



United States
Department of
Agriculture

Forest
Service

Southwestern
Region



Kaibab National Forest Proposed Land Management Plan

Coconino, Yavapai, and Mojave Counties, Arizona

DRAFT DRAFT DRAFT February 2011



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Summary

The Kaibab National Forest (NF) initiated its forest plan revision process by gathering information, talking with partners, and holding public meetings. The forest hosted public meetings in Williams, Tusayan, Flagstaff, Phoenix, Fredonia (all in Arizona), and in Kanab, Utah. There were also focused collaborative meetings on ecological sustainability, special areas, restoring fire-adapted ecosystems, wildlife, grasslands, springs/wetlands, aspen, and recreation. Consultation and collaboration with American Indian tribes has been ongoing.

This proposed Land Management Plan for the Kaibab National Forest was developed collaboratively and is the result of three years of iterative discussions and feedback. Comments received were used to modify and refine the proposed land management plan, as well as to identify issues and alternatives evaluated in the draft environmental impact statement (DEIS). This proposed plan is the preferred alternative. It can be found electronically on the Kaibab NF website at:

http://fs.usda.gov/goto/kaibab/draft_plan

Detailed assessments, evaluations, reports, and documents associated with the forest plan development can be viewed and downloaded from our Kaibab NF Land Management Plan Development website:

http://fs.usda.gov/goto/kaibab/plan_rev_docs

The final proposed action will be scoped with the DEIS in January 2012. The DEIS will evaluate the proposed action and alternatives in detail. Please submit your comments on this proposal to:

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Hand-delivered comments can be submitted to the Kaibab NF Supervisor's Office, 8:00 to 12:00; 12:30 to 4:30 Monday through Friday, excluding holidays. Electronic comments must be submitted in a format such as an email message, plain text (.txt), rich text format (.rtf), or Word (.doc or .docx) to:

comments-southwestern-kaibab@fs.fed.us

Comments received in response to this solicitation, including names and addresses of those who comment, will be considered part of the public record and will be available for public inspection.

TABLE OF CONTENTS

Summary	iii
Chapter 1: Introduction.....	1
Plan Area.....	1
Roles and Contributions of the Kaibab National Forest	2
Plan Purpose and Framework	4
Plan Consistency	4
Plan Content.....	4
Plan Components.....	5
Other Content	5
Plan Concepts	6
Plan Organization.....	7
Chapter 2: Forestwide Desired Conditions and Strategies.....	9
Forest Resources	9
Major Vegetation Community Types	9
Pinyon-Juniper Communities.....	10
Ponderosa Pine Forests	14
Mixed Conifer Forests.....	18
Aspen.....	23
Guidelines for Vegetation Management in All Forested Communities	26
Guidelines for Activities Following Large-scale Disturbances.....	27
Sagebrush Shrublands	28
Montane / Subalpine Grasslands	31
Colorado Plateau / Great Basin Grasslands.....	32
Semi-desert Grasslands	32
Desert Communities.....	33
Gambel Oak Shrublands.....	33
Wetland / Cienega	34
Cottonwood-Willow Riparian Forest.....	35
Soils and Watersheds.....	36
Natural Waters.....	38
Constructed Waters	40
Wildlife.....	41
Rare and Narrow Endemic Species	43
Nonnative Invasive Species.....	44
Air Quality.....	45
Caves, Karst, and Mines.....	47
Cliffs and Rocky Features	48
Cultural Resources	49
Traditional Cultural Properties.....	50
Forest Uses, Goods, and Services	52
Recreation and Scenery	52
Traditional and Cultural Uses.....	56
Livestock Grazing	57
Forestry and Forest Products	58
Wildland Fire Management.....	60
Transportation and Forest Access	62

Potable Water	64
Lands	65
Special Uses	65
Communication and Electronic Sites.....	66
Energy Transmission and Development	66
Mineral and Mining Activities.....	67
Chapter 3: Management Areas	71
Special Areas	71
Wilderness	71
Frank’s Lake Geologic-Botanic Area.....	74
Arizona Bugbane Botanical Area.....	75
Double A Wild and Free-Roaming Burro Territory	75
Kaibab Squirrel National Natural Landmark	76
Grand Canyon Game Preserve	76
Kaibab Plateau-North Rim Parkway	77
National Scenic, Historic, and Recreational Trails	78
Management Areas	79
Recommended Wilderness Areas.....	80
Wildland-urban Interface Areas	81
West-wide Energy Corridor	83
Developed Recreation Sites.....	83
Garland Prairie Management Area.....	84
Bill Williams Mountain Management Area	85
Red Butte Management Area	86
Buffalo Ranch Management Area.....	87
Chapter 4: Suitability.....	93
Timber Suitability	93
Grazing Suitability and Capability.....	95
Minerals and Energy Development Suitability.....	98
Recreation Suitability.....	100
Chapter 5: Monitoring and Evaluation.....	107
Introduction.....	107
Monitoring Matrix	108
L iterature C ited.....	121
G lossary.....	122
E ssential G overnment A cronym D ictionary (EGAD).....	134
L ist of P reparers.....	136
A ppendices	137
Appendix A. Proposed and Possible Actions.....	137
Appendix B. Relevant Laws, Regulation and Policy.....	140
Appendix C. Large Tree Retention Classes for Ponderosa Pine.....	159
Appendix D. Kaibab National Forest’s Climate Change Approach for Plan Revision	161
Appendix E: Kaibab National Forest Major Vegetation Community Types	170

List of Figures

Figure 1. Vicinity map of the Kaibab National Forest 1
Figure 2. Management areas on the North Kaibab Ranger District..... 89
Figure 3. Management areas on the Tusayan Ranger District 90
Figure 4. Management areas on the Williams Ranger District 91
Figure 5. Kaibab NF lands suitable and unsuitable for livestock grazing..... 97
Figure 6. Recreation opportunity settings for the Williams Ranger District..... 101
Figure 7. Scenic integrity objectives for the Williams Ranger District 102
Figure 8. Recreation opportunity settings for the Tusayan Ranger District..... 103
Figure 9. Scenic integrity objectives for the Tusayan Ranger District 104
Figure 10. Recreation opportunity settings for the North Kaibab Ranger District 105
Figure 11. Scenic integrity objectives for the North Kaibab Ranger District 106

List of Tables

Table 1. Timber suitability calculations for the Kaibab NF 93
Table 1. Timber suitability calculation for the Kaibab NF..... 94
Table 2. Grazing capability calculations for the Kaibab NF..... 95
Table 3. Areas unsuitable for grazing on the Kaibab NF 96
Table 4. Suitability for mineral and energy activities on the Kaibab National Forest 99
Table 5. Matrix for the Kaibab NF Monitoring Plan. 111

Chapter 1: Introduction

Plan Area

The Kaibab National Forest (NF) is one of six national forests in Arizona. It covers 1.6 million acres in north-central Arizona, and is located in Coconino, Yavapai, and Mohave counties. The Kaibab NF is broken into three geographically separate ranger districts: the North Kaibab Ranger District lies to the north of Grand Canyon National Park, the Tusayan Ranger District is to the south of Grand Canyon National Park, and the Williams Ranger District is southernmost, separated from the Tusayan Ranger District by private and Arizona State lands (figure 1). The Kaibab NF shares boundaries with Grand Canyon National Park, the Prescott and Coconino NNFs, Bureau of Land Management (BLM)-Arizona Strip District, the Navajo and Havasupai Indian Reservations, the City of Williams, the town of Tusayan, and private lands.

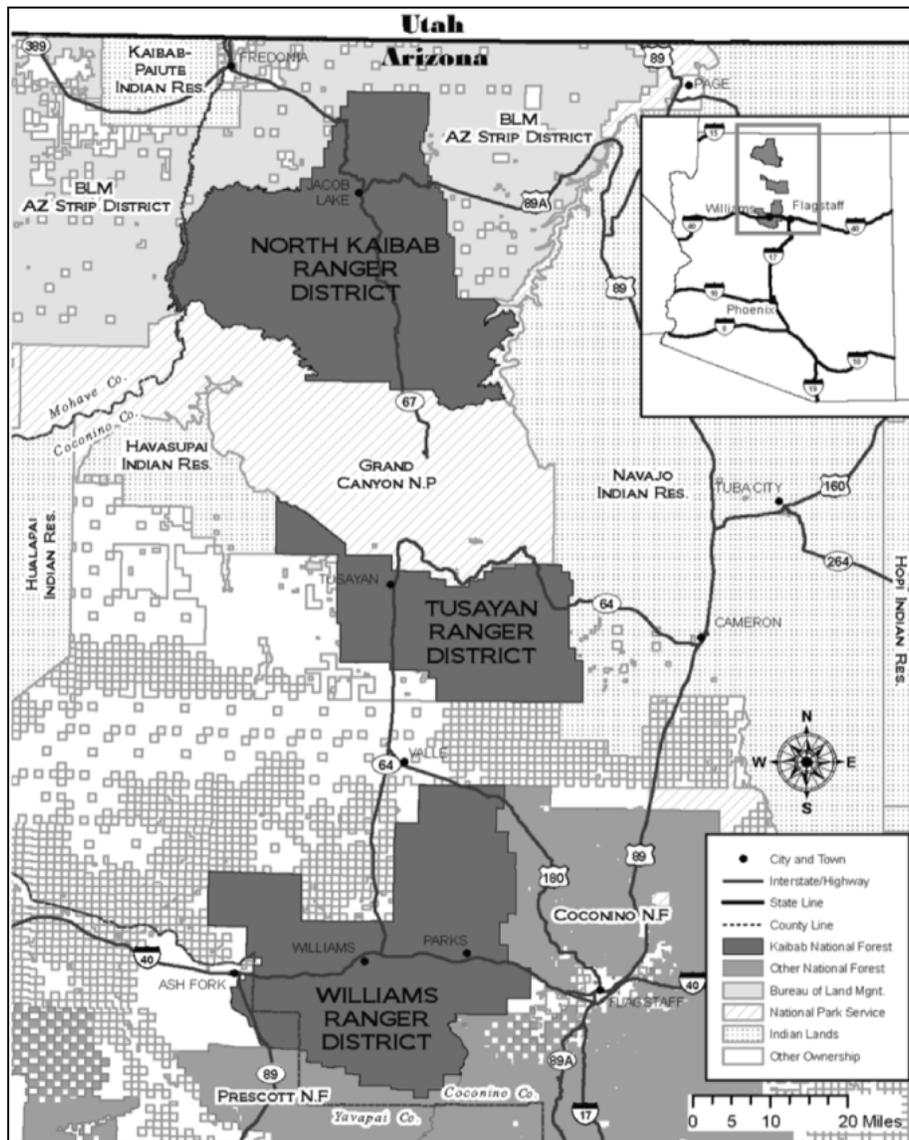


Figure 1. Vicinity map of the Kaibab National Forest

Roles and Contributions of the Kaibab National Forest

The distinctive history and characteristics of the Kaibab NF frame the roles and contributions it provides to the local area, State, region, and Nation. From the high-elevation lands of the Kaibab Plateau on the North Kaibab Ranger District to the rolling hills and open country of the Tusayan Ranger District to the scattered cinder cones and canyons on the Williams Ranger District, the forest includes wide variations in landscape, vegetation, and wildlife. As such, the Kaibab NF provides unique resources and recreation opportunities that attract a wide spectrum of forest users.

The diversity of wildlife found on the Kaibab NF provides enjoyment and aesthetic value for the photographer, bird watcher, nature lover, hiker, camper, and hunter. The forest is home to large mammals including mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), bighorn sheep (*Ovis canadensis*), pronghorn (*Antilocapra americana*), mountain lions (*Puma concolor*), black bear (*Ursus americanus*), and many other species.

The Kaibab NF has a diversity of vegetation types due to the range of elevation and soil types. Pinyon-juniper woodlands cover 40 percent of the forest, and are found at lower elevations. As elevation increases, pinyon-juniper transitions to ponderosa pine forest, which covers 35 percent of the forest. Other vegetation types include mixed conifer, grasslands, sagebrush shrublands, Gambel oak shrublands, and desert communities. Aspen, riparian, and wetland vegetation is present in small, yet important areas.

The Kaibab lies mostly within Coconino County, which is the second largest county in the United States. Of its 18,000 square miles, only 13percent is privately owned. Its population of 134,000 averages only about seven people per square mile. Due to the small percentage of private land in the area, the Kaibab NF has long played an important role in providing for a variety of resources, uses, and activities including ranching, logging, forest product collection, hunting, and cultural events.

American Indian tribes and people in nearby communities have long-time connections to the forest. It contains lands traditionally used by the Navajo, Hualapai, Paiute, Hopi, Havasupai, Yavapai, and Zuni people. The communities around the Kaibab NF were originally settled by Mormons, Spanish explorers, cattlemen, and loggers. This history continues to influence the culture today as western rural lifestyles and traditional uses are important to the local communities.

Recreationists engage in a variety of activities such as hiking, camping, sightseeing, and driving/riding for pleasure. Tourism has played an increased role over the last 20 years. The proximity of the forest to Grand Canyon National Park attracts visitors from across the Nation and throughout the world. Tourism-related activities contribute to local economic development and opportunities. Many area residents have jobs or businesses dependent on forest resources such as ranching, sandstone quarrying, wood harvesting, and outfitter-guiding.

Summary of the Analysis of the Management Situation

The management situation was analyzed in the 2009 Comprehensive Evaluation Report (CER; KNF 2009) and Supplement to the CER (KNF 2010). The CER evaluated the need for change in light of how management under the current Plan (as amended) was affecting the conditions and trends related to sustainability. The CER integrated key findings from the Ecological and the Socio-Economic Sustainability Reports. This integration displayed the key management needs for change, potential activities, and socioeconomic ecological interactions. These were used to identify where the conditions and trends indicated a potential need for change the Plan. The

supplement to the CER contains additional analysis and information about projections of demand, benchmarks, and species considerations. Together, these documents meet the content requirements of the Analysis of the Management Situation (AMS). These documents are available upon request and can be found on the Kaibab NF website at:

http://fs.usda.gov/goto/kaibab/plan_revision

The CER/AMS and subsequent management reviews considered this information along with the Forest Service mission, forest role and contributions, and anticipated demands. They identified four areas where there were priority needs for change in program direction. These are to:

- Modify forest structure and species composition to restore or maintain sustainability and restore historic fire regimes.
- Regenerate aspen to insure long-term healthy aspen populations.
- Restore natural waters and wetlands to insure healthy riparian communities.
- Restore grasslands by reducing tree encroachment and restoring fire.

The most apparent need for change is to reduce the risk of uncharacteristic fires and restore the structure, species composition, and function of forested ecosystems. This emerged as the highest need for change in the ecological sustainability report and as a very high need in the socio-economic sustainability analysis. The concordant socioeconomic and ecological benefits of restoring the reference conditions for forest structure include improving scenic integrity, providing for commercial and personal-use wood products, protecting cultural resources, protecting against undesired fire effects, improving public and firefighter safety, increasing understory diversity, and improving soil condition.

Restoring aspen also emerged as a high priority. Aspen is an important species because of its contribution to local ecological diversity and its high social and economic value associated with scenery and tourism. Aspen has declined in areas across the West due to the combined effects of elk browsing, insects, disease, severe weather events, and lack of fire disturbance. Aspen decline has been of particular concern on the Williams Ranger District.

Protecting springs and wetlands came forward as an important need for change. Natural waters in arid landscapes are centers of high biological diversity. About half of the natural springs on the KNF are currently departed from reference conditions. Protection of these rare resources can be accomplished by controlling invasive species, maintaining or removing constructed modifications, fencing out large ungulates, and reducing tree densities in adjacent potential natural vegetation types (PNVTs). There are high social and economic values associated with natural water bodies and ecological diversity, such as bird watching and traditional cultural uses.

Grasslands are much less abundant than they were historically, which reduces the amount of available habitat for grassland-associated species. The subalpine/montane grasslands on the North Kaibab Ranger District are linear and as a result are at a higher risk of loss because trees encroach from the edges and the openings close more quickly. There is a need to develop desired conditions and set objectives for grassland ecosystems on the Kaibab NF, which are lacking in the original Forest Plan.

New information and changing conditions will call for changes in management. As needs are identified, iterative and adaptive planning will facilitate the incorporation of new information. This Plan will be amended as needed over time. Under the National Forest Management Act (NFMA) of 1976, projects and activities must be consistent with the Plan. This proposed Plan focuses on the identified needs for change state above.

Plan Purpose and Framework

The land management plan guides the Kaibab NF in fulfilling its stewardship responsibilities to best meet the needs of the American people for the present and into the future. The Plan provides a framework to promote ecological integrity and guide management on the Kaibab National Forest so that it is ecologically sustainable and contributes to social and economic sustainability. This Plan is intended to provide guidance and information for project and activity decision making on the forest over the “plan period” which is generally considered to be 10 to 15 years. **It is strategic in nature and does not specifically authorize or prescribe any specific projects or activities.**

Project-level planning is the mechanism for plan implementation. Project planning translates the desired conditions and objectives in the plan into proposals that identify specific actions, design features, and project-level monitoring. Proposal development for projects addresses site-specific needs developed locally, with input from experts and stakeholders, and the most current and relevant information. Project decisions are made following public involvement and analysis.

Plan Consistency

As required by NFMA and the National Forest System Land Management Planning Rule, all projects and activities authorized by the Forest Service must be consistent with the plan. “Projects and activities” cover all actions under 16 U.S.C. 1604(i). A project or activity must be consistent with the plan by being consistent with applicable plan decisions. Plan decisions are discussed in detail below.

When a proposed project or activity is not consistent with a plan component, the responsible official has the following options:

- To modify the proposal so that the project or activity will be consistent,
- To reject the proposal, or
- To amend the plan contemporaneously with the approval of the project or activity so that the project or activity is consistent with the plan as amended. The amendment may be limited to apply only to the project or activity.

The Kaibab National Forest Land Management Plan (hereinafter referred to as Plan) covers the National Forest System (NFS) lands within the Kaibab NF boundary, with the exception of the Sycamore Canyon Wilderness, which is covered by the Coconino NF Land Management Plan. This Plan provides guidance for all of the Kendrick Mountain Wilderness, including the portion within the boundaries of the Coconino NF.

Plan Content

This Plan includes “plan components” and “other content.” Plan components are displayed in text boxes to distinguish them from other sections of the Plan. Once approved, any substantive changes to plan components would require a plan amendment with appropriate analysis as required under the National Environmental Policy Act (NEPA). A change to “other content” may be made using an administrative correction process. Administrative corrections are used to make changes such as updates to data and maps, management approaches, and relevant background information, and to fix typographical errors. The public is notified of all administrative corrections of the Plan.

Plan Components

Plan components (decisions) include: goals/desired conditions, objectives, standards, guidelines, suitability of uses, special areas, and monitoring. They were developed collaboratively with input from a variety of external and internal stakeholders with broad interdisciplinary representation. An interdisciplinary team refined the final form and organization of the Plan to make it as understandable, useable, and integrated as possible.

Goals (Desired Conditions) describe the aspirational picture for the Kaibab NF. Goals, as required by the 1982 rule provisions, are articulated as “desired conditions” in this Plan. They are the ecological and socioeconomic attributes toward which management of the land and resources of the plan area are directed. They are not commitments or final decisions approving projects or activities, rather they guide the development of projects and activities. They have been written to contain enough specificity to allow for determining progress toward their achievement. Projects are designed to maintain or move toward desired conditions to be consistent with the Plan over the long term. In some cases, goals/desired conditions may only be achievable over hundreds of years.

Objectives describe how the Kaibab NF intends to move toward the desired conditions. Objectives are concise projections of measurable, time-specific intended outcomes. Objectives have been established for the work considered most important to address the needs for change and achieve desired conditions. They also provide metrics for evaluating accomplishments.

Guidelines are technical design criteria or constraints on project and activity decisionmaking that help to make progress toward desired conditions. A guideline allows for departure from its terms, so long as the intent of the guideline is met. Deviation from a guideline must be specified in the decision document with the supporting rationale. When deviation from a guideline does not meet the original intent, a plan amendment is required.

Standards are technical design constraints that must be followed when an action is being taken to make progress toward desired conditions. Standards differ from guidelines in that standards do not allow for any deviation without a plan amendment.

Special Areas are lands within the NFS that have designations by Congress or other delegated authority. “Special areas” are designated because of their unique or special characteristics. Examples include wilderness, research natural areas, botanical areas, and national recreation trails.

Suitability of areas. NFS lands are identified as “suitable” for various uses. An area may be identified as suitable or not suitable for certain uses, depending on its compatibility with desired conditions and objectives for the area. This Plan addresses suitability for timber, grazing, recreation, minerals, and energy resource activities.

Monitoring is the part of the adaptive management strategy used to determine the degree to which on-the-ground management is maintaining or making progress toward desired conditions. The monitoring plan includes questions and performance measures designed to evaluate implementation and effectiveness, and inform adaptive management.

Other Content

The “other content” in this Plan includes background information, existing conditions, management approaches, and contextual information. Management approaches are not plan decisions, but they help clarify how plan direction may be applied. Management approaches include information and guidance for projects and activity decision making to help achieve

desired conditions and objectives. Management approaches describe priorities, considerations, and strategies for achieving desired conditions and articulate the strategies needed to effectively make progress toward desired conditions within the context of the operating environment of the Plan.

Plan Concepts

Adaptive management is a system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes are met or re-evaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain. (36 CFR 220.3), particularly for dynamic issues such as climate change, invasive species, and disturbances that are not easily predicted.

Sustainability is meeting the needs of the present generation without compromising the ability of future generations to meet their needs. Sustainability is composed of desirable social, economic, and ecological conditions or trends interacting at varying spatial and temporal scales, embodying the principles of multiple-use and sustained-yield (FSM 2020.5).

Integration recognizes and identifies key relationships between various plan resources and activities. Plan components are integrated to address a variety of ecological and human needs. For example, desired conditions for ponderosa pine incorporate habitat needs for a variety of species, as well as the scenic components recreationists desire. Interrelationships between parts of the plan are identified with crosswalks to show their systematic nature. In electronic versions of the Plan, these crosswalks are hyperlinked (indicated by blue italicized text) to allow users to be easily redirected to the other relevant sections of the Plan.

Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedback (FSM 2020.5).

Potential natural vegetation is the vegetation that would occur in the presence of natural disturbance processes such as frequent fire return intervals.

Natural variability references past conditions and processes that provide important context and guidance relevant to the environments and habitats in which native species evolved. Disturbance-driven spatial and temporal variability is vital to ecological systems. Biologically appropriate disturbances provide for heterogeneous conditions and subsequent diversity, whereas “uncharacteristic disturbance” such as high-intensity fire can have the effect of reducing diversity, increasing homogeneity, and resulting in states that may be permanently altered.

Climate change is addressed indirectly throughout this Plan with desired conditions in the form of functional ecosystems and resilient landscapes. Climate change is addressed directly in management approaches and the monitoring plan where appropriate. Appendix D provides a more detailed explanation of the strategy the Kaibab NF is using to address climate change.

All lands is the concept that ecosystems transcend land ownership boundaries, thus, effective land and resource management requires cooperation and collaboration among the Forest Service, other land-managing agencies, tribes, and private landowners. This Plan was developed using an approach whereby plan components were developed considering the greater landscape and the forest’s ecological, social, and economic role.

Plan Organization

Chapter 1 – Introduction briefly describes the planning area, the analysis of the management situation, purpose of this Plan, plan components, and how they are organized within the Plan.

Chapter 2 – Forestwide Desired Conditions and Strategies are presented first in this Plan. This chapter includes Desired Conditions (Goals), Objectives, Standards, and Guidelines and is split into two sections: Resources and Uses, Goods, and Services (activities). Standards and guidelines are typically located in the relevant activity section of the Plan. Where the standards or guidelines pertain to multiple activities, they may be located in the applicable resource section.

Chapter 3 – Management Areas contains the plan components applicable to specific areas that call for site-specific management. The management areas chapter is divided into two sections: Special areas and Management Areas (MAs). Special areas have specific designations such as wilderness or botanic areas. MAs include wildland-urban interface, utility corridors, developed recreation sites, and other specific places that call for special management such as Red Butte and Bill Williams Mountain.

Chapter 4 – Suitability is the appropriateness of applying certain resource management practices to a particular area of land in consideration of the relevant social, economic, and ecological factors. Suitability is determined based on compatibility with desired conditions and objectives in the plan area. Suitability is determined for timber, grazing, recreation, minerals, and energy resource activities. Descriptions of the criteria used in making the determinations are provided along with the results. The identification of an area as suitable for a particular use or uses is guidance for project and activity decision making, and is not a commitment or a final decision approving projects and activities and it does not mean that a particular use will or will not occur in the area.

Chapter 5 – Monitoring and evaluation of plan implementation is used to determine progress toward achieving desired conditions and objectives, and to determine how well management requirements, such as standards and guidelines, are being applied. The monitoring strategy provides a framework for subsequent monitoring and evaluation designed to inform future management.

Chapter 2: Forestwide Desired Conditions and Strategies

This chapter lays out the desired conditions and the strategies the Kaibab NF intends to use to achieve them. Desired conditions define what the forest should look like and what goods and services it should provide. Strategies consist of objectives, standards, and guidelines; they define when, where, and how to achieve the desired conditions. They define the actions needed to move toward desired conditions and the sideboards needed to constrain those actions in the form of objectives, standards, and guidelines.

Throughout this chapter, Plan Components (Plan Decisions) are displayed within text boxes. Text outside of boxes are not plan decisions, it is background material, explanations, or descriptions of Management Approaches.

Desired conditions and strategies (objectives, standards, and guidelines) related to the major vegetation types are presented first in this Plan because they provide the setting or habitat where the other resources occur and activities take place. These desired conditions are integrated and are intended to reflect not only healthy ecological systems, but also the social and economic considerations needed for long-term sustainability.

Forest Resources

Major Vegetation Community Types

The Kaibab NF contains 15 major vegetation communities. These communities are presented in the order of those occupying the greatest acreage on the forest to the least. The identified boundaries for the vegetation communities are based on the potential natural vegetation type that would occur in the presence of natural disturbance processes such as fire.

Desired conditions are described at multiple scales where appropriate. Descriptions at various scales are sometimes necessary to provide adequate detail and guidance for the design of future projects and activities that will help achieve the desired conditions over time. The three scales used in this plan are: fine scale, mid-scale, and landscape scale.

Fine scale is a 10-acre area or less at which the distribution of individual trees (single, grouped, or aggregates of groups) is described. Fine-scale desired conditions provide the “view” that could be observed standing in one location on the ground. Fine-scale desired conditions contain desirable variation appropriate at smaller spatial scales.

Mid-scale desired conditions are composed of assemblages of fine-scale units and include descriptions that are desirable when averaged across areas of 100- to 1,000-acre units.

Landscape scale is an assemblage of 10 or more mid-scale units, typically totaling more than 10,000 acres, composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes. Landscape-scale desired conditions provide the “big picture” overview with resolution that could be observed from an airplane, or less common components that are desired within the greater landscape.

Range of Values

Ranges of values presented in desired conditions account for natural or desired variation in the composition and structure within a community or resource area. Desired conditions may have a wide range due to spatial variability in soils, elevation, aspect, or social values. It may also be desirable to have different desired conditions within a particular vegetation community, such as a lower density of vegetation in the wildland-urban interface (WUI) than outside of the WUI to achieve the desired fire behavior within the proximity of property and human occupancy. Higher densities may be desired in other areas to meet habitat requirements for specific species.

Vegetation Structure

Vegetation structure includes both the vertical and horizontal dimensions. Horizontal structure may refer to patterns of trees or groups of trees and openings, as well as tree size and tree density. The vertical component can refer to the layers, appearance, and composition of vegetation between the forest floor and the top of the canopy. Several descriptive terms related to vegetation structure are used in desired condition statements and are defined in the glossary.

Pinyon-Juniper Communities

The pinyon-juniper vegetation communities are collectively composed of the juniper grassland, pinyon-juniper grassland, pinyon-juniper sagebrush, and pinyon-juniper persistent woodland communities. Pinyon-juniper communities generally occur at elevations between 5,300 and 7,400 feet. They occur on all three districts and cover about 638,000 acres on the Kaibab NF. Pinyon-juniper communities are the setting for a variety of uses and activities including wood cutting, livestock grazing, camping, hunting, and pinyon nut gathering.

Under their natural disturbance regime, these plant communities are dominated by one or more species of pinyon pine and/or juniper with at least 10 percent tree canopy. They can occur with a grass/forb-dominated understory (pinyon-juniper grasslands and juniper grassland forest communities), a shrub-dominated understory (pinyon-juniper sagebrush forest community), or a sparse discontinuous understory of some grasses and/or shrubs (pinyon-juniper persistent woodland forest community). Two-needle pinyon pine is common; as well as one-seed, Utah, Rocky Mountain, and alligator juniper. Species composition varies by location.

Most of the pinyon-juniper vegetation communities are currently younger and denser than they were historically, because of changes in wildfire occurrence. Greater tree density has increased competition for water and nutrients. This, in turn, has caused a reduction in understory plant cover and diversity, a loss of ground cover, and subsequent increases in soil erosion.

Pinyon-juniper communities provide important winter and spring range for wildlife. Mature pinyon-juniper stands are particularly important for bird species of conservation concern, many of which rely on the habitat features provided only by mature stands. Such features include large-diameter trunks for nest cavities and greater berry and seed production.

On the North Kaibab Ranger District, pinyon-juniper habitat provides primary and critical winter range and transitional habitat during migration for mule deer. Similarly, pinyon-juniper habitat on the Williams and Tusayan Ranger Districts provides winter and transitional range for elk and other game species.

Desired Conditions Common to All Pinyon Juniper Communities

- Pinyon-juniper communities occur as a shifting mosaic across the landscape interspersed with openings. The configuration of vegetation and openings provides enough sighting distance and hiding cover for pronghorn to escape predators.
- Old growth occurs throughout the landscape, generally in small areas as individual components, or as clumps. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- Canopy cover is at least 10% with a mix of young and mature clumps. The mature clumps are structurally diverse, containing large live trees, as well as trees with dead or broken tops, gnarls, and burls. Snags, green snags and downed trees > 10” at root collar are present and average 1-2 per acre. Some clumps have 30% to 40% canopy cover that provides habitat for nesting, bedding, and foraging.
- 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.
- Plant litter (leaves, needles, etc.) and understory plant cover contributes to soil stabilization, prevents erosion, promotes nutrient cycling, improves water retention, and provides the microclimate conditions necessary for pinyon seed germination.
- Nurse trees¹ provide understory microclimate with improved nutrient and soil properties, higher soil moisture, lower temperatures, and lower light levels, which increases the survival of pinyon seedlings under harsh conditions.
- There are opportunities for collecting forest products (firewood, pinyon nuts, posts and poles etc.) consistent with other desired conditions.
- A robust crop of pinyon pine nuts is regularly produced.

Pinyon-Juniper Grasslands

The pinyon-juniper grassland vegetation type is composed of the pinyon-juniper grassland and juniper grassland vegetation communities. These areas historically had at least 10 percent tree canopy cover, except in some post-fire communities, with an understory dominated by grassland species, often on deep soils with gentle topography. Areas that historically had less than 10 percent canopy cover are classified as grasslands. This distinction is necessary for differentiating between vegetation types and their respective desired conditions, but it is recognized that transition between pinyon-juniper grasslands and grassland savanna actually occurs along a gradient.

¹ Nurse trees are larger, faster-growing trees that provide the microclimatic conditions (e.g., shade, moisture, shelter from wind, or protection from foraging animals) necessary for the germination and growth of smaller slower growing trees or plants.

Desired Conditions for Pinyon-Juniper Grasslands

- Pinyon-juniper grasslands are generally uneven-aged and open in appearance. Trees occur as individuals, but occasionally are in small groups and range from young to old. Scattered shrubs and a dense herbaceous understory including native grasses, forbs and annuals are present to maintain soil productivity, resist soil erosion, and can support frequent low-intensity surface fires.
- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances (including insects, diseases, and fire) and climate variability.
- Understory height provides cover for pronghorn fawning, small mammal foraging, and songbird nesting, typically averaging 15 inches in height, when seasonal climatic conditions allow.
- Understory composition is within the natural range of variability and contains diverse native herbaceous plant species that provide nutrition for pronghorn and other species. Depending on soil type, ground cover typically averages 50 percent live vegetation and 50 percent nonliving vegetation, with vegetation composition averaging 40 to 60 percent grass, 10 to 30 percent forbs and 5 to 20 percent shrub.
- Fires are typically low-severity with a 0- to 35-year return interval (Fire Regime I).

Pinyon-Juniper Sagebrush Communities (Pinyon-Juniper Shrub)

In the pinyon-juniper sagebrush vegetation community, sage is the dominant shrub in most areas. However, in some areas, other shrub species may be dominant and sagebrush may not even be present. These lands may better be described as pinyon-juniper shrublands, but for consistency with the potential natural vegetation types (PNVTs) identified for the Southwestern Region, they are referred to as pinyon-juniper sagebrush communities.

Pinyon-juniper sagebrush communities are concentrated in areas dominated by cold season precipitation regimes. They are usually found on sites with coarse-textured, gravelly, or lithic soil characteristics. Pinyon is occasionally absent, but one or more juniper species are always present. These systems have open woodland canopies interspersed with Colorado Plateau and Great Basin shrub species such as big sagebrush (*Artemisia tridentata* Nutt.), rubber rabbitbrush (*Ericameria nauseosa* (Pall. Ex (Pursh)), fourwing saltbush (*Atriplex canescens* (Pursh) Nutt.), and winterfat (*Krascheninnikovia lanata* (Pursh).

Typical disturbances include fire, insects, and disease. Contemporary disturbances include mechanical removal of overstory trees. Fire absence since Euro-American settlement has not resulted in dramatic increases in tree densities as with other woodland types, presumably since fire occurrence may not have been significantly altered in this community type following Euro-American Settlement.

Desired Conditions in Pinyon-Juniper Sagebrush Communities

- The pinyon-juniper sagebrush shrub forest type is a mix of trees and shrubs that occur as shifting vegetation states (herbaceous-dominated, shrub-dominated, and tree-dominated) in even-aged and uneven-aged patches with a variable understory. There is a mix of large and small to mid-size juniper.
- The shrub component consists primarily of sagebrush, but, oak, cliffrose, and other

shrub species may also be present.

- The understory is dominated by shrubs depending on structural stage. The shrub component consists of one or more shrub species, which are well-distributed. Shrubs typically are in a closed-canopy state during the later successional stages.
- The composition, structure, and function of vegetation conditions are resilient to the frequency, extent, and severity of disturbances including insects, diseases, fire, and climate variability.
- Fires are mixed to high severity and have fire return interval of 35 to more than 200 years (Fire Regimes III and IV).

Pinyon-Juniper (Persistent) Woodlands

Persistent woodlands are scattered and not associated with a particular soil type, but occur where soils are thin and rocky. Historically, they were found on rugged upland sites that were not capable of developing an understory that could carry fire.

Desired Conditions for Pinyon-Juniper Woodlands

- Pinyon-Juniper Woodland (persistent) is characterized by even-aged patches of pinyons and junipers that at the landscape level form multi-aged woodlands. Tree density and canopy cover are high, shrubs are sparse to moderate, and herbaceous cover is low and discontinuous due to soil and other site conditions.
- Very old trees (>300 years old) are present. Disturbances rarely affect the composition, structure, and function. Insects, disease and mistletoe occur at endemic levels. Fire disturbance is infrequent and variable due to lack of continuous ground cover.

Guidelines for Management Activities in Pinyon-Juniper Communities

- The Pinyon-Juniper vegetation type (pinyon-juniper grassland, shrubland, or woodland) should be determined before developing project proposals to ensure the applicable desired conditions are applied.
- Restoration efforts should emphasize the retention of mature stands where they occurred historically, with a mix of mature trees, snags, and partially dead, or dying trees.
- Pinyon-juniper communities should maintain tree densities that maximize herbaceous plant growth and wildlife species diversity typical for their respective community subtype.
- Where pinyon-juniper obligate species occur (e.g., gray vireo), project designs should use methods (e.g., selective pruning, lop and drop, etc.) that allow for retaining large key habitat features such as 35 percent canopy closure, large live trees, snags, green snags, and downed trees.
- Project design for vegetation management activities should prioritize treatment areas along known wildlife corridors, in the wildland-urban interface, and in historic openings.
- Restoration treatments in pinyon-juniper should be rotated over time and various successional stages to maximize wildlife habitat and diversity.

Management Approach for Pinyon Juniper Communities (with exception of persistent Pinyon-Juniper Woodlands)

Although management is needed to achieve and maintain desired conditions in pinyon-juniper communities, it was not identified as a priority need for change in the CER/AMS. Due to limited capacity, the Kaibab NF is not currently setting restoration objectives for this vegetation type. To achieve and maintain desired conditions, the forest may thin or burn to reduce juniper densities to increase growth and vigor of understory species, reduce fuel loads, improve wildlife habitat, reduce vulnerability to pinyon *Ips* beetles, and increase herbaceous vegetation composition and cover. Strategies to accomplish work include:

- Working collaboratively with tribes, Arizona Game and Fish and other partners to plan and implement projects that will make progress toward desired conditions.
- When possible, allow natural ignitions to be managed for resource benefits and achieve desired conditions.

[See also the forestwide direction for [soils and watersheds](#), [nonnative and invasive species](#), [wildlife](#), [forestry and forest products](#), and [wildland fire management](#)]

Ponderosa Pine Forests

The ponderosa pine forest vegetation community includes two sub-types: Ponderosa pine-bunchgrass and ponderosa pine-Gambel oak. The ponderosa pine forest vegetation community generally occurs at elevations ranging from 6,200 to 8,200 feet. It occurs on all three ranger districts and covers about 541,000 acres in the Kaibab NF. It is dominated by ponderosa pine and commonly includes other species such as oak, juniper, and pinyon. Species such as aspen, Douglas-fir, white fir, and blue spruce may also be present, but occur infrequently as individual trees. This forest vegetation community typically occurs with an understory of grasses and forbs although it sometimes includes shrubs.

Ponderosa pine forests are used by a variety of wildlife including numerous birds, small mammals, elk, mule deer, and are particularly important for tassel-eared squirrels. Gambel oak, a component of the ponderosa pine cover type, is particularly important to many wildlife species, including Mexican spotted owls. Higher species richness has been correlated with higher densities of Gambel oak, a habitat that provides critical nesting and foraging resources for many northern Arizona birds.

The open park-like stands characteristic of the reference conditions for ponderosa pine forests promoted greater faunal diversity and fire resilience than the dense stands of today. The ponderosa pine forests are popular places to escape the heat in the summer and are the setting for many recreation activities including camping, hunting, hiking, sightseeing, and wildlife watching.

Ponderosa pine forests on the Kaibab NF are generally denser and more continuous across all developmental states than in reference conditions and accumulations of forest litter and woody debris are much higher than would have occurred under the historic disturbance regime. Lack of fire disturbance has led to increased tree density and fuel loads that increase the risk of uncharacteristically intense wildfire and drought-related mortality. When fires occur under current conditions, they tend to kill a lot of trees, including the large and old trees. These trees take longer to replace, moving the forest further from desired conditions, and increasing the time it would take to return to desired conditions. There is a moderate risk of insect and/or disease outbreak, which is also a function of increased tree density.

Fine-scale (10 acres or less) Desired Conditions for Ponderosa Pine

- Trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Tree groups are made up of clumps of various age classes and sizes classes which occur in areas typically less than 1 acre.
- Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking and consist of approximately 2 to 40 trees.
- Openings surrounding clumps and groups are variably shaped and comprised of a grass/forb/shrub mix. Some openings contain individual trees.
- Where historically occurring, there are oak thickets with various diameter stems, and low-growing, shrubby oak. These thickets provide forage, cover, and habitat for species that depend on them such as small mammals, foliage-nesting birds, deer and elk. Large oaks snags and partial snags with hollow boles or limbs are present.
- Gambel oak mast (acorns) provides food for wildlife species.
- Isolated infestations of dwarf mistletoe may occur, but the degree of severity and amount of mortality varies among the infected trees. Witch's brooms may form on infected trees, providing habitat for wildlife species
- Fires generally burn as surface fires, but single-tree torching and isolated group torching is not uncommon.

Mid-scale (100 to 1,000 acres) Desired Conditions for Ponderosa Pine

- The ponderosa pine forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages present.
- Stands are dominated by ponderosa pine, but other native species occur.
- The more biologically productive sites contain more trees per group and more groups per area. Basal area within forested areas generally ranges from 20 to 80 square feet per acre. Openings with grass/forb/shrub vegetation are variably shaped and typically range from 10 percent to 70 percent, with the more open conditions typically occurring on less productive sites.
- Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in the general forest (e.g., goshawk post-fledging family areas, Mexican spotted owl protected areas, drainages, and steep north-facing slopes).
- Patches of even-aged forest structure are present, but are infrequent. Disturbances sustain the overall variation in age and structural distribution.
- Snags 18 inches diameter at breast height (d.b.h.) or greater average 1 to 2 snags per acre. Snags and green snags of variable size and form are common.
- Downed logs (greater than 12 inches 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 greater than 3 inches in diameter (including downed logs), ranges from 3 to 10 tons per acre.
- Fires burn primarily on the forest floor and typically do not spread between tree groups as crown fire.

Landscape-scale (over 10,000 acres) Desired Conditions for Ponderosa Pine

- The ponderosa pine forest vegetation community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. The forest is generally uneven-aged and open. Groups of old trees are mixed with groups of younger trees. Occasional areas of even-aged structure are present. Denser tree conditions exist in some locations such as north-facing slopes, canyons, and drainage bottoms.
- The ponderosa pine forest is composed predominantly of vigorous trees, but declining trees are present. Snags, green snags, and coarse woody debris occur across the landscape.
- Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- The landscape is a functioning ecosystem that contains all components, processes, and conditions associated with endemic levels of disturbances (e.g., fire, dwarf mistletoe, insects, diseases, lightning, drought, and wind).
- Forest vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability.
- Organic ground cover and robust herbaceous vegetation provide protection for soil, and moisture infiltration, and contribute to plant and animal diversity and to ecosystem function.
- Grasses and needle cast provide the fine flashy fuels needed to maintain the natural fire regime. Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris loads, and nutrient cycling.
- The risk of uncharacteristic high-intensity fire and associated loss of key ecosystem components is low.
- Where it naturally occurs, Gambel oak is present with all age classes represented. It is reproducing and maintaining or expanding its presence on suitable sites across the landscape.
- Frequent, low-severity fires (Fire Regime I) occur across the entire landscape with a return interval of 0 to 35 years.

Objectives for Ponderosa Pine

To make progress toward the desired conditions and reduce the potential for active crown fire in ponderosa pine communities at a rate that would maintain the desired conditions over time:

- Mechanically thin 11,000 to 19,000 acres annually, using a combination of group-selection cuts with matrix thinning and all-size free thinning.
- Treat an average of 13,000 to 55,000 acres annually, using a combination of prescribed fire and naturally ignited wildfires.

Management Approach

Restoring ponderosa pine forests have been given emphasis in this plan because they are highly departed from desired conditions and were identified as a priority need for change. Projects in ponderosa pine are aimed at restoring forest structure as well as processes such as low-intensity fire, natural levels of disturbance, and nutrient cycling. Design features may increase diversity by promoting oak, aspen, openings, and understory production. While treatments strive to mimic the structure and patterns of reference conditions, they often also consider other desired conditions and objectives. As a result, reconstructed reference conditions are general guides, rather than rigid restoration prescriptions.

In ponderosa pine, reintroduction of fire as the primary disturbance agent is critical to restoration. However, fire management needs to maintain an appropriate balance between smoke emissions and public concerns (health, visibility, etc.). Dwarf mistletoe is a natural disturbance agent, but in some areas, levels of infection are unsustainable and exceed desired levels. Treatments for controlling mistletoe are typically aimed at maintaining infection levels that allow for development of a diversity of age-classes across the landscape, not to eliminate this naturally occurring disturbance agent.

Pine-oak habitat is managed as discussed under the Mexican Spotted Owl Recovery Plan (USFWS 1995). Many individual large oak trees as well as oak copses have become over-topped with pine trees. Treatments to promote oak regeneration and establishment are fairly effective, because oak sprouts prolifically after release treatments and may be cut or burned to stimulate new growth, maintain growth in large-diameter trees, or to stimulate mast production.

Illegal wood cutting is probably the biggest threat to oak, reducing both the amount and quality of oak habitat. Enforcement, education, and site-specific planning will be necessary to ensure quality oak habitat over the long term. Fuelwood collection opportunities are managed so that site-specific planning and permits may limit the amount and type of oak that can be collected in areas where live and dead woody oak habitat components are limited.

Incorporation of design features in thinning and planting prescriptions can be used to create “living snow fences” for shade, snow accumulation, wind protection and slow snowmelt and protect from sublimation caused by prevailing winds. This may help increase resiliency and help offset the effects of climate change.

Due to capacity and efficiency needs, mechanical thinning and burning treatments need to effectively make progress toward the desired conditions and retain characteristics of desired conditions for at least 20 years. Tools for creating desired stand conditions and openings include a variety of treatments and uneven-aged cutting methods such as single-tree and group selection, sanitation and salvage, limited even-aged regeneration cutting, thinning (see glossary), and managed fire.

Restoration activities would be prioritized in the areas identified by the Kaibab Forest Health Focus (KFHF) and then move to other areas of high risk and high value. The KFHF was a multi-stakeholder collaborative process that prioritized areas most in need of treatment. Primary indicators were related to high risk and high value such as those with closed canopies containing large trees. These areas were identified as high priority for restoration because they already contain many components of the desired condition, and a single treatment may come close to meeting the desired condition, but if lost, would take centuries to replace. The KFHF report can be accessed at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5120031.pdf.

On the Williams and Tusayan Ranger Districts, much of the needed restoration work is likely to be implemented through the Four Forest Restoration Initiative (4FRI). 4FRI is a large-scale

collaboratively driven project with the goal of restoring forest ecosystems on portions of four national forests: Coconino, Kaibab, Apache-Sitgreaves, and Tonto. This large-scale planning effort would help to attain desired conditions over a large portion of the Williams and Tusayan Ranger Districts. Coordination with the 4FRI planning effort has been ongoing to ensure consistency with this Plan.

[See also [guidelines for vegetation management in forested communities](#), [wildlife](#), [nonnative invasive species](#), [air quality](#), [forestry and forest products](#), and [wildland fire management](#) sections of this Plan.]

Mixed Conifer Forests

Mixed conifer forests occur on the North Kaibab and Williams Ranger Districts and cover approximately 147,000 acres on the Kaibab NF. The mixed conifer forests include three vegetation communities: Frequent fire mixed conifer, mesic mixed conifer, and spruce-fir. Frequent fire mixed conifer forests are the most common and are characterized by a frequent, low-intensity fire regime. Mesic mixed conifer and spruce-fir occur at moister, higher elevation sites, are interspersed with each other, and are less apparent at the landscape scale. Because of their interspersed nature and similar desired conditions, they are addressed together in this Plan.

Frequent Fire Mixed Conifer

The frequent fire mixed conifer forest vegetation community, often referred to as “dry mixed conifer” is a transitional vegetation type with increasing elevation between ponderosa pine and mesic mixed-conifer forest communities. It generally occurs at elevations ranging from 7,300 to 9,500 feet, but occurs at lower elevations in drainages, particularly on steep north-facing slopes. Ponderosa pine is the most common tree species in the frequent fire mixed conifer forest community, which distinguishes it from the mesic mixed conifer/spruce-fir community. Historically, shade-intolerant trees such as ponderosa pine, southwestern white pine, quaking aspen, and Gambel oak dominated frequent fire mixed conifer forests. Douglas-fir is often present, with lesser amounts of shade-tolerant species such as white fir and spruce. This forest community typically occurs with an understory of grasses, forbs, and shrubs.

