, and other special features from habitat alteration and/or disturbance from management activities to avoid disruption of species or their habitats that could affect survival or successful reproduction.	FW–WFP-G-4
New designated motorized dispersed camping access routes should be located away from environmentally sensitive areas.	FW-Rec-Disp-G-4
Trailheads avoid impacts to ecological and cultural resources. Trail use remains on established tread especially in sensitive areas. Trail access to springs should be limited to minimize erosion, trampling, compaction, and inadvertent introduction of invasive and undesirable plants, animals, and disease while still allowing access by wildlife. Where necessary to protect and promote soil and plant restoration, national forest visitor activities should be restricted from entry into soil and plant restoration sites. Except in the Long Valley MA, dispersed camping should be provided near but not within 200 feet of riparian, shoreline, or aquatic resources. Recreation in the city of Flagstaff municipal watershed (draining into the Inner Basin) should be limited to day use foot traffic. The area may be closed if unacceptable damage occurs as determined by degradation of water quality.	FW-Rec-Disp-DC-14; FW-Rec-Disp-G-2, 6, 10, 11
Campfire smoke in Oak Creek Canyon is minimal to protect habitat conditions for bats, birds, and other wildlife species and to improve air quality.	MA-OakCrk-DC-6
Commercial filming using aircraft is discouraged in the Sedona-Oak Creek Management Area except within the House Mountain-Lowlands Management Area and along paved highways.	MA-SedOak-G-10

Plan Component	Location Code in the Proposed Revised Plan
Fire suppression techniques that minimize disturbance impacts should be used where there are listed and Forest Service sensitive species.	FW-WFP-G-3, 4; SA-Wild-SecretMtn-DC-2
Unneeded roads are closed and naturalized to reduce human disturbance to wildlife and to reduce soil erosion.	FW-RdsFac-DC-4
To increase chances of survival for young wildlife, active roosts, nests, and dens should not be disturbed.	FW-BioPhys-Geo-G-3
The location of new, large linear infrastructure such as power lines has minimal effects to wildlife and minimizes habitat fragmentation. Power lines and towers are built (construction or reconstruction) to specifications compatible with raptor use. Alternative energy developments, such as wind energy, are designed to minimize impacts to other uses and resources, in particular wildlife and scenic integrity.New overhead utility lines and support towers should be located to minimize adverse ecological and scenic impacts through screening and other mitigations. Equipment of a comparable scale should be allowed for expansion of existing utility corridors before creating new sites or corridors in order to minimize scenic and ecological impacts. The number of towers should be minimized by approving designs capable of colocating multiple communication carriers/services.	FW-SpecUse-DC-2, 3, 5; FW-SpecUse-G-2, 4, 6
Air tour companies and rock climbing activities should not disturb occupied eyries between March 1 and August 31, to protect the area during the peregrine falcon breeding season and to protect other raptor species sensitive to noise disturbance.	FW-SpecUse-G-20
Off-trail nonmotorized use is discouraged forestwide in ecologically sensitive areas.	FW-Rec-Disp-DC-17
To improve the status of species and prevent Federal listing, management activities should comply with species conservation agreements, assessments, and strategies.	FW-WFP-G-12
The use of pesticides, herbicides, or any chemicals should be avoided near bat roosting, foraging, or watering areas to minimize contamination of bats or their prey. If application is necessary, apply techniques to minimize effects (e.g., small-sized spray blocks, application of buffers around roosts and riparian or aquatic habitats).	FW-WFP-G-12
Recreation uses should be excluded from RNAs and botanical and geological areas where they have a negative impact on the resource for which the area is designated.	SA-RNABotGeo-G-1

Alternative C

The designation of new wilderness areas and wildlife habitat management areas does more to reduce the likelihood of take of eagles as compared to alternative B. This alternative would also apply seasonal timing restrictions at the project level to minimize disturbance similar to alternative B. It also has similar effects as regards energy development and in botanical and geological areas as alternative B. In contrast to the other alternatives, it does not allow mountain biking in botanical and geological areas.

Considering all environmental and cumulative consequences that apply to alternative B, plus the differences analyzed above, this alternative could result in take—as defined in the Eagle Act—for bald or golden eagles on the forest, but alternative C would reduce disturbance to eagles in some parts of the forest more so than the other alternatives. When these area-specific restrictions are taken into account, this alternative would have the lowest likelihood of unavoidable take at the project level compared to the other alternatives.

Alternative D

Not recommending new wilderness areas makes this aspect of alternative D the same as alternative A. Allowing bicycles on designated trails in botanical and geological areas could have consequences on bald and golden eagles. Golden eagles nest in the Red Mountain Geological Area. Even though there are no mountain biking trails here at this time, they could be developed in the future. Although there are no known nests or roosts, bald and golden eagles could use portions of the other geological and botanical areas for nesting and roosting.

