Coronado National Forest

Draft Land and Resource Management Plan

United States
Department of
Agriculture

Forest
Service

August 2011

Printed on recycled paper – Month and Year

Draft Land and Resource Management Plan

Coronado National Forest

Cochise, Graham, Pima, Pinal, and Santa Cruz Counties, Arizona Hidalgo County, New Mexico

Responsible Official:	Regional Forester Southwestern Region 333 Broadway Boulevard SE Albuquerque, NM 87102 (505) 842-3292
For more information contact:	Forest Planner Coronado National Forest 300 West Congress, FB 42 Tucson, AZ 85701 (520) 388-8300 TTY 711 coronado-plan@fs.fed.us

Table of Contents

List of Figures

List of Tables

List of Preparers

Terry Austin	*Data Management Specialist*
Erin Boyle	*Assistant Forest Planner*
Eli Curiel	*Engineer*
Sarah Davis	*Planner, Collaboration and Partnerships*
Tami Emmett	*Realty Specialist*
Mary Farrell	*Heritage Program Leader and Tribal Liaison*
Richard Gerhart	*Staff Officer: Wildlife, Fish and Rare Plants*
William Gillespie	*Forest Archaeologist*
Larry Jones	*Forest Biologist*
Debby Kriegel	*Landscape Architect*
Robert Lefevre	*Forestry and Watershed Program Manager*
George McKay	*Lands program manager*
Linda Peery	*Planning Biologist*
Jennifer Ruyle	*Forest Planner*
Jeremy Sautter	*Lands Assistant*
Christopher Stetson	*Fire and Fuels Specialist*
Laura White	*Travel Management, Wilderness, Trails Project Leader,*
Craig Wilcox	*Forest Silviculturalist*

Chapter 1: Introduction

Purpose of Land and Resource Management Plan

The Land and Resource Management Plan (Forest Plan) is a guide for the management of the Coronado National Forest (the Forest) for approximately[1] the next 15 years. This plan:

- Is strategic in nature. It does not include project and activity decisions. Those decisions are made later, only after more detailed analysis and further public involvement.
- Is adaptive in that new knowledge and information can be analyzed and the Forest Plan can be amended, if appropriate, at any time.
- Honors the continuing validity of private, statutory, or pre-existing rights.

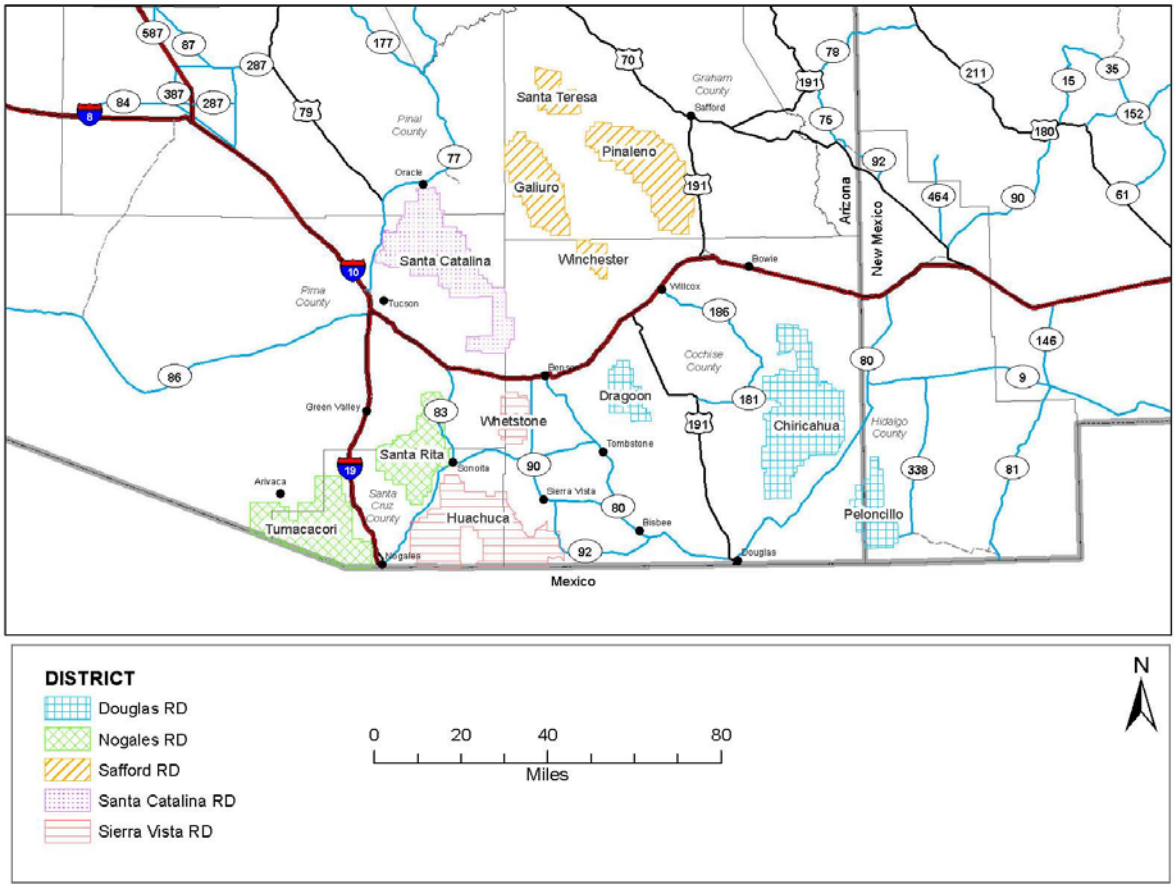

Figure 1. Vicinity Map of the Coronado National Forest

[1] May be revised sooner if needed because of important changed conditions.

Overview of the Coronado National Forest[2]

The Coronado National Forest (NF or the Forest) is an administrative component of the National Forest System (NFS). It administers 1,783,632 acres of National Forest System (NFS) lands. National forests across the United States were established to provide natural resource based goods and services to American citizens. Management of national forests is jointly based in the principles of conservation and multiple-use. The Coronado NF contributes a wide array of goods and services to its visitors and communities.

The present day Coronado NF has its origins in 1902, when the Santa Rita, Santa Catalina, Mount Graham and Chiricahua Forest Reserves were established to protect timber and watershed resources. Over the years, Forest units were combined, expanded, and reduced to result in the current configuration, which was established in 1953. It is now organized as five Ranger Districts and the Supervisor's Office. Each Ranger District administers one or more ecosystem management area (EMA)(Fig. 1), with the Supervisor's Office providing oversight for all administrative functions on the Forest. The Douglas Ranger District (located in Douglas, Arizona) administers the Chiricahua, Dragoon, and Peloncillo EMAs. The Nogales Ranger District (located in Nogales, Arizona) administers the Santa Rita and Tumacacori EMAs. The Safford Ranger District (located in Safford, Arizona) administers the Galiuro, Santa Teresa, Winchester, and Pinaleño EMAs. The Sierra Vista Ranger District (located in Sierra Vista, Arizona) administers the Huachuca and Whetstone EMAs. The Santa Catalina Ranger District (located in Tucson, Arizona) administers the Santa Catalina EMA.

The Coronado National Forest Land and Resource Management Plan (Forest Plan) covers all NFS lands within the boundary of the Coronado NF. While management direction is limited to Forest administrative boundaries, broader scales are also considered in the Forest Plan. Counties that surround the Coronado NF include Cochise, Graham, Pima, Pinal, and Santa Cruz Counties in the State of Arizona and Hidalgo County in the State of New Mexico. There are 12 federally recognized Native American tribes with a potential interest in the natural, historical, cultural, and other resources of the Coronado NF. These tribes include the Ak-Chin Indian Community, Fort Sill Chiricahua-Warm Springs Apache Tribe, Gila River Indian Community, Hopi Tribe, Mescalero Apache Tribe, Pascua Yaqui Tribe, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe, Tohono O'odham Nation, White Mountain Apache Tribe, Yavapai-Apache Nation, and the Pueblo of Zuni. The southernmost portion of the Coronado NF shares a contiguous international border with the Republic of Mexico. [3]

[2] Parts of this section are excerpted from The State of the Coronado, Sky Island Alliance in 2008.

[3] Link to map of Arizona tribes- http://edrp.arid.arizona.edu/tribes.html

Introduction

Overview of the Coronado National Forest

The lands of the Coronado NF consist of sixteen widely scattered mountain ranges representative of basin and range topography, and often characterized as "sky islands." These sky islands form distinct land masses located in southeastern Arizona and western New Mexico. They offer an unusual range of vegetative types and climates; the tree-covered mountains rising from grassy savannas and the Sonoran and Chihuahuan Desert lowlands are home to plant and animal communities described as among the most diverse found on Earth. The mountains of this region are part of the "Madrean Archipelago" which describes the chain of sky islands that stretch from the southern latitudes of the Sierra Madre Occidental to the northern latitudes of the Rocky Mountains (DeBano et al, 1995). .. The Sonoran Desert and Chihuahuan Desert also come together in this region, creating an overlap zone where many plants and animals are at the edge of their ranges.
The twelve Ecosystem Management Areas that comprise the Coronado National Forest range in size from approximately 27,981 acres in the Winchester EMA to 291,492 acres in the Chiricahua EMA. Each EMA supports a unique combination of vegetation, habitats and wildlife, thus harboring an amazing amount of biological diversity. Distinct species have evolved within the Coronado's sky islands due to barriers to movement. Mountain ranges harbor numerous endemic and rare species such as Mt. Graham red squirrel, Peloncillo talus snail, Huachuca water umbel and Chiricahua fox squirrel. The Pinaleño EMA boast as many as 18 species of plants and animals found nowhere else in the world. Sheltered canyons in the Huachuca, Chiricahua, Santa Catalina, and Santa Rita EMAs support a remarkable variety of bird species that attract birdwatchers from around the world.

The regional landscape began to take form between 70 and 40 million years ago during a period of intense folding and faulting. The activity was of volcanic and igneous intrusive origin, and of greatest importance in the placement of major ore bodies. Most of the present ranges were uplifted during the basin and range disturbance between 30 and 25 million years ago. The basin and range development exposed older rocks derived from a diverse geologic past: multiple marine invasions, volcanic explosions and lava flows, and metamorphic core complexes. Each sky island is a remarkable mixture of rock types including granite, rhyolite, dacite, basalts, gneiss, schists, quartzite, limestones, shale, and conglomerates. This great mix of rock types has led to an array of soils that support a huge diversity of grasses, shrubs, and trees; talus slopes that support a remarkable diversity of snails; limestone slopes and outcrops that greatly increase the diversity of plants; and vegetation growing in unexpected climatic zones. The erratic ridge lines, subtle tones of blue-gray limestone, speckled granite and pastel volcanics area a visual reminder of the many forces that shaped the sky islands.

Because of the north-south axis of the mountain ranges and their great variation in elevation, the Madrean Archipelago spans three major climatic zones (temperate, subtropical, and tropical). Following the recession of glaciers in North America, the climate of southeastern Arizona became warmer and drier, shifting the distribution of vegetation. Conifer forests that were once in the valleys as well as the mountains, disappeared from lower elevations. They hung on only in higher elevations where the air was cooler and precipitation more

frequent. Arizona cypress, also common on hillsides and lowlands, retreated back to cooler canyon bottoms. Sonoran and Chihuahuan desert vegetation, able to endure the warmer, drier conditions filled in the valleys and low elevations. As a result of warming,
plants left from this period are arranged on mountain slopes with species requiring less moisture and able to stand more heat at the lowest elevations, and species requiring the coolest and most moist conditions at mountain summits, or sheltered canyon bottoms, or on north-facing slopes. The vertical stacking of life zones (environments characterized by particular groupings of plants and animals) in these steep mountains packs tremendous species diversity into the space of each slope. In a day's walk, one can climb through desert and scrub habitats characteristic of central Mexico, up to spruce-fir forests characteristic of Canada. Madrean encinal savanna and woodland are widespread at middle elevations in this region, forming one of the distinguishing features of sky islands of the Coronado National Forest. Encinal communities bear strong affinities with flora of the Sierra Madre, and are strikingly different from oak dominated communities in other parts of the United States. Floral surveys of several U.S. sky island ranges have found species diversity at the community level to be higher in encinal woodlands than in virtually any other resident plant community — with roughly twice the number of species than is typical for temperate plant communities. Oak woodlands also support some 43 percent of the tree species known from the entire bi-national region. The Coronado National Forest manages the highest proportion of Madrean pine-oak woodlands, and Madrean encinal woodlands across all major landowners in Arizona.

The sky island region has received national and international recognition for its conservation value. In 1999 World Wildlife Fund recognized the greater Chihuahuan Desert Ecoregion as globally outstanding in its biological distinctiveness and named the ecoregion a top continental-level conservation target. The Coronado National Forest is located in the northwestern part of the Apachean Subregion of the Chihuahuan Desert Ecoregion. In 2001, Conservation International recognized the Madrean pine-oak woodlands and sky islands of Mexico and the United States as a conservation hotspot.

The Coronado National Forest retains remainders from its complex historic and cultural legacy. From pictographs, petroglyphs and pottery shards left by ancient peoples, to remnants of mines and ranches, to present day Apache uses of the Forest, the lands of the Coronado harbor a wealth of cultural values. Place names across the Forest are reminders of cultures and people who have lived in the sky island region and shaped the character of the Forest. Apache interest in the region remains strong. Despite having been nearly pushed out of the area in the late nineteenth century, Apache families continued to travel into the mountains of the Coronado National Forest to collect food products, medicinal plants, and to visit sacred sites. Today, many of the mountains managed by the Coronado are regarded as Apache homeland and as such are meaningful and sacred.

A wide variety of year-round recreational opportunities are available within the Coronado NF. Higher elevations are more popular during the summer, offering

Overview of the Coronado National Forest

temperatures 20 or more degrees cooler than the desert. Lower elevation recreation areas are located in scenic canyons and foothills, and these are most popular during the fall, winter, and spring. Special places include popular Sabino Canyon Recreation Area, Mount Lemmon, and Madera Canyon. Recreation opportunities on the forest include over 1,100 miles of trails (including the Arizona Trail, a National Scenic Trail), three scenic byways, four lakes, rental cabins, a state park, and dozens of developed campgrounds and picnic areas. Recreational opportunities also include skiing, historic interpretation, and private cabins.

The social and economic environment surrounding the Coronado National Forest is as diverse as the natural environment. It includes the large urban areas, international border cities, and many rural communities. Goods and services provided by the Coronado National Forest include rangeland forage for livestock production, fuel wood, and forest products such as beargrass for baskets, fiddleneck ferns for flower arrangements and manzanita branches for birdcage perches. Outfitting and guiding services provide an important link between visitors and the ecological treasures of the Forest. Many areas of the Forest are highly mineralized, and the Forest has an important role in supporting environmentally responsible mineral extraction. Of primary and increasing importance are the watersheds, and the ability to capture the precipitation that recharges aquifers, supplying domestic water sources to the cities and towns surrounding the Forest. Finally, the lands within what is now the Coronado NF will continue to provide sustenance and spiritual values to Native American tribes.

Summary of the Analysis of the Management Situation

Summary of the Analysis of the Management Situation

The management situation has been described in the Comprehensive Evaluation Report (CER) (USFS, 2009c) and CER Supplement (USFS, 2010a). Together these documents meet the content requirements of the Analysis of the Management Situation. The CER evaluates the need for change in light of how management under the 1986 Forest Plan, as amended, contributed to social, economic, and ecological sustainability. The CER also integrates key findings from the Ecological Sustainability Report (USFS, 2009b) and the Social and Economic Sustainability Report (USFS, 2009a). The CER considered information from these reports, along with public and Forest Service employee input, to identify where the conditions and trends indicate a need for change in the 1986 Forest Plan.

The CER/AMS identifies five themes where there are priority needs for change in management direction:

1. Ecosystem Restoration
2. Safety and Information
3. Public Access and Travel Patterns
4. Preservation of Open Space
5. Collaboration and Partnerships

New information and changing conditions will necessitate changes in management. As these changes become ripe for action, iterative and adaptive planning may facilitate the incorporation of new information into potential Forest Plan amendments. Under the National Forest Management Act (NFMA) of 1976, projects and activities must be consistent with the Forest Plan.

Forest Plan Content

This plan includes “plan decisions” and “other content.” Once approved, any substantive changes to plan decisions will require a plan amendment. A change to other content may be made using an administrative correction process. Administrative corrections are also used to make non-substantive changes to plan decisions such as corrections or updates of data and maps and typographical errors. The public is notified of all plan amendments and administrative corrections. “Plan decisions” are displayed herein with a grey border in the left margin to provide clear differentiation from other plan content.

Forest Plan Decisions

Plan decisions include goals (hereafter referred to as desired conditions), objectives, standards, guidelines, special areas, suitability, management areas, and monitoring and evaluation.

Desired Conditions: Describe future conditions that reflect the long-term goal of the Forest Plan, but without a specific timeframe. The description identifies goals and desired ecological, social, and economic conditions. Activities conducted during Plan implementation contribute to (i.e., move the Forest toward) the achievement of desired conditions.

Objectives: Objectives are concise, time-specific statements of measurable planned results, and represent intended management actions in order to strive toward achievement of desired conditions. Objectives are written to define actions or conditions to be achieved during the period that the Forest Plan is in effect. To achieve the objectives of the Forest Plan, site-specific project planning occurs during Plan implementation, generally the 10- to 15-year period after Plan development or revision.

Standards: Constraints upon project and activity decision making. A standard is an absolute requirement to be met in the design of projects and activities. A project or activity is consistent with a standard when its design is in accord with the explicit provisions of the standard; variance from a standard is not allowed except by plan amendment.

Guidelines: Sideboards that guide management activities. A project or activity is consistent with a guideline when its design follows the intent of a guideline; deviation from the explicit provisions of a guideline must be documented in the project record.

Suitability: A description of the uses and resource management activities that are appropriate within specific types of land allocations.

Management Areas (MA): Spatially defined areas for which suitable uses and standards and guidelines are defined. Management of each MA contributes to desired conditions. Within the broader set of MAs are special areas that are established at a national level either through legislation (congressional designation) or through administrative action (administrative designation). The Forest Plan may also recommend the establishment of special areas.

Monitoring and Evaluation: Key elements that will be monitored as implementation of the Forest Plan progresses (i.e., future site-specific actions). Monitoring is part of an adaptive management process that measures the performance of Plan implementation against the goals and desired conditions and objectives to which it aspires. It also evaluates whether the implementation of standards and guidelines are producing the desired results.

Other Plan Content

Other content in this plan includes the contents of chapters one, certain sections (background, other sources of direction, management approach, related plan content) and all appendices.

In addition to plan components, there are sections of the Forest Plan that include **General Descriptions**, and also **Management Approaches**.

General Descriptions: Explanatory narrative, descriptions of place, and other important information that supports the understanding of, or gives context to, plan decisions are included throughout the Forest Plan under this heading. General descriptions help managers and the public apply the direction listed within each of the plan components.

Management Approaches: Most sections of the Forest Plan include this additional content, which briefly describes the principal approaches to management that the responsible official is inclined to take. Management approaches do not make commitments of resources. They may illustrate suggestions as to how desired conditions and/or objectives could be met, convey a sense of priority among objectives, or indicate a possible future course of change to a program; partnership opportunities and collaborative arrangements may be discussed, as well as potential processes such as further analysis or inventory. The wording structure of management approaches is characterized with a verb ending in –ing, e.g. managing, cooperating, conducting, or collaborating.

Implementation of the Forest Plan

Implementation of the Forest Plan

During implementation, management activities affecting the Coronado NF need to be consistent with the Forest Plan. This consistency is achieved in the following ways: Management activities are developed specifically to achieve the desired conditions or objectives of the Forest Plan. To the extent practicable, documentation for such projects should identify the elements of the desired conditions or objectives to be achieved by the project. It should not be expected that all projects or activities would contribute to all desired conditions or objectives, but rather to a limited subset. It should also be recognized that some

Implementation of the Forest Plan

projects designed to contribute to some desired conditions or objectives may have consequences considered adverse to the achievement of other desired conditions or objectives. In this situation, the responsible official for the project needs to identify and disclose these effects in the project documentation and make a decision that balances these considerations.

There are also project activities that are necessary but are not specifically related to one of these elements of the Forest Plan (e.g. routine road maintenance, facility maintenance, etc.). Such projects should be briefly evaluated to assess if they conflict or impede contribution to the desired conditions or objectives.

In the implementation of the Forest Plan, projects are expected to comply with suitability, standards, and guidelines contained in the Forest Plan. Early in the project planning process, the applicable standards, guidelines, and suitability considerations should be identified. To ensure compliance with the Forest Plan, each project should document consistency with these standards and guidelines.

The Forest Plan is used as a direction source for future projects, plans, and assessments. It is not expected that this new direction be used to re-evaluate or change decisions that have been made under the previously existing Forest Plan. A smooth and gradual transition to the new Forest Plan is anticipated, rather than one that forces an immediate reexamination or modification of all contracts, projects, permits, and other activities that are already in progress. As new project decisions, contracts, permits, renewals, and other activities are considered, conformance to the new plan direction as described in the previous section is expected.

Changes to the Forest Plan

Changes to the Forest Plan

A change to the Forest Plan requires either administrative correction or amendment. The following summarizes circumstances that warrant corrections or amendments to the Forest Plan:

1. Administrative Corrections: are minor changes to the Forest Plan that do not substantively affect the management direction or create additional environmental consequences. These minor changes include the following:

- Other plan content that are not plan decisions as described in the previous section, “Other Plan Content.”
- Corrections and updates of data published in the Forest Plan and minor changes to maps of management areas.
- Changes in projections of timber management activities expected to occur during the plan period.
- Minor text changes such as typographical errors, clarification of explanatory text, etc.

An administrative correction must be initially published as a proposed correction either on the Coronado NF internet page or in a local newspaper of record. The proposed correction must identify the language or map to be corrected, the proposed correction, and the reason for the correction. The public will have an opportunity to comment on the proposed correction within a 30-day

Changes to the Forest Plan

period following publication. After reviewing the comments received, the final correction may be similarly published and the Forest Plan corrected.

2. Site-specific Forest Plan Amendments occur to allow specific projects or other activities to deviate from certain Forest Plan direction. These amendments occur only for a specific area or a specific project. They do not lead to changes in Forest Plan language, and if changes are made to management area map layers, they are made only for the area affected. Such amendments are usually proposed with appropriate NEPA analysis for the site-specific project proposal. The procedures for processing a site-specific plan amendment are outlined in the applicable planning regulation.

3. Programmatic Forest Plan Amendments change the text and language of the Forest Plan decisions identified in the earlier section, "Decisions of a forest plan," and any other changes that cannot be addressed through administrative corrections or site-specific plan amendments. The procedures for addressing a regular plan amendment are outlined in the applicable planning regulation.

Forest Plan Maps

Forest Plan Maps

The Forest Plan includes maps throughout the document. The following statement applies to all maps found within the Forest Plan:

> The USDA Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. Using GIS products for purposes other than those for which they were intended may yield inaccurate or misleading results. The USDA Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. Maps in this document are not a legal land line or ownership document. Public lands are subject to change and leasing, and may have access restrictions; check with local offices. Obtain permission before entering private land.

Commonly Used Acronyms

Commonly Used Acronyms

AMS – Analysis of the Management Situation
ATV – All Terrain Vehicle
BLM – Bureau of Land Management
CER – Comprehensive Evaluation Report
DBH – Diameter at Breast Height
EMA – Ecosystem Management Area
ESA – Endangered Species Act
FLPMA – Federal Lands Policy and Management Act
MGIO – Mount Graham International Observatory
MRDG – Minimum Requirements Decision Guide
MVUM – Motor Vehicle Use Map
NAGPRA – Native American Graves Protection and Repatriation Act
NEPA – National Environmental Policy Act

NF – National Forest
NFMA – National Forest Management Act
NFS – National Forest System
NPS – National Park Service
NWPS – National Wilderness Preservation System
OHV – Off Highway Vehicle
ORV – Outstandingly Remarkable Values
PAC – Protected Activity Center
PFA – Post-fledging Area
RNA – Research Natural Area
USFS – United States Forest Service
UTV – Utility Terrain Vehicle
WSA – Wilderness Study Area
WUI – Wildland-urban Interface
ZBA – Zoological and Botanical Area

Forest Plan Organization

The Forest Plan is organized into five chapters (Introduction, Forestwide Management, Management Areas, Geographic Areas, and Monitoring Plan) and appendices. For a quick preview of the Forest Plan structure, see the Table of Contents.

Chapter 1: Introduction describes the Coronado National Forest, summary of the analysis of the management situation, the purpose of this plan, its content, and organization. This chapter does not contain any plan decisions.

Chapter 2: Forestwide Management contains plan decisions and other content that are applicable forestwide.

Chapter 3: Management Areas contains plan decisions, suitability of areas, and other content that is applicable to particular management areas. The Coronado NF is divided into six management areas, including Wilderness Areas and Land Use Zones.

Chapter 4: Geographic Areas contains plan decisions and other content based on Ecosystem Management Areas (Fig.1). The Coronado NF has 12 Ecosystem Management Areas organized by five Ranger Districts.

Chapter 5: Monitoring and Evaluation contains the monitoring framework for subsequent monitoring and evaluation.

Glossary: Provides definitions of select words from this plan.

References Cited: Literature and documentation referenced in the plan.

Appendix A: Climate Change Trends and Coronado NF Land Management Planning provides regional and national guidance related to climate change and forest planning, and describes the relationship between both.

Appendix B: Communications Sites identifies the designated communications sites located on the Coronado NF.

Appendix C: List of Animal and Plant Species, with both common and scientific names, mentioned in this plan.

Appendix D: Consistency with Plan Decisions describes how projects and activities should be consistent with the decisions in this plan.

Appendix E: List of Other Sources of Information to aid in the implementation of this plan.

Forestwide Management

Chapter 2: Forestwide Management

Introduction

Introduction

This chapter describes Forestwide management direction. This direction applies to each subject area wherever it occurs across the whole Forest. Each subject area includes a general description followed by one or more plan components and recommended management approaches.

Climate

Climate

General Description

The climate of the southwestern United States is often referred to as dry and hot, but variation in topography, seasonal monsoons, and the strong influence of the El Nino Southern Oscillation (ENSO) and other large-scale circulation patterns add complexity to this region (see Appendix A). While low deserts of the Southwest experience heat and drying winds in the early summer, forested mountain areas and plateaus may experience cold and drifting snow during winter. Monsoon thunderstorms in July and August are often accompanied by flash flooding, while from fall to spring, the weather can be warm with clear skies. Precipitation patterns are characterized by two peaks each year; winter precipitation is produced primarily from large frontal systems moving over the region, whereas summer precipitation results largely from thunderstorms within the North American monsoon circulation. The Southwest also experiences periods of short- and long-term drought, often linked to anomalies in ENSO.

Scientists are virtually certain that average air temperatures across the globe are rising (IPCC 2007). Details and supporting literature regarding impacts of climate change for the Southwest are summarized in Appendix A. In summary, by the end of the 21st century, the Southwest, including the Coronado NF, is likely to experience:

- Temperature increases of five to eight degrees Fahrenheit (or about half a degree Fahrenheit /decade on average);
- An increase in the number of hot days, with summer heat waves lasting two weeks or longer;
- Warmer winters with reduced snowpack,
- A later monsoonal season;
- A 10 percent drop in annual precipitation in Southern Arizona; and
- An increase in extreme flood events following an overall increase in tropical storms.

The potential ecological implications of climate change trends in the Southwest indicate the following (see Appendix A):

- More extreme disturbance events, including wildfires, intense rain, flashfloods, and wind events.
- Greater vulnerability to invasive species, including insects, plants, fungi, and vertebrates.

Forestwide Management

Climate

- Long-term shifts in vegetation patterns. Cold-tolerant vegetation moving upslope or disappearing in some areas. Migration of some tree species to the more northern portions of their existing range.
- Potential decreases in overall forest productivity, due to reduced precipitation.
- Shifts in the timing of snowmelt (already observed) and increases in summer temperatures affecting the survival of fish species and efforts to reintroduce species into their historic range.
- Effects on phenology and changes in the date of flowering and associated pollination and food food-chain disruptions.
-
- Ecosystems and species that may be particularly vulnerable to climate change include;
- **Sky Island forests (spruce-fir, dry and wet mixed conifer, ponderosa pine-evergreen oak, Madrean pine-oak woodland).** These high elevation systems contain plant and animal species that are adapted to cooler climates. They are highly fragmented, so species cannot easily migrate to more suitable areas. They could become more fragmented in the future as suitable climates shift upward in elevation, reducing overall habitat size. These systems also contain many threatened and endangered species, and can be at particular risk for severe wildfires and insect outbreaks.
- **Aquatic, wetland, and riparian systems.** These systems also contain many threatened and endangered species. They are highly dependent on water, and thus are highly vulnerable to shifts in precipitation regimes. They may be further threatened by increased human demand for water for use in grazing, agriculture, and municipal drinking water. Many species are also physiologically dependent on narrow temperature ranges as well.
- **Species expected to be negatively affected by climate change include**: A recent wildlife vulnerability assessment found several vertebrate species to be vulnerable to climate change, including the Tarahumara frog, Mount Graham red squirrel, Mexican fox squirrel, elegant trogon, and Chiricahua leopard frog (Coe et al. 2011). Additional species, including plants and invertebrate species may also be vulnerable, especially those with narrow ranges that are not adapted to frequent disturbance.

Potential social and economic implications of climate change trends in the southwest and the Coronado National Forest indicate the following (see Appendix A):

- Potential decrease in forage and water availability for livestock.
- Increased recreation on the Coronado NF, where cooler temperatures will attract people to higher elevations as a refuge from increasingly hot summers.
- Greater numbers of diseases that favor warmer climates, heat-induced illnesses, reduced air quality, and increased cases of respiratory illness.
- Greater energy demands for cooling systems that could place greater pressure for permits for alternative energy on national forest lands.
- Increased pressures on the region’s already limited water supplies.
- Based on current climate model projections and research, the climate change factors that appear most likely to affect desired conditions in the revised

Forestwide Management

Climate

- land management plan on the Coronado National Forest are ecological, weather-related disturbances, and socioeconomic demands, as described:
- Projected increase in frequency of extreme weather events (intense storms).
- Projected increase in wildfire risks.
- Projected increase in outbreaks of insects, diseases beyond endemic levels, and non-native invasive species.
- Projected increase in demand for deceasing upland water supplies.
- Projected increase in National Forest socioeconomic uses and demands.

Desired Conditions for the Coronado NF's Response to Climate Change

Ecosystems retain their functions under changing and uncertain future environmental conditions, . These ecosystems provide a wide range of ecosystem services. Coronado National Forest landscapes retain the capacity to survive natural disturbances and threats to sustainability such as those driven by climate change and an increasing human population with local and regional needs. Ecosystem functions (such as nutrient cycling, water infiltration, carbon sequestration, etc.) are sustained as forests, woodlands, grasslands, and desert communities adapt to warmer, drier conditions. Ecosystems are resilient to changing natural disturbance regimes (e.g., drought, wind, fire, insects, and pathogens), allowing for shifting of plant communities, structure, and ages across the landscape.

Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of terrestrial and aquatic plants and animals. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the ecosystem. Contiguous blocks of habitat are interconnected, support a wide array of native species, and allow for genetic and behavioral interactions. Ecological processes allow connectivity of predator-prey relationships, metapopulations, and interactive wildlife species throughout the landscape. Habitat quality, distribution, and abundance exist to support recovery and/or stabilization of federally-listed and other species.

The forest continues to provide services for human uses, including recreation, grazing, forest products, and water resources. Recreation sites, such as campgrounds, are located in areas not at risk to flash flooding. Increased visitation of the Coronado National Forest to escape the summer heat is done so in a sustainable way so as not to decrease the natural character of the landscape. Water resources are made available for multiple uses and used sustainably.

Management Approaches

- Anticipating and planning for disturbances from intense storms. Planning for intense storms includes controlling soil erosion, relocating high-risk roads and trails, and constructing appropriately-sized culverts and stream crossings.
- Using a suite of adaptation options to manage ecosystems in the face of uncertainty. Options include increasing resistance to disturbances by preventing fires and pest invasions; promoting resilience of ecosystems so they return to their previous condition following a disturbance; and allowing
-

Forestwide Management

- ecosystems to respond to climate change by facilitating species and ecosystem migration.
- Increasing water conservation and planning for reductions in upland water supplies. This includes determining the water rights status of water resources, for range, wildlife, public drinking systems, water for fire-fighting, recreational uses, and aquatic habitats; and reviewing current status of State and regional water plans, forest and watershed health plans, and integrated regional water planning efforts.
- Anticipating increased forest recreation use. This includes planning for higher visitor use to escape the summer heat and making facilities and roads available to accommodate demands. It also includes anticipating changes in types of recreational uses, such as a decrease in snow-related recreation due to a shorter snow season.
- Monitoring climate change influences and the effectiveness of adaptation approaches. This includes taking advantage of existing monitoring plans to look for climate change-related signals and making use of Research Natural Areas to monitor additional impacts. It also includes monitoring the effectiveness of adaptation approaches so adjustments can be made when needed.

Vegetation

Vegetation Communities

General Description

Nine major vegetation communities are identified within the Coronado NF. Table 1 below displays the relative percentage of these vegetation communities.

Table 1: Major Vegetation Communities of the Coronado NF

Vegetation Community	Percent of Coronado NF
Madrean encinal woodland	43%
Grasslands	25%
Desert communities	10%
Interior chaparral	9%
Madrean pine-oak woodland	8%
Dry mixed conifer	3%
Ponderosa pine-evergreen oak	2%
Wet mixed conifer	<1%
Spruce-fir forest	<1%
Montane meadows, wetlands, and riparian areas	<1%

Desert communities include both the Sonoran and Chihuahuan deserts. The grassland category includes semi-desert, plains, and savannah grassland community types. The term “encinal” refers to oak communities. Desert communities, grasslands, interior chaparral, Madrean encinal woodlands, and Madrean pine-oak woodlands compose approximately 94 percent of the total area of the Coronado NF. Of this, Madrean encinal woodlands account for approximately 42 percent, and grasslands represent around 26 percent. In contrast, the combined area of montane meadows, wetlands, riparian areas, ponderosa pine-evergreen shrub, mixed conifer forest, and spruce-fir forest compose around 6 percent of the total area of the Coronado NF.

Riparian communities range across all elevation gradients, from deserts to subalpine forests, spanning a variety of characteristic vegetation communities. Therefore, riparian communities are composed of various plant species, dependent upon the elevation and upland vegetation community type in which they are found. There are three primary riparian associations on the Coronado NF: cottonwood-willow riparian forest (in deserts and grasslands), mixed broadleaf deciduous riparian forest (in oak and pine woodlands), and montane willow riparian forest (in mixed conifer forests).

Vegetation desired conditions are described at multiple scales when possible. The three scales used herein are landscape scale, mid-scale, and fine scale. Descriptions at these various scales are necessary to provide adequate detail and

guidance for the design of future projects and activities that will help achieve the desired conditions over time. In some cases, not enough information is available to provide descriptions at multiple scales. Descriptions begin with the landscape scale to provide the "big picture" desired conditions across the larger land area. Descriptions at the mid- and fine-scales provide additional detail necessary for guiding future projects and activities.

Landscape scale is typically composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes. An area at this scale is comprised of multiple mid-scale units. Mid-scale is composed of assemblages of fine scale units which have similar biophysical conditions. Fine scale is composed of individual biophysical features, such as a group of trees or shrubs, natural springs, etc.

Desired Conditions

Landscape Scale

Each vegetation type contains a mosaic of vegetative conditions, densities, and structures. This mosaic occurs at a variety of scales across landscapes and watersheds. The distribution of physical and biological conditions is appropriate to the natural disturbance regimes affecting the area. Vegetative conditions are resilient to the frequency, extent, and severity of disturbances under a changing climate, especially fire. Natural and human disturbances (e.g., planned and unplanned fire, mechanical vegetation treatments) provide desired overall plant density, structure, species composition, coarse woody debris, and nutrient cycling. Desired disturbance regimes are restored where practical.

Native plant communities dominate the landscape, while invasive species are non-existent or in low abundance. Establishment of invasive plant species new to the Coronado NF is prevented, even as climate change makes conditions more hospitable to new invaders. Existing invasive plant species are prioritized for eradication, containment, or control. Vegetation attributes, including appropriate densities, provide favorable conditions for water flow and quality. The composition, abundance, and mosaic of organic ground cover and herbaceous vegetation protects soil, provides moisture infiltration, and contributes to plant and animal diversity and ecosystem function.

Diverse vegetation structure, species composition, and densities provide quality habitat for native and desirable non-native plant and animal species throughout their lifecycle and at multiple spatial scales. Landscapes provide for the full range of ecosystem diversity at multiple scales, including habitats for those species associated with old-growth conditions.

Vegetation provides sustainable amounts of products, such as wood fiber or forage, for local and regional needs. Herbivory (the act of feeding on plants) aids in sustaining or improving native vegetation cover and composition. Livestock grazing and wood fiber harvest activity contribute to aspects of the social, economic, and cultural structure and stability of rural communities.

Vegetation conditions for federally listed species are consistent with existing recovery plans. Rare and culturally important plant species are valued and

Forestwide Management

Vegetation Communities

therefore enhanced and protected. Ecological conditions provide habitat for associated federally-listed species. Habitat conditions generally contribute to survival and recovery, and contribute to the de-listing of species under the Endangered Species Act.

Mid-Scale

The composition, density, structure, and mosaic of vegetative conditions reduce the threat of uncharacteristic wildfire hazard to local communities and ecosystems. Snags are present in woodland and forested vegetation communities in adequate numbers to provide habitat features such as cavities and loose bark, etc. Improved habitats for Proposed or Candidate species help preclude species listings as Threatened or Endangered under the Endangered Species Act. Potentially suitable habitat for sensitive plant species helps retain functional stability of the species.

Forest conditions in goshawk post-fledging areas (PFAs) are similar to general forest conditions, except that these forests contain 10 to 20 percent higher basal area in the mid-age to old tree groups than goshawk foraging areas and the remainder of the forest. Goshawk nest areas have forest conditions that are multi-aged, but are dominated by large trees with relatively dense canopies.

Fine Scale

Endemic rare plant communities are intact and functioning. Unique plant community habitats (e.g., limestone cliffs, margins of seeps and springs, talus slopes, mesquite bosques, cienegas, sacaton riparian grasslands, montane meadows, canyons, cliffs, and ledges) are present to maintain well-distributed populations of associated native plant species and provide refugia in a changing climate.

Native plants, including rare plant species, provide nectar, floral diversity, and pollen throughout the seasons that pollinator species are active. Desired habitat conditions promote pollinator success and survival.

Guidelines

1. Should connect treated patches with treated corridors and untreated patches with untreated corridors; should plan for wildlife movement corridors between treated areas and between untreated areas to increase available habitat.
2. For mine reclamation purposes or when wildfire requires an emergency response due to severity, size, and values at risk, treatments should be conducted using only native species or short-lived, non-persistent species.

Standards

1. Public and firefighter safety is the highest priority during all fire management activities.

Desert Communities

Desert Communities

General Description

Desert communities range in elevation from 2,600 to 3,200 feet, although they may extend beyond this range on steep southern exposures. Annual precipitation

averages from 10 to 13 inches. The predominant species are shrubs, desert trees, and succulents, with lesser amounts of grasses and forbs. Common plant species occurring in desert communities include catclaw acacia, triangle bursage, littleleaf paloverde, mesquite, desert ironwood, creosote bush, desert broom, desert willow, brittlebush, desert zinnia, barrel cactus, hedgehog cacti, cholla and prickly pear cacti, saguaro, threeawn grasses, bush muhly, and club moss. Common animal species occurring in the desert communities include desert bighorn sheep, kit fox, black-tailed jackrabbit, round-tailed ground squirrel, cactus wren, Gila woodpecker, Gambel's quail, desert tortoise, zebra-tailed lizard, Gila monster, desert spiny lizard, Sonoran coralsnake, Sonoran Desert toad, red-spotted toad, giant hairy scorpion, desert orangetip, and tarantulas. Gravel and rock cover ranges from 5 to 65 percent in floodplains, and from 35 to 85 percent on upland sites. Bedrock outcrops can be as high as 10 percent in uplands. Active erosion and sedimentation occurs in channels on floodplains.

Based on projections of future climate change for the region conditions may favor desert communities as they are adapted to the hot, dry conditions that are likely to increase in the area. However, they are susceptible to increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, fires, flash floods, landslides, and wind storms).

Desired Conditions

Landscape Scale

The predominant plant species are native shrubs and succulents. There is sparse to dense vegetation cover that includes cacti and agave species, desert grasses, desert scrub, and varying amounts of annual species. Fires are rare, with mean fire return intervals estimated at over 100 years. Ground cover consists primarily of gravel, cobble, and rock. Perennial plant basal area is low and ranges from 1 to 3 percent of the soil surface. Cover of annual forbs and grasses can be high after exceptionally wet winter or summer seasons, but is short-lived. Plant litter occupies 5 to 30 percent of the soil surface. There are no signs of compaction or accelerated erosion. The ability of soil to maintain resource values and sustain outputs is high. High quality habitat exists for animal species that live in this vegetation community. Traditional food and material plants thrive here, including bluedicks, careless weed, sotol, ephedra, yucca, buckhorn cholla, tulip prickly pear, limberbush, creosote bush, mesquite, and saguaro.