Fine-scale (10 acres or less) Desired Conditions for Frequent Fire Mixed Conifer

- 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. Openings are composed of grasses, forbs, and shrubs. Some openings contain individual trees or snags. Trees within groups are of similar or variable ages, and often contain more than one species. Tree groups typically are less than 1 acre, and at the mid-aged to old stages consist of 2 to approximately 50 trees per group.
- Dwarf mistletoe infections may be present on ponderosa pine and Douglas-fir, and rarely on other tree species, but the degree of infection severity and amount of mortality varies among infected trees. Witches brooms may be present with these infestations, providing habitat for wildlife.
- Fires generally burn as surface fires, but single-tree torching and isolated group torching occasionally occurs.

Mid-scale (100 to 1,000 acres) Desired Conditions for Frequent Fire Mixed Conifer

- The frequent fire mixed conifer forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. Forest appearance is variable, but generally uneven-aged and open; occasional patches of even-aged structure are present.
- Forest conditions in some areas contain 10 to 20 percent higher basal area in mid-aged to old tree group than in the general forest; these include goshawk post-fledging family areas (PFAs), Mexican spotted owl protected habitat, and north-facing slopes.
- The more biologically productive sites contain more trees per group and more groups per area. Basal area within forested areas generally ranges from 30 to 100 feet per acre. Openings with grass, forb, and shrub vegetation typically range from 10 to 50 percent of the area.
- The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages. Occasionally small patches (generally less than 50 acres) of even-aged forest structure are present. Disturbances sustain the overall variation in age and structural distribution.
- Where they naturally occur, groups or patches of aspen and all structural stages of oak are present.
- Snags and green snags, 18 inches d.b.h. or greater average 3 per acre. Downed logs (greater than 12 inches diameter at mid-point and greater than 8 feet long) average 3 per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre.
- Fires burn primarily on the forest floor and typically do not spread between tree groups as crown fire.

Landscape-scale (10,000 acres or more) Desired Conditions for Frequent Fire Mixed Conifer

- At the landscape scale, the frequent fire mixed conifer forest community is a mosaic of forest conditions composed of structural stages ranging from young to old trees.
- Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- Forest appearance is variable but generally uneven-aged and open; occasional patches of even-aged structure are present. The forest arrangement is in small clumps and groups of trees interspersed within variably sized openings of native grass/forb/shrub vegetation associations similar to reference conditions. Size, shape, number of trees per group, and number of groups per area are variable across the landscape.
- Denser tree conditions exist in some locations such as north facing slopes, canyons, and drainage bottoms.
- Where they occur naturally, groups of aspen and all structural stages of oak are present.
- The frequent fire mixed conifer forest community is composed predominantly of

vigorous trees, but declining trees are present and snags, top killed, lightning and fire scarred trees, and coarse woody debris (greater than 3 inches diameter) are well-distributed throughout the landscape.

- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and to climate variability. The landscape is a functioning ecosystem that contains all components, processes, and conditions that result from endemic levels of disturbances (e.g., fire, insects, diseases, and wind), including old-growth trees.
- Dwarf mistletoe is present and infects ponderosa pine and Douglas-fir, but occurs at endemic levels, which allows for the establishment and sustainability of the desired uneven-aged forest structure over time.
- Organic ground cover and robust herbaceous vegetation provide protection for soil, and moisture infiltration, and contribute to plant and animal diversity and to ecosystem function.
- Grasses and needle cast provide the fine flashy fuels needed to maintain the natural fire regime. Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.
- Frequent, low-severity fires (Fire Regime I) occur across the entire landscape with a return interval of 0 to 35 years.

Objectives for Vegetation Management in Frequent Fire Mixed Conifer

To reduce the potential for active crown fire and restore frequent fire mixed conifer communities:

- Burn an average of 1,000 to 13,000 acres annually, using prescribed fire and/or naturally ignited wildfires.
- Mechanically thin 1,200 to 2,100 acres annually.

Management Approach

The area south and west of North Canyon in the Saddle Mountain Wilderness was identified as a high priority treatment area by the Kaibab Forest Health Focus (KFHF) as it has both high risk and high ecological values. The strategy identified in the KFHF was to address the needs of this area first and then move to other areas of high fire risk. Fire-only treatments may be appropriate for some areas with open canopies and low fuel loads, but mechanical fuel reduction is needed in many frequent fire mixed conifer areas before fire can be safely reintroduced. There was limited agreement about appropriate treatment intensity and practices among stakeholders. There was agreement that to address these concerns, initial treatments in frequent fire mixed conifer that an experimental design approach would help to fill informational gaps and support adaptive learning in these areas.

The treatment objectives for this vegetation community have a wide acreage range. Treatment with prescribed burns has been shown to be costly, with narrow windows of opportunity. The ability to manage naturally ignited wildfires to achieve resource benefits has been very limited, and much remains to be learned. The number of acres treated each year is likely to increase over the plan period, as new information becomes available about practices and treatment effects, and as adaptive management is implemented. Additionally, as fuel loading is reduced on more acres, there will be an increased ability to let fire play its natural role.

Mixed conifer forest is managed as Mexican spotted owl habitat under the Mexican Spotted Owl Recovery Plan (USFWS 1995) by providing for denser areas of forest and key structural elements (e.g., large old trees and snags, downed woody debris) necessary to support Mexican spotted owl nesting, foraging, and dispersal, and to minimize disturbance to owls in those areas. The Kaibab NF works closely with the U.S. Fish and Wildlife Service to address the habitat needs of Mexican spotted owls.

[See also the [guidelines for vegetation management in forested communities](#), [wildlife](#), [nonnative invasive species](#), [recreation and scenery](#), and [forestry and forest products](#) sections of this Plan.]

Mesic Mixed Conifer / Spruce-Fir Forests

The mesic (wet) mixed conifer/spruce-fir forest vegetation community generally occurs at elevations ranging from approximately 6,800 to 9,500 feet. Tree species composition varies depending on seral stage, elevation, and moisture availability. The mesic mixed conifer / spruce-fir community may include early seral species such as aspen, Douglas-fir, New Mexico locust, southwestern white pine, or late seral species such as maple, white fir, corkbark fir, and spruce. Forests dominated by Engelmann spruce intermixed with corkbark fir and aspen occur at the highest elevations such as the top of Kendrick Mountain and the highest elevations on the Kaibab Plateau. Ponderosa pine is only a minor component, which distinguishes it from frequent fire mixed conifer.

Disturbances in this vegetation community typically occur at two spatial and temporal scales: larger infrequent disturbances (mostly fire) and smaller more frequent disturbances (fire, insect, disease, wind). On the Kaibab NF, this vegetation community rarely occurs continuously at the landscape scale (over 1,000 acres). The mesic mixed conifer / spruce-fir vegetation community has an understory of a wide variety of shrubs, grasses, and forbs, depending on soil type, aspect, elevation, disturbance, and other factors.

Fine-scale (10 acres or less) Desired Conditions for Mesic Mixed Conifer/Spruce-fir

- Mid-aged and older trees are typically variably spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking. Trees within groups can be of similar or variable species and ages.
- Small openings (gaps) are present as a result of past disturbances.
- Due to the presence of ladder fuels, fires usually burn either with low intensity, smoldering combustion, or transition rapidly in the canopy as passive or active crown fire.
- Dwarf mistletoe infections may be present on Douglas-fir or spruce, and rarely on other tree species, but the degree of infection severity and amount of mortality varies among infected trees. Witch's brooms may be present with these infestations, providing habitat for wildlife.

Mid-scale (100 to 1,000 acres) Desired Conditions for Mesic Mixed Conifer/Spruce-fir

- The size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary, but are frequently hundreds of

acres; groups and patches of tens of acres or less are relatively common.

- Forest conditions in some areas contain higher basal area than the general forest; examples include goshawk post-family fledgling areas, Mexican spotted owl nesting and roosting habitat, and north-facing slopes.
- A mosaic of primarily even-aged groups and patches, which vary in size, species composition, and age, is present.
- Grass, forb, and shrub-dominated openings created by disturbance may make up 10 to 100 percent of the mid-scale area, depending on the disturbance type.
- Aspen is occasionally present in large patches.
- Density ranges from 20 to 250 square feet of basal area per acre, depending upon disturbance and seral stages of groups and patches.
- The number of snags and downed logs (greater than 12 inches diameter at mid-point, over 8 feet long) and coarse woody debris (greater than 3 inches diameter) vary by seral stage. Snags 18 inches or greater at d.b.h. typically range from 1 to 5 snags per acre, with the lower range associated with early seral stages and the upper range associated with late seral stages.
- Coarse woody debris, including downed logs, vary by seral stage, with averages ranging from 5 to 20 tons per acre for early-seral stages; 20 to 40 tons per acre for mid-seral stages; and 35 tons per acre or greater for late-seral stages.
- During moister conditions, fires exhibit smoldering low-intensity surface fires with single-tree and isolated group torching. Under drier conditions, fires exhibit passive to active crown fire behavior with conifer tree mortality up to 100 percent across mid-scale patches (100 to 1,000 acres). High-severity fires generally do not result in areas of mortality exceeding 1,000 acres. Other smaller disturbances occur more frequently.
- Fire and other disturbances maintain overall desired tree density, structure, species composition, coarse woody debris, and nutrient cycling.
- Fire severity is mixed or high, with a fire return interval of 35 to over 200 years (Fire Regimes III, IV, and V).

Landscape-scale (10,000 acres or more) Desired Conditions for Mesic Mixed Conifer / Spruce-Fir

- The vegetation community is a mosaic of structural and seral stages ranging from young trees through old and is composed of multiple species. The landscape arrangement is an assemblage of variably-sized and aged groups and patches of trees and other vegetation similar to reference conditions.
- The landscape is composed predominantly of vigorous trees, but older declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris
- The forest landscape is a functioning ecosystem that contains all components, processes, and conditions that result from endemic levels of disturbances (e.g. insects, diseases, wind, snow, and fire), including snags, downed logs, and old trees.
- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances and climate variability.
- Dwarf mistletoe infestations may be present in stands that are composed of Douglas-fir

or spruce and rarely in other tree species. Infestation size, degree of severity, and amount of mortality varies among infested stands. Witch's brooms may be scattered throughout the infestations providing structural diversity in the stand and improved foraging and nesting habitat for wildlife species such as small mammals (e.g. tree squirrels), and raptors (e.g. goshawks, spotted owls).

- Old growth generally occurs over large areas as stands or forests where old growth is concentrated. Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- Organic ground cover and herbaceous vegetation provide protection for soil and moisture infiltration, and contribute to plant diversity and ecosystem function.
- Mixed severity fire (Fire Regime III) is characteristic at the lower elevations of this type. High severity fires (Fire Regime IV & V) are more common at the higher elevations.

Management Approach

No objectives have been set for the mesic mixed conifer/spruce-fir vegetation types. Potential projects in these areas include burning and mechanical treatments to restore the desired conditions, which were generally much less dense with far fewer shade-tolerant trees. The ability to manage naturally ignited wildfires and use prescribed burns to achieve resource benefits is currently very limited. As fuel loading is reduced on more areas, the ability to allow fire to play its natural role will increase. Limited agreement about treatment intensity and practices among stakeholders calls for initial treatments to include provisions for an experimental design approach and facilitation of multiparty monitoring to increase learning, agreement, and trust.

Mixed conifer forest is managed as Protected Habitat under the Mexican Spotted Owl Recovery Plan (USFWS 1995). The Kaibab NF works closely with the U.S. Fish and Wildlife Service to address the habitat needs of Mexican spotted owls.

[See also the [guidelines for vegetation management in forested communities, forestry and forest products](#), [wildlife](#) and [wildland fire management](#) sections of this plan.]

Aspen

Aspen is not considered a distinct vegetation community on the Kaibab NF, because it typically exists as smaller stands within a larger forest matrix dominated by ponderosa pine or mixed conifer vegetation. As a result, aspen is addressed as a component of other forested communities. Aspen occurs most extensively on the North Kaibab Ranger District at higher elevations and is estimated to cover about 25,000 acres. It is patchy on the Williams Ranger District with a total of about 2,000 acres, and is known only from three small clones on the Tusayan Ranger District (totaling about one acre).

At higher elevations, aspen stands can be expansive due to establishment after large-scale disturbances such as blowdowns or high-severity fires. At mid-elevations, aspen can be common in wet meadows or on mountain slopes, but can also occur in small isolated patches on rock outcrops or steep slopes. At the lower elevations of its range where precipitation is a limiting factor, aspen is generally confined to specific microsite areas, such as near springs, meadows, or steep, rocky drainages and side slopes.

Aspen is not usually a climax species on the Kaibab NF; rather, it is part of the mix of early seral species that are common after disturbances, particularly fire. In the West, dry environmental conditions rarely allow for successful establishment of new aspen seedlings, but major disturbance events can facilitate seedling germination. More typically, aspen reproduces asexually through root suckers that are a clone of the original parent tree. Fire and human disturbances regenerate this shade-intolerant species by opening up the canopy and removing conifers from the understory. Without disturbance, conifers gradually overtop aspen, closing the canopy and eventually killing mature trees and reducing regeneration. Aspen is highly susceptible to browsing and disease or death due to bark injuries. Further declines in aspen would result in a loss of diversity that could affect avifauna and invertebrates, including pollinators. The loss of aspen can change fire behavior because aspen acts as a natural fire break where it is intermingled with coniferous species.

Aspen stands are currently in decline throughout most of the Southwest as a result of fire absence, unmanaged forest succession, drought, and ungulate overbrowsing. On the Williams Ranger District, most stands are generally considered unhealthy. These aspen stands are dying or are dead because they have been overtopped by conifers and are unable to recruit new individuals due to heavy browsing and bark stripping by ungulates.

Aspen stands generally occur on moister sites and tend to have higher biodiversity and a greater abundance of plant, fungi, invertebrate, mammals, and cavity-nesting bird species than the surrounding forest. Aspen is second only to riparian ecosystems in biological diversity on the Kaibab NF, and supports more bird species populations than other forested areas in the western United States. Even small aspen stands provide refugia. The soft wood of decaying stems and snags provide valuable habitat, particularly for cavity-dependent species.

Aspen also has high scenic value. The green leaves and white trunks of aspen provide a natural contrast to the surrounding forest. Aspen attract both residents and visitors to northern Arizona to enjoy abundant wildlife, shade, and scenery. During the fall months, the forest is transformed into a patchwork of green and gold, drawing fall color lovers from around the State. Aspen provides unique and seasonal opportunities for hiking, biking, bird watching, nature exploration, picnicking, and other recreational activities.

Desired Conditions for Aspen (General)

- Aspen stands are characterized by disturbances that may include fire, mechanical treatments, insects, pathogens, and abiotic factors. Collectively, these agents of change promote healthy tree regeneration, decadence, and nutrient cycling. These processes further contribute to high-quality wildlife habitat and biodiversity.
- Aspen occurs in natural patterns of abundance and distribution at levels similar to or greater than those at time of Plan approval.
- Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes.
- Fire intervals are similar to reference conditions and maintain aspen.
- Understory vegetation consists of shrubby or herbaceous species, providing forage and cover for wildlife and habitat for invertebrates such as pollinators. Aspen provides opportunities for scenic enjoyment, recreation, and cultural or spiritual experiences.

Desired Conditions for Aspen in Ponderosa Pine and Frequent Fire Mixed Conifer

- In ponderosa pine and frequent fire mixed conifer vegetation types, the size, age, and spatial extent of aspen stands reflect reference conditions.
- Coniferous species comprise less than 10 percent of the overstory.
- Isolated aspen stands, diverse in vegetation structure and composition, provide wildlife refugia and diversity in an otherwise conifer-dominated landscape.

Desired Conditions for Aspen in Mesic Mixed Conifer / Spruce-Fir Forests

- Downed aspen and woody debris are scattered across the landscape and provide habitat for a variety of wildlife species (e.g., small mammals, reptiles, amphibians, and birds) while contributing to efficient nutrient cycling.
- Aspen occurs as a shifting mosaic across its range with new aspen clones establishing over time.
- The size, age, and spatial extent of aspen stands reflect large-scale disturbance patterns and processes.

Objectives for Restoring Aspen on the Williams and Tusayan Ranger Districts

- To protect, enhance, and expand regenerating aspen stands that are considered to be of particularly high ecological and socioeconomic conservation value:
- Fence 200 acres of aspen within 10 years of Plan approval to exclude ungulates.
 - Reduce conifer encroachment on 800 acres of aspen within 10 years of Plan approval.

Guidelines for Aspen Management

- Small patch clear-cuts (less than 5 acres in size), conifer removal, and wildland fire should be used to stimulate aspen sprouting in areas that have or previously had aspen.
- Aspen trees 10 inches or greater d.b.h. (both live and dead) should be protected during project activities, except where they may pose a risk to fences or regeneration efforts.
- Fences should be regularly inspected and maintained while aspen recovers. Fences should be removed when no longer needed.

Management Approach

Prioritization of aspen restoration efforts by their ecological and genetic contribution to the greater landscape and balanced with the forest's capacity to achieve the desired conditions. Collaborate with stakeholders to develop an aspen management protocol that uses a systematic approach to recover and sustain aspen and the associated understory native plant communities and wildlife. Work with the Arizona Game and Fish Department (AZGFD) on developing appropriate strategies for managing elk impacts to aspen on the Williams and Tusayan Ranger Districts and identifying population goals for elk on the forest. Other strategies to promote aspen such as jackstrawing, planting, public education, and improving the forage and browse in the surrounding area to diffuse browse pressure on aspen may be used.

In project design, it is important to consider the effect of tree densities on understory abundance and diversity because most biological diversity in ponderosa pine and frequent fire mixed conifer forest is found in the understories. Additionally, a robust understory is essential in carrying frequent, low-intensity fires with relatively low smoke emissions.

[See also relevant vegetation types, [wildlife](#), [nonnative invasive species](#), and [forestry and forest products](#).]

Guidelines for Vegetation Management in All Forested Communities

- Projects in forested communities that change stand structure should generally retain at least historic frequencies of trees by species across broad age and diameter classes at the mid-scale. As such, the largest and oldest trees are usually retained.
- On suitable timberlands, projects should retain somewhat higher frequencies of trees across broad diameter classes to allow for future tree harvest.
- Project design should manage for replacement structural stages to assure continuous representation of old growth over time.
- Project design and treatment prescriptions should generally retain:
 - Large, old ponderosa pine trees with reddish yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or knarled limbs (e.g. Thomson's age class 4, Dunning's tree class 5 and/or Keen's Tree Class 4, A and B7 (Appendix C).
 - Mature trees with large mistletoe brooms suitable for wildlife nesting, caching, and denning, except where retaining such trees would prevent the desired development of uneven aged conditions over time.
 - Large snags, partial snags and trees (>18inches dbh) with broken tops, sloughing bark, lightning scars >4" wide, and large stick nests (>18inches in diameter)
 - Known bat roost trees.
- The location and layout of vegetation management activities should effectively disconnect large expanses of continuous predicted active crown fire and improve habitat connectivity.
- Vegetation management prescriptions should provide for sufficient canopy breaks to limit crown fire spread between groups, allow for the redevelopment and maintenance of a robust understory, and mimic the spatial arrangement of the references conditions.
- Vegetation Management activities in mixed conifer forests should incorporate experimental design features and monitoring to accelerate learning and adaptive management.
- Trees established after 1890 should generally not be retained in areas where biophysical conditions would have supported stable openings over time.
- Vegetation management activities should meet or exceed goals for scenic beauty (scenic integrity objectives) by creating natural patterns, structure and composition of trees, shrubs, grasses and other plants.
- Vegetation management should favor the development of native understory species in areas where they have the potential to establish and grow.
- Even aged silvicultural practices may be used as a strategy for achieving the desired conditions over the long term, such as bringing mistletoe infection levels to within a sustainable range, or old tree retention.

- The maximum size opening that may be created in one harvest operation for the purpose of creating an even-aged stand should not exceed 40 acres except when it is following a large scale disturbance event such as a stand replacing fire, wind storm, insect or disease outbreak.
- When openings are created with the intent of regeneration, effort should be made to ensure that lands can be adequately restocked within 5 years of final harvest.
- Seed and plants used for revegetation should originate from genetically local sources.
- Heavy equipment and log decks should not be staged in montane meadows.

Large-scale Disturbance Events in Forested Communities

There has been a trend toward more large-scale disturbance events such as large stand-replacing fires and/or bark beetle epidemics. Following large-scale disturbance events, the desired conditions for the area would generally not change, except in cases where the environment has been so altered that the desired conditions are no longer obtainable. However, there is a need for management actions to accelerate progress toward desired the desired conditions.

Guidelines for Activities Following Large-scale Disturbances

- Threats to human safety and property should be promptly addressed following large disturbance events using measures such as signing and temporary closures.
- Recovery and restoration project design should seek to establish a trajectory toward the desired conditions for the affected vegetation type.
- Erosion control measures should be implemented to protect significant resource values and infrastructure such as stream channels, roads, structures, and archeological or historic sites.
- Where extensive tree mortality results from fires, insect epidemics, or wind events and sufficient timber value exists, salvage of dead trees should be considered where it would facilitate long-term restoration, rehabilitation, and public safety objectives.
- Practices that restore nutrient cycling and stabilize soils (revegetation, mulching, lop and scatter, etc.) should be implemented.
- Where conifer seed sources are lost or poorly distributed due to high-intensity fire, artificial regeneration (planting, etc.) should be implemented to promote the desired forest structure and accelerate the recovery of habitat conditions for native wildlife species.
- Some snags and coarse woody debris should be retained to provide for wildlife habitat, soil stabilization, and other resource benefits. Some clumps of large (18 inches d.b.h.) standing dead trees should be retained. Snag retention should be balanced with desired fuel levels over time.
- Project design should incorporate measures to protect regeneration and reforestation investments.
- The Kaibab National Forest Recreation Opportunity Settings and Scenery Management Guidebook² should be used when designing restoration projects.

² The Kaibab National Forest Recreation Opportunity Settings and Scenery Management Guidebook is updated as needed and provides more detailed information about plan implementation.

Objectives Following Large-scale Disturbances

To reestablish ponderosa pine in areas with inadequate seed source and reduce the time to achieve the desired forest structure:

- Plant 300 to 700 acres annually.³

Management Approach for Response to Uncharacteristic Disturbances

When high-intensity stand-replacing fires occur in the ponderosa pine and frequent fire mixed conifer PNVTs, it can take more than 100 years for the characteristic landscape to become restored, regardless of management activities. There is a need for a consistent, efficient, scientifically based response to these events, as they are likely to occur during the planning period. It is important for project design criteria to include both short- and long-term provisions for restoring scenic integrity, especially in sensitive foreground areas.

[See also [recreation and scenery](#), [nonnative invasive species](#), and relevant major vegetation communities]

Sagebrush Shrublands

Sagebrush shrubland communities in northern Arizona represent the southernmost reach of the greater sagebrush biome that covers much of the western United States and parts of southwestern Canada. On the Kaibab NF, the Sagebrush Shrubland vegetation community generally occurs at elevations between approximately 4,600 and 7,500 feet. At this southern extreme, the temperature and precipitation regime can limit the extent of grass cover in the sagebrush shrubland of the forest. The Kaibab NF contains a disproportionate amount of sagebrush compared to the greater ecoregions (KNF 2009). These communities are dominated by sagebrush (Wyoming big sagebrush [*Artemisia tridentata* ssp. *wyomingensis*], Basin big sagebrush [*A. t. ssp. tridentata*], Bigelow sagebrush [*A. bigelovii*], black sagebrush [*A. nova*], sand sagebrush [*A. filifolia*]), although other shrub species (e.g., rabbitbrush [*Chrysothamnus* spp., *Ericameria* spp.], saltbush [*Atriplex* spp.]), and succulents (e.g., yucca [*Yucca* spp.], cactus [*Opuntia* spp.]) occur and can dominate locally.

The understory, typically sheltered by the shrub overstory, consists of a variety of taller forbs and bunch-grasses, low-growing grasses and forbs, or well-developed cryptobiotic crusts. Plant cover is usually not continuous. Species composition varies by location. Fire disturbance is highly variable in type and frequency across elevation and moisture gradients and site productivity. Reference conditions indicate that about two-thirds of the sagebrush shrublands had mixed-severity fire occurring approximately every 120 years, and about one-third of the sagebrush shrublands had stand-replacing fire occurring at a longer interval (up to 240 years).

Sagebrush provides variable habitat that can include a mix of shrublands and grasslands. This diversity supports an abundance of birds, animals, and native plants, some of which are specially adapted to the system. Sagebrush shrublands provide critical habitat for migratory bird species, many of which are in decline across the country. Overall, wildlife species diversity may be lower in sagebrush systems than in habitat types with greater vertical complexity, but the species that occur in sagebrush systems often occur nowhere else. Populations of many bird species that depend on these ecosystems are in decline, and many have special conservation status. On the Kaibab NF, species that depend on shrub steppe habitat include Brewer's sparrow, sage sparrow,

³ This rate is based on the anticipated capacity, and may not meet the entire need.

and sage thrasher (AZGF species of greater conservation needs), green-tailed towhee, black-throated sparrow, and gray vireo (USFWS species of management concern). The following desired conditions are intended to address these habitat needs.

Desired Conditions for Sagebrush Shrublands⁴

- The composition, structure, and function of biotic and abiotic components of sagebrush shrublands are within or moving towards reference conditions. The majority of sagebrush is in mid-seral or mature states.
- Enough shrub cover exists to meet the needs of a variety of sagebrush-obligate wildlife species.
- A vigorous, but not necessarily dense, understory community of native grasses and forbs is present.
- Single trees or groups of trees cover less than 10 percent of any Terrestrial Ecosystem Survey (TES) 1 map unit polygon and less than 5 percent of the community.
- Shrub cover is at least 5 percent, and typically makes up 20 percent to 50 percent of any TES soil unit.
- Characteristic disturbances play a role in the function of the ecosystem.

Guidelines for Vegetation Management in Sagebrush Communities

- Prior to developing project proposals for restoring sagebrush communities, a determination should be made of the sagebrush sub-species because the differing sub-species indicate different desired reference conditions.
- Management activities should be designed to mimic the historic disturbance.
- In areas with moderate to high risk of cheatgrass invasion, fire should be excluded if adequate treatments are not available or if they are cost prohibitive.
- Where sagebrush communities are severely degraded, water should be strategically placed to improve animal distribution and reduce grazing impacts.

Grassland Communities

In northern Arizona, grasslands can consist of various perennial grasses, wildflowers, yucca, cactus, shrubs and/or trees. Life form composition varies due to fluctuations in the area's diverse topography, elevation, and associated microclimates. Grassland communities on the Kaibab NF are categorized as Montane/Subalpine, Colorado Plateau/Great Basin, or Semi-Desert. Collectively, these grasslands, savannas, and mountain meadows border every forest type on the forest. Each bears its own unique structure, composition, biological components, and conservation needs.

⁴ The Terrestrial Ecosystem Survey (TES) was published by the Kaibab NF in 1991. It maps and evaluates the terrestrial ecosystems in the forest. The TES contains predictions and limitations of soil and vegetation behavior for selected land uses, and highlights hazards and capabilities inherent in the soil and the impact of selected uses on the environment. It can be used to evaluate and adjust land uses to the limitations and potentials of natural resources and the environment. Full text of the TES can be found online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5138598.pdf.

Historically, these grassland communities had less than 10 percent tree cover and occur between 4,400 and 8,400 feet in elevation. Impacts from grazing, logging, and fire suppression practices that started in the late 1800s are still discernible on the landscape today. These practices reduced or eliminated the vegetation necessary to carry low-intensity surface fires across the landscape, thereby altering the natural fire regimes and allowing uncharacteristic forest succession to take place. About 200,000 acres of grassland communities across the forest have been encroached (i.e., invaded) upon by pinyon, juniper, and ponderosa pine trees due to disruption of the historic fire regimes and historic grazing patterns. These conditions have been further exacerbated by recent increases in invasive, nonnative plants, soil erosion, and low-density rural home development, which further threaten the ecological integrity of grassland systems on the Kaibab National Forest.

Grasslands provide important habitat for wildlife including birds, mammals and herpetofauna. However, functional grasslands are much less abundant than they were historically, which reduces the amount of available habitat for grassland-associated species. Many of these animals, such as prairie dogs, various snakes, and burrowing owls, use the consistent environmental conditions found below ground. Grasslands provide valuable breeding sites and foraging opportunities for both resident and migratory grassland associated birds, which have experienced greater declines than any other group of bird species. Pronghorn use grasslands for both cover and forage.

Desired Conditions for All Grasslands

- Vegetation is dominated by herbaceous plants composed of a mix of native grasses and forbs. The structure, composition, and distribution of vegetation are within the range of natural variability and occur in natural patterns of abundance and diversity, which vary depending on soil type and microclimate.
- Disturbance processes are similar to reference conditions and play a primary role in the function of the ecosystem.
- Vegetation height and cover are sufficient to support the historic fire return interval.
- Grass/forb/shrub canopy cover is typically above 25 percent, with less than one quarter of any grassland below this range.
- Tree canopy is less than 10 percent.,
- Shrub canopy is less than 10 percent.,

Objectives for Restoring Grasslands

To restore the extent and quality of grasslands and grassland habitat:

- Reduce tree density to less than 10 percent on 5,000 to 10,000 acres of historic grasslands annually.
- Modify fences and/or install pronghorn crossings on 50 miles of fence within 10 years plan approval.

Guidelines for Restoring Grasslands

- Pronghorn fence crossings should be installed along known movement corridors.
- Prior to implementation of grassland restoration treatments, consideration should be given to making the residual fuelwood available for personal collection.

- In areas where native herbaceous cover is sparse and seed sources do not exist, seeding should be considered.

Management Approach

Restoration of grasslands was identified as a primary need for change due to the relatively recent loss of grassland habitat due to tree encroachment. Potential strategies for implementing grassland restoration treatments include:

- Delineating historic grasslands based on the Terrestrial Ecosystem Soil types that are associated with grasslands (mollisols), evidence of presettlement trees, and historic maps.
- Prioritizing areas for treatment that are at greater risk of loss and that have the capacity to restore to fully functional, high-quality grasslands.
- Initiating public education efforts so the public can understand how conditions have changed and to gain public support.

Montane / Subalpine Grasslands

On the Kaibab NF, montane/subalpine grasslands occur at elevations from 6,000 to 8,400 feet. This community covers approximately 41,000 acres across the forest and can be found on all three ranger districts, although it is of limited extent on the Tusayan Ranger District. Areas of montane grasslands vary from small patches (less than 10 acres) surrounded by conifer forest to large landscape size areas (for example, Demotte Park, Garland Prairie, Government Prairie, and Pleasant Valley are several thousand acres each). Smaller patches can be circular in shape and coincide with small sinkhole features or long and narrow and coincide with valley bottoms. The montane/subalpine grasslands on the North Kaibab Ranger District are often linear, and as a result, are at a higher risk of loss because trees encroach from the edges and the openings close quickly. They are often forb-dominated and are better described as montane / subalpine meadows rather than grasslands.

High-elevation meadows are unique sites which often contain habitat for relict plant species that require cool moist conditions. As a result, these areas are particularly vulnerable to changes in climate, and are often considered a higher priority for vegetation treatment than areas at lower risk.

Desired Conditions for Montane / Subalpine Grasslands

- Montane and subalpine meadow vegetation has high soil productivity and biological diversity. Native species occur in natural patterns of abundance, composition, and distribution. Vegetation is healthy and at least stable.
- Vegetation and litter are sufficient to maintain and improve water infiltration, nutrient cycling, and soil productivity.

[See also [soils and watersheds](#) section]

Management Approach

The primary strategies for moving toward desired conditions focus on reducing conifer encroachment from grasslands. Other strategies may be used such as treatments that improve the

understory vegetation in the surrounding area, which improves elk and livestock distribution and reduces grazing pressure, as well as providing media and public information focused on the importance of meadows and appropriate activities within wet meadows.

Colorado Plateau / Great Basin Grasslands

Found at between 4,900 and 7,200 feet in elevation on the Tusayan and Williams Ranger Districts, this community consists of approximately 44,000 acres on the Kaibab NF. It consists of mostly grasses and interspersed shrubs, and is typically located in drainage bottoms surrounded by sagebrush or pinyon-juniper habitat. In some cases, ponderosa pine forest is present on the grassland border when it is on a north-facing aspect.

Grass species may include but are not limited to: Indian ricegrass (*Achnatherum hymenoides*), threeawn spp. (*Aristida spp.*), blue grama (*Bouteloua gracilis*), fescue spp. (*Festuca spp.*), needle and thread grass (*Hesperostipa comata*), spike fescue (*Leucopoa kingii*), *Muhlenbergia spp.*, James' galleta (*Pleuraphis jamesii*), and Sandberg bluegrass (*Poa secunda*). Shrub species may include but are not limited to: sagebrush (*Artemesia tridentate spp.*), cliffrose (*Purshia stansburiana*), rabbitbrush (*Chrysothamnus spp.*), saltbush (*Atriplex spp.*), Ephedra (*Ephedra viridis*), snakeweed (*Gutierrezia*), winterfat (*Krascheninnikovia lanata*), and wax currant (*Ribes cereum*). Historically, this vegetation type had less than 10 percent tree cover and 10 percent shrub cover. The area provides valuable winter habitat for deer, elk, antelope, and turkey.

Desired Conditions for Colorado Plateau/ Great Basin Grasslands

- Vegetation height and canopy cover are sufficient to carry fire under low wind conditions to support a 10- to 30-year fire return interval.

Management Approach

Vegetation management activities may be needed to enhance shrub diversity, distribution, and productivity to support wildlife.

Semi-desert Grasslands

Covering about 25,000 acres, semi-desert grasslands are found between 4,400 and 6,400 feet in elevation on the North Kaibab Ranger District. Species composition consists of mostly grasses and interspersed shrubs. Dominant grassland associations/types are blue grama (*Bouteloua gracilis*) grassland, Indian ricegrass (*Achnatherum hymenoides*), threeawn spp. (*Aristida spp.*), fescue spp. (*Festuca spp.*), needle and thread grass (*Hesperostipa comata*), spike fescue (*Leucopoa kingii*), *Muhlenbergia spp.*, James' galleta (*Pleuraphis jamesii*), and Sandberg bluegrass (*Poa secunda*). Shrub species may include but are not limited to: sagebrush (*Artemesia tridentate spp.*), rabbitbrush (*Chrysothamnus spp.*), saltbush (*Atriplex spp.*), Ephedra, snakeweed (*Gutierrezia*), winterfat (*Krascheninnikovia lanata*), and wax currant (*Ribes cereum*). Historically, this vegetation type would have had less than 10 percent tree cover. Semi-desert grasslands provide important winter range for mule deer and year-long habitat to pronghorn and bison.

Desired Conditions for Semi-desert Grasslands

- Vegetation height and canopy cover are sufficient to carry fire under low wind

conditions to support fire on a 10- to 30-year return interval.

Desert Communities

The desert communities vegetation type occupies a proportionately small area of the Kaibab NF, but provides habitat for a number of species not found in other areas. It is only found in the Kanab Creek Wilderness. It surrounds the Cottonwood-Willow Forest community and occurs at elevations ranging from 3,000 to 4,300 feet. Vegetation cover is sparse to dense and includes desert grasses, desert shrubs, succulent species, and some herbaceous cover. Fire did not historically play a role in this vegetation community.

Desired Conditions for Desert Communities

- Desert communities are characterized by extensive grasses with a shrub cover less than 30 percent. Ground cover ranges from 5 percent to 40 percent. Shrubs contribute to the native plant diversity and structure. Plant litter occupies up to 5 percent of the soil surface.
- Density of juniper and other shrubby species is maintained at levels which promote natural fire regimes and long fire return intervals. Fire occurrence is low and infrequent. Natural disturbance regimes include soil engineers such as arthropods and sometimes small mammals.
- Rocky outcroppings and shrubby plant species provide abundant browse and foraging opportunities for mule deer and bighorn sheep.
- Native ungulates are free from disease. Domestic livestock are absent.
- Native plants provide for traditional foods and materials including ephedra, yucca, and prickly pear.

Guidelines for Desert Communities

- Fire should not be used as a vegetation management tool in desert communities.

Management Approach

In the desert communities of Kanab Creek, it will be important to work collaboratively with Arizona Game and Fish and Bureau of Land Management to implement strategies identified in the Arizona Strip Desert Bighorn Sheep Management Plan within the desert communities of Kanab Creek.

[See also management area direction for [wilderness](#).]

Gambel Oak Shrublands

On the Kaibab NF, the Gambel oak shrubland vegetation community occurs at elevations ranging from 7,000 to 8,600 feet, and is associated with relatively steep, rocky, south-facing slopes. Gambel oak shrublands on the southern flank of Bill Williams Mountain on the Williams Ranger District and along the East Rim break in Saddle Mountain Wilderness on the North Kaibab Ranger District. Gambel oak shrublands make up less than 0.3 percent of the forest, and total approximately 5,360 acres.

Desired Conditions for Gambel Oak Shrublands

- The system is dominated by native tall shrubs and hardwood trees. Some areas contain many trees with relatively large hollow boles or limbs. Coniferous trees are widely scattered and are frequently mature or old. Young Gambel oak thickets and sometimes other species comprise a patchy shrub layer. An understory of grass and forbs is present.
- Low-intensity fire occurs regularly in intervals of less than 25 years.
- Nonnative species are absent or comprise less than 1 percent of the total cover.
- Old stands contain habitat for birds and arboreal nesting or roosting mammals. A variety of oak growth forms, sizes, and densities that benefit wildlife species can be found across the landscape.

Management Approach

Gambel oak may be managed to increase hard mast production, cavities, and deciduous foliage volume to promote and enhance wildlife habitat. Potential activities include thinning encroaching conifers and low-intensity fire to kill stems less than 6 inches in diameter (d.b.h.).

Wetland / Cienega

The wetland / cienega vegetation communities are associated with perennial springs or headwater streams where groundwater intersects the surface and creates pools of standing water, sometimes with channels flowing between pools. Soils are often saline. Riparian vegetation occurs in wet areas and ranges widely depending on amount, timing, and water source, as well as biophysical characteristics. Distribution and types of vegetation vary due to gradients in saturated soils and salinity. Some vegetation types found in saline areas of wetlands / cienegas include salt grass (*Distichlis spicata*), yerba mansa (*Anemopsis californica*), and sacaton. Pools and saturated soils support rushes, sedges, flat sedges, spike rushes, and other aquatic vegetation. Wetlands / Cienegas have historic and contemporary significance to area tribes due to the cultural value of water and because they contain traditionally used resources that are rare on the landscape.

On the Kaibab NF, wetlands / cienegas primarily occur as ephemeral wetlands at elevations ranging from 5,900 to 9,500 feet, but also occur in high elevation (3,500 to 11,000 feet) meadows with subsurface flows dominated by herbaceous cover. Historically, this vegetation community would have had less than 10 percent tree canopy cover.

Ephemeral wetlands contain standing water for a portion of the year (typically from snowmelt in years when precipitation is normal to above normal) and are dry for a portion of the year. They provide important resting habitat during spring migration. They cover about 1,500 acres on the North Kaibab and Williams Ranger Districts, and include landmarks such as Davenport, Dry, and Duck Lakes on the Williams Ranger District.

Standing water and vegetation in wetlands may be barely existent in dry periods, but during wet periods these communities can be highly productive. Tree encroachment and high tree density of adjacent vegetation types can lower the water table and reduce water flow in this system.

Drought and flooding are the primary natural disturbances. Fire is an infrequent disturbance, and enters from adjacent vegetation types.

Desired Conditions for Wetlands / Cienegas

- Wetland conditions are consistent with their flood regime and flood potential.
- Plant and animal species that require wetland habitats have healthy populations within the natural constraints of the particular wetland community.
- Wetlands infiltrate water, recycle nutrients, resist erosion, and function properly.

Objectives for Wetlands / Cienegas

- Restore native vegetation and natural water flow patterns on at least 6 acres of wetlands within 5 years of Plan approval.

[See also [natural waters](#).]

Cottonwood-Willow Riparian Forest

Southwestern riparian ecosystems, which include ephemeral, intermittent, and perennial streams and rivers, are ecologically dynamic habitats characterized by linear patches of vegetation. Riparian systems have decreased in size over the past 100 years, largely as a result of human development. In the West, factors such as livestock grazing, beaver extirpation and road development are commonly attributed to the loss of riparian habitat. Riparian areas are considered one of the most important habitat types for Arizona and the Southwest. Activities such as channelization and river diversion, domestic livestock grazing, timber, invasive species, recreation, and infrastructure development have led to a 90 percent reduction of this habitat type in Arizona and New Mexico, compared to historic (prior to 1890) conditions.

Cottonwood-willow riparian forests are characterized by dense groves of low, shrub-like trees or tall shrubs to woodlands of small to medium and large-sized trees. This vegetation type is found adjacent to permanent surface water, such as streams and springs. Usually an abrupt transition occurs between this and adjacent shorter and more open desert vegetation communities.

Riparian vegetation height depends on constituent plant species. Willow thickets range from 3 to 10 feet (1 to 3 meters) in height while Fremont cottonwoods may exceed 80 feet (24 meters). Plant species vary and may exist as a variety of structural stages ranging from seedlings through tree/shrub to large tree. Vegetation within this community is predominantly composed of deciduous species. Common native trees and shrubs, depending on location and elevation, include narrowleaf cottonwood (*Populus angustifolia*), box-elder (*Acer negundo*), bigtooth maple (*Acer grandidentatum*), Rocky Mountain maple (*Acer glabrum*), water birch (*Betula occidentalis*), aspen (*Populus tremuloides*), thin-leaf alder (*Alnus tenuifolia*), New Mexico locust (*Robinia neomexicana*), Scouler willow (*Salix scouleriana*), and arroyo willows (*Salix lasiolepis*). Canopy development and plant density depend on available water, plant species, and site characteristics. Soils vary from silty alluvial to rocky, sandy, well-drained substrates. Hot, dry summers, and cool to cold, moist winters characterize this vegetation type.

On the Kaibab NF, this vegetation community is located only within the Kanab Creek Wilderness area at elevations ranging from 3,200 to 4,500 feet. It evolved with flooding as a major natural disturbance. Upstream diversions, impoundments, and tamarisk invasion has resulted in departures from the historic flooding regime. As a result, this vegetation community on the Kaibab NF does not typically occur in patches large enough to be considered a “forest.”

Desired Conditions Cottonwood-Willow Riparian Forest

- The extent, diversity, and condition of riparian habitat contribute to ecological sustainability. Dense shrubbery and high levels of vegetative diversity (structural and compositional) and permanent water provide food, cover, and water for wildlife, including terrestrial and aquatic invertebrates and vertebrates.
- Vegetation is characterized by willow and other herbaceous understory species. Snag and gallery tree components comprise 55 percent mid-aged to mature cottonwood and willow trees, 25 percent younger trees and 20 percent in grass, shrubs, suckers, seedlings, and tree sprouts.
- Vegetation is structurally diverse and provides habitat for high bird species diversity and abundance with nesting and foraging opportunities for neotropical migrants.
- Mature cottonwood and other trees provide cavities for cavity-dependent wildlife such as woodpeckers, sapsuckers, and secondary cavity users. Tall trees provide lookouts and opportunities for nesting raptors.
- Water flow regime approximates reference conditions (i.e., perennial flows) and flows freely. Sedimentation is minimized. Springtime flooding contributes to ecosystem sustainability by optimizing germination conditions for seedlings and/or suckering opportunities from the parent plant.
- When nonnative vegetation is present, the spatial and structural composition contributes to overall faunal diversity.
- Grazing from domestic ungulates is minimal or absent.
- Soil is free from compaction and includes sand and gravelly reaches and provides suitable germination sites for desirable plant species.
- Sandy and vegetated terraces provide habitat for reptiles and amphibians.
- Shallow exposed watersides provide drinking and foraging opportunities for wildlife.
- Fire is limited or absent in this system.

Management Approach

The forest recognizes the importance of riparian areas during project planning and implementation, and emphasizes their protection while managing them within multiple-use guidelines.

Program managers work with public affairs to communicate the ecological significance of these systems to the broader public, to garner support for restoration activities, which may facilitate increasing water into these systems. Restoration activities may also include burning and/or mechanical removal of noxious species (tamarisk, Russian olive) followed by herbicide treatments (if necessary) and active revegetation of desirable species. The recent arrival of tamarisk beetles on the forest (originally introduced off-forest as a biological control agent) may call for active burning and planting of native species following tamarisk mortality to make progress toward desired conditions.

Soils and Watersheds

Soil and watershed condition is integral to all aspects of resource management and use. Good watershed management maintains the productive capacity of soils, protects water quality and

quantity, sustains native species, provides beneficial uses, and reduces the threat of flood damage to Forest Service infrastructure and downstream values.

On the Kaibab NF, there are 127 6th-level hydrologic unit boundary watersheds. Roughly two-thirds of these are in fair to excellent condition. Watershed conditions have been generally static over the last 20 years. Some portions of watersheds have been improved through tree thinning and managed fires while forest density in other areas continues to increase. The primary risk to watersheds on the Kaibab NF is uncharacteristic fire. Watersheds containing departed vegetation types are at higher risk of erosion, sedimentation and nonnative species invasion following uncharacteristic fire, as well as a downstream risk of sedimentation.

Desired Conditions for Soils

- Soils provide for diverse native plant species. Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration.
- Accelerated soil loss is minimal, especially on sensitive or highly erodible sites.
- Soils can readily absorb, store, and transmit water vertically and horizontally, accept, hold, release nutrients, and resist erosion.
- Infiltration rates are good in TES soil units that are described as well drained and moderately well-drained.
- Logs and other woody materials are distributed across the surface to maintain soil productivity.
- Biological soil crusts (mosses, lichens, algae, liverworts) are stable or increasing in semi desert grasslands, desert, pinyon-juniper, and sagebrush communities.

Desired Conditions for Watersheds

- Vegetation conditions within watersheds contribute to downstream water quality and quantity. Surface runoff, sheet, rill, gully erosion and subsequent sedimentation into connecting waters downstream is minimal.
- Flooding maintains normal stream characteristics (e.g., water transport, sediment, woody material) and dimensions (e.g., bankfull width, depth, slope, sinuosity). Vertical down cutting and embeddedness are absent in drainages.
- Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare.
- The fuels composition within watersheds does not put the watersheds at risk for uncharacteristic disturbance.
- Water quality meets or exceeds State of Arizona or Environmental Protection Agency water quality standards for designated uses. Water quality meets critical needs of aquatic species.

Guidelines for Soils and Watershed Management

- Projects should include design features to protect and improve watershed condition.
- In disturbed areas, erosion control measures should be implemented to improve soil conditions.

- Revegetation projects should use native species and locally collected seed when practicable.

Management Approach

Watershed protection was one of the primary reasons for establishing the national forests. Forested lands absorb precipitation, refill regional underground aquifers, sustain watershed stability and resilience, and provide aquatic and wildlife habitat. On the Kaibab NF, the highest risk to watersheds is uncharacteristic wildfire. Projects that reduce this risk and restore the natural vegetative and fuels composition also restore watersheds. As a result, the Kaibab National Forest uses an integrated management approach to make progress towards the soil and watershed desired conditions. Objectives to address these needs are found in the vegetation, nonnative species, and natural waters sections of this plan. With these and other activities the Kaibab NF generally employs Best Management Practices before, during and after activities to reduce or eliminate adverse effects.