As with alternative B, this alternative would also apply seasonal timing restrictions at the project level to reduce the likelihood of disturbance. Unlike alternative B, which proposes three new wilderness areas, this alternative does not, which lessens the protections for eagles to some degree. This alternative has the highest potential for risk to eagles from transmission lines. This alternative has similar consequences as B and C except for language related to certain geographic areas on the forest. The scenic integrity objectives associated with the power line between Sycamore and Red Rock-Secret Mountain Wilderness would change from a moderate to a low rating. The assumption is that the width of a power line corridor would not change under a moderate scenic integrity objective but can double in size under a low scenic integrity objective before it would be lowered to a very low scenic integrity objective category. Therefore, under alternative D, this segment of the power line could substantially increase in size, including the clearing of trees to meet regulations but it could get no larger than the distance between the Sycamore and Red Rock wilderness boundaries. This could increase transmission line size or number of lines within the corridor increasing localized risk to eagles. This risk could be reduced by location or design as described under alternatives B and C.

Each project would be evaluated at the site-specific level, and each would require a take permit from Fish and Wildlife Service if take is likely. Overall this alternative provides the least protection for bald and golden eagles.

Migratory Birds

Affected Environment

Considered for the migratory bird analysis were: (1) birds identified as priority species in the Arizona Partners in Flight Bird Conservation Plan (Latta et al. 1999) and (2) birds in Bird Conservation Regions 34 and 16 of the Fish and Wildlife Service's 2008 Birds of Conservation Concern (USFWS 2008).

The Arizona Partners in Flight Bird Conservation Plan and the Birds of Conservation Concern identify priority species of concern. Those that occur within Coconino NF habitats are analyzed. However, effects to western yellow-billed cuckoo, southwestern willow flycatcher, common black hawk, Yuma clapper rail, Mexican spotted owl, northern goshawk, ferruginous hawk, burrowing owl, red-naped sapsucker, and juniper titmouse are considered in the species viability analysis above and are not discussed here. The 27 species analyzed and their habitat associations are shown in table 42, Table 43, and table 44 earlier in this chapter. These species and habitat associations are summarized in table 130.

Table 130. Priority migratory birds and habitat

Species	Habitat	PNVT
Golden-crowned Kinglet Pine Grosbeak Swainson's Thrush Three-toed Woodpecker	Spruce-Fir	Spruce-Fir
Olive-sided flycatcher	Mixed Conifer	Mixed Conifer (both types)
Cordilleran Flycatcher Flammulated Owl Grace's Warbler Lewis' Woodpecker Olive Warbler Purple Martin	Ponderosa Pine	Ponderosa Pine
Grasshopper Sparrow Swainson's Hawk	High Elevation Grassland	Montane Subalpine Grassland Great Basin Grassland
Black-throated Gray Warbler Gray Flycatcher Gray Vireo Piñon Jay Sage Sparrow	Piñon Juniper	Piñon-Juniper Woodland Piñon-Juniper Evergreen Shrub
Black-chinned Sparrow Sage Sparrow Virginia's Warbler	Chaparral	Interior Chaparral
McGillvray's Warbler Red-faced Warbler	High Elevation Riparian	Montane Willow Mixed Broadleaf
Bell's Vireo Elf Owl	Low Elevation Riparian	Cottonwood Willow
Bendire's Thrasher	Desert, Semidesert Grassland	Desert Communities Semidesert Grasslands
Sage Sparrow	Desert, Semidesert Grassland, Piñon Juniper, Chaparral	Desert Communities, Semidesert Grasslands, Piñon-Juniper Evergreen Shrub, Piñon-Juniper Woodland, Interior Chaparral,

There are two important bird areas on the Coconino NF: Anderson Mesa and Lower Oak Creek, and a portion of a third, Salt and Verde River Important Bird Area. The habitats they contain were also considered in this analysis and are shown in table 131.

Table 131. PNVTs habitat acres within important bird areas

PNVT	Anderson Mesa IBA Acres	Lower Oak Creek IBA Acres	Salt and Verde IBA Acres
Cottonwood Willow Riparian		49	97
Desert Communities		29	

PNVT	Anderson Mesa IBA Acres	Lower Oak Creek IBA Acres	Salt and Verde IBA Acres
Grassland, Great Basin	46,100		
Grassland, Montane/Subalpine	2,516		
Grassland, Piñon Juniper	50,020		
Grassland, Semidesert		67	
Interior Chaparral		11	
Mixed Conifer with Aspen	1,39		
Piñon-Juniper Evergreen Shrub		385	38
Piñon-Juniper Woodland	15,886		
Ponderosa Pine	74,044		
Riparian, Cottonwood Willow			
Riparian, Mixed Broadleaf		170	
Riparian, Montane Willow	113		
Water	2,821		
Wetland Cienega	9,145		
Total IBA acres	**202,036**	**711**	**135**

Environmental Consequences

Common to All Alternatives

The primary direction for management of migratory birds is contained within the Migratory Bird Treaty Act, Executive Order 13186, and the 2008 Memorandum of Understanding between the U.S. Department of Agriculture Forest Service and the U.S. Fish and Wildlife Service to Promote the Conservation of Migratory Birds. The memorandum of understanding lists many actions the Forest Service shall take, such as to: address migratory bird conservation in developing, amending, or revising forest plans; participate in planning efforts of bird conservation regions; evaluate effects of agency actions on migratory birds within the NEPA process; minimize effects to migratory birds; cooperate with landowners; support studies and research; recognize and promote the value of migratory birds to the public; and promote collaboration. Applying the actions specified in the memorandum of understanding would contribute positively to migratory bird conservation for all alternatives, including the no action alternative (alternative A), by ensuring migratory birds are considered in forest planning and project NEPA and by applying approaches for identifying and minimizing take that is incidental to otherwise lawful activities.