Mid-Scale

On steep hillslopes, ridgetops, and moderately sloping pediments where soils have formed in place on acid igneous and related metamorphic parent materials like granite, gneiss, and rhyolite, the predominant species are foothill paloverde, saguaro, prickly pear, cholla, hedgehog cactus, ocotillo, coursetia, limber bush, false mesquite, brittlebush, triangle bursage, bush muhly, tanglehead, slender grama, purple threeawn, janusia, and spike moss.

Annual forbs and grasses, an important part of this plant community, fluctuate with precipitation from nearly nothing in dry years to several hundred pounds

per acre in wet years. Plant basal cover ranges from 1 to 3 percent, and cover by plant litter ranges from 5 to 30 percent. Canopy cover ranges from 0 to 10 percent for grasses, 1 to 10 percent for forbs, and 2 to 15 percent for shrubs and succulents. Tree canopy cover is 1 to 10 percent.

On moderately steep hillsides and fan piedmonts where alkaline soils are formed in alluvium from mixed parent materials, the predominant species are foothill paloverde, saguaro, prickly pear, cholla, barrel cactus, ocotillo, false mesquite, triangleleaf bursage, bush muhly, slender grama, curly mesquite, spidergrass, tangelhead, purple threeawn, janusia, ayenia and globe mallow. Annual forbs and grasses, an important part of this plant community, fluctuate with precipitation from nearly nothing in dry years to several hundred pounds per acre in wet years. Plant basal cover ranges from 1 to 3 percent, and cover by plant litter ranges from 10 to 75 percent. Canopy cover ranges from 1 to 20 percent for grasses, 1 to 15 percent for forbs, and 5 to 20 percent for shrubs and succulents. Tree canopy cover is 1 to 10 percent.

On moderately steep hillsides and fan piedmonts where non-alkaline soils are formed in alluvium from mixed parent materials, the predominant species are foothill paloverde, saguaro, prickly pear, cholla, ocotillo, whitethorn acacia, creosote bush, false mesquite, range ratany, desert zinnia, bush muhly, black grama, slim tridens, fluff grass, janusia, desert senna, and twinberry. Annual forbs and grasses, an important part of this plant community, fluctuate with precipitation from nearly nothing in dry years to several hundred pounds per acre in wet years. Plant basal cover ranges from 1 to 3 percent, and cover by plant litter ranges from 5 to 45 percent. Canopy cover ranges from 1 to 10 percent for grasses, 1 to 10 percent for forbs, and 5 to 20 percent for shrubs and succulents. Tree canopy cover is 1 to 10 percent.

On nearly level floodplains, low stream terraces, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the predominant species are foothill and blue paloverde, mesquite, catclaw acacia, desert willow, desert hackberry, wolfberry, big bursage, burrobrush, desert honeysuckle, bush muhly, sand and spike dropseed, sideoats grama, tanglehead, spidergrass, and mesa threeawn. Annual forbs and grasses fluctuate with precipitation from nearly nothing in dry years to several hundred pounds per acre in wet years. Plant basal cover ranges from 2 to 5 percent, and cover by plant litter ranges from 5 to 45 percent. Canopy cover ranges from 10 to 20 percent for grasses, 1 to 15 percent for forbs, and 5 to 15 percent for shrubs and succulents. Tree canopy cover is 10 to 15 percent.

Objectives

Suppress or eradicate buffelgrass on at least 5,000 acres of Sonoran Desert within 10 years of plan approval using herbicides and hand-pulling methods.

Guidelines

1. Ground-disturbing activities that occur in an area occupied by buffelgrass should include measures to eradicate buffelgrass during or following the

activity completion or, at minimum, implement measures to limit the potential for its spread into unoccupied areas.

2. Prescribed fire should not be used as a management activity in desert communities, except as a strategy to control invasive vegetation.

Management Approaches

- Designing projects within this vegetation community to comply with the Arizona Interagency Desert Tortoise Team's Recommended Standard Mitigationing Measures to the extent practicable.
- Supporting or assisting partners in monitoring Sonoran Desert plants and animals and their habitats in areas within or near the Forest boundary.

Grassland Communities

General Description

Grasslands on the Coronado NF include semi-desert, plains and savanna grasslands. Elevations range from 3,200 to 4,600 feet in the semi-desert grassland communities, although they may extend beyond this range on steep southern exposures. Annual precipitation averages from 12 to 16 inches. Ground cover consists mainly of gravel, cobble, and rock, ranging from 15 to 65 percent on steep and moderate slopes, and 10 to 35 percent in bottomlands. Bedrock outcrops can be as high as 15 percent on steep and moderate slopes, with the exception of moderate slopes with limestone parent material where bedrock outcrops range from 0 to 5 percent. In washes and bottomlands, bedrock outcrops are 2 percent or less. Channel areas are active with both erosion and sedimentation.

Elevations range from 4,000 to 5,500 feet in the plains grassland and savanna communities, although they may extend beyond this range on steep southern exposures. Annual precipitation averages from 16 to 20 inches. Ground cover by gravel, cobble, and rock ranges from 10 to 57 percent, except in bottomlands with loamy soils. Bedrock outcrops can be as high as 10 percent in steeper areas.

Common animal species occurring in the grassland communities include pronghorn, American badger, plains harvest mouse, scaled quail, black-throated sparrow, Botteri's sparrow, ornate box turtle, Mexican hog-nosed snake, round-tailed horned lizard, desert grassland whiptail, Sonoran spotted whiptail, Great Plains toad, plains spadefoot, and horse lubber grasshopper.

Based on projections of future climate change for the region, habitat suitable for grasslands could increase as warmer, drier conditions will most likely be more common. However, grassland ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, and landslides). Grasses make use of moisture in the upper soil layers. Intense precipitation events may lead to increased run-off, but decreased effective water infiltration. This could decrease vigor of native plants and lead to increased colonization of non-native invasive plant species.

Desired Conditions: Semi-desert Grassland

Landscape Scale

In the semi-desert grassland communities, the predominant species are native grasses. There is moderate to dense vegetation cover that includes desert grasses and forbs, succulent species, sub-shrubs, and some herbaceous cover of annuals. Species include hairy grama, black grama, blue grama, sideoats grama, tanglehead, plains lovegrass, curly mesquite, spidergrass, purple and blue threeawn, slim tridens, spreading ratany, false mesquite, velvet-pod and catclaw mimosa, prickly pear, agave, ocotillo, shin-dagger, and sotol. Fires are common, with mean fire return intervals estimated between 10 and 25 years. Plant basal area ranges from 5 to 15 percent of the soil surface. Plant litter occupies 5 percent to 45 percent of the soil surface. There are no signs of compaction or accelerated erosion. The ability of soil to maintain resource values and sustain outputs is high. High-quality habitat exists for animal species living in this vegetation community. Traditional food and material plants thrive here, including pigweed, coyote melon, canaigre, sacaton, agave species, sotol, ocotillo, soaptree and banana yuccas, staghorn cholla, Engelman prickly pear, oneseed juniper, and mesquite.

Mid-Scale

On steep hillslopes and ridgetops where soils have formed in place on acid igneous and metamorphic parent materials like granite, rhyolite, gneiss, schist, and quartzite, the potential native plant community is dominated by perennial grasses and sub-shrubs, with lesser amounts of large shrubs and succulents. The predominant species are black, sideoats, slender, sprucetop, Santa Rita, and hairy gramas, tanglehead, cane beardgrass, plains lovegrass, ocotillo, sotol, kidneywood, mimosa species, false mesquite, shrubby buckwheat, dalea, shin-dagger, agave, wire lettuce, penstemon, and ferns. Plant basal cover ranges from 5 to 12 percent, and cover by plant litter ranges from 25 to 40 percent. Canopy cover ranges from 20 to 50 percent for perennial grasses, 1 to 10 percent for forbs, and 10 to 15 percent for shrubs and succulents. Tree canopy cover is 0 to 2 percent and may include species like oneseed juniper, mesquite, and Arizona rosewood.

On moderately sloping pediments where soils have formed in place on acid igneous and metamorphic parent materials like granite, gneiss, schist, and rhyolite, the potential native plant community is dominated by perennial grasses and sub-shrubs, with lesser amounts of large shrubs and succulents. The predominant species are black, sideoats, slender, sprucetop, Santa Rita, and hairy gramas, tanglehead, Arizona muhly, curly mesquite, ocotillo, false mesquite, range and spreading ratany, shrubby buckwheat, dalea, agave, mimosa species, wire lettuce, penstemon, trailing four o'clock, spike moss, and shrubby deervetch. Plant basal cover ranges from 6 to 15 percent, and cover by plant litter ranges from 25 to 40 percent. Canopy cover ranges from 20 to 50 percent for perennial grasses, 0 to 3 percent for forbs, and 10 to 25 percent for shrubs and succulents. Tree canopy cover is 0 to 2 percent and may include species like oneseed juniper and mesquite.

Forestwide Management

Semi-desert Grassland

On steep hillslopes, ridgetops, and mesas where soils have formed in place on basic and intermediate igneous parent materials like basalt, andesite, and welded volcanic tuff and ash, the plant community is dominated by native perennial grasses, with lesser amounts of shrubs and succulents. The predominant species are sideoats grama, cane beardgrass, plains lovegrass, green sprangletop, purple and hairy gramas, curly mesquite, tanglehead, ocotillo, mimosa species, false mesquite, shrubby buckwheat, shin-dagger, agave, prickly pear, penstemon, bluedicks, globe mallow, and ferns. Plant basal cover ranges from 5 to 15 percent, and cover by plant litter ranges from 25 to 55 percent. Canopy cover ranges from 25 to 65 percent for perennial grasses, 1 to 10 percent for forbs, and 5 to 15 percent for shrubs and succulents. Tree canopy cover is 0 to 2 percent and may include species like oneseed juniper, mesquite, and netleaf hackberry.

On steep hillslopes and ridgetops where soils have formed in place on limestone parent materials, the plant community is dominated by native perennial grasses, shrubs, and succulents. The predominant species are sideoats grama, black grama, slim tridens, tanglehead, Hall's panic, New Mexico feathergrass, ocotillo, mariola, false mesquite, feather dalea, whitethorn acacia, sandpaper bush, creosote bush, twinberry, sotol, shin-dagger, banana yucca, prickly pear, bahia, dogweed, croton, bladderpod, and ferns. Plant basal cover ranges from 3 to 8 percent, and cover by plant litter ranges from 10 to 25 percent. Canopy cover ranges from 15 to 30 percent for perennial grasses, 1 to 10 percent for forbs, and 15 to 40 percent for shrubs and succulents. Tree canopy cover is 0 to 5 percent and may include species like oneseed juniper, mesquite, and rosewood.

On moderately steep hillsides and fan piedmonts where soils have formed in loamy alluvium from mixed sources, the plant community is dominated by native perennial grasses and sub-shrubs, with lesser amounts of large shrubs and succulents. The predominant species are sideoats, slender, black, sprucetop, and hairy gramas, tanglehead, cane beardgrass, plains lovegrass, wolftail, spidergrass, purple threeawn, false mesquite, range ratany, shrubby buckwheat, agave, prickly pear, barrel cactus, banana yucca, globe mallow, bluedicks, and wire lettuces. Plant basal cover ranges from 6 to 15 percent, and cover by plant litter ranges from 10 to 50 percent. Canopy cover ranges from 20 to 60 percent for perennial grasses, 1 to 15 percent for forbs, and 2 to 20 percent for shrubs and succulents. Tree canopy cover is 0 to 1 percent and may include species like oneseed juniper, catclaw acacia, and mesquite.

On moderately steep hillsides, fan piedmonts, and ballenas where soils have formed in coarse loamy, calcareous alluvium and colluviums, the plant community is dominated by native perennial grasses, shrubs, and succulents. The predominant species are sideoats grama, black grama, bush muhly, slim tridens, tanglehead, Hall's panic, spike pappusgrass, blue threeawn, ocotillo, condalia, mariola, false mesquite, range ratany, feather dalea, Wright's beebrush, Mormon tea, twinberry, desert zinnia, banana yucca, prickly pear, bahia, dogweed, croton, paperflower, and trailing four o'clock. Plant basal cover ranges from 6 to 15 percent, and cover by plant litter ranges from 10 to 50 percent. Canopy cover ranges from 20 to 60 percent for perennial grasses, 1 to 5 percent for forbs, and 5 to 30 percent for shrubs and succulents. Tree canopy

Forestwide Management

Semi-desert Grassland

cover is 0 to 1 percent and may include species like oneseed juniper and mesquite.

On nearly level floodplains, low stream terraces, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by native trees and shrubs with lesser amounts of perennial grasses, vines, and forbs. The predominant species are mesquite, catclaw acacia, desert willow, blue paloverde, netleaf hackberry, western soapberry, burrobrush, desert honeysuckle, clematis, greythorn, sacaton, bush muhly, sand and spike dropseed, sideoats grama, shortleaf tridens, tanglehead, green sprangletop, plains bristlegrass, spidergrass, mesa threeawn, coyote melon, canaigre, pigweed, morning-glory, ragweed, and wishbone bush. Plant basal cover ranges from 6 to 17 percent, and cover by plant litter ranges from 30 to 75 percent. Canopy cover ranges from 15 to 50 percent for grasses, 1 to 15 percent for forbs, and 2 to 20 percent for shrubs and succulents. Tree canopy cover ranges from 15 to 30 percent.

Plains and Savanna Grassland

Desired Conditions: Plains Grassland and Savanna Grassland

Landscape Scale

In the plains grassland and savanna communities, the predominant species are native perennial grasses. There is moderate to dense vegetation cover that includes mid- and short grasses and forbs, succulent species, sub-shrubs, taller shrubs, and some trees. Species occurring in plains grassland and savanna communities include sacaton, sideoats grama, purple grama, blue grama, hairy grama, black grama, curly mesquite, plains lovegrass, bullgrass, cane beardgrass, green sprangletop, Texas bluestem, crinkleawn, wooly bunchgrass, beggartick threeawn, spreading ratany, false mesquite, velvet-pod and catclaw mimosa, Parry agave, Palmer's agave, beargrass, sotol, cliffrose, mountain mahogany, oak, and juniper species. Fires are common, with mean fire return intervals estimated between 5 and 20 years. Plant basal area ranges from 10 to 20 percent of the soil surface. Plant litter occupies 20 to 70 percent of the soil surface. There are no signs of compaction or accelerated erosion. The ability of the soil to maintain resource values and sustain outputs is high. High-quality habitat exists for animal species that live in this vegetation community. Traditional food and material plants thrive here, including sacaton, yerba mansa, Hopi tea, skunkbush, yerba de pasmo, annual sunflower, sotol, agave, yucca, beargrass, oak, walnut, mesquite, and juniper.

Mid-Scale

On steep hillslopes and ridgetops where soils have formed in place on acid igneous and metamorphic parent materials like granite, rhyolite, gneiss, schist, and quartzite, the plant community is dominated by an open canopy of oak with an understory of native perennial grasses and sub-shrubs and lesser amounts of large shrubs and succulents. The predominant species are Emory oak, Mexican blue oak, Arizona white oak, sideoats grama, cane beardgrass, plains lovegrass, bullgrass, Texas bluestem, crinkleawn, wooly bunchgrass, ocotillo, beargrass, sotol, mimosa species, manzanita, Gregg's dalea, California bricklebush, coralbean, skunkbush, turpentine bush, shrubby buckwheat, Palmer's agave, trailing fleabane, and ferns. Plant basal cover ranges from 10 to 18 percent, and

Forestwide Management

Plains and Savanna Grassland

cover by plant litter ranges from 35 to 70 percent. Canopy cover ranges from 15 to 45 percent for perennial grasses, 1 to 10 percent for forbs, and 1 to 5 percent for shrubs and succulents. Tree canopy cover is 5 to 25 percent, composed primarily of live oak species but including species like alligator and oneseed junipers, border piñon, mesquite, and Arizona rosewood.

On moderately sloping pediments where soils have formed in place on acid igneous and metamorphic parent materials like granite, gneiss, schist, and rhyolite, the plant community is dominated by native perennial grasses and sub-shrubs, with lesser amounts of large shrubs, trees, and succulents. The predominant species include oak and juniper, black, sideoats, slender, sprucetop, Santa Rita, and hairy gramas, wolftail, Arizona muhly, bullgrass, plains lovegrass, Orcutt's threeawn, ocotillo, false mesquite, spreading ratany, shrubby buckwheat, Gregg's dalea, yerba de pasmo, Palmer's agave, mimosa species, manzanita, skunkbush, beargrass, wire lettuce, penstemon, and snake cotton. Gravel and rock cover ranges from 15 to 65 percent. Plant basal cover ranges from 7 to 15 percent, and cover by plant litter ranges from 20 to 70 percent. Canopy cover ranges from 20 to 50 percent for perennial grasses, 0 to 2 percent for forbs, and 5 to 25 percent for shrubs and succulents. Tree canopy cover is 0 to 7 percent and may include species like Emory oak, Arizona white oak, alligator and oneseed junipers, and mesquite.

On steep hillslopes, ridgetops, mesas, and moderately sloping pediments where soils have formed in place on basic and intermediate igneous parent materials like basalt, andesite, and welded volcanic tuff and ash, the plant community is dominated by native perennial grasses, with lesser amounts of shrubs, trees, and succulents. The predominant species include Emory oak, Arizona white oak, alligator juniper, sideoats grama, cane beardgrass, plains lovegrass, green sprangletop, bullgrass, Texas bluestem, purple and hairy gramas, curly mesquite, tanglehead, ocotillo, mimosa species, whiteball acacia, yerba de pasmo, shrubby buckwheat, Palmer's agave, banana yucca, prickly pear, penstemon, bluedicks, vetch, and lotus. Plant basal cover ranges from 8 to 18 percent, and cover by plant litter ranges from 25 to 70 percent. Canopy cover ranges from 15 to 65 percent for perennial grasses, 1 to 15 percent for forbs, and 2 to 15 percent for shrubs and succulents. Tree canopy cover ranges from 5 to 15 percent, composed primarily of live oak and juniper species but including species like border piñon, mesquite, and netleaf hackberry.
On steep hillslopes, ridgetops, and scarps where soils have formed in place on limestone parent materials, the plant community is dominated by large native shrubs, with an understory of native perennial grasses, sub-shrubs, and succulents. The dominant species are mountain mahogany, cliffrose, Mearn's sumac, desert ceanothus, sideoats grama, wooly bunchgrass, crinkleawn, bullgrass, purple muhly, black grama, blue threeawn, rough tridens, tanglehead, Hall's panic, New Mexico feathergrass, ocotillo, false mesquite, feather dalea, sotol, banana yucca, prickly pear, Parry's agave, pectis, acalypha, blue penstemon, and ferns. Plant basal cover ranges from 5 to 10 percent, and cover by plant litter ranges from 20 to 50 percent. Canopy cover ranges from 15 to 40 percent for perennial grasses, 1 to 10 percent for forbs, and 10 to 30 percent for shrubs and succulents. Tree canopy cover ranges from 1 to 10 percent and may include species like alligator and oneseed juniper, Emory, Arizona white and Mexican blue oaks, mesquite, and rosewood.

Forestwide Management

Plains and Savanna Grassland

On moderately steep hillsides, ridgetops, and saddles where soils have formed in loamy alluvium from mixed sources, the plant community is dominated by native perennial grasses and sub-shrubs, with lesser amounts of succulents and trees. Palmer's agave reaches its highest density on these areas. The predominant species are sideoats, sprucetop and hairy gramas, wolftail, tanglehead, cane beardgrass, plains lovegrass, Texas bluestem, bullgrass, green sprangletop, false mesquite, yerba de pasmo, shrubby buckwheat, Palmer's agave, talinum, bundleflower, rosary bean, sida, evolvulous, bluedicks, and lotus. Plant basal cover ranges from 8 to 18 percent, and cover by plant litter ranges from 20 to 50 percent. Canopy cover ranges from 30 to 70 percent for perennial grasses, 1 to 20 percent for forbs, and 4 to 20 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 10 percent and may include species like Emory, Arizona white and Mexican blue oaks and alligator and oneseed junipers. Most trees occur on north aspects.

On moderately steep hillsides where soils have formed in coarse loamy, calcareous alluvium and colluviums, the plant community is dominated by perennial grasses, shrubs, and succulents. Sotol and beargrass are abundant on these sites. Other dominant species are sideoats grama, black grama, slim, rough and shortleaf tridens, tanglehead, Hall's panic, New Mexico feathergrass, wooly bunchgrass, crinkleawn, blue threeawn, ocotillo, false mesquite, range ratany, feather dalea, bahia, Hopi tea, blue penstemon, croton, scurfpea, and trailing four o'clock. Plant basal cover ranges from 8 to 18 percent, and cover by plant litter ranges from 10 to 50 percent. Canopy cover ranges from 30 to 70 percent for perennial grasses, 1 to 5 percent for forbs, and 4 to 30 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 5 percent and may include species like Emory, Arizona white and Mexican blue oaks and alligator and oneseed junipers. Most trees occur on north aspects.

On fan terraces, plains, and piedmonts where soils have formed in loamy alluvium from mixed sources, the plant community is dominated by perennial grasses and sub-shrubs, with lesser amounts of succulents and trees. The predominant species are blue, black, sideoats, sprucetop, and hairy gramas, wolftail, vine mesquite, cane beardgrass, plains lovegrass, green sprangletop, false mesquite, yerba de pasmo, shrubby buckwheat, Palmer's agave, talinum, bundleflower, rosary bean, sida, evolvulous, bluedicks, and lotus.
Plant basal cover ranges from 7 to 20 percent, and cover by plant litter ranges from 20 to 65 percent. Canopy cover ranges from 30 to 75 percent for perennial grasses, 1 to 5 percent for forbs, and 1 to 5 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 5 percent and includes species like Emory oak, Arizona white oak, and alligator and oneseed junipers.

On fan terraces, ridgetops, and piedmonts where soils have formed in mixed, calcareous alluvium, the plant community is dominated by native perennial grasses, shrubs, and succulents. Soaptree yucca is abundant. Other dominant species include beargrass, sotol, sideoats grama, black grama, slim tridens, plains muhly, Hall's panic, New Mexico feathergrass, wooly bunchgrass, blue threeawn, ocotillo, false mesquite, range ratany, feather dalea, bahia, Hopi tea, blue penstemon, croton, scurfpea, and trailing four o'clock. Plant basal cover ranges from 5 to 17 percent, and cover by plant litter ranges from 10 to 40 percent. Canopy cover ranges from 20 to 45 percent for perennial grasses, 1 to 5

Forestwide Management

Semi-desert Grassland

percent for forbs, and 2 to 20 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 2 percent and includes species like Emory oak, Arizona white oak, and alligator and oneseed junipers.

On nearly level floodplains, low stream terraces, alluvial fans, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by trees, with lesser amounts of native perennial grasses, vines, and forbs. The predominant species are Arizona sycamore, Arizona white oak, Emory oak, alligator juniper, Arizona walnut, Arizona ash, mesquite, desert willow, netleaf hackberry, western soapberry, wild grape, sacaton, sideoats grama, green sprangletop, plains bristlegrass, Orcutt's threeawn, buffalo gourd, canaigre, pigweed, morning-glory, ragweed, and camphor weed. Channel areas are active, with natural rates of erosion and sedimentation. Plant basal cover ranges from 4 to 15 percent, and cover by plant litter ranges from 50 to 85 percent. Canopy cover ranges from 20 to 60 percent for grasses, 1 to 10 percent for forbs, and 0 to 5 percent for shrubs. Tree canopy cover ranges from 20 to 50 percent.

On nearly level floodplains, swales, and low stream terraces where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by native perennial grasses and grass-like plants and forbs. The predominant species are sacaton, sideoats grama, vine mesquite, mat muhly, blue grama, sedges, rushes, yerba mansa, xanthocephalum, annual sunflower, goldeneye, pigweed, and ragweed. Plant basal cover ranges from 20 to 40 percent, and cover by plant litter ranges from 25 to 65 percent. Canopy cover ranges from 30 to 85 percent for grasses, 0 to 10 percent for forbs, and 0 to 2 percent for shrubs. Trees can include species like Arizona white oak, Emory oak, and desert willow, and canopy cover ranges from 0 to 2 percent.

Grassland Communities

Grassland Communities

Objectives

1. Within 10 years following plan approval, treat at least 72,500 acres of grasslands using wildland fire (planned and unplanned ignitions), thinning, and mastication.

Guidelines

1. Some patches of shrubby species, such as mesquites and yuccas, should be retained undamaged during fuel-reduction projects.
2. Management activities should favor the development of native grasses in areas where they have the potential to establish and grow.

Interior Chaparral

Interior Chaparral

General Description

Interior chaparral occurs throughout the Coronado NF as a discontinuous band of vegetation. The majority of this vegetation type exists at mid-elevations (3,000 to 6,000 feet). It is bordered and intermixed with Madrean encinal woodland at the upper elevations and semi-desert grassland or Sonoran desert at the lower elevations. Shrub live oak and manzanita shrubs are the most common

Forestwide Management

Interior Chaparral

species within interior chaparral; however, a wide range of other shrubs and trees are also found. Common animal species occurring in interior chaparral include American black bear, javelina, cliff chipmunk, white-throated woodrat, scrub jay, rufous-sided towhee, Arizona alligator lizard and Sonora mountain kingsnake.

Based on projections of future climate change for the region, interior chaparral ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, and wind storms).

Desired Conditions

Landscape Scale

The interior chaparral varies from widely scattered pockets within grasslands and woodlands to more extensive areas on steep mountain slopes. Species composition and dominance vary across the broad range of soils and topography, but are dominated by shrubs, including one or some of the following: shrub live oak, birchleaf mountain mahogany, pointleaf manzanita, desert ceanothus, pringle manzanita, and yellow leaf silktassel. The canopy is nearly closed in about 90 percent of the community. Where it is more open, there is a grass and forb component, including native species found in the adjacent grassland and woodland communities. Ground cover consists primarily of shrub litter covering 35 percent to 45 percent of the soil surface. Fire regimes, a natural dynamic, provide landscape diversity, wildlife habitat, and soil stability, and maintain a variety of vegetation densities and age classes. Fire occurs at intervals of 20 to 100 years, and is usually stand–replacing in nature.

Fine Scale

Soil condition indicators (35 to 45 percent of total ground cover provided by litter and plant basal area and no signs of compaction or accelerated erosion) signify that soil function is being sustained and soil is functioning properly and normally. The ability of soil to maintain resource values and sustain outputs is high. Vegetation structure in chaparral stands immediately adjacent to high-risk components of the wildland-urban interface (WUI[4]) has an arrangement that is horizontal and close to the ground. Typical fire behavior is dramatically reduced as a result of this arrangement of the fuel profile.

Objectives

1. Treat at least 5,000 acres of interior chaparral over the 10 years following plan approval using wildland fire (planned and unplanned ignitions) and mechanical treatments.

[4] WUI areas include those of resident human populations at imminent risk from wildland fire. These areas may also include critical communications sites, municipal watersheds, high voltage transmission lines, observatories, church camps, scout camps, research facilities, and other structures that if destroyed by fire would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

Forestwide Management

Guidelines

Interior Chaparral

1. Vegetation treatments in interior chaparral should provide for maintaining a sustainable population of paniculate agaves.

Madrean Encinal Woodland

Madrean Encinal Woodland

General Description

Madrean encinal, or oak, woodland occurs throughout the Coronado NF discontinuously distributed in the mountain foothills at elevations ranging from 3,600 to 6,500 feet. These woodlands grade into grasslands at lower elevations and pine-oak woodlands at higher elevations. Emory oak is present throughout the range of Madrean encinal; however, Mexican blue oak and Arizona white oak are the most common oak species. Alligator and single-seed junipers are also common. Madrean Encinal Woodland plant species (such as manzanita, silktassel, ceanothus, skunkbush sumac, catclaw acacia, mountain mahogany, and rosewood) are common understory shrubs. Warm-season perennial bunchgrasses (such as sideoats grama, blue grama, hairy grama, plains lovegrass, deer grass, and longtongue muhly) dominate the understory. Common animal species occurring in Madrean encinal woodland include Coues' white-tailed deer, Mexican fox squirrel, yellow-nosed cotton rat, lesser long-nosed bat, white-nosed coati, acorn woodpecker, Mexican jay, hepatic tanager, Clark's spiny lizard, Gila spotted whiptail, eastern patch-nosed snake, green ratsnake, rock rattlesnake, Arizona eyed click beetle, and great purple hairstreak.

Based on projections of future climate change for the region, Madrean encinal woodland ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, and wind storms).

Desired Conditions

Landscape Scale

The Madrean encinal woodland is dominated by an open stand of oaks (5 to 25 percent) with denser stands of oaks on north facing slopes and in drainages (25 to 50 percent canopy). Species composition of the overstory is dominated by Emory oak, Mexican blue oak, Arizona white oak, gray oak, alligator juniper, and single-seed juniper. Ground cover is dominated by grasses such as threeawns, blue grama, sideoats grama, Rothrock grama, Arizona cottontop, plains lovegrass, curly-mesquite, green sprangletop, deegrass, longtongue muhly, or Texas bluestem. These native, perennial, generally warm-season bunchgrasses in the understory create a wide overlap with the grasslands. Additional ground cover consists primarily of tree and grass litter covering 10 percent of the soil surface in the open stands to 40 percent of the soil surface in the denser stands. Fires occur on average every three to seven years. Fires are generally of low severity and occur between April and July, resulting in an overstory canopy of less than 20 percent on about 60 percent of the landscape.

Forestwide Management

Madrean Encinal Woodland

Mid-Scale

On steep hillslopes, ridgetops, pediments, and scarps where soils have formed in place on limestone parent materials, the native plant community is dominated by trees and large shrubs with an understory of perennial grasses, sub-shrubs, and succulents. The dominant species are mountain mahogany, alligator juniper, Emory oak, Arizona white oak, border pinyon, cliffrose, manzanita, Mearn's sumac, wavy-leaf oak, desert ceanothus, sideoats and hairy gramas, pinyon ricegrass, bullgrass, purple muhly, rough tridens, cliff muhly, New Mexico feathergrass, southwestern stipa, false mesquite, feather dalea, sotol, banana and Schott's yuccas, Parry's agave, bouvardia, hairy goldaster, and ferns. Plant basal cover ranges from 2 to 10 percent, and cover by plant litter ranges from 20 to 50 percent. Canopy cover ranges from 5 to 40 percent for perennial grasses, 1 to 5 percent for forbs, and 1 to 10 percent for shrubs and succulents. Tree and large shrub canopy cover ranges from 10 to 40 percent and includes species like mountain mahogany, border pinyon, and alligator juniper. Other species occur in lesser amounts, such as Emory oak, Arizona white oak, oneseed, Utah and redberry junipers, and Arizona rosewood. Mountain mahogany forms tree-like woodlands on southern exposures with more oak species on cooler exposures. Mixed pinyon-juniper woodlands dominate on pediments and steep north exposures at higher elevations. Small canyon inclusions in this bedrock unit have sufficient extra moisture for riparian tree, shrub, grass, and forb species to persist. These areas are the conduit that provide for the safe capture and release of sediment and water.

On fan terraces, plains, and moderate to steep slopes where soils have formed in loamy alluvium from mixed sources; soils are old, loamy to clayey, deep, and slightly alkaline to slightly acid in reaction. The potential native plant community here is dominated by trees, with lesser amounts of perennial grasses, forbs, shrubs, and succulents. The predominant species are Emory and Arizona white oaks, manzanita, beargrass, Schotts yucca, blue, sideoats, and hairy gramas, Orcutt's threeawn, bullgrass, Texas bluestem, cane beardgrass, plains lovegrass, green sprangletop, crinkleawn, pinyon ricegrass, prairie junegrass, bottlebrush squirreltail, false mesquite, yerba de pasmo, shrubby buckwheat, The predominant species are Emory and Arizona white oaks, manzanita, beargrass, Schotts yucca, blue, sideoats, and hairy gramas, Orcutt's threeawn, bullgrass, Texas bluestem, cane beardgrass, plains lovegrass, green sprangletop, crinkleawn, pinyon ricegrass, prairie junegrass, bottlebrush squirreltail, false mesquite, yerba de pasmo, shrubby buckwheat, Palmer's agave, bouvardia, psoralea, rosary bean, trailing fleabane, and lotus. Plant basal cover ranges from 2 to 10 percent and cover by plant litter ranges from 20 to 75 percent. Canopy cover ranges from 5 to 50 percent for perennial grasses, 1 to 5 percent for forbs, and 0 to 5 percent for shrubs and succulents. Tree canopy cover ranges from 10 to 45 percent, consisting primarily of Emory oak, Arizona white oak, and alligator juniper.

On nearly level floodplains, low stream terraces, alluvial fans, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by trees, with lesser amounts of perennial grasses, vines, shrubs, and forbs. The predominant tree species are Arizona sycamore, Arizona cypress, Arizona white oak, Emory oak, grey oak, alligator

Forestwide Management

Madrean Encinal Woodland

juniper, Arizona walnut, Arizona ash, madrone, bigtooth maple, alder, ponderosa pine, Apache pine, Chihuahuan pine and Douglas fir. Understory species include wild grape, Virginia creeper, thimbleberry, redosier dogwood, Godding's yew-leaf, coyote and arroyo willows, poison ivy, Arizona wildrye, deergrass, sideoats grama, bulb panic, green sprangletop, Orcutt's threeawn, sedges, rushes and bullrushes, wood sorrel, geranium, tickclover, goldenrod, and meadow rue. Channel areas are active with both erosion and sedimentation. Streambanks are well protected by dense stands of trees, shrubs, and vines. In places, these areas have perennial streamflow. In other areas, flows are intermittent, but all areas receive extra water in the form of runoff from adjacent watersheds and have streamflow both in the fall and spring for prolonged periods. Plant basal cover ranges from 4 to 10 percent, and cover by plant litter ranges from 30 to 65 percent. Canopy cover ranges from 5 to 40 percent for grasses, 1 to 10 percent for forbs, and 0 to 5 percent for shrubs. Tree canopy cover ranges from 30 to 70 percent. Tree canopy in dry or intermittent stretches is dominated by sycamore, pine, cypress, juniper, and oak species. Tree canopy in perennial streamflow areas is dominated by sycamore, walnut, ash, willow, maple, alder, and dogwood.

On gently rolling pediments to steep hillslopes and ridgetops where soils have formed in place on igneous and metamorphic parent materials like granite, rhyolite, andesite, gneiss, schist, and quartzite, the plant community is dominated by trees, including Emory oak and Arizona white oak. Other trees include grey oak, border pinyon, and oneseed and alligator junipers, with an understory of perennial grasses and forbs, sub-shrubs, shrubs, and succulents. The primary understory species include sideoats grama, hairy grama, cane beardgrass, plains lovegrass, bullgrass, Texas bluestem, crinkleawn, wooly bunchgrass, Orcutt's threeawn, pinyon ricegrass, prairie junegrass, beargrass, Schott's yucca, mimosa species, manzanita, Toumey oak, turbinella oak, silktassel, California bricklebush, coralbean, skunkbush, shrubby buckwheat, Palmer's agave, trailing fleabane, bouvardia, blue curls, and ferns. Plant basal cover ranges from 5 to 10 percent, and cover by plant litter ranges from 35 to 70 percent. Canopy cover ranges from 5 to 45 percent for perennial grasses, 1 to 10 percent for forbs, and 1 to 5 percent for shrubs and succulents. Tree canopy cover ranges from 10 to 50 percent and consists primarily of Emory and Arizona white oaks. Understory species and density are unaffected by tree canopies from 10 to 35 percent, but are limited as tree canopy cover approaches 50 percent. Small canyon inclusions have sufficient extra moisture for riparian tree, shrub, grass, and forb species to persist there. These areas are the conduit to provide the safe capture and release of sediment and water in these mountain systems.

Fine Scale

Within patches, single large trees or small groups of trees are widely spaced between large expanses of grasses and shrubs. Total ground cover by litter and plant basal area is 15 to 65 percent, and the lack of signs of compaction or accelerated erosion indicates that the soil is functioning properly. The ability of soil to maintain resource values and sustain outputs is high.

Forestwide Management

Madrean Encinal Woodland

Objectives

1. Treat at least 367,000 acres using wildland fire (planned and unplanned ignitions) and mechanical treatments (thinning and mastication) within 10 years following plan approval.

Guidelines

1. Fuel reduction and habitat restoration projects should leave clusters of live trees and shrubs to benefit species that require these structures for breeding, feeding, shelter, and other habitat needs.
2. Fuel reduction and habitat restoration projects should leave snags for wildlife habitat.
3. The development of native grasses should be favored in areas where they have the potential to establish and grow.
4. Fuel reduction or fuelwood gathering projects should retain some large-diameter trees and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
5. Silvicultural treatments should result in structure and composition that fall within the historic range of variability.
6. Post treatment cleanup activities should be designed to leave all large woody debris over 10 inches in diameter.

Madrean Pine-Oak Woodland

Madrean Pine-Oak Woodland

General Description

Madrean pine-oak woodlands are bounded by Madrean encinal woodlands, plains, and savannah grasslands at the lowest elevations. The upper elevations are bounded by ponderosa pine-evergreen shrub and dry mixed conifer communities. Elevations range from 6,000 feet to over 8,000 feet. Annual precipitation averages from 20 to over 30 inches. Some plant species occurring in woodland communities include sideoats grama, blue grama, hairy grama, plains lovegrass, bullgrass, deergrass, longtongue muhly, mountain muhly, Texas bluestem, crinkleawn, prairie junegrass, pinyon ricegrass, bouvardia, silktassel, manzanita, Fendler's buckbrush, Parry's and Palmer's agave, beargrass, sotol, mountain mahogany, pine, fir, oak, pinyon, and juniper species. Ground cover consists primarily of organic layers (duff) of pine needles and/or oak leaves and twigs. Gravel, cobble, and rock cover ranges from 20 to 40 percent. Bedrock outcrop ranges from 5 to 40 percent of the surface. Common animal species occurring in Madrean pine-oak woodland communities include Coues' white-tailed deer, Arizona gray squirrel, common hog-nosed skunk, Gould's wild turkey, painted redstart, acorn woodpecker, red-faced warbler, whiskered screech-owl, mountain skink, striped plateau lizard, ridge-nosed rattlesnake, Sonoran mountain kingsnake, and Huachuca giant skipper.

Based on projections of future climate change for the region, Madrean pine-oak woodland ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, and wind storms).

Forestwide Management

Madrean Pine-Oak Woodland

Desired Conditions

Landscape Scale

In Madrean pine-oak woodland communities, the predominant species are native trees. There is moderate to dense vegetation cover that includes mid- and short perennial grasses and forbs, sub-shrubs, shrubs, and trees. The Madrean pine-oak woodland varies from generally open (with large trees providing 10 percent canopy with a grass understory) to groups of 50 percent canopy. Approximately 30 percent of the area is in the open condition; the remainder is closed. The predominant tree species are Arizona white oak, Emory oak, silverleaf oak, Apache pine, and Chihuahua pine. The oaks are generally tree form and do not dominate the community. Other commonly occurring trees include alligator juniper, Arizona madrone, Arizona cypress, and border piñon. A shrub layer is present and often contains species such as beargrass, littleleaf sumac, evergreen sumac, yellow leaf silktassel, birchleaf buckthorn, and ceanothus species. Grasses are common, including long tongue muhly and bullgrass. Ground cover is sufficient to carry fire through the landscape at low or moderate severity every 5 to 20 years. Fires are common, with mean fire return intervals in some communities between 7 and 50 years. Plant basal area ranges from 0 to 10 percent of the soil surface. Plant litter occupies 20 percent to 90 percent of the soil surface. Litter and plant cover values represent the range from after disturbance events (fire, drought) to the time at which site equilibrium is reached. There are no signs of compaction or accelerated erosion.

The ability of soil to maintain resource values and sustain outputs is high. High-quality habitat exists for animal species living in this vegetation community. Traditional food and material plants thrive here, including pine, fir, oak, walnut, pinyon, juniper, manzanita, skunkbush, agave, yucca, beargrass, monarda (oregano), and terragon,.

Mid-Scale

At elevations between 6,000 and 7,400 feet, the plant community is dominated by trees, primarily silverleaf oak and lesser amounts of alligator juniper and Arizona white oak. Other trees include Emory oak, grey oak, border pinyon, and Arizona, Apache and Chihuahuan pines, with a sparse understory of perennial grasses, forbs, and shrubs. The main large shrubs include turbinella oak, netleaf oak, Toumey oak, manzanita, silktassel, narrowleaf hoptree, and mountain mahogany. Perennial forbs and grasses occur in minor amounts and include bullgrass, longtongue muhly, sideoats grama, trailing fleabane, bouvardia, verbena, and ferns. Plant basal cover ranges from 3 to 5 percent. Cover by plant litter (primarily oak leaves and twigs) ranges from 55 to 90 percent. Canopy cover ranges from 0 to 5 percent for perennial grasses, 0 to 5 percent for forbs, and 1 to 15 percent for large shrubs. Tree canopy cover ranges from 50 to 70 percent, consisting primarily of silverleaf oak. The life form of silverleaf oak is virtually all multi–stem, resulting from repeated fires and coppice sprouting. Pine species come into this plant community on cooler northern aspects in long fire-free intervals.