The priority watersheds for restoration were identified on the Kaibab NF using the Watershed Condition Classification guide. The top six priority watersheds are Cataract Creek Headwaters , Coconino Wash Headwaters, Upper Hell Canyon, Upper Spring Valley Wash, Rock Canyon, and Slide Canyon. These priorities are expected to change over time with changed conditions, and new information.

Natural Waters

Streams, springs, groundwater, and other natural waters are centers of high biological diversity in arid landscapes, and the ecological health of these resources is important for forest ecosystem sustainability. Wildlife is more concentrated around open water sources than in the general landscape, and obligate aquatic and semi-aquatic species on the forest are sometimes entirely dependent on these limited and scattered water sources. Collectively, these resources contribute to connectivity for wildlife across the landscape. Springs are highly productive habitats in otherwise low-productivity arid landscapes. Springs are frequently more stable ecologically than surrounding upland ecosystems in arid regions, and may offer biological refugia for some species, particularly those that are narrowly endemic.

Natural waters provide water and food resources that are especially vital to wildlife; particularly birds, bats, and invertebrates. Springs have important traditional cultural significance to humans inhabiting arid landscapes. Contemporary uses include contributions to potable local and urban water supplies and agricultural uses such as livestock watering. These uses are vital to domestic and commercial interests in and around the forest. In addition, springs provide cultural and recreational opportunities.

Desired Conditions for Natural Waters

- Stream channel stability and aquatic habitats retain their inherent resilience to natural and other disturbances. Stream channel morphology reflects changes in the hydrological balance, runoff, and sediment supply appropriate to the landscape setting.
- Springs and ponds have the necessary soil, water, and vegetation attributes to be healthy and functioning. Water levels, flow patterns, groundwater recharge rates, and geochemistry are similar to reference conditions.
- Within its capability, stream flow and water quality are adequate to maintain aquatic habitat and water sources for native and selected nonnative wildlife.
- The necessary physical and biological components, including cover, forage, water, microclimate, and nesting/breeding habitat, provide habitat for a diverse community of plant and wildlife species.
- Riparian-dependent plant and animal species are self sustaining and occur in natural patterns of abundance and distribution. Native macroinvertebrates are appropriately abundant and diverse.
- Unwanted nonnative species do not exert a detectable impact on aquatic and wetland ecosystems.
- Native amphibians are free from or minimally impacted by nonnative predation and diseases.
- Springs, streams, and ponds have appropriate plant cover to protect banks and shorelines from excessive erosion.
- Hydrophytes⁵ and emergent vegetation exist in patterns of natural abundance in wetlands and springs in levels that reflect climatic conditions. Overhanging vegetation and floating plants such as water lilies exist where they naturally occur.
- Where springs or other natural waters have been modified for livestock and/or human consumption, developments are operational.
- The location and status of springs and water resources is known, organized, and available.

Objectives for Natural Waters

- Protect and/or restore at least 10 individual springs within 5 years of Plan approval.

Guidelines for Activities In and Around Natural Waters

- Access to natural waters should be restricted to designated trails and points of entry to mediate erosion and prevent trampling and inadvertent introduction of nonnative and undesirable biota and disease.
- Activities in and around waters should use decontamination procedures to prevent the spread of chytrid fungus.
- Fences constructed around natural waters should allow bats and other desirable wildlife to pass through unharmed.
- Diversions of water sources that recharge wetlands should be assessed and appropriate

⁵ A plant that grows only in water or very moist soil.

actions should be identified to mitigate or minimize effects.

- Spring source areas should be preferentially protected.
- Forest springs information should be maintained in a database that facilitates long-term archiving, easy data entry, and comparison with monitoring results.
- Water rights for springs should be secured where there are no existing water rights or claims.
- The impacts of management activities on springs, streams, and wetlands should be evaluated and minimized..

Management Approach

Due to the limited information available, forest efforts and emphasis are placed on improving knowledge on the distribution of water resources and aquatic or wetland biota, resource protection, and rehabilitation of springs, including groundwater flow and geochemical analyses. Potential management activities include fencing or other physical protections, restoration of diversions, and revegetation with native species.

Develop collaborative strategies and partnerships for spring inventory, assessment, restoration, monitoring, and research when appropriate. Use volunteers to maintain and improve fence exclosures and decrease agency maintenance costs.

The Forest Service and Arizona Department of Environmental Quality (ADEQ) share the common objective of improving and protecting the nation's waters. ADEQ serves as the designated management agency within the context of the Arizona Water Quality Management Program for all NFS lands within the Kaibab NF. The forest coordinates with ADEQ to ensure Forest Service projects meet the requirements of State Water Quality Management Plans and the Non-point Source Management Program developed pursuant to Federal regulations and the Clean Water Act.

To meet common objectives, the forest works with partners and stakeholders (i.e., Museum of Northern Arizona [MNA], Grand Canyon Wildlands Council [GCWC], The Nature Conservancy [TNC], Grand Canyon Trust [GCT], National Park Service [NPS], AZGFD, and USFWS) to develop a GIS layer of northern Arizona springs and seeps. Collaborate with stakeholders and use public education and outreach to garner support for spring restoration.

[See also [wetland / cienega](#) vegetation.]

Constructed Waters

Various water impoundments have been constructed for a variety of purposes including reservoirs, constructed lakes, and stock tanks on the Kaibab NF. Some of these constructed waters also provide unique riparian habitat for various wildlife species.

Desired Conditions for Constructed Waters

- Constructed waters provide safe access and egress for wildlife.
- Constructed waters do not contribute to the spread of diseases, unwanted nonnative species, or unnatural patterns of wildlife distribution.
- Reservoirs maintain high quality for parameters such as temperature, dissolved

oxygen, and water levels within the seasonal range of variable conditions.

- Artificial waters do not concentrate ungulate use in aspen stands. Desirable nonnative fish species provide recreational fishing opportunities in reservoirs and lakes consistent with the needs of native species.

Guidelines for Activities in or Near Constructed Waters

- In riparian aquatic areas, current protocols for preventing the spread of chytrid fungus should be followed.
- If new drinkers⁶ are necessary, they should be constructed in areas that reduce ungulate impact to sensitive vegetation or soils such as riparian, aspen, and wet meadow areas.
- Drinkers should be maintained to provide water during times of scarcity.
- Scholz Lake should not be managed for recreational sport fishing.

Management Approach

Work with Arizona Game and Fish, grazing permittees, and sporting groups to manage constructed waters. Improve understanding of whether and how drinkers, tanks, and other constructed water features influence wildlife distribution and movement.

Wildlife

Differences in past management history and topographical and geological conditions, particularly between the South Zone (Williams and Tusayan) Ranger Districts and the North Kaibab Ranger District provide for variation in wildlife distribution and habitat use. The spatially disjunct nature of the three districts influences movement patterns of wide-ranging mammal herds such as elk, mule deer, and pronghorn.

While the Forest Service has the ultimate responsibility over National Forest System lands, the Kaibab NF generally manages the wildlife habitat on NFS lands, the AZGFD is the lead agency responsible for managing wildlife populations in Arizona, and the U.S. Fish and Wildlife Service (USFWS) regulates threatened and endangered species and migratory species.

Most species habitat needs are addressed through management direction of vegetation and biogeologic conditions which provide quality habitat. The primary needs for threatened, endangered, and sensitive species are addressed through law, regulation, and policy (e.g., recovery plans and conservation agreements). As a result, this Plan contains limited species-specific direction.

Desired Conditions for Wildlife

- Wildlife species are distributed throughout their potential natural range.
- Habitat is available at the appropriate spatial, temporal, compositional, and structural levels such that it provides adequate opportunity for breeding, feeding, nesting, and carrying out other critical life cycle needs for a variety of vertebrate and invertebrate species.

⁶ Drinkers provide water for livestock in a contained, above-ground location.

- Species with specific habitat needs such as snags, logs, large trees, interlocking canopy, and cavities are provided for.
- Grasses, forbs, and shrubs provide forage, cover, fawning, and nesting sites.
- Interconnected habitats allow for movement of wide-ranging species and promote natural predator-prey relationships, particularly for strongly interactive species (e.g., mountain lions, prairie dogs).
- Habitat configuration and availability allow wildlife populations to adjust their movements (e.g., seasonal migration, foraging, etc.) in response to climate change and promote genetic flow between wildlife populations.
- Human-wildlife conflicts are minimal.
- Goshawk nest areas are multi-aged forests dominated by large trees with interlocking crowns and are generally denser than the surrounding forest.
- Hunting and other wildlife-based recreation opportunities exist, but do not compromise species populations or habitat.

Guidelines for Wildlife Management

- The recommendations in the Recovery Plan for the Mexican Spotted Owl and other threatened and endangered species should be followed.
- Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of wildlife, particularly raptors, Region 3 Sensitive Species⁷, and narrow endemics.
- A minimum of 6 nest areas (known and replacement) should be located per territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (NW to NE) aspects. Nest areas should generally be 25 to 30 acres in size.
- Goshawk PFAs (Post-fledging Family Areas) of approximately 420 acres in size should be designated surrounding the nest sites.
- Potentially disturbing project-related activities should be minimized in occupied goshawk nest areas during nesting season of March 1 through September 30.
- Potentially disturbing project-related activities should be restricted within 300 yards of active raptor nest sites between April 1 and August 15.

Management Approach

The Kaibab NF strives to create and maintain natural communities and habitats in the amounts, arrangements, and conditions capable of supporting viable populations of existing native and desired nonnative plants, aquatic, and wildlife species within the planning area, while contributing to broader landscape-scale initiatives where appropriate. This is accomplished in an integrative fashion by working closely with range, fire, timber, and other resource areas to coordinate and maximize activities for wildlife benefit.

⁷ Regional forester's Sensitive Species List for the Southwestern Region can be found at http://www.fs.usda.gov/detail/r3/plants-animals/?cid=FSBDEV3_022105

The forest also maintains strong partnerships between the State, other Federal agencies, academia, and non-government organizations to accomplish this task. Emphasis is placed on the protection of key habitats that contain threatened, endangered, and/or sensitive species of plants and animals. The forest works with the U.S. Fish and Wildlife Service and other partners to prevent listing, recovery, and de-listing of such species and improvement of critical habitats.

The forest continues to support the Arizona Game and Fish in various capacities directed toward managing wildlife and wildlife habitat. Areas for potential collaboration include (but are not limited to) achieving management goals and objectives specified in Arizona's State Wildlife Action Plan (SWAP), carrying out the cooperative agreement for the management of the Grand Canyon National Game Preserve, working closely with the Bureau of Land Management, Grand Canyon National Park, and Arizona Game and Fish in managing desert bighorn sheep, and working collaboratively with the Arizona Wildlife Linkages Workgroup to implement strategies identified in the Arizona Wildlife Linkages Assessment as well as the Coconino County Wildlife Corridor Assessment.

The forest cooperates with State, Federal, and non-government organizations to re-establish naturally occurring species which have been affected by anthropogenic activities. These include species such as the California condor, northern leopard frog, the Apache trout, and, where feasible and appropriate, the recovery and/or restoration of strongly interactive species within their historic range.

Cooperation with State and Federal wildlife management agencies should also help to minimize conflicting wildlife resource issues related to hunted, fished, and trapped species.

Potential climate change, drought, El Niño Southern Oscillation (ENSO), and the resulting potential effects of management activities are considered during project planning. Particular species that are sensitive to changes in weather may need special consideration. Changes in typical weather patterns can affect migration habitat use, breeding seasons, and fecundity (i.e., in hotter drier years, mitigations may be needed to reduce physiological stress on breeding wildlife). Climate change is an important consideration when designating recovery areas for wildlife species.

Rare and Narrow Endemic Species

Some species face threats simply by virtue of their relatively limited distribution. Species (or subspecies) are considered to have a restricted distribution if they are limited in extent in the Southwest. A species is considered to be a narrow endemic if it has extremely limited distribution and/or habitat in northern Arizona. Due to limited distributions and potential susceptibility to perturbations, some species may require specific management considerations. On the Kaibab NF there are 73 species for which restricted distribution is considered a threat; of these, 47 are narrow endemics (see appendix D for details).

Desired Conditions for Rare and Narrow Endemic Species

- Habitat and refugia are present for narrow endemics or species with restricted distributions and/or declining populations.
- Location and conditions of rare and narrow endemic species are known.

Guidelines for Rare and Narrow Endemic Species

- Project design should incorporate measures to protect and provide for rare and narrow endemic species where they occur.

Management Approach

Species-specific information and management recommendations can be found in the Kaibab NF endemic species guidebook, which is to be maintained as a living document, updated with new information and locations as they become available.

[See also [natural waters](#); [caves, karsts, and mines](#); [cliffs and rocky features](#); [Pediocactus Conservation Area](#); and [Arizona Bugbane Botanical Area](#)]

Nonnative Invasive Species

Invasive species threaten native species, ecosystem function, and the quantity and quality of forest goods and services. The primary invasives are plants such as bull thistle, cheatgrass, knapweeds, and Dalmatian toadflax. These plants have made significant increases in their overall population size in the Plan area over the last 10 years. Leafy spurge, yellow starthistle, and the knapweeds (Russian, diffuse, and spotted) are of particular concern due to their invasiveness. These plants tend to outcompete native plants and form monocultures. Invasive weeds have been documented to alter soil temperature, soil salinity, water availability, nutrient cycles and availability, native seed germination, infiltration and runoff of precipitation, fire severity and frequency. The alteration of physical conditions and disturbance regimes allow the invasive species to spread farther. The forest also has known populations of invasive animals including bull frogs and crayfish, which have the potential to adversely affect ecosystem function.

Desired Conditions for Nonnative Invasive Species

- Invasive species are contained and/or controlled so that they do not disrupt the structure or function of ecosystems.
- Visitor experiences are not adversely impacted by the presence of invasive species.

Guidelines for Nonnative Invasive Species

- All ground-disturbing projects should assess the risk of noxious weed invasion and incorporate measures to minimize the potential for the spread of noxious and invasive species.
- New populations should be detected early, monitored, and treated as soon as possible.
- Treatment approaches should use Integrated Pest Management (IPM) practices to treat noxious and nonnative invasive species. IPM includes manual, biological, mechanical, and herbicide/pesticide treatments.
- Use of pesticides, herbicides, and biocontrol agents should minimize impacts on non-target flora and fauna.

Management Approach

Strategies to prevent the spread of nonnative invasive weeds include education, inventory, and control guidelines. Educational programs that increase weed awareness are critical to effectively manage weeds. Weed treatments focus on those species that pose the greatest threat to biological diversity and watershed condition. To effectively manage invasive weed populations, it is important to coordinate with other agencies, grazing permittees, and adjacent land owners to prevent and control weeds.

Invasives are most effectively managed through prevention and the use of best management practices. Many of these practices avoid activities that would provide vectors for nonnative species to spread (e.g., water and vehicles used in fire suppression).

Air Quality

The goal of air quality management is to meet human health standards, to meet visibility goals in areas of high scenic value, and to address and respond to other air quality concerns, such as nuisance smoke.

Human health standards are defined in the National Ambient Air Quality Standards (NAAQS) set by the Environmental Protection Agency (EPA) for seven pollutants considered harmful to public health: carbon monoxide, lead, nitrogen dioxide, particulate matter 10 microns in size or smaller (PM₁₀), particulate matter 2.5 microns in size or smaller (PM_{2.5}), ozone, and sulfur dioxide. Population centers with the potential to be impacted from management activities on the Kaibab NF are Sedona and the Sedona/Verde Valley, Flagstaff, Williams, Parks, and Tusayan. The Sedona/Verde Valley is carefully monitored as it receives diurnal air drainage from the Prescott, Kaibab and Coconino National Forests. To protect visibility in the national parks and wilderness areas of high scenic value, Congress designated all wilderness areas over 5,000 acres and all national parks over 6,000 acres as mandatory Federal Class I areas in 1977, subject to the visibility protection requirements in the Clean Air Act. The Class I areas most likely to be impacted by activities on the Kaibab NF are Grand Canyon National Park and Sycamore Canyon Wilderness Area.

EPA defines nuisance smoke as the amount of smoke in the ambient air that interferes with a right or privilege common to members of the public, including the use or enjoyment of public or private resources. Complaints of the odor or soiling effects of smoke, poor visibility, and impaired ability to breathe or other health-related effects are common examples. While no laws or regulations govern nuisance smoke, it effectively limits opportunities of land managers to use fire. Public outcry regarding nuisance smoke often occurs long before smoke exposures reach levels that violate NAAQS. The areas of particular concern for nuisance smoke from wildland fire on the Kaibab NF are the Sedona/Verde Valley, Flagstaff, Williams, Parks, Tusayan, Grand Canyon National Park, and Sycamore Canyon Wilderness Area.

Coconino County enjoys good air quality. Few pollution sources, such as large metropolitan areas, industry, or power plants exist in Northern Arizona, contributing to its reputation for clean air. Air quality in the airsheds Kaibab NF shares with lands of other ownership experiences some impacts from emission sources and processes off-forest, such as pollution from distant metropolitan communities, or industrial activities on lands of other ownership. These impacts are outside the scope of forest management control.

Road dust has not been demonstrated to be a measurable contributor on a regional level to visibility in the 16 Class I areas located on the Colorado Plateau (ADEQ 2003). Although road

dust has been a localized issue associated with implementation of some projects in the past, it has been addressed with site-specific mitigation measures.

Temporary decreases in air quality from management activities on the Kaibab NF are primarily from prescribed burns. Wildfires originating on the forest also produce emissions. The NAAQS pollutant of concern from wildland fire is fine particulate matter, both PM₁₀ and PM_{2.5}. Studies indicate that 90 percent of smoke particles emitted from wildland fires are PM₁₀, and about 90 percent of PM₁₀ is PM_{2.5}. Because of its small size, PM 2.5 has an especially long residence time in the atmosphere and penetrates deeply into the lungs.

Ozone is also a NAAQS pollutant. Levels are increasing, and are trending up in northern Arizona. Smoke from prescribed burns and wildfires may contribute to ozone formation under certain weather conditions, but prescriptive criteria that land managers can use to minimize ozone creation do not yet exist.

The same fine particulate matter that poses health risks is also largely responsible for visibility impairment. The State of Arizona has developed a State implementation plan with long-term strategies to make “reasonable progress: in improving visibility in Class I areas inside the state and in neighboring jurisdictions (US EPA 1999),” and focuses on anthropogenic sources of emissions. Smoke and visibility impairment from wildland fire that closely mimics what would occur naturally is generally acceptable.

The public will tolerate several days of nuisance smoke in a row, and up to several weeks total a year, but even the most supportive have tolerance limits. Public acceptance of smoke varies greatly from year to year. Acceptance of smoke from prescribed burns and beneficial wildfires is high following seasons with high-profile, high-severity events, and during extremely dry years when the threat of large, high-severity incidents is elevated. Conversely, acceptance wanes during wetter years when the threat of uncharacteristic fires is low.

Federal agencies in Arizona fund a Smoke Management Group that is housed in the Arizona Department of Environmental Quality (ADEQ) offices. This group assembles and coordinates planned burning activities from all Federal agencies on a daily basis, and works closely with officials in ADEQ to approve or disapprove burning activities to help ensure compliance with both health standards and visibility goals.

Much of the forest is departed from its historic fire regime. By not burning periodically, accumulated fuels contribute to a greater amount of emissions when large uncharacteristic severe wildfires occur. Prescribed burns, are implemented when ventilation conditions are favorable to reduce the concentration of emissions, and other emission-reduction techniques are used when feasible. They generally produce far fewer emissions than the uncharacteristic severe wildfires they are designed to deter. On wildfires that are managed for resource objectives, management ignitions are used to protect values at risk by consuming fuels around them, to assist in confining the fire to the desired fire area, to modify fire intensity, and even to manage smoke production. On these wildfires, timing of these management ignitions are often at the fire manager’s discretion, and they can also be performed when ventilation conditions are favorable. Over time, as fire re-entry occurs, the reduced fuel load will result in lower emissions per acre when burned.

Desired Conditions for Air Quality

- Air quality meets all State and Federal ambient air quality standards.
- Management activities on the Kaibab National Forest do not adversely impact Class I airshed visibility as established in the Clean Air Act.

Guidelines for Air Quality

- Project design for prescribed burns and strategies for managing wildfires, should incorporate as many emission reduction techniques as feasible, subject to economic, technical, and safety criteria, and land management objectives.
- Decision documents, which define the objectives and document line officer approval of the strategies chosen for wildfires, should identify smoke sensitive receptors, and identify appropriate objectives and courses of action to minimize and mitigate impacts to those receptors.

Management Approach

Public tolerance for nuisance smoke, rather than law, regulation, or policy, effectively sets the social limit to the number of acres that can be treated with wildland fire. Community public relations and education, coupled with pre-burn notification, greatly improve public acceptance of fire management activities. In order to maintain public support for prescribed burns and the use of wildfires to accomplish resource benefits, it is important for land managers be responsive to the public's tolerance thresholds to balance ecological benefits with social and economic values.

Caves, Karst, and Mines

Caves, karst, and mines provide habitat for species, particularly bats, that require specialized niches for roosting and overwintering. Bats are important to cave ecosystems, especially large roosts. Cave ecosystems rely almost entirely on the surface for nutrients. As a result, bats deposit considerable amounts of surface nutrients into caves via guano. Because of this, the presence of bats can support an entire ecosystem. Consequently, cave-roosting bats are often considered keystone species. Eighteen bat species are known to regularly use caves in the American Southwest, and Arizona is home to all cave-roosting bats occurring in the Southwest. Many caves also have important traditional cultural significance to area tribes.

Desired Conditions for Caves, Karst, and Mines

- Caves maintain moisture and temperature levels consistent with reference conditions.
- Archeological, geological, and biological features of caves and mines are not disturbed by visitors.
- Caves, karst features, and abandoned mines provide quality habitat for bat species. Disease is within natural levels.
- Mine closures do not compromise habitat for species that require specialized niches for roosting and overwintering (e.g., bats).

Guidelines for Managing for Caves, Karst, and Mines

- Project design should include protections for subsurface geologic features where they occur.
- When entering caves or mines, decontamination procedures should be followed for preventing the spread of white-nose syndrome (WNS; *Geomyces destructans*).
- Caves containing endemic species should be managed for the protection of those species over other uses.

- Before closing caves or mines, they should be inspected to determine if bats are using these areas. If roost sites are present, closure structures should allow bats to continue to use the cave or mine, such as wildlife friendly bat gates that meet the most current recommendations.

Management Approach

Currently, neither the cause nor the transmission of WNS are well understood; however, it is known that a cave or abandoned mine environment containing this fungus is infectious to hibernating bats. To ensure that management activities are using the best available information the Kaibab NF has been collaborating with the USFWS, Bat Conservation International the AZGFD, and others to address conservation management for bat species, including the development of a response plan for WNS. A complete inventory of caves and associated endemic species may be needed on the Kaibab NF to inform management.

Additionally, strategies include working with public affairs, recreation, invasive species, cave and mine staffs; and State and other Federal agency partners; involved publics, such as local caving groups; to internally and externally increase WNS awareness at local and regional levels.

Cliffs and Rocky Features

Desired Conditions for Cliffs and Rocky Features

- Cliff ledges provide cover and nesting habitat for wildlife such as the American peregrine falcon, California condor, snakes, bats, birds, and small mammals.
- Rocks and rocky areas promote seedling germination and maintain cover for vertebrate and invertebrate species.
- Rock climbing and related recreational activities do not disrupt the life processes of rare or threatened species or diminish the function of specialized vegetation, such as mosses, lichens, and fleabanes.
- Rockslides and talus slopes are natural, undisturbed features that provide habitat for wildlife such as lizards, snakes, and land snails.

Guidelines for Activities On or Near Cliffs and Rocky Features

- Activities involving heavy machinery or blasting should minimize impacts to habitat associated with rocky features and cliffs.
- Near known active raptor nest sites, temporary closures and use restrictions should be implemented for rock climbing and other potentially disruptive activities.
- Where recreation activities have the potential to trample known populations of narrow and endemic plant species, signs should be posted educating the public to stay on designated trails and avoid impacts.
- Talus slopes should be surveyed for endemic species prior to authorizing quarrying, rock hounding, or construction activities that may alter them.

Cultural Resources

The Kaibab NF is rich in historically and culturally significant resources. To date, approximately 30 percent of the forest has been surveyed for cultural resources and over 9,600 historic properties have been identified and documented. These historic properties are related to a long history of human occupation and use of the forest dating back at least 12,000 years. Such sites include preceramic lithic scatters associated with Archaic hunter-gatherers, pithouse and masonry structures associated with early farmers, historic sites related to Native American and early Anglo-European use of the area, numerous petroglyph and pictograph sites, and traditional cultural properties. Forty-four historic properties on the Kaibab NF have been listed to the National Register of Historic Places for their historic significance and more than 2,400 additional sites have been determined to be eligible for inclusion to the National Register.

Desired Conditions for Cultural Resources

- Cultural resources including known traditional cultural properties, are preserved, protected, or restored.
- Historic artifacts are preserved in situ or, when necessary, curated following current standards.
- All historic properties are evaluated for their eligibility to the National Register and properties that are appropriate are listed to the National Register of Historic Places.
- Cultural resource findings will be synthesized and shared with the scientific community and public through formal presentations, publications, and educational venues.
- Public understanding about the cultural resources and historic preservation issues contribute to their protection.
- The forest's historic documents, including photographs, maps, journals, and Forest Service program management records, are available to the public for research and interpretation.

Objectives for Cultural Resource Management

- A "Passport in Time"⁸ project is hosted every year.
- At least 20 interpretive presentations are provided to the public each year.
- Non-project-related cultural resource survey is conducted in areas with a high likelihood of historic properties on at least 100 acres per year.

Guidelines for Cultural Resources Protection

- The purposeful excavation of human remains for educational purposes such as research or field schools should not be permitted.
- For archaeological projects with the potential to address the culture history of area

⁸ Passport in Time (PIT) is a volunteer archaeology and historic preservation program of the USDA Forest Service. PIT volunteers work with professional Forest Service archaeologists and historians on national forests throughout the United States on activities such as archaeological survey and excavation, rock art restoration, surveys, archival research, historic structure restoration, oral history gathering, and analysis and curation of artifacts. For more information, visit: <http://www.passportintime.com/>.

tribes, the forest should ensure that such projects address topics of known importance to tribes.

Management Approach

Kaibab NF has been and will continue to work to identify, evaluate, and protect cultural resources. Collaborative partnerships and volunteer efforts that will assist the forest in historic preservation will be developed and maintained. The forest uses a proactive approach in protecting cultural resources from adverse impacts and conducts outreach to educate the public on the history of the Kaibab NF and historic preservation issues. Partnerships with federally recognized tribes help to protect ancestral sites and manage cultural resources through meaningful collaboration. Memoranda of understanding with federally recognized tribes promote strong working relationships by addressing issues of mutual concern.

Traditional Cultural Properties

A traditional cultural property (TCP) is a type of historic property under the National Historic Preservation Act defined as “eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community’s history, and (b) are important in maintaining the continuing cultural identity of the community.” In northern Arizona, TCPs are predominantly, but not necessarily, associated with American Indian tribes or communities.

Desired Conditions for Traditional Cultural Properties

- Traditional practitioners have access to TCPs for ceremonial use and privacy to conduct ceremonies.
- TCPs are preserved, protected, or restored for their cultural importance and are generally free of impacts from other uses.
- The significant visual qualities of TCPs are preserved consistent with the TCP eligibility determination.
- Traditional use of TCPs by the associated cultural groups is accommodated.
- Confidential and or sensitive information regarding TCPs is protected.

Guidelines for Traditional Cultural Properties

- Development of new facilities and commercial and recreational activities should be minimized in TCPs.
- Consultation with federally recognized tribes should be conducted for all proposed special use permits within TCPs.

Management Approach

In order to achieve and maintain the desired conditions for TCPs, the forest continues to identify, evaluate, and protect TCPs and work with associated communities to collaboratively manage TCPs by developing programmatic agreements, management plans, memoranda of understanding, or other management tools. The forest accommodates and facilitates traditional use of TCPs

important to maintaining the continuing cultural identity of associated communities. The forest takes an active role in educating the public on the importance of TCPs and issues related to their management while protecting confidential and/or sensitive information regarding TCPs.

[See also [*traditional and cultural uses*](#), [*Kanab Creek Wilderness*](#), [*Bill Williams Mountain Management Area*](#), and [*Red Butte Management Area*](#) sections of this Plan.]

Forest Uses, Goods, and Services

NFS Lands were reserved with the intent of providing multiple uses, goods, and services to satisfy public needs over the long term. The following sections describe the desired conditions and strategies for meeting this intent.

Recreation and Scenery

The natural, cultural, and scenic environments of the Kaibab NF offer settings for a wide range of high-quality recreation opportunities. The forest provides quiet, mountain, forested, and high desert places to escape from urban environments and pursuits and enjoy cooler temperatures. Cultural features provide historic context to the natural scenery, adding to the richness of these places. Scenic areas and associated outdoor recreation provide places to hike, bike, fish, hunt, view wildlife, drive for pleasure, and enjoy the peace, quiet, and spiritual values of nature. The forest provides both frontcountry and backcountry opportunities.

The frontcountry is composed of outdoor areas that are easily accessible by vehicle and heavily visited by day-users. Frontcountry locations include developed areas, tend to be more crowded, and attract a wider range of visitor than backcountry. Recreation opportunity spectrum (ROS) classes of Urban, Rural, some Routed Natural and Routed Modified characterizes frontcountry areas.

Backcountry recreational areas are more remote and are not as easily accessed as frontcountry areas. They are used primarily by overnight visitors (i.e., backpackers). ROS classes of Semi-primitive Motorized, Semi-primitive non-motorized, primitive, and some Routed Natural and Routed Modified designations characterize backcountry areas. See chapter 4 for more information on recreation suitability and for ROS maps of the Kaibab NF.

Desired Conditions for Recreation and Scenery

- The forest provides a range of recreation opportunities for forest users and is balanced with the ability of the land and management to support them.
- Recreation use levels are compatible with other resource values including scenery, cultural, soil, vegetation, water, wildlife. The biological, cultural, recreation, and scenic environment is sustained and enhanced for present and future generations.
- The forest provides a diverse range of high-quality, sustainable recreation settings and corresponding high-quality scenery consistent with public demand and resource capability, emphasizing locally popular dispersed and developed recreation places and those important to the tourism industry.
- Conservation education actively engages children and adults. Recreationists recognize their part and share in the responsibility for conserving natural and cultural resources.
- A sustainable recreation program contributes to local economies, jobs, and valued ways of life.
- Information and education programs are provided and result in increased forest stewardship, partnerships, and volunteerism.
- A variety of hiking opportunities exist.
- Opportunities for off-highway vehicle (OHV) riding and driving for pleasure are available on the designated system of NFS roads and motorized trails. OHV use is compatible with non-motorized recreation.

- User conflicts are infrequent.

Desired Conditions for Recreation – Frontcountry

- Frontcountry areas provide initial contact points for forest users and developed recreation settings where people can engage in a variety of recreation activities including scenic driving, hiking, camping, picnicking, fishing, and boating. Motorized and non-motorized recreation opportunities are available.
- Recreation settings retain high to moderate scenic quality. Some human-influenced elements in the background are present.
- Service centers such as district offices, visitor information centers, developed campgrounds, and other staffed recreation sites provide information and services in communities and along primary forest access corridors and scenic byways.
- Frontcountry areas are safe, orderly, and capable of supporting moderate to high visitor use.
- Formal interpretive programs are provided, as well as opportunities for self-guided nature study.
- Constructed facilities in frontcountry settings provide for user comfort and resource protection. They blend in with the surrounding landscape and often incorporate naturally occurring or natural appearing materials. The number and size of constructed facilities is appropriate for the use and activities that occur at each site.
- Developed campgrounds meet the needs of vehicle-based camping. The overall capacity of campgrounds meets demand at high-use seasons including large groups.
- Artificial and modified natural waters provide opportunities for fishing, picnicking, natural quiet, wildlife viewing, and in some cases, for camping and boating.
- The existing recreation term permits such as golf courses, ski lodges, and resorts are economically viable and adequately serve forest visitors so that no new ones are needed.

Desired Conditions for Recreation – Backcountry

- Backcountry areas are mostly undeveloped places where people engage in a variety of more primitive recreation activities. Visitors rely on their outdoor skills and provide their own equipment as they engage in recreation activities.
- Main access corridors to NFS lands and contact points such as developed trailheads and observation points have information available and provide a transition and orientation place for forest users as they enter backcountry areas. Visitor use in these areas is moderate and disperses from these points.
- Facilities are few in number, use the minimal area needed, and have simple construction designs that blend in with the surrounding area and are made of native materials or other well matched materials. Constructed facilities provide for natural resource protection.
- Informal pullouts and minimal signing provide access to areas such as a forest trail, a walk to a scenic vista, or wildlife viewing location.
- Users have low to occasional contact with other visitors and Forest Service personnel.

- Visitors can find information about available recreation opportunities in the area. Informal interpretive and educational information is available at secondary visitor contact points and focus on appropriate use of the Kaibab NF and incorporate natural and cultural resource conservation messages.
- Backcountry recreation settings retain high to moderate scenic quality.
- Areas adjacent to private land, wilderness, some backcountry areas (semi primitive non-motorized, semi-primitive motorized) provide opportunities for natural quiet and spiritual values.
- Visitors have access to information that enriches their recreation experiences and contributes to an understanding of their role in public land stewardship. “Leave No Trace,”⁹ “Tread Lightly”¹⁰ and archeological resource protection principles are promoted and practiced by the visiting public.
- Forest visitors are familiar with natural processes and the evolving role of humans in natural systems.

Standards for Recreation Activities

- Areas within a half mile of developed campgrounds, cabin rentals, administrative sites, and the East Rim Overlook are closed to dispersed camping¹¹.
- The maximum allowable occupancy of NFS lands within the Kaibab National Forest is 14 out of any 30 consecutive days, except as allowed by permit.

Guidelines for Activities Affecting Recreation and Scenery

- Any new motorized trailheads should be located in frontcountry areas, incorporate or convert existing roads, protect open space, and protect natural and cultural resources.
- Group uses should be concentrated in frontcountry areas.
- Resource impacts should be reduced in front and backcountry areas by directing camping to existing dispersed campsites or establishing new designated campsites.
- Pack-it-in pack-it-out practices should be used in all Forest Service managed facilities and dispersed sites not managed under permit.
- The Kaibab National Forest Recreation Opportunity Spectrum and Scenery Management Handbook (KNF 2004)¹² and Built Environment Image Guide should be used for recreation management and project design.

⁹ “Leave No Trace” is a program that strives to educate all those who enjoy the outdoors about the nature of their recreational impacts as well as techniques to prevent and minimize such impacts.

¹⁰ “Tread Lightly” is a program designed to “promote responsible outdoor recreation through ethics education and stewardship” (<http://www.treadlightly.org>). The program is framed under five principles: 1) travel responsibly; 2) respect the rights of others; 3) educate yourself; 4) avoid sensitive areas; and 5) do your part by modeling appropriate behavior, properly disposing of waste, etc.

¹¹ Implementation and enforcement of this standard would require a closure order.

¹² The Kaibab NF Recreation Opportunity Spectrum/Scenery Management System (ROS/SMS) Guidebook (KNF 2004) provides detailed information about applying the Recreation Opportunity Spectrum in the management of outdoor recreation settings and the Scenery Management System and its related scenic integrity levels on the forest.

- In areas with high scenic integrity objectives, only minimal alterations from landscape character goals described in the desired conditions should be allowed.
- In areas with moderate scenic integrity objectives, only slight alterations should be allowed, which ensure that deviations remain visually subordinate to the landscape character.
- In areas with low scenic integrity objectives, only moderate alterations should be allowed.¹³

[See also guidance for recreation resource management in [special uses](#), [transportation and forest access](#), [recreation suitability](#), [developed recreation sites](#), and [Bill Williams Mountain Management Area](#) sections of this Plan.]

Management Approach

Recreation management decisions on the KNF are guided by three primary approaches. These approaches are aimed at providing managers a more complete framework within which to consider management actions. Their purpose is to minimize increased development levels in remote settings and to protect and manage both low and high use areas and facilities. These approaches guide actions in response to changing or increasing use.

1. Provide a range of recreation opportunities. Above all, to manage in a way that maximizes the opportunities available to all types of recreationists, to the degree allowed by this plan and other agency regulations.
2. Concentrate use at specific sites or locations rather than dispersing use within the area or to other areas. In keeping with the principles of recreation ecology, this approach would assure that impacts associated with recreational use are constrained to particular areas.
3. Minimize the extent to which forest management actions disperse use from high to low use areas. This would help accomplish the goal of constraining the number and size of areas impacted by recreational use where possible.

The ultimate goal of these approaches is to maintain our visitors' perceived freedom to recreate how and where they choose, while retaining healthy, sustainable public lands. Application of the approaches is primarily accomplished through collaborative education efforts first, and by regulation and enforcement only when necessary. When impact and user capacity questions arise, indicators and standards methods help to determine how and where to allocate visitor use. These approaches would not preclude the forest from developing new sites or adapting old sites to accommodate new uses, provided appropriate analyses are conducted to make those decisions.

As the population in Northern Arizona and the popularity of mountain biking and OHV use continue to grow, the pressure for more trails will likely increase. Any new trail development needs to strike a balance between opportunities for different types of recreation and other resource concerns. Due to the nature of motorized, equestrian, and bicycle trail use, regular maintenance is needed. Partners, volunteers, and a potentially a fee system could help to provide

¹³ Descriptions of the terms "minimal," "slight," and "moderate" can be found in Agricultural Handbook Number 701, "Landscape Aesthetics: A Handbook for Scenery Management." In general, "minimal" means deviations are not evident because they closely follow the form, line, color, texture, and pattern common to the landscape character; "slight" means that noticeable deviations are subordinate to the landscape character being viewed; and "moderate" means deviations may begin to dominate the landscape but borrow from the characteristics of the valued landscape character.

increased capacity and revenue for maintenance materials, operation, education and enforcement of regulations.

Many forest users have expressed concerns about recreation use impacts and a desire for opportunities to engage in shared stewardship of the forest. With limited forest service budgets, and increased pressure volunteers and partners play will like play an increasing important role in helping to construct and maintain trails, and manage dispersed camping, especially at popular areas such as viewpoints.

The Kaibab places emphasis in its specific niches. As such, recreation opportunities on the North Kaibab Ranger District emphasize dispersed recreation, non-motorized trail and wilderness opportunities, while on the Williams and Tusayan Districts, the recreation emphasis is on day-use areas, developed recreation opportunities and facilities such campgrounds.

Traditional and Cultural Uses

The Kaibab NF recognizes that area tribes have cultural ties and knowledge about lands now managed by the Forest Service, and that they have important roles in the stewardship of the land. Tribes with aboriginal territories and traditional ties to the land now administered by the forest include the Havasupai Tribe, the Hopi Tribe, the Hualapai Tribe, the Kaibab Band of Paiute Indians, the Navajo Nation, the Yavapai-Prescott Indian Tribe, and the Pueblo of Zuni. The Kaibab NF shares boundaries with the Havasupai and Navajo reservations and is in close proximity to numerous tribal communities. Tribal members visit the Kaibab NF to gather medicinal plants and for other traditional and cultural purposes. The forest recognizes the importance of maintaining these traditions to area tribes and accommodates traditional use of the forest by American Indians compliant with existing laws and regulations.

Desired Conditions for Traditional and Cultural Uses

- Traditionally used resources are not depleted and are available for future generations.
- Tribal members have access to sacred sites for individual and group prayer and traditional ceremonies and rituals. There are opportunities for solitude and privacy for ceremonial activities.
- Traditional uses such as the collection of medicinal plants and wild plant foods are valued as important uses.
- The forest provides a setting for educating tribal youth in culture, history, and land stewardship, and for exchanging information between tribal elders and youth.

Guidelines for Traditional and Cultural Uses

- Activities and uses should be administered in a manner that is sensitive to traditional American Indian beliefs and cultural practices.
- The temporary closure authority should be used to accommodate traditional use.
- Tribal traditional use of medicinal plants and other botanical resources should take priority over applications for commercial harvesting.
- Important traditional use resources should be monitored to ensure healthy sustainable plant populations are available for traditional uses.

Management Approach

Establishing and maintaining strong, mutually beneficial working relationships with tribes is critical to the future success of the forest in addressing tribal issues related to land management. Because all lands managed by the forest were once tribal lands, the Forest uses a shared stewardship approach to land management based on meaningful consultations with area tribes. The forest and area tribes have a mutual interest in maintaining healthy, sustainable populations of plants and other resources important for traditional and cultural purposes.

The Kaibab NF continues to work with tribes to identify, collaboratively manage, and monitor these resources and supplement the forest plant guidebook to contain more detailed information about culturally important plants. The forest works to accommodate traditional use of the forest and balance traditional use needs of tribes with the long-term protection of forest resources. Tribal relationships and communication may be enhanced through volunteer opportunities and employment of tribal members. The forest works with other land managers to develop consistent and clear policy across boundaries regarding traditional use whenever possible.

Livestock Grazing

Western lifestyles associated with ranching and livestock grazing have long been a part of the landscape. These historic and contemporary uses have become symbols of independence and contribute to the sense of place. Many people living in the local communities participate in or have connections to ranching and identify with the associated values.

During World War II, Congress demanded as much protein production as possible from rangelands, and many areas were grazed unsustainably. Kaibab NF made major reductions in authorized livestock from the 1950s through the 1970s in an effort to balance forage production with capacity. Further adjustments to grazing management have been made through site-specific NEPA analysis and decisions on all allotments. Currently, the forest manages the range resource to balance livestock numbers with forage capacity.

Desired Conditions for Livestock Grazing

- There are opportunities to engage in ranching activities and graze livestock on NFS lands, which contribute to the social, economic, cultural and stability of rural communities.
- Grasses and forbs provide adequate forage for permitted livestock consistent with other desired conditions.
- Allotment fencing allows for passage of animals prone to movement restrictions such as pronghorn.

Guidelines for Livestock Grazing

- Livestock management should favor the development of native cool season grasses and forbs.
- As grazing permits are waived back to the forest, they should be evaluated for conversion to forage reserves to improve flexibility for restoring fire-adapted ecosystems and range management in times of drought.
- New construction and reconstruction of fences should have a barbless bottom wire that is at least 18 inches high.

- Annual operating instructions for livestock grazing permittees should ensure livestock numbers are balanced with capacity and address any relevant resource concerns (e.g., forage production, weeds, fawning habitat, soils, etc.).
- Post-fire grazing should not be authorized until Forest Service range staff confirms range readiness (see glossary).
- Livestock use in aspen areas should be authorized at levels that are consistent with the desired conditions for aspen regeneration and establishment.
- Livestock use in and around wetlands should be evaluated on an allotment-specific basis. Mitigation measures such as deferment and fencing (full or partial) should be implemented as needed to minimize potential livestock effects.
- The concentrated use of montane meadows for livestock grazing should be minimized when soils are saturated to reduce grassland impacts. When no other options are available, use should be rotated annually.
- Rights to the Rain Tank Grazing Allotment should be first offered to the Havasupai tribe if a permit becomes available.

Management Approach

Adaptive management is being used in the forest's recent rangeland management projects by using monitoring to adjust management to maintain and improve the rangeland resources. In general, the Kaibab NF continues to keep grazing at conservative use levels (30 to 40 percent). This grazing intensity, based on percent use of forage by weight, should provide for plant integrity, density, diversity, and regeneration over time.

To make adjustments for changing conditions, the annual operating instructions are reviewed. Numbers may go up and down annually, but do not exceed the number set in the grazing permit. The annual operating instructions are the means by which adjustments of livestock numbers, change of season of use, and pasture rest periods are made in response to monitoring information such as frequency, canopy cover, Parker Three-Step plots and allotment inspections. Grazing intensity (measured before the end of the growing season) in combination with other factors such as weather patterns, likelihood of plant regrowth, and previous years' utilization levels is used in determinations. Projects involving new or modified fences, corrals, salt stations, and artificial water sources promote healthy wildlife interaction and movement. Deferred-rotation grazing with a special emphasis of deferment during the spring may be necessary to manage toward desired conditions.

[See also the desired conditions for the relevant vegetation types.]

Forestry and Forest Products

NFS Lands were reserved with the intent of providing goods (including production of a sustainable supply of forest products) and services to satisfy public needs over the long term. The Forest Service focus has broadened over time, and the desired conditions for this Plan are focused on outcomes rather than outputs. As a result, no specific timber volume outputs are desired for the forest. Rather, timber production activities are tools that economically contribute to restoring and maintaining ecosystem diversity and supporting a viable wood products processing industry over the long term. Therefore, some level of regulated forest production is appropriate from forested lands.

Loss of the region's wood harvesting and utilization infrastructure has been a critical impediment to implementing large-scale mechanical thinning treatments necessary for prompt and effective restoration of fire-adapted forests. Although there are initial signs of emerging small-scale operations, the development of a competitive market for the wood fiber removed by restoration-based treatment is needed. Without establishment of a viable industry, it is unlikely that forest restoration will occur on a scale that will produce the needed widespread improvements in ecological health or reduction in the risk of anomalous, high-intensity wildfire.

Desired Conditions for Forestry and Forest Products

- Wood products (e.g., wood pellets for home and industrial heating, oriented strand board, animal bedding, wood molding, pallets, structural lumber, firewood, post and poles, biomass for electricity) and other products (e.g., Christmas trees, boughs, wildflowers, mushrooms, grasses, seeds, nuts, cones, etc.) are available to businesses and individuals in a manner that is consistent with other desired conditions on a sustainable basis within the capacity of the land.
- A sustainable supply of wood is available to support a wood harvesting and utilization industry of a size and diversity that can effectively and efficiently restore and maintain the desired conditions for ponderosa pine and frequent fire mixed conifer communities.
- Wood products are available to local tribes for traditional uses.

Guidelines for Forestry and Forest Products

- Timber harvest activities should be carried out in a manner consistent with maintaining or making progress toward the desired conditions in this Plan.
- Harvesting systems should be selected based on their ability to meet desired conditions and not on their ability to provide the greatest dollar return.
- On lands classified as not suited for timber production, timber harvesting should only be used for making progress toward desired conditions or for salvage, sanitation, public health or safety.

Guidelines for Personal Fuelwood Collection

The following should be permitted for personal-use fuelwood gathering:

- Dead and downed ponderosa pine, Douglas-fir and spruce, juniper, pinyon pine, Gambel oak, or aspen.
- Standing dead:
 - Ponderosa pine, Douglas-fir or spruce less than 12 inches d.b.h. or less than 15 feet in total height
 - Juniper without green foliage
 - Pinyon pine less than 12 inches diameter at root collar (DRC) or less than 12 feet in height
 - Gambel oak less than 8 inches DRC
 - Aspen less than 12 inches d.b.h.
- Live trees specifically designated by the Forest Service.

Management Approach

Mechanical tree removal and burning treatments need to effectively make progress toward the desired conditions and are intended to retain characteristics of desired conditions for at least 20 years. The objectives in this Plan would mechanically thin 11,000 to 19,000 acres in ponderosa pine and another 1,200 to 2,400 acres annually in the dry mixed conifer type forestwide.

This restoration work in ponderosa pine and dry mixed conifer PNVTs is anticipated to be implemented using a combination of prescriptions to meet desired conditions including free thinning all sizes to a target basal area, group-selection cuts with matrix thinning to a target basal area, individual tree selection, and thin from below. Implementation of the proposed mechanical thinning treatments across the forest would result in a significant supply of wood that could support a wood harvesting and utilization industry and help pay for treatments.