Most Forest Service management activities would not meet the definition of take under the Migratory Bird Treaty Act, which is "… to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). Vegetation removal or destruction is not considered a taking; however, activities done during breeding seasons, such as hazard tree or snag removal, timber harvest, fuels reduction, and

prescribed fire, could result in unintentional take if active nests with eggs or young are present in trees and shrubs or on the ground. These activities would occur under all alternatives considered in this analysis.

Under all alternatives, the Verde Wild and Scenic River would be managed according to the comprehensive river management plan which emphasizes management of migratory birds and recognizes the high importance of riparian habitat to the diversity of migratory birds.

There are a number of areas on the forest that are seasonally closed for a variety of reasons. Examples include reduced disturbance during breeding seasons for a variety of species, reduced disturbance for big game winter range, and no motorized use to provide a more primitive hunting experience. Under all alternatives, these seasonal closures across the forest would reduce disturbance to migratory birds and their habitat because of restrictions on human activities.

Alternative A

There are no specific goals, objectives, standards, or guidelines for migratory birds in the 1987 plan. However, there are some for some species that also have Federal status or are designated as Forest Service sensitive, for example, raptors. These have been addressed in other portions of this analysis and are not further addressed here. Some of these species have seasonal restrictions to protect breeding habitat but in general, migratory birds do not under alternative A. Therefore, unintentional take could occur from management activities that destroy nests or kill individual birds. The goal to “Manage habitat to maintain viable populations of wildlife and fish species and improve habitat for selected species” (p. 22-1) states a general goal that would include migratory birds. A number of wildlife and fish standards and guidelines apply to migratory birds and their habitat but are very general in nature (p. 64 and 66).

There would be no specific guidance for the management of important birding areas, which are designated by the Audubon Society as high quality migratory bird habitat in alternative A.

Guidance for road maintenance and construction activities does not have restrictions to protect disturbance-sensitive species under alternative A. It also does not provide guidance on avoiding impacts to streams and riparian areas. The lack of direction for these resources could result in unintentional take except where timing restrictions apply more generally.

Plan components under alternative A would promote old-growth components on 20 percent of the associated vegetation types, but would not be consistent with desired conditions or promote characteristics of old growth that support wildlife in uneven-aged matrix of tree groups and forest at the mid-scale (see “Vegetation and Fire” section for more details).

Effects to migratory bird habitat are discussed in the coarse filter analysis for the associated PNVT. Considering environmental and cumulative consequences common to all alternatives and the effects disclosed above, alternative A would likely result in some unintentional take of migratory birds, but it would not likely occur to such an extent that would have a measurable negative effect on migratory bird populations.

Alternative B

Guidance in alternative B would provide for migratory bird habitat through desired conditions, objectives, standards, and guidelines that tie population of wildlife species and habitat conditions,

restore or enhance terrestrial wildlife habitat, and broaden seasonal timing restrictions to apply to all threatened, endangered, and sensitive species if they are pertinent, instead of just specific species listed under alternative A (mainly raptors and owls). Additional general direction to improve habitats and maintain viable populations in forestwide wildlife direction would also apply to migratory birds (see coarse filter evaluations for more details). Overall, unintentional take that could occur from management activities that destroy nests or kill individual birds would occur slightly less often under alternative B compared to alternative A.

There is no specific guidance for the management of important birding areas, which are designated by the Audubon Society as high quality migratory bird habitat in alternative B.

Alternative B has clearer guidelines for mitigating impacts from roads to riparian areas and wildlife habitat than alternative A. Instead of focusing narrowly on road construction, as alternative A does, alternative B includes guidelines on construction of permanent and temporary roads, road realignment and relocation, and naturalization and decommissioning which provide broader protections for migratory birds from this activity. Alternative B is, therefore, less likely to result in unintentional take of migratory birds from road construction and maintenance activities than alternative A.

Recommending additional wilderness areas (Strawberry Crater, Davey's, and Walker Mountain) would impact migratory birds and their habitats. About 14,768 acres would be recommended and this would impact all species except golden-crowned kinglet, pine grosbeak, Swainson's thrush, three-toed woodpecker, and olive-side flycatcher because their mixed conifer and spruce-fir habitats do not occur in recommended wilderness in this alternative. Recommendation would generally result in less disturbance. Vegetation treatments may be less likely to occur because they would be more expensive and there would be limitations on access. The use of wildfire with resource objectives is more likely in the 8,390 acres of migratory bird habitat associated with Davey's and Strawberry Crater, whereas wildfires are more likely to be suppressed in Walker Mountain recommended wilderness (6,378 acres). The risk of uncharacteristic fire would be higher in Walker Mountain (see "Vegetation and Fire" section for details). Both of these activities could result in incidental take.

Plan components under alternatives B through D would further promote old-growth components within an uneven-aged matrix of tree groups and forest at the mid-scale, aggregated across the landscape in frequent fire forest types, rather than just on 20 percent and would be more consistent with desired conditions than alternative A (see "Vegetation and Fire" section for more details).