At elevations between 6,500 and 8,900 feet, the plant community is dominated by Arizona pine, Apache pine, Chihuahuan pine, Arizona white oak, and Gambel oak. Perennial grasses in the understory plant community include

Forestwide Management

Madrean Pine-Oak Woodland

longtongue muhly, mountain muhly, bullgrass, screwleaf muhly, pine dropseed, Arizona fescue, pinyon ricegrass, nodding brome, muttongrass, prairie junegrass, and Pringle needlegrass. Perennial forbs include sneezeweed, columbine, geranium, wood sorrel, verbena, meadow rue, goosegrass, gentian, mule ears, and groundsel species. Common shrubs include netleaf oak, Fendler's buckbrush, Palmer's oak, New Mexico locust, turbinella oak, creeping mahonia, mountain snowberry, flame sumac, wild rose, and wax currant. Plant basal cover ranges from 5 to 10 percent. Cover by plant litter ranges from 40 to 80 percent and includes both grass litter and a duff of pine needles. Canopy cover ranges from 5 to 25 percent for perennial grasses, 0 to 5 percent for forbs, and 0 to 10 percent for large shrubs. Tree canopy cover ranges from 20 to 60 percent, consisting primarily of pines.

Fine Scale

Patches of single, large trees or small groups of trees are widely spaced between large expanses of grasses and shrubs. Total ground cover by litter and plant basal area ranges from 20 to 100 percent, and there are no signs of compaction or accelerated erosion. The soil is functioning properly and the ability of soil to maintain resource values and sustain outputs is high.

Objectives

1. Treat at least 25,000 acres using wildland fire (planned and unplanned ignitions), and thinning and mastication over the 10 years following plan approval.

Guidelines

1. Management activities should favor the development of native grasses in areas where they have the potential to establish and grow.
2. Should retain large trees (greater than 18" diameter) and snags at edges of meadows and forest openings
3. Burn prescriptions should minimize scorching of boles crowns of trees, and shrubs that are to be retained.
4. Silvicultural treatments should result in structure and composition that fall within the historic range of variability.
5. Paniculate agaves should be retained during vegetation treatments.
6. Large woody debris (such as logs, slabs, and bark) should be retained in amounts up to at least three tons per acre.
7. When thinning, conifer snags 18 inches or greater in diameter at breast height (DBH) at 1-2 snags per acre and oak snags 10 inches or greater DBH should be retained.
8. When thinning, downed logs 12 inches or greater at midpoint and at least 8 feet long should be retained at an average of 3 logs per acre.
9. Clusters of trees and shrubs should be maintained in treatment areas to benefit species that require these structures for breeding, feeding, shelter, and other needs
10. Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
11. A range of tree basal areas consistent with the Mexican spotted owl recovery plan should be maintained during fuel reduction and forest restoration projects.

Forestwide Management

Madrean Pine-Oak Woodland

12. An uneven-aged forest management approach should be emphasized; however, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity.
13.
Surveys for reforestation needs should be conducted within two years following a wildfire other event greater than 2,000 acres.

Management Approaches

Favoring natural regeneration where feasible unless the following circumstances exist: 1) endangered species habitat needs to be restored, 2) the time period of recovery is deemed excessive due to size of deforested area is large and seed sources for natural reforestation at distant, or 3) there is concern for loss of site capacity from soils loss or extreme competition with early seral species.
Planting native species from local seed zones unless approved by Regional Geneticist (does not apply to short-term burned area response seeding).
15 Maintaining a seed inventory for each major conifer species based on a seed collection plan approved by the Regional Geneticist
16. Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determine the least costly manner of executing a treatment and determining priorities when funding prevents treatment of all acres.

Ponderosa Pine Evergreen Shrub

Ponderosa Pine-Evergreen Shrub

General Description

The ponderosa pine-evergreen shrub ecosystem generally occurs at elevations ranging from approximately 5,000 to 10,000 feet. This community is dominated by ponderosa and Arizona pines and can be distinguished from the Madrean pine-oak woodland by somewhat more even-aged stand dynamics. Ponderosa pine-evergreen shrub has two subclasses: one with a more continuous layer of perennial grasses and a relatively minor shrub component, and one with an understory of primarily evergreen shrubs (including manzanita, turbinella oak, sumac species, and mountain mahogany species). Common animal species occurring in this community include North American porcupine, Abert's squirrel (non-native), striped skunk, white-breasted nuthatch, Gould's wild turkey, Grace's warbler, flammulated owl, Yarrow's spiny lizard, Arizona black rattlesnake, and Chiricahua white butterfly.

Under changing climate conditions, ponderosa pine-evergreen shrub ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, and wind storms). High-risk occurrences could include uncharacteristically intense wildfire, increased rate of insect or disease attack due to warming temperatures, and increasing challenges to regeneration of ponderosa pine, especially on warmer, drier areas such as south-facing slopes.

Desired Conditions

Landscape Scale

At the landscape scale, the ponderosa pine-evergreen shrub is composed of trees from structural stages ranging from young to old. Old growth is well distributed in the landscape. Forest stand appearance is variable but generally uneven-aged and open; areas of even-aged structure are present. The forest arrangement includes small clumps and groups of trees interspersed within variably-sized openings of moderate- to high-density shrubs and limited grass cover. Openings typically range from 10 percent in more productive sites to 70 percent in the less productive sites. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. All structural stages of oak are present, with old trees occurring as dominant individuals or in small groups. Denser tree conditions exist in some locations, such as north-facing slopes and canyon bottoms.

The ponderosa pine-evergreen shrub is composed predominantly of vigorous trees and shrubs, but declining trees and shrubs are a component. Declining trees provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris (greater than 3 inches in diameter), all well-distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater DBH and average 1 to 2 snags per acre; large oak snags (greater than 10 inches DBH) are a well-distributed component. Downed logs (greater than 12-inch diameter at midpoint and more than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 3 to 10 tons per acre.

The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from natural disturbances (e.g. insects, diseases, fire, and wind), including old growth. Dwarf-mistletoe occurs in less than 15 percent of trees in uneven-aged forest structures and less than 25 percent in even-aged forest structures. Limited grasses, forbs, and a moderate density of shrubs, needle cast, and small trees maintain the natural fire regime.

Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Low- to mixed-severity fires (Fire Regimes I and III) are characteristic in this type. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

Mid-Scale

At the mid-scale, the ponderosa pine-evergreen shrub community is characterized by variation in the size and number of tree groups, depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area. Tree density within forested areas generally ranges from 20 to 80 square foot basal area per acre. Openings typically range from 10 percent in the more productive

Forestwide Management

Ponderosa Pine Evergreen Shrub

sites to 70 percent in the less productive sites. The mosaic of tree groups comprises a mix of even-aged and uneven-aged patches with all age classes and structural stages present.

The mix of natural disturbances sustains the overall age and structural distribution. Fires are of low- to mixed-severity, burning on the forest floor as well as in the overstory. Crown fires occur in small patches.

Forest structure in the wildland-urban interface (WUI) has smaller, more widely-spaced groups of trees than in the non-WUI. There are no stand-replacement fires in the WUI. As ignitions occur, flame lengths will typically be less than four feet. Forest stands are able to withstand and recover from periodic naturally-occurring or unwanted, human-initiated wildland fires.

Fine Scale

Trees typically occur individually or in small groups in which they are variably spaced, with some tight clumps. Crowns of trees within mid- to old-age groups are interlocking or nearly interlocking. Openings in between tree groups are variably shaped and comprised of shrubs, forbs, and grasses. Some openings may contain a high density of shrubs and/or individual trees, including large oaks. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. The size of tree groups is typically less than 0.5 acres.

Objectives

1. Over the 10 years following plan approval, treat at least 12,500 acres using wildland fire (planned and unplanned ignitions) and mechanical treatments (thinning and mastication).

Guidelines

1. Vegetation treatments should be designed such that replacement structural stages are proportionally present to assure continuous representation of old growth over time.
2. Within cleared right-of-way boundaries, slash should be treated 3. Within foreground distance zones of trails (and especially in the immediate foreground within 300 feet of trails), roads, use areas, and water bodies, slash should be treated
4. Slash piles from harvest activities should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
5. Management activities should favor the development of native grasses in areas where they have the potential to establish and grow.
6. Fuel reduction or fuelwood gathering projects should retain some large-diameter trees and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
7. Silvicultural treatments should lead to structure and composition that fall within the historic range of variability.
8. Large woody debris (such as logs, slabs, and bark) should be retained in amounts up to at least three tons per acre.
9. A range of tree basal areas consistent with the latest Mexican spotted owl recovery plan should be maintained during fuel reduction and forest restoration projects.

Forestwide Management

Ponderosa Pine Evergreen Shrub

10. An uneven-aged forest management approach should be emphasized; however, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity.
11. When thinning, conifer snags 18 inches or greater diameter-breast-height (DBH) at 1-2 snags per acre and oak snags 10 inches or greater DBH should be retained.
12. When thinning, downed logs 12 inches or greater at midpoint and at least 8 feet long at an average of 3 logs per acre should be retained.
Surveys for reforestation needs should be conducted within two years following a wildfire other event greater than 2,000 acres.

Management Approaches

Favoring natural regeneration where feasible unless the following circumstances exist; 1) endangered species habitat needs to be restored, 2) the time period of recovery is deemed excessive due to size of deforested area is large and seed sources for natural reforestation at distant, or 3) there is concern for loss of site capacity from soils loss or extreme competition with early seral species.
Planting native species from local seed zones unless approved by Regional Geneticist (does not apply to short-term burned area response seeding).
Maintaining a seed inventory for each major conifer species based on an seed collection plan approved by the Regional Geneticist
Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determine the least costly manner of executing a treatment and determining priorities when funding prevents treatment of all acres.

Dry Mixed Conifer

Dry Mixed Conifer

General Description

This forest type is transitional with increasing elevation between ponderosa pine-evergreen shrub and wet mixed-conifer forest types and generally occurs at elevations ranging from approximately 5,500 to 9,500 feet. Dry mixed conifer forests are dominated by primarily shade-intolerant trees such as ponderosa pine, southwestern white pine, Douglas-fir, and Gambel oak, with a lesser presence of aspen and shade-tolerant species such as white fir. This forest type typically occurs with an understory of grasses, forbs, and shrubs. Fires occur frequently and are generally not limited by lack of fuel connectivity or high fuel moistures. Common animal species occurring in dry mixed conifer include Mt. Graham red squirrel, American black bear, elk (non-native), Allen's big-eared bat, long-legged myotis, Northern goshawk, Mexican spotted owl, brown creeper, broad-tailed hummingbird, Madrean alligator lizard, greater short-horned lizard, wandering gartersnake, pine satyr, and Weidemeyer's admiral butterfly.

Based on projections of future climate change for the region, dry mixed conifer forest ecosystems are susceptible to decreases in plant

productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, wind storms, and ice storms). Extended drought from delayed monsoons could lead to increased tree mortality, resulting in increasing risk of intense wildfire.

Desired Conditions

Landscape Scale

At the landscape scale, the dry mixed conifer type is a mosaic of forest conditions composed of structural stages ranging from young to old trees. Old growth occurs as groups of old trees, often mixed with groups of younger trees or occasionally as a patch comprised mostly of old trees. Forest stand appearance is variable, but generally uneven-aged and open; occasional patches of even-aged structure are present. The forest arrangement includes small clumps and groups of trees interspersed within variably-sized openings of grass, forb, and shrub vegetation associations similar to historic patterns. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. Openings typically range from 10 percent in more productive sites to 70 percent in the less productive sites. Where they naturally occur, groups or patches of aspen and all structural stages of oak are present. Denser tree conditions exist in some locations, such as north-facing slopes and canyon bottoms.

The dry mixed conifer type is composed predominantly of vigorous trees, but declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris (greater than 3 inches in diameter), all well-distributed throughout the landscape. Snags are typically 18 inches or greater DBH and average 3 per acre. Downed logs (those greater than 12 inches in diameter at midpoint and more 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.

The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, severity of disturbances, and to climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g. insects, diseases, fire, and wind), including old growth. Dwarf-mistletoe occurs in less than 15 percent of trees in uneven-aged forest structures and less than 25 percent in even-aged forest structures. Grasses, forbs, shrubs, needle cast (fine fuels), and small trees maintain the natural fire regime. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Frequent, low-severity fires (Fire Regime I) are characteristic in this type, including throughout goshawk home ranges. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

Mid-Scale

At the mid-scale, the dry mixed conifer type is characterized by variation in the size and number of tree groups, depending on elevation, soil type, aspect, and

Forestwide Management

Dry Mixed Conifer

site productivity. The more biologically productive sites contain more trees per group and more groups per area. Tree density within forested areas generally ranges from 30 to 100 square foot basal area per acre. Openings typically range from 10 percent in more productive sites to 70 percent in the less productive sites. The mosaic of tree groups generally consists of an uneven-aged forest with all age classes and structural stages. Occasionally, small patches (generally less than 50 acres) of even-aged forest structure are present.

Disturbances sustain the overall age and structural distribution. Fires typically burn on the forest floor and do not spread between tree groups as crown fire.

Forest structure in the wildland-urban interface has smaller and more widely spaced groups of trees. Forest stands are open, greatly reducing stand-replacement fire occurrence. Grasses and forbs are abundant, with overall diversity and forest health enhanced through a mosaic of even-aged and uneven aged stands.

Fine Scale

Trees typically occur in irregularly shaped groups and are variably spaced, with some tight clumps and with crowns of mid- to old-aged trees interlocking (clumped trees) or nearly interlocking. Openings surrounding tree groups are variably shaped and comprised of a grass, forb, and shrub mix. Some openings contain individual trees or snags. Trees within groups are of similar or variable ages and represent one or more species. Tree groups typically are less than 1 acre in size, and at the mature and old stages, consist of 2 to approximately 50 trees.

Objectives

1. Treat at least 13,800 acres using wildland fire (planned and unplanned ignitions) and thinning within 10 years following plan approval.
2. Survey for reforestation needs within 2 years following a wildfire other event greater than 1,000 acres.

Guidelines

1. Vegetation treatments should be designed such that replacement structural stages are proportionally present to assure continuous representation of old growth characteristics across the landscape over time.
2. Within cleared right-of-way boundaries, slash should be treated 3. Within foreground distance zones of trails, roads, use areas, and water bodies, (and especially in the immediate foreground within 300 feet of these areas), slash should be treated
4. Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
5. Management activities should favor the development of native bunchgrasses in areas where they have the potential to establish and grow.
6. Fuel reduction or fuelwood gathering projects should retain some large-diameter trees and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
7. Should retain large trees, snags, and hardwood trees at edges of meadows and forest openings.

Forestwide Management

Dry Mixed Conifer

8. Silvicultural treatments should result in structure and composition that fall within the historic range of variability.
9. Large woody debris (such as logs, slabs, and bark) should be retained in amounts up to at least 3 tons per acre.
10. A range of tree basal areas consistent with the most recent Mexican spotted owl recovery plan should be maintained during fuel reduction and forest restoration projects.
11. An uneven-aged forest management approach should be emphasized; however, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity.
12. When thinning, conifer snags 18 inches or greater diameter-breast-height (DBH) at 1-2 snags per acre and oak snags 10 inches or greater DBH should be retained.
13. When thinning, downed logs 12 inches or greater at midpoint and at least 8 feet long at an average of 3 logs per acre should be retained.

Management Approaches

Favoring natural regeneration where feasible unless the following circumstances exist: 1) endangered species habitat needs to be restored, 2) the time period of recovery is deemed excessive due to size of deforested area is large and seed sources for natural reforestation at distant, or 3) there is concern for loss of site capacity from soils loss or extreme competition with early seral species.
Planting native species from local seed zones unless approved by Regional Geneticist (does not apply to short-term burned area response seeding).
Maintaining a seed inventory for each major conifer species based on an seed collection plan approved by the Regional Geneticist
Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determine the least costly manner of executing a treatment and determining priorities when funding prevents treatment of all acres.

Wet Mixed Conifer

Wet Mixed Conifer

General Description

The wet mixed conifer forest type generally occurs at elevations ranging from approximately 5,500 to 10,000 feet. Tree species composition varies, depending on seral stage, elevation, and moisture availability. This forest type can be composed of early seral species such as aspen, Douglas-fir, New Mexico locust, southwestern white pine, and Rocky Mountain maple, and late seral species such as white fir and Engelmann spruce. Ponderosa pine may be present in minor proportions, decreasing with increasing elevational gradients. This forest type intergrades with the spruce-fir forest type at its upper elevation range, with ever-increasing amounts of Engelmann spruce and corkbark fir in the later seral stages. Disturbances in this type typically occur at two spatial and temporal scales: large–scale, infrequent disturbances (mostly fire) and small–scale, frequent disturbances (fire, insect, disease, and wind). Fire occurrence and

behavior in this type are generally limited more by higher fuel moisture than by lack of woody fuels. Wet mixed conifer has an understory of a wide variety of shrubs, grasses, and forbs depending on soil type, aspect, elevation, disturbance, and other factors. Common animal species occurring in wet mixed conifer are the same as the ones found in dry mixed conifer.

Based on projections of future climate change for the region, wet mixed conifer forest ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, wind storms, and ice storms). Wet mixed conifer on the Coronado NF occurs within slightly more moist areas at higher elevations. Extended drought from a delayed monsoonal season could lead to increased tree mortality, resulting in increasing risk of intense wildfire.

Desired Conditions

Landscape Scale

The wet mixed conifer forest type is a mosaic of structural and seral stages ranging from young to old trees. The landscape arrangement is an assemblage of variably-sized and -aged groups and patches of trees and other vegetation associations similar to historic patterns. Tree groups and patches are comprised of variable species composition, depending on forest seral stages. An approximate balance of seral stages is present across the landscape; each seral stage is characterized by distinct dominant species composition and biophysical conditions. Old growth occurs as patches on the landscape. Canopies in this forest type are generally more closed than in dry mixed conifer. An understory consisting of native grass, forbs, and/or shrubs is present.

The wet mixed conifer type is composed predominantly of vigorous trees, but older declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris, all well-distributed throughout the landscape. Snags are typically 18 inches or greater DBH and 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. The amount of downed logs (those that are greater than 12 inches in diameter at midpoint and more than 8 feet long) and coarse woody debris (greater than 3 inches in diameter) varies by seral stage.

The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The forest landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g. insects, diseases, wind, and fire), including old growth. Dwarf-mistletoe occurs in less than 15 percent of trees in uneven-aged forest structures and less than 25 percent in even-aged forest structures. Organic ground cover and herbaceous vegetation provide protection of soil, allow for infiltration of water, and contribute to plant and animal diversity and to ecosystem function. Mixed-severity fire (Fire Regime III) is characteristic of this type. High- severity fires (Fire Regimes IV & V) rarely occur. Natural and anthropogenic disturbances are

sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

Mid-Scale

At the mid-scale, 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 in the hundreds of acres and occasionally in the thousands of acres. Groups and patches of tens of acres or less are relatively common. A mosaic of primarily even-aged groups and patches, which vary in size, species composition, and age, is present. Grass, forb, and shrub openings created by disturbance may comprise 10 to 100 percent of the mid-scale area depending on the disturbance type and scale. Aspen is occasionally present in large patches.

Density ranges from 20 to 110 square foot basal area per acre, depending upon disturbance and seral stages of groups and patches. Coarse woody debris, including downed logs, varies by seral stage, with averages ranging from 5 to 20 tons per acre for early seral stages, 20 to 40 tons per acre for mid seral stages, and 80 tons per acre or greater for late seral stages.

Mixed- (Fire Regime III) and high-severity (Fire Regime IV) fires and other disturbances maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. High-severity fires generally do not exceed 1000-acre patches of mortality. Other smaller disturbances occur more frequently.

Forests in the wildland-urban interface are dominated by early-seral, fire-adapted species growing in an overall more open condition than the remainder of the forest. These conditions result in fires that burn primarily on the forest floor and rarely spread as crown fire.

Fine Scale

Trees are typically variably-spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking. Trees within groups can be of similar or variable species and ages. Small openings are present as a result of disturbances.

Objectives

1. Treat at least 2,400 acres using wildland fire (planned and unplanned ignitions) and thinning within 10 years following plan approval.

Guidelines

1. Forest landscapes should be managed such that replacement structural stages are proportionally present to assure continuous representation of old growth over time.
2. Within cleared right-of-way boundaries, slash should be treated as appropriate.
3. Within foreground distance zones of trails, roads, use areas, and water bodies, (and especially in the immediate foreground within 300 feet of these areas), slash should be treated
4. Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.

Forestwide Management

Wet Mixed Conifer

5. Vegetation treatments should be designed to create stand conditions that enhance cone production of white fir, corkbark fir, Engelmann spruce, and Douglas-fir in order to provide a reliable Mt. Graham red squirrel food source.
6. Fuel reduction or fuelwood gathering projects should retain some large diameter trees and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
7. Large trees and snags at edges of meadows and forest openings should be retained.
8. Silvicultural treatments should result in structure and composition of the vegetation communities that fall within the historic range of variability.
9. Large woody debris should be retained in amounts up to at least 5 tons per acre.
10. A range of tree basal areas consistent with the most recent Mexican spotted owl recovery plan should be maintained during fuel reduction and forest restoration projects.
11. An uneven-aged forest management approach should be emphasized; however, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity.
12. When thinning, conifer snags 18 inches or greater diameter-breast-height (DBH) at 1-2 snags per acre and oak snags 10 inches or greater DBH should be retained.
13. When thinning, downed logs 12 inches or greater at midpoint and at least 8 feet long at an average of 3 logs per acre should be retained.

Surveys for reforestation needs should be completed within two years following a wildfire other event greater than 1,000 acres.

Management Approaches

- Use chemical pheromones if necessary to control pests and disease before they affect forests at the stand level.
- Favoring natural regeneration where feasible unless the following circumstances exist: 1) endangered species habitat needs to be restored, 2) the time period of recovery is deemed excessive due to size of deforested area is large and seed sources for natural reforestation at distant, or 3) there is concern for loss of site capacity from soils loss or extreme competition with early seral species.

Spruce Fir

Spruce-Fir

General Description

The spruce-fir forest type generally occurs at elevations ranging from approximately 8,500 to the highest elevations on the Coronado NF at 10,720 feet. This forest type intergrades with the wet mixed conifer forest type at the lower elevation range. It is dominated by Engelmann spruce, but contains other species dependant on elevation and local physical site factors. Understory plant species commonly include currants, maples, honeysuckle, whortleberry, alpine clover, and sedges. Spruce-fir forests occur on the coldest, wettest, highest-elevation mountain tops on the Coronado NF. Common animal species occurring in spruce-fir include Mt. Graham red squirrel, long-tailed vole,

Forestwide Management

Spruce Fir

cordilleran flycatcher, warbling vireo, Clark's nutcracker, stellar's jay, Yarrow's spiny lizard, and twin-spotted rattlesnake.

The climax stages of Engelmann spruce co-dominates with corkbark fir (sub-alpine fir). The common seral tree species are aspen, Douglas-fir, and southwestern white pine. Disturbances in this type typically occur at two spatial and temporal scales: large–scale, infrequent disturbances (mostly fire) and small–scale, frequent disturbances (fire, insect, disease, and wind).

Based on projections of future climate change for the region, spruce-fir forest ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, wind storms, and ice storms). Spruce-fir on the Coronado NF occurs at the highest elevations, and thus is among the most susceptible to loss of suitable climate. Extended drought from a delayed monsoonal season could lead to increased tree mortality, resulting in increasing risk of intense wildfire.

Desired Conditions

Mid-Scale

At the mid-scale, the size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary but are mostly in the hundreds of acres and occasionally in the thousands of acres. There may be frequent, small disturbances, resulting in groups and patches of tens of acres or less. A mosaic of primarily even-aged groups and patches, which vary in size, species composition, and age, are present. Grass, forb, and shrub openings created by disturbance may comprise 10 to 100 percent of the mid-scale area, depending on the type of disturbance. Aspen is occasionally present in large patches.

Density ranges from 20 to 250 square foot basal area per acre, depending upon disturbance and seral stages of the groups and patches. Coarse woody debris, including downed logs, varies by seral stage, ranging from 5 to 20 tons per acre for early seral stages, 20 to 40 tons per acre for mid seral stages, and 80 tons per acre or greater for late seral stages.

Mixed- (Fire Regime III) and high-severity (Fire Regimes IV and V) fires and other disturbances maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

Forest conditions in the wildland-urban interface are more open, in some cases consisting primarily of grass, forbs, shrubs, and trees whose canopies generally do not touch. These conditions generally result in surface fires. Stand-replacement fires do not occur.

Fine Scale

Trees grow tightly together with interlocking crowns and are generally of the same height and age during early group/patch development but may be multilayered in late development. Small openings are present as a result of

Forestwide Management

Spruce Fir

disturbances. Ground cover consists primarily of needle cast, which ranges from 90 percent to 95 percent of the soil surface; plant basal area occupies the remaining 5 to 10 percent of the soil surface, contributing to a nearly completely covered ground surface. There are no signs of compaction or accelerated erosion, and the soil is functioning properly. The ability of soil to maintain resource values and sustain outputs is high.

Objectives

1. Complete the Pinaleno Ecosystem Restoration Project within 10 years of plan implementation.

Guidelines

1. Vegetation treatments should be designed such that replacement structural stages are proportionally present to assure continuous representation of old growth over time.
2. Within cleared right-of-way boundaries, slash should be treated 3. Within foreground distance zones of trails, roads, use areas, and water bodies, (and especially in the immediate foreground within 300 feet of these areas), slash should be treated.
4. Slash from fuelwood harvest should be managed to a level compatible with the Forest Service's ability to protect the remaining resources.
5. Trees and shrubs that are retained during silvicultural treatments should be protected from scorching in subsequent burning treatments.
6. Large trees and snags at edges of meadows and forest openings should be retained.
7. Silvicultural treatments should be designed so that the structure and composition fall within the historic range of variability.
8. Large woody debris (such as logs, slabs, and bark) should be retained in amounts up to at least 5 tons per acre.
9. When thinning, conifer snags 18 inches or greater diameter-breast-height (DBH) at 1-2 snags per acre and oak snags 10 inches or greater DBH should be retained.
10. When thinning, downed logs 12 inches or greater at midpoint and at least 8 feet long at an average of 3 logs per acre should be retained.

Surveys for reforestation needs should be completed within two years following a wildfire other event greater than 200 acres.

Management Approaches

- Treating Forest pests and diseases, using chemicals if necessary, before they affect forests at the stand level.
- Preparing for emerging threats such as the spruce aphid and white pine blister rust by surveying for resistant populations, collecting seed and developing progeny tests (Spruce Fir only)
- Favoring natural regeneration where feasible unless the following circumstances exist: 1) endangered species habitat needs to be restored, 2) the time period of recovery is deemed excessive due to size of deforested area is large and seed sources for natural reforestation at distant, or 3) there is concern for loss of site capacity from soils loss or extreme competition with early seral species.

Forestwide Management

Spruce Fir

- Planting native species from local seed zones unless approved by Regional Geneticist (does not apply to short-term burned area response seeding).
- Maintaining a seed inventory for each major conifer species based on an seed collection plan approved by the Regional Geneticist
- Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determine the least costly manner of executing a treatment and determining priorities when funding prevents treatment of all acres.
-
-

Wildland-Urban Interface

Wildland–Urban Interface

General Description

The wildland-urban interface (WUI) includes those areas of human populations and their residences at imminent risk from wildfire, as well as human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that, if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but may also include the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved. These areas may be particularly susceptible to an increase in the severity and intensity of wildfires and flash floods, as are projected to increase under a changing climate.

Desired Conditions

As a result of vegetation management, most wildfires in the WUI are low- to mixed-severity surface fires that result in limited loss of structures or ecosystem function. Patterns of treatments are effective in modifying fire behavior.

WUI residents and visitors are knowledgeable regarding wildfire protection of their homes and property, including defensible space. People using WUI areas are educated about the potential danger of wildlife, particularly black bears and mountain lions, and measures they can take to prevent encounters.

WUI areas are accessible, allowing for improved safety and efficiency of wildfire suppression operations.

Objectives

1. Treat 5,000 to 10,000 acres in the WUI every year to reduce the risk of fire hazard to communities and the forest.

Guidelines

1. Public and firefighter safety should be the highest priority during all fire management activities.

Management Approaches

The following management approaches will help to achieve the desired conditions and objectives for the wildland-urban interface:

Forestwide Management

Wildland-Urban Interface

- Supporting the development and implementation of Community Wildfire Protection Plans.
- Encouraging landscape-scale planning for wildfire management across jurisdictional boundaries.
- Educating property owners on the need to take primary responsibility for maintaining a defensible space around their property.

Montane Meadows

Montane Meadows

General Description

High-elevation, or montane, meadows generally occur only within mixed conifer and spruce-fir vegetation types. Meadow size ranges from less than 1 acre to 30 acres. Montane meadows may have a defined channel system, generally at the lowest elevations. Common animal species occurring in the montane meadows include the Graham Mountains pocket gopher, long-tailed vole, wild turkey, Atlantis fritillary butterfly, and Weidemeyer's admiral butterfly.

Based on projections of future climate change for the region, montane meadows are susceptible to decreases in plant productivity from water limitations and increased heat, colonization of invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, wind storms, and ice storms). Montane meadows on the Coronado NF occur at the highest elevations and are highly fragmented, making them among the most vulnerable to a changing climate.

Desired Conditions

Vegetation composition includes junegrass, various sedges and docks, hemlock-parsley, native iris, native onion, and false hellebore. Trees are not common, with the exception of alder, which may be present near the edges of meadows. Soil is not compacted, and over 70 percent of the surface is occupied by plant basal area and herbaceous litter.

Guidelines

1. There should be no new water diversions in meadows unless it can be demonstrated that there would be no significant changes to the native plant assemblage, such as species diversity and biomass.
2. Meadows should not be used as staging areas for off-highway vehicles or livestock, or for storage of equipment or forest products.
3. Road construction or maintenance in meadows should be avoided. If these activities are necessary, they should be designed and implemented so that water flow, wetland recharge, and ecosystem function are not impaired.
4. When thinning edges of meadows and clearings, all large standing trees and snags greater than 12 inches diameter-breast-height should be retained.

Wetlands

General Description

Wetlands are characterized by low water flow and soils that are frequently or periodically saturated by ground or surface water. Wetland habitats contain a distinctive native plant community typical of saturated soils. Plants may include sedges, rushes, mosses, monkey flowers, lilies, and algae. Common animal species occurring in the wetlands include Northern raccoon, Arizona treefrog, Northern Mexican gartersnake, and Huachuca springsnail among other specialized aquatic invertebrates.

Based on projections of future climate change for the region, wetlands are susceptible to decreased soil moisture from increased evaporation and decreased surface water inputs during drought periods. Increased extreme precipitation events could lead to flash floods that could damage vegetation and be too rapid to be absorbed by underlying soils.

Desired Conditions

Water flow patterns and recharge rates in wetlands are similar to historic levels when possible, given projected changes in precipitation under and altered climate. Disturbances such as flooding and fire contribute to the episodic low velocity transport of sediments. Flood flows, when they occur, are spread across the floodplain and are not concentrated in channels. Plant and animal species that require wetland habitats have healthy, extant populations, within the natural constraints of the particular wetland community. Native macro-invertebrates are abundant and diverse. Endemic populations are stable. Non-native wetland species are non-existent or do not significantly impact native species; non-native grasses are not present, or are present in amounts that do not alter the fire regime.

Objectives

(Other relevant objectives are located under Natural Water Sources.)

1. Restore native vegetation and natural water flow patterns on at least 10 wetland sites within 10 years of plan approval
2. Maintain or increase the existing acreage of wetlands on the Forest over the 10-year period following plan approval.

Guidelines

1. Livestock grazing in wetlands should only be allowed when a site-specific analysis has determined that there would be no significant deleterious effects to wetland form or function. Analysis should consider grazing season, timing, intensity, duration, and frequency.
2. Road construction or maintenance in wetlands should be avoided. If those activities are necessary, they should be designed and implemented so that water flow, wetland recharge, and ecosystem function are not impaired.

Standards

1. The total acreage of existing wetlands will not be diminished due to management activities.

Forestwide Management

Management Approaches

Wetlands

- Acquiring, if and when possible, water rights to diversions that are currently limiting wetland recharge, and restoring water flow to as near the natural pattern and volume as possible.
-

Riparian Areas

Riparian Areas

General Description

Riparian areas occur in channels throughout all vegetation types. Vegetation supported within riparian areas varies with watershed size, geology, elevation, and aspect. Riparian area health is largely dependent on the storage and movement of sediment through the channel system. Natural disturbances (including flooding, scouring, and drying out) result in changes that promote a diverse channel community structure necessary for recruitment of riparian species. Common animal species occurring in riparian areas include Arizona gray squirrel, white-nosed coati, gray hawk, elegant trogon, eared quetzal, sulphur-bellied flycatcher, rose-throated becard, canyon spotted whiptail, Mexican gartersnake, Tarahumara frog, wet canyon talussnail.

Based on future climate projections, riparian areas are susceptible to changes in the frequency, intensity, timing, and spatial extent of extreme weather events (e.g., droughts, flash floods, landslides, and wind storms). These events, coupled with increased ambient air and soil temperatures, can create corresponding shifts in plant evapotranspiration rates, water infiltration, overland flow, erosion, sediment delivery, and loss of organic ground cover.

Cottonwood-Willow Riparian Forest

Where soil and channel confinement conditions permit, this low-elevation type is found along channels within desert communities, desert grasslands, plains grasslands and savannah communities, interior chaparral, and Madrean encinal woodlands. Species include but are not limited to Fremont cottonwood, velvet ash, Arizona sycamore, Arizona walnut, Goodding willow, yewleaf willow, and Arizona cypress. Channel banks may be composed of bedrock, boulders, or soil.

Mixed Broadleaf Forest

This mid-elevation vegetation is found along channels within desert grasslands, plains grasslands and savannah communities, interior chaparral, Madrean encinal woodlands, and Madrean pine-oak woodlands. Vegetation includes many tree species, both upland and true riparian. True riparian species include but are not limited to Fremont cottonwood, Arizona sycamore, velvet ash, Arizona walnut, and a variety of willows. The forest often contains oaks and conifers from upstream and adjacent uplands. The majority of trees and ground vegetation are native. Channel banks may be composed of bedrock, boulders, or soil.

Montane Willow Forest

This high-elevation vegetation type is found along channels within Madrean pine-oak woodlands, ponderosa pine-evergreen oak forest, mixed conifer forest, and spruce-fir forest vegetation types. There are many tree species, both upland and true riparian. Species include but are not limited to box elder, Arizona

sycamore, velvet ash, Arizona walnut, Arizona alder, Arizona cypress, and willows. The forest often contains oaks and conifers from upstream and adjacent uplands. Channel banks may be composed of bedrock, boulders, or soil.

Desired Conditions

Channels and their adjacent floodplains are capable of filtering sediment, capturing bedload, aiding floodplain development, improving flood-water retention, and increasing ground-water recharge. Vegetation and root masses stabilize streambanks against the cutting action of water currents. All trees and ground vegetation are native. The ecological condition of riparian areas is resilient to animal and human use. Tree canopy cover is between 30 and 100 percent. Soil banks are 70 to 100 percent occupied by vegetation.

Where water is perennial, stream flows and water quality characteristics (as described in the desired conditions for Natural Water Sources) support aquatic wildlife. Native fish and other aquatic species are present, and habitat conditions are capable of providing self-sustaining populations. Native fish and amphibian populations are free from or minimally impacted by non-native predation and diseases. Habitat and ecological conditions are capable of providing self-

sustaining populations of native, riparian-dependent plant and animal species. Fire rarely burns through this vegetation type, and fire in the surrounding watershed periodically provides slight increases in sediment and water that cause minimal channel modification.

Objectives

By the end of the first decade following plan approval:

1. Apply for at least 10 instream flow water rights on streams for recreation and wildlife purposes, including fish.
2. Treat 2,500 to 10,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to maintain watershed stability and, thereby, the structure and function of streams, floodplains, and riparian vegetation.

Guidelines

1. Livestock grazing in riparian areas should only be allowed when a site-specific analysis has determined that there would be no significant deleterious effects to riparian area form or function. Analysis should consider grazing season, timing, intensity, grazing period and frequency.
2. Vegetation treatments should favor the retention of snags and growth of large riparian trees.
3. Silvicultural treatments in riparian communities should be designed so that the resulting vegetation structure and composition fall within the historic range of variability.
4. Vegetation treatments should favor the retention of large-diameter woody debris in and near stream channels.
5. New roads should not be located in riparian areas.
6. Riparian areas should not be used as points of ignition for prescribed burns.

Forestwide Management

Riparian Areas

7. Road construction and realignment of existing roads should be avoided in riparian areas; when necessary to build roads in riparian areas, use design options that preserve natural water flow and native vegetation communities.

Management Approaches

The following management approach will help to achieve the desired conditions and objectives for riparian areas:

- Cooperating with neighboring agencies and landowners when making decisions about managing riparian areas.
-

Biophysical Features

Biophysical Features

General Description

Biophysical features include natural and man-made structures such as caves and karst, cliffs, talus slopes, rocky outcrops, rock cavities and abandoned mines. They also include non-mineral features such as snags and large woody debris. Biophysical features occur in all vegetation types and at all elevations throughout the Forest. These features provide specialized seasonal and year-round habitats for a variety of wildlife species including bats, cliff-nesting birds, talussnails and several unique montane reptiles and amphibians. Several species of rare plants are adapted for growth on rocky sites and cliff faces. Underground features such as caves often contain unique geological, archeological and biological resources. Animal species found in caves and mines range from cave-obligate pseudoscorpions to many species of bats to opportunistic users like black bear, ringtail and black-tailed rattlesnake. Species associated with rocky areas and cliffs include desert bighorn sheep, Peregrine falcon, Yarrow's spiny lizard, rock rattlesnake, barking frog, and talussnails. Rare plant species found in rocky sites include Bartram's stonecrop, Catalina beardtongue and many others.

Desired Conditions

Cliffs and rock outcrops support nesting, roosting, and feeding habits of birds of prey, desert bighorn, bats, snails, western barking frogs, and other species. Rock climbing and related recreational activities are compatible with the protection of resident wildlife and plant species, and do not diminish the quantity or quality of specialized vegetation and wildlife habitat. Rockslides and talus slopes are undisturbed, providing habitat for wildlife such as lizards, snakes, and land snails. Talus slopes maintain near-historic levels of moisture and are free from excessive sedimentation. Rocky habitats occupied by species of conservation concern are maintained.

Standing dead trees, tree hollows, cavities, loose bark and downed woody debris are available in all vegetation communities for retention of wildlife values.

Objectives

1. Install an average of two wildlife-friendly closures at mines, caves or adits each year during the plan period.

Guidelines

Relevant guidelines and standards are also found in the Vegetation, Wildlife and Minerals sections of this plan.

1. Talus slopes should not be altered and materials should not be removed from them. In areas that harbor talussnails, vegetation treatments should be designed to retain microhabitat characteristics for endemic snails and other talus-dependant species.
2. Management activities should be designed to avoid or minimize the alteration of naturally occurring rocky outcroppings or cliff faces.
3. Environments in caves and abandoned mines should not be altered except where necessary to protect associated natural resources or to protect health and safety. Where mine closure is necessary to protect human health and safety, closures should preserve habitats for roosting bats and avoid direct impacts to bats.
4. Surface management activities in the vicinity of cave and karst features should avoid actions that would significantly impact underground ecosystems by modifying drainage patterns, subsurface airflow or other natural processes.

Standards

1. When closing mine features and caves to public entry, shall conduct pre-closure inspections to determine if cave-dependent or other species are present. Closures will be designed and implemented to address the needs of resident or historically occurring wildlife within the constraints of meeting public safety needs.

Management Approaches

The following management approaches will help to achieve desired conditions and objectives for biophysical features:

- Managing identified bat roosts to provide for the enhancement and protection of bat populations. Protection measures may include seasonal closures, public education, and wildlife-friendly gates.
- Preparing specific management prescriptions for caves with high resource, educational or recreational values, hazardous conditions, or heavy use. These prescriptions should include guidelines for appropriate use, necessary restrictions, and monitoring requirements. Planning priority is for those caves currently under permit.
- Managing bat roosts in consultation with state and federal wildlife agencies. Engaging caving organizations in cave-management activities, such as seasonal surveys, closures, and wildlife-friendly gate development at specific sites.
- Engaging climbing organizations in cliff management activities, such as seasonal surveys, closures and education.
- Recommending for withdrawal from mineral entry those areas needed to protect caves from mining activities.

Natural Water Sources

General Description

There are approximately 100 miles of perennial streams and 400 springs and seeps on the Coronado NF. All streams, springs, and seeps are small, with a low volume of surface water generally present. Many springs and seeps are developed in a manner that diverts water from the natural source for uses such as livestock and wildlife watering and domestic use. Most species of animals need water to drink. Species that need it for other critical life history components (e.g., breeding, feeding, respiration) include lowland and Chiricahua leopard frogs, Arizona treefrog, Sonoran mud turtle, Couch's spadefoot, tiger salamander, Mexican gartersnake, checkered gartersnake, black-necked Gartersnake, Gila chub, Gila topminnow, desert sucker, Huachuca springsnail, Stephan's riffle beetle, predaceous diving beetle, giant water bug, and many species of insects with aquatic larvae.

Based on projections of future climate change for the region, natural water sources are susceptible to increased evaporation from warmer temperatures and altered frequency and severity of both droughts and flash floods. Water resources are also at risk due to competing demands for multiple uses. These effects place additional stress on native species that depend on them for their life histories, especially if these species also rely on a narrow range of water temperatures.