The amount of wood that is estimated to be available for sale from the suitable land within the plan area for the first decade of plan implementation is called the Allowable Sale Quantity (ASQ). The ASQ is better described as the “average allowable sale quantity” because it may be exceeded in a given year as long as the ten-year average is not exceeded. For this plan, the ASQ is 107,815 CCF (hundred cubic feet).

Once the desired conditions are met, the amount of wood that can be sustained from lands being managed for timber production under a specified management intensity consistent with multiple-use objectives is the long-term sustained yield (LTSY). The LTSY calculated for the proposed plan is 74,737 CCF.

Wildland Fire Management

The Guidance for the Implementation of Federal Wildland Fire Management Policy (2009) provides much of the current direction for managing wildland fire on Federal lands. This document provides definition of wildland fire used in this Plan.

Wildland fire describes any non-structure fire that occurs in the wildland.

Wildland fires are categorized into two distinct types:

- Wildfires – Unplanned ignitions including human and naturally caused fires. These include prescribed fires that have been declared escaped wildfires.
- Prescribed fire – Planned ignitions.

Most of the forest’s vegetation is adapted to recurring wildfires started by lightning from spring and summer thunderstorms. Frequent, low-intensity fire plays a vital role in maintaining ecosystem health of much of the pinyon-juniper, ponderosa pine, and frequent fire mixed conifer vegetation types. These three vegetation types cover over 80 percent of the forest. Grasslands are also adapted to frequent fire. Other vegetation types, such as pinyon-juniper-sagebrush, mesic mixed conifer, and spruce-fir, are also fire-dependent, but have a historic fire regime of less frequent, mixed-severity fires.

The condition and structure of most of northern Arizona’s forests, woodlands, shrublands, and grasslands have changed dramatically from reference conditions. Today, the Kaibab NF contains uncharacteristically dense forests with many more young trees than were present historically. Ponderosa pine, spruce, fir, juniper, and pinyon seedlings have invaded forest openings, grasslands, and savannahs. The forest and woodlands are deficient in grasses, forbs, and shrubs due to tree competition, and are at high risk for insect and disease outbreaks. With the denser

interlocking canopy cover and accumulated live and dead woody material, the probability and occurrence of large, uncharacteristic, stand-replacing fires continues to increase. These fires burn with more intensity, have higher tree mortality, degrade watersheds, sterilize soils, and threaten homes and communities.

Entry with fire during appropriate weather and fuel moisture conditions is the most cost-effective way to reduce the likelihood of a high-severity fire. A single fire entry, with low to moderate fire behavior, reduces high-severity fire potential for 5 to 10 years in ponderosa pine and frequent fire mixed conifer, and other vegetation communities in Fire Regime 1. With repeated entry with fire within the historic fire frequency interval, the risk of a high-severity fire could be kept to a minimum indefinitely, except for a few days per year that fire danger indices are at their peak. To achieve a forest that is resilient to fire disturbance even during dry and windy conditions, forest structure needs to be more in line with desired conditions. In addition to treatment with fire, activities such as thinning and tree harvesting are needed to reduce tree density and canopy cover. Strategic placement and design more efficiently protects values at risk because activities are costly, and the capacity to implement activities across the landscape is limited.

Desired Conditions for Wildland Fire Management

- Wildland fire maintains and enhances resources and, as nearly as possible, is allowed to function in its natural ecological role.
- Regular fire entry protects social, economic, and ecological values at risk from high-severity disturbance effects.
- Wildland fires burn within the range of intensity and frequency of the historic fire regime of the vegetation community. Uncharacteristic high-severity fires rarely occur, and do not burn at the landscape scale.
- Wildland fire is understood, both internally and by the public, as a necessary natural disturbance process integral to the sustainability of the forest's fire adapted vegetation communities.

Standards for Wildland Fire Management

- Human-caused wildfires will be suppressed at the lowest cost with the fewest negative consequences with respect to firefighter and public safety.
- Managers will use a decision support process to guide and document wildfire management decisions.

Guidelines for Wildland Fire Management

- Decision documents for wildland fires that progress past initial attack should include interdisciplinary input to assess site-specific values at risk and develop project or incident objectives and courses of action to enhance or protect those values.
- Planned or ongoing wildland fires should address the potential for noxious weed invasions, and develop mitigation measures.
- Decision documents for wildland fires should include objectives to minimize fire-created openings to those within the reference range of variability for the vegetation community. Associated courses of action to address those objectives should also be

developed.

- Decision documents for wildland fires should address wildlife desired conditions for key habitat features that provide structural diversity such as snags, large oaks, and oak thickets. Associated courses of action or management practices to address those objectives should also be developed.
- If current or anticipated fire behavior and fire effects exceed the desired fire behavior and effects, protection objectives should be developed, or a more conservative prescription window produced. Strategies and tactics to mitigate those effects should be implemented on active wildland fires.

Management Approach

Objectives for wildland fires may be developed based on fuel conditions, current and expected weather, current and expected fire behavior, topography, resource availability, and values at risk. Social understanding and tolerance may also affect objectives, as well as adjoining governmental jurisdictions having similar or differing missions and directives.

Wildland fire may be concurrently managed for one or more objectives. Objectives can change as the fire spreads across the landscape; parts of a fire may be managed to meet protection objectives, while other parts are managed to maintain or enhance resources.

In areas not highly departed from desired conditions, wildland fires are likely to be managed to burn with the intensity and frequency of the reference fire regime when fire weather conditions are appropriate, and resources are available to successfully meet objectives.

In areas moderately to highly departed from desired conditions, somewhat higher fire intensities, and the associated fire effects may be acceptable or even desirable at the fine scale, to move fire behavior toward desired conditions. Multiple small areas of high mortality are preferred over a single large, high-severity event.

Fire is one tool in the process of restoring the forest's fire-adapted ecosystems; in areas departed from desired conditions it is ideally integrated with mechanical treatments that further restore forest structure. In some areas, however, fire may be the only viable tool. Examples of such areas are steep rugged terrain where the high cost and hazards preclude mechanical treatment, or in remote areas of the forest where the distance to high values does not justify the expenditure of limited funds and work capacity. Fire can be successfully used in these areas to treat NFS lands at the landscape scale, and at a minimal cost. Objectives allowing for higher fire intensities, and higher levels of mortality may be needed in these areas to achieve the structural change that will not occur through other means.

Responses to wildland fires are coordinated across jurisdictional boundaries whenever there is potential for managing an incident or a burn on more than one jurisdiction (e.g., Grand Canyon National Park, Coconino NF). This is done with the understanding that fire-adapted ecosystems span jurisdictional boundaries.

[See also forestwide direction for each vegetation community type, [livestock grazing](#), [air quality](#), [wildlife](#), and the [wildland-urban interface areas](#).]

Transportation and Forest Access

The Kaibab NF transportation system road network consists of thousands of miles of arterial, collector, local, and closed roads ranging from maintenance level 1 (closed to all motorized uses)

to 4 (smooth-surfaced that provide a moderate degree of user comfort and convenience at moderate travel speeds). The road system provides access to areas on the forest including private land, facilities under special use permits, recreational opportunities, research sites, and facilities that support forest and resource management.

Desired Conditions for Transportation and Forest Access

- Forest roads, bridges, and trails provide safe, legal, and reasonable access for recreation opportunities and resource management.
- Resource impacts from roads and trails are balanced with the benefits of having the road or trail available for use.
- High-use smooth-surfaced roads provide safe access for low-clearance vehicles.
- Low-use roads provide access for high-clearance vehicles.
- All designated routes open to wheeled motorized vehicles are shown on a motor vehicle use map (MVUM) that is readily available to the public.
- The Inventoried Roadless Areas are free from activities that would alter their roadless character.
- An adequate sign system exists to provide for traveler safety, location information, and compliance.
- The forest has the road and trail rights-of-way needed to administer the forest and provide public access.
- Roads and culverts do not contribute to headcuts or downcuts in ephemeral drainages.
- Roads allow for safe and healthy wildlife movement in areas of human development.
- Vehicular collisions with animals are rare.

Objectives for the Transportation System

- Within 10 years of Plan approval, obliterate 15 percent of non-system roads (unauthorized, unneeded, and decommissioned).
- Grade surfaces and clean culverts and ditches on 100 miles of open National Forest System roads each year.

Standards for Transportation Management

- Motor vehicle use off the designated system of roads, trails, and areas is prohibited, except as identified on the MVUMs and as authorized by law, permits, and orders in connection with resource management and public safety.

Guidelines for Transportation

- Motorized uses in semi-primitive non-motorized areas should be restricted, except for necessary minimal administrative activities, permitted activities, and emergency access needs.
- Construction of permanent roads or temporary roads in semi-primitive non-motorized areas should be avoided unless required by a valid permitted activity. If authorized,

roads should be constructed and maintained at the lowest maintenance level needed for the intended use.

- Roads should not be located in meadows when they can be located in other areas.
- Roads should be decommissioned when no longer needed.
- Prior to road or trail construction in areas where subsurface geologic features are prominent, the proposed alignment should be surveyed for subsurface voids
- Surveys should be conducted to assess wildlife use (bats, birds, etc.) and intensity before demolishing and/or modifying structures such as old bridges. If surveys determine that wildlife are actively using the structures, project design should include efforts to minimize impacts.

Management Approach

In order to support resource management and provide safe and efficient travel on NFS lands, the Kaibab NF provides extensive management of the Forest Transportation System including conducting inventories, surveys and analyses, formulating plans, and executing reconstruction, maintenance, and obliteration operations. Transportation and facility management on the forest is integrated and coordinated with Federal, State, county, and other local transportation authorities. This includes working closely with the AZGFD, the Arizona Wildlife Linkages Working Group, and ADOT to identify wildlife habitat needs, potential barriers to wildlife movement, and to mediate such threats during new projects by designing effective wildlife crossings and travel migration areas early in the transportation planning process.

Roads that serve year-round residents of inholdings are typically turned over to other public road agency jurisdictions. In cases where those agencies do not accept jurisdiction of the road, the Forest Service attempts to enter into road maintenance agreements to apportion the road maintenance according to the amount of use by each type of traffic. This results in some NFS roads being maintained by the county, homeowner, association, the Forest Service, or some combination thereof.

Potable Water

The Kaibab NF currently has 18 potable water systems. These include concessionaire operated, Forest Service operated, and systems on Forest Service land operating under a special use permit. Some of these systems are hauled water systems which receive water from other systems.

The City of Williams has the only municipal water system supplied by a watershed located on the Forest. The watershed is approximately 26,061 acres in size. Most (96percent) of this watershed is within the Cataract Creek Headwaters and Dogtown Wash HUC12 sub-watersheds. Citizens of Williams, Arizona depend on this watershed as a source of public drinking water and for other benefits.

Desired Conditions for Potable Water

- The City of Williams Municipal Watershed provides a treatable and reliable source of water.
- Potable water systems are safe for human consumption.

Management Approach

To operate and maintain potable water systems that provide water to forest facilities, the Forest Service often enters into agreements with partners (concessionaires, other agencies, or private entities). Both parties operate these systems jointly to ensure water quality standards are maintained. Strategies to better achieve the desired conditions include providing training to supervisors and certified water system operators, and conducting routine sanitary surveys, maintenance, and review of water quality from hauled sources.

Lands

The two primary functions of the lands program are the identification and maintenance of land line locations between NFS lands and lands of other ownership, and land adjustments. Land adjustments consolidate and improve management efficiency through real estate transactions including sales, purchases, exchanges, conveyances, and rights-of-way within the proclaimed forest boundary.

Desired Conditions for Lands

- NFS lands exist in a pattern that promotes efficient management, which consist of large contiguous areas that provide efficient and effective resource management and wildlife connectivity within and across NFS lands.
- Lands identified for disposal and acquisition are displayed on the land adjustment map.
- The public has access to NFS lands within the Kaibab NF.

Objectives for Lands

- Obtain public access for all permanent roads and trails within the Kaibab NF boundary in 10 years of Plan approval.

Management Approach

Work closely with the State, counties, and other Federal agencies to resolve rights-of-way issues and to ensure that public access to the various parts of the forest on State, county or permanent NFS roads meets management objectives for all ownerships.

Work with adjacent landowners to minimize conflicts between public land users and private landowners. Resolve permanent legal public access issues by purchase, exchange, donation, and condemnation of rights-of-way.

Special Uses

Special use permits authorize services that support the Forest Service mission and meet the needs of the public. Permits are a partnership between the Forest Service and private businesses and individuals to provide services and facilities. Special use permits allow for occupancy and use of NFS lands for appropriate, safe activities that meet demonstrated public needs when consistent with the desired conditions for the specific area. Permits may be longer term such as energy transmission and electronic sites.

Desired Conditions for Special Uses

- Special use permits support and contribute to the forest and district niches. Permanent structures associated with special uses are concentrated on existing sites or designated corridors, minimizing the number of acres encumbered by special use authorizations.
- Special use activities blend into the landscape and do not draw attention to the activity or equipment.

Standards for Special Uses

- Competitive OHV and motorized events are not permitted on the forest.

Guidelines for Special Uses

- Uses should be combined to the extent possible in light of technical and environmental constraints.

Communication and Electronic Sites

Communications and electronic sites have been established (>10 sites) on the Kaibab NF as a legitimate use of National Forest System lands. These play an important role in ensuring good communications across northern Arizona and provide a critical link in national communication systems. Requests to use Federal lands for communication and electronic sites have increased over the past few years and it is likely these types of special use permits will increase.

Desired Conditions for Communications and Electronic Sites

- Wildland fires do not interrupt the operation of communication and electronic facilities.

Guidelines for Communications and Electronic Sites

- New communication sites should have a communication site management plan in place prior to the start of operations that is consistent with forest land management plan.
- The number of communications and electronic sites should be the minimal that is consistent with appropriate public services that require the use of forest lands.
- Environmental disturbance should be minimized by co-locating communications and electronic sites.

Energy Transmission and Development

National emphasis on energy transmission and development and is expected to grow. Requests to use Federal lands for energy development have rapidly increased over the past few years, and as the demand for alternative power sources continue to grow, it is likely these types of special use requests will increase. Most of the requests have been for energy transmission corridors, wind

farms, and solar energy development. Most of the direction for the permitting process of energy transmission and development is conducted in accordance with the Forest Service's special use authorization process and is not within the scope of this Plan.

Desired Conditions for Energy Transmission and Development

- Energy transmission and development on the forest meets the legal mandates to facilitate the transmission and development of energy resources in a manner that minimizes adverse impacts and does not detract from meeting other desired conditions applicable to the area.
- Energy corridors provide a reliable supply of energy essential to local, regional, and national economic demands.
- Joint use of rights-of-way are provided to concentrate uses to the extent possible.
- Energy transmission lines are not visible (usually underground) across the landscape.
- Vegetative conditions and land uses within energy rights-of-way facilitate the operation and maintenance of the associated facilities and infrastructure. They may differ from the surrounding PNVT desired conditions in that they generally consist of low-growing or non-woody vegetation.
- Wildland fires do not interrupt the delivery of energy resources within the rights-of-way.

Standards for Energy Transmission

- Major utility corridor development is confined to the area identified and mapped in the West-wide Energy Corridor Programmatic EIS.

Guidelines for Energy Transmission and Development

- Environmental disturbance should be minimized by co-locating pipelines, power lines, fiber optic lines, and associated infrastructure.
- Existing energy corridors should be used to their capacity with compatible upgraded powerlines, before evaluating new routes.
- When compatible with protection of heritage resources, the use of below-ground utilities should be optimized in order to avoid potential conflicts with wildlife, scenery, wildfire, and long-term vegetative management.

[See also [West-wide Energy Corridor management area](#)]

Mineral and Mining Activities

Minerals of economic interest are classified as leasable, salable, or locatable. Coal, oil shale, oil and gas, phosphate, potash, sodium, geothermal resources, and all other minerals that may be acquired under the Mineral Leasing Act of 1920, as amended, are referred to as leasable minerals. Common varieties of sand, stone, gravel, pumicite, and clay that may be acquired under the Materials Act of 1947 are considered salable minerals or mineral materials. Minerals that are not salable or leasable, such as gold, silver, copper, tungsten, and uranium, are referred to as locatable minerals. Locatable mineral deposits include most metallic mineral deposits and certain

nonmetallic and industrial minerals. Locatable minerals are subject to the General Mining Law of May 10, 1872, as amended, and for the most part are outside the scope of this Plan.

Salable minerals on the forest consist of sand and gravel deposits, building materials, and volcanic deposits such as cinders. Sand and gravel deposits exist but are relatively isolated within the North Kaibab and Tusayan Ranger Districts, and are mostly associated with the Moenkopi Formation and alluvial deposits. On the Williams Ranger District, gravel deposits have formed at the bottom of the southwestern slope of the Mogollon Rim. Building materials (primarily flagstone) are widespread along this same section of the Rim, and are associated with the Coconino Sandstone. Cinders, basalt, and other volcanic deposits occur on the Williams Ranger District, which is part of the San Francisco Volcanic Field.

The commercial demand for saleable materials (e.g., flagstone, cinders, etc.) has decreased over the last few years with the downturn in the general economy. As the economy recovers, the demand for these construction products is expected to increase. Recently, there has been an increase in the quantity of materials needed for government road projects. Currently, there are no active mineral leases and no known coal, oil, or gas reserves on the forest. The geological formations of the area do not favor such leasable mineral deposits and the potential for oil, gas, or geothermal energy is low across the entire Kaibab NF.

All of the Tusayan and North Kaibab Ranger Districts and the Kendrick Wilderness on the Williams Ranger District are withdrawn from locatable mineral entry. Existing mining claims in these areas may be developed where existing claims can prove valid existing rights. The locatable mineral deposits on the Williams Ranger District are associated entirely with stratabound deposits, which are small, and in today's economic climate are not commercially viable.

Desired Conditions for Mineral and Mining Activities

- Mineral and mining activities meet the legal mandates to facilitate the development of minerals on the forest in a manner that minimizes adverse impacts to surface and groundwater resources, and that do not detract from meeting other desired conditions applicable to the area.

Standards for Mineral and Mining Activities¹⁴

- Surface use and occupancy is restricted within foreground¹⁵ of heritage resource sites nominated or listed on the National Register of Historic Places.
- Construction of oil and gas well surface facilities within foreground of heritage resource sites with National Register status and in the visible foreground of State highways is prohibited.
- Oil and gas leases and plans of operation for exploration shall incorporate the following stipulations
 - “Yearlong surface occupancy is prohibited in recreation, administrative and special use sites; on slopes of 15 percent or greater, and within foreground of all sites listed on the National Register.”

¹⁴ These standards were retained direction from the original Forest Plan.

¹⁵ Foreground is defined as the part of a scene, landscape, etc., which is nearest to the viewer, and in which detail is evident, usually ¼ to ½ mile from the viewer

- “Replanting of areas impacted by operations in tree plantations at the cessation of project is required.”

Guidelines for Mineral and Mining Activities

- Adverse surface impacts should be minimized through the appropriate administration of mining and mineral laws and regulations. Soil disturbance should be kept to a minimum.
- Restoration and reclamation of surface disturbance associated with mineral activities should be implemented to achieve 70 percent of ground cover (as compared to nearby undisturbed areas) with permanent native vegetation within three growing seasons.
- Surface use should be restricted or prohibited in areas with habitat for threatened, endangered, and sensitive plant and animal species, and for heritage resources nominated or listed on the National Register of Historic Places. Use and occupancy should be restricted yearlong in areas supporting populations of threatened, endangered and sensitive plant species.
- On acquired lands where the Forest Service holds the mineral rights, leasable (hard rock) mineral activities that would remove more than 50 pounds of materials should not be permitted.

[See also [minerals and energy development suitability](#).]

Chapter 3: Management Areas

This Chapter of the Plan contains direction for management areas that have specific management direction that differs from the general forest. In some cases, there may appear to be a conflict between direction presented at larger and finer scales. If there is an apparent conflict, the direction at the finer scale takes precedence. There are two types of management areas: Special Areas and Management Areas (MAs).

Special Areas are land units within the NFS given special designation through statute or a separate administrative process because of their unique or special characteristics. Special areas include areas such as Wilderness, Research Natural Areas, and Botanic Areas. Area-specific Plan direction is developed where desired conditions or management differs from those in the surrounding area.

Management Areas are delineated to aid in management and provide plan direction for specific sites. Land management Areas such as wildland urban interface areas and utility corridors apply to more than one area on the Forest. Others such as Red Butte and Bill Williams Mountain are geographically specific.

Throughout this chapter, Plan Components (Plan Decisions) are displayed within text boxes. Text outside of boxes are background material, explanations, or descriptions of Management Approaches and are not plan decisions.

Special Areas

Wilderness

Designated wilderness provides places where natural processes predominate and impacts of humans are minimized. Congress set aside these places to pass on to future generations. Wilderness provides large areas for the study of nature and unique scientific and educational opportunities. Wilderness areas are:

- "...lands designated for preservation and protection in their natural condition..." Section 2(a)
- "...an area where the earth and its community of life are untrammelled by man..." Section 2(c)
- "...an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvement or human habitation..." Section 2(c)
- "...generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable..." Section 2(c)
- "...outstanding opportunities for solitude or a primitive and unconfined type of recreation..." Section 2(c)
- "...shall be devoted to the public purposes of recreation, scenic, scientific, educational, conservation and historic use." Section 4(b)

(Wilderness Act of 1964 (Pub. L. 88-577))

Existing Wilderness on the Kaibab NF:

Kendrick Mountain Wilderness

Kendrick Mountain Wilderness is a 6,510-acre area that encompasses Kendrick Peak, one of the highest peaks in the San Francisco volcanic field. In 2000, the entire wilderness was burned in a large wildfire. Fire intensities ranged from light to very severe, with more intensely burned areas most evident on the west, north, and east slopes of the peak. Montane mixed conifer forests are present in the unburned and lightly burned areas. Natural recovery processes are occurring in more intensely burned areas, with aspen and other early seral species becoming established in those sites. Unstable volcanic soils have undergone severe erosion on the steeper slopes within burned areas.

The eastern part of the Kendrick Mountain Wilderness lies on the Coconino NF, but the Kaibab Land Management Plan (this plan) contains direction for the entire wilderness area.

Kanab Creek Wilderness

Kanab Creek Wilderness is a 75,300-acre area on the north side of the Grand Canyon. Kanab Creek is a major tributary of the Colorado River, flowing down from its source some 50 miles north in southern Utah. Along the way, Kanab Creek cuts a canyon that drains a large area of deep gorges cut into the walls of the Kanab and Kaibab Plateaus. Elevations vary between 2,000 feet at the Colorado River to about 6,000 feet on the rim. The plateaus above are arid with sparse vegetation, while the canyon bottoms are comprised of riparian zones. Most of the slopes in this wilderness exceed 40 percent, and the canyon walls have been eroded into intricate sculptures of knobs, potholes, and fins in many places. The upper areas support desert bighorn sheep, Kaibab mule deer, and almost all the chukar partridges in Arizona. The lower regions support numerous reptiles, snakes, birds, and lizards. The Kanab Creek Wilderness contains the only Desert Community and Cottonwood Willow Vegetation communities on the Kaibab NF.

[See also forestwide direction for [cottonwood-willow riparian forest](#) and [desert communities](#).]

Saddle Mountain Wilderness

Saddle Mountain Wilderness is a 40,539-acre area that straddles the eastern edge of the Kaibab Plateau. It is a rugged landscape of narrow drainage bottoms and steep scarps. The gentle slopes on the main ridge of the area drop dramatically to form the Nankoweap Rim on the south. Elevations range from about 6,000 feet on Marble Canyon Rim to 8,000 feet on Saddle Mountain itself, a prominent ridge with a profile that resembles a saddle, horn and all. Utah juniper and pinyon pine in the lowlands give way to mixed conifer in the highlands. The only perennial free-flowing stream on the Kaibab NF, North Canyon Creek, lies entirely within the Saddle Mountain Wilderness Area.

Sycamore Wilderness

Sycamore Canyon is the second largest canyon in the Arizona red rock country. The 21-mile long scenic canyon reaches a maximum width of about 7 miles. Sycamore Canyon Wilderness is 55,937 acres. It is a Class I Airshed and it is located in within the Coconino, Kaibab, and Prescott NFs.

Note: Management direction for the Sycamore Wilderness is contained in the Coconino NF Land Management Plan.

Desired Conditions for Wilderness Areas

- The environment is essentially unmodified. No services are provided and self-reliance is required. The naturally occurring scenery dominates the landscape. Manmade features are rare and use natural or complimentary materials. Some constructed features are present.
- Wilderness provides opportunities for primitive and unconfined nonmotorized and nonmechanized recreation and contiguous wildlife habitat. Human encounters are only with individuals or small parties, are infrequent, and opportunities for solitude are common.
- Enduring, high-quality wilderness values are maintained while providing for solitude and primitive, unconfined recreation experiences.
- Designated wilderness areas are used within the limits of acceptable change⁸ parameters established for each area.
- Natural processes are maintained within the wildernesses. Fires function in their natural ecological role.
- Wilderness areas have minimal to no nonnative, invasive species.
- Wilderness boundary postings are well maintained.
- Maps and information brochures are up-to-date and available to the public.
- A reproducing population of Apache trout is maintained in North Canyon Creek.

Objectives for Wilderness Areas

- Inspect and maintain at least 10 percent of wilderness trails and signs annually.

Standards for Wilderness Areas

- Group size is limited to 12 people in wilderness areas.
- Competitive events are not permitted in wilderness areas.
- Establishment geo-caches will not be permitted in wilderness areas.

Guidelines for Wilderness Areas

- Wildfires should be suppressed in the desert communities of the Kanab Creek Wilderness.
- Non-native, invasive species should be treated within wilderness in order allow natural processes to predominate.

Management Approach

Wilderness on the KNF is managed consistent with the 1964 Wilderness Act, specifically with a focus on maintaining untrammled natural processes and freedom for primitive and unconfined recreation opportunities. Further, the KNF wilderness is guided by the elements that allow wildernesses to be considered “managed to standard” according to Forest Service policy. This

means that KNF wildernesses receive recreation site monitoring, invasive species monitoring, and educational efforts, along with several other emphases.

In a broader sense, KNF wilderness management follows the Limits of Acceptable Change¹ framework. In order to assure that conditions within each wilderness remain within an acceptable range of impacts, monitoring is conducted to assess current condition and compare them to the desired condition. If a current condition departs from the desired condition, a management response may be appropriate. Responses may range from increased signing, education, or patrols to changes to the type and intensity of permitted use. Management responses would depend on the type and degree of departure from the desired condition.

Similar to recreation management in general, management of wilderness includes a concentrated use philosophy. Through this approach, known impacts from recreational use are focused in areas that can absorb those impacts without significant degradation of the wilderness resource. Management actions intentionally do not shift user impacts from high- to low-use areas. The net effect of concentrating use is to leave more pristine areas in their natural state, thus preserving the overall character of the wilderness.

Frank's Lake Geologic-Botanic Area

The Franks Lake Geologic-Botanic Area is 145 acres and was established as an ecosystem management area in the original Kaibab Forest Plan (1988). At 8,550 feet elevation, the geologic-botanic area represents a relatively undisturbed example of limestone sinks, or karsts. There are three such sinks within the geologic-botanical area. The three sinks, along with their tributary drainage, represent various stages of geologic and vegetative development associated with the Kaibab limestone geology, which dominates the Kaibab Plateau. The easternmost sink is known as Franks Lake and contains a grassy meadow and small pond.

In the water, typical plants include bulrush, cattail, and pondweed. Around the edges, grasses and grasslike plants include sedges, rushes, and Kentucky bluegrass. Blue spruce, Englemann spruce, ponderosa pine, and quaking aspen characterize the surrounding forest community. The lake supports nesting mallards and various shorebirds.

Desired Condition for Frank's Lake Geologic-Botanic Area

- The natural features are preserved, perpetuating the natural ecologic processes affecting the area.
- There is minimal evidence of human disturbance.

Guidelines for Frank's Lake Geologic-Botanic Area

- Camping within the fenced boundary of Frank's Lake should not be permitted.
- Livestock should be excluded from the Frank's Lake Geologic Botanic Area.

¹ The Limits of Acceptable Change (LAC) system is a framework for establishing acceptable land and appropriate resource and social conditions in recreation settings, particularly wilderness. The LAC was developed in response to the need of managers for a means of coping with increasing demands on recreational areas in a visible, logical fashion. For more information visit: <http://www.fs.fed.us/r8/boone/documents/lac/lacsummary.pdf>.

Arizona Bugbane Botanical Area

This 490-acre area was established as a botanical area to protect the Arizona bugbane (*Actea arizonica*), a candidate species for threatened status. It is located in a canyon bottom on the north face of Bill Williams Mountain. Only a few population areas of this plant are known in northern and central Arizona. It is found in montane riparian habitats characterized by Douglas-fir, maple, and bracken fern. A primary threat to this species is trampling by hikers in areas where access to the populations is easy. Uncharacteristic fire is also a threat.

Desired Conditions for the Arizona Bugbane Botanical Area

- Arizona bugbane has a sustainable population and is at low risk for extirpation.

Objectives for the Arizona Bugbane Botanical Area

- Annually inspect the recreation trails and maintain to manage hiking use.

Guidelines for the Arizona Bugbane Botanical Area

- Arizona bugbane plants should not be collected, except through scientific permit.
- Trail maintenance and any other potentially disturbing activities in the botanical area should be evaluated, and protective measures should be implemented to protect the population.
- Public information and recreational brochures should not feature this area.

Management Approach

Arizona bugbane is managed under U.S. Fish and Wildlife Service (USFWS) direction through the Arizona Bugbane Conservation Agreement (USFWS et al. 1998). This agreement represents a commitment by the Forest Service and the Fish and Wildlife Service to manage this species to ensure that it does not become threatened or endangered. The character of this area is maintained by limiting access and managing threats. Fire suppression activities may be needed to prevent damage to the plant colony and habitat.

Double A Wild and Free-Roaming Burro Territory

Wild burros have been known to occupy the area since the late 1800s. A wild burro is a free-roaming, unclaimed, unbranded burro that descended from pack animals that wandered off or were released by prospectors and miners. This territory was established as required by the Wild Free Roaming Horse and Burro Act of 1971 (PL 92-195) and has been managed under cooperative agreement with the Bureau of Land Management since 1984. The Territory is approximately 30,000 acres and is located in the northwestern portion of the Williams Ranger District, in the northern half of the Double A grazing Allotment.

Desired Conditions for the Double A Wild and Free Roaming Burro Territory

- A biologically sound and genetically viable burro population is in balance with native wildlife, permitted livestock, and other resource values.

Guidelines for the Double A Wild and Free Roaming Burro Territory

- Population control measures should be implemented to maintain genetic diversity and desired resource conditions in the area.

Management Approach

The Forest Service coordinates management of the Wild Horse and Burro program with the BLM to facilitate agency coordination to benefit both agencies. Partnering and coordination is key to maintaining the desired burro herd size, including capture/relocation and fertility treatments.

Kaibab Squirrel National Natural Landmark

In 1965, 278,459 acres of ponderosa pine forest within the Kaibab NF and Grand Canyon National Park were designated as the Kaibab Squirrel National Natural Landmark. National Natural Landmarks (NNLs) are designated by the Secretary of Interior and represent unique examples of ecological and geological features that comprise our nation's natural history. The NNL designation is not a land withdrawal and does not direct or prohibit any activity. The Kaibab Squirrel NNL was designated for the Kaibab squirrel and for its largely intact example of the western climax community of ponderosa pine.

Desired Conditions for the Kaibab Squirrel National Natural Landmark

- The Kaibab Squirrel National Natural Landmark provides quality ponderosa pine habitat for the Kaibab squirrel.

Management Approach

The needs for the Kaibab Squirrel National Natural Landmark are addressed in the forestwide direction for the ponderosa pine vegetation type. The forest continues to work collaboratively with the NPS National Natural Landmarks (NNL) Program Intermountain Regional Coordinator, as well as other interested parties, in developing a better understanding of the habitat use, distribution, and conservation needs of this unique species. Direction for areas with NNL designations requires Federal agencies to consider the unique properties of the NNL in their planning and impact analysis (Fed. Reg. 64: 25718) and provides opportunities to secure funding and develop partnerships to achieve management and conservation goals.

Grand Canyon Game Preserve

The Grand Canyon Game Preserve was established through a Presidential Proclamation by Theodore Roosevelt on June 29, 1906, to protect game species and their habitat on the Kaibab Plateau. The original proclamation does not provide a habitat management prescription, but provides a general statement about the vision. Section 1 of the Grand Canyon Game Preserve Act states, "The Reserve should be set aside for the protection of game animals and be recognized as a breeding place therefore." The Forestwide plan direction for vegetation, wildlife, and other habitat features are consistent with the spirit of the proclamation, as a result there is very little specific direction for this area.

Desired Conditions for the Grand Canyon Game Preserve

- The Grand Canyon Game Preserve provides quality breeding habitat for game animals.
- There are a variety of vegetation types, in all stages of development, which provide a range of habitats for native and desired nonnative wildlife species, including natural predators.

Management Approach

The Kaibab NF cooperates with the Arizona Game and Fish Department in carrying out the cooperative agreement for managing the Grand Canyon Game Preserve. The game preserve is managed in the spirit of the original proclamation, informed by advances in scientific information and societal values, with an emphasis on the wise use of natural resources

Kaibab Plateau-North Rim Parkway

Highway 67 is designated as an Arizona State Scenic Road, a National Forest Scenic Byway, and a National Scenic Byway. Under the National Scenic Byway Program, the U.S. Secretary of Transportation recognizes and supports certain roads as National Scenic Byways or All-American Roads, based on their outstanding archaeological, cultural, historic, natural, recreational, and scenic qualities. It provides resources to help manage the intrinsic qualities within the broader byway corridor to be treasured and shared.

The Kaibab Plateau-North Rim Parkway was designated because of its scenic beauty, and natural and cultural qualities. The byway nomination mentions that Highway 67 is unique in that the entire route is located on national forest and national park lands and contains an opportunity to highlight natural resource management activities. The Kaibab Plateau-North Rim Parkway is managed to provide visitors with opportunities to enjoy the outstanding scenery of natural and cultural landscapes on the Kaibab Plateau. The route follows Arizona State Route 67 from Jacob Lake, Arizona, to Grand Canyon National Park North Rim. Open seasonally, the parkway travels through ponderosa pine and mixed conifer forests and high country meadows on its way to the Grand Canyon. Wildlife including deer, wild turkeys, coyotes, and many bird species, is abundant in the area.

Desired Conditions for the Kaibab Plateau-North Rim Parkway

- The Kaibab Plateau-North Rim Parkway provides exceptional opportunities for scenic driving.
- Views along the byway are natural appearing and include a variety of landscape characters including coniferous forest, aspen and other deciduous species, and high-elevation meadows.
- Road corridor improvements and interpretive facilities are designed and constructed to blend well and complement the natural and cultural environment surrounding the byway. Facilities are designed to accommodate people with varying abilities.
- Forest management activities remain largely unnoticeable.
- Scenic byways exhibit natural-appearing landscapes where human activities do not stand out in the foreground, for up to ½ mile (high scenic integrity).

National Scenic, Historic, and Recreational Trails

Congress designated National Scenic, Historic, and Recreation Trails under the authority of the National Trails System Act of 1968. Five such designated trails or trail systems occur on the Kaibab NF:

Arizona National Scenic Trail

The Arizona National Scenic Trail is a nonmotorized, primitive trail that stretches approximately 807 miles from Mexico to Utah across Arizona. It connects deserts, mountains, forests, wilderness, canyons, historic sites, communities, and people, and passes through some of the most renowned landscapes in the State. The Arizona National Scenic Trail is Arizona's only national scenic trail, and it showcases the State's diverse life zones and scenery. A wide variety of nonmotorized recreationists, including hikers, equestrians, mountain bicyclists, cross-country skiers, and other outdoor enthusiasts enjoy the trail.

The trail covers about 75 miles on the Kaibab NF—25 miles on the Tusayan District and 50 miles on North Kaibab Ranger District. The trail transects the Grand Canyon National Park and connects two segments on the forest.

Beale Wagon Road National Historic Trail

A portion of the historic Beale Wagon Road crosses the Kaibab NF on Williams Ranger District. The historic route led from Fort Smith, Arkansas, to the Colorado River, and served as an important immigration route to California before the Civil War. Lieutenant Edward F. Beale surveyed and constructed the route between 1857 and 1859. In laying out the route, Beale used segments that indigenous peoples had used for centuries. The route was largely abandoned when the railroads were established through the area. The Beale Wagon Road route on the forest is marked by large rock cairns and survey markers. There is no constructed trail tread, and motorized vehicles are prohibited from using the historic trail.

Overland Road National Historic Trail

The historic Overland Road was established in 1863 as a military route connecting Flagstaff and Prescott, Arizona. Much of the route followed older indigenous pathways that skirt rugged Sycamore Canyon. Originally, the military, migrants, and freighters used the route heavily, and it continues to be used as a livestock driveway today.

The route of the Overland Road on the Kaibab NF is marked by large rock cairns. There is no constructed trail tread.

I-40 – Parks Rest Area National Recreation Trail

The I-40- Parks Rest Area National Scenic Trail was designated in 1979. It is a self-guided interpretive trail located immediately adjacent to the westbound rest area on Interstate 40, between Flagstaff and Williams, AZ. The half-mile paved trail provides information about the ponderosa pine forest, Forest Service management and nearby recreation opportunities.

Bill Williams Mountain Complex National Recreation Trails

The Bill Williams Mountain Complex National Recreation Trails are a series of non-motorized trails accessing Bill Williams Mountain. It includes the Clover Springs Bypass, Buckskinner, City Link, Benham (4.5 miles), Bill Williams (4 miles), and Bixler Saddle Trails (2 miles). The trails

start in the ponderosa pine vegetation type and climb the flanks of the mountain providing panoramic views of the Williams Ranger District. The trails offer a variety of hiking opportunities from moderate to difficult.

Desired Conditions for National Scenic, Historic, and Recreational Trails

- Views in the immediate foreground (0 to 300 feet) of the National Scenic and Recreation Trails include natural-appearing landscapes. The landscapes have high scenic values and generally appear unaltered by human activities.
- Signage helps users find nearby developed sites, trailheads, recreation facilities, and drinking water sources.
- User conflicts between differing recreational uses are infrequent.
- In remote areas, the sights and sounds of roads, motorized trails, utility corridors and other facilities are rarely encountered.
- The Arizona National Scenic Trail provides both short- and long-distance nonmotorized recreation opportunities in mainly remote and primitive settings representative of the dramatic natural landscapes and varied vegetation of Arizona.
- Along most of the Arizona National Scenic Trail, infrastructure and facilities are few and are constructed in such a way as to be compatible with the scenic, natural, historic, and cultural qualities for which it was established.

Guidelines for National Scenic, Historic, and Recreational Trails

- Projects should preserve the recreation opportunity setting for any affected segments.
- Special use authorizations for trail segments that receive high public use should be limited.

Management Approach

The forest works with the Arizona Trail Association, volunteer groups, and adjacent landowners to maintain trail corridors and the condition and character of the surrounding landscape. None of these trails are in Wilderness, so motorized vehicles may be used for trail maintenance and administrative use.

A comprehensive plan is currently being developed for the Arizona National Scenic Trail that will provide management direction for its use including, but not limited to, specific objectives and practices to be observed in management of the trail, detail any needed cooperative agreements, and identify carrying capacity of the trail and a plan for its implementation. Until the Comprehensive Management Plan is completed, the forest will manage the trail consistent with the 1995 Arizona Trail Management Guide, where applicable.

Management Areas

Management areas (MA) have been established for places on the Kaibab NF with a need for more specific management direction than the general forest. They may be discrete or overlapping. Where there are apparent differences in plan direction, the finer, more restrictive guidance applies.

Recommended Wilderness Areas

The forest evaluated potential wilderness areas as part of the Forest planning process. The purpose of the potential wilderness area (PWA) evaluation was to identify and inventory all areas within the Kaibab NF that satisfy the definition of wilderness found in the 1964 Wilderness Act. The forest followed a three-step process for identifying potential wilderness areas which included an inventory of potential areas, an evaluation of potential areas; and a determination (by the Kaibab leadership) on those areas that would be included in this proposed plan.

The potential wilderness evaluation process identified eleven areas on the North Kaibab Ranger District totaling about 6,240 acres that would be recommended for wilderness designation in this proposed plan. The largest of these areas is adjacent to the Saddle Mountain Wilderness. It is about 1,300 acres and contains a unique landform commonly referred to as the “Cockscomb.” There are eight small areas adjacent to the Kanab Creek Wilderness that would bring the wilderness boundary up to the rim. Also included are the upper reaches of Grassy and Quaking Aspen canyons which are adjacent to proposed wilderness in Grand Canyon National Park. These lands make up the Recommended Wilderness Area MA. The intent of this management area is to provide direction that would retain or improve the wilderness values of these areas.

Desired Conditions for Recommended Wilderness Areas

- The environment is essentially unmodified. No services are provided and self-reliance is required. The naturally occurring scenery dominates the landscape. Manmade features are rare and use natural or complimentary materials. Some constructed features are present.
- The area is free of motorized and mechanized recreation activities.
- The recommended wilderness areas provide opportunities for primitive and unconfined nonmotorized and nonmechanized recreation and contiguous wildlife habitat. Human encounters are only with individuals or small parties, are infrequent, and opportunities for solitude are common.
- Enduring, high-quality wilderness values are maintained while providing for solitude and primitive, unconfined recreation experiences.
- Natural processes are maintained within the recommended wildernesses. Fires function in their natural ecological role.
- Recommended wilderness areas have few to no nonnative, invasive species.
- Maps and information brochures are up-to-date and available to the public.

Guidelines for Recommended Wilderness Areas

- Wildfires should be suppressed in the recommended wilderness areas adjacent to Kanab Creek in the desert communities PNVT.
- Non-native, invasive species should be treated within recommended wilderness areas in order allow natural processes to predominate.

Management Approach

Recommended wilderness on the KNF is intended to be managed consistent with the intent of the 1964 Wilderness Act, specifically with a focus on maintaining or achieving wilderness values.

Although all of these areas have been managed as semi-primitive, non-motored areas in the past, they have not been managed as wilderness. Some contain evidence of human activities such as old road beds, stumps from timber sales, and livestock management structures.

Management may be needed including restoration, trail maintenance, and road obliteration to achieve or retain the desired wilderness values. Because recommended wilderness is not designated wilderness, use of motorized or mechanized equipment may be appropriate when it is used to move the areas toward the desired natural appearing primitive settings.

Wildland-urban Interface Areas

The wildland-urban interface (WUI), in general terms, is the wildland area surrounding resident populations, and other human developments having special significance, that are at imminent risk from wildfire. People increasingly seek to live in more secluded lands bordering public lands. At the same time, large high-severity wildfires are increasing in occurrence as the conditions of forests become more departed from reference conditions, putting these widely spaced homes and rural communities at risk. This creates the most dangerous and complex fireline situations that Federal, municipal, and rural firefighters face. Desired conditions and guidelines specific to this area are necessary to reduce the risk to firefighter safety, as well as to human developments.

The Healthy Forest Restoration Act (HFRA) of 2003 defines the WUI as an area within or adjacent to an at-risk community that is identified in a Community Wildfire Protection Plan (CWPP). Two CWPPs have been prepared that have large WUI zones that overlap Kaibab NF. The WUI zone outlined in the Greater Williams Area CWPP covers all of the forested cover type on the Williams Ranger District, and is 326,000 acres in size. The Tusayan CWPP WUI Zone covers 63,720 acres—nearly 20 percent of the district. The rationale for such large zones is that wildfires in recent history, under critical fire danger conditions, have demonstrated rapid rates of spread over great distances in a single burning period, posing threats to communities and infrastructure miles from the point of origin.

Achieving desired conditions for the entirety of the CWPP WUI zones is a long-term aspiration, but it is outside the capacity of the Forest Service to achieve within the projected life of this Plan. Also, these zones do not cover many other highly valued human developments at risk on, and adjacent to, the forest.

For the purposes of this Plan, the WUI area is refined to a buffer around WUI values to focus more intensive treatments where they will have the most impact for fire protection, and includes the following lands:

- Half-mile buffer around all private lands.
- Half-mile buffer around administrative sites, fee-use cabins, fire lookouts, developed campgrounds, day-use picnic areas, and facilities managed under special use permits.
- Half-mile buffer around at-risk communication sites.

Desired Conditions for WUI Areas

- Wildland fires in the WUI area do not result in the loss of life, or property or characteristic ecosystem function.
- Wildland fires in the WUI are low-intensity surface fires. Firefighters are able to safely and efficiently suppress wildfires in the WUI using direct attack.
- When WUI intersects vegetation types with a mixed- or high-severity fire regime,

characteristic ecosystem function is modified to promote low-intensity surface fires.

- The desired tree basal area in the WUI is on the lower end of the range given in the vegetation community desired conditions.
- Ladder fuels are nearly absent.
- Logs and snags, which often pose fire control problems, are present in the WUI, but at the lower end of the range given in the vegetation community desired conditions.
- Dead and down fuel load is between 1 and 5 tons per acre. This light fuel load is desirable even in vegetation types with higher reference fuel loads, such as mesic mixed conifer, to provide improved fire protection to human developments deemed to have special significance.
- Openings between tree groups are of sufficient size to discourage isolated group torching from spreading as a crown fire to other groups.
- Openings with grass/forb/shrub vegetation occupy the mid to upper end of the percentage range in the desired conditions. Trees within groups may be more widely spaced with less interlocking of the crowns than desirable in adjacent forest lands.

Management Approach

Firefighters need more open stands, with few ladder fuels, and low fuel loadings, where wildfires drop to the surface before they reach the values at risk. Treatments in the WUI area are designed to provide a zone where firefighters can safely perform direct attack on wildfires. The more open stand conditions also serve to protect NFS lands from human-caused fires started on private lands because firefighters can more readily contain a wildfire before it burns into denser, more flammable vegetation in the forest at large.

While fire protection is the key objective in this area, other resource objectives are also met, and the integrity of the ecosystem is maintained. Treatments are guided by the same forestwide desired conditions for forest resources, goods, and services as outside the zone, but lands within the WUI area are managed to achieve the more open end of the desired conditions for the vegetation community.

A half-mile buffer around human developments is the starting point for determining where more open, intensive treatments occur. This distance is recommended in the HFRA (2003), and provides a distance conducive for passive crown fire to transition to surface fire. During project-specific planning, the area where more intensive treatments are needed may call for adjustment. Continuous steep slopes, continuous heavy fuels, or other fire hazards may indicate a need to expand more open treatments. On the other hand, sound reasons for retaining more dense stands may exist. For example, in the case of a habitat for a narrow endemic species, less intensive treatment, no treatment, or moving the buffer area to the outside or around the more densely stocked area may be necessary.

All private lands, regardless of whether they contain human improvements or the type of improvements they contain, are treated as WUI. In doing so, making subjective value judgments on different structures is avoided. It also accounts for the potential that any given private inholding could be developed during the lifespan of the Plan.

Due to variable budgets, market capacity, and workforce capacity, achieving desirable structural changes through planned mechanical treatments is sometimes delayed or occurs sporadically. Projects that include lands in the WUI should allow flexibility in the order of treatment

implementation. This allows fire managers the option to burn before mechanical treatments, greatly reducing fire hazard in the WUI area in the interim until mechanical treatments take place.

Including maintenance burning in project design is essential to securing the investment made with mechanical thinning and initial entry burns. Without maintenance burning, the fire protection value from treatments is largely lost within 40 to 50 years, because of increased fuel loads and more densely stocked stands.

Well-planned trails at the WUI provide sufficient legal access between NFS trails and neighborhoods, reducing the potential development of user-created social trails.

[See also major vegetation communities and [wildland fire management](#).]