When considering the effects disclosed above alternative B would likely to result in some unintentional take of migratory birds; however, alternative B would not likely to occur to such an extent that would have a measurable negative effect on migratory bird populations.

Alternative C

Alternative C's additional recommended wilderness areas would result in more restrictive management such as limited access and elimination of motorized vehicle traffic which would result in less disturbance for migratory birds than other alternatives. The south end of the Verde Valley is the location on the forest that would be most affected since it contains much of the recommended wilderness. As a result, the likelihood of take occurring in these areas would be

lower than on the rest of the forest (see “Special Areas” and “Vegetation and Fire” sections for more details).

Recommending 13 wilderness areas would impact migratory birds and their habitats. About 91,473 acres would be recommended, and this would impact all species except golden-crowned kinglet, pine grosbeak, Swainson’s thrush, and three-toed woodpecker because their spruce-fir habitat does not occur in recommended wilderness in this alternative. Recommendation would generally result in fewer disturbances. Vegetation treatments may be less likely to occur because they would be more expensive and there would be limitations on access. There is a higher likelihood of using wildfire with resource objectives in the 53,780 acres of migratory bird habitat associated with Abineau, Barbershop, East Clear Creek, Railroad Draw, Davey’s, Strawberry Crater, Cimmaron-Boulder, and Hackberry; whereas wildfires are more likely to be suppressed in the Black Mountain, Cedar Bench, Tin Can, Walker Mountain, and Deadwood Draw recommended wilderness areas (37,693 acres). The risk of uncharacteristic fire would be higher in the latter recommended wilderness areas (see “Vegetation and Fire” section for details). Both of these activities could result in incidental take.

Alternative C is expected to be similar to alternative B and would not greatly improve the percentage of old growth over alternative A. It would do slightly less than alternative B to promote and maintain old growth forest components due to potential reductions in fire treatment from recommended wilderness designations (see “Vegetation and Fire” section for more details).

The Anderson Mesa Important Bird Area overlaps the Anderson Mesa, Jack’s Canyon, and Pine Grove Wildlife Habitat Management Areas. This alternative would reduce disturbance to wildlife from public motorized access in about 6 percent of the important bird area that is within the Jack’s Canyon and Pine Grove WHMAs. Alternative C contains a guideline to reduce the public road density for the Anderson Mesa Wildlife Habitat Management Area to an average of 1 mile of road per square mile. Currently the area has 1.01 miles of public roads per square mile; over the life of the proposed revised plan, roads would be decommissioned and closed to lower the average to 1.0 mile per square mile. Road closures would result in a minimal reduction of roads within Anderson Mesa WHMA. This guideline would also retain a road density, which minimizes the likelihood of increasing road density over time. In locations where road closures occur in the Anderson Mesa IBA, there would be a slight reduction in disturbance to migratory birds and their habitat.

Current levels of motorized dispersed camping would be maintained because a guideline in alternative C that states, “There should be no net increase in the area of motorized dispersed camping corridors designated within each WHMA.” Under all alternatives, the location of camping corridors could change; however, under alternative C, the net area of camping corridors would remain stable but the net area could increase under alternatives A, B, and D. Therefore, this guideline would have a lower likelihood of disturbance to migratory birds, depending on the location of designated camping corridors and the respective habitat impacted, compared to alternatives A, B, and D.

Within WHMAs, disturbance to migratory birds would also be reduced compared to alternatives A, B, and D due to less human use as outlined in the following guidelines:

- Large group recreation events and large commercial tours within WHMAs should not be permitted except in developed sites and in support of research.

- In the East Clear Creek and Jacks Canyon WHMAs, public access should be provided on roads that access developed sites, trailheads, and interpretive sites and improved and maintained roads providing connectivity from State Highway 87 to Rim Road (FR 300). In Pine Grove WHMA, public motor vehicle access should not be provided.
- All roads within WHMAs that are not open for public access are managed for administrative use or decommissioned; however, project-specific NEPA would need to occur to determine the exact locations of restricted public motorized access within these WHMAs.
- Guidelines for WHMAs would restrict or limit public motorized access and restrict road density to no more than an average of 1 mile of road per square mile (in the Anderson Mesa WHMA). The following lists specific WHMAs and additional miles of road with no public motor vehicle access within each: Anderson Mesa (4 miles[53]), East Clear Creek (34.8 miles), Hospital Ridge (1.1 miles), Jack's Canyon (24.2 miles), and Pine Grove (2.3 miles). Overall, this direction could reduce human disturbance to pronghorn and to their habitat.

Unintentional take could still occur from management activities that destroy nests or kill individual birds but is likely to occur less frequently in these areas of the forest.

Considering environmental and cumulative consequences common to all alternatives and the effects disclosed above, alternative C is likely to result in some unintentional take of migratory birds, but it would not likely occur to such an extent that would have a measurable negative effect on migratory bird populations. This alternative would have greater positive impacts on migratory birds and their habitats than alternatives A, B, or D.

Alternative D

Not recommending additional wilderness areas would make this aspect of alternative D the same as alternative A.

Allowing bicycles on designated trails in botanical and geological areas would have no appreciable effects on migratory birds.

Considering environmental and cumulative consequences common to all alternatives and the effects disclosed above, alternative D would likely result in some unintentional take of migratory birds, but it would not likely occur to such an extent that would have a measurable negative effect on migratory bird populations.