Desired Conditions

Landscape Scale

Watersheds, streams, wetlands, and riparian areas have characteristics, processes, and features consistent with their natural condition. Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances, including climate variability and change. Water resources maintain the capability to respond and adjust to disturbances without long-term adverse changes. Vegetation conditions (as described in each section above) contribute to maintaining downstream water quality, quantity, and aquatic habitat features. Upland soil erosion contributes sediment in amounts that do not impair stream function or water quality.

Mid-Scale

In-stream flows provide for recreational uses and wildlife habitat, including fish. They also provide for channel and floodplain maintenance, recharge of riparian aquifers, and water quality. Stream flows provide connectivity among fish populations and provide unobstructed routes critical for fulfilling the needs of aquatic, riparian-dependent, and many upland species of plants and animals. Water quantity and quality meet the needs for livestock, recreation, road construction, fire fighting, domestic use, and other authorized activities. Stream channels and floodplains are dynamic and resilient to disturbances.

The water and sediment balance between streams and their watersheds allow a natural frequency of low and high flows. Extreme flooding rarely occurs, and occasional flooding does not disrupt normal stream characteristics (e.g., water and sediment transport, woody material) or considerably alter stream

dimensions (e.g., bank-full width, depth, slope, sinuosity). Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare. Water quality meets or exceeds State of Arizona, State of New Mexico, and/or Environmental Protection Agency standards for designated uses. Water quality meets critical needs of aquatic species. Non-point-source pollution of streams and lakes from sediment, excessive nutrients, or hazardous chemicals does not reduce water quality beyond the state standards for Arizona and/or New Mexico.

Fine Scale

Infiltration at outflows allows for soil moisture recharge, supporting the native assemblages of vegetation.

Objectives

1. Apply for at least 10 in-stream flow water rights on streams for recreational purposes and wildlife habitat, including fish, within 10 years of plan approval.
2. Reconstruct at least 3 developed springs within 10 years of plan approval to provide aquatic habitat for the recovery of plant and/or animal species.
3. Complete 3 stream restoration and/or development projects to benefit aquatic species of conservation concern within 10 years of plan approval.

Guidelines

1. Projects in upland habitats adjacent to streams should be designed to minimize input of sediment to streams.
2. Water quality, quantity, and habitat features at natural springs and seeps should be protected or enhanced.
3. Should reduce fuel build up around natural water sources to protect them from catastrophic fire.
4. Management activities should not impair soil moisture recharge at outflows of natural water sources.
5. Projects affecting perennial streams should be designed and constructed to allow for the natural in-stream movement of native fish, except where barriers are necessary to preclude the movement of non-native species.

Management Approaches

- Cooperating with Arizona Department of Environmental Quality and New Mexico Environment Department to meet water quality standards.
- Actively participating in the Gila River water rights adjudication in order to meet water needs for livestock, recreation, and other authorized activities.
- Considering all available techniques for eradicating undesirable aquatic species.
- Implementing Total Maximum Daily Load plans to enable the Forest to meet or exceed State of Arizona or Environmental Protection Agency water quality standards for designated uses.

Constructed Waters

General Description

There are approximately 400 developed springs, 300 wells, and 1,100 stockponds on the Coronado NF. These constructed water facilities provide surface water resources, in many cases perennial, which augment natural water resources. The structures include earthen stock ponds, reservoirs, wildlife drinkers, and concrete or steel storage tanks or watering troughs. These facilities can often provide valuable habitat features for native wildlife such as Sonora tiger salamander, but can also harbor invasive aquatic species such as American bullfrogs, crayfish and green sunfish that prey on or compete with native wildlife. Poorly designed waters can entrap native wildlife or be inaccessible.

Based on projections of future climate change for the region, constructed water sources are susceptible to increased evaporation from warmer temperatures and altered frequency and severity of both droughts and flash floods. Water resources are also at risk due to competing demands for multiple uses. These effects place additional stress on native animal species that depend on them as a water source. However, a reduction in water availability could lead to a reduction in or slow of non-native aquatic species invasions.

Desired Conditions

Artificial structures for holding standing water (such earthen stock ponds, reservoirs, wildlife drinkers, concrete or steel storage tanks or watering troughs, and habitat restoration ponds) are distributed across the landscape in a pattern and density sufficient to sustain wildlife and livestock. Water sources are perennial where possible, providing a high-quality supply of water and aquatic habitat for plants and animals.

Constructed waters that are used for livestock watering are available for and used by native species. They provide environments that encourage the reproduction of native aquatic organisms and provide important refugia for native wildlife during periods of drought, which are projected to be more frequent under future climate conditions. If aquatic invasive species, such as American bullfrogs, northern crayfish, green sunfish, non-native tiger salamanders, non-native mollusks, and non-native aquatic plants are present, their numbers are low and can be controlled. Water borne disease, if present, do not spread among ponds. Water quality is high, and organic pollutants such as nitrates, nitrites, phosphates, and sulfur compounds are at levels that are non-toxic to native species.

Objectives

1. Install wildlife escape ramps in all above-ground constructed waters within 8 years of plan approval.

Guidelines

1. Wildlife escape ramps should extend to the bottom and near edge of above-ground constructed waters, and at an angle to avoid entrapment of wildlife underneath the ramp.

Forestwide Management

Constructed Waters

2. Artificial waters constructed for livestock should be designed and/or retrofitted to provide a year-round drinking and habitat resource for native wildlife.

Standards

1. No constructed water source will be removed or altered such that water quantity is reduced, unless an alternative water source is constructed.

Management Approaches

- Working closely with Fish and Wildlife Service and state wildlife management agencies to ensure the viability of native aquatic species.
- Cooperating with range permittees and state wildlife management agencies to maximize the benefits of artificial water developments for all uses.
- Diverting overflow, where possible, to allow for soil moisture recharge and wetland habitat features.
- Considering all available techniques for eradicating undesirable aquatic species.
- Seeking opportunities to educate the public about the threats posed to native species by invasive aquatic species.

Soil

Soil

General Description

Soil is the mineral and organic matter that occurs on the land surface throughout all vegetation types. It is characterized by horizons or layers that are distinguishable from the parent material beneath as a result of weathering of that parent material, additions of organic matter, and chemical and physical processes. It is the transition area between air and the parent material beneath, and makes a site capable of supporting vegetation. Soil can be shallow (less than 20 cm) or deep (200 cm) and may contain varying amounts of sand, silt and clay particles, as well as all sizes of unweathered rocks. Regardless of the depth, the surface is extremely important as it must provide for the exchange of gases and water infiltration. Compaction of the surface, removal of the surface layer (erosion), or removal of vegetation can all affect the processes soil carries out in its role of supporting vegetation communities.

Based on projections of future climate change for the region, soils are susceptible to water limitations and increased evaporation from increased temperatures. Longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (e.g., droughts, flash floods, landslides, wind storms, and ice storms) could make soils more susceptible to erosion.

Desired Conditions

Ecological and hydrologic functions are not impaired by soil compaction. The soil condition rating is satisfactory across the forest,. Vegetation and litter limit the formation of rills, gullies, and pedestals; excessive soil deposition, and topsoil loss. Soils provide for diverse native plant species. Vegetative ground cover is distributed across the soil surface as described in forestwide vegetation

Forestwide Management

community desired conditions and promotes nutrient cycling and water infiltration.

Soil

Objectives

1. Enhance or restore 2,500 to 15,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to attain soil condition indicators of ground cover by litter and ground cover by plant basal area within 10 years of plan approval.

Management Approaches

- Prioritizing watershed improvement projects based on implementing objectives for vegetation communities

Air

Air

General Description

Air above the Coronado NF is divided into five airsheds, four in Arizona and one in New Mexico. Airsheds are used to describe air quality related values (AQRVs) and impairment by pollutants, including smoke and emissions from permitted activities. The Clean Air Act as amended assigns federal land managers, in this case the forest supervisor, the responsibility to protect AQRVs in Class I attainment areas, and to protect human health, plant and animal health, and visual quality in all areas. There are two Class I attainment areas within the Coronado NF: the Chiricahua Wilderness Area and the Galiuro Wilderness Area. Two additional Class I attainment areas are adjacent to the Coronado NF; Saguaro National Park and Chiricahua National Monument. Of the various Coronado NF programs, fire management has the most notable activities that involve air quality.

Based on projections of future climate change for the region, airsheds are susceptible to increased levels of pollutants (particulates and aerosols) resulting from longer, more severe fire seasons, increased occurrence of warmer air masses that can suspend higher concentrations of pollutants, and frequent or intense wind storms that can transport pollutants short and long distances.

Desired Conditions

Air quality above the Coronado NF meets state air quality standards, including visibility and public health. Air quality-related values, including high-quality visual conditions, are maintained within the Class I airsheds over the Galiuro and Chiricahua Wildernesses.

Management Approaches

- Participating with the States of Arizona and New Mexico in the air quality regulatory process by reviewing air permit applications for new and modified industrial facilities to ensure that their air emissions do not adversely impact the air quality-related values (such as visibility) of federally protected wilderness areas.
- Considering Class I and Class II airsheds when determining the response to wildland fires.
-

- Managing and coordinating the timing, duration, and frequency of planned ignitions throughout the Forest to minimize regional impacts to air quality.

Animals and Rare Plants

General Description

The Coronado NF has the highest biological diversity of any national forest in the western United States of America. This is because it is situated at a convergence zone of ecological regions, has a wide variety of vegetation communities, and has steep elevational gradients. Biological diversity is further enhanced by a long growing season, bi-modal precipitation, and the evolutionary consequences of isolation of the sky island mountain ranges.

The number of species inhabiting the Coronado NF and adjoining lands is not precisely known, and new species are periodically described. Conservative estimates include about 2,100 species of plants, 466 species of birds, 110 species of mammals, 91 species of reptiles, over 240 species of butterflies, and nearly 200 species of mollusks

Based on projected future climate change, terrestrial wildlife species are susceptible to habitat loss and fragmentation resulting from more frequent or extreme disturbance events, including wildfire, droughts, flash floods, landslides, and wind storms. Wildlife species are also susceptible to alterations in the timing of plant phenology events (green-up, flowering, fruit ripening, etc.), especially those that influence critical life behaviors (migration, breeding, and dispersal).

Based on projected future climate change, aquatic species are susceptible to increased water temperatures, altered seasonal discharge events, increases in drought severity during summer flows, and increased predation pressure. There may be decreases in water flow, and possibly, a shorter period of sustained flows in the spring due to reduced winter snowpack. Sustained flows and desired temperatures in the spring are needed for successful spawning. There also may be the potential for fragmentation of habitat, with resulting increases in competition and predation in pools, due to little or no water flow in some stream segments.

Desired Conditions

Naturally occurring native ecosystems are present and sustainable across the Coronado NF, providing habitat to support a full complement of plants and animals. Habitats are interconnected within the Forest boundary while the interspaces between Ecosystem Management Areas allow for movement of wide-ranging species and promote natural predator-prey relationships.
Forest boundaries are permeable to animals of all sizes and offer consistent, safe access for ingress and egress of wildlife. In particular, segments of the Forest boundary identified in Figure 2[5] remain critical interfaces that link wildlife

[5] Boundary areas were selected using data from Arizona's Wildlife Linkages Assessment, an interagency effort available at http://www.azdot.gov/Highways/OES/AZ_WildLife_Linkages/assessment.asp

Forestwide Management

Animals and Rare Plants

habitat on both sides of the boundary. Fences, roads, recreational sites, and other man-made features do not impede animal movement or contribute to habitat fragmentation.

The collection of animals and plants (e.g., butterflies, mushrooms) does not negatively impact species abundance. Native species that are known to have been present during the first decade of the twenty-first century continue to exist, and none have been extirpated.

Fire-adapted native plants are relatively abundant and fire functions as a critical natural process. Trees in terrestrial and riparian areas provide structural features that accommodate arboreal species such as cavity-nesting birds. Naturally occurring ground structures similarly allow for resting, breeding, and foraging activities by a variety of species. Bats and other cave-dependent wildlife have high-quality habitat in caves and abandoned mine features. Permitted activities, such as livestock grazing, outfitter guiding, and ecotourism guiding, do not compromise healthy populations of native species, nor do they adversely impact habitat components. Hunting, fishing, and other wildlife-based recreation activities are encouraged where wildlife populations are flourishing. Human-wildlife conflicts are rare.

Non-native species occur only where populations are manageable and/or desirable; generally, they are rare across the Forest.

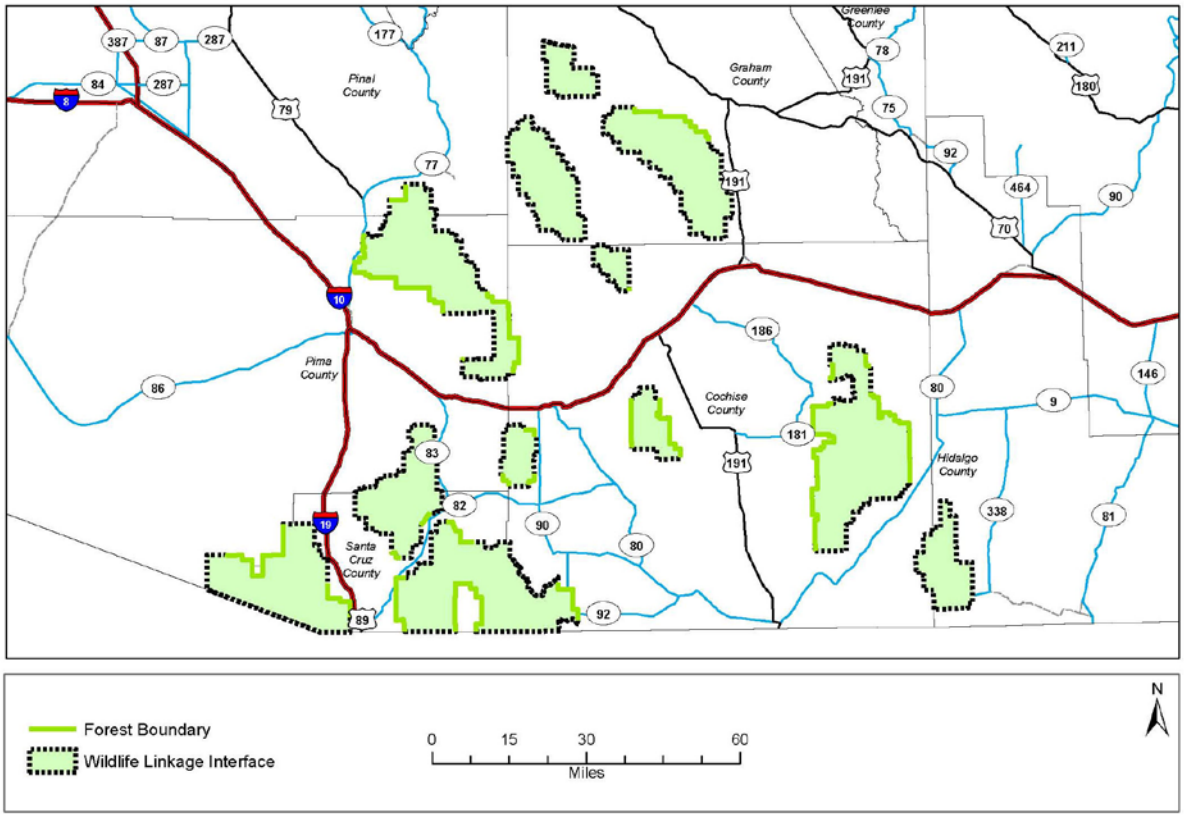

Figure 2. Wildlife Linkages Interface

Forestwide Management

Animals and Rare Plants

Guidelines

Guidelines for protecting wildlife, fish, and rare plants are also found in various other sections of chapters 2, 3, and 4.

1. Guidelines for protecting northern goshawks:

a. A minimum of three goshawk nest areas and three replacement nest areas should be located per goshawk territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (NW to NE) aspects. Nest areas should generally be 25 to 30 acres in size[6].

b. Goshawk post-fledging areas (PFAs) of approximately 420 acres in size should be designated surrounding the nest sites[7].

c. In goshawk foraging areas and PFAs, groups of 3 to 5 reserve trees should be retained within management-created openings greater than 1 acre in ponderosa pine-evergreen shrub and dry mixed conifer communities, and 6 reserve trees should be retained within management-created openings greater than 0.5 acres in wet mixed

[6] Adopted from: Reynolds et al, 1992. Management Recommendations for the Northern Goshawk in the Southwestern United States; pages 21-22, Nest Area Management Recommendations.
[7] Ibid.

conifer and spruce-fir communities[8].
d. In occupied goshawk nest areas, human presence should be minimized between March 1 and September 30[9].
2. Active raptor nests on cliff faces should be protected from disturbance during the nesting season.
3. Management activities should be restricted at nest areas of Mexican spotted owls during the breeding season; additionally, nest trees should not be modified by any activity occurring outside of the reproductive period.
4. Wildlife-resistant trash cans should be at all developed recreation areas; additionally, wildlife-resistant food storage boxes should be at all developed campgrounds.
5. Identified bat roosts should be protected from disturbance during periods of bat occupancy. During non-occupancy periods, activities should not modify biophysical features that contribute to roost habitat quality or contribute to the spread of diseases harmful to bats.

Standards

Standards for protecting wildlife, fish and rare plants are also found in various other sections of chapters 2, 3 and 4.
1. The current configuration of existing protected activity centers (PACs) will be retained as functional units for the conservation of Mexican spotted owls.

Management Approaches

- Maintaining strong partnerships between the Forest Service, state and federal agencies, county and local governments, and non-governmental organizations to accomplish conservation planning and management.
- Using results from the monitoring of management indicator species to design adaptive management strategies to meet species conservation needs.
- Cooperating and collaborating with state and federal wildlife management agencies and other partners to monitor wildlife, fish, and rare plant species occurring on Forest Service administered lands.
- Coordinating with Animal and Plant Health Inspection Service Wildlife Services and state and federal wildlife agencies to resolve wildlife resource conflicts on Forest Service-administered lands.
- Cooperating with state and federal agencies, counties and municipal governments, and non-government organizations to re-establish extirpated species, recover federally listed species, and to manage Forest Service sensitive species in a way that prevents trends toward federal listing.
- Coordinating with county, municipal, state and federal agencies, adjacent landowners, and non-governmental organizations to ensure habitat connectivity between sky islands is preserved, restored, and enhanced for wildlife utilizing corridors between Forest blocks; in particular, Forest boundaries identified as being critical for wildlife ingress and egress (see Figure 2) are prioritized during coordinated efforts.
- Considering potential changes in climate when designing projects and analyzing the effects of proposed projects on wildlife species, especially those species that have been identified as being sensitive to change.
-

[8] Ibid.
[9] Ibid.

- Considering the reintroduction of extirpated species where appropriate, reasonable, and desirable.

Invasive Species

General Description

Some non-native plants and animals are classified as invasive species. Both terrestrial and aquatic invasives are a growing threat to native species, ecosystem function, and the quantity of forest goods and services. Invasive plants, such as buffelgrass, threaten native plant communities by competing for resources. Even though complete eradication of invasives is not always possible, aggressive control of existing populations is important to protect native ecosystem diversity. Certain species may not be eliminated regardless of forest managers' best efforts.

Based on projections of future climate change for the region, conditions could favor the spread and establishment of invasive species, which are often more widely adapted to a range of climates and often early colonizers following disturbances.

Desired Conditions

Infestations of invasive exotic plants do not contribute to the loss of native species or impairment of ecosystem function. Invasive animals are non-existent or occur in low numbers and do not significantly affect the productivity or sustainability of native wildlife.

Objectives

See objective for Desert Communities.

Guidelines

1. Habitat improvement and aquatic restoration projects within or adjacent to water sources occupied by ranid frogs, Mexican Gartersnake, Sonoran Tiger Salamanders or native fish should include provisions to remove non-native invasive animals.

Management Approaches

- Detecting and treating new populations of invasive species before they become established.
- Eradicating or managing invasive species with a coordinated forestwide approach using integrated pest management.
- Coordinating the Forestwide integrated pest management approach with the plans and efforts of other federal, state, and local agencies, non-governmental organizations, volunteers, partners, and landowners.
- Developing treatment plans and actions that are responsive to current guidance regarding public and ecosystem health, and that contribute to the protection and recovery of federally-listed and Forest Service sensitive wildlife and plant species.
- Following the Forest Service Guide to Noxious Weed Prevention Practices.

Forestwide Management

Forest Products

Forest Products

General Description

Common forest products available from the Coronado NF include sawlogs, firewood, cactus, and beargrass. Sawlogs and firewood are generally available as by-products of forest restoration or forest fuels reduction projects. Other less common forest products include manzanita, ferns, and mushrooms.

It is unclear how a changing climate may alter the availability of forest products in the future. Some species that are more adapted to drier climates may be more abundant, while others may become less abundant. An increased need for fuels reduction and restoration projects to restore ecosystem resilience may increase the availability of sawlogs and firewood during some periods.

Desired Conditions

A sustainable supply of wood products (e.g., small roundwood, sawlogs, biomass, firewood) and other products (e.g., Christmas trees, beargrass, cactus, ferns, and fungi) are provided within the capacity of the land to produce these goods. Results of silvicultural treatments reflect natural disturbance regimes and contribute to ecosystem sustainability. Forest products, particularly those related to wood fiber are made available as part of fuel treatment projects and restoration activities.

Management Approaches

- Making timber and other forest products available for the public either through personal-use permits or commercial sales
- Working with agencies and private organizations to promote forest product use where it is available as a result of forest management activities.
- Encouraging use of forest products in lieu of onsite burning or chipping through stewardship contracting.
- Ensuring the continued sustainability of special forest products, such as tree boughs, firewood, posts and poles, wildflowers, mushrooms, grasses, seeds, nuts, cones, and berries through monitoring commercial sales and free-use permit harvest levels.
- Recognizing the rights of members of tribes whose aboriginal territories include the land now administered by the Coronado NF to collect forest materials for traditional, cultural, and religious uses.
- Collaborating through government-to-government agreements with tribal governments on the management of species important to maintaining the social and cultural well-being of tribes.

Minerals

Minerals

General Description

The potential for locatable minerals within the boundaries of the Coronado NF is high because the geology of the sky island makeup of the forest exposes mineralized and uplifted mountain blocks managed by the forest. These sky islands lay within a broad swath cutting across the continent characterized by significant mineralization. There are numerous mining claims throughout the forest, but most prominently within the Sierra Vista and Nogales Ranger

Forestwide Management

Districts. Common variety, or saleable, minerals have never been a significant component of minerals operations on the forest and there are no saleable mineral operations on the forest at this time.

Forest Products

Desired Conditions

Opportunities for environmentally sound minerals development are available. Important wildlife habitats, visually sensitive areas, and areas with large capital investments are protected through surface occupancy restrictions imposed on locatable mineral activities. Adverse surface resource impacts are minimized through the appropriate administration of mineral laws and regulations.

All mineral exploration and mining activities are operating in environmentally sound ways so as to minimize environmental impacts to other Forest resources through protection and mitigation measures, including adequate post-mining reclamation assurances. Abandoned and inactive mines disturbed by past mineral exploration and mine development have been returned to stable conditions and an appropriate, functioning, vegetative state, and do not pose health, safety, or environmental hazards. Sites identified as candidates for or designated as having special status are protected from entry under the mining laws.

Guidelines

1. Talus slopes should not be used as a source of building materials.
2. Mine reclamation should utilize a geomorphic approach that results in landforms similar to adjacent natural terrain and hydrologic functions similar to natural systems in order to minimize long-term monitoring and maintenance requirements.
3. Mining activities should incorporate reclamation measures that reduce contrasts with the surrounding landscapes.

Standards

1. Approved occupancy on National Forest lands for mining purposes is restricted to site security measures. Permanent structures and/or occupancy are limited to only those that are necessary and incidental to approved mining operations.
2. Mine reclamation treatments will be conducted using only native species.

Management Approaches

- Using operating plans and bonds for rehabilitation to protect and restore surface resources.

Public Access

Public Access

General Description

Public access to the Coronado NF is provided through a system of forest arterial, collector, and local roads and trails, which are interconnected with public roads, highways, and trails (local, county, state, and other federal) within, adjacent to and adjoining the National Forest. Within the Forest boundary, there are numerous scattered private inholdings with roads and trails often crossing these inholdings to access National Forest System (NFS) lands adjacent to and adjoining them. At the Forest boundary, there are about 300 motorized access

points, most of which are located at an interface of NFS and non-federal lands (state, county, private and other ownerships). There are also a number of trailheads located at the Forest boundary that provide non-motorized access to wilderness areas and NFS lands. Many roads and trails that provide access to NFS lands across non-federal lands (state, county, private and other ownerships) within and adjacent the Coronado NF have no legal right of public access (written and unwritten title) and may be closed without notice.

Desired Conditions

Permanent legal access to and within the Coronado NF for public and administrative users is available and easily accessible on a system of forest arterial, collector, and local roads and trails which are interconnected with public roads, highways, and trails (local, county, state, and other federal) adjacent to, adjoining, and within the National Forest.

Legal status deficiencies of the existing system of forest roads and trails have been resolved; these roads and trails are available for use by public lands users, unless restricted for administrative purposes.

Motorized and non-motorized access to forest roads and trails from non-federal lands (state, county, private, and other ownerships) adjacent to, adjoining, or within the Coronado NF unavailable and closed to the general public by a non-federal landowner or agency (exclusive non-federal access) are limited to use for administrative purposes or only when specifically authorized under the terms of a Forest Service permit.

The proliferation of user-created roads and conflicts between public land users and private landowners due to blocked or controlled forest motorized and non-motorized access through non-federal lands (state, county, private, and other ownerships) adjacent to, adjoining, or within the Coronado NF has been minimized and rarely occurs.

Objectives

Within the first decade following plan approval:

1. Allow no net loss of public access, unless restricted for Forest Service administrative purposes.
2. Increase the number of permanent legal access routes to and within the Coronado NF by resolving the legal status deficiencies of 40-50 existing and proposed forest roads and trails, using a variety of methods.

Guidelines

1. Where no legal right of public or administrative access exists (written or unwritten title) or can't be determined, needed right-of-way easements for existing and proposed roads and trails through non-federal lands (state, county, private, and others) adjacent to, adjoining, within, or a combination thereof, should be acquired using a variety of methods.
2. If a non-federal landowner or agency (state, county, private, and other ownerships) is unwilling to grant needed right-of-way easements for an existing or proposed road or trail alignment, the road or trail should be realigned, reconstructed, and/or constructed around the non-federal land onto NFS, other federal and non-federal lands (state, county, private, and other ownerships), or a

Forestwide Management

Public Access

combination thereof, where a permanent legal right of public access exists, can be secured, or is unneeded.

3. Exclusive motorized and non-motorized access routes across NFS lands to the forest system of roads and trails from adjacent private developments, and subdivisions, and other non-federal ownerships (state, county, and others) should not be authorized.

4. Access routes across NFS land to the forest system of roads and trails from adjacent private developments, subdivisions, and other non-federal ownerships or agencies (state, county, and others) should be available for use by the general public.

Standards

1. Where an existing road through non-federal lands (state, county, private, and other ownerships) to and within the Coronado NF that has traditionally provided public access to the forest system of roads and trails is closed to general public use by a non-federal landowner or agency (state, county, private, and other ownerships) and a right of public access (written or unwritten title) does not exist:

a. Limit the use of the road(s) across NFS lands to administrative purposes or only where specifically authorized under the terms of a permit.

b. Do not allow ancillary uses of roads that are not open to the general public outside the terms of a permit.

Management Approaches

- Determining the legal status of an existing forest road and trail that has been closed by a non-federal landowner or agency (private, state, county, and other ownerships).
- Work closely and in partnership with private landowners, county, state, and other federal agencies, third-parties, interested organizations, and individual publics to resolve public access issues and to ensure permanent legal public access to the various parts of the Forest on local, county, state, or permanent NFS roads and trails that meet Forest management objectives.

Motorized Transportation System

Motorized Transportation System

General Description

The motorized transportation system available for public use is displayed on the Motor Vehicle Use Maps (MVUM). The MVUM include designated roads, trails, and areas for each ecosystem management area. The designations include vehicle class, time of year of use, and any designations for dispersed camping or game retrieval. The MVUM are reviewed and updated an needed on an annual basis. The Coronado NF motorized transportation system also includes National Forest System roads that are only available for administrative and permitted use. This system of roads is not displayed on the MVUM.

Based on projections of future climate change for the region, roads are susceptible to the altered frequency, severity, timing, and spatial extent of disturbance events (e.g., flash floods and landslides). Increased recreational use to escape summer heat could lead to additional wear and tear and heavy use of roads in some areas.

Forestwide Management

Motorized Transportation System

Desired Conditions

The Coronado NF has a designated system of routes open for motor vehicle use by the public. The motorized transportation system is environmentally sustainable and meets public needs and desires under a changing climate. It provides access to National Forest System (NFS) lands for public and administrative use. Access roads to wilderness trailheads or wild backcountry trails/routes are maintained for safe travel by trail users. Visitors are respectful and stay on designated routes: they do not create new routes or expand existing trails, they avoid sensitive habitats like wetlands and meadows, and they cross streams only at fords where the road or trail intersects the stream. Each NFS road has a clear purpose, and redundancy is minimized. Class of vehicle is appropriate for a given road level, and user conflicts are minimal. Arterial access roads are readily identifiable and have surfaces that are suitable for passenger car use and emergency vehicles. There is adequate signing to assist travelers in finding their destination. The occurrence of gullies, washouts, or slides is minimal. Road edges are intact and safe even in excessive traffic areas. There are adequate turnouts or passing areas and adequate sight distances available.

High-clearance roads and motorized trails are available for exploring the forest in off-highway vehicles (OHVs) in a responsible and respectful manner. Users do not cause unacceptable resource damage or create unauthorized routes. Roads are suitable for low traffic volume and low speed. Road surfaces are primarily rough or primitive, but most are available for use by the more experienced traveler with a high ground-clearance vehicle. These roads provide opportunities in appropriate places for safe, responsible motorized recreation and provide varying backcountry touring experiences for a variety of vehicle classes. Long-distance loop routes provide opportunities for extended day trips with varying levels of challenge. Where appropriate, motorized trails provide a distinct backcountry touring experience for motorcycles, ATVs, and UTVs and minimize conflicts with other visitors.

The existing road system provides adequate access for resource management activities, sufficient legal public access to the Forest and its amenities such as campgrounds and trailheads, and access for homeland security purposes near the international border. Access roads to wilderness trailheads and secondary backcountry roads are maintained for safe travel. Trailhead parking adequately accommodates vehicles and trucks pulling trailers, where appropriate.

There is an ongoing road maintenance program to prevent damage to resources from roads and to support safe travel by the public in a variety of vehicle types. Unneeded roads, as identified through the Transportation Analysis Planning process, are closed and rehabilitated to reduce human disturbance to wildlife and to reduce soil erosion.

Objectives

1. Complete maintenance on at least 150 miles of high-clearance (maintenance level 2) roads annually throughout the plan period.

Forestwide Management

Motorized Transportation System

2. Complete maintenance on at least 200 miles of passenger car (maintenance level 3, 4, and 5) roads annually throughout the plan period, based on a safety prioritization.
3. Decommission, close, and restore 3 to 10 miles of unneeded non-system roads annually throughout the plan period, except for roads identified for potential public access routes.
4. Where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat, install at least one hardened road surface at the crossing to prevent downstream effects each year.
5. Realign or remove 2 miles of roads in wetlands or meadows within 10 years of plan implementation.

Guidelines

1. Where impacts to archeological sites from road maintenance are unavoidable, they should be mitigated by adding fill to protect sites, ensuring lead-out ditches and other features are not excavated within sites, or by conducting archaeological data recovery.
2. Road construction or maintenance in wetlands or meadows should be avoided. If those activities are necessary, they should be designed and implemented so that water flow, wetland recharge, and ecosystem function are not impaired.
3. Construction of roads across sensitive soils and scenic lands should be avoided.

Standards

1. Motor vehicle use is allowed on the designated system of roads and motorized trails shown on the Motor Vehicle Use Map (MVUM) that is on file at each District office. Motor vehicle use is prohibited in all other locations, unless it is specifically authorized by law, permit, and/or orders issued by the Forest in conjunction with resource management and public safety actions.

Management Approaches

- Seeking easements and road maintenance agreements with local government agencies and private organizations to supplement Forest Service funded maintenance.
- Conducting road maintenance activities with the priorities of maintaining public access, protecting the road investment, protecting other resources, user safety, and user economy.
- Establishing partnerships with local OHV user groups and the Arizona State Parks OHV Ambassador Program to encourage safe, responsible OHV use and to improve public outreach and education.
- Evaluating travel routes (authorized, unauthorized, or closed) to designate motorized trails that provide a distinct backcountry touring experience for motorcycles, ATVs, and UTVs where compatible with other resource objectives.
- Prioritizing road decommissioning for areas that will function as high-quality wildlife habitat and quiet areas.
- Following existing memorandums of understanding, agreements, and guidelines with public road agencies and cooperators regarding operation and maintenance in easements on forest land.

Recreation

General Description

The Coronado NF offers a rich variety of year-round recreational opportunities in myriad settings, which contributes to the quality of life enjoyed by residents and visitors alike. Some of the most popular recreation activities on the forest include scenic driving, hiking, birdwatching, camping and picnicking, horseback riding, hunting and fishing, snow sports, rock climbing, and caving. Higher elevations on the forest are most popular during the summer, offering temperatures 20 or more degrees cooler than the desert. Higher elevations provide shady conifer forests, lush streams, mountain meadows, and awesome views across southeastern Arizona. These mountaintop sites also provide opportunities to ski and play in the snow during the winter months. Many of the low elevation recreation areas are located in scenic canyons or foothills, and these sites are most popular during the fall, winter, and spring. Some of the special places on the Coronado NF include Sabino Canyon Recreation Area, which hosts a visitor center and a shuttle system, and Mt. Lemmon, a scenic byway that climbs from deserts to pines and offers numerous vista points, several campgrounds, and a ski area. There are four lakes on the Coronado NF, providing fishing, boating, and lakeside camping. Madera Canyon and Cave Creek Canyon offer world-renowned birdwatching opportunities. In several locations on the forest, visitors can rent historic cabins. Visitors can explore numerous scenic drives on the Coronado NF, and 3 designated scenic byways. Eight wilderness areas provide places to explore and experience quiet and solitude, and there are over 1,100 miles of trail available, including the Arizona National Scenic Trail

Based on projections of future climate change, recreation and transportation sites are susceptible to increased use for relief from increased temperatures in urban areas, and to damage from altered frequency, severity, timing, and spatial extent of disturbance events (e.g., fire, droughts, flash floods, landslides, and wind storms). Winter activities, such as skiing, may be reduced due to a reduction in snowpack under higher temperatures.

Desired Conditions

The diverse landscapes of the Coronado NF offer a variety of settings for a broad range of recreational opportunities and a place for visitors to escape from busy urban life into quiet, natural, wild places. Landscapes range from primitive settings that provide opportunities for solitude to more developed, rustic settings that provide opportunities for social interaction and greater human comforts. Although development and population in the region continue to grow, recreation settings on the Coronado NF are stable, retaining their natural character, and loss of remote, undeveloped settings does not occur. Recreation activities are balanced with the ability of the land to support them and create minimal user conflicts. The Coronado NF fulfills a unique and vital role as a place of learning and caring about the environment.

Growing demand for recreation is accommodated within the capacity of the land to support it, and areas that can accommodate additional use, such as at Peña Blanca Lake, are fully utilized. Recreation on the Coronado NF enhances the quality of life for residents and provides tourist destinations, which contribute to

local economies. Interpretation and visitor education programs help visitors understand how to reduce their impacts on ecosystems, and visitors actively help support the Coronado NF's efforts to protect natural resources and wilderness values. Low-impact recreation principles are promoted and widely practiced by the visiting public.

Developed recreation facilities such as campgrounds and picnic areas are clean, in good repair and provide a safe setting for visitors. Most meet current accessibility guidelines. Visitor centers are open to the public on busy days and provide places where visitors can find information and learn about natural and cultural resources on the Coronado NF. Heritage sites provide unique opportunities for visitors to connect with the past. Interpretive features help people learn about the special places they visit. Facilities and infrastructure are maintained and replaced as needed. Developed sites blend with the natural setting, and uses in these places do not cause damage to ecologically sensitive areas. Potable water is provided in high-use areas.

Special-use permits augment the variety of suitable outdoor recreation experiences on the Coronado NF. Permitted facilities blend well into the natural landscape.

Dispersed recreation activities on the Coronado NF include scenic driving, hiking, bird watching, rock climbing, horseback riding, mountain biking, camping, and hunting, among others. Visitors use off-highway vehicles (OHVs) responsibly, staying on designated routes and in identified camping areas. Forestwide dispersed recreation sites are small and clean, and resource damage is minimal. Activities such as paintballing, geocaching, and rock climbing do not detract from the natural character of the forest, impact resources such as aesthetics, soils, vegetation, and wildlife, or contribute to user conflicts.

Opportunities exist in appropriate places for responsible motorized recreation where designated, with varying experiences for a variety of vehicle classes. Forest visitors can enjoy semi-primitive motorized recreation and explore the backcountry in OHVs along designated routes. Noise from motorized vehicles is infrequent in locations away from areas of higher road density. In other areas, the presence and impact of people and machines is unobtrusive. These areas offer non-motorized recreation opportunities in a variety of settings that provide differing levels of challenge and seclusion, while limited primitive or high-clearance roads allow for motorized access.

Places, such as Redington Pass, that receive heavy dispersed recreation use and are within easy driving distance of urban areas provide opportunities for well-managed, safe recreation. Visitors to these areas can enjoy the outdoors in clean, natural settings without conflicts with unsafe or illegal activities or exposure to excessive noise and disturbance.

A system of well-marked and well-maintained non-motorized trails provides opportunities for visitors to explore the Forest's wilderness areas and other un-roaded places. Wilderness and other settings where visitors can experience quiet and solitude are well dispersed throughout the forest and easily accessed. Roads to trailheads are open and maintained, and trailheads provide adequate parking

and vehicle turnaround space. Damage to resources from trailheads and trails is minimal. Historic trails are preserved and reestablished where appropriate and feasible. Unauthorized user-created ("wildcat") trails are rare.

Visitors enjoy the beautiful scenery, while understanding that fire and vegetation management projects are necessary for the health of vegetation communities within the forest landscape. Recreation sites and settings along the international border with Mexico are clean and border security infrastructure blends well with the landscape. Visitors understand the risks associated with illegal border activity and are informed about appropriate safety precautions.

Objectives

1. Reduce the backlog of recreation deferred maintenance in developed sites by 20 percent within five years of plan approval.
2. Retrofit or install wildlife-resistant trash cans at all developed recreation areas and wildlife-resistant food storage boxes at all developed campgrounds within 10 years of plan approval.

Guidelines

1. The Recreation Opportunity Spectrum (ROS) framework[10] for guiding recreation planning and management and the Coronado NF ROS maps should be used as projects are planned and implemented.
2. Recreation sites should be managed for capacities that do not cause unacceptable resource damage, or impact the landscape character.
3. When possible, activities that effect visitors should be scheduled outside of the major recreation season.
4. The Coronado NF paint color guidelines, the USFS Built Environment Image Guide, and the Coronado NF Architectural Guidelines for Recreation Residences should be used for public and private facilities across the Forest.
5. Roads that are primarily used to access motorized dispersed campsites should be located away from floodplains and environmentally sensitive areas.
6. In recreation areas popular with Spanish-speaking visitors, information should be provided in both English and Spanish.
7. Rock climbing should be managed to balance demand for the activity and the need to protect plants, animals, and other natural resources.

Management Approaches

- Utilizing recommendations from various recreation plans (such as concept plans, corridor management plans, and interpretive plans).
- Completing recreation management plans as needed. This includes concept plans, corridor management plans, interpretive plans, and others.
- Encouraging local communities, partnerships, volunteers, and permit holders to help the Forest manage a sustainable recreation program, and ensuring that partners benefit from their roles in providing recreational opportunities.
- Visiting campgrounds and dispersed sites on a regular basis to make public contacts and ensure fee compliance, provide information, and promote responsible recreation principles.

[10] See glossary for definitions of ROS settings.