West-wide Energy Corridor

Two corridors were identified in the West-wide Energy Corridor Record of Decision (ROD) that cross the Kaibab NF, both of which follow existing high-voltage lines (500 kV). One is on the Tusayan Ranger District, which follows the Four Corners line (# 47-68), and crosses the southern portion of the district. The other corridor is located on the Williams Ranger District (# 61-207), which follows the Navajo Project Line across the district from the southwest to the northeast. These corridors were defined in the ROD as being 3,500 feet wide with the centerline identified as the center of existing transmission line and is open to both pipeline and transmission line development (See Figures 3 and 4). Both of these corridors were identified in the original 1988 Kaibab Forest Plan to allow expansion for major utility lines. The EIS for the West-wide Corridor identified potential energy corridors; evaluated effects resulting from their designation; identified mitigation measures of potential effects anticipated from future development; and included interagency operating procedures applicable to the planning, construction, operation, and decommissioning of future projects within the corridors. The environmental consequences of any future projects would be evaluated in site-specific project-level planning. The West-wide Corridor decision to designate energy corridors on NFS lands in 10 western states is programmatic in nature and **does not authorize specific right-of-way projects**. Future development within the corridors would need to meet appropriate NEPA requirements and comply with other applicable laws, regulations, and policies.

Desired Conditions for the West-wide Energy Corridor

- The West-wide Corridor provides for energy transmission needs across the Kaibab NF.

[See also [energy transmission and development](#) section of this Plan.]

Developed Recreation Sites

This MA totals 1,556 acres and includes 15 major public and private sector developed recreation sites and other smaller sites (trailheads, interpretive sites, etc.). Many visitors to the forest campgrounds and lodges come from the Phoenix metropolitan area for climatic relief from extreme summer temperatures.

Most campgrounds in the Williams Ranger District unit are adjacent to impounded lakes that offer water-oriented recreation activities. Most of the fishing use on the forest occurs in this MA. All fish are stocked by Arizona Game and Fish Department. With the exception of White Horse Lake, all of these lakes are water storage facilities for the City of Williams. Campground capacity is established to ensure water quality preservation.

Desired Conditions for Developed Recreation Sites

- Developed campgrounds are places where structures and human-caused vegetation changes may be seen, but they do not dominate the view or attract attention (low to moderate scenic integrity).
- Human activities in the areas visible from campgrounds (foreground to middle ground, 300 feet to 4 miles) do not attract attention or stand out, and the landscapes appear natural (moderate to high scenic integrity).
- Volunteer hosts are provided at all public sector fee campgrounds.

Objectives for Developed Recreation Sites

- Reconstruct or construct at least one-quarter of developed campsites into small group sites within 10 years of Plan approval.
- Reduce developed site recreation deferred maintenance by an average of 5 percent each year.

Guidelines for Developed Recreation Sites

- Reconstruction and improvements of private sector developed sites should be within site capacity allocations.
- Surveys should be conducted to assess bat activity and intensity of use before demolishing and/or modifying structures such as old buildings. If surveys determine that bats are actively roosting in such structures and no alternate bat roost sites exist in the immediate vicinity, project design should include efforts to minimize impacts and to provide for alternate roost sites such as bat boxes where feasible.
- Developed recreation site vegetation management plans should guide tree removal and burning activities in the campgrounds.

[See also the [recreation and scenery](#) section of this Plan.]

Garland Prairie Management Area

The Garland Prairie Management Area is an approximately 340 acre area on the Williams Ranger District that was identified as a potential Research Natural Area (RNA) in the original Forest Plan but was never designated. RNAs are field ecological research areas established for the purpose of research, observation, and study. They are selected and established to preserve a wide spectrum of pristine areas that typify important habitat types and serve to preserve and maintain genetic diversity, maintain baseline or reference areas for the study of ecologic changes, and as a control to other similar habitats being manipulated for research or management purposes. When Garland Prairie was originally recommended as an RNA, there was a need for montane grassland type representation. This is no longer true, and as a result it does not meet the criteria identified in Region 3 Research Natural Area process.

Garland Prairie is typical of the high elevation grassland ecotone dominated by Arizona fescue and mountain muhly. In the past, this area was grazed by sheep and cattle, but there are no range improvements. It was considered to be in “good” condition when livestock was excluded in 1989,

since then, there has been tree encroachment by ponderosa pine and infestations of Dalmatian toadflax.

Desired Conditions for the Garland Prairie Management Area

- The area serves as a reference for the study of ecologic changes, and as a control to other similar habitats being manipulated for research or management purposes.
- Lightning fires are able burn naturally within the area.

Objectives for Garland Prairie Management Area

- Inspect the boundary fence annually and maintain as needed.

Guidelines for Garland Prairie Management Area

- The area should be protected from activities that directly or indirectly modify ecologic processes.

Management Approach

The PNVT for the Garland Prairie Management area is a “Montane/Subalpine Grassland”. While Garland Prairie would not necessarily make a good RNA, the Kaibab NF recognizes it has continued value as a reference area because grazing has been excluded since 1989 and it was considered in “good condition” when it was identified in the original forest plan.

Bill Williams Mountain Management Area

Bill Williams Mountain has been identified as a management area because it contains multiple resources and uses of high natural, cultural, and economic value. It is eligible as a traditional cultural property, and has been identified as a sacred site by American Indian tribes. It contains a Mexican Spotted Owl Protected Activity Center, the Arizona Bugbane Botanical Area, and communication towers that serve the Arizona Department of Public Safety, the U.S. Customs and Border Protection, and the Federal Aviation Administration. The mountain contains a ski area, a fire lookout tower, and historic trails. The watershed makes up a large portion of the municipal water supply for the City of Williams and contains the headwaters of Cataract Creek, which flows into the Havasu drainage and ultimately onto the Havasupai Reservation and Village.

This management area has the highest value areas per acre on the Kaibab NF with regard to both economic and amenity values. It is at high risk for uncharacteristic wildfire due to its steep slopes, dense vegetation, and high fuel loading. If a large wildfire occurred within the area, it could adversely affect many valuable resources.

Desired Conditions for the Bill Williams Mountain Management Area

- The risk is low for substantial damage to municipal water supply, infrastructure, water quality, visual quality, and cultural integrity (e.g., tribes and local communities).
- The risk of damage to electronic sites is low and communication related to the site is uninterrupted.

- Bill Williams Mountain provides quality habitat for Arizona Bugbane, Mexican spotted owls, and culturally important plants.

Objectives for the Bill Williams Mountain Management Area

- Implement a project to improve the health and sustainability of forested conditions on and surrounding Bill Williams Mountain within 5 years of Plan approval.

Guidelines for Activities in the Bill Williams Mountain Management Area

- The existing term permit for the Elk Ridge Ski Area on Bill Williams Mountain should be restricted to the existing established permit area.
- High-use roads within the municipal watershed should be maintained to prevent erosion and sedimentation.
- Commercial plant collection within the Bill Williams MA should not be permitted.
- Vegetation treatments immediately adjacent to the Arizona Bugbane Botanical Area should leave enough tree cover to maintain cooler temperatures and higher humidity microsite conditions near the bugbane populations.

Standards for Activities in the Bill Williams Mountain Management Area

- Artificial snow making within the Bill Williams MA will not be permitted.

Management Approach

Project planning would best be served by a collaborative process because of the complexity of the multiple high values and stakeholders. Seasonality of uses, access, and resource needs call for coordination and consideration of timing of implementation in project planning.

The highest priority for fuel reduction treatment is the north and east slopes because of the potential risk and consequences of a high-intensity wildfire. Steep slopes and concerns about erosion and sedimentation may call for treatments to either treat fuels in place, or use cable or aerial harvest systems. Other priority areas for treatments are in the WUI.

[See also [traditional and cultural uses](#), [special uses](#), [major vegetation communities](#), [wildlife](#), and [wildland fire management](#).]

Red Butte Management Area

The Red Butte Management Area is of particular importance to several American Indian tribes. It lies within a larger area that is eligible as a traditional cultural property and has been identified as a sacred site to American Indian tribes in the area. TCP boundaries are largely confidential and do not usually correlate to features that can be identified on the ground. The Red Butte MA boundary was selected to include the geologic formation of Red Butte, the core area of the eligible TCP, and to facilitate manageability.

Desired Conditions for Red Butte Management Area

- The environment is essentially unmodified. Naturally occurring scenery dominates the landscape.

Guidelines for Red Butte Management Area

- Activities should be coordinated with tribes to minimize impacts to ceremonial activities.
- Temporary closures should be implemented upon request by the tribes to provide privacy for traditional activities.
- The helipad on Red Butte should only be used for administrative purposes.
- Commercial use such as outfitter guides, plant collection, and fuel wood in the Red Butte MA should not be permitted.

Management Approach

Tribal members have identified air traffic surrounding Red Butte as disruptive to tribal ceremonies. The Forest Service does not have the authority to regulate air traffic (flights), so it is important that the Kaibab NF work closely with and educate potential operators about the impacts. When temporary closures are in place for traditional or ceremonial use, a request for air operators to avoid the area may be made.

Buffalo Ranch Management Area

The bison herd has been present on the North Kaibab Ranger District for more than 100 years and was specifically mentioned in legislation leading to the Grand Canyon Game Preserve. The State of Arizona owns and manages the bison herd on NFS land through an agreement between the Arizona Game and Fish Department and the U.S. Forest Service.

Desired Conditions for the Buffalo Ranch Management Area

- Bison are a desired introduced species in the designated Buffalo Ranch MA in Houserock Valley.
- There are opportunities to hunt buffalo (bison).
- The bison herd size is within the range identified in the MOU.

Guidelines for the Buffalo Ranch

- Bison should be confined to the area identified in the MOU.

Management Approach

Coordination and cooperation between the Kaibab NF, AGFD, Grand Canyon National Park, and researchers will be needed to identify workable solutions for managing the bison.

Pediocactus Conservation Area

Pediocactus paradinei (which is also known as the Paradine or Kaibab plains cactus) was previously a Category 1 candidate for listing as endangered by the Fish and Wildlife Service. In lieu of formal listing, an interagency Conservation Assessment and Strategy was prepared for the Paradine plains cactus (*Pediocactus paradinei*, B.W. Benson). This management area was established to aid in managing this species.

Desired Conditions for the Pediocactus Conservation Area

- Paradine plains cactus (*Pediocactus paradinei*) has a sustainable population and is at low risk for extirpation.

Guidelines for the Pediocactus Conservation Area

- Collection of Paradine plains cactus plants should not be permitted.
- Project activities should incorporate protective measures for the Paradine plains cactus. Any potentially ground disturbing activities in the Pediocactus Conservation area should be evaluated and protective measures should be implemented to minimize resource impacts.
- Non-native invasive weeds should be regularly monitored and promptly treated.
- Motorized access should be restricted.
- Public information and recreational brochures should not feature this area.

Management Approach

The character of this area is maintained by limiting access and managing threats. Suppression actions may be needed to prevent damage to the plants and habitat.

[See also sections for [pinyon-juniper communities](#), [sagebrush shrublands](#), [rare and narrow endemic species](#), and [nonnative invasive species](#)]

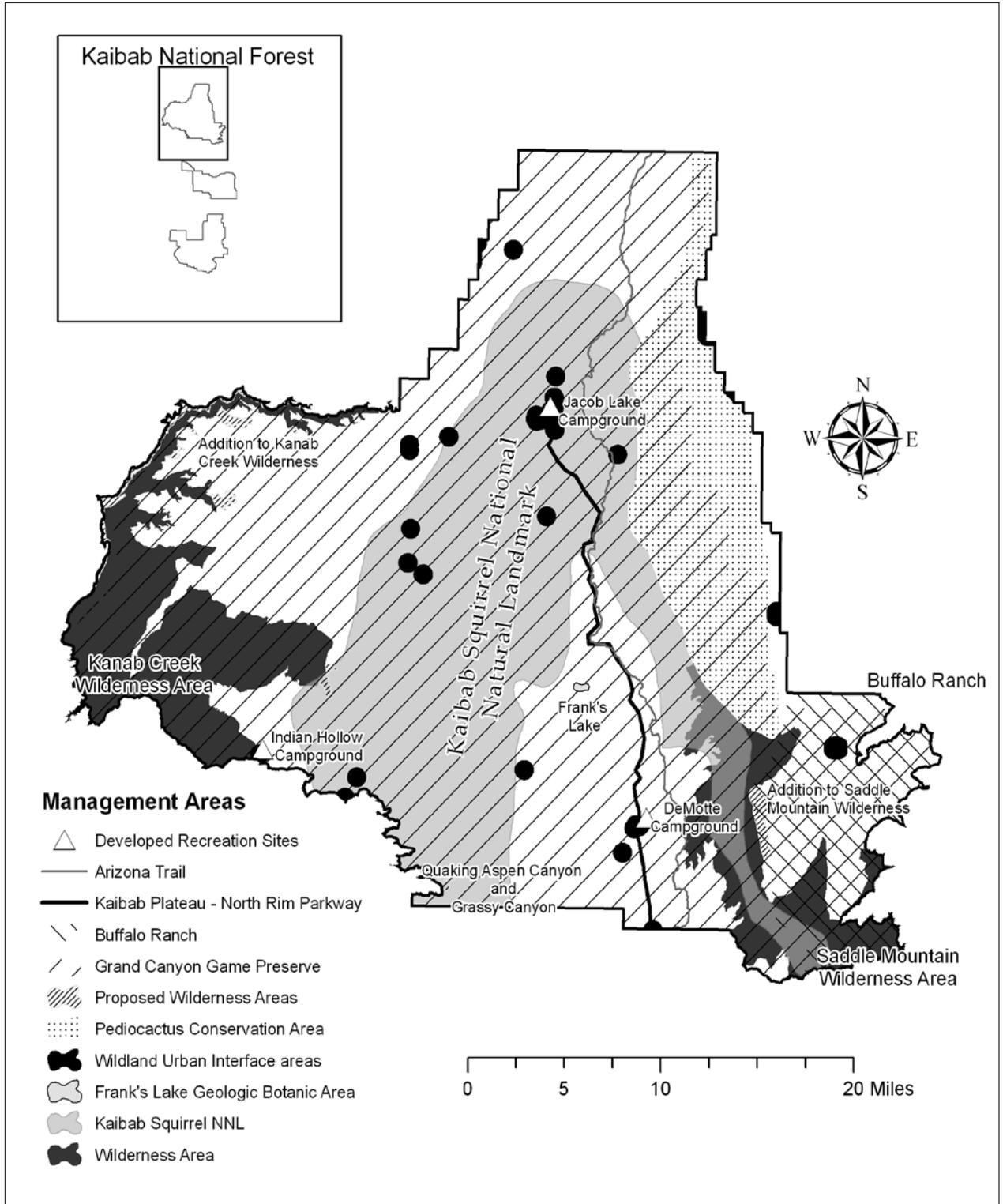


Figure 2. Management areas on the North Kaibab Ranger District

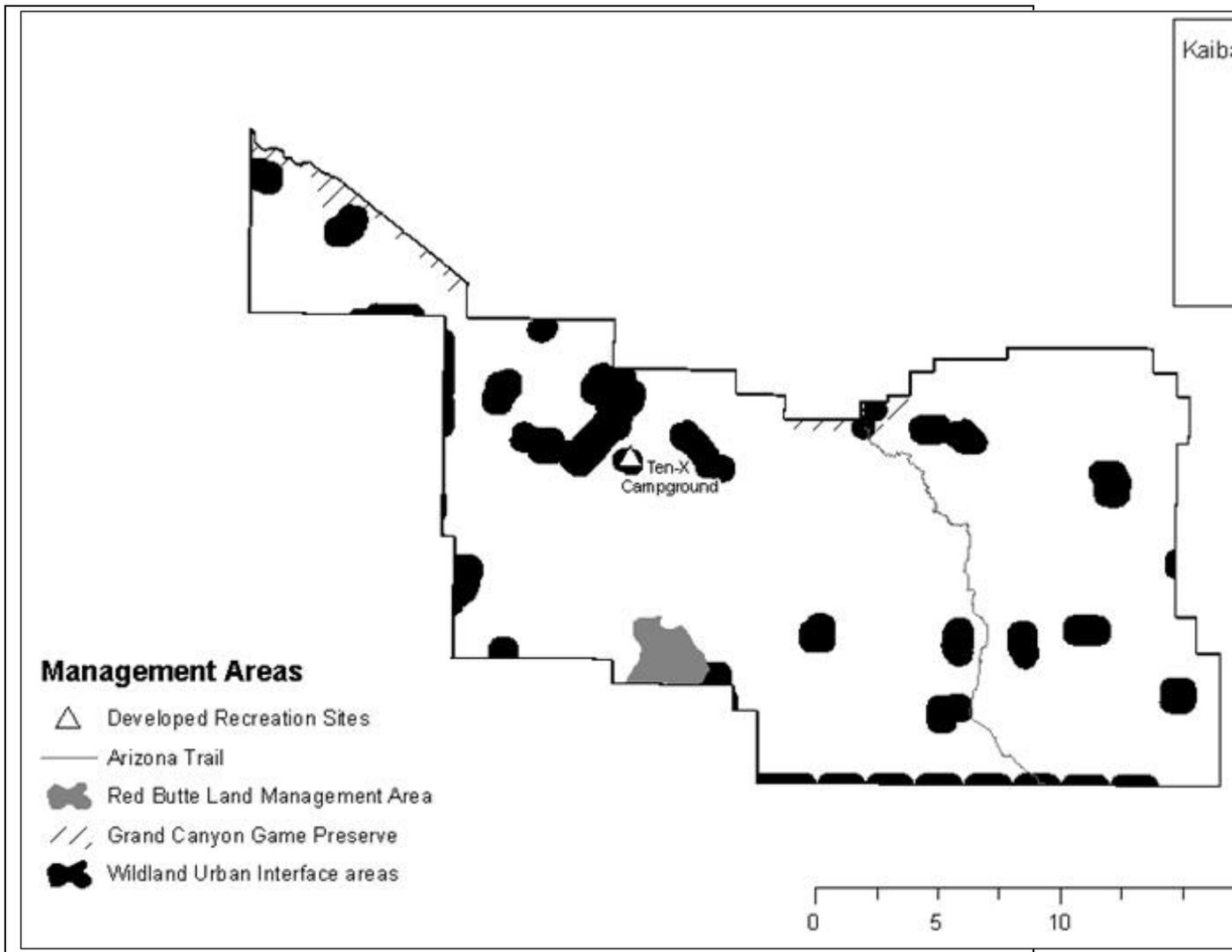


Figure 3. Management areas on the Tusayan Ranger District

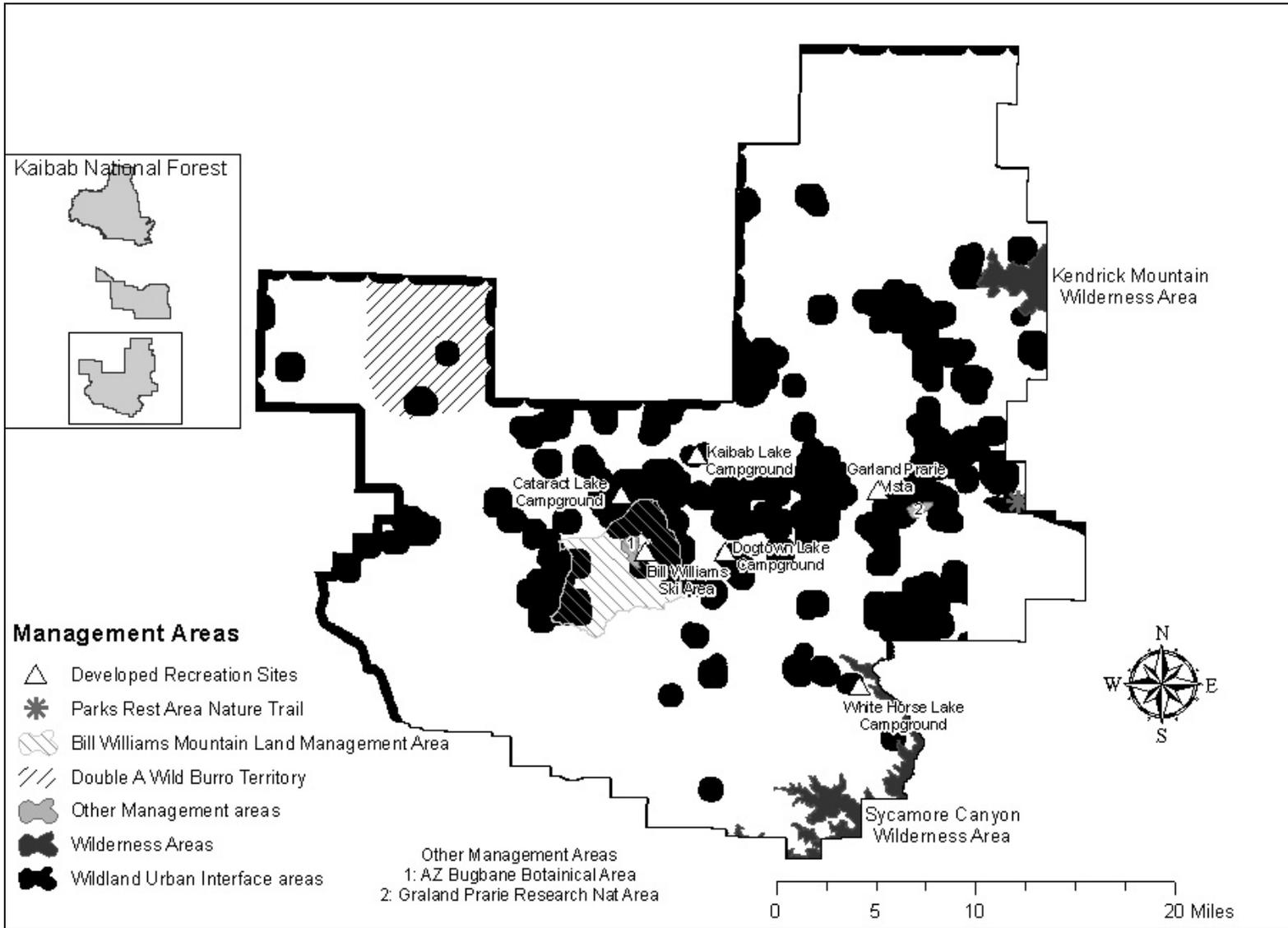


Figure 4. Management areas on the Williams Ranger District

Chapter 4: Suitability

The National Forest Management Act (NFMA) states that national forest plans shall provide for multiple-use and sustained yield of products and services through management of renewable surface resources to best meet the needs of the American people. NFMA also requires that NFS lands be classified as to their suitability for various uses including: timber production, forage production, and recreation opportunities. Suitability is the appropriateness of applying certain resource management practices to a particular area of land in consideration of the relevant social, economic, and ecological factors. Suitability is determined based on compatibility with desired conditions and objectives in the plan area. Lands identified in the plan as suitable or not suitable for a particular use does not mean that the use will or will not occur on those lands. Suitability decisions provide guidance for project and activity decision making, and are not commitments or a final decisions approving projects and activities.

Timber Suitability

The NFMA requires that NFS lands be classified as to their suitability for timber production. NFS lands were reserved with the intent of providing goods and services to satisfy public needs over the long term. These goods include the production of a sustainable supply of forest products. Timber production is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees for industrial or consumer use. Timber production activities can contribute to social, economic, or ecological sustainability. Timber production has the potential to offset some or all of the costs of thinning and other forest development or maintenance activities that lower uncharacteristic fire and insect risk, increase understory plant diversity and abundance, and create employment opportunities.

Areas unsuitable for timber production are those that are either not desirable or not feasible to manage for periodic harvests of forest products. For example, restoration of grasslands often requires cutting trees. These trees can be made available for sale, but the intent for the future is to maintain them as grasslands, and as a result timber production would not be desirable because it is inconsistent with the desired conditions. Where long-term resource productivity would be impaired or law, regulation, or policies prohibit it, timber production is not feasible.

In accordance with the provisions of the current planning rule, a GIS analysis was conducted on all NFS lands managed by the Kaibab NF to derive acres of land categorized into suitable and not suitable for timber production, which varied by alternative (219.14). Lands not suitable for timber production were removed and placed into the following categories: nonforested (219.14(a)(1)), irreversible resource damage (219.14(a)(2)), adequate restocking not assured (219.14(a)(3)), and withdrawn (219.14(a)(4)). The remaining land was then categorized as tentatively suitable for timber production.

For each alternative, lands not appropriate for timber production were removed from the tentatively suitable lands category into lands where management area prescriptions preclude timber production (219.14(c)(1)), lands where management requirements (219.27) cannot be met (219.14(c)(2)), and lands not cost-efficient in meeting timber objectives (219.14(c)(3)). Table 1 provides acreages used in the timber suitability calculation. More information about this process can be found in the Draft Environmental Impact Statement for the Kaibab Land Management Plan, Appendix G.

Table 1. Timber suitability calculation for the Kaibab NF

Land Category	Acres
Gross area of Kaibab NF	1,593,936
Area not administered by the Forest Service (Camp Navajo and private lands)	-57,762
NFS Lands administered by the Kaibab NF	1,536,174
Non-forested ¹	-847,376
Irreversible resource damage	-54,265
Adequate restocking not assured	-21,834
Withdrawn (219.14(a)(4))	-117,563
<i>Sub-Total: Not-suitable for timber production</i>	-1,041,038
Lands Tentatively Suitable for Timber production	501,046
Management prescriptions preclude timber production	-89,808
Management requirements cannot be met	-16,903
Not cost efficient in meeting timber objectives	-13,025
<i>Sub-Total: Not appropriate for timber production</i>	-119,736
Lands Suitable for timber production	381,310

¹ Includes forested lands that are not capable of producing industrial wood, such as pinyon-juniper woodlands.

Grazing Suitability and Capability

Procedures in the 1982 Planning Rule require that the suitability and capability for producing forage for grazing animals on NFS lands be determined in forest planning. Capability is the potential of an area of land to produce resources and supply goods and services. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology. Suitability is the appropriateness of applying certain resource management practices to a particular area of land in consideration of the relevant social, economic, and ecological factors. Areas within the plan area are not suitable if livestock grazing would be incompatible with the desired conditions or result in substantial and permanent impairment of the land.

Capability to produce forage for grazing animals was determined for the original Forest Plan (KNF 1988). Most landscape-scale conditions that influence capability have not changed significantly since the initial evaluation. However, the data and analysis tools used in the initial determination were not as accurate or precise as what is available today. For this proposed plan, capability was reassessed using the corporate GIS data. Table 2 displays the results of the recent capability analysis. The area capable for livestock grazing has about 12 percent fewer acres than the original forest plan. More detail about the process and rationale behind these calculations are documented in the white paper “Grazing capability calculations for the Kaibab NF” and are filed in the project record.

Table 2. Grazing capability calculations for the Kaibab NF

Grazing Capability Category	Acres
Gross area of Kaibab NF	1,593,936
Area not administered by the Forest Service (Camp Navajo and private lands)	-57,762
Adjustments to plan area (Kendrick and Sycamore Wilderness)	-5,489
<i>Net Analysis Area</i>	<i>1,530,685</i>
Slopes greater than 40 percent	-165,710
Severe erosion hazard (Terrestrial Ecosystem Survey)	-176,782
Forage productivity less than 100 lb/ac/yr (based on TES)	-88,540
Total “No Capability” Areas	-431,032
Lands tentatively capable for livestock grazing	1,099,653

The original Plan identified four management areas as unsuitable for livestock grazing. They are the Arizona Bugbane Botanic Area, Garland Prairie Research Natural Area, Franks Lake Geologic/Botanic Area, and Developed Recreation Sites. These management areas are still identified as unsuitable, but a 219-acre adjustment was made to the area managed as Developed Recreation Sites. Two developed recreation sites have been closed since the original plan was signed and they are no longer managed for recreation: Moqui Lodge and Benham Snowplay Area, 202 and 17 acres, respectively. The desired conditions for these areas would no longer preclude livestock grazing. As a result, this revised plan shows these areas as suitable.

Since the original Plan was approved, each allotment on the Kaibab NF has received site-specific environmental review for the authorization of grazing. The decisions for those analyses were reviewed for areas where livestock grazing was not authorized. Site-specific NEPA identified three large contiguous areas were not authorized for grazing following environmental review: the

Kanab Creek Allotment, Jump-up Pasture of the Central Winter Allotment, and the Bill Williams Mountain portion of the Hat Allotment. In this revised plan, these areas have been identified as not suitable for livestock grazing.

Table 3. Areas unsuitable for grazing on the Kaibab NF

Feature	Area (acres)	Note
Arizona Bugbane Botanic Area	618	Management areas closed to grazing in the original Forest Plan.
Garland Prairie Research Natural Area	340	
Franks Lake Geologic/Botanic Area	170	
Existing Developed Recreation Sites	3,986	
Kanab Creek Allotment	39,280	Closed to grazing in site-specific NEPA decision in March 2001
Jump-up Pasture, Central Winter Allotment	15,745	
Bill Williams Mountain, Hat Allotment	2,500	Closed to grazing in site-specific NEPA decision in September, 2010
Total Unsuitable Area	62,700	

A suitable determination indicates that grazing is compatible with the desired conditions for the relevant portion of the plan area. It is guidance for project and activity decision making, and is not a commitment or a final decision. It does not mean that grazing will or will not occur in a particular area. The final decision to authorize livestock grazing and the determination for how lands are managed (including those that have been identified as not capable of producing forage), is made at the project/allotment level. The decision to authorize grazing and under what conditions is made following environmental review (NEPA) where site-specific conditions can be assessed and addressed through project design.

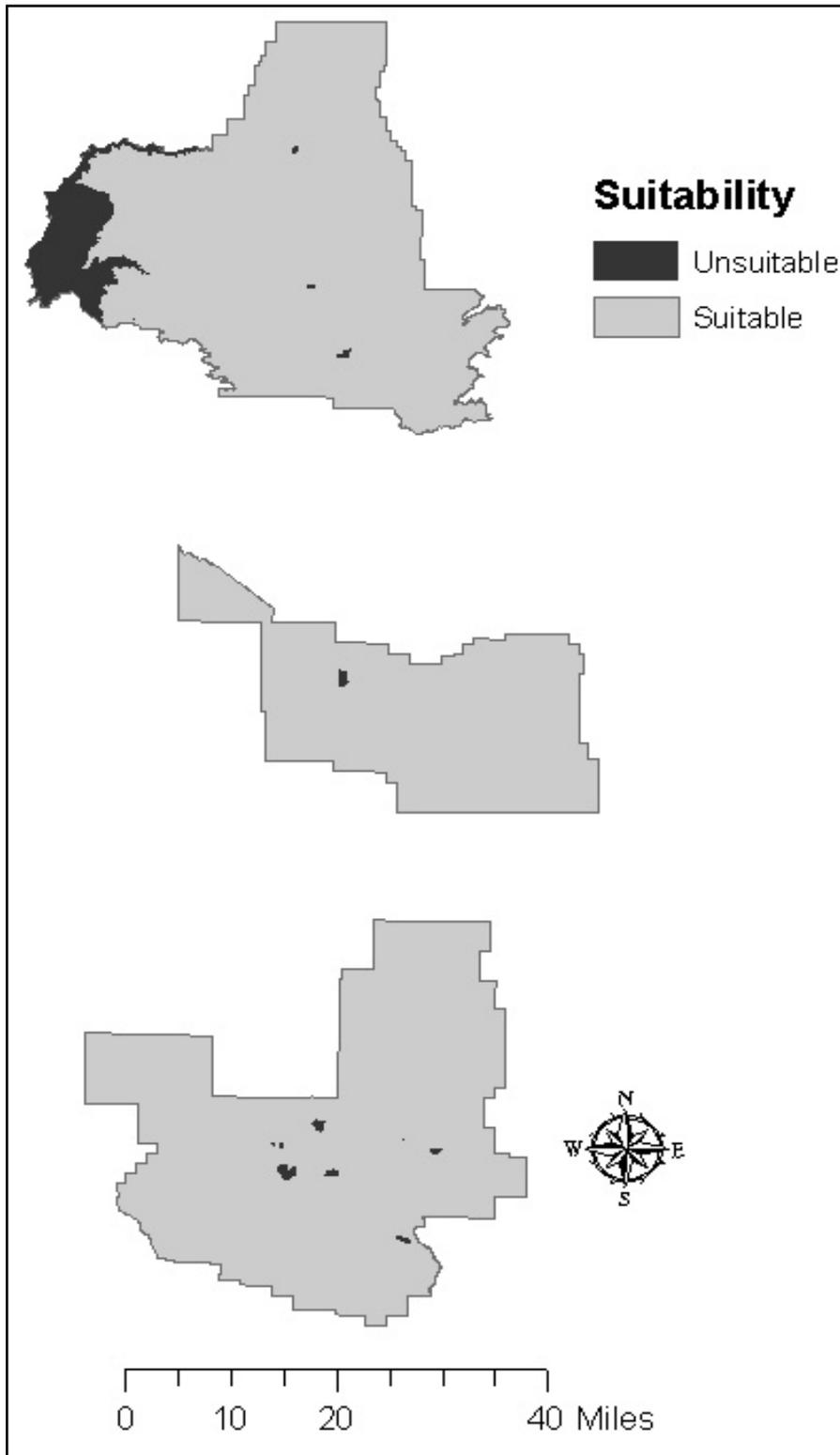


Figure 5. Kaibab NF lands suitable and unsuitable for livestock grazing

Minerals and Energy Development Suitability

The forest plan decisions can make suitable (or unsuitable) determinations for extraction or use of common variety minerals and energy (oil, gas geothermal) resources on Kaibab NF. Minerals are classified as leasable, salable, or locatable. Coal, oil shale, oil and gas, phosphate, potash, sodium, geothermal resources, and all other minerals that may be acquired under the Mineral Leasing Act of 1920, as amended, are referred to as leasable minerals. Common varieties of sand, stone, gravel, pumicite, and clay that may be acquired under the Materials Act of 1947 are considered saleable minerals or mineral materials. Any minerals that are not saleable or leasable, such as gold, silver, copper, tungsten, and uranium, are referred to as locatable minerals. Locatable minerals include most metallic minerals and certain nonmetallic and industrial minerals.

Locatable minerals are subject to the General Mining Law of May 10, 1872, as amended, and withdrawal decisions are outside the authority of National Forest Planning. The areas of the North Kaibab and Tusayan Ranger Districts that were designated as part of the Grand Canyon Game Preserve are closed to locatable mineral entry. This area of “public domain lands” was designated as a game preserve in 1906 and was set aside from mineral entry as described in the 1872 General Mining Law. In 1985, a court decision determined that the area is open to leasable minerals activities that are consistent with the character of the game preserve.

The remaining areas of the North Kaibab and Tusayan Ranger Districts were recently withdrawn from locatable mineral entry under the Record of Decision for the Northern Arizona Withdrawal (January 9, 2012). The Record of Decision for the Northern Arizona Withdrawal prevents the establishment of new mining claims on public domain lands within the Tusayan Ranger District, and the specified portions of the North Kaibab Ranger District, but would have no effect on existing valid claims. Existing valid mining claims may still be developed within the withdrawn area where valid existing rights can be proven.

The following were considered in evaluating potential changes to mineral and energy suitability:

- Solar and wind resources are being developed near the Kaibab NF and requests for development on the forest have been received. Energy transmission was addressed in the Western Energy Corridor EIS. Solar and wind generation demands and technology are rapidly changing and may need to be revisited within the plan period.
- Demand for mineral materials is likely to continue.

Table 4 displays the current status of minerals and energy resources suitability on the Forest.

Table 4. Suitability for mineral and energy activities on the Kaibab National Forest

Location	Suitability	Notes
Grand Canyon Game Preserve	Withdrawn	This area is withdrawn from all locatable mineral entry. It is available for saleable and leasable mineral development on a case-by-case basis and government uses as needed, for roads and facility maintenance or construction that are consistent with the purpose of the Game Preserve.
Kanab Creek Wilderness		Most of this wilderness area was withdrawn from locatable mineral entry with the designation of the Grand Canyon Game Preserve. The remaining portions of the area were withdrawn from all mineral entry with its wilderness designation.
Kendrick Mountain Wilderness		This area was withdrawn from all mineral entry with its wilderness designation.
Saddle Mountain Wilderness		This wilderness area was withdrawn from locatable mineral entry with the designation of the Grand Canyon Game Preserve. It was withdrawn from all mineral entry with its wilderness designation.
The remaining portions of the Tusayan Ranger District and North Kaibab Ranger District		Withdrawn from locatable mineral entry with the Record of Decision for the Northern Arizona Withdrawal, January 9, 2012. These areas are available for saleable and leasable mineral entry and development.
Administrative, communication and electronic sites		Most administrative sites are currently withdrawn. Note: a few are in the process of being withdrawn and have not been finalized. Administrative, communication and electronic sites that are not currently withdrawn are unavailable.
Areas of acquired lands for which the Forest Service has mineral rights	Unavailable	Determination regarding mineral rights would be made on a site-specific basis in response to proposals.
Bill Williams Watershed	Unavailable	Due to the high value of the Williams Municipal Watershed and the potential for adverse effects associated with mineral uses, this area is unavailable for mineral entry.
Solar and wind	Unavailable	There are opportunities off of the the Kaibab NF on adjacent private, tribal, and Arizona State lands. These areas would be considered first for solar and wind development. This screening process is specified in FSH 2709.11, chapter 70.
All other NFS lands on the Kaibab NF	Available	Open to mineral and energy resource development consistent with the desired conditions, standards, and guidelines of this plan.

Withdrawn: Not open to locatable mineral entry except for mining claims with valid existing rights.

Available: Open to entry for locatable mineral development and saleable or leasable resources if site-specific NEPA determines it is appropriate.

Unavailable: Not open to entry for saleable or leasable mineral development. Open to locatable mineral entry.

Recreation Suitability

Recreation suitability on the Kaibab National Forest corresponds to the recreation opportunity spectrum (ROS) and scenery management system scenic integrity objectives (SIO). ROS is based on the premise that visitors choose specific settings for their recreation activities to enjoy the desired experiences. Using a classification system, seven potential classes of recreation opportunity are applied. Each class describes different outdoor recreation settings and characteristics such as size, scenic quality, type and degree of access, remoteness, level of development, social encounters, and amount of on-site management. The classes include primitive, semi-primitive nonmotorized, semi-primitive motorized, roaded natural, roaded modified, rural, and urban. By describing the existing recreation opportunities in each class, ROS helps visitors match with their preferred recreation setting. For more information about the ROS see the ROS user guide at www.fs.fed.us/cdt/carrying_capacity/rosguide_1982.pdf

The Forest Service developed the scenery management system to provide a vocabulary and systematic approach for managing scenery in national forests. It integrates the biological, physical, and cultural elements that combine to make each landscape unique. The process involves identifying scenery components as they relate to people, mapping the components and developing a value for aesthetics from the data gathered. Most recreation-oriented people who visit national forests have an image of what they expect to see. Application of the mapping is based upon the assumption that people value most highly the more visually attractive and naturally appearing landscapes. Scenic integrity is used to describe the degree of intactness of the scenery, and the levels include very high, high, moderate, low, and very low. Scenic integrity can also be used to describe past, present and future landscapes.

The ROS classes and SIO levels displayed in the suitability maps indicate the desired conditions for the landscape. The existing ROS and SIO may not currently meet these desired conditions, but projects are to maintain or improve these to meet the desired conditions.