Cumulative Effects – Species

Cumulative effects from implementation of the alternatives include both the potential effects of forest management on the wildlife resource and the potential effects of land management on adjacent lands of other ownership (i.e., private, State, tribal, other Federal agencies, county, etc.)

[53] This number is an estimate of the number of miles needed to meet the road density guideline for Anderson Mesa WHMA. Road locations would be determined at the project-specific level.

on the wildlife resource. In general, cumulative effects include impacts from past activities and potential future activities, such as agricultural use, forestry, fire, human development, and recreation.

Cumulative effects of alternatives A, B, C, and D were evaluated by considering the management actions of other entities of a similar planning scope within a relevant spatial and temporal context. The analysis area for wildlife includes the Coconino NF and relevant portions of Arizona Game and Fish Department's Region II and Bird Conservation Regions 16 (Southern Rockies/Colorado Plateau) and 34 (Sierra Madre Occidental). The analysis area encompasses the three counties immediately adjacent to and/or surrounding the Coconino NF: Coconino, Navajo, and Yavapai. The analysis area is of a spatial extent that accounts for effects on wide-ranging species such as big game and migratory birds that travel across numerous land jurisdictions. The area encompasses similar habitat types as identified in the proposed action area and reflects similar ecological settings which wildlife species referenced in this DEIS could or would use. These effects were evaluated for the life of the forest plan or approximately 10 to 15 years.

Landscape-Level Cumulative Effects

Human Structures on the Landscape

Road projects to lessen congestion on nearby arterial roads could improve access to the forest and lower travel times which may result in more recreation and noise disturbance to wildlife on portions of the forest affected by these areas. Because the forest road system would not be altered, the ability to drive off of main roads into the forest would not be improved and so most of these impacts would occur near highways and main roads where there are already impacts. These changes are, therefore, not likely to result in cumulative effects for wildlife (See "Infrastructure" section).

Infrastructure needs tied to growth in adjacent communities may increase habitat fragmentation under alternative A because there are fewer restrictions on where these facilities can be located and on requiring that they be colocated with existing facilities. Alternatives B, C, and D would do more to consolidate utilities and to bury them wherever possible so they do not pose a hazard to terrestrial wildlife (See "Infrastructure" and "Lands and Special Uses" section).

Potential development of alternative energy resources outside of the Coconino NF, would likely result in new utility corridor and potential solar or wind energy development proposals from energy providers (see "Lands and Special Uses" cumulative effects). Alternative energy developments in order to be cost effective typically occur at a scale of several thousand acres per development. Mitigations are still being developed for wind turbines effects to bats and birds and it is not clear what methods are effective at this time. Solar energy developments also alter vegetation communities. Both of these types of developments require a large increase in road infrastructure to support operations and maintenance which can increase sedimentation where they occur. Therefore, for the foreseeable future, alternative energy developments on non-NFS lands would reduce habitat availability and quality and increase fragmentation.

Forest and Woodlands Habitat

Under all alternatives, prescribed fires and mechanical thinning would continue across the forest (and adjacent lands) in the coming years to reduce accumulated fuels that can cause uncharacteristic wildfire. Cumulatively, these actions are expected to improve habitat while

decreasing the overall long-term viability risk to wildlife species that evolved with fire-adapted ecosystems. Further information on the cumulative effects to species habitats may be found in this chapter in the "Vegetation and Fire" section and in "Riparian Resources" and "Water Quality, Quantity, and Watersheds" in the "Aquatic System" section.

Similar forest planning efforts are underway on two neighboring national forests: the Kaibab and Apache-Sitgreaves NFs. Both are also revising their land management plans concurrently with the Coconino NF, based upon the same regional vegetative desired conditions, standards, and guidelines and similar objectives for Ponderosa Pine and Mixed Conifer types. The cumulative restoration activities from the action alternatives (alternatives B, C, and D) from these plans could have a pronounced effect on modifying stand structure to be less susceptible to stand-replacing fire in these vegetation types, while promoting resiliency with regard to climate change. Collectively, the net result of these proposed revised plans should be positive and beneficial for wildlife species by ensuring the persistence of these habitats into the future and by providing continuity of suitable habitats. This should decrease the overall risk to species viability.

Another large-scale planning effort in the analysis areas would focus on improving resiliency in fire-adapted ecosystems is the Four Forest Restoration Initiative. If implemented, the Four Forest Restoration Initiative could treat up to 55,000 acres annually across the Kaibab NF and adjacent NFS lands. The cumulative effect of this process could have widespread beneficial outcomes in restoration across the forest including decreased susceptibility to large disturbances (e.g., uncharacteristic wildfire and insect outbreaks) and increased water yields from winter snowfall through the creation of interspaces. The scale of this project is such that these changes could have a meaningful impact on wildlife habitat by improving adaptability of ponderosa pine types to a changing climate and providing for it well into the future.

The landscape, however, has become more fragmented as a result of human activities that include urban development, ranching, and fire suppression. As a result, there has likely been a net loss of intact, potential habitat and an increased risk to viability for wildlife on adjacent lands; this trend is expected to continue in the future. As a result, the Coconino NF would play an increasing role in the conservation of these habitats and associated wildlife species on NFS lands.