Forestwide Management

Recreation

- Establishing an ongoing program and long-term partnerships to help the Forest maintain trails and address international border-related impacts such as trail damage and trash.
- Considering additional partnerships to help the Coronado NF share stewardship with others and provide desired recreation opportunities.
- Working closely with the Department of Homeland Security and the Border Patrol to manage recreation settings and opportunities and visitor safety in the international border region.
- Managing international border-related trash by prioritizing cleanup efforts at high-visibility recreation areas (including Cave Creek, Madera Canyon, Peña Blanca Lake, Parker Canyon Lake, and Carr Canyon).
- Using the Coronado NF Transition Plan and the Forest Service Outdoor Recreation Accessibility Guidelines to improve accessibility for visitors.
- Completing the evaluation of desired ROS settings.
- Developing sign plans as needed for Scenic Byways and other popular areas that provide improved visitor information and a strong and consistent Forest Service image.
- Evaluating potentially-eligible wild & scenic rivers, and when appropriate, recommending designation.
- Designating special areas when appropriate to help manage recreation and/or enhance recreation opportunities.
- Developing interpretive facilities and conservation education programs to provide the opportunity for visitors and the increasingly urban population in southeastern Arizona to learn about and appreciate nature and wild places.
- Expanding semi-primitive non-motorized opportunities by closing roads which are determined to be unnecessary.
- Designating in the MVUM those routes that are appropriate for people to use vehicles to access dispersed campsites.
- Increasing recreation opportunities within the capacity of the land to accommodate the population of southeastern Arizona by expanding existing developed recreation sites and encouraging use at underutilized recreation sites.
- Considering the use of permit and reservation systems to preserve the integrity of the Forest's natural resources and to reduce visitor conflicts where recreation impacts cannot otherwise be reasonably managed. Examples include activities in wilderness areas, popular rock climbing locations, and dispersed activities with the potential for resource damage or visitor conflicts.
- Exploring options for improving OHV opportunities by developing or connecting motorized trails.
- Improving non-motorized travel opportunities where such access is currently unavailable by constructing new trails or improving existing historic trails.
- Working with adjacent landowners to maintain the Arizona Trail corridor and the condition and character of the surrounding landscape

Scenic Quality

General Description

The Coronado National Forest sky islands are unique among the lands in southeastern Arizona. The mountains provide a spectacular backdrop for residents living in desert cities, and visitors enjoy the natural beauty of these special places year-round. Based on projections of future climate change, scenic landscapes are susceptible to increased use for relief from increased temperatures in urban areas and to damage from altered frequency, severity, timing, and spatial extent of disturbance events (e.g., fire, droughts, flash floods, landslides, and wind storms).

Desired Conditions

Scenic resources on the Coronado NF are in excellent condition and are sustainable and resilient to short-term disturbances and climate change. Visitors enjoy vast open spaces and a variety of natural landscapes, including deeply carved desert canyons, riparian corridors with towering sycamores and cottonwoods, rolling native grasslands, oak woodlands, and mountaintop conifer forests. The Forest's sky islands provide a visual backdrop to cities and roads in the surrounding deserts.

The Coronado NF continues to be the primary provider of large-scale, natural, public lands in southeastern Arizona. Scenery on the Coronado NF enhances the quality of life for residents and provides tourist destinations, which contribute to local economies. In the rare instances where visitors see utilitarian structures (such as communications towers, transmission lines, astrophysical facilities, and administrative sites), these elements blend into the landscape well. Mining activities are rarely seen, and mines that are no longer operational have been naturalized by restoring mine sites topography and vegetation from the surrounding natural landscape.

Most landscapes on the Coronado NF feature a mosaic of plant species, structures, ages, and densities. Older-aged vegetation communities and large trees are common. Disturbances, including insect and disease outbreaks and wildfire, occur within their natural scale and do not diminish large viewsheds or major portions of any ecosystem management area. Scenic quality is affected for short periods of time by vegetation management projects, as described in the objectives for forestwide vegetation communities. These areas resume a natural appearance as quickly as possible.

Along scenic byways and other popular travel routes, visitors find occasional developed recreation sites that provide desired amenities (restrooms, picnic tables, etc.), but these facilities are in character with the National Forest System setting. Occasionally, visitors see unique historic sites; these areas are positive scenic elements, providing a glimpse of times past. Private cabins appear rustic and blend with the landscape. Landscapes away from roads provide opportunities for dispersed recreation, solitude, and spending time in pristine wildlands with minimal evidence of human activity.

Forestwide Management

Scenic Quality

Guidelines

1. The Coronado NF Scenery Management System maps (including scenic integrity, scenic class, concern levels, and Scenic Integrity Objectives) and the SMS project-level implementation guide should be used as projects are planned and implemented.
2. Facilities should be designed to complement the character of the surrounding natural landscape. This applies to public recreation sites, administrative sites, facilities owned by other governments (such as Dept. of Homeland Security), and private structures.
3. For forest health improvement projects, scenic integrity objectives may be temporarily lowered if necessary to meet project objectives. Slash, stumps, logs, and skid roads in foreground along system roads and trails should be cleaned up within one year following treatment, though effects from prescribed fire (blackened, scorched vegetation and tree trunks) can be visible for two to three years following treatments. To use this exception, provide written documentation in the project-level decision that describes the timeline for completion and final expectations for appearance.
4. New facilities added to electronic sites, astrophysical complexes, and administrative sites, should be clustered within existing areas. Facility colors and materials should blend with the landscape, structures should generally be below the height of vegetation, and vegetation that screens views to facilities should be protected and encouraged.
5. Vegetation management projects should avoid even spacing of retained trees, leave a diversity of tree species and sizes, leave large trees whenever possible, avoid damage to vegetation that will remain, cut stumps at ground level and angle them away from viewing locations, remove slash as soon as possible, and naturalize disturbed areas. Management activities such as vegetation treatments and prescribed fire should appear as part of the natural landscape over time.
6. Utility lines should be buried in areas with sensitive scenic resources, especially areas along scenic byways, and within recreation areas.
7. Mines and quarries should be reclaimed by re-contouring topography and re-vegetating sites so that they mimic adjacent landscapes.

Standards

1. Only native or non-persistent seed and plant materials will be used when re-vegetating disturbed sites.

Management Approaches

- Incorporating restoration of scenic quality in areas where it has been negatively impacted as other project work is accomplished and/or funds are available.
- Designating special places, where appropriate, to help protect scenic resources.
- Interpreting vegetation treatments and natural disturbance events when they occur along major roads or trails.
- Scheduling activities that affect scenic quality outside of the major recreation season.
- Improving areas with poor existing scenic conditions (i.e., areas with existing scenic integrity low, very low, or unacceptably low)..

Forestwide Management

Scenic Quality

- Removing facilities (buildings, utility poles/lines, other structures) are no longer useful, unless they are historic and/or desired features.
- Working with willing landowners, communities, local governments, and partners to promote voluntary open space conservation.

Special Uses

Special Uses

General Description

Currently, the Coronado NF administers over 620 special use authorizations. These uses include such activities as outfitting and guiding, research, various types of utility lines, communications sites, road permits and easements, and recreation residences. Also included are permits for campground, marina and store facilities, filming, and numerous recreation events. The Coronado NF also supports, through the permitting process, military, local law enforcement and Department of Homeland Security activities.

Desired Conditions

Special-use activities on National Forest System (NFS) lands provide needed services to communities that cannot be reasonably accommodated on non-federal lands. These activities supplement and complement services that the Coronado NF provides. Any negative environmental, social, and visual impacts are prohibited or minimized; the permit area and duration are the minimum necessary to accommodate the use.

Objective

1. Phase out permits for isolated cabins, privately-owned buildings, and residences that are not part of the recreation residence program by December 31, 2028.

Guidelines

1. Facilities should be sited and designed to blend into the landscape as much as possible. Whenever possible, heights of structures should be kept below the height of surrounding vegetation, and vegetation that screens views to utilitarian facilities should be protected and encouraged.
2. Phone and power distribution lines that cross NFS lands to access private inholdings or Forest Service facilities should be located and designed so as to be screened by topography or vegetation as much as possible.
3. Phone or power distribution lines requests to cross NFS lands to access private lands outside the Forest boundary should not be permitted outside of existing utility corridors.
4. New or reconstructed utility lines should be placed underground when possible to protect scenic resources, unless this is not feasible because of overriding environmental concerns or technical considerations.
5. New electric transmission lines and natural gas pipelines should be located in existing corridors that meet the scenic integrity objective. Existing corridors that do not meet the Scenic Integrity Objective should be relocated when construction becomes necessary.
6. Public access to special-use areas such as communication sites should not be restricted unless there are safety concerns.

7. Equestrian activities authorized under special-use permits should be limited to existing NFS trails and roads.
8. Requests for permits and/or easements for private gates, driveways, trails, and/or roads to cross NFS lands to access private lands located outside the Forest boundary should be denied unless a public benefit can be shown.

Standards

1. A special-use permit is required for collection of plants or animals in all zoological and/or botanical areas.
2. Major utility corridor development is confined to the area identified and mapped in the 2008 West-wide Energy Corridor Programmatic EIS.
3. Communications sites will be managed to the following standards:
a. Maximize the co-location of new and existing buildings and structures.
b. Site use shall be allocated to users on a facility-need basis.
c. Maintenance of NFS roads and trails to access communication sites, above and beyond normal Forest Service maintenance, will be carried out by the facility owner or association only after obtaining the proper authorizing document (e.g., road use permit).
d. Clearing of vegetation will be limited to that which poses a hazard to facilities and operational efficiency (see the communication site plan for further direction).
e. High- and low-power communication uses will be authorized only where designated as such in the communications site plans. Any potential electromagnetic interference must be resolved by the site users before construction can proceed. Senior uses on a site have priority over new or proposed uses. Microwave corridors will be protected from electromagnetic interference.
f. All new and replacement towers must be self-supporting.
g. New and replacement antennas and towers will be below the height for which the Federal Aviation Administration requires lights because of the interference with the fire lookout tower and aesthetics.
h. All utility lines connecting to communications sites will be buried underground.
i. All buildings and towers will meet color requirements set forth in the Coronado NF's Architectural Guidelines for Recreation Residences. Microwave dishes will utilize dark grey/brown covers. Other antennas will be dark grey/brown, when available through the manufacturer.
4. Group size authorized in outfitter-guide permits in wilderness areas will be limited to 15 persons for day use, except Rincon Mountain Wilderness and Mt. Wrightson Wilderness where the limit is which is 18 persons for day use, and 6 persons for overnight use in all wilderness areas.
5. Limit non-pedestrian activities (e.g., bicycle and equestrian) authorized under special-use permits to existing NFS trails and roads.
6. Limit motorized special-use activities to existing NFS roads and NFS motorized trails.
7. Require obliteration of non-NFS trails created by activities authorized under special-use permits.

Management Approaches

- Maintaining existing communications sites and completing site management plans for all sites with the cooperation of communication site user groups.

Forestwide Management

Scenic Quality

- Continuing to establish user groups or organizations for each site.
- Favoring consolidation or co-location of facilities within existing sites over opening new sites or expanding existing sites. Group uses according to compatibility (governmental vs. private).
- Utilizing the forestwide policy for management of recreational residences, as generally outlined in the Architectural Guidelines for Recreation Residences on the Coronado NF (the Guidelines). Managing items not covered in the Guidelines with input from a committee consisting of the district rangers of Douglas, Safford and Santa Catalina Ranger Districts, and the forest supervisor or deputy forest supervisor.
-

Heritage Resources

Heritage Resources

General Description

Coronado NF heritage resources provide the public with opportunities to gain a broader understanding of the 12,000-year history of human habitation in southeastern Arizona. Heritage resources help people connect with the past, not only to enhance their sense of time and place, but also to illuminate aspects of Arizona history that are relevant to modern life and land-use decisions.

Desired Conditions

Heritage resources on the Coronado NF, including known Native American sacred sites and traditional cultural properties, are preserved, protected, and/or restored for their cultural and scientific importance and are generally free from inappropriate impacts. Landscapes, sites, traditions, and stories contribute to the Forest community's appreciation of the diverse human communities who have lived in the region and how they adapted to the cultural and physical environment. As appropriate, eligible and historically-significant heritage properties are listed on the National Register of Historic Places. The Forest's priority heritage assets are protected and preserved. Archaeological, ethnographic, and historical data guide efforts to manage current ecosystems and in some cases restore historic ones.

Forest facilities that are eligible for the National Register of Historic Places are available for continued use, for Forest administration, public recreation and interpretation, and tribal events, as appropriate. Important archaeological artifacts are protected, either in-place in their original contexts or in secure curation facilities. The Forest's historic documents, including photographs, maps, journals, and Forest Service (FS) program management records, are available for research and interpretation by the FS, other agencies, universities, tribes, and the public.

Objectives

1. Complete 200 acres of non-project inventory each year, so that the Forest's currently unidentified heritage resources can be recorded, evaluated, and protected.
2. Over the planning period, nominate at least 5 individual sites or at least 2 districts to the National Register of Historic Places.
3. Conduct stabilization or maintenance at 1 to 5 priority heritage assets per year.

4. Host, sponsor, or participate in at least 2 interpretive events for the public each year.
5. Provide opportunities for volunteers to participate in heritage resource conservation activities at 2 to 5 archaeological sites or historic properties per year.
6. Within 10 years of plan approval, enter at least 2 historic sites in the Arizona "Rooms with a View" cabin rental program.
7. Inspect each priority heritage asset at least once every 5 years.

Guidelines

1. During project implementation, adverse effects to historic properties listed on or are eligible for the National Register should be avoided and protected.
2. Unevaluated sites should be managed as if eligible for the National Register, unless consultation with the State Historic Preservation Officer indicates otherwise.
3. Contracts, permits, and leases which have the potential to affect cultural resources should include appropriate clauses on protection responsibilities and liability for damage.
4. Historic values should be considered in the development and modification of facilities.

Management Approaches

- Maintaining and enhancing coordination and cooperation with other land-managing agencies, tribes, and public-private alliances that advance the stewardship of the Nation's diverse heritage. Cooperative efforts can include (1) fostering the educational, aesthetic, inspirational, cultural, and economic benefits of historic preservation and conservation as outlined in the Arizona State Historic Preservation Plan, (2) encouraging public interpretation at historic sites where it contributes to the region's sense of community and inter-cultural understanding, and (3) facilitating cross-boundary heritage tourism to contribute to the region's economy and sense of place.
- Maintaining and enhancing the partnerships with tribes, universities, colleges, professional organizations, volunteers, and avocational archaeologists that play an integral role in the management of heritage resources.
- Developing appropriate measures to protect cultural resources from deterioration due to natural forces, visitor use, and vandalism. Protective measures may include signing, fencing, administrative closure, patrolling, interpretive signs, landscape treatments and revegetation projects, and stabilization or data recovery.
- Pursuing opportunities to interpret heritage resources to the public. On-site interpretation can include interpretive trails, signs, exhibits, and self-guided and specialist-guided tours at historic and prehistoric sites. Off-site interpretation can include lectures, professional reports and publications, brochures, programs, and displays. Interpretation of cultural resources can be integrated with other resource interpretation and with recreation facilities and programs. The Forest can pursue opportunities to develop cooperative efforts with other federal and state agencies interested in cultural resource

Forestwide Management

Heritage Resources

- interpretation, such as the Bureau of Land Management and other national forests, and with private partners.
- Maintaining architectural National Register properties for rehabilitation and re-use, in accordance with the Secretary of the Interior's standards and guidelines, and developing programmatic memoranda of agreement for the maintenance and treatment of structures listed in the National Register, to ensure proper long-term treatment and facilitate consultation with the State Historic Preservation Officer.
- Prioritizing areas to survey as follows: (1) areas suspected to have high site density, (2) areas suspected to have under-represented site types, (3) areas of traditional importance to tribes, (4) areas where site densities or ongoing impacts are unknown and need to be assessed, and (5) areas subject to future development and disturbance.
- Prioritizing sites that need management or treatment plans as follows: (1) sites subject to ongoing or planned impacts or deterioration, (2) sites of high traditional, scientific, or community value, (3) historic buildings or facilities with high potential for adaptive reuse, and (4) sites and/or historic buildings or facilities whose location, setting, or condition leave them especially vulnerable to impacts from visitor use.
- Prioritizing sites or districts to nominate to the National Register of Historic Places as follows: (1) sites or districts of high traditional, scientific, or community value, (2) sites or districts where National Register status would facilitate management by heightening public appreciation, acknowledging or highlighting tribal history, or increasing eligibility for grants, and (3) sites or districts under threat from planned development or use with potential for negative impacts on heritage resources that would benefit from protections provided by National Register listing.
- Prioritizing stabilization or maintenance based on new and existing management and treatment plans, determined as above.
- Prioritizing interpretive events as follows: (1) potential for collaboration and partnerships, (2) integration with state, regional, and tribal initiatives, (3) potential for outreach to children and under-served populations, (4) potential for productive hands-on activities that benefit heritage and natural resources of the Forest.
- Preparing a forestwide heritage plan.
- Developing a cultural history overview for each mountain range.
- Preparing an administrative history for each district.
- Developing and renewing memoranda of understanding with each tribe to facilitate tribal consultation in the National Historic Preservation Act Section 106 process.
- Developing a database of fire-sensitive sites and structures that would be available for fire management planning purposes and for facilitating resource protection.
- Incorporating digitized historic maps or plats into a geographic information system database.

Tribal Relations

General Description

American Indian tribes are sovereign nations; therefore, the Forest Service strives to establish and maintain government-to-government relationships with each tribe. The Forest Service has certain federal trust responsibilities to American Indian tribes. In meeting these responsibilities, Forest managers are required to consult tribes when proposed policies or management actions may affect their interests. Culturally affiliated tribes retain rights to use Coronado NF lands in ways that are not allowed by the general public. Access or use by the general public may be temporarily denied to allow tribal members to exercise their rights and interests in privacy and solitude.

Tribes with aboriginal territories and traditional ties to the land now administered by the Forest include the Ak-Chin Indian Community, the Fort Sill Apache Tribe, the Gila River Indian Community, the Hopi Tribe, the Mescalero Apache Tribe, the Pascua Yaqui, the Pueblo of Zuni, the Salt River Pima Maricopa Indian Community, the San Carlos Apache Tribe, the Tohono O'odham Nation, the White Mountain Apache Tribe, and the Yavapai-Apache Nation. All tribes whose aboriginal territories are now part of the Coronado NF are recognized as having important roles in the stewardship of the land. Under a changing climate, some forest products for traditional tribal uses may be vulnerable to more frequent or extreme disturbance events, including wildfire, droughts, flash floods, landslides, and wind storms.

Desired Conditions

Traditional lands on the Forest provide a setting for the education of tribal youth in culture, history, and land stewardship. Interpretive and educational exhibits, events, and other media that focus on the history of the lands now managed by the Coronado NF provide the general public with a greater understanding and appreciation of native history, culture, and traditions.

Traditional tribal uses (such as the collection of medicinal plants, wild plant foods, basketry materials, and fuelwood) are facilitated. Tribal members have access to sacred sites for individual and group prayer and traditional ceremonies and rituals, and the integrity of sacred sites is maintained or improved whenever feasible. When available, Forest administrative sites can be used by tribal families and organizations through government-to-government agreements. All sacred objects, human remains, funerary objects, and objects of cultural patrimony removed from Forest land are repatriated to the appropriate tribe under the Native American Graves Protection and Repatriation Act (NAGPRA).

Objectives

1. Within 5 years of plan approval, the Forest will have completed NAGPRA repatriations of all items collected prior to 1990.

Management Approaches

Consulting with tribes to identify sacred sites or traditional cultural properties and to develop a strategy for appropriate recognition and

Forestwide Management

Tribal Relations

management.

- Cooperating with Apache tribes and other Forests in a multi-property traditional cultural property National Register nomination study.
- Initiating a Tohono O'odham Nation traditional cultural property National Register nomination study for the Santa Rita Mountains.
- Honoring through words and actions the trust responsibilities of federal agencies toward tribes, and acknowledging the historic and legal basis of tribal rights.
- Working together with tribes to build respectful, collaborative relationships, to develop ways of accomplishing mutual desired conditions and objectives, and to collaborate in ecosystem restoration efforts.
- Making Forest recreational or administrative sites available for use by tribal families and organizations through government-to-government agreements.
- Consulting with tribes at early stages of planning and project design, so that tribal perspectives' needs, and concerns, as well as traditional knowledge can be incorporated into project design and decisions.
- Collaborating with tribes, federal and state agencies, private foundations, and landowners to facilitate management by landscape rather than jurisdiction, so that tribes, the public, contractors, and researchers can cross from one federal agency's jurisdiction to another without encountering contradictory rules and policies.
- Identifying opportunities where traditional lands on the Forest can provide a setting for the education of tribal youth in culture, history, and land stewardship.
- Developing interpretive and educational exhibits or other media that focus on the history of the Coronado NF in collaboration with tribes to provide the general public with a greater understanding and appreciation of our shared history, culture, and traditions.
- Developing government-to-government relationships with tribal officials, to meet requirements of Executive Order 13175 and developing consultation protocols.
- Providing Forest employees opportunities to receive training so they understand the unique legal relationship between the federal government and Indian Tribes, set forth in the U.S. Constitution, treaties, statutes, executive orders, and court decisions.
- Encouraging tribal members to engage in traditional activities, such as the collection of medicinal plants, wild plant foods, basketry materials, and fuel wood for personal use.
- Ensuring that tribal members have access to sacred sites for individual and group prayer and traditional ceremonies and rituals, and that the integrity of sacred sites is maintained or improved whenever feasible.
- Developing interpretive information about the history and human occupation of the lands now part of the Coronado NF in collaboration with tribes.

Range Management

Range Management

General Description

The focus of range management on the Coronado NF is the production of a diverse array of tangible and intangible products. Tangible products include

forage for grazing and browsing livestock and wildlife. Intangible products include natural beauty and quiet places. Livestock grazing is permitted on about 90 percent of the Coronado NF. Grazing use is administered through a grazing permit system on designated livestock grazing allotments.
Based on projections of future climate change, conditions may be preferable for grassland habitat. However, suitable forage for grazing or browsing and availability of water for livestock may be reduced during extended drought periods, and increased disturbances could favor non-native species that are unsuitable for grazing.

Desired Conditions

The Coronado NF provides forage for grazing in support of domestic livestock production as a viable, sustainable economic activity. Communities surrounding the Coronado NF benefit from the interactions of livestock production activities with other economic sectors, and from the social, cultural, and ecological values tied to conservation ranching.

Domestic livestock grazing does not alter the desired composition and structure of plant communities. Rangeland ecosystems are diverse, resilient, and functioning within a healthy, sustainable landscape in the face of a changing climate. Areas that are grazed have stable soils, functional hydrology, and biotic integrity, while supporting healthy, diverse populations of native wildlife.

By supporting livestock production on working landscapes with an extensive, low-impact land use, the Coronado NF contributes to preserving large areas of unfragmented open space. These open spaces sustain biological diversity and ecological processes and help to preserve the rural cultural heritage of southeastern Arizona and southwestern New Mexico.

Guidelines

1. Forage utilization should be based on site specific resource conditions and management objectives, but in general should be managed at a level corresponding to light to moderate intensity (15-45% of current year's growth). Exceptions may be allowed in order to meet objectives related to scientific studies, fuels reduction, invasive plant control, or other targeted grazing or site-specific objectives.
2. Burned areas should be given sufficient deferment from grazing, especially during the growing season, to ensure plant recovery and vigor.
3. Construction or reconstruction of livestock fencing and replacement of non-permeable fencing where wildlife movement is restricted should be consistent with the appropriate state wildlife agency standards[11] for safe passage of wildlife and/or species-specific fencing guidelines developed at the local or regional level[12].
4. Grazing management practices should be designed to maintain or promote ground cover that will provide for infiltration, permeability, soil moisture

[11] For Arizona Game and Fish Department, refer to the most recent Wildlife Water Development Standards; for New Mexico Game and Fish Department, use available habitat or species-specific guidelines.
[12] Examples include those found in products developed by working groups or collaboratives of wildlife agencies, academics, and research/management organizations.

storage, and soil stability appropriate for the ecological zone. Additionally, grazing management should retain ground cover sufficient for the forage and cover needs of native wildlife species.

5. Within riparian areas, structures used to manage livestock should be located and used in a way that does not conflict with riparian functions and processes.
6. Treatments for restoring rangelands should emphasize the use and perpetuation of native plant species.
7. Grazing intensity, frequency, occurrence, and period should provide for growth and reproduction of desired plant species while maintaining or enhancing habitat for wildlife.
8. Management practices to achieve desired plant communities should consider protection and conservation of known cultural resources, including historical sites, prehistoric sites, and plants of significance to Native American peoples.

Standards

1. Grazing permits will not be issued for domestic goats or sheep in the Galiuro or Santa Catalina mountain ranges.
2. New issuance, renewal, modification, and management of grazing permits shall comply with the Coronado National Forest's Stockpond and Aquatic Habitat Management and Maintenance Guidelines for the Chiricahua Leopard Frog. Additionally, for the San Rafael Valley and surrounding areas, permits shall be in compliance with the Coronado National Forest's Stockpond Management and Maintenance Plan for the Sonora Tiger Salamander.
3. In areas occupied by Lowland Leopard Frogs, stockponds will be managed according to the general guidance, as applicable, of the Coronado National Forest's Stockpond and Aquatic Habitat Management Guidelines for Chiricahua Leopard Frog (if Lowlands are included in the revised guidelines, then this no longer applies).

Management Approaches

- Following the monitoring protocols found in the Forest Service's Southwestern Region Rangeland Management Training Guide, Technical Interagency Guide, and Principles of Obtaining and Interpreting Utilization Data on Rangelands.
- Collaborating with permittees, other agencies, University of Arizona Cooperative Extension, and other stakeholders to develop consistency in monitoring protocols and to leverage resources to accomplish landscape-scale monitoring.
- Reviewing current management of each active allotment at least once every 10 years to identify consistency with current grazing authorization decisions (NEPA).
- Annually meet with permittee to discuss timing, intensity, duration, and frequency of livestock use, as well as infrastructure needs.
- Establishing, where feasible, grass reserves to help facilitate restoration work, while providing for permittee considerations.

Land Ownership Adjustments and Boundary Management

General Description

The "Sky Islands" nature of the Coronado National Forest combined with the current complex land ownership pattern within and adjacent to the National Forest leads to the need for an intensive and extensive land ownership adjustment and boundary management program. This program includes: land ownership adjustments (donation, purchase, land exchange, and limited sales), withdrawals, right of way acquisition, land line location, and boundary modifications. Land line location surveys ensure that boundary lines are accurate. All of these programs ensure that public access, watershed protection, wildlife habitat, recreation, open space, and scenic resources continue to flourish on the Coronado National Forest.

Desired Conditions

The landownership pattern within the boundaries of the Coronado NF is characterized by large contiguous blocks of National Forest System land. Complex and fragmented landownership patterns have been consolidated through collaborative land adjustments with non-federal landowners or agencies (state, county, private and others ownerships).

Lands acquired are valuable for public access, watershed protection, wildlife habitat, recreation, open space, and scenic resources. Administrative complexes costly to maintain and manage (with a backlog of deferred maintenance) and/or NFS lands encumbered by long-term land occupancy commitments and authorizations which have lost their National Forest character and provide minimal benefit to the general public have been disposed of through landownership adjustments.

Road and trail right-of-way easements have been acquired to maintain the integrity of forest resources and provide public access to NFS lands for all existing or proposed road or trail alignments through non-federal lands (state, county, private, and other ownerships) (refer to Public Access section).

Property lines between NFS and non-federal lands (state, county, private, and other ownerships) and boundary lines of special areas, such as the National Wilderness Preservation System, are easily identified and recognized by public land users, private landowners, and Forest Service personnel.

Existing National Forest System unit boundaries have been modified to provide National Forest status to lands acquired, or lands to be acquired from non-federal (state, county, private, and other ownerships) landowners, located outside unit boundaries, to provide logical exterior unit boundaries, and facilitate current and future management and administration of the Coronado NF.

An interconnected network of undeveloped open space within and adjacent to the National Forest provides opportunities for legal public access, corridors for wildlife movement, and supports healthy ecosystems.

Guidelines

Land Exchanges

1. Land exchanges should result in an improved forest landownership pattern, more effective management of NFS lands, and foster sound community development.
2. Land exchanges should not result in the creation of isolated NFS parcels surrounded by non-federal lands or isolated non-federal parcels surrounded by NFS lands.
3. The non-federal lands considered for exchange into federal ownership should meet one or more of the following criteria:
   a. Lands that provide needed public and administrative access, protect public lands from fire or trespass, or prevent damage to resources.
   b. Lands that contain vital threatened and endangered species habitat or vital wildlife habitat.
   c. Lands providing services to the public (e.g., developed and dispersed recreation, open space).
   d. Wetlands, riparian areas and other water-oriented lands.
   e. Lands that contain unique, natural or cultural values.
   f. Lands within designated wilderness.
   g. Lands that will improve public land management, meet specific administrative needs, or benefit other national forest programs.
   h. Lands that meet programs prescribed or endorsed by acts or reports of Congress or the Department of Agriculture.
4. Federal lands offered by the United States in a proposed land exchange should meet one or more of the following criteria:
   a. Lands needed to meet the needs of communities and the public.
   b. Lands that provide for improved public land management.
   c. Lands that will improve management, benefit specific resources, or increase management efficiency.
   d. Lands that have lost their wildland characteristics.
   e. Lands with long-term land occupancy commitments, high management and operating costs, do not contribute significantly to achieving management objectives, have minimal benefit to the general public, and would not create an isolated non-federal parcel surrounded by NFS lands, such as, but not limited to, recreation residence areas and administrative sites.

Land Line Location

1. Land Line Location surveys should be prioritized by the following criteria:

a. Where known litigation is pending, a title claim has been asserted, encroachments are suspected, or the probability of encroachment can be reduced.

b. Where significant resource values exist and utilization or manipulation of resources is planned (this includes the location, by survey, of right-of-way easements necessary for resource management).

c. All remaining property lines.

2. A BLM resurvey should be requested where there has been an extensive loss or obliteration of original corner monuments and/or where the potential for future litigation regarding the property boundaries between the National Forest and private lands are high.

3. Painting and excessive clearing of property lines should be avoided.

Open Space

1. The Forest should work with willing landowners, communities, local governments, and partners to promote voluntary open space conservation. Participation in any local planning efforts regarding development and/or use of non-federal lands in regards to open space should be limited to an information provider and stakeholder to help promote access and recreation opportunities as well as reduce ecological impacts and wildfire risks for communities.

Standards

Land Line Location

1. All surface-disturbing projects, including vegetation and fuel control projects, will require a search for and protection of all land survey corner monuments and their accessories (bearing trees, bearing rocks, reference monuments) prior to any surface or vegetative disturbance.
2. All property lines needed for surface-disturbing projects will be located and posted prior to project implementation.
3. All fences to be constructed along Forest boundaries will be located by a registered land surveyor in the applicable State (Arizona or New Mexico).

Withdrawals

1. Before recommending a new withdrawal or an extension or continuation of an existing withdrawal is applied for and requested; alternative protection opportunities such as the issuance of a Right-of-Way under Title V of FLPMA or notation in the Public Land Records will be explored and sufficient analysis, justification, and determination of need provided.

Management Approaches

Land Line Location

- Minimizing future encroachment cases and resolving present encroachments should be considered a priority.
- Considering opportunities to resolve boundary issues permanently at a substantial cost savings by consolidating non-federal (state trust, county, private and other ownerships) and NFS lands through the land adjustment program.
- Acting on cooperative and joint land surveying opportunities with adjoining non-federal landowners (state trust, county, private and other ownerships).

Landownership Adjustments

- Consolidate the forest landownership pattern through exchange, purchase, or donation, and other landownership adjustment authorities.
- Acquiring non-federal lands or interest in lands from non-federal landowners (state, county, private, and others ownerships) that resolve public access issues, contain vital threatened and endangered species habitat or vital wildlife habitat, are water oriented and/or provide additional public recreational opportunities.

Land Exchanges

- Considering opportunities to consolidate small private land inholdings into economically viable units.
- Evaluating the Federal lands to determine the merits of exchanging them into non-federal ownership.

Right-of-way

- Ensuring administrative and public access to NFS National Forest System lands by acquiring road and trail rights-of-way needed to meet Public Access objectives using various acquisition methods. Priority for road and trail rights-of-way acquisitions should be as follows:

a. Public access to NFS lands.
b. Administrative access to NFS lands.

Boundary Modification

- Recommending modification of the existing proclaimed National Forest Boundary to:

a. Provide National Forest status to acquire lands located outside the proclaimed boundary or to facilitate potential landownership adjustments with landowners (state, county, private, and other ownerships) and land management agencies.
b. Provide logical exterior boundaries and facilitate current and future management and administration of the Coronado NF.

Withdrawals

- Requesting new withdrawals and the extension or continuation of a needed existing withdrawal when necessary to:

a. Preserve a unique resource area where no reasonable alternative to a withdrawal will provide adequate protection and the area will not survive without undue damage or impacts caused by mineral development. Examples of unique resource areas are: research and/or experimental areas, botanical and zoological areas, cultural, historical, and archaeological areas, paleontological and geological areas, and other areas with special characteristics or unique values.
b. Protect high value Federal improvements where relocation or replacement is impractical. Impractical means there would be an added cost or inconvenience to the Forest Service which could not be adequately compensated for in a plan of operations, drilling permit, or lease.
c. Recommending the continuation of withdrawals at least three years prior to an existing mineral withdrawal's expiration date.
d. Recommending revoking withdrawals that no longer serve the purpose for which they were withdrawn or lack sufficient justification of need.

Management Areas

Chapter 3: Management Areas

Introduction

This chapter describes management areas, which are mapped areas that have specific management direction in addition to the Forestwide management direction described in Chapter 2. The management areas described in this chapter occur in more than one place on the Forest. They include wilderness areas, wilderness study areas, recommended wilderness areas, eligible wild and scenic rivers, and land use zones. There is a general description and one or more plan components for each management area.

Designated Wilderness Areas

Designated Wilderness Areas

The Coronado National Forest has eight designated wilderness areas that make up almost 19 percent of the Forest. Table 2 below displays the size of the wilderness areas and the ecosystem management area (EMA) that each is located within (see Chapter 4 for descriptions of EMAs).

Table 2: Designated Wilderness Areas

Wilderness Areas	Acres	Ecosystem Management Area
Chiricahua Wilderness	87,700	Chiricahua
Galiuro Wilderness	76,317	Galiuro
Miller Peak Wilderness	20,228	Huachuca
Mt. Wrightson Wilderness	25,260	Santa Rita
Pajarita Wilderness	7,553	Tumacacori
Pusch Ridge Wilderness	56,933	Santa Catalina
Rincon Mountain Wilderness	38,950	Santa Catalina
Santa Teresa Wilderness	26,780	Santa Teresa
TOTAL	339,721	

Plan Components for Designated Wilderness Areas

Wilderness Character

Desired Conditions

The ecological systems within wilderness areas across the Coronado NF vary naturally over time and space. Wilderness areas provide a wide variety of opportunities for exploration, solitude, natural risk, challenge, and primitive and unconfined recreation. Wild landscapes harbor the Forest's richest concentration of quiet places, with the sights and sounds of humankind substantially unnoticeable. Developments (e.g., fences, structures, and water containment features) are rare; those that exist offer visitors a glimpse of past cultures and traditional land uses.

Guidelines

1. Wilderness character should be maintained or improved. This includes untrammeled, natural, and undeveloped qualities, as well as opportunities for solitude or primitive and unconfined recreation.
2. Restrictions on visitor freedom (e.g., closures, permit systems, area quotas) should only be used when less-invasive measures have proven insufficient to meet management objectives.

Management Approaches

- Completing and implementing wilderness management plans for each existing wilderness area.

Scenic Quality in Wilderness

Desired Conditions

Visitors find exceptional aesthetic value in wilderness areas across the Forest. Scenic conditions are natural, unaltered, and wholly intact. Landscape character and sense of place are evident at the highest possible level.

Guidelines

1. When trees or other materials are used for building trails, fences, signage, or other structures, materials should be harvested out of view from trails and campsites. Cutting or removing of materials should not be evident.

Standards

1. Wilderness areas shall be managed for a scenic integrity objective of Very High, except when specified otherwise in an individual wilderness management plan.

Vegetation in Wilderness

Desired Conditions

Vegetation communities in wilderness areas are consistent with those across the Forest, and represent pristine conditions for each type. Distribution, abundance, and diversity are sufficiently maintained when possible through natural disturbance processes (e.g., fire, insects, disease), and vegetation alterations are unnecessary to sustain communities (except in cases where climate change severely alters disturbance regimes) . Ecosystems that once departed from a sustainable state have been restored to functioning systems that are resilient to a changing climate.

Guidelines

1. Vegetation treatments should only be used to restore or maintain communities to functioning systems that are sustainable and resilient under changing climate conditions and disturbance regimes.
2. Gathering of dead and downed fuelwood should be limited to recreational campfire use.

Wildlife in Wilderness

Desired Conditions

Wilderness contributes to preserving the natural processes and habitats that sustain native species. Wilderness habitats are particularly valuable to threatened and endangered species, where the factors that threaten their existence are greatly minimized. Human-wildlife interactions do not lead to wildlife habituation to human food sources.

Guidelines

1. Non-native species should not be introduced into areas adjacent to wilderness areas when it is likely that individuals of that species will spread to wilderness areas during ordinary life processes.

Standards

1. Non-native species shall not be introduced into any wilderness area.
2. Reintroductions shall only occur when a species is determined to be indigenous to the area and when it was extirpated by human-induced events.

Soil and Water in Wilderness

Desired Conditions

Natural processes dominate soil and water cycles in wilderness areas. Water quality is high. Trails and campsites do not contribute soil sediment to downstream water resources.

Guidelines

1. Designated camping areas should be located on durable surfaces, and should be contained to prevent from increasing in size or compaction.

Standards

1. Water quality measurements shall be made with temporary use of portable equipment.

Management Approaches

- Working with local hiking and equestrian groups to maintain trails and to close and restore user-created trails.

Recreation and Education in Wilderness

Desired Conditions

Educational materials on minimum-impact camping and travel skills and on wilderness etiquette are available to visitors through the Coronado NF website, printed materials, trailhead information boards, personal contacts (both pre-trip and in the field), and other means. Once inside wilderness areas there are no information boards, and interpretation of the environment is primarily through self-discovery or facilitated in a group setting. Recreational structures (e.g., fire rings, improvised camp furniture) are temporary and easily dismantled. Recreational use does not result in the deposition of trash or other man-made items, or cause excessive noise or visual impacts which detract from wilderness character. Group day use size does not exceed 15 persons; except the Rincon

Mountain Wilderness and Mt. Wrightson Wilderness were day use group size does not exceed 18 persons. Overnight group size does not exceed 6 persons. When traveling on trails, there is very low interaction between users; when traveling cross country, almost no human encounters occur.

Standards

1. The existing recreation opportunity spectrum classification composition shall be maintained at Primitive, unless specified otherwise for an individual wilderness area.
2. Outfitter-guide operating plans model appropriate wilderness practices, such as Leave No Trace principles, and incorporate awareness for wilderness values in their interaction with clients and others.

Management Approaches

- Completing visitor-use estimates and capacity studies for each area if needed.
- Adjusting group size if visitor use threatens wilderness character.

Trails and Signage in Wilderness

Desired Conditions

An interconnecting system of trails provides visitors with delineated access into, through, and out of wilderness areas, as well as to certain destinations within each area. Trails are well-marked and maintained, blend into the landscape and do not dominate the viewshed. Non-NF system trails are rare. Signage is durable and easy to locate without dominating the natural backdrop. Visitors engage in self-willed, primitive recreation.

Guidelines

1. Trail maintenance should be coordinated to avoid anticipated high-use visitor periods to minimize encounters.
2. New trail construction should only be considered if the objective is to enhance wilderness character (e.g., control overuse, limit resource degradation).
3. Bridges should not be constructed or installed.
4. Signs within wilderness areas should provide directional information only, unless a specific need exists for an individual wilderness area

Standards

1. Natural, and preferably locally-available, materials will be used in the construction and signing of trails within wilderness areas, except when specified otherwise for an individual wilderness area.

Management Approaches

- Prioritizing trail reconstruction based on potential for loss of wilderness values, impacts to wilderness recreation experience, and amount of use.
- Engaging hiking and equestrian groups in collaborative trail maintenance and construction projects and long-term partnerships.
- Evaluating trails that are minimally used for their need and impact on wilderness character.
-

Fire in Wilderness

Desired Conditions

Fire plays a natural ecological role in wilderness areas, acting as a primary disturbance that contributes to each area's natural character. Fire in wilderness areas varies in size and severity. Fires within an acceptable level of risk span into and across delineated wilderness boundaries and rarely require physical human intervention. Wildfires do not threaten the natural characteristics of an area, nor do they threaten other resources or structures or other resources adjacent to wilderness areas; suppression of fire is rarely necessary.

Guidelines

1. Natural unplanned ignitions should be used to obtain resource benefits.
2. Prescribed fire should be used to create conditions that enable naturally-occurring fires to return to their historic role or to achieve wilderness area desired conditions.
3. Minimum Impact Suppression Tactics should be used in the control and management of fire in wilderness.

Management Approaches

- Consulting a wilderness resource advisor during all fires that enter or start within wilderness areas, and for any fires with the potential to enter wilderness areas or affect the character of an adjacent wilderness area.

Insects and Disease in Wilderness

Desired Conditions

Along with fire, indigenous insects and diseases are recognized as natural disturbance mechanisms in wilderness areas. The scientific value of observing the role of indigenous insects and diseases as a natural dynamic in the ecosystems is exceptionally high.

Guidelines

1. Human controls should not be applied to insect and disease life cycles, except to protect resources on adjacent lands or when unnatural loss is anticipated to occur.

Land Ownership and Boundary Adjustment in Wilderness

Desired Conditions

Boundaries are posted and noticeable to visitors. The location of private lands within wilderness areas is publicized. Employees and visitors are educated about land ownership rights. Wilderness character and experiences appear seamless across agency boundaries where Forest wilderness areas border other agency wilderness areas.

Management Approaches

- Communicating with landowners regularly to ensure that visitor-landowner conflicts are minimized.
- Partnering with other federal agencies to ensure management is as consistent as possible for contiguous wilderness areas.
-

Management Areas

Research in Wilderness

Designated Wilderness Areas

Desired Conditions

Wilderness areas provide an ideal outdoor laboratory for studying the natural environment in its most pristine form. Scientific studies allow for discovery of wilderness-dependent information. Research contributes to the understanding of complex ecosystem interactions and disturbances, and aids managers in improving wilderness management strategies. Field studies do not detract from wilderness character.