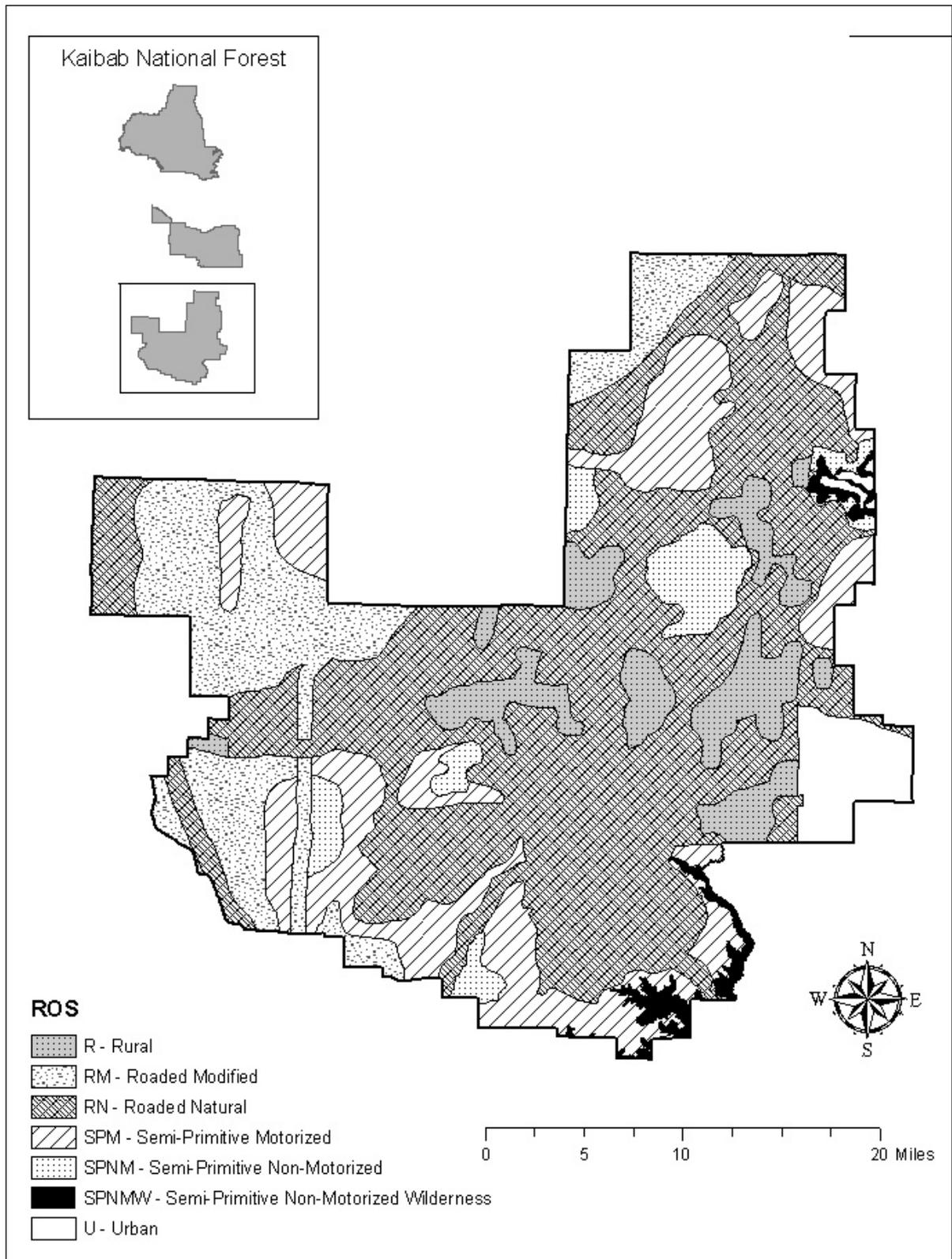


Figure 6. Recreation opportunity settings for the Williams Ranger District

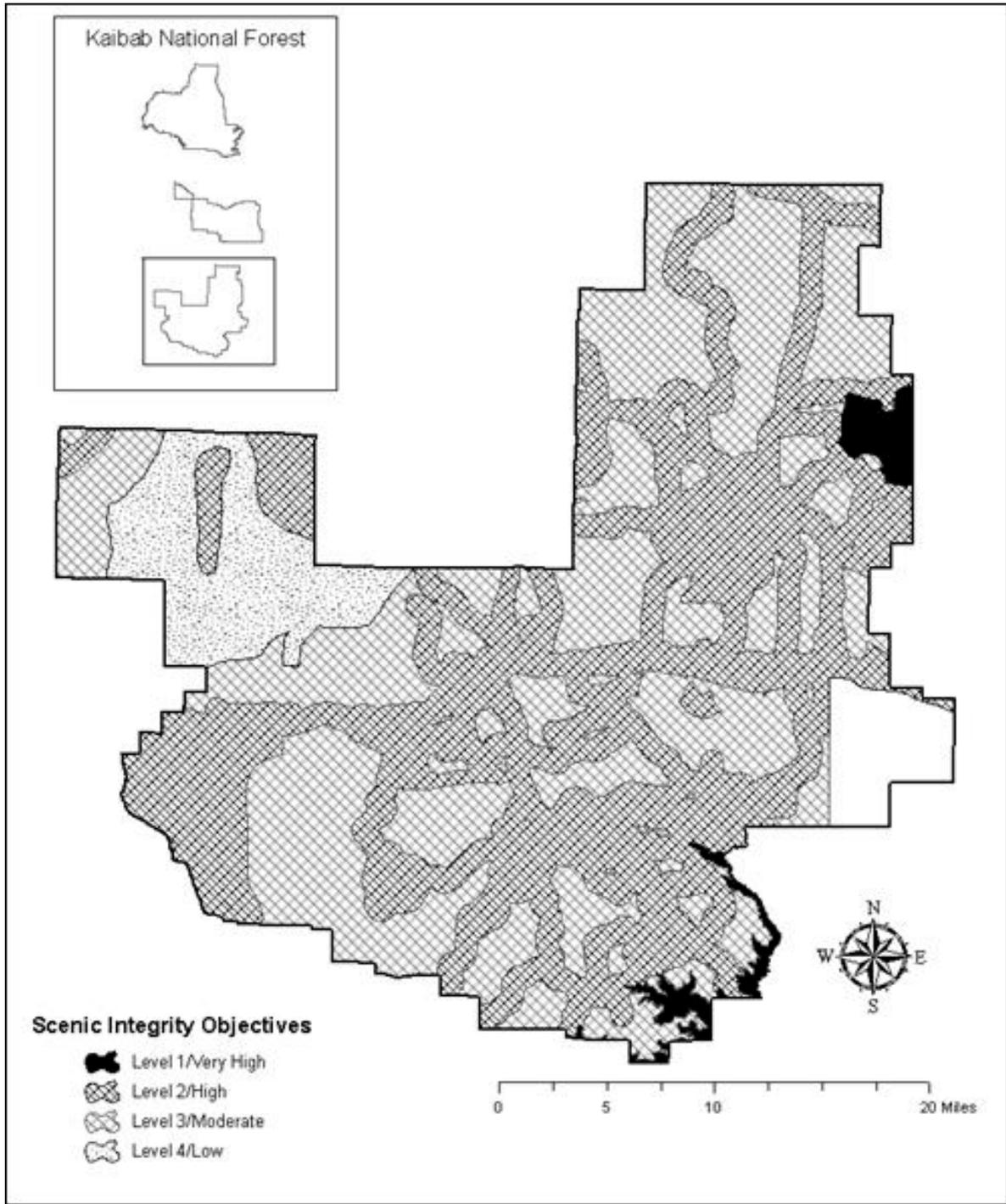


Figure 7. Scenic integrity objectives for the Williams Ranger District

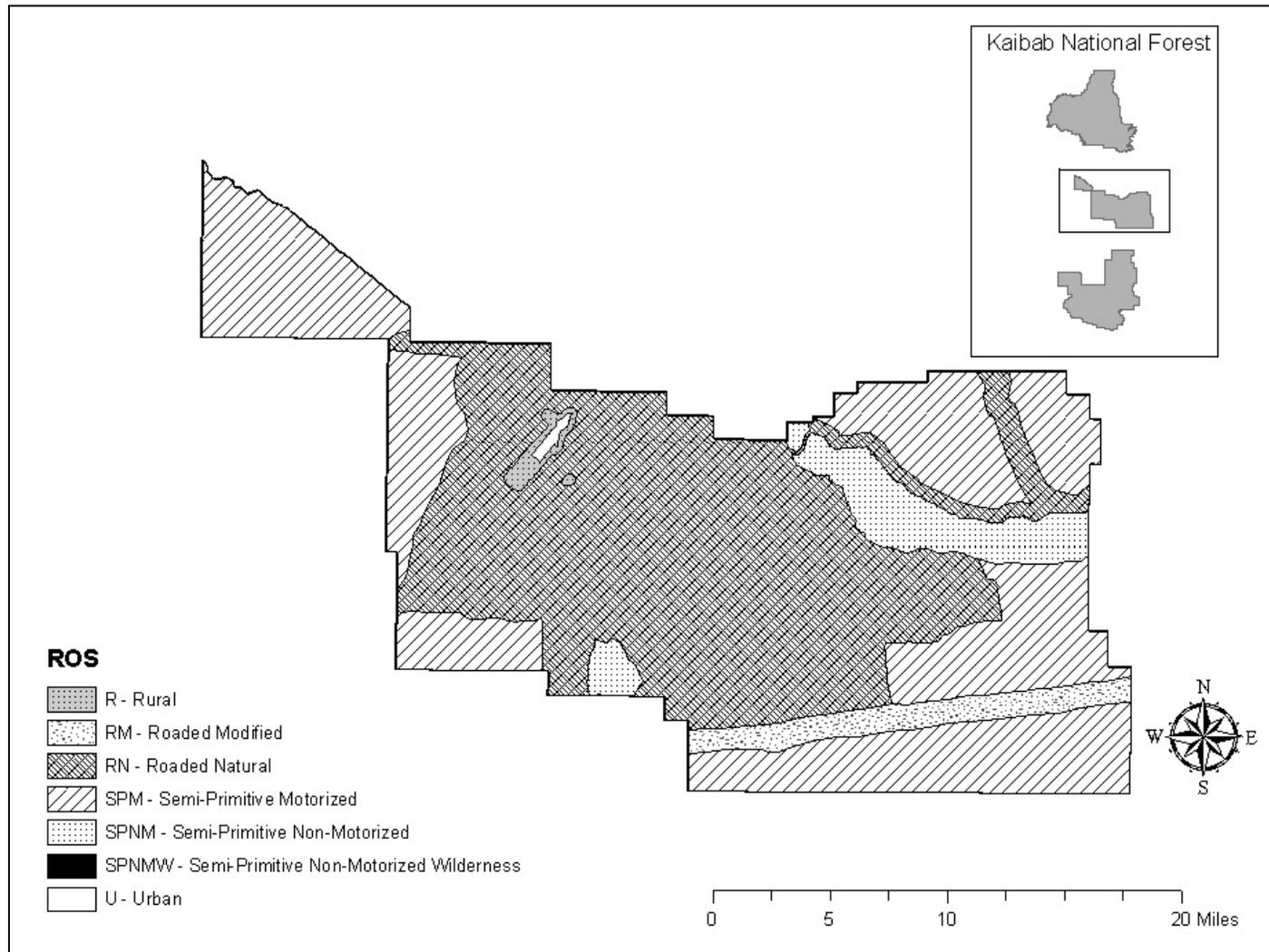


Figure 8. Recreation opportunity settings for the Tusayan Ranger District

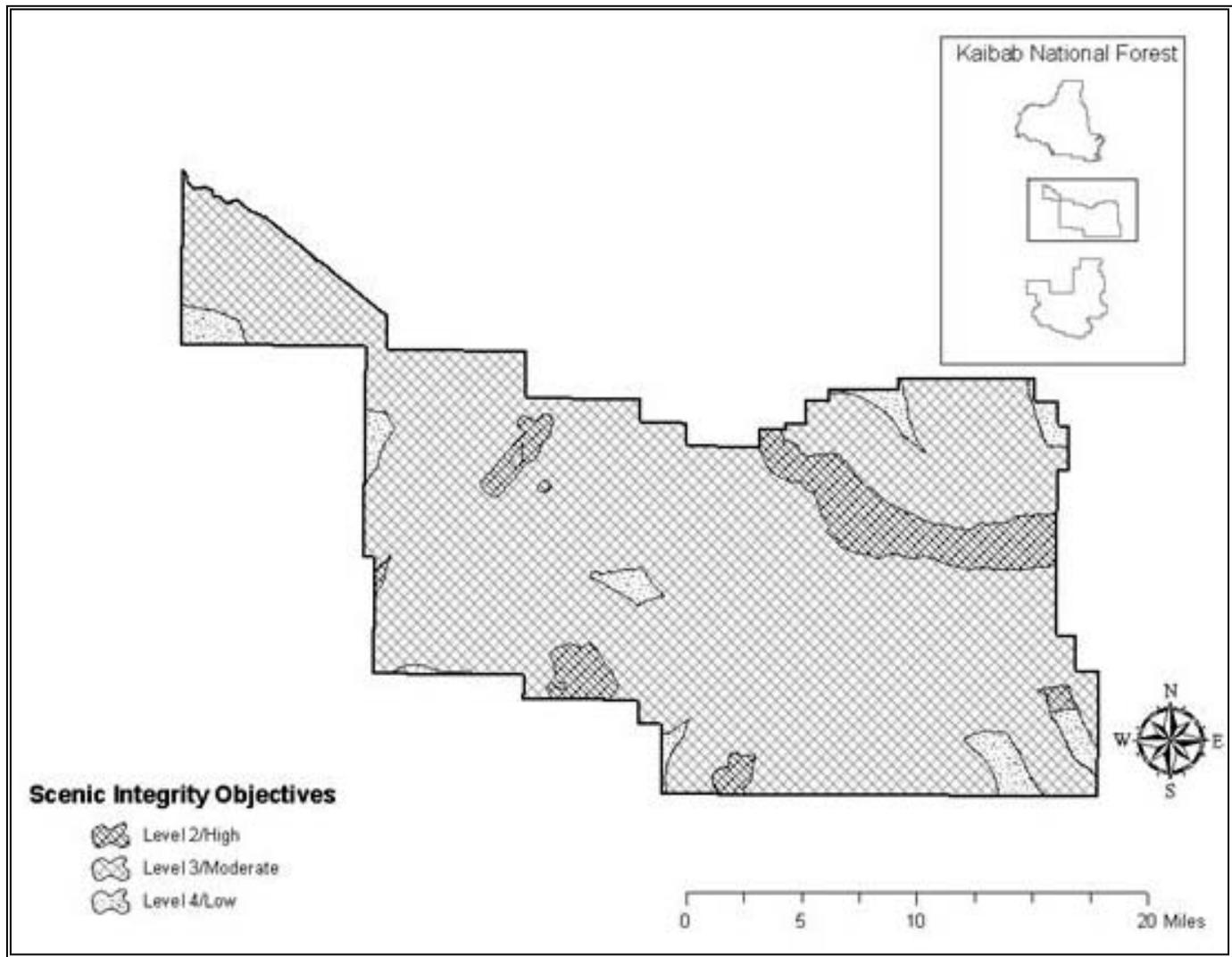


Figure 9. Scenic integrity objectives for the Tusayan Ranger District

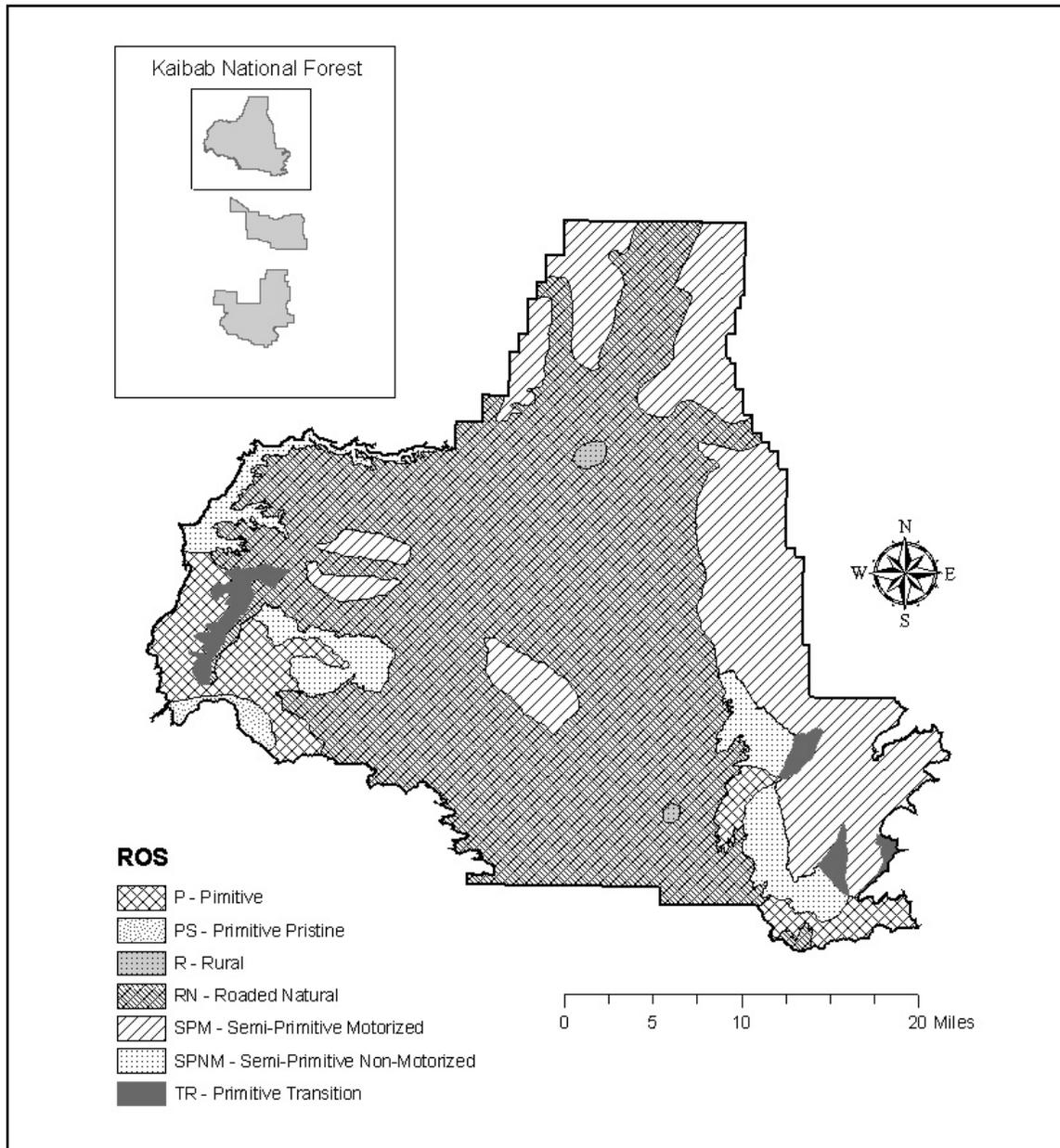


Figure 10. Recreation opportunity settings for the North Kaibab Ranger District

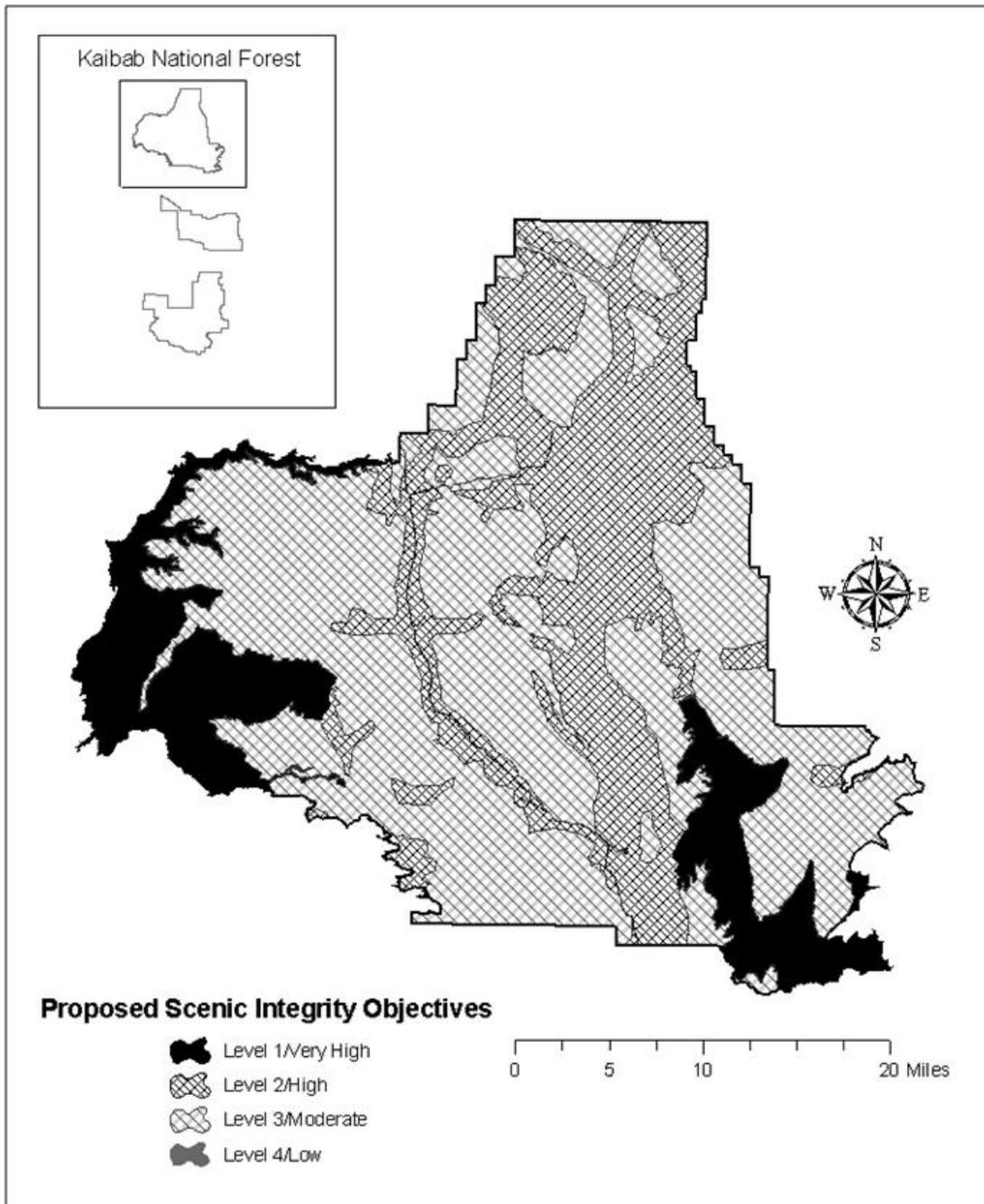


Figure 11. Scenic integrity objectives for the North Kaibab Ranger District

Chapter 5: Monitoring and Evaluation

Introduction

Monitoring and evaluation are required by the 1982 Planning Rule provisions. Monitoring and evaluation document and report how well a plan is being implemented, how well it is working, and if its direction is still appropriate. Evaluation examines altered conditions that result from management, identifies possible reasons desired conditions are not being met, and proposes alternative solutions. Monitoring is essential to provide information to the responsible official so they may decide if a change in plan components or other plan content may be needed to be responsive to changing conditions and issues. Monitoring is the feedback that enables adaptive management.

Monitoring and evaluation are fundamental to good program management and they:

- Provide data on project implementation and effectiveness
- Improve decision making
- Allow for accountability to stakeholders
- Help identify needed changes in management
- Inform further information needs

The monitoring plan outlines the general framework for achieving the forest plan monitoring objectives. It is strategic in nature and contains specific questions that ask how well the Kaibab NF is moving toward and achieving its desired conditions and objectives within a given resource area. The monitoring plan uses a multi-scaled approach to monitor short- and long-term changes. Monitoring is not completed on every activity. It does not address project-level compliance monitoring, which is conducted to evaluate consistency with law, regulation, or policy; unless such monitoring answers a forestwide question. It is not intended for research purposes and may have varying degrees of statistical rigor.

This monitoring plan is intended to be adaptive in nature and incorporates strategies which are holistic, collaborative, and grounded in science. This approach should provide the Kaibab NF with the best chance for achieving long-term sustainability of its natural resources, as well as the natural resources of the greater landscape. A more detailed discussion on the relationship between monitoring, evaluation and adaptive management can be found in the project record.

An interdisciplinary team developed this monitoring plan to: 1) meet legal requirements, 2) be consistent with corporate data standards and protocols, and 3) address the various aspects of forest management in an integrated manner.

The monitoring framework has three components:

1. Forest Plan Direction that provides broad, strategic guidance, and specifies the monitoring requirements in the forest plan itself. It provides the overall monitoring strategy including specific questions that need to be answered, what will be monitored, timetables for reporting, and other information.
2. A Monitoring and Evaluation Implementation Guide that provides specific, technical guidance. It describes how, where, and when to accomplish the monitoring prescribed in

the forest plan and provides the specific methods, protocols, and analytical procedures. The guide is intended to be flexible so that it can be modified in response to new information, updated procedures, emerging issues, and budgetary considerations without amending the forest plan.

3. An Annual Monitoring Evaluation Review that provides a process to review the current year findings and evaluate the need for modifications.

Monitoring Strategies

These strategies employ and build on existing methodologies and sources of information, but when additional need and capacity arise they can be expanded and modularized to increase the robustness and comprehensiveness of data collection and processing. Furthermore, these strategies should strive to achieve statistically valid outputs through transparent data collection, processing, and analysis processes.

Critical to this design is a framework and associated methodology which is systematic, transparent, and can be analyzed using contemporary statistical approaches. This design should facilitate consistency in data collection methods by partners (e.g., adjacent landowners, stakeholders, tribes, etc...), in turn, fostering greater efficiency, accountability, comparability of data, and the ability to better leverage monetary resources.

Information Management

Data will be designed and collected according to appropriate data standards and entered into corporate databases such as Natural Resource Inventory System (NRIS), or Geographic Information System (GIS). The information can then be accessed and analyzed to produce information products such as monitoring reports that would be available for internal and external review, and should provide the information necessary to make informed management decision.

Monitoring and Evaluation Implementation Guide

A more prescriptive implementation guide will be developed prior to plan implementation. The implementation plan will provide “the how” in terms of specific sample designs and strategies, identify indicator variables and models to be used, and determine any appropriate target thresholds/ benchmarks to be met. The implementation guide is not part of the plan, rather it is supplemental information to improve effective implementation the plan. As such, it can be updated easily to be adaptive and responsive to emerging issues, new science, changes to recommended survey methodologies and techniques, and fluctuations in budget. The guide will be developed collaboratively with area experts and statisticians so that it reflects the best available science and yields statistically valid, robust and contemporary data sets to the extent possible.

Monitoring Matrix

This monitoring matrix contains the plan decisions of the monitoring plan. It includes a combination of effectiveness and implementation monitoring. It is organized by five primary methods of data acquisition. Each matrix subheading is described in detail below. The order of monitoring items within each subheading follows the order of each resource area within the Forest Plan.

In many cases, data collected on one metric may help to answer several questions, improving efficiency and utility of the data. Efficiency is also achieved by leveraging existing and complimentary data sources from internal as well as external parties to the extent practicable. Frequency of data collection, evaluation and reporting varies by resource area and monitoring question. That is, not every item identified in the matrix is monitored or reported out on every year.

Data Acquisition Methods

Specific monitoring question require that data be gathered at multiple scales. As a result, a combination of strategies for obtaining data are used including existing methodologies and sources of information, rigorous field assessment protocols, remote sensing techniques, and existing monitoring efforts and other sources of information. Additionally, data collected for other purposes that can be used to answer monitoring questions are specified, obtained, and evaluated as part of the monitoring plan.

Rapid Plots: Indicate status of key ecological attributes for a focal ecological resources at the mid to fine spatial scales although measurements in multiple locations may provide wide spatial coverage. Data includes relatively simple field-based metrics. Examples include snags, down logs, large trees, presence of nonnative invasive species, and soil conditions.

Rapid plots data would be collected on key parameters using a systematic sampling framework superimposed across the entire Forest. Planned and existing forest projects would help guide the plot placement process. With the intent that data collected at the project level would be aggregated with other rapid plot data to make inferences at the forest level.

Remotely Sensed: Indicate status of key ecological attributes for a focal ecological resource at landscape scales and/or at coarser spatial resolution. Data sources include GIS and remote sensing imagery, which would indicate changes in land cover across an entire forest. Examples include landscape composition, pattern, and fragmentation. Some data collected through rapid plots may be used to validate and improve the accuracy of remote sensing data.

Existing Sources: Existing data the Forest or its partners already collect and report out on. Much of this data is managed under The Natural Resource Manager (NRM) system, a system of database tools for managing Agency data across the Forest Service. Natural Resource Manager includes Forest Service Activity Tracking System (FACTS), Infrastructure (Infra), and the Natural Resource Information System (NRIS), among others. Data routinely collected by the Arizona Department of Environmental Quality, Arizona Game and Fish Department, and USDA Animal and Plant Health Inspection Service (APHIS) are other sources of existing data sources which can be leveraged to answer forest-wide questions.

Interviews: Largely qualitative in nature and may be subjective. These may include questions posed to resource specialists, partners or during tribal discussions with some follow up interpretation of the results to obtain information.

Intensive: Indicate status of key ecological attributes for focal ecological resources at fine spatial scales or spatial resolution although measurements in multiple locations can provide wide spatial coverage. Data sources might include simple to complex field based-metrics that are usually quantitative and collected within a statistical sampling design. Examples include surveys of birds to assess density levels, analyses involving specific soil and water chemistry parameters, and quantitative vegetation structure measurements.

Matrix Data Fields

Resource area: A quantitative or qualitative resource, use, or activity parameter that can be assessed, e.g., vegetation communities, wildlife species, invasive species, recreation, etc.

Monitoring question: Specific monitoring questions were developed to ensure that the information essential to measuring progress toward meeting the forest plan objectives and desired conditions was collected and evaluated. Monitoring questions focus on key plan components where carrying out projects and activities are planned and changes are likely to result over time.

Metric: Metrics are key attributes for a particular resource area. Indicators were selected that were specific and measurable, occasionally including multiple metrics. In some cases, one metric can answer several different questions. These attribute measurements can be quantitative and/or qualitative and should provide enough information to answer the monitoring question(s). Indicators should be conducive to effective and systematic repeatable monitoring with existing survey methodology, and within budgetary constraints.

Driver: Monitoring driver(s) identify the reason(s) for monitoring a particular item. Drivers can be (1) Legal and regulatory requirements and Forest Service Manual direction; (2) Forest plan desired conditions, goals, objectives, standards, and guidelines; (3) Validation of assumptions and predictions; or (4) Court rulings or legal and regulatory compliance.

Measurement interval: Describes how often monitoring information is collected. This varies based on the resource area, monitoring drivers, and questions.

Evaluation and reporting interval: Describes how often monitoring information is evaluated and reported. Data will be assessed after 2 years to establish a “baseline” through which to compare change. A comprehensive review would be conducted approximately every 5 years. This would allow the forest to evaluate the overall monitoring program and management actions and to identify if any conditions that would trigger a change in management or prompt further investigation.

Precision and Reliability: Two categories of precision and reliability are appropriate at the forest plan scale:

Class A (Quantitative) are methods appropriate for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy and precision.

Class B (Qualitative) are methods based on project records, personal communications, ocular estimates, pace transects, informal visitor surveys, and similar types of assessments. The degree of repeatability, reliability, accuracy, and precision are not as high as Class A methods, but they still provide valuable information and are more appropriate for some resource areas.

Table 5. Matrix for the Kaibab NF Monitoring Plan

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
RAPID PLOT							
01	Ponderosa Pine and Frequent Fire Mixed Conifer	Are snags, coarse woody debris, downed logs and large old trees at desired levels at the midscale (100-1000 acre average)?	Number per acre	<p>Vegetation Midscale Desired Condition (DC): Snags 18 inches DBH or greater average 1 to 2 snags per acre. Snags and green snags of variable size and form are common. Downed logs (greater than 12 inches diameter at mid-point, and greater than 8 feet long) average 3 logs per acre within the forested area of the landscape.</p> <p>Coarse woody debris greater than 3 inches in diameter (including downed logs), ranges from 3 to 10 tons per acre (PIPO). Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre (FFMC)</p> <p>Vegetation Landscape DC: Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity.</p> <p>Soils DC: Logs and other woody materials are distributed across the surface to maintain soil productivity.</p> <p>MSO Recovery Plan</p>	1-5	2-5	A
02	Ponderosa Pine and Frequent Fire Mixed Conifer	Is the fuel loading within the desired range?	Tons per acre	<p>Midscale DC Ponderosa pine: Coarse woody debris greater than 3 inches in diameter (including downed logs), ranges from 3 to 10 tons per acre.</p> <p>Midscale DC Frequent fire Mixed Conifer: Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre.</p>	1-5	2-5	A

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
03	Soil and Watersheds	What is the percent of effective ground cover? What is the proportion of live and dead vegetation, rock, and bare ground?	Percent cover	Soils DC: Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration. Vegetation Landscape DC Organic ground cover and robust herbaceous vegetation provide protection for soil, and moisture infiltration, and contribute to plant and animal diversity and to ecosystem function.	1-5	2-5	A
04	Soils and Watersheds	Are the effects of forest management resulting in changes to the productivity of the soils (e.g. evidence of platy structures, pedestalling of vegetation or rock, rills)?	Presence/absence	Soil DC: Soil function and inherent long-term productivity are sustained so that the soil can resist erosion, recycle nutrients, and absorb water. Soil DC: Soils can readily absorb, store, and transmit water vertically and horizontally, accept, hold, release nutrients, and resist erosion. National Forest Management Act, 1976 (16 U.S.C. 1604(g)(3)(C)).	1-5	2-5	A/B
05	Soils and Watersheds	Is there downcutting and/or embeddedness in ephemeral drainages?	Presence/absence	Watershed DC: Vertical down cutting and embeddedness are absent in drainages.	1-5	2-5	B
06	Non-Native Species	What is the percent cover of noxious weeds ¹ by species?	Percent cover	Non-Native Invasive DC: species are contained and/or controlled so that they do not disrupt the structure or function of ecosystems. Non-Native Invasive Guideline: New populations are detected early, monitored, and treated as soon as possible.	1-5	2-5	A

¹ **Noxious weed** is a legal term applied to plants or plant parts regulated by Federal and State laws. Arizona Administrative Codes R3-4-244, R3-4-245 (Arizona Department of Agriculture 1999) regulate certain invasive species in the state: "A noxious weed is defined as any species of plant that is detrimental or destructive and difficult to control or eradicate and includes plant organisms found injurious to any domesticated, cultivated, native or wild plant."

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
REMOTELY SENSED							
07	Ponderosa Pine and Frequent Fire Mixed Conifer	How many acres of the forest is in an uneven aged open state, at the midscale (above 100 acres)?	Acres	<p>Landscape DC: The ponderosa pine forest vegetation community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. The forest is generally uneven-aged and open</p> <p>Midscale DC: The ponderosa pine forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages present.</p> <p>Midscale DC: Forest conditions in some areas contain 10 to 20 % higher basal area in mid-aged to old tree groups than in the general forest (e.g. goshawk post-fledging family areas, Mexican spotted owl protected areas, drainages, and steep north facing slopes).</p> <p>Other: Mexican Spotted Owl (MSO) Recovery Plan</p>	3-5	3-5	A/B
08	Ponderosa Pine and frequent fire Mixed conifer	How many acres are predicted to support active crown fire as modeled under typical peak fire danger conditions at the mid-scale?	Acres	<p>•Midscale DC: Fires burn primarily on the forest floor and typically do not spread between tree groups as crown fire.</p> <p>Obj (PIPO): To reduce the potential for active crown fire in ponderosa pine communities:</p> <ul style="list-style-type: none"> • Mechanically thin 11,000 to 19,000 acres annually. • Burn an average of 13,000 to 55,000 acres annually using a combination of prescribed fire and naturally ignited wildfires. <p>Obj (fPMC): Burn an average of 1,000 to 13,000 acres annually using prescribed fire and/or naturally ignited wildfires. Mechanically thin 1,200 to 2,100 acres per year.</p>	3-5	3-5	A

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
09	Ponderosa Pine and Frequent Fire Mixed Conifer	Is the stand density within a range that will allow for a robust understory?	Acres, SDI ²	Landscape DC: Organic ground cover and robust herbaceous vegetation provide protection for soil, and moisture infiltration, and contribute to plant and animal diversity and to ecosystem function.	3-5	3-5	A/B
10	Ponderosa Pine, Mixed conifer, spruce fir, and pinyon-juniper communities.	How many acres are at high risk for insect outbreaks?	Acres, SDI	Ponderosa Pine Landscape DC: The landscape is a functioning ecosystem that contains all its components, processes, and conditions associated with endemic levels of disturbances (e.g. fire, dwarf mistletoe, insects, diseases, lightning, drought, and wind)/ Forest vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability.	Annual	2-5	A/B
11	Ponderosa Pine and Frequent Fire Mixed Conifer	What is the total area within the desired range for Basal area? Openings?	BA, Open: Canopy	Midscale DC: Basal area within forested areas generally ranges from 20 to 80 sqft ² /acre. Openings with grass/forb/shrub vegetation are variably-shaped and typically range from 10% to 70%	3-5	3-5	A
12	Aspen	What is the areal extent and configuration of aspen on the Kaibab NF?	Acres	Aspen DC: Where aspen is present; it is stable or increasing in ponderosa pine and frequent fire mixed conifer forests.	3-5	3-5	A
13	Grasslands	What percent of the grassland PNVT has <10% canopy cover?	Percent cover	Grassland DCs: Tree canopy cover ranges from 0% to 9%, depending upon specific site conditions	3-5	3-5	A/B
14	Wildlife	Does habitat configuration provide functional connectivity for pronghorn?	Suitability Index ³	Wildlife DCs: Interconnected habitats allow for movement of wide-ranging species. Habitat configuration and availability allows wildlife populations to adjust their movements (e.g. seasonal migration, foraging etc.) in response to climate change and promote genetic flow between wildlife populations.	3-5	3-5	A/B

² Stand density index (SDI) is a relative measure of stand density the converts a stand's current density into a density at a reference size(Reineke 1933).

³ Based on connectivity modeling (Hurteau 2010)

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
EXISTING SOURCES							
15	Fire adapted ecosystems	How many acres were burned with desired fire behavior and effects?	Acres	<p>Finescale DC: Fires generally burn as surface fires, but single tree torching and isolated group torching is not uncommon.</p> <p>Midscale DC: Fires primarily burn on the forest floor and typically do not spread between tree groups as crown fire.</p> <p>Landscape DC: Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris loads, and nutrient cycling. Frequent, low severity fires (Fire Regime I) occur across the entire landscape with a return interval of 0 to 35 years.</p>	Annually	5	A
16	Fire adapted ecosystems	How many acres were treated with mechanical thinning by PNVT?	Acres	<p>Objective Ponderosa pine: To reduce the potential for active crown fire in ponderosa pine communities: <ul style="list-style-type: none"> • Mechanically thin 11,000 to 19,000 acres annually.. </p> <p>Objective Frequent fire Mixed Conifer: Mechanically thin 1,200 to 2,100 acres per year.</p> <p>Objective Grasslands: Reduce tree density to less than 10 percent on 5,000 to 10,000 acres of historic grasslands annually.</p>	Annual	2-5	A
17	Aspen (Tusayan and Williams RD)	What was the total area of aspen fenced?	Acres	Aspen Objective: Fence 200 acres of aspen within 10 years of plan approval.	Annual	2-5	A
18	Aspen	How many acres treated for conifer encroachment?	Acres	Aspen Objective: Reduce conifer encroachment on 800 acres of aspen within 10 years of plan approval.	Annual	2-5	A
19	Grasslands	What is the relative composition and cover of grasslands?	Frequency	<p>Grassland DCs: Vegetation is composed of a mix of native grasses and forbs. The structure, composition, and distribution of vegetation are within the range of natural variability and occur in natural patterns of abundance.</p> <p>Grass/forb/shrub canopy cover is typically above 25%, with less than one quarter of any grassland below this range.</p>	1-5	2-5	A/B

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
20	Grasslands	How many miles of fence were modified for pronghorn?	Miles	Grass lands Obj: Modify fences and/or install pronghorn crossings on 50 miles of fence within 10 years plan approval.	Annual	2-5	A
21	Ponderosa Pine, Mixed conifer, Spruce fir, and Pinyon-juniper	What is the acreage of outbreaks of insects and disease?	Acres	Ponderosa Pine Landscape DC: The landscape is a functioning ecosystem that contains all its components, processes, and conditions associated with endemic levels of disturbances (e.g. fire, dwarf mistletoe, insects, diseases, lightning, drought, and wind). Forest vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability.	Annual	2-5	A
22	Wildlife (MIS ⁴)	What is the estimated population trend of pronghorn?	Trend	FSM Policy: Population trends of the management indicator species will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with state fish and wildlife agencies, to the extent practicable.	Annual	2-5	A/B
23	Nonnative Invasive Species	What is the areal extent of priority non-native invasive plants on the KNF?	Acres	Invasive species DC: New populations are detected early, monitored, and treated as soon as possible.	Annual	2-5	A
24	Nonnative Invasive Species	How many acres of invasive plants were treated?	Acres	Invasive Obj: Treat 2,000 to 3,000 invaded acres annually.	Annual	2-5	A
25	Natural Waters	How many springs were protected and restored?	Count	Natural Waters Obj: Protect and/or restore at least 10 individual springs within 5 years of plan approval.	Annual	2-5	A
26	Natural Waters	How many acres of wetlands were restored?	Acres	Natural Waters Obj: Restore native vegetation and natural water flow patterns on at least 6 acres of wetlands within 5 years of plan approval.	Annual	2-5	A
27	Natural and Constructed Waters	Are there any water bodies not meeting Arizona Water Quality standards?	Count	Watershed DC: Water quality meets or exceeds State of Arizona or Environmental Protection Agency water quality standards for designated uses. Water quality meets critical needs of aquatic species.	2-5	2-5	A

⁴ Management Indicator Species

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
28	Air Quality	How many days did forest activities contribute to exceeding State standards for visibility and public health?	Count	Air Quality DC: Air quality above the Kaibab National Forest meets State air quality standards for visibility and public health.	Annual	2-5 years	A
29	Recreation	Is the forest providing adequate recreational opportunities for the public?	Visitor Use	Recreation DC: The forest provides a range of recreation settings and corresponding high quality scenery for the public to engage in developed and dispersed recreation activities in concert with other resource management and protection needs. Recreation opportunities are balanced with the ability of the land to support them. Minimal user conflicts.	5	5	B
30	Recreation	How many miles of trails were maintained to standard?	Miles	Recreation DCs: Recreation use levels are compatible with other resource values including scenery, cultural, soil, vegetation, water, wildlife. The biological, cultural, recreation, and scenic environment is sustained and enhanced for present and future generations.	Annual	2-5	A
31	Cultural Resources	How many acres of non-project-related cultural resource surveys were conducted?	Acres	Cultural Resource Objective: Non-project-related cultural resource survey is conducted in areas with a high likelihood of historic properties on at least 100 acres per year.	Annual	2-5	A
32	Forestry and Forest Products	How many acres of suitable timber lands were managed (TSI, harvest, etc.) for timber production?	Acres	National Forest Management Act 1976	Annual	2-5	A
33	Forestry and Forest Products	How much wood was offered?	CCF ⁵	Forestry and Forest Products DC: A sustained level of timber outputs is available from suitable timberland in an economically efficient manner to support local dependent industries and support local communities. A sustainable wood harvesting and utilization industry exists of a size and diversity required to effectively and efficiently restore and maintain the ponderosa pine vegetation community.	Annual	2-5	A

⁵ CCF: Wood volume (Hundred Cubic Feet)

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
34	Forestry and Forest Products	How many direct jobs does the forest support/provide from harvesting and utilization of wood products?	Number of jobs	Forestry and Forest Products DC: A sustainable wood harvesting and utilization industry exists of a size and diversity required to effectively and efficiently restore and maintain the ponderosa pine vegetation community.	2-5	2-5	A
35	Forestry and Forest Products	Have there been significant investments in the wood harvesting and utilization infrastructure in the operating area?	Production capacity	Forestry and Forest Products DC: A sustainable wood harvesting and utilization industry exists of a size and diversity required to effectively and efficiently restore and maintain the ponderosa pine vegetation community.	2-5	2-5	B
36	Forestry and Forest Products	What was the average cost per acre to the Forest Service for mechanical treatments?	Dollars/acre	National Forest Management Act (1976)	2-5	2-5	A
37	Forestry and Forest Products	What is the ratio of costs to revenues for mechanical thinning activities?	Cost: revenue	National Forest Management Act (1976)	2-5	2-5	A
INTERVIEWS							
38	Ponderosa Pine, Mixed conifer, spruce fir, and pinyon-juniper communities.	Were there any incidences of insect outbreaks in recently treated areas? If so, where?	Presence/absence, location	National Forest Management Act (1976)	Annual	2-5 years	A/B
39	Pinyon-Juniper Woodlands	Was a robust crop of pinyon nuts produced on any of the Districts?	Presence/absence, location	PJ DC: A robust crop of pinyon pine nuts are regularly produced.	Annual	5	B

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
40	Recreation and Transportation	Are there areas of the forest where recreation or vehicle use is causing detrimental resource effects that are in need of management? Where is it occurring?	Presence/absence, location	<p>Recreation DC:The forest provides a range of recreation opportunities for forest users and is balanced with the ability of the land and management to support them.</p> <p>Transportation DCs: Roads and culverts do not contribute to headcuts or downcuts in ephemeral drainages. Roads allow for safe and healthy wildlife movement in areas of human development. Vehicular collisions with animals are rare.</p>	2-5	2-5	A/B
41	Cultural Resources	Are cultural resources being protected in place?	Yes or no	Cultural Resource DC: • Cultural resources including known traditional cultural properties, are preserved, protected, or restored.	Annual	2-5	B
42	Livestock Grazing	Are livestock numbers balanced with forage capacity on each allotment	Yes or no	Livestock grazing DC: Grasses and forbs provide adequate forage for permitted livestock consistent with other desired conditions.	Annual	1-5	B
43	Tribal Traditional and Cultural Uses	Are plant species of known medicinal and cultural value being depleted?	Yes or no	<p>Tribal Traditional and Cultural Use DC: Traditional tribal uses, such as the collection of medicinal plants, wild plant foods, basketry materials, and fuel wood, are recognized as important uses and are supported by the Forest.</p> <p>Traditionally used resources are not depleted and are available for future generations.</p>	1-2	2-5	B
44	Arizona Bugbane Botanical Area	Were the monitoring requirements met as identified in the AZ Bugbane conservation agreement?	Yes or no	<p>DC for Bugbane Botanic Area: Arizona Bugbane has a sustainable population and is at low risk for extirpation. The character of this area is maintained.</p> <p>Other: Arizona Bugbane Conservation Agreement</p>	5	5	B
45	Pediocactus Conservation Area	Were the monitoring requirements met as identified in the Pediocactus conservation agreement?	Yes or no	<p>Pediocactus Conservation Area DC: Paradine plains cactus.(<i>Pediocactus paradinei</i>) has a sustainable population and is at low risk for extirpation.</p> <p>Other: Pediocactus Conservation Agreement</p>	5	5	B

No.	Resource Area	Monitoring Question	Metric	Driver (desired conditions, objectives, policy, etc.)	Measurement Interval (years)	Evaluation / Report Interval (years)	Precision
INTENSIVE							
46	Aspen	Is aspen regenerating and becoming established in treated areas?	Regeneration and recruitment	Aspen DC: Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes, Where aspen is present; it is stable or increasing in ponderosa pine and frequent fire mixed conifer forests.	2-5 years	5 years	A/B
47	Natural and Constructed Waters	What is the functional condition of the lakes and wetlands on the KNF?	PFC ⁶	Natural Waters DC: Water levels, flow patterns, groundwater recharge rates, and geochemistry are similar to reference conditions. Constructed Waters DC: Reservoirs maintain high quality for parameters such as temperature, dissolved oxygen, and water levels within the seasonal range of variable conditions.	3-5 years	5 years	A/B
48	Natural Waters	In treated/protected areas, are water flow patterns and vegetation intact?	Yes or no	Natural Waters DC: Water levels, flow patterns, groundwater recharge rates, and geochemistry are similar to reference conditions.	2-10	2-10	B
49	Wildlife (TES⁷)	Are Mexican spotted owls present in PACs?	Occupancy	Mexican spotted Owl Recovery Plan	1-5	2-5	B
50	Wildlife (MIS)	What is the estimated population density and trend for Graces Warbler, Western Bluebird and Ruby-crowned kinglet?	Density and trend	FSM Policy: Population trends of the management indicator species will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with state fish and wildlife agencies, to the extent practicable.	1-5	5-10	A/B
51	Double A Wild Free-Roaming Horse and Burro Territory	What is the estimated burro population within the area?	Count	DC for Wild and free roaming burro territory: A biologically sound burro population is in balance with native wildlife, permitted livestock, and other resource values. Other: Wild Free-Roaming Horses and Burros Act of 1971: Forest Service Handbook sections 2263.1 Territory Plans and 2265.3 - Removal of Excess Animals.	3-5	3-5	B

⁶ Proper functioning condition

⁷ Threatened, Endangered, and Sensitive species

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Glossary

Adaptive management is a system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes are met or re-evaluated. Adaptive management stems from the recognition that knowledge about natural systems is sometimes uncertain.

Age-class is defined as trees that originated within a relatively distinct range of years. Typically the range of years is considered to fall within 20 percent of the average natural maturity (e.g., if 100 years is required to reach maturity, then there would be five 20-year age classes).

Basal area is the cross-sectional area at breast height (4.5 feet above the ground) of trees measured in square feet. Basal area is a way to measure how much of a site is occupied by trees. The cross-sectional area is determined by calculating the tree's radius from its diameter (diameter/2 = radius) and using the formula for the area of a circle ($\pi \times \text{radius}^2 = \text{cross-sectional area}$). Basal area per acre is the summation of the cross-sectional area of all trees in an acre or in a smaller plot used to estimate basal area per acre. Diameter at root collar (defined below) is used to calculate the cross-sectional area of multi-stemmed trees such as juniper and oak.

Browse is either (1) the part of shrubs, half shrubs, woody vines, and trees available for animal consumption; or (2) to search for or consume browse. Interagency Technical Reference 1734-4 Sampling Vegetation Attributes. 1999 (ITR 1734-4).

Clump refers to a tight cluster of two to five trees of similar age and size originating from a common rooting zone that typically lean away from each other when mature. A clump is relatively isolated from other clumps or trees within a group of trees, but a standalone clump of trees can function as a tree group.

Coarse woody debris is woody material on the ground greater than 3 inches in diameter, including logs.

Connectivity is the ecological conditions that exist at several spatial and temporal scales that provide landscape linkages that permit the exchange of flow, sediments, and nutrients; the daily and seasonal movements of animals within home ranges; the dispersal and genetic interchange between populations; and the long distance range shifts of species, such as in response to climate change.

Corridor is a linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries.

Critical area is an area which should be treated with special consideration because of inherent site factors, size, location, condition, values, or significant potential conflicts among uses.

Deciview (*dv*): A measure of visual air quality. Similar to the decibel scale for sound, the deciview scale is linear with respect to perceived visual changes. A 1 *dv* change is approximately a 10 percent change in the extinction coefficient, which is a small, but usually perceptible scenic change.

Declining refers to the senescent (aging) period in the lifespan of plants that (for trees) includes the presence of large dead and/or dying limbs, snag-tops, large, old lightning scars, and other characteristics that indicate the later life stages of vegetation.

Diameter at breast height (d.b.h.) is the diameter of a tree typically measured at 4.5 feet above ground level.

Diameter at root collar (drc) is the diameter typically measured at the root collar or at the natural ground line, whichever is higher, outside the bark. For a multi-stemmed tree, drc is calculated from the diameter measurements of all qualifying stems (1.5 inches or greater diameter and at least 1 foot in length).

Dispersed recreation. Outdoor recreation in which visitors are spread over relatively large areas. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the visitors.

Disturbance is any relatively discrete event in time that disrupts ecosystem, watershed, community, or species population structure and/or function and changes resources, substrate availability, or the physical environment.

Disturbance regime. A description of the characteristic types of disturbance on a given landscape; the frequency, severity, and size distribution of these characteristic disturbance types; and their interactions.

Diversity. The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Ecosystem services are benefits people obtain from ecosystems, including (1) Provisioning services, such as clean air and fresh water, energy, fuel, forage, fiber, and minerals; (2) Regulating services, such as long term storage of carbon; climate regulation; water filtration, purification, and storage; soil stabilization; flood control; and disease regulation; (3) Supporting services, such as pollination, seed dispersal, soil formation, and nutrient cycling; and (4) Cultural services, such as educational, aesthetic, spiritual and cultural heritage values, recreational experiences and tourism opportunities.

Endemic. A population that has unique genetic characteristics and likely exists in a very limited geographic area.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Even-aged stand. A stand of trees composed of a single age class.

Even-aged management is the application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Managed even-aged forests are characterized by a distribution of stands of varying ages (and, therefore, tree sizes) throughout the forest area. The difference in age between trees forming the main canopy level of a stand usually does not exceed 20 percent of the age of the stand at harvest rotation age. Regeneration in a particular stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and is harvested. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Federally recognized Indian Tribe. An Indian or Alaska Native Tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian Tribe under the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479a.

Fire regime refers to the patterns of fire that occur over a long period of time across an appropriately scaled area and its immediate effects on the ecosystem in which it occurs. Five fire regimes are classified based on frequency (average number of years between fires) and severity (amount of replacement on the dominant overstory vegetation) of the fire. These five regimes are:

Fire Regime I – 0- to 35-year frequency and low (surface fires most common, isolated torching can occur) to mixed severity (less than 75 percent of dominant overstory vegetation replaced);

Fire Regime II – 0- to 35-year frequency and high-severity (greater than 75 percent of dominant overstory vegetation replaced);

Fire Regime III – 35- to 100+ year frequency and mixed severity;

Fire Regime IV – 35- to 100+ year frequency and high severity;

Fire Regime V – 200+ year frequency and high severity

Fire suppression: The work of extinguishing a fire or confining fire spread.

Forage is (1) browse and herbage which is available and can provide food for animals or be harvested for feeding; or (2) to search for or consume forage. ITR 1734-4.

Foraging areas (goshawk) are the areas that surround the post-fledgling family areas that goshawks use to hunt for prey. They are approximately 5,400 acres in size.

Forest land is land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for nonforest use. Lands developed for nonforest use include areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearing and powerline clearing of any width.

Functioning ecosystem is an ecosystem that contains all components and processes necessary to maintain resilience over time.

Gap refers to the space occurring in a forested area as a result of individual or group tree mortality from small disturbance events or from local site factors such as soil properties that influence vegetation growth patterns.

Goals are concise statements that describe desired conditions to be achieved sometime in the future. They are normally expressed in broad, general terms and are timeless in that they have no specific date by which they are to be completed. Goal statements form the principal basis from which desired conditions and objectives are developed.

Goods and services. The various outputs, including on-site uses, produced from forest and rangeland resources.

Goshawk post-fledging family areas (PFAs). The areas that surround nest areas. They represent an area of concentrated use by the northern goshawk family until the time the young are no longer dependent on adults for food. PFAs are approximately 420 acres in size (not including the nest area acres).

Group refers to a cluster of two or more trees with interlocking or nearly interlocking crowns at maturity surrounded by an opening. Size of tree groups is typically variable depending on forest type and site conditions, and can range from fractions of an acre (a two-tree group) to many acres. Trees within groups are typically non-uniformly spaced, some of which may be tightly clumped.