Grassland and Desert Habitat

In Coconino County, a large percentage of the Montane Subalpine Grassland PNVT has undergone a vegetation type conversion, and in Yavapai County, much of the development has been and is continuing to occur in Semidesert Grassland and Desert Communities PNVTs. Development increases habitat fragmentation and decreases the ability of fire to play its natural role in the surrounding area. New homes and property developments change and increase the amount of values at risk from fire and replace natural landscapes with human ones. These alternations change the decision on whether or not to suppress fire, the amount of sedimentation and the kind of pollutants carried in runoff, and change the vegetation communities so that some associated wildlife can no longer use these areas. These changes also prevent the movement of animals migrating across the area through the introduction of barriers such as roads or reduce the available food, water, and cover for migrating animals. Adjacent properties can also become vectors for the introduction of exotic, invasive species.

Interior Chaparral Habitat

Although there has been little change in the distribution of Interior Chaparral, there has been an increase in the distribution of people, especially residential housing, near portions of this PNVT, such as Oak Creek Canyon. Consequently, portions of Interior Chaparral are now considered wildland-urban interface. A more narrow range of conditions is needed to let fires run their natural course in wildland-urban interface than in wildland areas because of the now nearby human population and associated infrastructure. Often this results in the exclusion of fire. This, combined with a now higher potential for human-caused fires, results in increased potential for uncharacteristic fire. The abundance and distribution of this small, fire-adapted PNVT has changed little over time, so there is a low probability that these two factors could cause a loss of viability of the associated species.

The management effect to habitat quality of Interior Chaparral is moderate in the 1987 plan (alternative A), because it is scarcely referenced. In contrast, alternatives B, C, and D provide desired vegetation and soil conditions and describe the natural role of fire in this PNVT. They also state, "to enhance the protection of human health and safety, watershed treatments such as vegetation thinning, prescribed burning, and channelization should be focused where protection of people, structures, and community infrastructure (e.g., roads, bridges, and power corridors) in, and associated with, the wildland-urban interface are at risk." This would result in positive management effects, because it would result in maintenance or improvement of most occurrences. In all alternatives, a management approach emphasizes the PNVT-specific need for working with stakeholders to address the threat of uncharacteristic fire.

Riparian Habitat

Some of the PNVTs may not be able to make a full recovery to lower percentages of departure. For example, with Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Forest, and lower elevation springs, dropped water tables threaten sustainability. Water tables have dropped because of a legacy of water diversions that occurred historically and that were largely outside Forest Service management authority. They are also predicted to drop in areas adjacent to Verde Valley cities as a result of groundwater pumping by municipalities, and that trend may continue. Consequently, portions of the Cottonwood Willow Riparian Forest PNVT are now perched above the water table and its long-term sustainability may be threatened.

In Riparian Forest PNVTs, wetland-cienegas and springs, external factors that negatively affect native fish, amphibians, and other associated species include groundwater pumping and resulting stream dewatering and diversion. The State of Arizona has the authority to regulate the use of water on and off of NFS lands. As the population of Arizona has grown, particularly in fast-growing areas like the Verde Valley, demand for drinking water and water for commercial and industrial uses has increased for cities and counties (see "Socioeconomic" and "Aquatic Systems" sections). Private household and businesses have higher demand for water on a daily basis than agricultural land uses. As a result, population increases are associated with faster drawdown of groundwater and diversions most of the time. These influences make the forest's continued coordination with local governments, private landowners, and the State critical to maintaining the viability of aquatic species that are dependent on habitats supported by the water table.

Dispersed camping next to water bodies is still permitted on adjacent national forests and so the Coconino's proposed revised plan and alternatives C and D would be more restrictive and may

shift some of this use and associated impacts to adjacent public lands. As a result, sedimentation and water quality impacts from campfires may continue in these areas.

For cumulative effects concerning sedimentation, which may affect species associated with perennial waters, see the "Soils" section.

Alpine Tundra Habitat

Because all Alpine Tundra in the area is managed by the Forest Service, there are no cumulative effects for this habitat.

Species-Specific Cumulative Effects

In addition to these broad-scale influences to species' habitat, table 132 summarizes more specific cumulative effects to specific species. Species not shown in the table were determined not to have species-specific cumulative effects, but the landscape-level cumulative effects would apply.