Guidelines

1. Research proposals should not be approved in wilderness areas if locations outside of wilderness areas provide similar research opportunities.
2. Field marking of temporary plots, points, or other research design components should not be noticeable to visitors or impair wilderness character.
3. Installations, such as cameras and remote sensing equipment, should be avoided.

Chiricahua Wilderness

Chiricahua Wilderness

General Description

At the heart of the Chiricahua Ecosystem Management Area (EMA) lies the 87,700-acre Chiricahua Wilderness. This wilderness area was designated by the 1964 Wilderness Act and expanded by the 1984 Arizona Wilderness Act. More than a century ago, the Chiricahua Apache Tribe called the area of the Chiricahua Wilderness home. This mountainous landscape rises to an elevation of 9,797 feet at Chiricahua Peak. The Chiricahua Wilderness contains nine of the ten major vegetation communities.

Table 3: Major Vegetation Communities of the Chiricahua Wilderness

Vegetation Community	Percent of Chiricahua Wilderness
Madrean encinal woodland	45.4
Dry mixed conifer	18.9
Madrean pine-oak woodland	14.2
Interior chaparral	10
Desert communities	7.1
Ponderosa pine-evergreen oak	2
Grasslands	1.7
Wet mixed conifer	0.5
Riparian areas	0.3

Its terrain supports diverse plant life, and this habitat is known to support populations of birds most often observed in Mexico. Dense brush, steep elevations, precipitous canyon walls, and an undependable water supply limit

Management Areas

Chiricahua Wilderness

recreational use of the Wilderness to the 13 established trails. Portions of Rucker Canyon, Turkey Creek and Cave Creek are contained within the Wilderness boundary. To the north, the Chiricahua National Monument Wilderness, managed by the National Park Service, augments the Wilderness character of the mountain range.

Objectives

1. Remove trash along 4 miles of NF system trails annually during the first decade following plan approval.

Guidelines

1. Trailhead parking areas should be designed to passively limit visitor-use to levels that maintain wilderness character.

Standards

1. Air quality shall be maintained at the Class I level.
2. The existing recreation opportunity spectrum classification shall be maintained at Primitive.
3. The Cima Administrative Site and Monte Vista Cabin shall be maintained

Management Approaches

- Coordinating management strategies with Chiricahua National Monument Wilderness, managed by the National Park Service.
- Considering a permit system to facilitate pre-trip education, limit visitor use to a level compatible with wilderness values, and inform managers of the numbers, type, and spatial distribution of visitors in the Chiricahua Wilderness.
- Coordinating with local user groups to develop a volunteer wilderness stewardship program, emphasizing non-confrontational educational opportunities and information-sharing.
- Integrating wilderness ethics education with information pertaining to wildlife-watching opportunities to limit adverse effects on wilderness character, particularly within the South Fork of Cave Creek and near the Rustler Park area.
- Determining the capacity and need for outfitter and guide services within the Chiricahua Wilderness to meet increasing demand for special-use permit requests.

Galiuro Wilderness

Galiuro Wilderness

General Description

Much of the Galiuro EMA was designated as wilderness by the 1964 Wilderness Act. This 76,317-acre Wilderness abuts the Bureau of Land Management-administered Redfield Canyon Wilderness to the south. The highest elevation is 7,671 feet on Bassett Peak. The Galiuro Wilderness contains six of the ten major vegetation communities.

Management Areas

Galiuro Wilderness

Table 4: Major Vegetation Communities of the Galiuro Wilderness

Vegetation Community	Percent of Galiuro Wilderness
Madrean pine-oak woodland	34.6
Madrean encinal woodland	26.1
Interior chaparral	20.6
Dry mixed conifer	11.4
Grasslands	6.8
Desert communities	0.5

The Galiuro Wilderness preserves the primitive and wild character of the area for future generations. Within it, the precipitous, rocky, and brushy Galiuro Mountains rise abruptly in block-like uplifts from desert plains. Nineteen miles in length and six miles in width (on average), these mountains are almost entirely within the designated Wilderness. The area is characterized by many rugged cliffs displaying brightly-colored rocks and exposed soils, the result of mostly wind-driven erosion. Bisected by two main canyons (Redfield and Rattlesnake), the Galiuro Wilderness supports vegetation that varies from semi-desert grasslands; pinon, juniper, oak, and brush; and mixed conifers and aspens at high elevations. Lightly-used trails traverse the ridges and valleys, accessing the few springs that provide the only sources of water in a range where there are no perennial streams.

Objectives

1. Eradicate any known occurrences of buffelgrass within one year of its discovery.

Standards

1. Air quality shall be maintained at the Class I level.
2. Powers Cabin shall be maintained and preserved.

Management Approaches

- Coordinating management strategies with the Redfield Canyon Wilderness, managed by the Bureau of Land Management.
- Working with volunteer groups and educational organizations to preserve historic structures and restore degraded wilderness character where evidence of past human activities persist.

Miller Peak Wilderness

Miller Peak Wilderness

General Description

Named for the highest point in the Huachuca Mountains, the Miller Peak Wilderness was established in 1984 by the Arizona Wilderness Act and encompasses 20,228 acres in the upper elevations of the Huachuca EMA. The Miller Peak Wilderness contains six of the eight major vegetation communities.

Table 5: Major Vegetation Communities of the Miller Peak Wilderness

Vegetation Community	Percent of Miller Peak Wilderness
Madrean encinal woodland	51.4
Dry mixed conifer	17.9
Desert communities	10.1
Interior chaparral	9.6
Madrean pine-oak woodland	4.9
Wet mixed conifer	3.4
Grasslands	2.6
Riparian areas	0.1

From atop 9,466-foot Miller Peak, the views extend into Mexico and across southeastern Arizona, with countless mountain ranges in all directions. The Arizona Trail traverses the Wilderness (and a major portion of the EMA) before reaching its southern terminus at the international border with Mexico. The Arizona and other trails crisscross slopes and ridgelines, navigating sheer cliffs and deep canyons, geographic features that collectively support over 170 species of birds, 78 species of mammals, and over 60 lizard species.

Objectives

1. Annually remove trash along 5 miles of NF system trails within the Miller Peak Wilderness during the first decade following plan approval.
2. Restore 1 mile of user-created trails each year.

Guidelines

1. Signs should be constructed from durable materials to sustain the impacts associated with the international border. In some cases, man-made materials for signs or sign posts may be the most appropriate for this purpose, although natural-appearing materials suitable for a primitive ROS setting should be favored.
2. Impact and restoration studies should be encouraged in this wilderness area

Management Approaches

- Coordinating with U.S. Border Patrol to develop strategies that ensure illegal immigrants and traffickers are not funneled into the Miller Peak Wilderness as enforcement activities ensue.
- Working with volunteer groups, partners, and agency personnel to clean off-trail sites where discarded refuse from illegal immigrants has collected and degraded the wilderness character.
- Communicating with U.S. Border Patrol officers to maximize safety awareness when large groups are present and during the high visitor-use season.
- Considering a permit system to reduce and contain visitor impacts.
-

- Coordinating with U.S. Border Patrol to ensure that agents are aware of wilderness policies and mindful of the wilderness characteristics unique to this area.
- Making cautionary information related to the international border should be made available at all trailheads.
- Protecting historic structures from natural and human-caused disturbances.
- Encouraging impact and restoration studies in this wilderness area.
-

Mt. Wrightson Wilderness

General Description

The Mt. Wrightson Wilderness was designated by the 1964 Wilderness Act. A focal point of the Santa Rita Mountains, the 25,260-acre Mt. Wrightson Wilderness is characterized by rough hillsides, deep canyons, and lofty ridges topped by 9,452-foot Mt. Wrightson. The Mt. Wrightson Wilderness contains eight of the ten major vegetation communities.

Table 6: Major Vegetation Communities of the Mt. Wrightson Wilderness

Vegetation Community	Percent of Mt. Wrightson Wilderness
Madrean encinal woodland	46.8
Madrean pine-oak woodland	21.1
Interior chaparral	10.4
Desert communities	7.7
Dry mixed conifer	6.0
Grasslands	5.1
Wet mixed conifer	1.6
Riparian areas	1.2

Ponderosa pine and Douglas-fir dominate higher reaches of the area, while lower and more exposed slopes are oak woodlands. Stream-fed canyons support an abundance of plant and animal life, including many montane Mexican plants that grow nowhere else north of the international border. This diversity that characterizes the Mt. Wrightson Wilderness attracts nature enthusiasts who value wildlife viewing as vital to their Wilderness experience.

Objectives

1. Remove trash along three miles of NF system trails annually during the first decade following plan approval.
2. Eradicate any and all known occurrences of buffelgrass and yellow bluestem within one year of their discovery.

Guidelines

Trailhead parking areas should be designed to passively limit visitor use at levels that maintain wilderness character.

Management Areas

Mt. Wrightson Wilderness

Standards

1. Wilderness areas within Madera Canyon shall be managed at the highest possible scenic integrity level, with a level of Very High.

2. The existing recreation opportunity spectrum classification composition shall be maintained at Semi-Primitive Non-motorized, or increased to Primitive where possible.

Management Approaches

- Preventing buffelgrass and yellow bluestem outbreaks by treating infestations outside of the wilderness area boundary before they have a chance to spread into the wilderness.
- Considering a permit system to facilitate pre-trip education, limit visitor use to a level compatible with wilderness values, and inform managers of the numbers, type, and spatial distribution of visitors in the Mt. Wrightson Wilderness.
- Coordinating with local user groups to develop a volunteer wilderness stewardship program, emphasizing non-confrontational education and information-sharing.
- Encouraging the University of Arizona and other academic and scientific communities to include wilderness values and opportunities to limit adverse impacts into their research designs.

Pajarita Wilderness

Pajarita Wilderness

General Description

The 7,553-acre Pajarita Wilderness is in the Tumacacori Ecosystem Management Area and was designated in 1984 by the Arizona Wilderness Act. The Pajarita Wilderness contains five of the ten major vegetation communities.

Table 7: Major Vegetation Communities of the Pajarita Wilderness

Vegetation Community	Percent of Pajarita Wilderness
Madrean encinal woodland	38.0
Desert communities	36.4
Grasslands	23.5
Riparian areas	1.9
Interior chaparral	0.2

The Pajarita Wilderness encompasses a large portion of Sycamore Canyon, California Gulch, and the Goodding Research Natural Area. More than 660 species of plants have been identified within its borders, 17 of which are found nowhere else on earth. Pajarita means “little bird” in Spanish, and more than 160 species of birds have been identified here along with more than 200 species of butterflies. Two major trails lead into the Pajarita Wilderness; Sycamore Canyon Trail runs south from Hank and Yank Spring and the Border Trail skirts

Management Areas

the international border from Summit Motorway, a rough four-wheel-drive road that parallels the eastern edge of the Wilderness.

Pajarita Wilderness

Objectives

1. Remove trash along 1 mile of NF system trails annually within the Pajarita Wilderness during the first decade following plan approval.

Guidelines

1. Signs should be constructed from durable materials to sustain the impacts associated with the international border. In some cases, man-made materials may be the most appropriate for this purpose, although natural-appearing materials should be favored.

Management Approaches

- Coordinating with U.S. Border Patrol to develop strategies that ensure illegal immigrants and traffickers are not funneled into the Pajarita Wilderness as enforcement activities ensue.
- Working with volunteer groups, partners, and agency personnel to clean off-trail sites where discarded refuse from illegal immigrants has collected and impaired wilderness character, and to restore user-created trails.
- Preventing buffelgrass outbreaks by treating infestations outside of the wilderness area boundary before they have a chance to spread into the wilderness.
- Communicating with U.S. Border Patrol officers to maximize safety awareness when large groups are present and during the high visitor-use season.
- Considering a permit system to reduce and contain visitor impacts.
- Coordinating with U.S. Border Patrol to ensure that agents are aware of wilderness policies and mindful of the wilderness characteristics unique to this area. Further, working to ensure that actions taken by the U.S. Border Patrol are guided by the Forest's intent to maintain or improve wilderness values. Cautionary information related to the international border should be made available at all trailheads.

Pusch Ridge Wilderness

Pusch Ridge Wilderness

General Description

Pusch Ridge is one of the most prominent geographic features of the Santa Catalina Mountains. It forms the backbone of the 56,933-acre Pusch Ridge Wilderness designated in 1978. The Pusch Ridge Wilderness contains eight of the ten major vegetation communities.

Table 8: Major Vegetation Communities of the Pusch Ridge Wilderness

Vegetation Community	Percent of Pusch Ridge Wilderness
Madrean encinal woodland	32.1
Desert communities	27.3
Madrean pine-oak woodland	19.8
Grasslands	11.3
Interior chaparral	5.8
Riparian areas	1.6
Wet mixed conifer	1.3
Dry mixed conifer	0.8

Elevations range from 2,800 to 8,800 feet, creating a diverse biological community that extends from desert up to mixed conifer forest. Topography consists of razorback ridges, precipitous canyons, and mountain tops that support a few mountain meadows. The wildlife community inhabiting this varied setting is diverse as well. Black bear, coatimundi, Steller's jay, cactus wren, saguaro cactus and Douglas-fir are all present in this wilderness. Finger Rock Canyon harbors a well-studied collection of xero-riparian vegetation, a common and important habitat type utilized by many species here and across the Forest. The extensive trail network in Pusch Ridge and its proximity to a major metropolitan area make it the Forest's most heavily visited wilderness area.

Objectives

1. Annually during the first 6 years following plan approval, treat exotic invasive grass populations (buffelgrass, fountain grass, natal grass) along trails in one previously untreated canyon on the southwest slope of the Pusch Ridge Wilderness; re-treat each area as necessary during each of the 4 years following initial treatment.

Guidelines

1. Recreation facilities should not be developed in the Pusch Peak area.
2. Trailhead parking areas should be designed to passively limit visitor use at levels that maintain wilderness character.

Standards

1. Wilderness areas near Sabino Canyon Recreation Area, Mount Lemmon communication sites, and along the General Hitchcock Highway shall be managed at the highest possible level, with a scenic integrity level of Very High.
2. The existing recreation opportunity spectrum classification shall be maintained at Semi-Primitive Non-motorized in areas near heavily used trailheads and Primitive elsewhere.
3. Man-made materials shall only be used in the construction and signing of trails when natural materials cannot be obtained at, or transported to, the site; natural-appearing materials suitable for a primitive ROS setting should be favored.

Management Areas

Pusch Ridge Wilderness

Management Approaches

- Considering a permit system to facilitate pre-trip education, limit visitor use to a level compatible with wilderness values, and inform managers of the numbers, type, and spatial distribution of visitors in the Pusch Ridge Wilderness.
- Coordinating with local user groups to develop a volunteer wilderness stewardship program, emphasizing educational opportunities and information-sharing.
- Using education to prevent the unlawful collection of cultural artifacts.
- Encouraging the University of Arizona and other academic and scientific communities to include wilderness values and opportunities to limit adverse impacts into their research designs.
- Utilizing the most effective combination of treatments available to buffelgrass, fountain grass, and natal grass containment/eradication efforts to maximize effectiveness and minimize the amount of time required for management intervention; treatment options should include manual removal and herbicides.
- Maintaining favorable habitat conditions for bighorn sheep within the entire wilderness area, and especially within the Bighorn Sheep Management Area.
- Discouraging cross-country travel in educational efforts to limit impacts to vegetation, soils, water, and wildlife.

Rincon Mountain Wilderness

Rincon Mountain Wilderness

General Description

The Rincon Mountain Wilderness was designated in 1984 at the southeastern edge of the Santa Catalina Ecosystem Management Area. This wilderness area spans 38,950 acres along the Forest boundary and the highest elevation is 7,325 feet. The Rincon Mountain Wilderness contains six of the ten major vegetation communities.

Table 9: Major Vegetation Communities of the Rincon Mountain Wilderness

Vegetation Community	Percent of Rincon Mountain Wilderness
Madrean encinal woodland	38.7
Grasslands	26.7
Desert communities	25.5
Interior chaparral	6.6
Madrean pine-oak woodland	2.1
Riparian areas	0.4

The Rincon Mountain Wilderness is contiguous with the larger Saguaro Wilderness, which is administered by the National Park Service as part of Saguaro National Park-East. There are a few rough four-wheel-drive roads

Rincon Mountain Wilderness

leading to the northern boundary and some trails leading into it from the National Park. The Rincon Mountain Wilderness is accessible primarily by a single two-wheel-drive road (National Forest System Road 35) along its eastern boundary.

Objectives

1. Include trail mileage on directional signs at wilderness trailheads within 10 years of plan approval.

Guidelines

1. Trailhead parking areas should be designed to prevent motorized trespass beyond the wilderness boundary.

Management Approaches

- Coordinating management strategies with the Saguaro Wilderness, managed by the National Park Service.
- Encouraging visitors to limit off-trail group size (including cross-country travel and at dispersed camping areas) to no more than 6 people and 6 riding/packstock animals per group.

Santa Teresa Wilderness

Santa Teresa Wilderness

General Description

The 26,780-acre Santa Teresa Wilderness covers just over half of the Santa Teresa EMA; it was designated in 1984. Adjacent to the northeast boundary is the North Santa Teresa Wilderness, managed by the Bureau of Land Management. This is one of the more remote and lightly-visited Wilderness areas on the Forest. Elevations rise to 7,481 feet on the summit of Cottonwood Peak. The Santa Teresa Mountain Wilderness contains six of the ten major vegetation communities.

Table 10: Major Vegetation Communities of the Santa Teresa Wilderness

Vegetation Community	Percent of Santa Teresa Wilderness
Interior chaparral	31.9
Madrean encinal woodland	30.0
Madrean pine-oak woodland	13.1
Grasslands	12.7
Ponderosa pine-evergreen oak	12.1
Desert communities	0.2

Caves and alcoves have hollowed out eroded cliffs into picturesque formations. Thick chaparral vegetation covers the terrain with stands of ponderosa pine and Douglas-fir on the north flanks and the crest of Cottonwood Peak. Black bear coati, javelina, and mountain lion are present. Several foot trails traverse the deep canyons and bald summits, but are lightly used and may be difficult to

Management Areas

follow. The most frequent use of these trails is by ranchers during periodic livestock drives. Water is available year-round at several springs.

Santa Teresa Wilderness

Management Approaches

- Coordinating management strategies with the North Santa Teresa Wilderness, managed by the Bureau of Land Management.
- Coordinating with the Bureau of Land Management and San Carlos Apache Tribe to maintain and improve access to wilderness trailheads.

Recommended Wilderness Areas

General Descriptions

Recommended Wilderness Areas

Ku Chish Recommended Wilderness Area. The XXXX-acre Ku Chish Recommended Wilderness Area is located at the north end of the Chiricahua EMA. This recommended wilderness area is adjacent to the Chiricahua National Monument Wilderness, which is managed by the National Park Service. Steep terrain and an undependable water supply limit recreational use mainly to the three established trails in the recommended wilderness area.

Mount Graham Recommended Wilderness Area. The Mount Graham Wilderness Study Area (WSA) was designated as such by the Arizona

Wilderness Act of 1984. This 62,000-acre area circles the high peaks of the Pinaleño EMA. It was recommended for formal wilderness designation in the 1986 Coronado Forest Plan. In 1989, an additional 442 acres adjacent to the Mount Graham WSA was administratively recommended for wilderness designation. The area is characterized by steep mountainsides and canyons. Because of the areas unusual shape, access is most readily available from Swift Trail Parkway, in its interior, rather than from trailheads around the base of the EMA. One access point at the end of Marijilda Canyon Road (National Forest System Road 57) allows hikers to follow a rare, perennial drainage into the WSA, a canyon believed to support the highest diversity of lizard species in the United States.

Desired Conditions

See Plan Components for Designated Wilderness Areas

Guidelines

See Plan Components for Designated Wilderness Areas

Standards

See Plan Components for Designated Wilderness Areas

Management Approaches

See Plan Components for Designated Wilderness Areas

Management Areas

Wilderness Study Areas

Wilderness Study Areas

General Descriptions

Bunk Robinson and Whitmire Canyon Wilderness Study Areas. The New Mexico Wilderness Act of 1980 created both the Bunk Robinson and Whitmire Canyon Wilderness Study Areas (WSAs), which occupy a large portion of the Peloncillo EMA. Each was enlarged with the Arizona Wilderness Act of 1984, for a total of 17,482 acres in the Bunk Robinson WSA and 10,889 in the Whitmire Canyon WSA. To allow for flexibility in managing wildlife habitat, and because their ecosystems are well-represented in other Arizona wilderness areas, both WSAs were recommended for non-wilderness designation in the 1986 Forest Plan. Until Congress makes a decision, Bunk Robinson and Whitmire Canyon WSAs will continue to be managed to maintain their existing wilderness character.

Desired Conditions

Wilderness study areas are natural in appearance and essence. They provide unconfined opportunities for exploration, solitude, natural risk, challenge, and primitive recreation. When traveling on trails, human encounters are generally limited. When traveling cross-country, almost no human encounters are expected. There is little evidence of human developments or human activities. Ecological disturbance processes such as fire, insects, and disease are the primary factors affecting landscape patterns in wilderness study areas.

There is little or no evidence of camping activity, unauthorized trails, or trash. Where needed, outfitters and guides provide services to visitors seeking a wilderness experience. Visitor use is in balance with wilderness characteristics.

Guidelines

1. Wilderness study areas should be managed to preserve or enhance scenic resources.
2. Wilderness study areas should be managed for primitive recreation settings.
3. New recreation facilities other than trails should not be constructed.
4. Timber harvest should not be permitted.
5. Gathering of forest products for sale should not be permitted.
6. Mechanized or motorized trails should not be designated.
7. New roads should not be constructed.

Eligible Wild, Scenic, and Recreational Rivers

Eligible Wild, Scenic, and Recreational Rivers

General Description

In 1993 rivers on the Coronado National Forest were evaluated to determine their eligibility as either wild, scenic, or recreational rivers. This evaluation resulted in 16 river segments being eligible for designation. In 2008 the 16 river segments were re-evaluated and all were determined to still be eligible. Table 11 displays the potential classification and outstanding remarkable values for each eligible segment.

Table 11: Eligible Wild, Scenic, and Recreational River Segments

Eligible River Segment	Classification	Outstandingly Remarkable Values (ORVs)	Length (miles)	Ecosystem Management Area
Ash Creek	Recreation	Scenic, recreation, wildlife, fish, historic, cultural, and ecological	6.2	Pinaleño
Cima (Winn Falls) Creek	Wild	Scenic, recreation, wildlife, historic, cultural, and riparian	2.5	Chiricahua
Grant Creek	Recreation	Scenic, recreation, wildlife, fish, historic, cultural, and ecological	5	Pinaleño
Lower Canada del Oro	Recreation	Scenic, wildlife, fish, and historic	3.4	Santa Catalina
Lower Cave Creek	Recreation	Scenic, recreation, geologic, fish, wildlife, historic, cultural, ecological, and riparian	7	Chiricahua
Lower Romero Canyon	Recreation	Recreation, wildlife, fish, historic, and cultural	2.2	Santa Catalina
Lower Sabino Creek	Recreation	Scenic, recreation, wildlife, fish, historic, and cultural	3.2	Santa Catalina
Lower South Fork Cave Creek	Scenic	Scenic, recreation, wildlife, fish, geologic, cultural, riparian, and ecological	1.4	Chiricahua
Post Creek	Scenic	Scenic, recreation, wildlife, fish, and cultural	2.2	Pinaleño
Redfield Canyon	Scenic	Scenic and wildlife	9.1	Galiuro
Eligible River Segment	**Classification**	**Outstandingly Remarkable Values (ORVs)**	**Length (miles)**	**Ecosystem Management Area**
Rucker Creek	Wild	Scenic, recreation, wildlife, fish, and geologic	5.9	Chiricahua
Sycamore River	Scenic	Scenic, recreation, wildlife, fish, historic, cultural, and ecological	5	Tumacacori

Eligible River Segment	Classification	Outstandingly Remarkable Values (ORVs)	Length (miles)	Ecosystem Management Area
Upper Canada del Oro	Wild	Scenic, wildlife, and fish	6	Santa Catalina
Upper Romero Canyon	Wild	Scenic, recreation, wildlife, fish, and cultural	6.1	Santa Catalina
Upper Sabino Creek	Wild	Scenic, recreation, wildlife, historic, and cultural	8	Santa Catalina
Upper South Fork Cave Creek	Wild	Scenic, recreation, wildlife, fish, historic, and riparian	6.2	Chiricahua

Management Areas

Wilderness Study Areas
Eligible Wild, Scenic, and Recreational Rivers

Desired Conditions

Wild rivers are free of impoundment. The shoreline is essentially primitive with little or no evidence of human activity. The area is inaccessible except by trail and no developed recreation facilities exist. The water quality meets or exceeds state standards.

Scenic rivers are free of impoundment. The shoreline is largely

primitive and undeveloped, and there is no substantial evidence of human activity. Evidence of human activities generally diminishes over time. Roads may reach or bridge the river. Improvements that occur are minimally intrusive in the landscape.

Recreation rivers are generally readily accessible by road or trail. Encounters with people are expected and recreation opportunities vary depending on their compatibility with the outstandingly remarkable value of the eligible segment. Vegetation management is used to enhance recreation river values. Improvements (such as primitive roads, trails, bridges, fences, or signs) may dominate the landscape. Facilities are visually complementary with the landscape.

Standards

The conditions that support the classification and outstandingly remarkable values will be maintained when implementing projects.

Arizona National Scenic Trail

General Description

The Arizona National Scenic Trail (ANST) is a non-motorized, largely primitive trail that stretches 800+ miles across Arizona to connect deserts, mountains, forests, wilderness, canyons, historic sites, communities and people. It passes through some of the most renowned landscapes in the state of Arizona and is the only national scenic trail in the State. The ANST showcases Arizona's diverse life zones and scenery, and is enjoyed by a wide variety of non-motorized recreationists, including hikers, equestrians, mountain bicyclists, cross-country skiers and others. Starting in the Coronado National Memorial, on the border between the U.S. and Mexico, the Trail climbs and descends from one Coronado National Forest "sky island" to another. It traverses the Huachuca Mountains, Canelo Hills, Patagonia Mountains, Santa Rita Mountains, Rincon Valley, Rincon Mountains and Santa Catalina Mountains. There are 143 miles of ANST on the Coronado National Forest. North of the Coronado, the Trail continues across rolling Sonoran Desert hills and mountains, crosses the Gila River, then winds through the Superstition Mountains and on to the Mogollon Rim and the forests of northern Arizona. It crosses the Grand Canyon on the South and North Kaibab Trails, then continues across the Kaibab Plateau to end at the Utah border next to the Vermillion Cliffs National Monument. About 70 percent of the Trail lies on National Forest land, but the ANST also crosses Bureau of Land Management, National Park Service, Arizona State Parks, Arizona State Trust Land, county, private and municipal lands.

Desired Conditions

The ANST provides both short and long-distance non-motorized recreation opportunities in mainly remote and primitive settings representative of the dramatic natural landscapes and varied vegetation of Arizona. Along most of the 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 the ANST was established. In remote areas, the sights and sounds of roads, motorized trails, utility corridors and other facilities are rarely encountered. Near towns and developed recreation facilities, the ANST may become a more accessible and highly developed route with access to amenities via connector trails. Recreation and other activities on or adjacent to the ANST do not negatively impact cultural and natural resources, scenic integrity, or the non-motorized recreation experience. User conflicts are infrequent. Signage, while unobtrusive, is sufficient to help long-distance travelers find nearby developed sites, trailheads, recreation facilities, and drinking water sources. Trailheads are conveniently placed and, where equestrian use is common, sufficient parking space for trucks pulling trailers exists.

Guidelines

1. Management actions should not result in recreation setting changes from less to more developed, particularly within ½ mile of the ANST.
2. Permitted recreation special use authorizations should be managed to protect the desired recreation setting for a non-motorized trail.

Management Areas

Arizona National Scenic Trail

3. New road or motorized trail construction across or adjacent to the ANST should be avoided.
4. Placement of new utility corridors and communication facilities should be avoided by choosing alternate locations, or co-located with existing utility corridors and facilities.
5. Utilities lines should be buried when feasible to mitigate visual impacts.
6. Forest health projects should be managed to minimize long-term visual impacts within and adjacent to the ANST corridor.
7. Fire on or in the foreground of the ANST should be managed using minimum impact suppression tactics, or other tactics appropriate for the protection of values and resources for which the trail was designated.[13]

Management Approaches

- Working with the Arizona Trail Association and adjacent landowners and agencies to maintain the trail corridor and the condition and natural character of the surrounding landscape.
- Managing the ANST and corridor consistent with the 1995 Arizona Trail Management Guide, where applicable, until such time as the Comprehensive Management Plan is completed.
- Managing the ANST and corridor consistent with the Comprehensive Management Plan when completed.

Land Use Zones

Land Use Zones

There are four land use zones on the Coronado National Forest: Wild Backcountry, Roaded Backcountry, Developed Recreation, and Motorized Recreation.

Wild Backcountry

Wild Backcountry

General Description

The Wild Backcountry Land Use Zone is managed to maintain natural features and landscapes with the minimum infrastructure necessary to support a range of non-motorized uses. Motorized access is available via primitive, infrequently maintained roads. It includes Inventoried Roadless Areas, areas adjacent to Wilderness areas, and other relatively pristine, sparsely roaded areas. This zone offers recreational opportunities in the primitive to semi-primitive recreation opportunity spectrum. This means settings can be primitive, wilderness-like areas that are natural and provide many opportunities for non-motorized recreation that include challenge and solitude; roadless areas that provide many dispersed non-motorized recreation opportunities such as hiking, camping and birdwatching but are closer to roads and have more visitors than the most primitive settings; and similar areas that are accessed by primitive roads or motorized trials and are used for a wide variety of activities, both recreational

[13] *Jolly, D. F. 1993. Minimum impact suppression tactics guidelines for the northern region of U.S. Department of Agriculture Forest Service, Missoula , Montana*

Management Areas

Wild Backcountry

and other, including enjoyment of scenery, escape from the crowded areas, hunting, off highway vehicle use, dispersed camping, hiking, horseback riding, mountain biking, mining, and cutting firewood. Generally, the only facilities in these areas are primitive roads and trails. This land use zone makes up 618,879 acres, or about 35 percent of the Coronado NF.

Desired Conditions

The wild character of these areas is preserved. Settings are natural, and the sights and sounds of motorized vehicles are infrequent along roads and non-existent in unroaded areas. Crowds or other urban elements are not evident. Motorized access is available via a few primitive or high-clearance roads. Motorized vehicle access is allowed into limited areas. Dispersed camping sites are available to those who seek them but are used infrequently. Recreational impacts on the landscape are minimal. Vegetation within these sites is vigorous and quickly recovers from the impacts of camping activities. Opportunities for solitude and quiet recreation are readily found. Hunters enjoy a challenging and remote experience. Visitors are able to explore and discover remote portions of the Forest via primitive backcountry motorized routes. Quiet experiences are available in this entire zone, with the exception of areas directly adjacent to the small number of access roads.

Guidelines

1. Lands should be managed to maintain the undeveloped character of the areas.
2. Temporary roads should be allowed only for administrative access, national security, tribal needs, forest health projects, or fires.
3. New roads should be allowed only as needed to restore motorized public access to NFS land. 4. Scenic resources should be managed so that human activities are minimally visually evident, as per the Coronado NF scenic integrity objective (SIO) maps.
5. New utility structures and power lines should not be allowed.
6. Vegetation treatments should reflect the natural disturbance regimes for the vegetation community.

Management Approaches

- Exploring opportunities for creating and preserving quiet recreation areas through vehicle class designations on specific roads, i.e., limiting use to vehicles that produce noise within a decibel range compatible with quiet recreation goals.
- Removing roads and temporary facilities when they are no longer needed.

Roaded Backcountry

Roaded Backcountry

General Description

The Roaded Backcountry Land Use Zone is managed for a balance of dispersed motorized, non-motorized and quiet recreation uses. The natural character and recreation settings are retained and development is limited. This zone offers a range of recreation opportunities. Remote areas are roadless, have no facilities other than trails, and are available only for non-motorized recreation where encounters with other visitors are infrequent. This setting offers ample opportunities for privacy and challenges to visitors' self-reliance and outdoor

Management Areas

Roaded Backcountry

skills. The most accessible areas are near roads and contain settings that, while predominantly naturally-appearing, show some evidence of resource modification and utilization. Road densities tend to be higher and roads are better than primitive. In these settings the number of interactions between users may be moderate to high and evidence of other users can be prevalent. Self reliance on outdoor skills is only of moderate importance with little opportunity for challenge and risk. Roaded Backcountry makes up 653,727 acres, or about 37%, of the Coronado NF.

Desired Conditions

Settings are natural and there are very few permanent facilities. Opportunities for quiet recreation exist both away from roads and along many less heavily used routes. Dispersed campsites are clean and impacts from campers are minimal. National Forest System roads provide access to trailheads; remote, undeveloped camping areas; and occasionally developed recreation facilities or administrative sites. Most roads are unpaved. Forest visitors can enjoy semi-primitive motorized recreation and explore the backcountry in off-highway vehicles along designated roads or motorized trails.

Guidelines

1. The level and type of development should be limited in order to protect the natural character inherent in this zone.
2. Managers should consider expanding the ability of existing facilities before proposing new facilities.
3. New roads may be constructed, reconstructed, or relocated for a variety of public and administrative uses and needs.
4. Scenic resources should be managed so that human activities are visually subordinate and blend into to the landscape, as per the Coronado NF scenic integrity objective maps.
5. New utility structures and power lines should be located within existing communications sites and utility corridors.

Developed Recreation

Developed Recreation

General Description

This land use zone includes the major public access corridors into the Coronado National Forest. The roads in this zone are mostly paved and are popular sightseeing routes. In some cases, the main roads are designated as scenic byways. Visitors often spend the day in these areas, and destinations include campgrounds, picnic areas, vista points, visitor centers, and lakes. Organization camps and recreational residences are found in some areas. There are many popular trailheads in these areas, and hiking trails generally provide access to Roaded Backcountry and Wild Backcountry zones, and to wilderness areas. This land use zone covers 38,792 acres, or about 2 percent of the Coronado NF.

Management Areas

Developed Recreation

Desired Conditions

Facilities are in good condition and blend into the forest setting. Visitors can enjoy natural settings with a high level of comfort and safety. Roads are well maintained and accommodate all types of vehicles.

Guidelines

1. These areas should be managed to protect their natural character.
2. As public facilities are constructed or renovated, they should be made more accessible to meet or exceed accessibility guidelines.
3. Scenic resources should be managed so that human activities are visually subordinate and blend into to the landscape as much as possible, as per the Coronado NF scenic integrity objective maps.
4. New utility structures and power lines should not be allowed, and upgrades to existing overhead lines should be buried when replaced.
5. Livestock grazing should not be permitted within Developed Recreation Zone sites, except where designated allotments overlap with recreation area boundaries, or for the purposes of targeted grazing for vegetation management.

Management Approach

- Managing these areas in accordance with guidance provided in existing and future plans (such as Corridor Management Plans, Recreation Concept Plans, etc.).

Motorized Recreation

Motorized Recreation

General Description

This land use zone is assigned to areas that have a high level of motorized use. Two different types of motorized use areas are included in this zone: Highway corridors that cross Coronado NF Lands (where vehicles are traveling at high speeds and most travelers are simply passing through the forest), and off-highway vehicle (OHV) corridors (where facilities for OHV use are provided). This zone provides a wide variety of recreational experiences, including driving for pleasure, while mitigating effects of motorized use and minimizing conflicts with other users. This land use zone covers 3,035 acres, or less than one percent of the Coronado NF.

Desired Conditions

In highway corridors, forest visitors have opportunities for driving for pleasure. Visitors can enjoy natural settings beyond the roadway, and roads are paved, well maintained, and accommodate all types of vehicles. The sights and sounds of highway traffic are only incidentally apparent outside of these areas.

In OHV corridors, forest visitors can enjoy casual, semi-primitive motorized recreation and explore in off-highway vehicles along designated roads and routes. Long-distance loop routes exist that provide varying experiences for different vehicle classes. Separate motorized trails [e.g., single track motorized trails for dirt bikes and all-terrain vehicles (ATV)] exist to minimize conflicts among OHV types. Where non-motorized trails traverse this land use zone, adequate signing and enforcement deters motorized use of these trails. OHV and ATV use is concentrated in defined areas that promote a high-quality, motorized

Management Areas

use experience. The sights and sounds associated with OHV use are only incidentally apparent outside of these areas.

Developed Recreation

Guidelines

- 1. In OHV corridors, development of new facilities should protect natural resources and mitigate OHV impacts.
- 2. In highway corridors, the Forest Service should assist other agencies who maintain roadways.

3. Scenic resources should be managed so that human activities are visually subordinate and blend into the landscape, as per the Coronado NF scenic integrity objective maps.

Management Approach

- In OHV corridors, focusing the level and type of OHV facilities to protect the natural resources.
- Removing facilities that are obsolete or no longer needed.

Chapter 4: Suitability

Suitability of Uses and Special-Use Permits

General Description

This section describes the appropriateness of applying certain resource management practices to a particular area of land. A unit of land may be suitable for a variety of individual or combined management practices. The land units considered in the suitability determinations are the land use zones and wilderness areas, both described in Chapter 3, and research natural areas, described in Chapter 4. Table 4 below applies to selected activities that may be allowed on the Coronado NF, and is not inclusive of all activities that may be considered over the planning period. Table 5 applies to the suitability of activities that require special-use permits issued by the Coronado NF.

Table 12: Suitability of Selected Activities by Land Use Zone and Special Area

Suitable Uses	Wild Backcountry	Roaded Backcountry	Motorized Recreation	Developed Recreation	Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area	Arizona National Scenic Trail	Research Natural Areas
Motorized access	Yes (Limited)	Yes	Yes	Yes	No	Administrative only	No
ATV-focused recreation	No	No	Yes	No	No	No	No
Dispersed motorized camping	Yes	Yes	Yes	Yes	No	No	No
Recreation facilities	No	Yes	Yes	Yes	No	Yes	No
Timber harvest (for ecosystem restoration)	Yes	Yes	Yes	Yes	No	Yes	By exception[14]
Timber production	No	No	No	No	No	No	No

[14] Only if allowed in the establishment record for the RNA.

Livestock grazing	Yes	Yes	Yes	No	Yes	Yes	By exception[15]
Forest products (commercial)	Yes	Yes	Yes	No	No	No	No
Forest products (traditional)	Yes	Yes	Yes	Yes	Yes	Yes	No
Fuelwood products	Yes	Yes	Yes	Yes	No	No	No

[15] Ibid.