Herbage is the above-ground material of any herbaceous plant, ITR 1734-4 1999.

Hydrologic function. Behavioral characteristics of a watershed described in terms of ability to sustain favorable conditions of water flow. Favorable conditions of water flow are defined in terms of water quality, quantity, and timing.

Hydrologic unit code. The United States is divided and subdivided into successively smaller hydrologic units which are identified by unique hydrologic unit codes (HUCs). The number of digits in a HUC indicates its relative size; HUCs with more digits are smaller than HUCs with fewer digits.

Initial attack/initial action. Actions taken by the first firefighting resources to arrive at a wildfire.

Integrated resource management. Multiple use management that recognizes the interdependence of ecological resources and is based on the need for integrated consideration of ecological, social, and economic factors.

Invasive species are species that are not native to the ecosystem being described. For all ecosystems, the desired condition is that invasive species are rarely present, or are present at levels that do not negatively influence ecosystem function.

Key area: A relatively small portion of a range selected because of its location, use, or grazing value as a monitoring point for grazing use. It is assumed that key areas, if properly selected, will reflect the overall acceptability of current grazing management over the range.

Key Ecological Attributes are attributes for which alteration beyond some critical range/threshold will lead to loss of the resource in short period of time. Examples include changes in structure, composition, pattern and process.

Litter: Dead, unattached organic material on the soil surface that is effective in protecting the soil surface from raindrop splash, sheet, and rill erosion and is at least ½-inch thick. Litter is composed of leaves, needles, cones, and woody vegetative debris, including twigs, branches, and trunks.

Long-term sustained-yield timber capacity is the highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple-use objectives.

Maintain. In reference to an ecological condition: to keep in existence or continuance of the desired ecological condition in terms of its desired composition, structure, and processes. Depending upon the circumstance, ecological conditions may be maintained by active or passive management or both.

Management area. A land area identified within the planning area that has the same set of applicable plan components. A management area does not have to be spatially contiguous.

Management concern: Issue, problem, or condition which constrains the range of management practices identified by the Forest Service in the planning process.

Management direction: Statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.

Management intensity: Management practice or combination of management practices and associated costs designed to obtain different levels of goods and services.

Management practice: A specific activity, measure, course of action, or treatment.

Management prescription: Management practices and intensity selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives.

Mosaic is described as the patterns of patches, corridors, and matrix (forest or non-forest) that form a landscape in its entirety.

Multiple use: The management of all the various renewable surface resources of the NFS so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

Native species. An organism that was historically or is present in a particular ecosystem as a result of natural migratory or evolutionary processes; and not as a result of an accidental or deliberate introduction into that ecosystem. An organism's presence and evolution (adaptation) in an area are determined by climate, soil, and other biotic and abiotic factors.

Nest areas (goshawk) are the areas immediately around a nest that are used by northern goshawks in relation to courtship and breeding activities. They cover approximately 30 acres and contain multiple groups of large, old trees with interlocking crowns.

Noxious weed is a legal term applied to plants or plant parts regulated by Federal and State laws. Arizona Administrative Codes R3-4-244, R3-4-245 (Arizona Department of Agriculture 1999) regulate certain invasive species in the state: "A noxious weed is defined as any species of plant that is detrimental or destructive and difficult to control or eradicate and includes plant organisms found injurious to any domesticated, cultivated, native or wild plant." The director of Arizona's noxious weed program uses five biological criteria to describe noxious weeds: (1) exotic, (2) invasive, (3) competitive, (4) persistent, and (5) aggressive.

Nutrient cycling is the circulation of exchange of elements such as nitrogen and carbon between non-living and living portions of the environment.

Objectives are concise, time-specific statements of measurable planned results that respond to pre-established goals. Objectives form the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

Old growth in southwestern forested ecosystems is different than the traditional definition based on Northwestern infrequent fire forests. Due to large differences among Southwest forest types and natural disturbances, old growth forests vary extensively in tree size, age classes, presence and abundance of structural elements, stability, and presence of understory (Helms 1998), Old growth refers to to specific habitat components that occur in forests and woodlands – old trees,

dead trees (snags), downed wood (coarse woody debris), and structure diversity (Franklin and Spies 1989, Helms 1998, Kaufmann et al. 2007). These important habitat features may occur in small areas, with only a few components, or over larger areas as stands or forests where old growth is concentrated (Kaufmann et al. 2007). In the Southwest, old growth is considered “transitional” (Oliver and Larson 1996), given that the location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). Some species, notably certain plants, require “old forest” communities that may or may not have old growth components but have escaped significant disturbance for lengths of time necessary to provide the suitable stability and environment.

Openings are spatial breaks between groups or patches of trees as large or larger than groups, that contain grass, forb, shrub, and/or tree seedlings, but are largely devoid of big trees with a total tree cover of less than 10% in openings.

Patches are areas larger than tree groups in which the vegetation composition and structure are relatively homogeneous. Patches comprise the mid-scale, thus they range in size from 100 to 1,000 acres

Plan or land management plan. A document or set of documents that provide management direction for an administrative unit of the NFS developed under the requirements of a planning rule.

Planning area is the area of the NFS covered by a plan.

Planning horizon: The overall time period considered in the planning process that spans all activities covered in the analysis or plan and all future conditions and effects of proposed actions which would influence the planning decisions.

Planning period. One decade. The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects, and benefits.

Potential natural vegetation types are the “climax” vegetation that will occupy a site without disturbance or climatic change. PNV is an expression of environmental factors such as topography, soils, and climate across an area.

Predator-prey relationship is a natural relationship which helps to maintain healthy wildlife populations. Top-level predators hunt sick, weak, and/or young prey; this in turn keeps growth and carrying capacity of hunted species in balance with their surrounding environment. Examples include carnivores such as mountain lions and wolves, which prey on deer or elk, or raptors which regulate small mammal populations.

Prescribed fire. A wildland fire originating from a planned ignition to meet specific objectives identified in a written, approved, prescribed fire plan for which NEPA requirements have been met prior to ignition.

Project. An organized effort to achieve an outcome on NFS lands identified by location, tasks, outputs, effects, times, and responsibilities for execution.

Public issue. A subject or question of widespread public interest relating to management of the NFS.

Post-fledging family areas (goshawk) surround the nest areas. They represent an area of concentrated use by the goshawk family until the time the young are no longer dependent on adults for food. PFAs are approximately 420 acres in size.

Range condition is a subjective expression of the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community. (USDA Forest Service, Southwestern Region, Record of Decision for Amendment of Forest Plans, Arizona and New Mexico.) It is evaluated relative to desired conditions.

Range readiness is the condition when grazing would not permanently damage perennial plants. Range readiness is determined when plants that would likely be grazed exhibit at least one of the following characteristics: seed heads or flowers, multiple leaves or branches, and/or a root system that does not allow them to be easily pulled from the ground. These characteristics provide evidence of plant vigor, reproductive ability, and recovery.

Recreation opportunity spectrum: Framework for defining the types of outdoor recreation opportunities the public might desire, and identifying that portion of the spectrum a given national forest area might be able to provide. The broad classes are:

Primitive (P). Characterized by essentially unmodified natural environment. Interaction between users is very low and evidence of other users is minimal. Essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is generally not permitted. Very high probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.

Semi-primitive Nonmotorized (SPNM). Characterized by a predominantly natural or natural-appearing environment. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is generally not permitted. High probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.

Semi-primitive motorized (SPM). Characterized by a predominantly natural or natural-appearing environment. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but they are subtle. Motorized use is generally permitted. Moderate probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.

Roaded natural (RN). Characterized by a predominantly natural-appearing environment with moderate evidence of the sights and sounds of other humans. Such evidence usually harmonizes with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities. Opportunity to affiliate with other users in developed sites, but with some chance for privacy.

Roaded modified (RM). Characterized by substantially modified natural environment except for campsite. Roads and management activities may be strongly dominant. There is moderate evidence of other users on roads. Conventional motorized use is provided for in construction standards and design of facilities. Opportunity to get away from others, but with easy access.

Rural (R). Characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to

maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites. Facilities for intensified motorized use and parking are available. Opportunity to observe and affiliate with other users is important, as is convenience of facilities.

Urban (U). Characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Resource modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans on-site are predominant. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site. Opportunity to observe and affiliate with other users is very important, as is convenience of facilities.

Recreation setting. The social, managerial, and physical attributes of a place that, when combined, provide a distinct set of recreation opportunities. The Forest Service uses the recreation opportunity spectrum to define recreation settings and categorize them into six distinct classes: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban.

Reference conditions. Environmental conditions that infer ecological sustainability. When available reference conditions are represented by the *characteristic* range of variation (not the total range of variation), prior to European settlement and under the current climatic period. For many ecosystems, the range of variation also reflects human-caused disturbance and effects prior to settlement. It may also be necessary to refine reference conditions according to contemporary factors (e.g., invasive species) or projected conditions (e.g., climate change). Reference conditions are most useful as an inference of sustainability when they have been quantified by amount, condition, spatial distribution, and temporal variation.

Research natural areas are specially designated areas that represent some of the finest examples of natural ecosystems for the purposes of scientific study, education, and for maintenance of biological diversity.

Resilience is an ecosystem concept used to infer the capacity of the system to absorb disturbance and reorganize so it retains essentially the same function, structure, and identity.

Resiliency is the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

Responsible line officer is the Forest Service employee who has the authority to select and/or carry out a specific planning action.

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

Risk. A combination of the likelihood that a negative outcome will occur and the severity of the subsequent negative consequences.

Satisfactory range condition is the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community as evaluated relative to desired conditions; deemed meeting or moving toward those desired conditions. (Adapted from USDA Forest Service, Southwestern Region, Record of Decision for Amendment of Forest Plans, Arizona and New Mexico.)

Satisfactory watershed condition is a state where ground cover conditions are effectively maintaining land productivity.

Scenic integrity objectives in the context of the Plan are equivalent to goals or desired conditions. Scenic integrity describes the state of naturalness or a measure of the degree to which a landscape is visually perceived to be “complete.” The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the landscape character valued by constituents for its aesthetic quality. Scenic integrity is the state of naturalness or, conversely, the state of disturbance created by human activities or alteration. Scenic integrity is measured in five levels:

Very high (unaltered): A scenic integrity level that generally provides for ecological change only.

High (appears unaltered): Human activities are not visually evident. In high scenic integrity areas, activities may only repeat attributes of form, line, color, and texture found in the existing landscape character.

Moderate (slightly altered): Landscapes where the valued landscape character “appears slightly altered.” Noticeable deviations must remain visually subordinate to the landscape character being viewed.

Low (moderately altered): Human activities must remain visually subordinate to the attributes of the existing landscape character. Activities may repeat form, line, color, or texture common to these landscape characters, but changes in quality of size, number, intensity, direction, pattern, and so on, must remain visually subordinate to these landscape characters.

Very Low (heavily altered): Human activities of vegetative and landform alterations may dominate the original, natural landscape character, but should appear as natural occurrences when viewed at background distances.

Silvicultural system is a management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop and provide for regeneration, and according to the type of forest thereby produced.

Snags are standing dead or partially dead trees (snag-topped), often missing many or all limbs. They provide essential wildlife habitat for many species and are important for forest ecosystem function.

Soil condition rating. A qualitative rating developed within the Southwestern Region of the Forest Service that provides an overall picture of soil condition vital in sustaining ecosystems. It

is based on three soil functions: the ability of soil to resist erosion, infiltrate water, and recycle nutrients. There are four soil condition ratings:

Satisfactory – soil function is being sustained and soil is functioning properly and normally

Impaired –ability of the soil to function properly and normally has been reduced or there exists an increased vulnerability to degradation

Unsatisfactory – degradation of vital soil functions result in the inability of the soil to maintain resource values, sustain outputs or recover from impacts

Inherently unstable – these soils are eroding faster than they are renewing themselves

Stand density index (SDI) is a relative measure of stand density the converts a stand's current density into a density at a reference size. Stand density index was first presented by Reineke (1933).

Strongly interactive species is a species whose absence leads to significant changes in some feature of its ecosystem(s). Such changes include structural or compositional modifications, alterations in the import or export of nutrients, loss of resilience to disturbance, and decreases in native species diversity. The type of interactions these species have with their surrounding environment is paramount to the persistence of certain ecosystem features through time. Examples of strong interactions include mutualisms (e.g., pollinators such as butterflies, spore and seed dispersers such as birds), consumers (e.g., large predators such as mountain lions), and ecosystem engineers (e.g., prairie dogs, beavers).

Suitability is the appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

Sustainability. The capability to meet the needs of the present generation without compromising the ability of future generations to meet their needs. For purposes of this part, “ecological sustainability” refers to the capability of ecosystems to maintain ecological integrity; “economic sustainability” refers to the capability of society to produce and consume or otherwise benefit from goods and services including contributions to jobs and market and nonmarket benefits; and “social sustainability” refers to the capability of society to support the network of relationships, traditions, culture, and activities that connect people to the land and to one another, and support vibrant communities.

Timber production is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of this plan, the term timber production does not include production of fuelwood.

Total maximum daily load. 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 total maximum daily load 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.

Traditional cultural property. A type of historic property defined as “eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living

community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community.”

Uneven-aged forests are forests that are composed of three or more distinct age classes of trees, either intimately mixed or in small groups.

Uneven-aged management is the application of a combination of actions needed to simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Unsatisfactory range condition is the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community as evaluated relative to desired conditions deemed not meeting or moving toward those desired conditions. (Adapted from USDA Forest Service, Southwestern Region, Record of Decision for Amendment of Forest Plans, Arizona and New Mexico.)

Unsatisfactory watershed condition is a state where effective ground cover conditions are such that impairment of land productivity is occurring.

Viable population. A population of a species that continues to persist over the long term with sufficient distribution to be resilient and adaptable to stressors and likely future environments.

Watershed. A region or land area drained by a single stream, river, or drainage network; a drainage basin.

Watershed condition. The state of a watershed based on physical and biogeochemical characteristics and processes.

Wetlands are areas inundated by surface or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil condition for growth and reproduction. Generally includes swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

Wide-ranging species are species which have large area requirements, utilizing expansive landscapes for breeding, foraging, and movement that are typically beyond the boundaries of any one land management jurisdiction. Examples include large birds of prey, migratory birds, and nomadic mammals subject to seasonal movements (e.g., winter and summer range for deer, elk, and pronghorn).

Wilderness. Any area of land designated by Congress as part of the National Wilderness Preservation System that was established in the Wilderness Act of 1964 (16 U.S.C. 1131-1136).

Wildfire: Unplanned ignition of a wildland fire, such as fire caused by lightning, unauthorized or accidental human-caused fires, or an escaped prescribed fire.

Wildland fire: General term describing any non-structure fire that occurs in the wildland. This includes both prescribed fires and wildfires.

Wildland fire use: Management of either wildfire or prescribed fire to meet resource objectives specified in land or resource management plans.

Wildland-urban interface (WUI): Line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels.

Essential Government Acronym Dictionary (EGAD)

Acronym	Term
4FRI	Four forest restoration initiative
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
AM	Adaptive management
AMS	Analysis of the management system
ANST	Arizona National Scenic Trail
APS	Arizona Public Service Company
AZGFD	Arizona Game and Fish Department
AOI	Annual operating instructions
BA	Basal area
BCI	Bat Conservation International
BMP	Best management practice
CER	Comprehensive evaluation report
CWPP	Community wildfire protection plan
d.b.h.	Diameter at breast height
DC	Desired conditions
EIS	Environmental impact statement
DRC	Diameter at root collar
ENSO	El Niño Southern Oscillation
FACTS	Forest Service ACTivity Tracking System
FHP	Forest health protection
FHWA	Federal Highway Administration
FIA	Forest inventory assessment
FSH	Forest Service Handbook
FSM	Forest Service Manual
GCT	Grand Canyon Trust
GCWC	Grand Canyon Wildlands Council
GIS	Geographic Information System
HFRA	Healthy Forest Restoration Act
HUC	Hydrologic init code
KFHF	Kaibab Forest Health Focus
KNF	Kaibab National Forest
MA	Management Area
MIS	Management indicator species
MNA	Museum of Northern Arizona
MOU	Memorandum of understanding
MSO	Mexican spotted owl
MVUM	Motor vehicle use map

Acronym	Term
NAAQS	National ambient air quality standards
NAU	Northern Arizona University
NEPA	National Environmental Policy Act
NF	National forest
NFMA	National Forest Management Act
NFS	National Forest System
NKRD	North Kaibab Ranger District
NNL	National natural landmark
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
NRIS	Natural Resource Information System
OHV	Off-highway vehicle
PEIS	Programmatic environmental impact statement
PFC	Proper functioning condition
PJ	Pinyon-juniper
PNVT	Potential natural vegetation type
RAVG	Rapid Assessment of Vegetation Condition after Wildfire
RD	Ranger district
RMBO	Rocky Mountain Bird Observatory
RNA	Research natural area
ROD	Record of decision
ROS	Recreation opportunity spectrum
ROW	Right-of-way
SAVS	System for assessing vulnerability of species
SDI	Stand density index
SI	Scenic integrity
SIO	Scenic integrity objectives
SWAP	State Wildlife Action Plan
T&E	Threatened and Endangered
TCP	Traditional cultural property
TES	Terrestrial Ecological Survey
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VDDT	Vegetation Development Dynamics Tool
WBWG	Western Bat Working Group
WNS	White nose syndrome
WUI	Wildland-urban interface

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Appendices

Appendix A. Proposed and Possible Actions

This appendix describes the proposed and possible actions that may occur on the plan area during the life of the plan (approx. 10 to 15 years) including the probable methods of forest vegetation management practices expected to be used (16 U.S.C. 1604(e)(2) and (f)(2)). This list of proposed and possible practices is not intended to be all-inclusive, it is simply a list of possible actions that may take place based on the plan objectives, current uses, and expected trends. This information is not a commitment to take any action and is not a “proposal” as defined by the Council on Environmental Quality regulations for implementing NEPA (40 CFR 1508.23, 42 U.S.C. 4322(2)(C)).

A plan amendment is not required to change or modify any of the proposed or possible actions. The list of these actions can be updated at any time through an administrative correction of the plan.

Vegetation Management

Mechanically thin 11,000 to 19,000 acres in ponderosa pine and another 1,200 to 2,400 acres annually in the dry mixed conifer type forestwide. Thinning treatments would use a combination of prescriptions to meet desired conditions including free thinning all sizes to a target basal area, group-selection cuts with matrix thinning to a target basal area, individual tree selection, thin from below, sanitation, and regeneration cuts.

The Allowable Sale Quantity (ASQ) is 107,815 CCF (hundred cubic feet) per year. The ASQ is better described as the “average allowable sale quantity” because it may be exceeded in a given year as long as the ten-year average is not exceeded.

Other vegetation management activities expected to occur include:

- Reducing tree density in pinyon-juniper woodlands
- Planting trees in areas where seed source has been lost
- Reducing conifer encroachment, fencing, and monitoring aspen
- Restoring grasslands by mechanically cutting trees.

Fire Management

- Rx fire and managed wildfire in all vegetation communities except in desert communities.
- Suppressing human caused wildfires.

Water Resources

- Restore and protect springs through fencing, maintenance, revegetation, and establishing trails and points of entry.
- Fence wetlands for resource protection
- Monitor water quality of lakes

Wildlife and Plants

- Modify fences and install pronghorn crossing to improve habitat connectivity
- Conduct floristic surveys
- Collaborate with other Federal and State biologists and researchers to address a variety of wildlife issues.
- Inspect and maintain fenced exclosures
- Monitor populations of invasive species that occur on the Kaibab NF
- Treat weeds using herbicides and hand pulling

Recreation

- Maintain trails according to development level and managed use.
- Provide interpretive programs for school groups and other opportunities to connect with youth.
- Education and outreach programs and/or signing to help reduce user conflicts, such as conflicts between motorized and non-motorized users.

Livestock Grazing

- Grazing of cattle, sheep, and horses consistent with other desired conditions.
- Monitoring and adapt grazing management

Forestry and Forest Products

- Offer wood products for sale
- Provide opportunities for commercial and personal fuelwood collection
- Sell Christmas tree permits
- Provide forest products for traditional cultural uses

Heritage Resources

- Conduct cultural resources surveys.
- Host “Passport In Time” and other cultural resource events and projects.
- Provide interpretive programs.

Roads and Access

- Road grading and culvert cleaning
- Maintaining ownership boundaries
- Acquiring legal access, as opportunities arise
- Decommission roads that are no longer needed
- Implement decisions made under the 2005 Travel Management Rule

Land Adjustments

- Land adjustments where feasible and advantageous to the Kaibab NF

Minerals and Energy Uses

- Uranium mining on claims with valid existing rights.
- Sandstone quarrying
- Rehabilitation of common variety mineral sites no longer in use

Special Uses

- Construction and maintenance of communications and electronic sites.
- Authorization of outfitter guide permits.

Special Areas

- Implement the comprehensive plan for the Arizona National Scenic Trail including trail maintenance and signing
- Capture and relocate wild burros

Appendix B. Relevant Laws, Regulation and Policy

The operating environment for managing National Forest System lands comes from a variety of sources. This appendix contains a partial listing of relevant statutes, regulations, policies, and agreements. Forest projects and activities are developed to be consistent with the direction found in the Plan, as well as applicable laws, regulations, and executive orders. Other relevant sources that provide varying levels of guidance include Forest Service Handbooks and Manuals, programmatic agreements, Memoranda of Understanding, Memoranda of Agreement, and existing decisions.

Federal Statutes

The following is a partial listing of relevant laws which have been enacted by Congress. A Federal statute, or law, is an act or bill which has become part of the legal code through passage by Congress and approval by the President (or via congressional override). Although not specified below, many of these laws have been amended.

American Indian Religious Freedom Act (AIRFA) as amended (42 U.S.C. 1996)

Protects and preserves for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use, and possession of sacred objects and the freedom to worship through ceremonial and traditional rites.

Americans with Disabilities Act of 1990

Provides a clear and comprehensive national mandate for the elimination of discrimination against individuals with disabilities; for clear, strong, consistent, enforceable standards addressing discrimination against individuals with disabilities; to ensure that the Federal government plays a central role in enforcing the standards established in this Act on behalf of individuals with disabilities; and to invoke the sweep of congressional authority, including the power to enforce the fourteenth amendment and to regulate commerce, in order to address the major areas of discrimination faced by people with disabilities.

Antiquities Act of 1906 (16 U.S.C. 431- 433)

Prevents the appropriation, excavation, injury, or destruction of any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the United States without permission. Provides for permits, for misdemeanor-level penalties for unauthorized use and authorizes the President to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the United States to be national monuments, and to reserve as a part thereof parcels of land needed for the proper care and management of the objects to be protected. The Archaeological Resources Protection Act has replaced the Antiquities Act as the authority for special use permits if the resource involved is 100-years-old or greater.

Archaeological and Historic Preservation Act of 1974 (AHPA) (16 U.S.C. 469)

Is also known as the Archaeological Recovery Act. AHPA amended and expanded the Reservoir Salvage Act of 1960 and was enacted to complement the Historic Sites Act of 1935 by providing for the preservation of significant scientific, historical and archaeological data which might be lost or destroyed as the result of the construction of a federally authorized dam or other construction activity. AHPA also allows for any Federal agency responsible for a construction project to appropriate a portion of project funds for archaeological survey, recovery, analysis, and publication of results.

Archaeological Resources Protection Act of 1979 as amended, (ARPA) (16 U.S.C. 470 aa et seq.)

The act establishes permit requirements for removal or excavation of archaeological resources from Federal and Indian lands. Provides criminal and civil penalties for the unauthorized excavation, removal, damage, alteration, defacement, or the attempted unauthorized removal, damage, alteration, or defacement of any archaeological resource, more than 100 years of age, found on Federal or Indian lands. Prohibits the sale, purchase, exchange, transportation, receipt, or offering of any archaeological resource obtained from public lands or Indian lands. The act further directs Federal land managers to survey land under their control for archaeological resources and create public awareness programs concerning archaeological resources.

Bald and Golden Eagle Protection Act of 1940, as amended

Prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." Disturbance includes impacts that result from human-induced alterations in the nesting area even when eagles are not present. Sections 22.26—28 allow take of bald and golden eagles or their nests where it is unavoidable and where it is compatible with the continued preservation of the eagle. Permits for take are issued based on certain criteria such as, but not limited to, certifications, reporting, and monitoring.

Clean Air Act of August 7, 1977, as amended (1977 and 1990) 42 U.S.C. §7401 et seq. (1970)

Enacted to protect and enhance the quality of the Nation's air resources; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and, to encourage and assist the development and operation of regional air pollution prevention and control programs.

Clean Water Act (see Federal Water Pollution Control Act)

Common Varieties of Mineral Materials Act of July 31, 1947

Authorizes the Secretaries of the Interior and Agriculture, under such rules and regulations as they may prescribe, to dispose of mineral materials (including but not limited to common varieties sand, stone, gravel, pumice, pumicite, cinders, and clay) and vegetative materials

(including but not limited to yucca, manzanita, mesquite, cactus, and timber or other forest products) on public lands of the United States, if the disposal of such materials is not otherwise expressly authorized by law, is not expressly prohibited by laws of the United States, and would not be detrimental to the public interest.

Cooperative Forestry Assistance Act of July 1, 1978

Authorizes the Secretary of Agriculture to assist in the establishment of a coordinated and cooperative Federal, state, and local forest stewardship program for the management of non-Federal forest lands and forest lands in foreign countries.

Emergency Flood Prevention (Agricultural Credit Act) Act of August 4, 1978

Authorizes the Secretary of Agriculture to undertake emergency measures for runoff retardation and soil-erosion prevention, in cooperation with land owners and users, as the Secretary deems necessary to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood, or other natural occurrence is causing or has caused a sudden impairment of that watershed.

Endangered Species Act of 1973, as amended

Authorizes the determination and listing of species as endangered and threatened; prohibits unauthorized taking, possession, sale, and transport of endangered species; authorizes the assessment of civil and criminal penalties for violating the Act or regulations; and, authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the Act or any regulation issued there under. Section 7 of the Act requires Federal agencies to use their authorities to carry out programs for the conservation of endangered and threatened species and to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

Section 4 of the Act directs the development and implementation of recovery plans for threatened and endangered species and the designation of critical habitat. Several species listed under the Act are found on the Kaibab NF, some with recovery plans and some with designated critical habitat. Those with a recovery plan and/or a critical habitat designation are listed below:

Recovery Plan for the Mexican Spotted Owl

http://warnercnr.colostate.edu/~alanf/reprints/mso_rec_plan.pdf

Recovery Plan for the Apache trout

http://ecos.fws.gov/docs/recovery_plan/090903.pdf

Recovery Plan for the Southwestern Willow Flycatcher

http://www.fws.gov/southwest/es/arizona/SWWF_RP.htm

Recovery Plan for the California Condor

http://ecos.fws.gov/docs/recovery_plans/1996/960425.pdf

Energy Policy Act of 2005

Requires the Secretary of Agriculture to ensure timely action on oil and gas permits, improve collection and retrieval of oil and gas information, and improve inspection and enforcement of permit terms (Section 362).

Energy Security Act of June 30, 1980

Authorizes the Secretary of Agriculture to make available timber resources of the National Forest System, in accordance with appropriate timber appraisal and sale procedures, for use by biomass energy projects.

Federal Advisory Committee Act of October 6, 1972

Sets standards and uniform procedures to govern the establishment, operation, administration, and duration of advisory committees.

Federal Cave Resources Protection Act of November 18, 1988

Established requirements for the management and protection of caves and their resources on Federal lands, including allowing land managing agencies to withhold the location of caves from the public, and requiring permits for any removal or collecting activities in caves on Federal lands.

Federal Land Policy and Management Act of October 21, 1976

Requires that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. Also states that the United States shall receive fair market value of the use of the public lands and their resources unless otherwise provided for by law.

Federal Noxious Weed Act, 1974, as amended

Authorizes the Secretary of Agriculture to designate plants as noxious weeds by regulation; to prohibit the movement of all such weeds in interstate or foreign commerce except under permit; to inspect, seize and destroy products, and to quarantine areas, if necessary to prevent the spread of such weeds; and to cooperate with other Federal, state and local agencies, farmers associations, and private individuals in measures to control, eradicate, prevent, or retard the spread of such weeds.

Federal Water Pollution Control Act and Amendments of 1972 (Clean Water Act)

Enacted to restore and maintain the chemical, physical, and ecological integrity of the Nation's waters. Provides for measures to prevent, reduce, and eliminate water pollution; recognizes, preserves, and protects the responsibilities and rights of States to prevent, reduce, and eliminate pollution, and to plan the development and use (including restoration, preservation, and enhancement) of land and water resources; and provides for Federal support and aid of research relating to the prevention, reduction, and elimination of pollution, and Federal technical services

and financial aid to state and interstate agencies and municipalities for the prevention, reduction, and elimination of pollution.

Established goals for the elimination of water pollution; required all municipal and industrial wastewater to be treated before being discharged into waterways; increased Federal assistance for municipal treatment plant construction; strengthened and streamlined enforcement policies; and expanded the Federal role while retaining the responsibility of States for day-to-day implementation of the law.

Fish and Wildlife Conservation Act of September 15, 1960

Requires the Secretaries of the Interior and Agriculture, in cooperation with state agencies, to plan, develop, maintain, and coordinate programs for the conservation and rehabilitation of wildlife, fish, and game on public lands under their jurisdiction.

Food, Conservation & Energy Act of 2008 (2008 Farm Bill) Public Law 110-246 Title VIII – Forestry, Subtitle A, B, and C,

Subtitle A: Amendment to the Cooperative Forestry Assistance Act of 1978. Establishes national priorities for private forest conservation, a community forest and open space conservation program, and a Secretary level Forest Resources Coordinating Committee.

Subtitle B: Cultural and Heritage Cooperation Authority. Authorizes the Secretary of Agriculture to provide forest products to Indian tribes for traditional and cultural purposes; to protect the confidentiality of certain information, including information that is culturally sensitive to Indian tribes; to utilize National Forest System land for the reburial of human remains and cultural items, including human remains and cultural items repatriated under the Native American Graves Protection and Repatriation Act; prevent the unauthorized disclosure of information regarding human remains or cultural items reburied on National Forest System land; to ensure access to National Forest System land, to the maximum extent practicable, by Indians and Indian tribes for traditional and cultural purposes; to increase the availability of Forest Service programs and resources to Indian tribes in support of the policy of the United States to promote tribal sovereignty and self-determination; and to strengthen support for the policy of the United States of protecting and preserving the traditional, cultural, and ceremonial rites and practices of Indian tribes, in accordance with the American Indian Religious Freedom Act (42 U.S.C. 1996).

Subtitle C. Amendments to Other Forestry Related Laws. Amends the Lacey Act to include the illegal taking of plants, establishes an Emergency Forest Restoration Program, and renews authority and funding for the Healthy Forest Reserve Program.

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974

Directs the Secretary of Agriculture to prepare a Renewable Resource Assessment every ten years; to transmit a recommended Renewable Resources Program to the President every five years; to develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System; and to ensure that the development and administration of the resources of the National Forest System are in full accord with the concepts of multiple use and sustained yield.

Freedom of Information Act of November 21, 1974

Governs which government records are released to the public either automatically or upon request.

Healthy Forests Restoration Act of 2003 (H.R. 1904)

Purposes are to reduce wildfire risk to communities and municipal water supplies through collaborative hazardous fuels reduction projects; to assess and reduce the risk of catastrophic fire or insect or disease infestation; to enhance efforts to protect watersheds and address threats to forest and rangeland health (including wildfire) across the landscape; to protect, restore, and enhance forest ecosystem components such as biological diversity, threatened/endangered species habitats, enhanced productivity.

Historic Sites Act of 1935 (16 U.S.C. 461)

Establishes a policy to preserve for public use historic sites, buildings, and objects of national significance for the benefit of the people. Authorizes the National Park Service's National Historic Landmarks Program.

Land and Water Conservation Fund Act of September 3, 1964

Authorizes the appropriation of funds for Federal assistance to States in planning, acquisition, and development of needed land and water areas and facilities and for the Federal acquisition and development of certain lands and other areas for the purposes of preserving, developing, and assuring accessibility to outdoor recreation resources.

Mineral Leasing Act of February 25, 1920

Provides that the deposits of certain minerals on land owned by the United States shall be subject to lease to citizens of the United States, provided royalties on such deposits are paid to the United States.

Mining and Minerals Policy Act of December 31, 1970

States that it is the policy of the Federal government to foster and encourage the development of economically sound and stable domestic mining, minerals, metal, and mineral reclamation industries; the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs; mining, mineral, and metallurgical research to promote the wise and efficient use of our natural and reclaimable mineral resources; and the study and development of methods for the disposal, control, and reclamation of mineral waste products and the reclamation of mined land.

Multiple-Use Sustained-Yield Act of June 12, 1960

States that it is the policy of Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes, and authorizes and directs the Secretary of Agriculture to develop and administer the renewable surface resources of the national forests for the multiple use and sustained yield of products and services.

National Environmental Policy Act of January 1, 1970

Directs all Federal agencies to consider and report the potential environmental impacts of proposed Federal actions, and established the Council on Environmental Quality.

National 1990 Farm Bill (title XII – Forest Stewardship Act) Act of November 28, 1990

Directs the Secretary of Agriculture to establish a competitive forestry, natural resources, and environmental grants program, and provides for other research programs.

National Forest Management Act of October 22, 1976

The National Forest Management Act reorganized, expanded, and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on National Forest System lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of National Forests.

National Historic Preservation Act of 1966 as amended (NHPA) (16 U.S.C. 470)

Sets forth the Federal government's policy to preserve and protect historical and cultural resources. This act states that the historical and cultural foundations of the Nation should be preserved as a living part of the Nation's community life and development in order to give a sense of orientation to the American people. Directs all Federal agencies to take into account the effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. Establishes inventory, nomination, protection, and preservation responsibilities for federally owned historic properties. As amended extends the policy in the Historic Sites Act to State and local historical sites as well as those of national significance, expands the National Register of Historic Places, establishes the Advisory Council on Historic Preservation and the State Historic Preservation Officers, and requires agencies to designate Federal Preservation Officers. Establishes criteria for designating Tribal Historic Preservation Officers to assume the functions of a State Historic Preservation Officer on Tribal lands.

National Historic Preservation Act of December 12, 1980 as amended (1980 and 1992)

Authorized the Federal government to accelerate its historic preservation programs and activities; to give maximum encouragement to agencies and individuals undertaking preservation by private means; and to assist state and local governments and the National Trust for Historic Preservation in the United States to expand and accelerate their historic preservation programs and activities.

Organic Administration Act of June 4, 1897

Authorizes the President to modify or revoke any instrument creating a national forest; states that no national forest may be established except to improve and protect the forest within its boundaries, for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States.

Authorizes the Secretary of Agriculture to promulgate rules and regulations to regulate the use and occupancy of the national forests.

Public Rangelands Improvement Act of October 25, 1978

Establishes and reaffirms the national policy and commitment to inventory and identify current public rangeland conditions and trends; manage, maintain and improve the condition of public rangelands so that they become as productive as feasible for all rangeland values in accordance with management objectives and the land use planning process; charge a fee for public grazing use which is equitable; continue the policy of protecting wild free-roaming horses and burros from capture, branding, harassment, or death, while at the same time facilitating the removal and disposal of excess wild free-roaming horses and burros which pose a threat to themselves and their habitat and to other rangeland values.

Religious Freedom Restoration Act (RIFRA) (42 U.S.C. § 2000bb),

Government shall not substantially burden a person's exercise of religion even if the burden results from a rule of general applicability, except when the government demonstrates that application of the burden to the person is in furtherance of a compelling governmental interest; and is the least restrictive means of furthering that compelling governmental interest.

Secure Rural Schools and Community Self-Determination Act of 2000

Through this law the Forest Service gives rural communities the means to build and improve schools, provide road maintenance, emergency services, and conservation programs for their citizens. Thus, communities are no longer dependent on Federal timber sales from national forests to improve local schools and roads.

Sikes Act of October 18, 1974, as amended

This Act authorizes the Forest Service to cooperate with state wildlife agencies in conservation and rehabilitation programs for fish, wildlife, and plants considered threatened or endangered.

Small Tracts Act of January 22, 1983

Authorizes the Secretary of Agriculture to sell, exchange, or interchange by quitclaim deed all right, title and interest, including the mineral estate, of the United States in and to certain lands within the national forest when he determines it to be in the public interest.

Tribal Forest Protection Act of 2004 (Public Law 108-278).

Authorizes the Secretary of Agriculture and the Secretary of the Interior to enter into an agreement or contract with Indian tribes meeting certain criteria to carry out projects to protect Indian forest land.

U.S. Mining Laws (Public Domain Lands) Act of May 10, 1872

Provides that all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are free and open to exploration and purchase, and the lands in which they are found to occupation and purchase by citizens of the United States and those who have declared

their intention to become such, under regulations prescribed by law, and according to the local customs or rules of miners, so far as the same are applicable and not inconsistent with the laws of the United States. There are a number of Acts which modify the mining laws as applied to local areas by prohibiting entry altogether or by limiting or restricting the use which may be made of the surface and the right, title, or interest which may pass through patent.

Wild Free-Roaming Horses and Burros Act of December 15, 1971, as amended by Federal Land Policy Management Act of 1976 and Public Rangelands Improvement Act of 1978

Protects wild free-roaming horses and burros from capture, branding, harassment, or death; and states they are to be considered in the area where presently found an integral part of the natural system of the public lands.

Wild and Scenic Rivers Act of October 2, 1968

Instituted a National Wild and Scenic Rivers System by designating the initial components of that system, and by prescribing the methods by which and standards according to which additional components may be added to the system from time to time.

Wilderness Act of September 3, 1964

Established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas" and administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness. Provides for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. states that no Federal lands shall be designated as "wilderness areas" except as provided for in the Act or by a subsequent Act.

Kaibab NF wilderness areas are designated under the following authorities:

- **Arizona Wilderness Act of 1984** (Public Law 48-406) designates Kanab Creek and Kendrick Mountain and Saddle Mountain areas.

Regulations

Below is a partial listing of relevant regulations. Federal executive departments and administrative agencies write regulations to implement laws. Regulations are secondary to law. However, both laws and regulations are enforceable.

36 CFR 60 National Register of Historic Places

Sets forth the procedural requirements for listing properties on the National Register.

36 CFR 63 Determinations of Eligibility for Inclusion in the National Register of Historic Places

Developed to assist agencies in identifying and evaluating the eligibility of properties for inclusion in the National Register, and to explain how to request determinations of eligibility.

36 CFR 62 National Natural Landmarks Program.

The procedures in this part set forth the processes and criteria for the identification, evaluation, designation and monitoring of national natural landmarks.

36 CFR 65 National Historic Landmarks Program

Sets forth the criteria for establishing national significance and the procedures used by the Department of the Interior for conducting the National Historic Landmarks Program.

36 CFR 212 Forest Development Transportation System²⁵

Sets forth the requirements for the development and administration of the forest development transportation system.

36 CFR 219 Planning

Sets forth a process for developing, adopting, and revising land and resource management plans for the National Forest System.

36 CFR 221 Timber Management Planning

Sets forth the requirements for management plans for National Forest timber resources.

36 CFR 222 Range Management

Sets forth the requirements for range management on the national forests, and for the administration of wild and free-roaming horses and burros and their environment. See Subpart B (Management of Wild Free-Roaming Horses and Burros).

36 CFR 223 Sale and Disposal of National Forest System Timber

Sets forth the requirements relating to the sale and disposal of National Forest System timber.

36 CFR 228 Minerals

Sets forth the rules and procedures through which use of the surface of National Forest System lands, in connection with mining and mineral operations, shall be conducted so as to minimize adverse environmental impacts on National Forest System surface resources.

36 CFR 241 Fish and Wildlife

Sets forth the rules and procedures relating to the management, conservation, and protection of fish and wildlife resources on National Forest System lands.

36 CFR 251 Land Uses

Sets forth the rules and procedures relating to the use and occupancy of National Forest System lands.

²⁵ Travel Management; Designated Routes and Areas for Motor Vehicle Use; Final Rule is found in 36 CFR 212, 251, 261, and 295

36 CFR 254 Landownership Adjustments

Sets forth the rules and procedures relating to exchange and conveyance of National Forest System lands.

36 CFR 261 Prohibitions

Sets forth the general prohibitions relating to the use and occupancy of National Forest System lands.

- 36 CFR 261.7 Unauthorized Livestock

36 CFR 293 Wilderness-Primitive Areas

Sets forth the requirements for the administration of wilderness and primitive areas.

36 CFR 294 Special Areas

Sets forth the requirements for designation of special recreation areas.

36 CFR 295 Use of Motor Vehicles Off Forest Development Road

Sets forth the rules and procedures relating to the administrative designation and location of specific areas and trails of National Forest System lands on which the use of motor vehicles traveling off of National Forest development roads is allowed.

36 CFR 296 Protection of Archaeological Resources: Uniform Regulations

Implements the Archaeological Resources Protection Act by establishing the uniform definitions, standards, and procedures for Federal land managers to follow in providing protection for archaeological resources located on public lands and Indian lands, including definitions of prohibited acts and penalties. The regulations also provide requirements for issuing permits under the authority of the Archaeological Resources Protection Act to any person proposing to excavate and/or remove archaeological resources from public lands or Indian lands.

36 CFR 297 Wild and Scenic Rivers

Sets forth the rules and procedures relating to Federal assistance in the construction of water resources projects affecting Wild and Scenic Rivers or study rivers on lands administered by the Secretary of Agriculture.

36 CFR 800 Protection of Historic Properties

Sets forth the provisions for the administration of the National Historic Preservation Act.

40 CFR 51.300-309 Regional Haze Rule

The primary purposes of this subpart are to require States to develop programs to assure reasonable progress toward meeting the national goal of preventing any future, and remedying any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution; and to establish necessary additional procedures for new source permit applicants, States and Federal Land Managers to use in conducting the visibility

impact analysis required for new sources under §51.166. This subpart sets forth requirements addressing visibility impairment in its two principal forms: “reasonably attributable” impairment (*i.e.*, impairment attributable to a single source/small group of sources) and regional haze (*i.e.*, widespread haze from a multitude of sources which impairs visibility in every direction over a large area).

40 CFR 1500 Council on Environmental Quality

Council on Environmental Quality regulations implementing the National Environmental Policy Act.

43 CFR 3 Preservation of American Antiquities

Implements the provisions of the Antiquities Act of 1906.

43 CFR 10 Native American Graves Protection and Repatriation Act Regulations

Implements the provisions of the Native American Graves Protection and Repatriation Act of 1990.

49 CFR 24.102, 103, 104 Basic acquisition policies, Criteria for appraisals, Review of appraisals

Real property acquisition

50 CFR 402 Regulations Governing Interagency Cooperation—Endangered Species Act of 1973, as amended

Interprets and implements the Act. Addresses forms of consultation (early, formal, informal and emergency), conferencing, preparation of biological assessments, designation of lead agency, responsibilities of Federal agency following issuance of a biological opinion, reinitiation of formal consultation, and irreversible or irretrievable commitment of resource.

Executive Orders

Below is a partial listing of relevant executive orders. Executive orders are official documents by which the President provides instructions to executive departments and agencies. An executive order may be used to reassign functions among executive branch agencies. It may adopt guidelines, rules of conduct, or rules of procedure for government employees or units of government. It can also establish an advisory body or task force.

EO 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994

Addresses Environmental Justice in minority and low-income populations and is designed to focus Federal attention on the environmental and human health conditions in minority communities and low-income communities with the goal of achieving environmental justice. The order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority communities and low-income

communities' access to public information on, and an opportunity for public participation in, matters relating to human health or the environment.

EO 13007 Indian Sacred Sites, 1996

Requires each executive branch agency with statutory or administrative responsibility for the management of Federal lands, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites.

EO 13175 Consultation and Coordination with Indian Tribal Governments, 2000

Promotes regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, strengthens the United States government-to-government relationships with Indian tribes, and reduces the imposition of unfunded mandates upon Indian tribes

EO 11990 Protection of Wetlands, 1977

Requires each Federal agency to provide leadership and to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for acquiring, managing, and disposing of Federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

EO 13112 Invasive Species, 1999

Ensures that Federal programs and activities to control and prevent invasive species are coordinated, effective, and efficient. It defines invasive species as "...an alien (or non-native) whose introduction does or is likely to cause economic or environmental harm or harm to human health."

EO 13433 Facilitation of Hunting Heritage and Wildlife Conservation, 2007

Directs Federal agencies with programs and activities that have a measureable effect on public management, outdoor recreation, and wildlife management, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

EO 13186 Responsibility of Federal Agencies to Protect Migratory Birds, 2001

Directs Federal agencies, as practicable, to support the conservation of migratory birds, restore and enhance the habitat of migratory birds, prevent or abate pollution or detrimental alteration of the environment for the benefit of migratory birds, ensure agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners-in-Flight, ensure that environmental analyses of Federal actions required by NEPA

evaluate effect on migratory birds, and promote research, education and training related to conservation of migratory birds.

Forest Service Directives

The following is a partial listing of national and regional Forest Service policies relevant to this Plan. A complete listing can be found in Forest Service Manuals and Forest Service Handbooks at <http://www.fs.fed.us/im/directives/>

The Directives System is the primary basis for the management and control of all internal programs and serves as the primary source of administrative direction for Forest Service employees. The system sets forth legal authorities, management objectives, policies, responsibilities, delegations, standards, procedures, and other instructions.

The Forest Service Manual (FSM) contains legal authorities, goals, objectives, policies, responsibilities, instructions, and the necessary guidance to plan and execute assigned programs and activities. Forest Service Handbooks (FSH) are directives that provide instructions and guidance on how to proceed with a specialized phase of a program or activity. Handbooks either are based on a part of the FSM or they incorporate external directives. Forest Service Manuals and applicable Forest Service Handbooks provide guidance only and do not provide required direction.

FSM 1000 Organization and Management

- **FSM 1010** Laws, Regulations, and Orders
- **FSM 1020** Forest Service Mission

FSM 1400 Controls

- **FSM 1410** Management Reviews

FSM 1500 External Relations

- **FSM 1560** State, Tribal, County, and Local Agencies, Public and Private Organizations

FSM 1600 Information Resources

FSM 1900 Planning

- **FSM 1920** Land and Resource Management Planning
- **FSM 1950** Environmental Policy and Procedures

FSM 2000 National Forest Resource Management

- **FSM 2060** Ecosystem Classification, Interpretation, and Application
- **FSM 2070** Biological Diversity
 - **FSM 2070.3** Vegetation Ecology (use of native plants in revegetation, rehabilitation, and restoration)

- **FSM 2080** Noxious Weed Management, Southwestern Region supplement (weed free policy)

FSM 2200 Range Management

- **FSM 2260** Wild Free-Roaming Horses and Burros

FSM 2300 Recreation, Wilderness, and Related Resource Management

- **FSM 2320** Wilderness Management
- **FSM 2330** Publicly Managed Recreation Opportunities
 - FSM 2332.11 Hazard Trees
- **FSM 2350** Trail, River, and Similar Recreation Opportunities
- **FSM 2353.4** Administration of National Scenic and National Historic Trails
 - FSH 2309.18 Trails Management Handbook
- **FSM 2360** Heritage Program Management
 - FSM 2300-99-3 Southwest Region Supplement

FSM 2400 Timber Management, Southwestern Region.