Table 132. Cumulative effects by species

Species	Cumulative Effects
Arizona cliffrose	The Arizona cliffrose is endemic to soils derived from white Tertiary limestone lakebed deposits. It occurs in four disjunctive populations in central Arizona. Most of the population near Cottonwood is on the Coconino NF. The population near Horseshoe Lake is on the Tonto NF. Recreation, road construction and maintenance, utility corridors, land exchanges, mining, and grazing are the activities most likely to affect these populations. Both forest plans direct that projects will be assessed to determine impacts to Arizona cliffrose and that appropriate consultations will be requested, but neither plan contains specific prohibitions that would preclude the need for consultation requests fro all of these uses. In the "Prescott National Forest Draft Land and Resource Management Plan," there is direction to locate mineral materials and motorized trails outisde of areas identified as medium or high potential rare plant habitat within the Verde formation. This addresses some of the possible impacts from recreation and mining, but does not address the effects of nonmotorized trails and uses and so impacts from these recreation types would still be possible under their proposed revised plan. The Tonto National Forest plan does not have direction for cliffrose or the Verde formation that removes the risk of these activities from impacting Arizona cliffrose. Portions of the Desert Communities PNVT are separated from each other by State and private land. Consequently, there is a moderate likelihood that Arizona cliffrose would be limited by conditions in its habitat on non-NFS lands, even though a large portion of the Cottonwood population is protected by the Verde Valley Botanical Area.Private land development has decreased the percentage of the Verde Formation soil limestone soil type that is in it's natural condition. This has reduced the overall abundance of habitat for Arizona cliffrose outside the forest boundary. Dead Horse State Park limits disturbance to this soil type from recreation by limiting hiking and bicycling to trails to support the viability of this plant.
Bald eagle	Further ensuring that bald eagles are protected, the forest also refers to and applies guidance within the conservation assessment and strategy (CAS) developed for bald eagles in Arizona (Driscoll et al. 2006). The Southwestern Region signed the memorandum of understanding (MOU), along with other partners, agreeing to conserve the bald eagle and implement the CAS. This results in additional assurance that bald eagles will be protected at the project level and that the potential for take is minimized in a consistent way across all national

Species	Cumulative Effects
	forests in the Southwest. Because wintering bald eagles are migratory and juvenile and adult bald eagles are known to wander outside of the breeding season, off-forest activities that impact bald eagles on migration routes or on summer breeding grounds can adversely impact eagles and result in take. Several of the bald eagle breeding areas on the Verde River are shared with the Prescott NF; therefore, guidance identified in the Prescott NF's forest plan can impact eagles in that area. AZGFD stocks nonnative fish in the Verde River and other locations. Bald eagles prefer native fish species, so this can have negative impacts on foraging eagles.
Bald eagle, golden eagle	FWS issued national guidelines to advise landowners, land managers, and others when and under what circumstances the Eagle Act may apply to their activities (USFWS 2007c). The goal is to minimize impacts to bald eagles through implementation of the recommendations in the plan. The forest refers to and applies the guidance in the plan at the site-specific level to minimize impacts and avoid take. The coordinated management increases the effectiveness of the Coconino NF efforts to maintain the species viability. FWS issues permits for take of eagles for native American tribes.
Bigelow's onion, Heath-leaf wild buckwheat, Rusby milkwort, Verde Valley sage, and Ripley's Wild Buckwheat	Private land development in the Verde Valley has decreased the percentage of the Verde formation-limestone soil type that is in its natural condition; this has reduced the overall abundance of habitat for these species outside the forest boundary. Dead Horse State Park limits disturbance to this soil type from recreation by limiting hiking and bicycling to trails, but it does not carry out other management activities to support the viability of these rare plants.
Bluehead sucker, Little Colorado River sucker, roundtail chub, Little Colorado spinedace, coldwater: macroinvertabrates	The Apache-Sitgreaves NFs' recommended Leonard Canyon wilderness (as proposed in one alternative for their proposed revised plan) would help protect some aquatic species habitat on or near the Coconino NF in that canyon, but the overall impact to the species would be small and of a localized nature. The addition of this wilderness would not relieve the species from negative nonnative fish and invertebrate impacts.
Chiricahua leopard frog (CLF)	Because other extant populations of CLF occur on the Apache-Sitgreaves National Forests (ASNFs) and Tonto National Forest (TNF), management activities and recovery actions on those forests can also have impacts. The ASNFs has reduced road densities within some CLF habitat, and maintained or increased livestock exclusion from sites, reducing potential negative impacts to the CLF (USDA Forest Service 2011k). TNF has worked to improve and restore CLF habitat in Gentry Creek and Crouch Creek and frogs have been released into these sites (USDA Forest Service 2011k). Cumulatively, these actions on the ASNFs and TNF have contributed positively to CLF and their habitat, but implementation of some of the standards and guidelines in their forests plans could negatively impact CLF, and the overall finding for CLF and proposed critical habitat is "may affect, likely to adversely affect." The ASNFs is currently in the forest plan revision process, but the TNF is not. The guidance in these plans will have effects that are cumulative to the Coconino NF's forest plan, but what the guidance will be is unknown at this time.
Clark's grebe	Drought can reduce the amount of water and shorten the height or reduce the density of vegetation needed for nesting; degrade the water quality and quantity for its prey; or in severe cases, such as what occurred in the early 2000s, dry suitable habitat altogether. Large herds of elk, 500 or more, frequently use Mormon Lake during the summer for feeding, watering, and resting. This could reduce vegetation height and density of nesting habitat when it overlaps with the breeding season. AZGFD controls elk population numbers through the administration of hunting permits.