Table 13: Suitability of Special-Use Permits by Land Use Zone

Forest Service Manual 2720 Section	Special-Use Permit Category	Wild Backcountry	Roaded Backcountry	Motorized Recreation	Developed Recreation	Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area	Arizona National Scenic Trail	Research Natural Areas
2721.1	Group Use	Not Suitable	Not suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2721.2	Individual Use	Designated areas	Suitable	Suitable	Designated areas	Not suitable	Not suitable	Not suitable
2721.31	Private Lodging	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2721.32 and 2721.33	Hotel, Motel, and Resort	Not suitable	Suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2721.4	Facility-Related Activities (Except Recreation Event)	By exception	By exception	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2721.49	Recreation Event	Non-motorized Suitable	Suitable	Suitable	By exception	Not Suitable	Suitable	Not suitable
2721.5	Facility-Related Service (Except Outfitter and Guide Service)	Not suitable	Not suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2721.53	Outfitter and Guide Service	Suitable	Suitable	Suitable	By exception	Suitable	Suitable	Not Suitable
2721.6	Winter Recreation	Not suitable	Not suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2722.1 and 2722.2	Crops and Agricultural Improvements	Not suitable	Suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable

Forest Service Manual 2720 Section	Special-Use Permit Category	Wild Backcountry	Roaded Backcountry	Motorized Recreation	Developed Recreation	Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area	Arizona National Scenic Trail	Research Natural Areas
2722.3	Range Facilities	Suitable	Suitable	Not suitable	Not suitable	Not suitable	Suitable	Not suitable
2722.41	Convenience Enclosure	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable
2723.11 and 2723.13	Group Use and Other Religious Meetings	Not suitable	Suitable	Not suitable	Designated areas	Not suitable	Not suitable	Not suitable
2723.12	Native American Traditional Religious Activity	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable
2723.2	Religious Facilities	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2723.3	Public Information	Suitable	Suitable	Not suitable	Suitable	Not suitable	Suitable (at trailheads)	Not suitable
2723.4	Sanitary Systems	Not suitable	Not suitable	Not suitable	Suitable	Not suitable	Suitable (at trailheads)	Not suitable
2723.5	Community Residence	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2723.6	Service Uses	Not suitable	Not suitable	By exception	By exception	Not suitable	Not suitable	Not suitable
2723.7	Encroachments	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2724.1	Feasibility, Site, and Resource Survey	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable

Forest Service Manual 2720 Section	Special-Use Permit Category	Wild Backcountry	Roaded Backcountry	Motorized Recreation	Developed Recreation	Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area	Arizona National Scenic Trail	Research Natural Areas
2724.2	Research	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable
2724.3	Training	Suitable	Suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable
2724.42 and 2724.43	Cultural Resources Nondisturbing and Disturbing Use	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable
2724.44	Treasure Hunting	Suitable	Suitable	By exception	Not suitable	Not suitable	Not suitable	Not suitable
2724.5	Historical Building, Improvements, and Sites	Suitable	Suitable	Not suitable	Suitable	Suitable	Not Suitable	Suitable
2725.11	Construction Camps and Residence	Not suitable	Suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2725.2	Storage	Not suitable	Suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2725.3	Manufacturing	Not suitable	Not Suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2725.41	Weighing or Scaling Station	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2725.5	Arts	Suitable	Suitable	Suitable	Suitable	By exception	Suitable	Suitable
2725.9	Timber	Suitable	Suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable

Forest Service Manual 2720 Section	Special-Use Permit Category	Wild Backcountry	Roaded Backcountry	Motorized Recreation	Developed Recreation	Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area	Arizona National Scenic Trail	Research Natural Areas
2726.1	Powerplants Under the Authority of the Federal Energy Regulatory Commission	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2726.21	Wind Power Facility	Not suitable	Suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2726.22	Fossil Fuel Powerplant	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not Suitible	Not suitable
2726.3	Oil and Gas Development	Not suitable	Suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2726.4	Electric Distribution	Suitable	Suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable
2726.4	Electric Transmission	By exception	By exception	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2727.1	Aircraft Facilities	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2727.2	Marine	Not suitable	Not suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2727.3	Railroads	Not suitable	Suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
2727.41	Department of Transportation Easement	Not suitable	Suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable

Forest Service Manual 2720 Section	Special-Use Permit Category	Wild Backcountry	Roaded Backcountry	Motorized Recreation	Developed Recreation	Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area	Arizona National Scenic Trail	Research Natural Areas
2725.5	Road and Trail Authorization	Suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable	Not suitable
2727.6	Pipeline - Non-Energy Related	Not suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable	Not suitable
2727.71	Tramway and Conveyor	Not suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable	Not suitable
2728.1	Communication Use	Suitable on existing communications sites	Suitable onexisting communications sites	Suitable on existing communication sites	Suitable on existing communications sites	Not suitable	Not suitable	Not suitable
2728.2	Telephone and Telegraph	Suitable	Suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable
2729.1	Water Transmission	Suitable	Suitable	Suitable	Suitable	Not suitable	Not suitable	Not suitable
2729.2	Water Impoundment	Suitable	Suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2729.3	Water Development	Suitable	Suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable
2729.4	Water Measurement	Suitable	Suitable	Not suitable	Suitable	Suitable	Not suitable	Suitable
2729.5	Water Treatment	Not suitable	Suitable	Not suitable	Suitable	Not suitable	Not suitable	Not suitable

Geographic Areas

Chapter 5: Geographic Areas

Introduction

Introduction

Chapter 4 describes management direction that applies to unique geographic areas called ecosystem management areas (EMAs). Twelve EMAs are defined here, based on the major mountain ranges that comprise the Coronado NF. There is a description of each EMA and one or more plan components, as well as recommended management approaches. This chapter also includes management direction for special areas within EMAs, such as research natural areas or zoological/botanical areas. The management direction described in this chapter applies to the identified geographic area, in addition to the Forestwide and management area-specific direction described in Chapters 2 and 3. This chapter is organized by grouping ecosystem management areas by ranger district (Douglas, Nogales, Sierra Vista, Safford, and Santa Catalina Ranger Districts).

Douglas Ranger District

Douglas Ranger District

The Douglas Ranger District consists of three Ecosystem Management Areas: Chiricahua, Dragoon, and Peloncillo. The Douglas Ranger District is the only District that extends into the State of New Mexico.

Chiricahua EMA

Chiricahua Ecosystem Management Area

General Description

The Chiricahua Ecosystem Management Area (EMA) includes 291,496 acres of National Forest System land, encompassing nearly all of the Chiricahua Mountains. Steep canyons with densely timbered slopes dissect the range, radiating in all directions from 9,797-foot Chiricahua Peak. The Barfoot, Long, and Rustler Parks are world-renowned for uncommon bird and reptile species, including the largest known population of twin-spotted rattlesnakes. Rock formations are visible from many vantage points throughout the EMA. At the heart of the Chiricahua EMA lies the 87,700-acre Chiricahua Wilderness and at the north end lies the 28,207-acre Recommended Ku Chish Wilderness Area.

Several four-wheel drive roads cross the Chiricahua EMA at the northern and southern extents. A single two-wheel-drive accessible road crosses the range from east to west over Onion Saddle, but is usually closed in the winter. Numerous developed sites have camping and picnicking facilities and are all accessible with a two-wheel-drive vehicle. Dispersed areas are also available throughout the Chiricahua EMA for recreation use. In particular, the ridges and drainages surrounding Cochise Head (the single largest rock outcrop on the Coronado National Forest) remain rugged and remote with access limited primarily to on- and off-trail travel. West of this landmark, within the northern portion of the EMA, Chiricahua National Monument is contiguous with the Forest on three sides.

The Chiricahua Mountains, along with all the lands in the southeastern corner of Arizona, were once part of the Chiricahua Apache Reservation, and the

mountains continue to be a special place for the descendants of the Chiricahua Apaches. Many of these descendants now live in Oklahoma and New Mexico as part of the Mescalero and Chiricahua-Warm Springs-Fort Sill Apache Tribes, though the San Carlos Apache Tribe in Arizona also counts Chiricahua descendants among its members. Ancestors of members of the White Mountain and San Carlos Apache Tribes frequented the mountain ranges of the Douglas Ranger District, and Apache Scout camps were located in the Chiricahua Mountains in the nineteenth century. Today, members of the Mescalero Apache Tribe make trips to the Chiricahua EMA to teach tribal youth about their history and heritage.

Pole Bridge Canyon Research Natural Area. This research natural area (RNA) was established in 1931 to feature distinctive tree populations of the Mexican pine-oak ecosystem, particularly Apache pine, southwestern white pine, border piñon, and Arizona pine. An additional 105 acres have been proposed for inclusion as the Pole Bridge Canyon Research Natural Area Extension. The addition includes examples of two Chihuahua pine habitat types, Chihuahua pine/Arizona white oak and Chihuahua pine/silverleaf oak, providing a more complete representation of the Sierra Madrean pine-oak ecosystem within this RNA. Both the Pole Bridge Canyon RNA and the proposed extension are encompassed by the Chiricahua Wilderness.

Proposed Cave Creek Canyon Birds of Prey Zoological-Botanical Area. Located in the eastern portion of the Chiricahua EMA the 27,040 acre proposed Cave Creek Canyon Birds of Prey Zoological-Botanical Area (ZBA) is recommended for designation. 17,032 acres of this recommended ZBA is located within the Chiricahua Wilderness Area. A smaller area was originally recommended for designation in the 1986 Forest Plan, the 762-acre Proposed South Fork of Cave Creek ZBA. This special area protects a diverse assemblage of migratory and year-round wildlife, as well as the rare riparian setting that attracts these species. Recent research has found that Cave Creek Canyon harbors the United States' densest known population of breeding raptors. World-class birding is a highlight of the area.

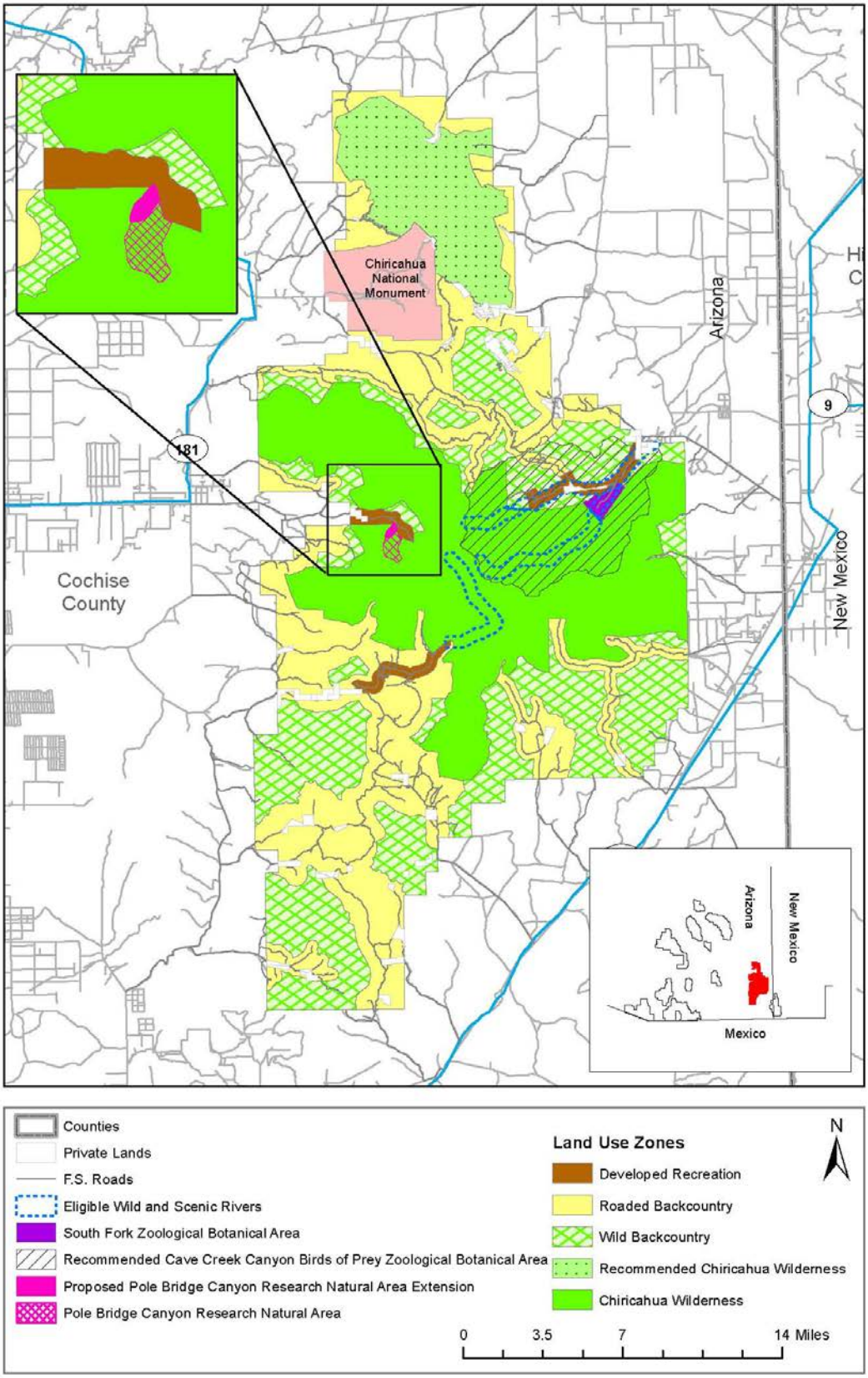

Figure 3: Chiricahua EMA Land Use Zones and Special Areas

Geographic Areas

Douglas Ranger District

Chiricahua EMA

Desired Conditions

The Chiricahua EMA offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Pinery Road over Onion Saddle provides a scenic driving experience and vehicular access to high elevations. Recreation facilities are sufficient in size and number to accommodate demand while supporting a high quality, outdoor experience. Administrative sites, such as Rucker, Pinery, Rustler Park, and Cima Administrative Sites, are in good condition and available as appropriate for Forest Service, tribal, and public use as part of the "Rooms with a View" cabin rental program. Recreation residences and the organization camp blend well with the natural landscape and do not expand beyond their authorized footprint. Permanent legal public vehicular access to NFS lands within the EMA is established and is easily accessible by public land and administrative users.

Cultural and historic properties (such as Camp Rucker, Rustler Park, Cima Cabin, Barfoot Lookout, and Monte Vista Lookout Cabin) retain integrity of setting, location, association, materials, design, workmanship, and feeling to provide the public and Forest Service employees a long-term perspective on the region's spirit, character, and identity, and to impart information about the past history of the mountain. Historic Apache scout camps have been identified and are protected, in partnership with the White Mountain and San Carlos Apache Tribes. Archaeological sites of the Chiricahua Mountains provide tribes, researchers, and the public with scientific data about, as well as tangible links to, the long and diverse history of southeastern Arizona.

Descendants of the Chiricahua Apaches feel welcome in their traditional homeland, and make use of campgrounds, dispersed camping areas, and administrative sites for cultural and educational events. Medicinal plants, wild plant foods, ceremonial plants, basketry materials, and other traditional resources are available for collection by tribal members. Sites that have been identified as sacred or holy for the Chiricahua Apache are available to Chiricahua Apache descendents and members of the Fort Sill and Mescalero Apache Tribes for individual and group prayer and traditional ceremonies and rituals.

High-elevation meadows are dominated by native grasses and grass-like plants, and are relatively free of trees and shrubs. The wildlife and vegetation species in the area surrounding Barfoot Park are perpetuated. Elements of spruce-fir communities, including stands of Engelmann spruce, exist in the mixed conifer forests above 8,500 feet. Cave Creek Canyon supports a full cohort of native nesting birds, particularly cavity-nesting birds, and provides opportunities for world-class birding. Unique wildlife and vegetation species are perpetuated in the Cave Creek Canyon Birds of Prey Zoological-Botanical Area and the Pole Bridge Research Natural Area. Recreation activities and other uses do not degrade these values. Cave Creek and the South Fork of Cave Creek retain the characteristics required to be designated an "Outstanding Arizona Water" by the Arizona Department of Environmental Quality.

Geographic Areas

Douglas Ranger District

Chiricahua EMA

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 20 percent of the Chiricahua EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Guidelines

1. Cattle should be excluded from Camp Rucker to foster protection of the historic buildings and ruins.
2. During vegetation treatments considerations of mesic microenvironments for woodland and talus snails endemic to the Chiricahua EMA should be incorporated (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).
3. Management activities involving ground disturbance and/or vegetation management should incorporate, site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Chiricahua EMA, these species and associated management threats include, but are not limited to, the following:

Chiricahua fleabane: plant canopy removal in rocky and cliff habitats
Chiricahua gentian: grazing and concentrated recreation
copper mine milk-vetch: grazing and concentrated recreation
Hinkley's Jacob's ladder: grazing, hiking, and fire
Porsild's starwort: grazing and fire in montane meadows
purple-spike coralroot: collecting
Rusby's hawkweed: uncharacteristic fire
smooth baby-bonnets: grazing

Standards

1. Within the Pole Bridge RNA and Proposed Pole Bridge RNA Extension:
a. Vegetation cutting is prohibited, including harvest of forest products and fuelwood.
b. New roads or other improvements are prohibited; the use of existing roads and trails is allowed for fire management purposes.
c. Livestock grazing is not permitted.
d. Camping is prohibited.
2. Within the Proposed Cave Creek Canyon Birds of Prey ZBA:
a. A special-use permit is required for any plant or animal collection.
b. A special-use permit is required for scientific research that would involve placing anything on Forest lands within the Proposed ZBA.

Management Approaches

- Consulting with the Mescalero, Ft Sill, San Carlos, and White Mountain Apache Tribes to develop stewardship plans for archaeological sites and other traditionally important places, and to foster collaborative stewardship with Ft Bowie.
- Establishing a memorandum of understanding (MOU) between the Forest Service and the Mescalero Apache Tribe to facilitate tribal events in the Chiricahua EMA.
- Collaborating with Friends of Cave Creek Canyon in their area of interest
-

Geographic Areas

Douglas Ranger District

Dragoon EMA

Dragoon Ecosystem Management Area

General Description

The rugged Dragoon Ecosystem Management Area contains 54,211 acres of the Dragoon Mountains and adjoining semi-desert grasslands and savannahs. Elevations range from 4,600 feet to the 7,519-foot Mt. Glenn. The Dragoon Mountains, and specifically Cochise Stronghold (both East and West Stronghold Canyons), have long been recognized as a special place for the descendants of the Chiricahua Apaches (including Mescalero, San Carlos, and Chiricahua-Warm Springs-Fort Sill Apache Tribes). Members of the Four Southern Tribes collect basketry materials at the lower elevations of the Dragoons, as their ancestors probably did centuries ago.

The natural fortress of Cochise Stronghold's granite domes and rock formations attracts rock climbers, photographers, wildlife-viewers, and hikers from around the country. East Stronghold Canyon offers developed recreation opportunities while West Stronghold Canyon features a more dispersed recreational experience. The rugged terrain does not lend itself to additional road developments. The soils within this EMA are fragile and easily damaged by vehicles driving off of roads. Access throughout much of the EMA is via unpaved roads.

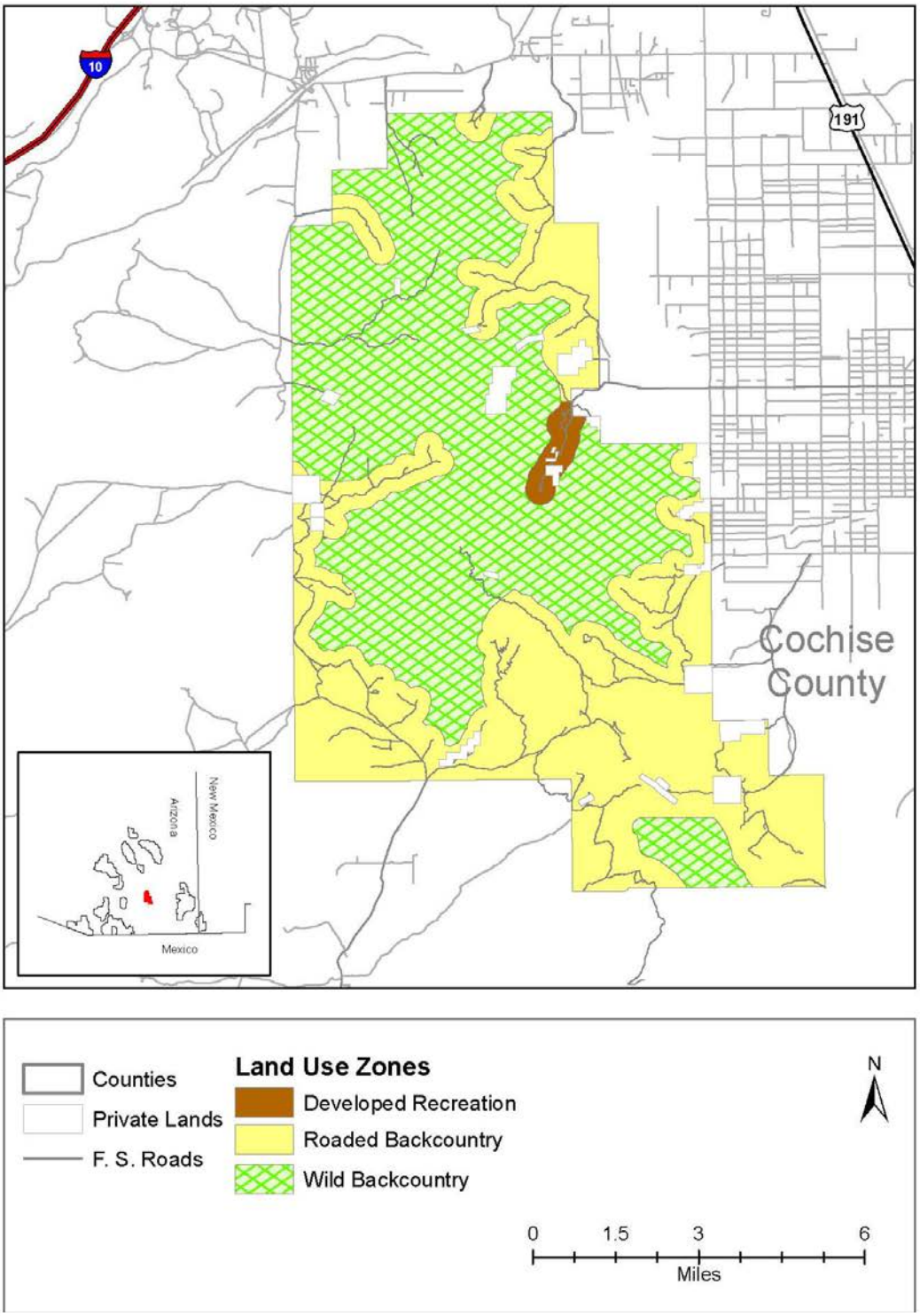

Figure 4: Dragoon EMA Land Use Zones and Special Areas

Geographic Areas

Douglas Ranger District

Dragoon EMA

Desired Conditions

The Dragoon EMA offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for dispersed recreation. The unroaded core of the EMA is wild in character and opportunities for quiet recreation exist. Geologic features and rock formations that dominate the Dragoon EMA provide outstanding rock-climbing opportunities. Rock climbers and other visitors do not cause permanent resource damage, and abide by restrictions needed for wildlife protection. Well-contained motorized dispersed campsites are available along the western edge of the EMA, and campers do not cause permanent damage to soils or vegetation. The East Stronghold Canyon area offers opportunities for safe developed recreation, and interpretation of the history and ecology of the area. The number of miles of trails is sufficient to provide non-motorized access, and users do not create unauthorized trails. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found.

Stands of Arizona cypress exist in the cool drainages on the east side of the Dragoon EMA. An open savanna vegetation structure occurs along portions of the west flank of the Dragoon EMA.

Permanent legal public vehicular access to NFS lands in the EMA is established, and is easily accessible by public land and administrative users.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 15 percent of the Dragoon EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Guidelines

1. Existing motorized dispersed camping areas on the west side of the EMA should be limited to defined motorizeddispersed camping areas identified on the Motor Vehicle Use Map.
2. During vegetation treatments, considerations of mesic microenvironments for woodland and talus snails endemic to the Dragoon EMA should be incorporated (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).
3. Areas disturbed by unauthorized motorized camping (outside of the defined dispersed camping areas) on the west side of the EMA should be revegetated and protect them from new disturbance.

Peloncillo EMA

Peloncillo Ecosystem Management Area

General Description

The Peloncillo Ecosystem Management Area is one of the most remote portions of the Coronado NF. Access is limited to primitive roads, primarily Geronimo Trail (NFSR 63), and there are no developed recreation sites. Large unroaded areas are valued for their solitude and unconfined recreation opportunities. The relatively narrow range of elevation (from 4,593 to 6,624 feet) supports a surprising diversity of wildlife, most notably reptile and amphibian species.

Although mostly xeric, Cloverdale Cienega is one of the Peloncillo's rare aquatic features. The EMA's 87,985 acres straddle the Arizona-New Mexico border, with 81 percent in New Mexico. Situated southeast of the Chiricahua Mountains and just north of the U.S.-Mexican border, this southern portion of the Peloncillo range was occupied for millennia by farmers and foragers who had trading and cultural ties with neighboring groups, and was within the heartland of Chiricahua Apache territory. The 15,690-acre Bunk Robinson Wilderness Study Area and the 12,840-acre Whitmire Canyon Wilderness Study Area flank the Geronimo trail to the south and north, respectively.

Proposed Guadalupe Canyon Zoological Area. This area was recommended for designation in the 1986 Forest Plan to protect 3,478 acres of habitat for unique wildlife associations. It would complement the Bureau of Land Management's outstanding natural area in lower Guadalupe Canyon, which is recognized for its exceptional birding habitat. The Proposed Guadalupe Canyon Zoological Area forms part of the Peloncillo EMA's southern boundary and is almost entirely contained within the Bunk Robinson WSA.

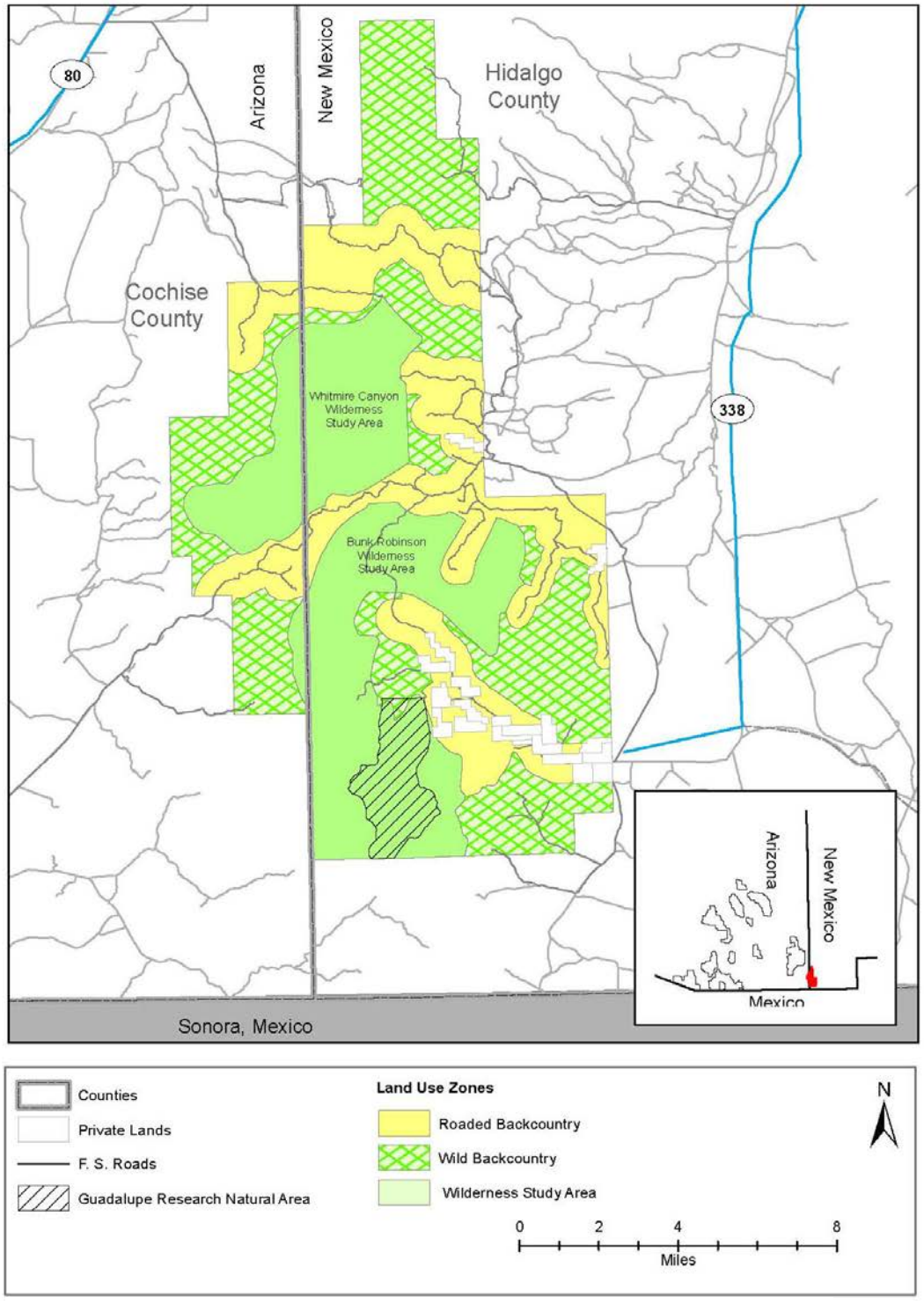

Figure 5: Peloncillo EMA Land Use Zones and Special Areas

Geographic Areas

Douglas Ranger District

Peloncillo EMA

Desired Conditions

Recreation opportunities are primarily undeveloped, and the entire EMA is available for primitive and dispersed recreation. Geronimo Trail (NFSR 63) provides opportunities for scenic driving and vehicular access through the EMA. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found.

The Cloverdale Cienega is dominated by perennial graminoid species such as spike rush, deergrass, and sedges. Flood flows, when they occur, are spread across the floodplain and not concentrated in channels. Unique wildlife species are perpetuated in the Guadalupe Canyon Zoological Area. Other uses do not degrade these unique values. Species that have historically moved freely between habitat in Mexico and within the Peloncillo EMA continue to do so.

Permanent legal public access to the northern end and southeastern corner of the EMA is established, easily accessible by public land and administrative users, and interconnected to state, county, local public, and other federal roads and trails. The complex landownership patterns (checkerboard ownership) on the eastern (New Mexico) side of the EMA are consolidated into contiguous blocks of private land surrounded by NFS land and are easily identifiable and recognizable by public land users, private landowners, and Forest Service personnel. Permanent legal public vehicular access to NFS lands in the Deer Creek, Starvation, and Skeleton Canyon, Whitmire and Deer Flat, Foster Draw and Black Mountain, Crescent and Cordy Cowen Tank, and other areas within the EMA is established and is easily accessible by public land and administrative users.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 35 percent of the Peloncillo EMA to create resiliency to disturbance. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Guidelines

1. During vegetation treatments within Skull Canyon, considerations of mesic microenvironments for talus snails endemic to the Peloncillo EMA should be incorporated (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).
2. Management activities involving ground disturbance and/or vegetation management should incorporate, , site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Peloncillo EMA, these species and associated management threats include, but are not limited to, the following:
Chiricahua mudwort: grazing and concentrated recreation
copper mine milk-vetch: grazing and concentrated recreation
New Mexico bitterweed: noxious weed control

Standards

1. Within the Proposed Guadalupe Canyon Zoological Area:
a. A special-use permit is required for any plant or animal collection.

Geographic Areas

b. A special-use permit is required for scientific research that would involve placing anything on Forest lands within the Proposed ZA.

Douglas Ranger District Peloncillo EMA

Management Approaches

- Collaborating with the Malpia Borderlands Group in their area of interest.

Nogales Ranger District

Nogales Ranger District

The Nogales Ranger District consists of two Ecosystem Management Areas: Santa Rita and Tumacacori. This Ranger District shares 29 miles of the international boundary with Mexico.

Santa Rita EMA

Santa Rita Ecosystem Management Area

General Description

The Santa Rita Ecosystem Management Area takes its name from the mountain range it encompasses, the summit of which is 9,462-foot Mt. Wrightson. Its distinctive pyramid-shaped profile rises above the surrounding savannas and deserts, visible from much of southeastern Arizona, and creates a striking backdrop for travelers along Interstate 10 and Highways 82 and 83. Notably, in 1985 these two state highways were designated “Patagonia-Sonoita Scenic Road” by the Arizona Department of Transportation in 1985. The 148,421-acre Santa Rita EMA is visible from metropolitan Tucson and second only to the Santa Catalina Mountains in terms of recreational appeal. Madera Canyon, a popular birding area, offers developed recreation opportunities, including rental cabins at the Santa Rita Lodge and a gift shop. The east side of the EMA offers opportunities for off-highway vehicle use and dispersed recreation, not limited to camping, hunting, and foot-trail-based pursuits. An unmistakable geologic feature known as Elephant Head, at the EMAs northwest extent, attracts backcountry rock climbers and serves as an attractive goal for cyclists along the Elephant Head Mountain Bike Route. The Arizona Trail traverses the range from south to north. At the core of the Santa Rita Mountains is the 25,260-acre Mount Wrightson Wilderness.

The Santa Rita EMA has a long-history of human use prior to its development as a popular recreation area. Archaeological sites dating back thousands of years testify to hunting, farming, and plant collecting practices; members of the Four Southern Tribes, the San Carlos Apache Tribe, and the Pascua Yaqui continue to visit the range to collect important traditional plants. Extensive mining and ranching became prevalent in the late nineteenth century and continues at a smaller scale today.

Forest Service administration and federal relief projects of the Great Depression are visible in old ranger residences and a Civilian Conservation Corp camp. A century-old partnership between the Forest Service and the University of Arizona resulted in construction of the Florida Station, which serves as headquarters for the Santa Rita Experimental Range, located just beyond the northern boundary of the EMA. Another joint venture between the University of Arizona and the Smithsonian Institution has placed a telescope and observatory at the top of the EMA’s second highest peak, Mount Hopkins, where research and public education continue today.

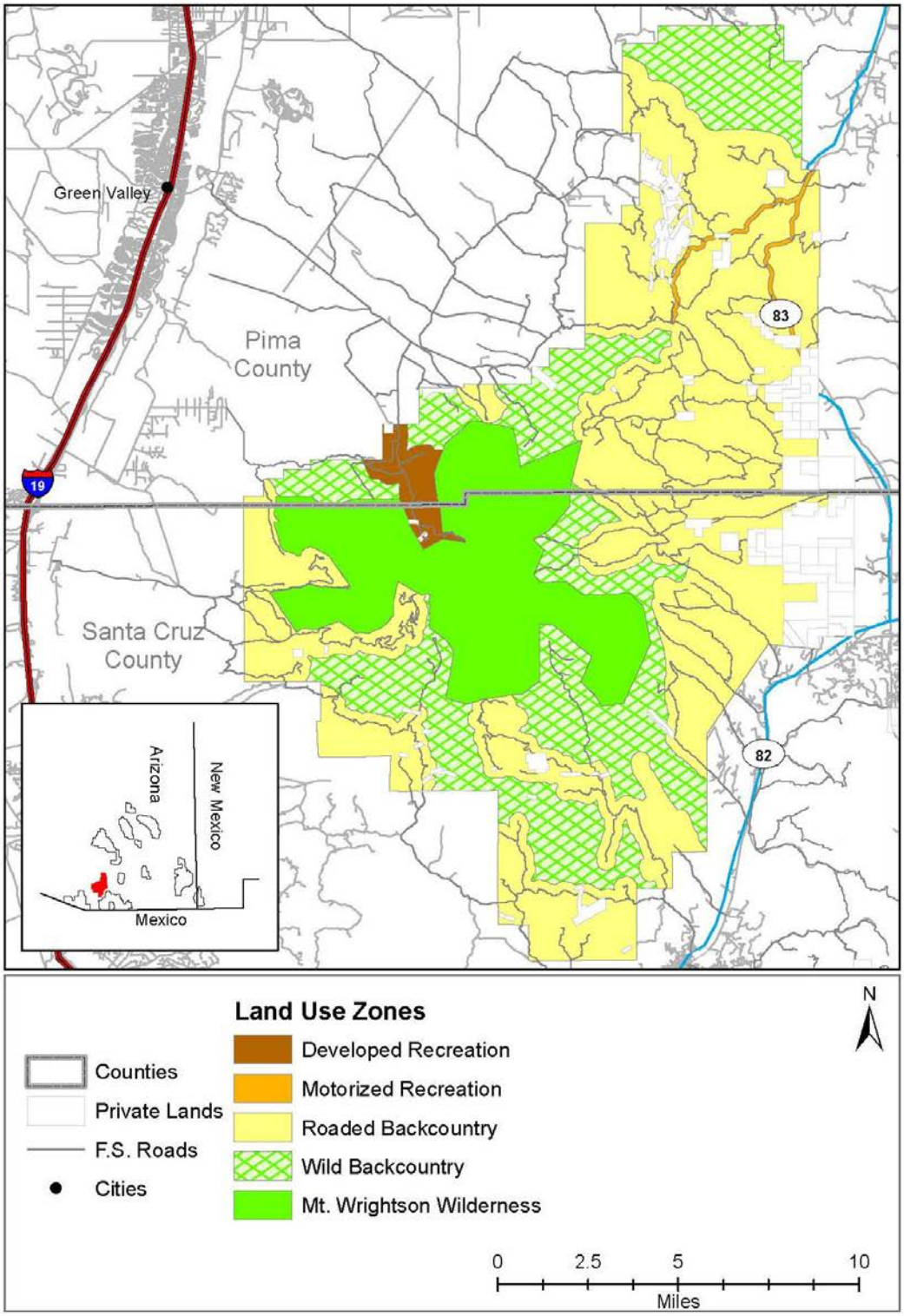

Figure 6: Santa Rita EMA Land Use Zones and Special Areas

Geographic Areas

Nogales Ranger District

Santa Rita EMA

Desired Conditions

The Santa Rita EMA offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. In Madera Canyon, there are opportunities to camp in a developed recreation facility or in undeveloped campsites. Trailheads are well marked and lead to a network of well-maintained hiking trails. World-class bird watching opportunities exist along roads and trails. The Santa Rita EMA offers an environment in which to recreate where risks are predominately natural and visitors do not feel threatened. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found.

Kentucky Camp National Historic District is preserved and interpreted to provide the public with an understanding of the role mining and ranching has played in the development of southeastern Arizona. The Kent Springs Center and Kentucky Camp are available to the public and to tribes for a variety of recreational and educational experiences. Areas around Kentucky Camp and along the Greaterville Road continue to provide tribes with places to collect traditional basketry materials and plant foods. The Forest continues to collaborate with the University of Arizona and the local communities to preserve historic Florida Station, and to expand its use and functionality as an environmental education center for youth and adults.

The Santa Rita backcountry touring routes offer motorized and dispersed camping recreation opportunities. Elephant Head Mountain Bike Route offers a combination of lightly-traveled roads and remote trails designed to both challenge a rider's skill and to provide a scenic, backcountry experience. The Arizona Trail National Scenic Trail and the Patagonia-Sonoita Scenic Road provide excellent opportunities to recreate and enjoy the scenery.

Water quality in Mansfield Canyon meets the State of Arizona’s water quality standards.

Cave of the Bells offers caving opportunities in a manner that protects the natural cave environment. The dark skies above the Santa Rita EMA present conditions conducive to astronomical research. The Smithsonian Mt. Hopkins telescopes offer educational opportunities and promotes scientific discovery.

Outstanding split mineral interests (50 percent non-federal/50 percent federal ownership) have been acquired and consolidated into a contiguous block of subsurface federal ownership affording more efficient management as well as greater protection of valuable natural resources and desired forest landscape conditions. The complex landownership pattern (fragmented checkerboard ownership intermingled with irregular shaped parcels) within the EMA are consolidated into contiguous blocks of NFS and private land and are easily identifiable and recognizable by public land users, private landowners, and Forest Service personnel. Legal status deficiencies of needed existing forest roads and trails system have been resolved.

Geographic Areas

Nogales Ranger District

Santa Rita EMA

Objectives

- Within 10 years of plan approval, treat the vegetation on at least 20 percent of the Santa Rita EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Guidelines

1. During vegetation treatments, considerations of mesic microenvironments for woodland and talus snails endemic to the Santa Rita EMA should be incorporate (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).
2. Management activities involving ground disturbance and/or vegetation management should incorporate, site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Santa Rita EMA, these species and associated management threats include, but are not limited to, the following:

Arizona eryngo: invasive weeds and riparian degradation from grazing
Arizona Manihot: habitat degradation from grazing and recreation
beardless chinch weed: grazing and road maintenance
chisos Coralroot: mining
Cochise woolwort: grazing
Huachuca cinquefoil: grazing and recreation
Pima pineapple cactus: road construction, grazing, mining, aggressive invasive grasses, and illegal collection
Santa Rita yellowshow: grazing, mining, and competition with exotic grasses
Southwest monkeyflower: unknown

Management Approaches

- Collaborating with the Friends of Madera Canyon and Friends of Kentucky Camp in their areas of interest.

Tumacacori EMA

Tumacacori Ecosystem Management Area

General Description

The Tumacacori Ecosystem Management Area is the Forest's most southwesterly administrative land unit, encompassing 203,800 acres. Bounded by the Santa Cruz River on the east and the Altar Valley on the west. The Tumacacori EMA shares 29 miles on its southern boundary with the U.S.-Mexico international border. At 6,422 feet, Atascosa Peak forms the summit of the EMA, presiding over the rugged and rocky Atascosa Mountains and Tumacacori Highlands. Vast rolling landscapes of grasslands and oak woodlands cascade in all directions from these dominating features. Water is a comparatively abundant feature of this EMA. Aliso Spring, on the northwest slope of the Tumacacori Mountains, provides rare habitat for lowland leopard frogs and other aquatic-obligates. Further south, canyons of the Pajarito Mountains open into Mexico, harboring riparian vegetation and a fantastic diversity of birds, mammals, and reptiles. One such drainage, Sycamore Canyon, has long been world-renowned for bird watching opportunities and was recognized in 2003 as an Important Birding Area by the Arizona Chapter of the

Geographic Areas

Nogales Ranger District

Tumacacori EMA

Audubon Society. The Tumacacori EMA generally remains wild in character, with developed recreation centered around Pena Blanca and Arivaca Lakes, and with dispersed recreation abundant within its boundaries. The 7,420-acre Pajarita Wilderness lies in the southern portion of the EMA.

In addition to outstanding biophysical features, the Tumacacori EMA is also rich in cultural history. The area was associated first and foremost with the O'odham people. They were the group living in and around the area when Europeans arrived, and though decimated in the first century of direct contact, they were still using the area on a regular basis into the 20th century. Other groups (including Apaches, and particularly Western Apaches) visited often in the eighteenth and nineteenth centuries and lived just east of the EMA at the presidio community of Tubac in the nineteenth century. The Yaquis, or Yoemem, are best known for their use of the Highlands area in the early twentieth century, but whose presence dates to the time of initial Jesuit entry into the region. Other groups have more limited historic-period connections with the area. Both the Hopi and Zuni have connections from the standpoint that they consider some of the ancestors of tribal members to have migrated from southern Arizona. The O'odham occupation of the Tumacacori EMA ended abruptly in 1916 when the main Papago Indian Reservation was created and those Tohono O'odham living outside the boundaries were forced to leave the area and move to the reservation.

Wild Chile Botanical Area. This 2,836-acre area within the Rock Corral Canyon sub-watershed was designated in 1999 to provide additional notoriety, protection, and research opportunities for the wild chile (Capsicum annuum var. aviculare) and other plants of economic importance or conservation concern. The primarily oak woodlands, interspersed with desert grasslands and deciduous riparian vegetation, harbor wild chile plants occurring at the northernmost edge of wild chile populations found anywhere in the world.