- **FSM 2430** Commercial Timber Sales, Southwestern Region, Small Sales and Commercial/Personal Use Permits of Timber, Fuelwood, and other forest products
- **FSM 2470** Silvicultural Practices

FSM 2500 Watershed and Air Management

- **FSM 2540** Water Uses and Development, Southwestern Region supplement
 - FSH 2509.25 Watershed Conservation Practices Handbook

FSM 2600 Wildlife, Fish, and Sensitive Plant Habitat Management

FSM 2700 Special Uses Management

- **FSM 2726** Energy Generation and Transmission
- **FSM 2728** Communications
 - FSH 2709.11 Special Uses Handbook

FSM 2800 Minerals and Geology

- **FSM 2810** Mining Claims
- **FSM 2820** Mineral Leases, Permits, Licenses

- **FSM 2850** Mineral Materials
 - FSH 2809.15 Minerals and Geology Handbook

FSM 3100 Cooperative Fire Protection

FSM 3400 Forest Pest Management

FSM 5100 Fire Management

FSM 5400 Land Ownership

- **FSM 5410** Appraisals
- **FSM 5420** Land Purchases and Donations
 - FSH 5409.13 Land Acquisition Handbook
- **FSM 5430** Exchanges
- **FSM 5460** Right-of-Way Acquisition
 - FSH 5409.17 Rights-of-Way Acquisition Handbook

FSM 5500 Land Ownership Title Management

FSM 7300 Buildings and Other Structures

- **FSM 7310** Buildings and Related Facilities
 - FSH 7309.11 Buildings and Related Facilities Handbook

FSM 7400 Public Health and Pollution Control Facilities

- **FSM 7420** Drinking Water

FSM 7500 Water Storage and Transportation

FSM 7700 Transportation System

- **FSM 7710** Travel Planning
 - FSH 7709.55 Travel Analysis
 - FSH 7709.56 Preconstruction Handbook
 - FSH 7709.57 Road Construction Handbook
- **FSM 7720** Development (Policy on Transportation)
- **FSM 7730** Operation and Maintenance
- **FSM 7731** FSH 7709.59 Road Operations

State Regulations

Arizona Administrative Code, Title 18. Environmental Quality, Chapter 2. Department of Environmental Quality Air Pollution Control, Article 15. Forest and Range Management Burns. http://www.azsos.gov/public_services/Title_18/18-02.htm

Arizona Administrative Code, Title 18. Environmental Quality, Chapter 4. Department of Environmental Quality Drinking Water Regulations. http://www.azsos.gov/public_services/title_18/18-04.htm

Arizona Administrative Code, Title 18. Environmental Quality, Chapter 5. Department of Environmental Quality Environmental Reviews and Certification. http://www.azsos.gov/public_services/title_18/18-05.htm

Arizona Administrative Code, Title 18. Environmental Quality, Chapter 9. Department of Environmental Quality Water Pollution Control. http://www.azsos.gov/public_services/title_18/18-05.htm

Arizona Administrative Code, Title 18. Environmental Quality, Chapter 11. Department of Environmental Quality Water Quality Standards. http://www.azsos.gov/public_services/title_18/18-11.pdf

Arizona Department of Environmental Quality Regional Haze State Implementation Plan for the State of Arizona. <http://www.azdeq.gov/environ/air/haze/download/2sip.pdf>

Arizona Department of Environmental Quality Revision State Implementation Plan for Regional Haze. http://www.azdeq.gov/environ/air/haze/download/2004_RH_SIP_Revision.pdf

Arizona Revised Statute, Title 17 – Game and Fish, Section 308. Unlawful camping relative to water and wildlife or domestic stock access. <http://www.azleg.gov/ArizonaRevisedStatutes.asp?Title=49>

Arizona Revised Statute, Title 49 – The Environment, Chapter 2 Water Quality Control, Article 3.1 Arizona Pollutant Discharge Elimination System Program. <http://www.azleg.gov/ArizonaRevisedStatutes.asp?Title=49>

Programmatic Agreements

Memorandum of Understanding (04-MU-110460000-060) between the USDA Forest Service, Southwestern and Intermountain Regions and the State of Utah jointly identifies priority restoration needs; to build capacity to accomplish needed restoration projects; and to expand the use of stewardship contracting or other tools that encourage local employment in order to benefit the management of the National Forests and communities of the Central Colorado Plateau and Great Basin.

Memorandum of Understanding between Forest Service, Southwestern Region, and the State of Arizona Department of Environmental Quality outlines responsibilities and activities related to water quality.

Memorandum of Understanding between the Havasupai I Tribe and the USDA Forest Service-Kaibab National Forest (2008)

Memorandum of Understanding between the Hopi Tribe and the USDA Forest Service-Kaibab National Forest (2004)

Memorandum of Understanding between the Hualapai Tribe and the USDA Forest Service-Kaibab National Forest (2007)

Memorandum of Understanding between the Kaibab Band of Paiute Indians and the USDA Forest Service-Kaibab National Forest (2008)

Various MOUs with other agencies and organizations to promote conservation of migratory birds, to recover California Condor, to facilitate survey and monitoring of bats and bat habitat with Bat Conservation International, and to improve coordination between AZ Game and Fish and the Forest Service Southwestern Region.

First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities among New Mexico Historic Preservation Officer and Arizona State Historic Preservation Officer and Texas State Historic Preservation Officer and Oklahoma State Historic Preservation Officer and the Advisory Council on the Historic Preservation and United States Department of Agriculture Forest Service Southwestern Region.

Other

Arizona Bugbane Conservation Assessment and Strategy for the Coconino and Kaibab National Forests (USDA FS 1995). The character of this area is maintained by limiting access and managing threats. Suppression actions may be needed to prevent damage to the plant colony and habitat.

Paradine Plains Cactus (*Pediocactus paradinei*) Conservation Assessment and Strategy on the North Kaibab R.D.m Kaibab N.F. and the Arizona Strip District, BLM 1996.

Kaibab National Forest Recreation Opportunity Spectrum-Scenery Management Guidebook, Kaibab National Forest Recreation Facility Analysis, Forest Service Built Environment Design Guide, ROS Book

Parker, Patricia L. and Thomas F. King, 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties, National Register Bulletin, US Department of the Interior, National Park Service, National Register, History and Education.

USDA, Forest Service, Coconino National Forest 1987. Land Management Plan as amended June 1996. The Coconino NF Plan provides direction for the Sycamore Canyon Wilderness which is located within and managed by three national forests—the Coconino, Kaibab, and Prescott NFs.

USDA, Forest Service, Kaibab National Forest, Williams RD 1984. Wild Burro Interim Management Plan: Double A wild burro territory.

USDA, Forest Service, Southwestern Region 2005. Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds: Coconino, Kaibab, Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona, MB-R3-16-1.

USDOE and USDOJ 2008. Programmatic Final Environmental Impact Statement, Designation of Energy Corridors on Federal Lands in the 11 Western States.

<http://corridoreis.anl.gov/documents/fpeis/index.cfm#vol1>

National Wildfire Coordinating Group (NWCG) Review and Update of the Federal Wildland Fire Management Policy (2001)

http://www.nwccg.gov/branches/ppm/fpc/archives/fire_policy/index.htm

National Interagency Fire Center (NIFC) Guidance for Implementation of Federal Wildland Fire Management Policy (2009) <http://www.nifc.gov/policies/guidance/GIFWFMP.pdf>

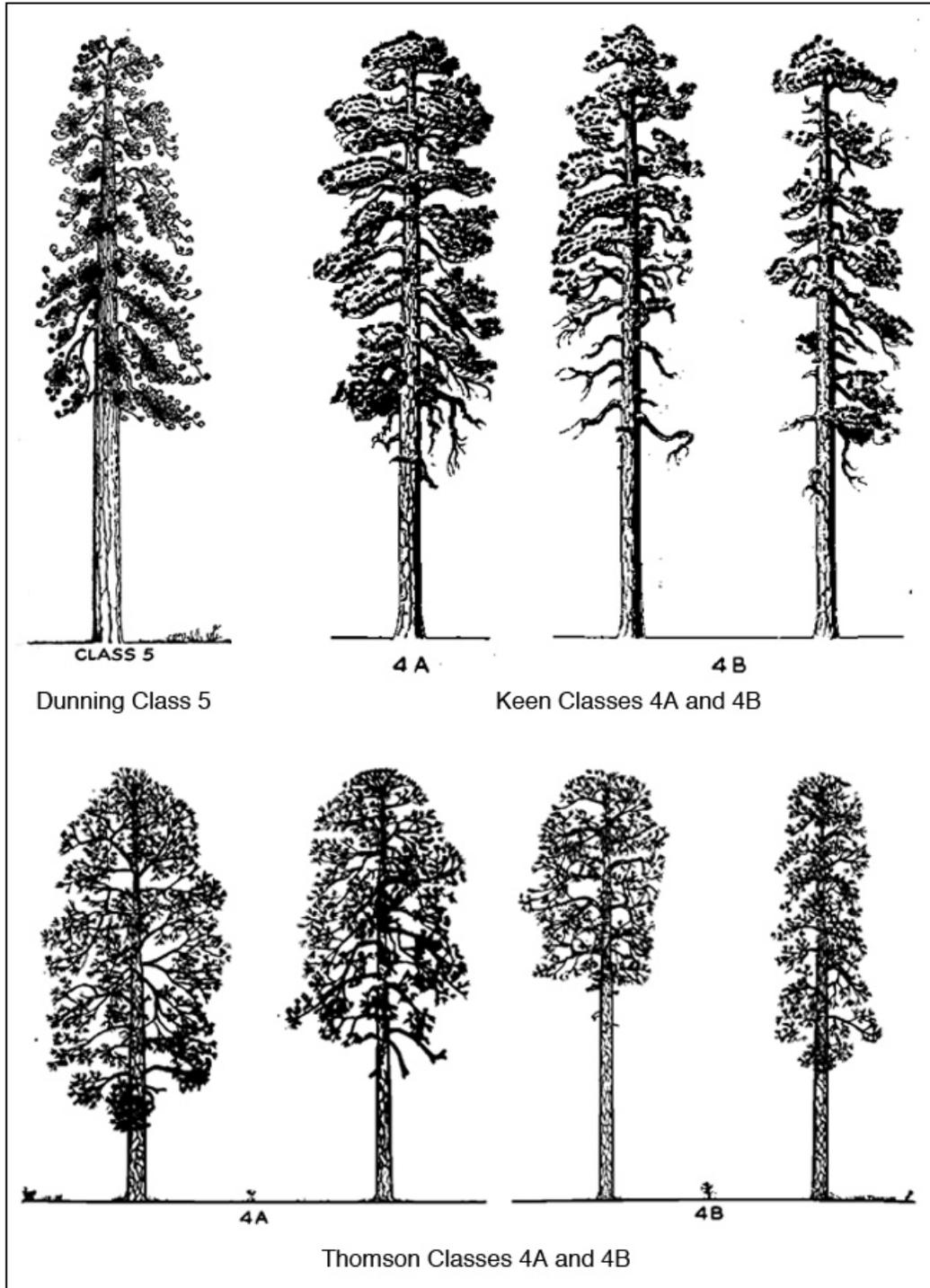
National Interagency Fire Center (NIFC) Interagency Prescribed Fire Planning and Implementation Guide (2008)

http://www.nifc.gov/fuels/downloads/directions/RXFireGuide_08.30.06.pdf

Wildland Fire Decision Support System (WFDSS)

http://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml

Appendix C. Large Tree Retention Classes for Ponderosa Pine



Age Class Descriptions

Dunning (1928) Age Class 5: Overmature; usually largest trees in stand; bark light yellow with wide, long and smooth plates; tops flat with terminals rarely discernable; nearly all branches are drooping, gnarled, and crooked.

Keen (1943) Age Class 4: Overmature; making no further height growth; diameter growth very slow; bark light yellow, uniform for entire bole (except in extreme top), with wide, long and smooth plates and often shallow fissures; tops usually flat or occasionally rounded or irregular; branches large, heavy, and often gnarled or crooked and mostly drooping except in extreme top.

Thomson (1940) Age Class 4: Mature to overmature; trees usually large; bark reddish-brown to yellow with wide, long and smooth plates; tops usually flat and making no further height growth; branches mostly large and drooping, gnarled or crooked.

Appendix D. Kaibab National Forest's Climate Change Approach for Plan Revision

This appendix summarizes Kaibab National Forest's Climate Change Approach for Plan Revision and guidance excerpted from *Southwestern Climate Change Trends and Forest Planning: A Guide for Addressing Climate Change in Forest Plan Revisions for Southwestern National Forests and National Grasslands* (USDA Forest Service-Southwestern Region, May 2010).

Introduction

Climate scientists agree that the earth is undergoing a warming trend, and that human-caused elevations in atmospheric concentrations of carbon dioxide and other greenhouse gases are among the causes of global temperature increases. The observed concentrations of these greenhouse gases are projected to increase. Climate change may intensify the risk of ecosystem change for terrestrial and aquatic systems, thereby affecting ecosystem structure, function, and productivity.

Strategies for protecting climate-sensitive ecosystems through management will become increasingly important because changes in climate would likely continue regardless of emissions mitigation. Climate change exacerbates the already difficult task of managing the National Forest System for multiple goals. This document summarizes how the Kaibab NF intends to incorporate current and possible future climate change into the land management planning process. The primary consideration for evaluating responses to climate change lies with the forest's ability to modify social, economic, and ecological conditions on the planning unit.

Current Conditions and Trends

Current conditions and trends described in the draft environmental impact statement (DEIS) for the Proposed Kaibab Forest Plan and alternatives addresses risks, vulnerabilities, and potential ecological changes that could result from climate change. The Plan addresses potential climate change impacts that are most likely to affect ecological systems, goods, and services. Evaluation of climate change impacts may lead to recognition that some conditions may be difficult to maintain over time. Particular attention is given to ecosystems that are most at risk due to climate change and vulnerable ecosystem components, such as aquatic systems, grassland plant diversity, and high-elevation ecosystems. Information from the evaluation of current conditions and trends was used to develop the social, economic, and ecological desired conditions in the Plan.

Integrating Climate Change into Land Management Plans

Climate change is addressed as an integrated part of the Kaibab NF Land Management Plan, rather than as a standalone set of desired conditions. An example is the desired condition, "The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and components that provide resiliency to climate variability." Integration of climate-relevant desired conditions throughout the planning document helps to ensure these concepts are considered during project-level planning.

Desired conditions for the planning unit were developed considering potential climate effects to:

- Increased extreme weather-related forest disturbances (floods, drought, wind-throw)
- Water stresses (ground water, runoff, and timing), aquatic biota
- Wildfire risks

- Shifts in major vegetation types for the Southwest
- Threatened, endangered, and sensitive species
- Forest insects and disease
- Weather-related stresses on human communities (temperature, air quality)
- Outdoor recreation
- Wildlife movement and biodiversity

Monitoring

No specific element of the monitoring plan was developed solely for monitoring climate change. However, the forest plan monitoring program incorporates provisions that should improve understanding of the relationships between key plan components and climate change. For example, an inventory of the aquatic ecosystems and information about water temperatures and water flows associated with climate change can be useful for tracking variability within ecosystem condition and trends observed over a prescribed evaluation period. Monitoring the frequency and spatial extent of uncharacteristic wildlife occurrences and insect outbreaks would help the forest assess how well management is mitigating for hotter drier and more fire-prone conditions, and whether existing management is promoting resilient ecosystems. Along similar lines, monitoring springs which are sensitive to variable precipitation and naturally more predisposed to the effects of prolonged drought, would help the forest to prioritize protection and restoration focused on those ecosystems while gleaned information about endemic species levels and refugia. It may also be possible to discern climate change related patterns in habitat use through long-term monitoring of songbirds and their habitat.

Although not an exhaustive list, some of the key Kaibab NF monitoring plan questions which have climate change relevance include the following:

- What percentage of the forest is in an uneven-aged open state, at the midscale (above 100 acres)?
- How many acres burned with desired fire behavior and effects?
- What is the total area of contiguous acres (above the midscale) at risk for active crown fire?
- What is functional condition of the natural lakes and wetlands?
- What are the areal extent, distribution, and abundance of priority nonnative invasive plants on the Kaibab NF?
- What are the forest-level densities, population estimates, and/or proportion of habitat occupied for song birds?

As part of its 2010 to 2015 strategic plan, the Forest Service launched a Roadmap for Responding to Climate Change (USDA 2010b). This comprehensive science-based plan emphasized a set of long- and short-term approaches for managing climate change while providing the agency with a clear, common vision. This strategic plan should help the Forest Service better provide for sustainability over time with climate uncertainty. The roadmap focuses on three primary activity areas: (1) assessing current risks, vulnerabilities, policies, and gaps in knowledge; (2) Engaging internal and external partners in seeking solutions; and (3) Managing for resilience, in ecosystems as well as in human communities. A component of the strategic plan is a “Performance Scorecard” <http://www.fs.fed.us/climatechange/pdf/Scorecard.pdf>), to be completed annually by each national forest or grassland. This scorecard has a series of questions focused on the above

three activity areas which would allow each management unit to assess how well integration of climate change considerations is happening at the local scale. The scorecard assesses agency capacity, partnerships and education, adaptation, mitigation, and sustainable consumption. All forests are expected to be compliant with 7 of the 10 scorecard elements by 2015.

Decision Documents

Pertinent aspects of climate change would be addressed in the rationale of decision documents, particularly those that may affect the social, economic, and ecological systems within the planning unit that are most at risk. Examples of ecosystems, characteristics, and species most at risk include fire-adapted vegetation, native aquatic species, and endemic species. Examples of socioeconomic systems at risk of change include risks to private property and infrastructure from uncharacteristic fires, livestock grazing, winter recreation, water recreation, and personal use products. Increasingly, tools are available to aid in understanding and evaluating how climate change could affect forest resources. These tools can help with describing existing conditions and trends, developing project design criteria, and evaluating potential effects as they relate to changing conditions (see planning tools below).

Potential Climate Change Effects

Based on current projections, the primary regional-level effects of climate change most likely to occur in the Southwest include: (1) warmer temperatures, (2) decreasing precipitation, (3) decreased water availability with increased demand, (4) increased extreme disturbance events, and (5) increased use of national forests for relief from higher temperatures in lower-elevation cities. These climate change factors could, in turn, affect ecological, weather-related disturbances, and socioeconomic demands, including increases in:

- Frequency of extreme weather events (intense storms),
- Wildfire risks,
- Outbreaks of insects, diseases, and spread of nonnative invasive species,
- Demand for water,
- National forest socioeconomic uses and demands, and
- Changes in habitat quality and quantity for certain desired wildlife and plant species.

Extreme Weather Events

Climate change likely would increase flash floods, making the region's growing population more susceptible to loss of life and property. While the Southwest is expected to become warmer and drier, it is also likely to experience more flooding. This relates in part to the fact that warm air holds more moisture than cooler air. The frequency of floods is also influenced by the rate of snowmelt in the winter and spring, the character of the summer monsoon, and the incidence of tropical hurricanes and storms in the autumn.

Hurricanes and other tropical cyclones are projected to become more intense in the future. Since Arizona typically receives 10 percent or more of its annual precipitation from tropical storms, it is likely that this change would also increase flooding. A potential increase in extreme storms, floods, heat waves, and droughts may present challenges for achieving desired conditions.

Impacts from extreme weather events could include changes in the composition and diversity of desired ecosystems; destruction of habitat; damage to infrastructure such as trails, facilities, and

roads; loss of recreation opportunities, and reduced wood and forage supplies. Disturbances that exceed the historic range of natural variation can change the composition, structure, and function of watersheds and some vegetation types, affecting a wide range of resources. Heavy rains and higher flood levels could affect the structural integrity of built infrastructure and increase maintenance needs. Flooding is a natural and beneficial disturbance in many aquatic systems. However, damage to aquatic systems from flash flooding causes erosion, downed trees, and inundation that can change streamside habitats, affect aquatic life, and impact the functioning condition of stream channels. These disturbances could create challenges in the ability of a forest to achieve desired conditions for aquatic habitats. Overall, increasing weather-related disturbances could divert limited forest staff and funding to recovery efforts for extended periods, which would delay progress toward desired conditions, or modify them to allow for more dynamic conditions when desired conditions may not be attainable.

Wildfire

Historically, wildfires have played an important role in the vitality of fire-adapted ecosystems. Past forest management and fire suppression practices have changed the dynamics of fire on the landscape within the Southwestern Region's national forests, resulting in greater fuel loads and risk of wildfire. A combination of fire suppression and Federal land-management agencies in the West routinely exceed expenditures of over \$1 billion per year for wildfire suppression. Since about the mid-1970s, the total acreage of area burned and the severity of wildfires in ponderosa pine and mixed-conifer forest have increased.

Fire frequency and severity are likely to increase as temperatures rise and precipitation decreases. Severe wildfires reduce the land's ability to sequester and store carbon. Population growth in the Southwest may also lead to greater numbers of human-caused wildfires. The 2002 Rodeo-Chediski fires and the 2011 Wallow fire in Arizona were started by humans. Combined, these fires combined burned over a million acres.

Outbreaks of Insects, Diseases, and Nonnative Invasive Species

Disturbances associated with climate change can have secondary impacts indirectly caused by wildfire and climate-related extremes. Increased variation in temperature and moisture can cause stress and increase the susceptibility of forest ecosystems to invasions by insects, diseases, and nonnative species. New environmental conditions can lead to a different mix of species that tend to favor plants and animals that can adapt their biological functions or are aggressive in colonizing new territories (Whitlock 2008). However, changes in adaptability may be too slow, given the predicted rate of change. Species that are already broadly adapted may become more prevalent and species with narrow adaptability may become less prevalent. Disturbance factors that create more vulnerability in native ecosystems or require extensive controls to maintain the status quo are likely to adversely affect the health and diversity of forests.

Desired conditions for healthy forests include resilience to dramatic changes caused by abiotic and biotic stressors and mortality agents (pine beetle), and a balanced supply of essential resources (light, moisture, nutrients, growing space). Insects and diseases typically invade in cycles followed by periods of relative inactivity. Nonnative invasive species, such as cheatgrass and saltcedar, are expected to continue to increase in numbers and extent. Vulnerabilities to forest threats from an environment that may be much different from the historic range of natural variability is an active area of research, and includes developing new management approaches for changing conditions.

Diminishing Water Resources

Locations of most snowpack and upland reservoirs are on national forests in the Southwest. In much of the Southwest, less precipitation is falling as snow, and spring melting is occurring earlier in the year. The Colorado River, Rio Grande, and several other southwestern rivers have streamflows that appear to be peaking earlier in the year, suggesting that the spring temperatures in these regions are warmer than in the past, causing snow to melt earlier. Water supplies are projected to become increasingly scarce, calling for trade-offs among competing uses, potentially leading to conflict. In the Southwest, intense debate is likely to occur over resource allocation and conservation of available supplies.

Climate-Related Socioeconomic Demand

Populations in Arizona and New Mexico are growing at an unprecedented rate. As of the latest American Communities Survey 2006, Arizona's population was over 6 million. The total increase for Arizona between 1980 and 2006 was 123 percent. The combination of population growth and climate change would likely exacerbate climatic effects, putting even greater pressure on water, forest, and other resources. Climate change could have long-term impacts on many of the amenities, goods, and services from forests, including productivity of locally harvested plants such as berries or ferns; local economics through land-use shifts from forest to other uses; forest real estate values; and tree cover and composition in urban areas and associated benefits and costs.

Climate Change and Wildlife Habitat

While climate change has the potential to affect all wildlife species, some are inherently more vulnerable than others, particularly species with specialized niches, limited mobility, and limited physiological adaptability. Certain habitats are more vulnerable to a changing climate. For example, springs and seeps are a valuable natural water source for a variety of birds and mammals, particularly in arid environments. These areas may offer critical refugia for rare and narrow endemic species. However, springs are especially sensitive to variable precipitation and likely to dry up during prolonged drought. As such, the unreliability of natural water resources would make it harder for wildlife species to persist, pushing the limits of their natural range.

Managing for landscape connectivity will be important, as connectivity facilitates movement of species among habitats (Taylor et al. 1993, Millar et al. 2007). Connectivity has two components, structural and biological connectivity and biological components. Structural connectivity, the spatial structure of a landscape, can be described from map elements. Biological connectivity is the response of individuals to the scale of landscape features (Brooks 2003). Promoting connectivity in landscapes with flexible management goals that can be modified as conditions change may assist species to respond naturally to changing climates. Reducing fragmentation and planning at landscape scales to maximize habitat connectivity will become increasingly important (Millar et al. 2007).

Management Strategies to Address Key Climate Change Concerns

Actions to address climate change factors of most concern are those that:

1. Reduce vulnerability by restoring and maintaining resilient native ecosystems,
2. Anticipate increases in forest recreation,

3. Use markets and demand for wood and biomass for restoration, renewable energy, and carbon sequestration,
4. Enhance adaptation by anticipating and planning for intense disturbances,
5. Conserve water, and
6. Monitor climate change influences.

Managing ecosystems under uncertainty necessitates flexible and adaptive approaches that are reversible, are implemented in incremental steps, which allow for new information and learning, and that can be modified with changing circumstances (Millar et al. 2007). Southwestern ecosystems have evolved under a long and complex history of climate variability and change. Taking into consideration the number of mega-droughts and other climate-related variation, through time, southwestern systems have some built-in resilience. Kaibab's proposed plan focuses on restoring and maintaining resilience in forest and grassland ecosystems. Risks of increased wildfire, insects and disease outbreaks, and invasive species represent ongoing, broad-scale management challenges. These issues are not new. However, climate change has the potential to increase and exacerbate the impacts of these ecosystem risks.

Because our understanding of climate change is rapidly evolving, management decisions that are robust to uncertain, while being both strategic and tactical in nature would likely be most effective at managing for climate change. Peterson et al. (in press) have developed a guidebook for climate change response on national forests. It recommends the following strategies which incorporate both science and management: (1) become aware of basic climate change science and integrate that understanding with knowledge of the local resource conditions and issues (review), (2) evaluate sensitivity of natural resources to climate change (rank), (3) develop and implement options for adapting resources to climate change (resolve), and (4) monitor the effectiveness of on-the-ground management (observe), and adjust as needed.

Restoring and maintaining resilience would likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change-related impacts and variability. Managing for resistance (e.g., maintenance thinning to prevent catastrophic fire, forest insect or disease pandemics) and resilience (e.g., noxious weed control) offer meaningful responses to climate change.

Prescribed fires are a management tool that can serve multiple purposes, from sustaining desired conditions for fire-adapted ecosystems and sustaining habitat for threatened and endangered species, to reducing fuel loads. Prescribed burning is also a management strategy that will be important for maintaining desired habitats in a changing climate with more natural disturbances. With projections of storms that are more frequent, and other more extreme weather events, and increased stress from forest pests in a warmer, drier climate, prescribed burning will continue to be an important management strategy for the future.

Forests serve as significant carbon reservoirs; however, large-scale fire events can counter this benefit by releasing significant amounts of carbon into the atmosphere. Fuel treatments (e.g., thinning, prescribed fire) as identified in the proposed action, promote low-density stand structures, characterized by larger, fire-resistant trees. This strategy should afford for greater carbon storage in southwestern fire-adapted ecosystems over time (North et al. 2009, Hurteau and North 2009). Although fire-excluded forests contain higher carbon stocks, this benefit is outweighed in the long term by the loss that would be likely from uncharacteristic stand-replacing fires (Hurteau et al. 2011) if left untreated.

Prescribed burning helps to mitigate the negative impacts of stand-replacing fire in dry, dense forests, by consuming less biomass and releasing less carbon into the atmosphere (Wiedinmyer and Hurteau 2010). Further, research has shown that the long-term gains acquired through prescribed fire and mechanical thinning outweigh short-term losses in sequestered carbon. In the long term (e.g., 100 years) thinning and burning would create more resilient forests, less prone to stand-replacing events, and subsequently, able to store more carbon in the form of large trees.

Slash resulting from mechanical thinning can be used in place of fuels (North and Hurteau 2011, Sorenson et al. 2011). Not all forest products sequester carbon equally. For example, products with longer on average life spans (e.g., houses), have a greater potential to store carbon than short-lived products such as fence posts. In addition, biomass products created from slash can be used in place of fossil fuels, greatly reducing carbon emission into the atmosphere (Ryan et al. 2010). These types of discussions of trade-offs in emission and carbon storage rates are likely to be increasingly relevant in decision-making. Wood products that can substitute for building materials such as steel and concrete produce far less greenhouse gas emissions during their production while simultaneously sequestering carbon (Ryan et al. 2010).

Although current programs and guidance are already in place to limit introduction of nonnative species, treat invasive species, and control insects and diseases, these efforts are likely to become more critical to maintaining desired conditions for healthy forests under a changing climate. Due to the fragmented land ownership patterns, success in reducing forest pests requires going beyond national forest boundaries, and continued collaboration with partners will be needed. In addition, management practices (such as prescribed selection-cutting for age-class diversity) that sustain healthy forests and provide adequate nutrients, soil productivity, and hydrologic function, promote resilience and reduce the potential for disturbance and damage.

The Wildlife Society with the Inkley et al. Report (2004) recommended several actions to help wildlife adapt to climate change and its potential effects on wildlife. These include: (1) managing for diverse conditions; (2) reducing nonclimate stressors on ecosystems; (3) reducing the risk of uncharacteristic high-intensity fires; (4) conducting medium- and long-range planning; (5) ensuring ecosystem processes; and (6) employing monitoring and adaptive management. As well as controlling for invasive plant species. Finally, it will be important to set priorities by appropriately balancing sensitive and vulnerable species and systems with those that are resistant and resilient (NWF 2011).

On the Kaibab NF, existing collaborations between the AZGFD and Coconino County generally encourage the protection of open lands and the preservation of the land's natural character within local and regional contexts. These collaborative strategies should decrease the potential for future land fragmentation while improving the overall integrity of the landscape. This should also provide for more resilience with regard to climate change for those wildlife species that may need to adjust migration routes, foraging corridors, or breeding grounds.

Planning Tools

To assist each national forest with better integration of climate change considerations into project-level planning, the agency is actively engaged in developing user-friendly planning tools, assessments, and Web-based resources. For example, resource managers are encouraged to use rapid assessment tools, such as the Climate Project Screening Tool (CPST) (Morelli et al. *in press*). The CPST is a decision-support tool which provides a direct link between best available science and management actions. Further, it is a process-oriented activity that integrates climate change trends for a particular region, with project design considerations for various resource

areas. Composed of a series of climate change-related questions relevant to the area of interest (developed collaboratively by scientists and interdisciplinary team specialists), the final outcome of the exercise for a particular project is a decision of proceed, modify, or cancel, given how well it meets the climate-change considerations in the preceding questions, i.e., does it still make sense to do the project? Finally, this tool helps managers set priorities by considering the effects of different projects with regard to climate change, and helping to reduce management uncertainty.

Specifically for wildlife, the Forest Service Rocky Mountain Research Station has developed a System for Assessing Vulnerability of Species (SAVS). This system helps wildlife specialists quantify the relative impact of expected climate-change effects for terrestrial vertebrate species. This decision-support tool uses criteria related to expected response or vulnerability of species in a questionnaire to provide a framework for assessing vulnerability to climate change. The questionnaire focuses on habitat, physiology, phenology, and biotic interactions. This tool helps to inform management by identifying specific traits and issues related to vulnerabilities of individual species. Additional information on this application can be found at:

<http://www.fs.fed.us/rm/grassland-shrubland-desert/products/species-vulnerability/>

Finally, a comprehensive website has been launched which serves as a clearinghouse for climate change-related information. Organized by resource area, this is a “one-stop shopping” site that provides scientists and managers with the information and resources needed to incorporate the most up-to-date climate change considerations into both near- and long-term planning initiatives: <http://www.fs.fed.us/ccrc/>.

Summary

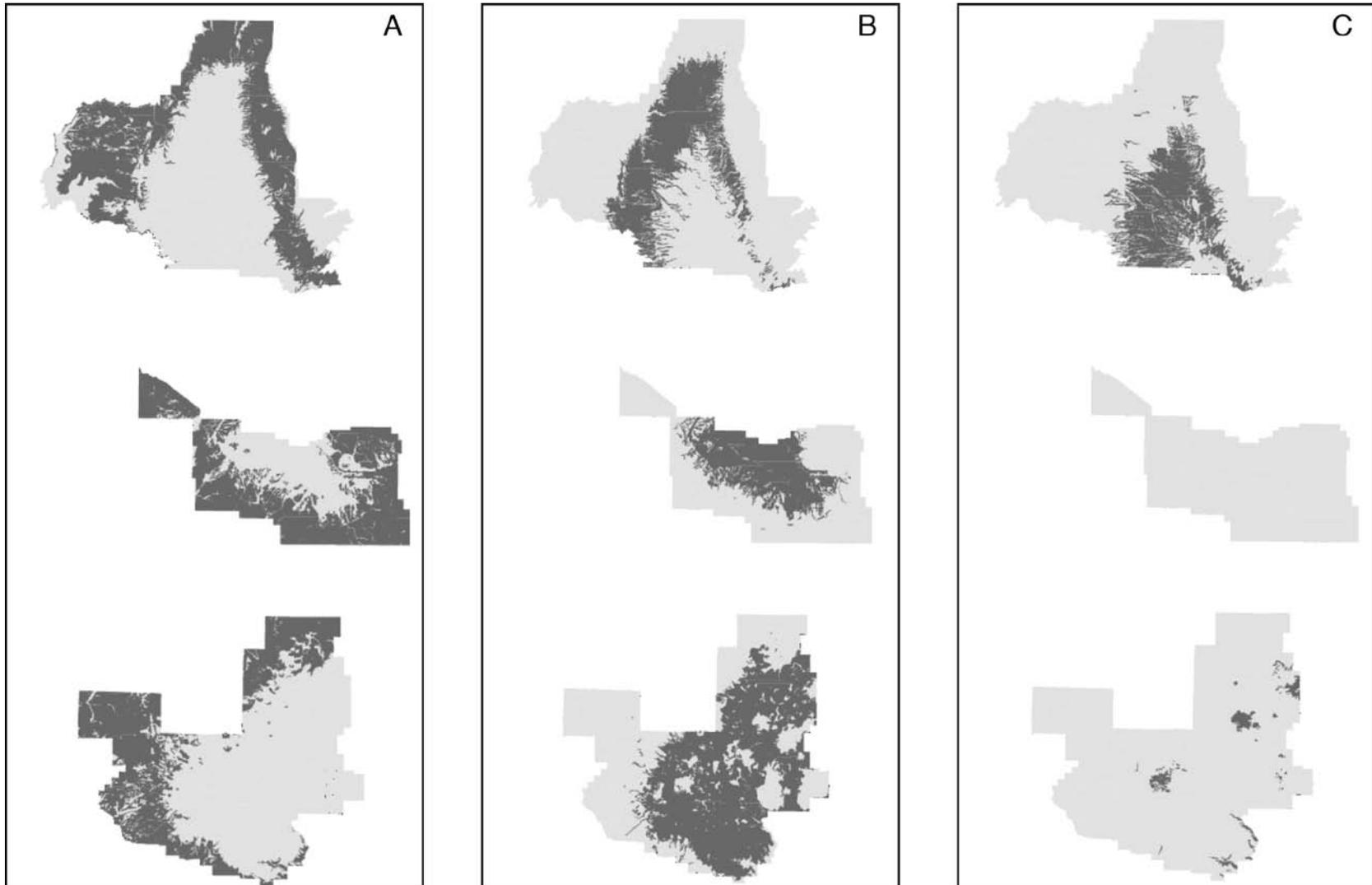
By managing for resistant and resilient ecosystems, promoting landscape connectivity, and implementing concepts of adaptive management, land management plans can provide the framework for responding to new information and changing conditions related to climate change that have the potential to increase impacts to ecosystem risks. The revised Kaibab NF Land Management Plan should provide clear management direction and include the necessary monitoring and mechanisms that would facilitate adaptation over time.

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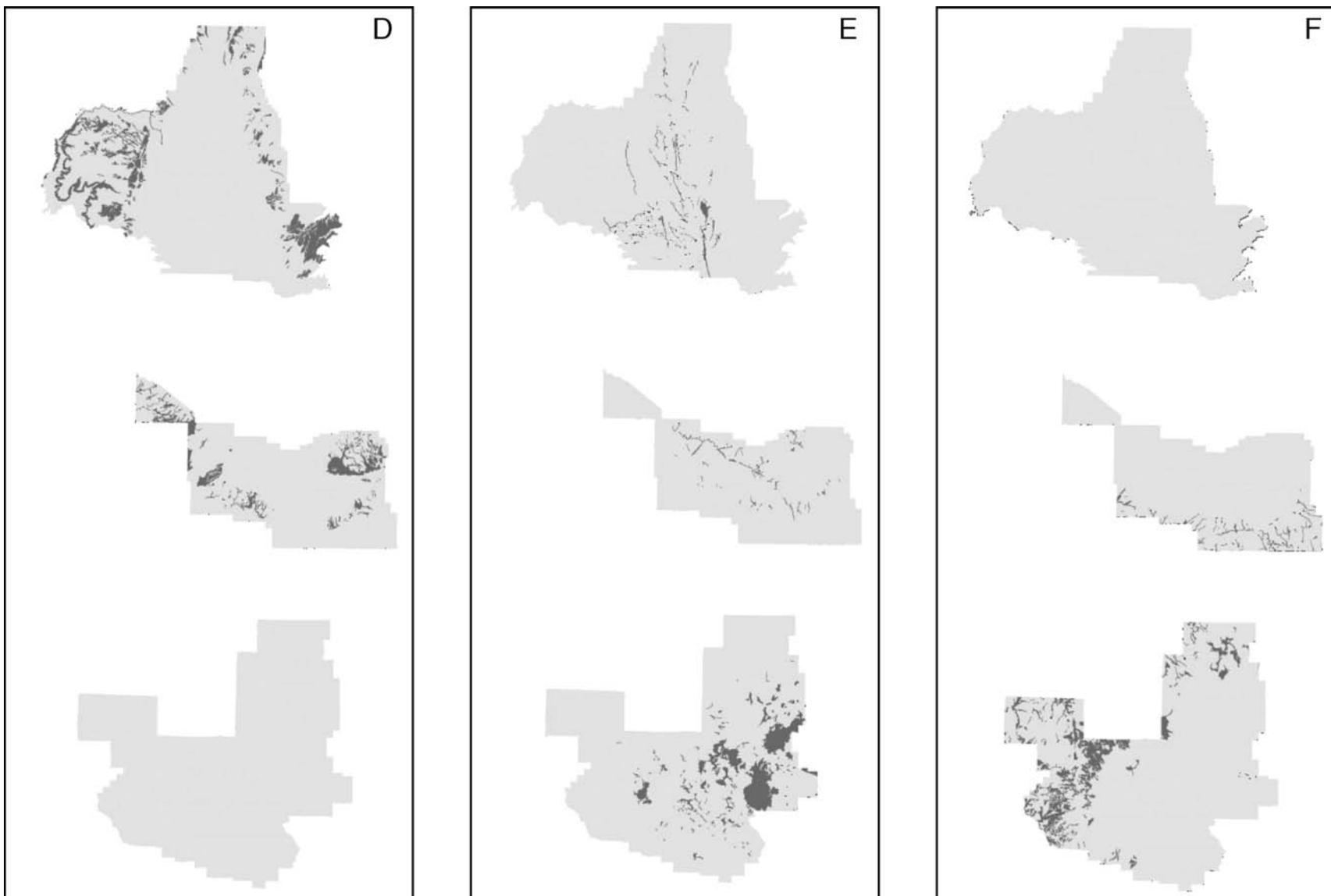
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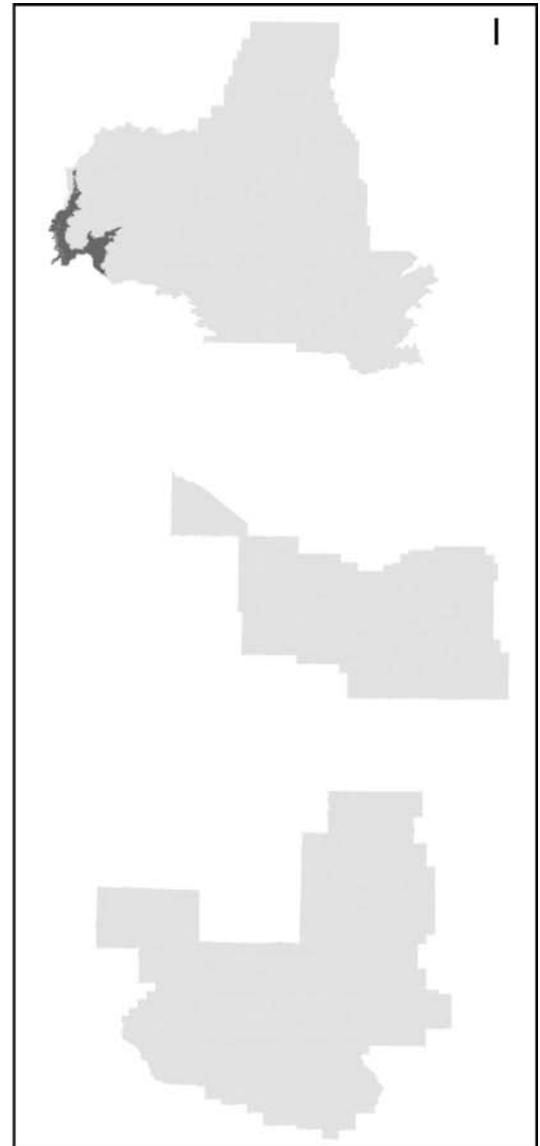
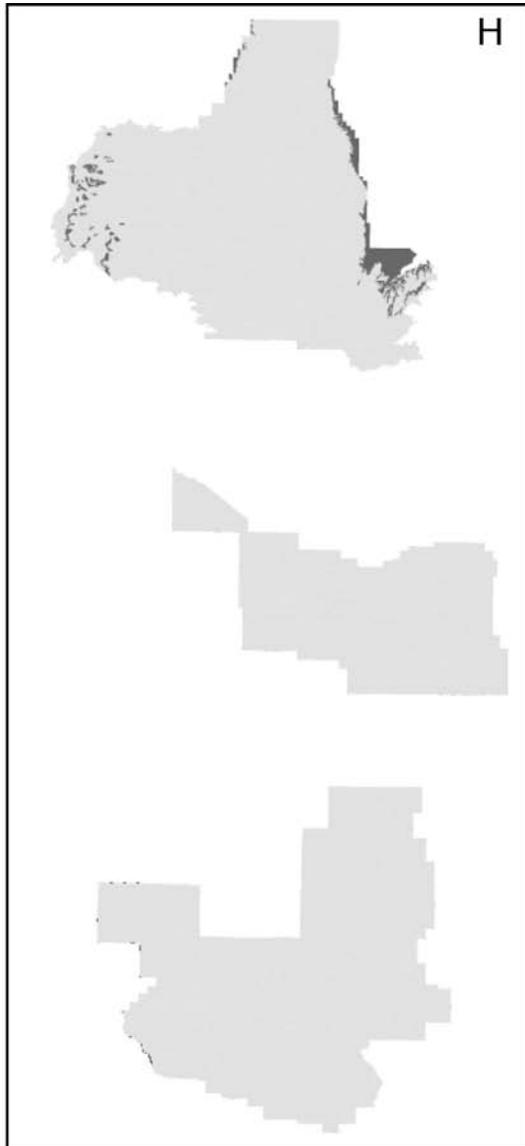
Appendix E: Kaibab National Forest Major Vegetation Community Types



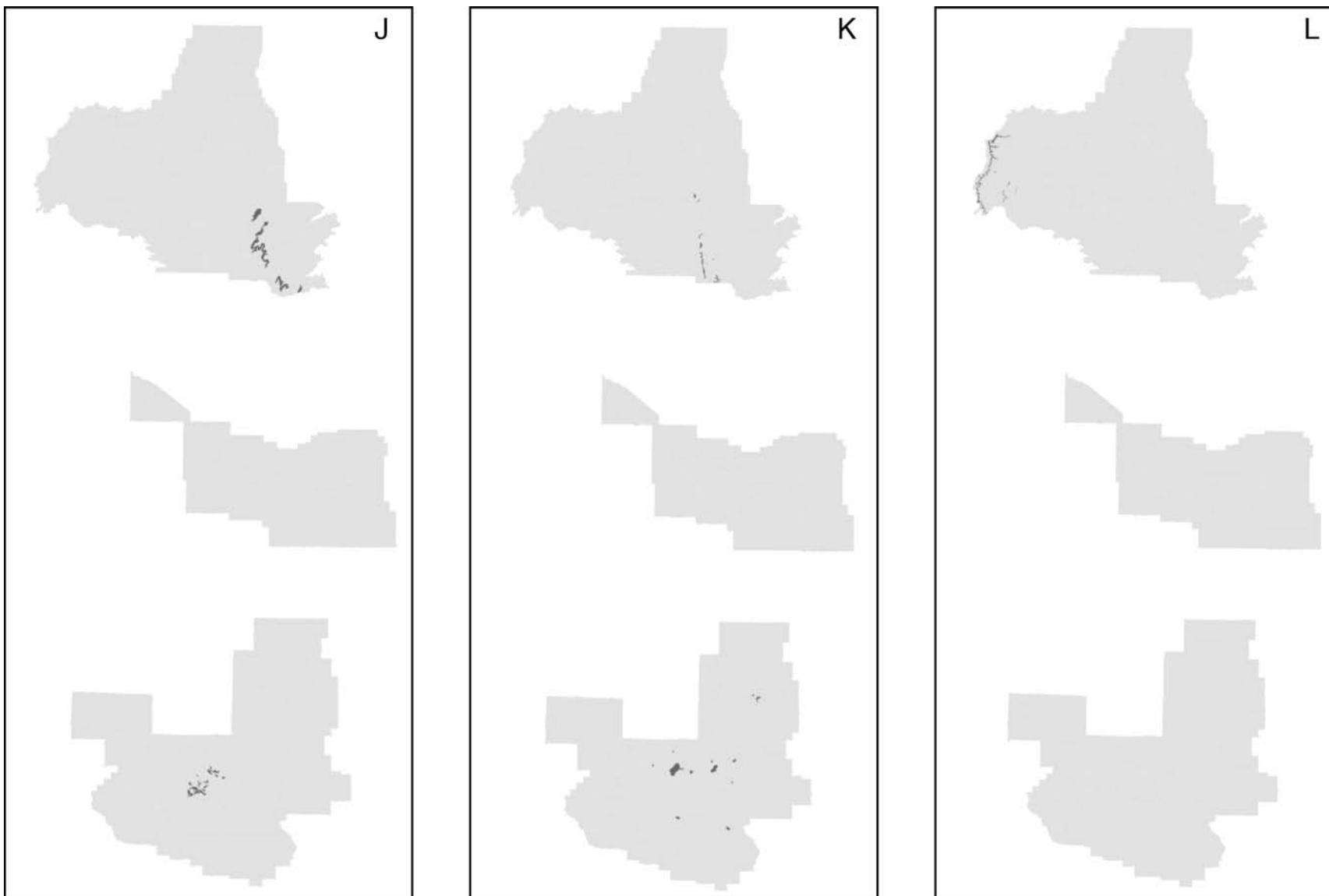
Kaibab National Forest vegetation types (dark areas): pinyon-juniper woodland (A), ponderosa pine (B), and mixed conifer (C)



Kaibab National Forest vegetation types (dark areas): sagebrush shrubland (D), montane/subalpine grassland (E), and Colorado Plateau/Great Basin grassland (F)



Kaibab National Forest vegetation types (dark areas): spruce-fir (G), semi-desert grassland (H), and desert communities (I)



Kaibab National Forest vegetation types (dark areas): Gambel oak shrubland (J), wetland/cienega (K), and cottonwood-willow riparian forest (L)