Species	Cumulative Effects
Colorado pikeminnow	The Coconino, Prescott, and Tonto NFs manage 113.2 miles of the Verde River that is designated for occupation by the nonessential, experimental population of Colorado pikeminnow. The majority of these fish are being stocked in the Verde River at Beasley Flat and Childs river access points. These reintroductions are considered experimental, nonessential populations, and low survival with no successful reproduction has been documented as a result of these releases (USDI Fish and Wildlife Service 2002c).
Common black hawk	Alteration and elimination of riparian habitat through clearing, water diversion, damming, and lowering of the water table by underground pumping all negatively impact habitat for common black hawk. These activities would result in the portion of the habitat on the forest being of increased importance to maintaining the viability of the species.
Diamond Valley suncup, Sunset Crater beardtongue	Non-forest actions include a rapidly growing population of Doney Park, Timberline, and similar neighborhoods that are within the range of Sunset Crater beardtongue. Effects of this increasing human population include increases of human impacts to surrounding NFS lands and possibly a decrease in suitable habitat available on lands of other ownership through alteration of habitat by human activities such as development.
Fossil Creek bedstraw, Metcalfe's tick trefoil, Cochise sedge, Fossil springsnail, Yuma clapper rail, western yellow-billed cuckoo, northern Mexican garter snake, narrow-headed gartersnake, bats, common black hawk, Abert's towhee, lowland leopard frog, Arizona toad, reticulate Gila monster, spotted skipperling	The "Fossil Creek Wild and Scenic River Comprehensive River Management Plan" (CRMP) is being developed concurrent with the forest's proposed revised plan. The proposed action for the CRMP includes reduced traffic on major roads, closing user created roads, eliminating overnight camping along the most popular parts of the creek, and providing day-use facilities that would reduce sedimentation into the stream. Even if an alternative is selected, it is likely to include managing recreation to prevent resource damage in the river corridor. This would enhance the contributions of the proposed revised plan to the viability of associated species.
Golden eagle	FWS issued interim guidance for golden eagles that identified inventory and monitoring protocols, and other information and recommendations to support management and take permit issuance. This increases consistency across all Federal activities including highway construction, which is reasonably foreseeable given the environmental assessment for upgrading Interstate 17.
Gunnison's prairie dogs	In Arizona, Gunnison's prairie dogs are found in the grasslands, and to a lesser extent, shrublands north of the Mogollon Rim and south of the Colorado River. Their presence within this range is highly fragmented and widely scattered and is most likely an artifact of historic control efforts and current plague outbreaks. Most of predicted prairie dog habitat is on tribal, private and State land, where it has fewer protections than on Federal land. In fact, it is sometimes seen as a nuisance animal on ranches, and landowners can legally remove them from their property. Forest Service lands comprise 6.61 percent of predicted range and so can only support a small population compared to non-NFS lands (Underwood 2007). Shooting of prairie dogs is authorized under a hunting license from the Arizona Game and Fish Department (AZGFD). AZGFD has instituted seasonal shooting closures from April 1 to June 15 to protect pregnant and lactating prairie dogs and their young (Underwood 2007).

Species	Cumulative Effects
Mexican gray wolf	Reintroduction and management activities on the Apache-Sitgreaves and Gila NFs are the primary influences on Mexican gray wolf recovery in Arizona and New Mexico. Additionally, with elk and deer being the primary food sources for wolves, herd management conducted by AZGFD influences prey availability for wolves.
Mexican spotted owl	FWS is currently in the process of revising the recovery plan for the Mexican spotted owl (FWS 2011a). Guidance contained therein would be applied to projects on the all Federal lands.
Northern Mexican gartersnake	External factors such as decreasing precipitation and aquifer recharge from climate change, and decreased recharge from groundwater pumping in nearby communities could degrade habitat quality of the riparian types and ephemeral/intermittent drainages and negatively influence viability regardless of management effects.
Page springsnail	Page springsnail would continue to be considered critically imperiled on lands adjacent to the forest. Habitable springs adjacent to the Coconino NF contain nonnative fish, which have negative impacts on native fauna. Other factors that negatively affect Page springsnail and its habitat include: groundwater pumping and resulting reduced spring flow; water diversion; and activities at Page Springs and Bubbling Ponds Hatcheries, including use of chlorine to remove nonnative fish.
San Francisco groundsel	Because this is an isolated population that only occurs on the Coconino NF, there are no cumulative effects. .
Sonora sucker, bluehead sucker, Little Colorado River sucker, longfin dace, desert sucker, lowland and northern leopard frog	External factors that negatively affect native fish include groundwater pumping, and resulting stream dewatering and diversion. These influences make the forest's continued coordination with local governments, private landowners, and the State critical to maintaining the viability of aquatic species that are dependent on habitats supported by the water table.
Southwestern river otter	In 1981 and 1982, AZGFD introduced a Louisiana subspecies (*L.c.lataxina*) into Fossil Creek and the Verde River near the Fossil Creek and East Verde confluences. This introduced species is successfully reproducing and would cause genetic swamping of the native form. It is unlikely that any still exist and, thus, the native form is not viable. Otters of this subspecies now occur all along the Verde River; up Oak Creek as far as Red Rock State Park; and in Sycamore Canyon, Wet Beaver Creek, West Clear Creek, and Fossil Creek.
Western yellow-billed cuckoo	Threats are habitat loss, unmanaged grazing, pesticide application, and disturbance. Principal causes of riparian habitat losses are conversion to agricultural and other uses, dams and river-flow management, stream channelization and stabilization, and livestock grazing. Development, dams, fencing, major transportation corridors, and road construction and maintenance can fragment habitat which can alter seasonal movements, dispersal, gene flow, and predator-prey relationships.