Known as chiltepines in Mexico, where they are more common, wild chiles have been traditionally harvested in the area for decades, if not centuries, and are an important food crop worldwide. Wild cotton, tepary beans, and two species of wild gourds are also found in the Wild Chile Botanical Area.

Goodding Research Natural Area. Originally established as Sycamore Scenic Area in 1962, the 545-acre Goodding RNA was renamed and given RNA status in 1970. All but 7 acres are located within the Pajarita Wilderness. Widely recognized for its aesthetic and biological diversity, Leslie N. Goodding, the renowned Arizona botanist for whom it was named, called Goodding RNA a "hidden botanical garden." Besides sustaining rare and varied riparian vegetation and wildlife, the area was designated for its representation of the oak savannah vegetation community. An additional 1,670 acres were later proposed as the Goodding Research Natural Area Extension, with 1,470 of these acres located adjacent to the southern boundary of the existing RNA, all within the Pajarita Wilderness. The remaining 200 acres straddle the wilderness boundary beyond the northern edge of the existing RNA, and 47 acres of this portion are within the Pajarita Wilderness. The Proposed Goodding RNA Extension would protect additional populations of rare plants and animals, including the supine bean.

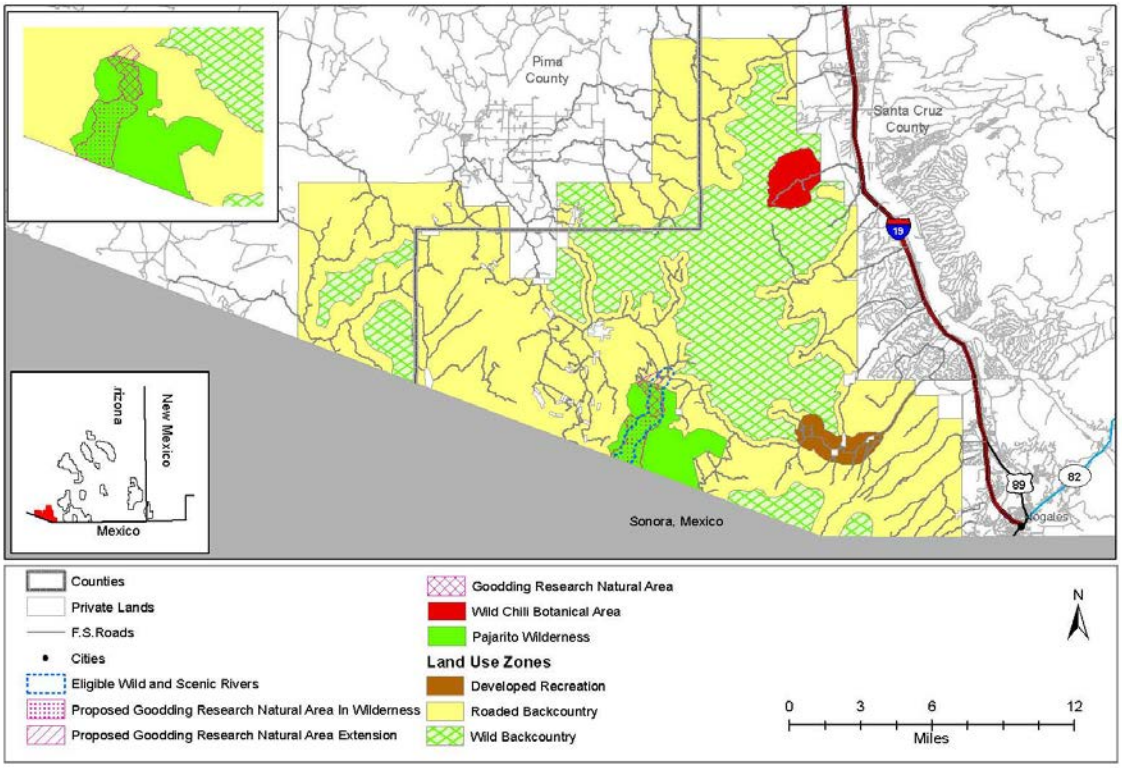

Figure 7: Tumacacori EMA Land Use Zones and Special Areas

Geographic Areas

Nogales Ranger District

Tumacacori EMA

Desired Conditions

The Tumacacori EMA offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and
dispersed recreation. The core mountainous and roadless area has a wild and rugged character. Ruby Road (Forest System Road 39) provides scenic driving and vehicular access through the Tumacacori EMA. Fishing and boating opportunities are provided at Pena Blanca and Arivaca Lakes. Well-maintained visitor facilities (including a boat ramp, a lakeshore trail, overnight accommodations, picnic areas, and fishing docks) are available at Pena Blanca Lake. Water-based recreational activities do not contribute to the spread of invasive aquatic species. California Gulch and Sycamore Canyon offer outstanding bird watching opportunities. Aliso Spring provides habitat for native aquatic species. The Tumacacori EMA offers an environment in which to recreate where the risks are predominately natural and visitors do not feel threatened. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found.

Plants that are traditionally important to the O'odham people (including acorn-bearing oaks, agaves, banana yucca, beargrass, walnuts, mulberry, chiltepines, and sayas) are available for sustainable traditional and cultural uses.

Geographic Areas

Nogales Ranger District

Tumacacori EMA

Historically significant buildings, such as the Atascosa Lookout, are maintained and rehabilitated for continued use. Multiple-use management of the Wild Chile Botanical Area perpetuates the existence of wild chiles. Traditional uses of wild chiles do not threaten existing populations.

Activities related to the international border minimally impact natural resources including scenic quality. Species that have historically moved freely between habitats in Mexico and within the Tumacacori EMA continue to do so.

Permanent legal public access to the northern and eastern side of the EMA has been established, is easily accessible by public land and administrative users, and is connected to state, county, local public, and other federal roads and trails. The complex landownership patterns (fragmented checkerboard ownership intermingled with irregular-shaped parcels) within the EMA have been consolidated through landownership adjustments, and boundaries are easily identifiable and recognizable by public land users, private landowners, and Forest Service personnel.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 25 percent of the Tumacacori EMA to create resiliency to disturbances. One-third of this treatment should target the area east of the Goodding RNA to Nogales, from the international border to the vicinity of Ruby Road. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Guidelines

1. Fuel reduction and vegetation treatments should leave islands of mesic microenvironments around riparian areas, colluvium, and woody debris on side slopes and stream channels (ephemeral and perennial)
2. In rocky stream areas where large granitic boulders occur, projects should be designed to minimize or avoid impact to *Mannia californica* and *Plagiochasma wrightii* habitat.
3. Within the Wild Chile Botanical Area:

a. Planned and unplanned ignitions should be used seasonally prior to wild chile flowering and fruiting.

b. Wild chile plants should be protected from burning when high-severity fire threatens the population.

c. Disturbance of archeological sites during research and monitoring activities should be prevented.

4. Management activities involving ground disturbance and/or vegetation management should incorporate, , site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Tumacacori EMA, these species and associated management threats include, but are not limited to, the following:

Cochise woolwort: grazing
recurved corycactus: illegal collection, grazing, road construction and maintenance
soft Mexican-orange: fire

Geographic Areas

Nogales Ranger District

Tumacacori EMA

Standards

1. Within the Wild Chile Botanical Area:
a. Livestock grazing is prohibited during the growth period of wild chiles, approximately August to November.
b. A special-use permit is require for any plant or animal collection (excluding traditional uses) and for research activities that involve placing anything on Forest lands.
2. Within Goodding RNA and Proposed Goodding RNA Extension:
a. Do not permit livestock grazing.
b. Harvest of forest products, including fuelwood, is prohibited.

Management Approaches

- Fostering collaborative research to explore Native American history and heritage, such as working with the Pascua Yaqui to investigate the battle site near Bear Valley Ranch.
- Supporting continued research and monitoring of wild chiles by Native Seeds/Southwestern Endangered Aridland Resource Clearing House and other non-profit or educational organizations.
- Providing opportunities for tribes and the local communities to collect mesquite wood for personal use as part of vegetation management treatments.
- Coordinating with the Department of Homeland Security in the protection of archeological sites during law enforcement activities.

Sierra Vista Ranger District

Sierra Vista Ranger District

The Sierra Vista Ranger District consists of two Ecosystem Management Areas: Huachuca and Whetstone. This Ranger District shares 26 miles of the international boundary with Mexico.

Huachuca EMA

Huachuca Ecosystem Management Area

General Description

An expansive area containing 276,350 acres of land, the Huachuca Ecosystem Management Area includes the massive Huachuca Mountains, the smaller Patagonia Mountains and Canelo Hills, and the vast, rolling grasslands of San Rafael Valley. Fort Huachuca shares the EMA's northeastern border, and the entire south edge of the EMA lies on the international boundary with Mexico. The Miller Peak Wilderness encompasses 20,190 acres of the EMA's upper elevations in the Huachuca Mountains.

Several perennial streams, including Bear Canyon, Scotia Canyon, and Redfield Canyon, provide year-around habitat for aquatic species. These streams generally have at least permanent pools of water, even when continuous flows cease during the driest seasons.
Ancestors of the Chiricahua Apache, the Western Apache, and the O'odham once used the entire EMA and continue to visit areas near Fort Huachuca for acorn collection. Noted by seventeenth-century Spanish Captain Juan Mateo Manje, the Huachuca range (or Sierra de Huachuca) most likely got its name from a nearby Piman village.

Geographic Areas

Sierra Vista Ranger District

Huachuca EMA

Numerous access roads penetrate the Huachuca EMA, connecting to a network of unpaved roads within. The route from Montezuma Pass to Sonoita, via Parker Canyon Lake, is a favorite scenic drive navigable to two-wheel-drive vehicles despite having a dirt surface in most sections. Visitors concentrate along Carr Canyon, within campgrounds and picnic areas surrounding Parker Canyon Lake and at eastside access points near the thriving community of Sierra Vista. Highway 82 closely borders the west side of the EMA, providing additional access for visitors to the Patagonia Mountains.

Appleton-Whittell Elgin Research Ranch. Just south of Elgin at the north-northeastern edge of the EMA lies the Appleton-Whittell Elgin Research Ranch (Research Ranch), a cooperative partnership among the National Audubon Society, U.S. Forest Service, Bureau of Land Management, the Nature Conservancy, Swift Current Land and Cattle Co., LLC, and the Research Ranch Foundation. Of a total 7,543 acres, the Coronado National Forest is the landowner of 2,375 acres. The Research Ranch is managed under a memorandum of understanding that emphasizes research, education, conservation, and restoration; it is particularly valued as a scientific control area. Special-area designations on Forest property within the Research Ranch contribute to these objectives, including the Elgin Research Natural Area.

Elgin Research Natural Area (RNA). This RNA was created in 1974 to provide opportunities to research shortgrass open grassland associations near the southwestern extremity of their normal range. Additionally, since domestic livestock have been absent for much of the latter half of the 20th century, the RNA offers an excellent opportunity to study natural trends in vegetation composition and soil stability following removal of livestock grazing. The 480-acre tract of land is a mixture of state, federal, and private landownership, all within the Research Ranch boundary; 290 acres are National Forest lands.

Proposed Canelo Research Natural Area. Recommended for designation in the 1986 Forest Plan, the Proposed Canelo RNA would set aside 350 acres of Forest lands within the southern portion of the Research Ranch. Like the Elgin RNA, this area offers an opportunity to monitor long-term ecological changes in the absence of livestock grazing. Canelo RNA would feature open oak (encinal) woodlands vegetation community. Turkey Creek flows perennially through the western portion of the Proposed Canelo RNA, supporting diverse riparian habitat and rare aquatic species.

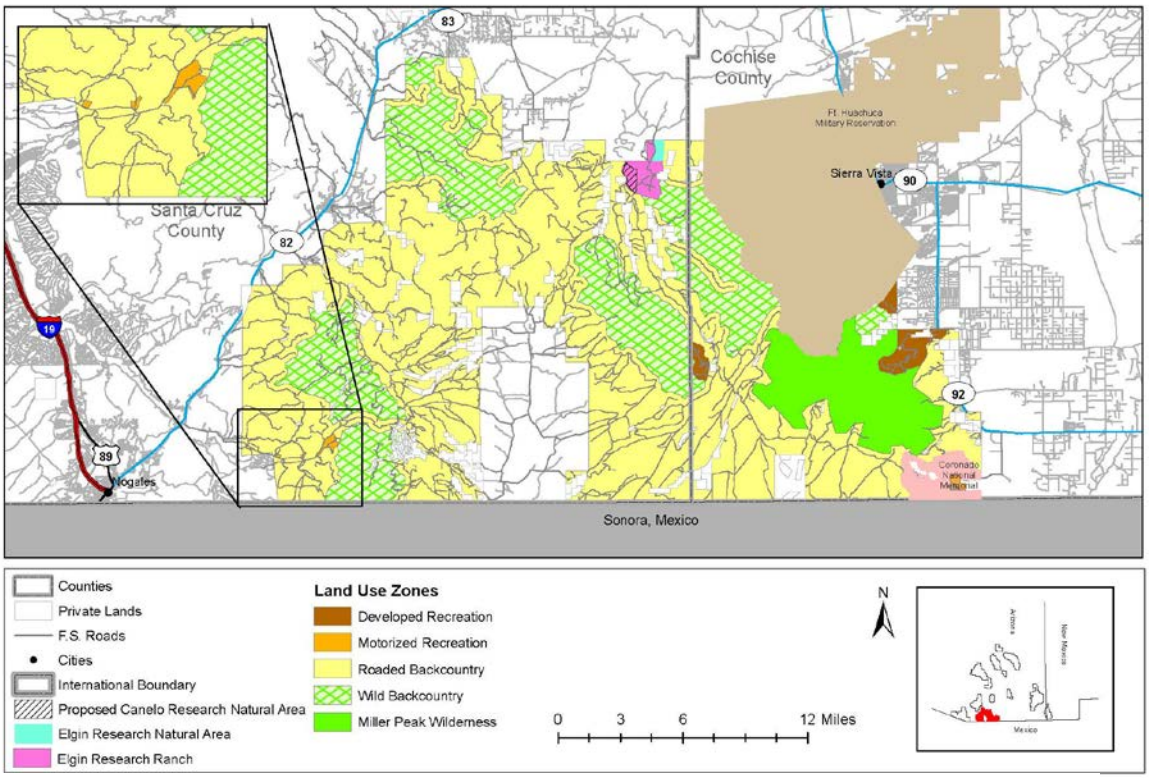

Figure 8: Huachuca EMA Land Use Zones and Special Areas

Geographic Areas

Sierra Vista Ranger District

Huachuca EMA

Desired Conditions

The Huachuca EMA offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. Parker Canyon Lake provides developed recreation opportunities, including boating, sport-fishing, camping, and picnicking. Recreational activities do not contribute to the spread of aquatic invasive species. Vistas from the scenic Montezuma Pass route are highly scenic. The Arizona Trail National Scenic Trail offers opportunities for hiking, cycling, and horseback riding across the EMA along a continuous north-south trending transect. A well-maintained road network provides ample opportunities for vehicle-related activities without compromising the wild character of adjacent unroaded areas. World-class birding opportunities exist throughout the EMA. Acorn collection is facilitated for cultural, personal, and traditional use.

Perennial streams, including Bear Canyon, Scotia Canyon, and Redfield Canyon, provide year-around habitat for aquatic species. These streams generally have at least permanent pools of water, even when continuous flows cease during the driest seasons.

Geographic Areas

Sierra Vista Ranger District

Huachuca EMA

The Huachuca EMA offers an environment in which to recreate where risks are predominately natural and visitors do not feel threatened. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Activities related to the international border minimally impact natural resources including scenic quality. Wildlife species that have historically moved freely between habitats in Mexico and within the Huachuca EMA continue to do so.

The legal status deficiencies of the existing forest roads and trails to and within the EMA have been resolved and all needed roads currently providing public access to the EMA remain open, unless restricted for administrative purposes. The complex landownership patterns of fragmented checkerboard ownership intermingled with irregular-shaped parcels within the EMA has been consolidated through landownership adjustments.

Scientists from colleges and universities, state and federal agencies, non-profit organizations, and independent associations use the Research Ranch as a control or reference area to evaluate the effects of various land uses, including ranching, hunting, restoration activities, and recreation, on grassland ecosystems.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 25 percent of the Huachuca EMA to create resiliency to disturbance. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

Guidelines

1. During vegetation treatments, mesic microenvironments for woodland and talus snails endemic to the Huachuca EMA should be protected (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).
2. Management activities involving ground disturbance and/or vegetation management should incorporate, , site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Huachuca EMA, these species and associated management threats include, but are not limited to, the following:

beardless chinch weed: grazing and road maintenance
Cochise woolwort: grazing
elusive browallia: fuelwood cutting, hiking, and grazing
Huachuca cinquefoil: grazing and recreation
Huachuca milkvetch: habitat degradation, and trampling from recreation and grazing
Huachuca water umbel: Water diversions, grazing, invasives, and mining
Pima pineapple cactus: road construction, grazing, mining, aggressive invasive grasses, and illegal collection
purple-spike coralroot: collecting, fire, and maintenance of facilities
Rusby's hawkweed: catastrophic fire
smooth baby-bonnets: grazing

Geographic Areas

Sierra Vista Ranger District

Huachuca EMA

Standards

1. In aquatic sites occupied by Arizona Treefrog, management activities must not deplete water levels.
2. Within Elgin RNA and Proposed Canelo RNA:

a. Livestock grazing will not be permitted.
b. Harvest of forest products, including fuelwood, will not be permitted.

Management Approaches

- Collaborating with Friends of Brown Canyon Ranch and Friends of the Huachucas in there are of interest.

Whetstone EMA

Whetstone Ecosystem Management Area

General Description

At 45,023 acres, Whetstone Ecosystem Management Area is the Forest's second smallest administrative land unit. Its namesake range, the Whetstone Mountains, provides a scenic backdrop for travelers along Interstate 10, with precipitous cliff bands rising dramatically from a sea of desert scrub and desert grassland. Apache Peak is the range's focal point, appropriately named for the Western Apaches that considered these mountains part of their territory. Historically, the Whetstone Mountains were also within the territory of the Chiricahua Apache, and archaeological sites indicate long use by Hohokam, ancestral O'odham. Today, access is via primitive roads and trails, as this is one of the least-developed EMAs on the Forest. Trails originating in Karchner Caverns State Park at the northern border of the EMA are popular. There are no developed recreation sites, but opportunities for dispersed recreation abound.

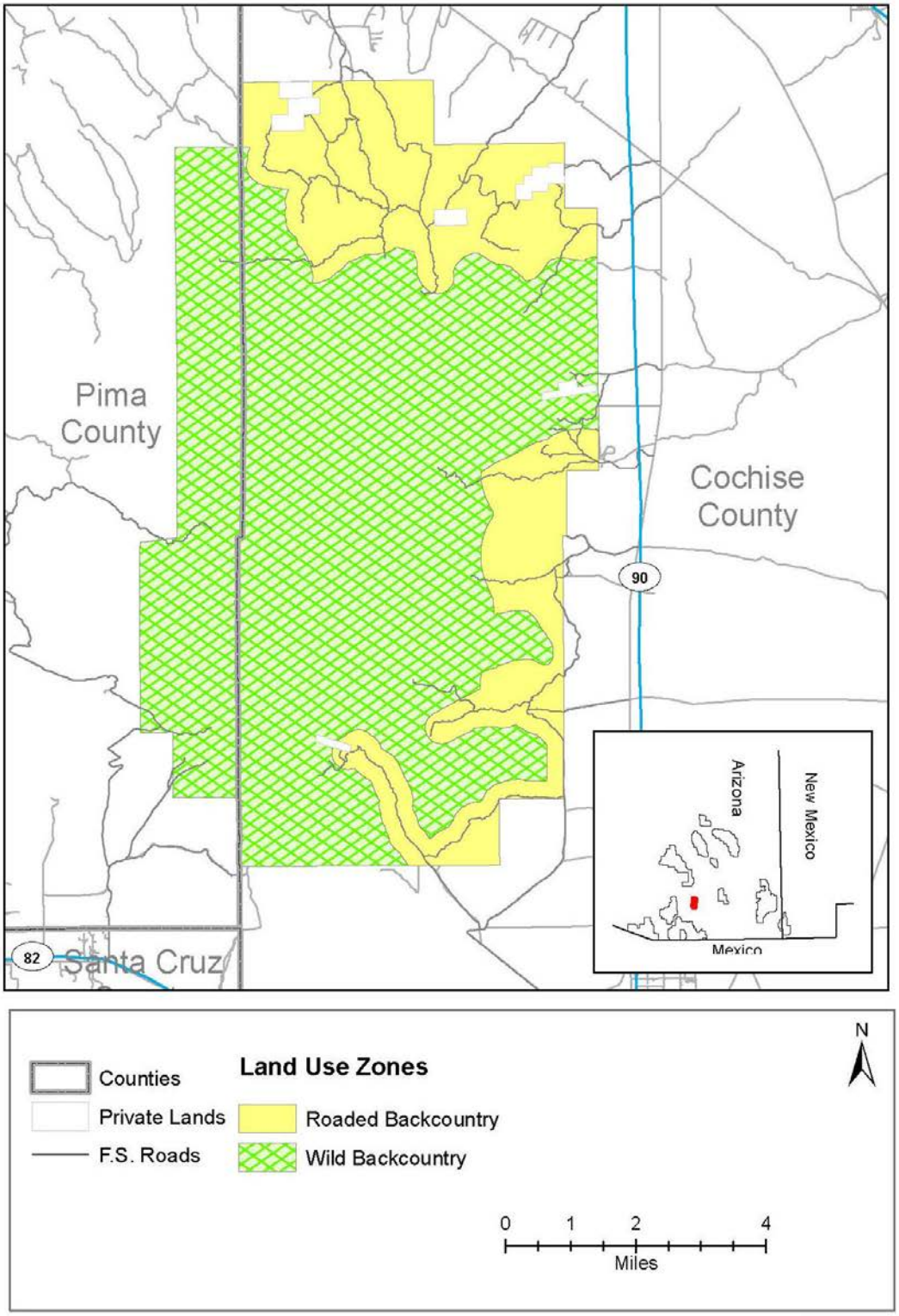

Figure 9. Whetstone EMA Land Use Zones and Special Areas

Geographic Areas

Sierra Vista Ranger District

Whetsone EMA

Desired Conditions

The wild character of the Whetstone EMA is preserved and there are ample opportunities for solitude and quiet. Recreation opportunities are primarily undeveloped, and the entire EMA is available for primitive and dispersed recreation and for hunting. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Riparian resources of French Joe Canyon provide a refuge for migratory birds and other riparian species.

The EMA is one contiguous block of federal land within its proclaimed boundaries. There is permanent legal public road and trail access into the north, south, east, and western sides of the EMA, and it is easily accessible by public land and administrative users and connected to state, county, local public, and other federal roads and trails. Permanent legal public vehicular access to NFS lands in Anderson Canyon, Easter Mountain, and Cottonwood Canyon, Middle and Guindani Canyons, and other areas within the EMA is established and is easily accessible by public land and administrative users.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 15 percent of the Whetstone EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Guidelines

1. During vegetation treatments, mesic microenvironments for woodland and talus snails endemic to the Whetstone EMA should be protected (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).

Safford Ranger District

Safford Ranger District

The Safford Ranger District consists of four Ecosystem Management Areas: Galiuro, Pinaleño, Santa Teresa, and Winchester.

Galiuro EMA

Galiuro Ecosystem Management Area

General Description

The Galiuro Ecosystem Management Area encompasses 134,517 acres of primarily undeveloped lands, including 714 acres of private inholdings. Two major canyons, Rattlesnake and Redfield, and twin ridges running northeast to southwest form the dominant geologic features of the area. From golden grasslands, 7,651-foot Bassett Peak rises up to form the EMA's highest point. Access is mainly via gravel and dirt roads, mostly lying on the east side of the mountain, with travel generally restricted to foot and horseback in the interior of the range. There is one developed recreation area in the Galiuro EMA. Dispersed areas throughout the mountains offer a wealth of opportunities for backcountry hiking, camping, and solitude. The 76,317-acre Galiuro Wilderness abuts Bureau of Land Management-administered Redfield Canyon Wilderness to the south.

Geographic Areas

Safford Ranger District

Galiuro EMA

The Galiuro Mountains are rich in both cultural and natural history. The EMA was historically within the territory of the Western Apaches. The Hopi Tribe and Zuni Pueblo have ancestral sites in the San Pedro Valley to the west, and likely used the Galiuro Mountains in centuries past. At Power's Cabin deep within the mountain range, a famous old west shoot-out took place in 1918. Wolves roamed the range until the mid-1950s, and black bear and mountain lion are still plentiful today.

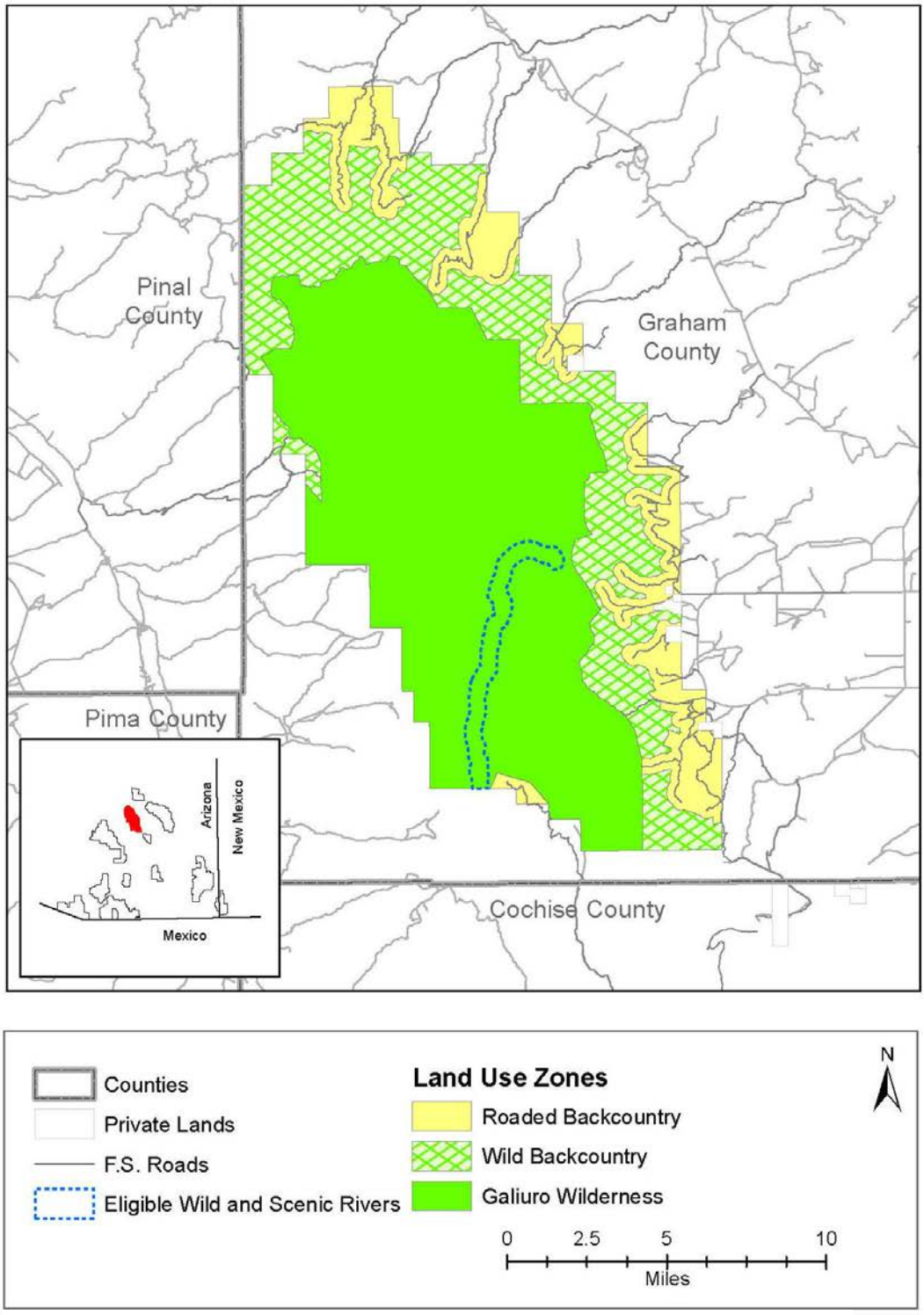

Figure 10. Galiuro EMA Land Use Zones and Special Areas

Geographic Areas

Safford Ranger District

Galiuro EMA

Desired Conditions

The wild character of the Galiuro EMA is preserved, and there are ample opportunities for quiet recreation and solitude. Recreation opportunities are primarily undeveloped and the entire EMA is available for primitive and dispersed recreation. Powers Cabin is preserved as an historic site.
The EMA is one contiguous block of federal land from its original boundaries to the Winchester EMA. The proclaimed National Forest boundary at the southeast corner connects with the northwest corner of the Winchester EMA.

There is permanent legal public road and trail access into all sides of the EMA, it is easily accessible by public land and administrative users, and it is connected to state, county, local public, and other federal roads and trails. Permanent legal public vehicular access to NFS lands in the Schoenholzer Canyon, Copper Creek, Keilberg Canyon, and YLE Canyon area, Fourmile Canyon, First Trail Canyon, Rattlesnake Mesa and Willow Creek area, and other areas within the EMA is established and is easily accessible by public land and administrative users.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 40 percent of the Galiuro EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Pinaleño EMA

Pinaleño Ecosystem Management Area

General Description

The Pinaleño Ecosystem Management Area encompasses a massive mountain range of 198,879 acres. The Pinaleño EMA has elevations well over 10,000 feet and dwarf surrounding ranges. This EMA rises from the surrounding semi-desert grasslands up to the Forest's only representative spruce-fir vegetation community. Residents of the Gila Valley (Safford, Thatcher, and other communities) consider Mount Graham a special place, part of a tradition of retreating to the mountain for relief from summer heat. The entire range (or Dzil nchaa si'an) has been formally recognized as a traditional cultural property important to the Western Apache groups, including White Mountain, San Carlos, and Yavapai Apache, and as a place of outstanding significance in Western Apache religion, culture, and history. The mountain continues to play a vital role in Western Apache life ways and tribal well-being. Dził Nchaa Si'an is home to mountain spirits, serves as a source of natural resources and traditional medicine for ceremonial uses, and is used as a place of prayer and a source of power to Western Apache people. The Hopi Tribe, the Pueblo of Zuni, and the Four Southern Tribes of Arizona also have sacred sites and shrines within the Pinaleño Mountains. The entire EMA has been determined eligible for listing on the National Register of Historic Places. Primary access into the mountains is via State Highways 366 (which was designated "Swift Trail Parkway" by Arizona Department of Transportation in 1992) and 266 (over Stockton Pass). Non-motorized trails penetrate the range for travel by foot and horseback. One of

Geographic Areas

Safford Ranger District

Pinaleño EMA

these, Arcadia Trail (#328), was named "Arcadia National Recreation Trail" by the Chief of the Forest Service in 1979.

Visitor facilities include developed campgrounds, picnic areas, and a visitor center that is staffed partly by volunteers. There are also many popular locations for dispersed recreation. Large unroaded areas, including the Mount Graham Wilderness Study Area, offer opportunities for backcountry hiking and solitude. Additionally, two special management/emphasis zones contribute to the uniqueness of the EMA: the Wet Canyon Talussnail Area and the Mt. Graham Astrophysical and Biological Research Area. University of Arizona's Mount Graham International Observatory (MGIO) has become an important astrophysical research facility and contributes to the rich multiple-use history of the range. The 62,442-acre Recommended Mount Graham Wilderness Area circles the high peaks of the EMA.

Goudy Canyon Research Natural Area. A portion of the EMA's mixed conifer forests within Goudy Canyon was designated a research natural area in 1972 to provide opportunities to study Mexican white pine (now considered Southwestern white pine) and Douglas-fir in near-optimal stand conditions. The Recommended Mount Graham Wilderness Area overlaps the entire RNA. Motorized access to the northern boundary of Goudy Canyon RNA is easily available via the Swift Trail, providing opportunities for wilderness-oriented recreation to occur.

Wet Canyon Talussnail Area. On the eastern slope of the Pinaleño Mountains, 1,220 acres of the Wet Canyon talussnail's (Sonorella macrophallus) optimal habitat and the watershed that surrounds it is protected within this special area, recognized in a 1998 Forest Plan amendment. As the name implies, this land snail is restricted to talus slopes in canyon bottoms, and is barely more than a half an inch in diameter. It is endemic to the Pinaleño Mountains, and perhaps even to the Wet Canyon watershed. Five other talussnails are also endemic to the Pinaleño Mountains; they share common habitat requirements and are therefore mutually benefited by the existence of the Wet Canyon Talussnail Area.

Mount Graham Astrophysical and Biological Research Area. Designated in 1989 by the Arizona-Idaho Conservation Act, this area encompasses 3,071 acres in the highest elevation of the Pinaleño EMA with management emphasis on biological research for the Mt. Graham red squirrel and spruce-fir vegetation type, and astronomical research at the Mt. Graham International Observatory.

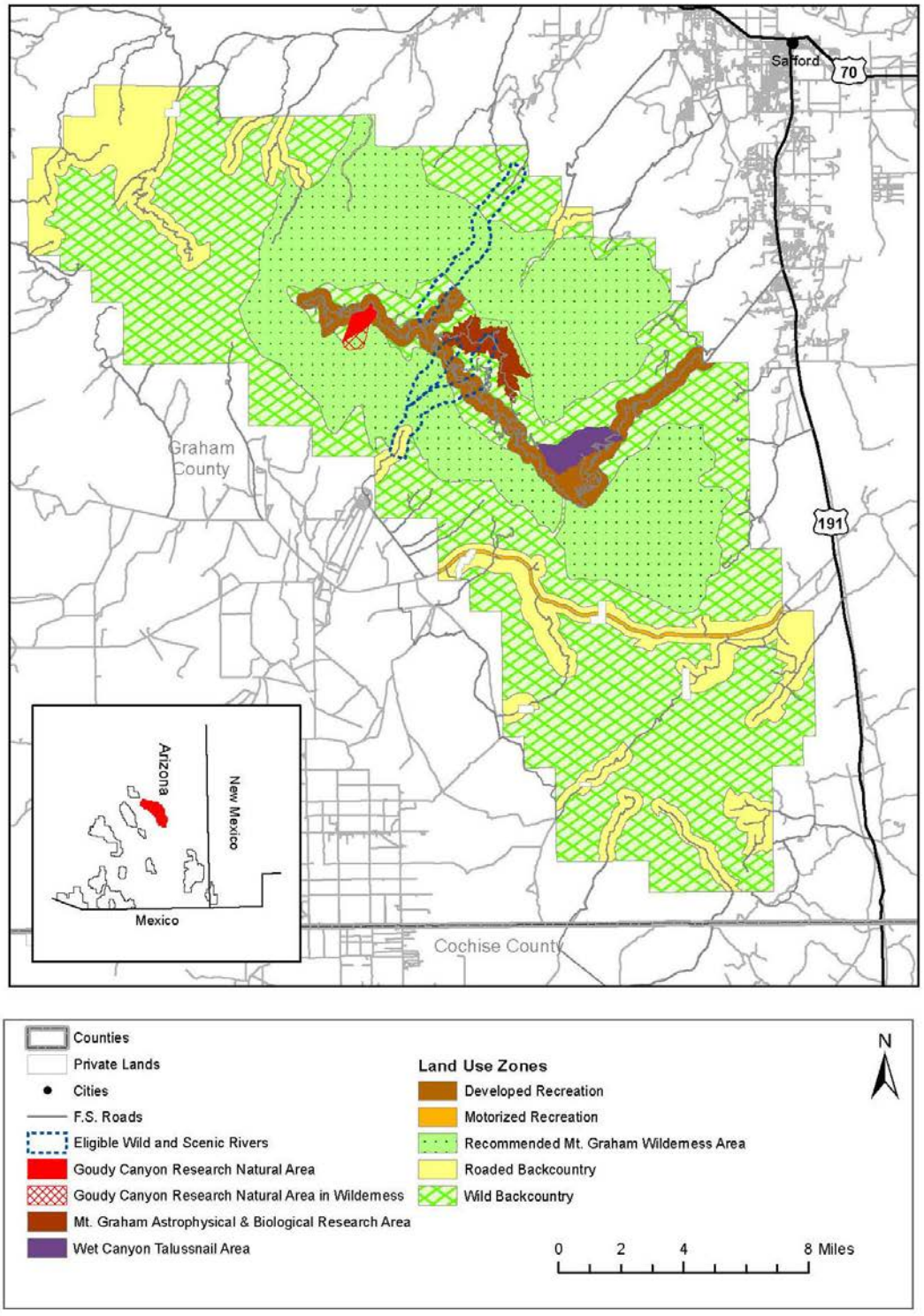

Figure 11. Pinaleño EMA Land Use Zones and Special Areas

Desired Conditions

The Pinaleño EMA offers a wide spectrum of developed recreation opportunities for a growing public, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. The Swift Trail Parkway, a state-designated scenic byway, provides vehicular access to the EMA's primary recreational opportunities year-round and access to high elevations from spring to fall. The scenic, natural qualities valued by visitors are retained. Interpretive signs along the Swift Trail provide educational information about the surrounding natural and cultural resources. Trails in the Mt. Graham Astrophysical and Biological Research Area are open to hikers and visitors are provided with information about the cultural significance of the area and the ways to be respectful.

Recreation facilities are sufficient in size and number to accommodate demand and support a high-quality, outdoor experience. Riggs Lake and Frye Mesa Reservoir offer opportunities for fishing and other lake-based recreation. These activities do not contribute to the spread of invasive aquatic species. Up-to-date, locally-focused, and science-based natural and cultural information is available to visitors at the Columbine Visitor Center. Horse corrals at several recreation sites along Swift Trail offer equestrians places to organize rides and to camp. Recreation residences and the Columbine organization camp blend well with the natural landscape and do not expand beyond their authorized footprints. Permanent legal public vehicular access to NFS lands in the EMA is established and is easily accessible by public land and administrative users.

The integrity of the Western Apache Traditional Cultural Property is retained or improved wherever feasible. Members of the White Mountain and San Carlos Apache Tribes and the Yavapai Apache Nation have access to *Dzil Nchaa Si'an* for ceremonial, religious, collecting, and gathering activities. The mountain provides a setting for the education of tribal youth in culture, history, and land stewardship. When available, Forest administrative sites can be used by tribal families and organizations through government-to-government agreements. Interpretive and educational exhibits or other media that focus on the history of the Forest are developed in collaboration or consultation with the Western Apache tribes, so that the general public gains a greater understanding and appreciation of Apache history, culture, and traditions. Traditional uses, such as the collection of medicinal plants, wild plant foods, basketry materials, and fuelwood, are available for collection by tribal members.

The dark skies above the Pinaleño EMA present conditions conducive to astronomical research. Existing telescopes offer educational opportunities and promote scientific discovery. University of Arizona researchers, employees, students, volunteers who visit the MGIO, and Observatory employees are informed about the importance of *Dzil Nchaa Si'an* to Western Apache people and how to be respectful when visiting, living, residing, or working on the mountain.

High-elevation meadows are dominated by native grasses and grass-like plants, and are relatively free of trees and shrubs. The spruce-fir vegetation community is regenerating with species representative of a healthy mix of spruce-fir seral

stages. The Wet Canyon Watershed provides habitat for the Wet Canyon talussnail. The Mt. Graham Astronomical and Biological Research Area provides habitat for the Mt. Graham red squirrel and astrophysical research at the Mt. Graham International Observatory MGIO). Recreational uses or management activities do not degrade these special habitats.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 25 percent of the Pinaleño EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Guidelines

1. The Forest should consult with White Mountain and San Carlos Apache Tribes to protect the physical integrity of the *Dzil Nchaa Si'an* Traditional Cultural Property, restore the ecosystem, and mitigate the effects of the MGIO and other developments on the mountain.
2. The Mount Graham International Observatory permittee should be notified of all wildland fires that may affect the observatory.
3. During vegetation treatments, considerations of mesic microenvironments for woodland and talus snails endemic to the Pinaleño EMA should be incorporated (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).
4. Management activities involving ground disturbance and/or vegetation management should incorporate, site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Pinaleno EMA, these species and associated management threats include, but are not limited to, the following:
broad-leaf ground-cherry: grazing
leafy Jacob's ladder: unknown
Rusby's hawkweed: fire
white-flowered cinquefoil: fire and loss of natural fire regime
5. Within habitat for Mount Graham red squirrel (MGRS):
a. Red squirrel habitat needs should supersede the needs of all other species of plants and animals.
b. Hiking use levels should not negatively impact MGRS habitat or individuals.
c. Vegetation treatments should be designed and implemented to avoid disturbance of MGRS middens.

Standards

1. Within the Goudy Canyon RNA:
a. Wildlife habitat improvement, water yield improvement, and related improvement projects are prohibited.
b. Vegetation manipulation, including timber sale and harvest of forest products, will not be allowed except for approved research purposes.
2. Within habitat for the Mount Graham red squirrel:
a. No new recreational residence or developed recreation areas will be established.

Geographic Areas

Safford Ranger District

Pinaleño EMA

Management Approaches

- Using planned and unplanned ignitions to reduce the potential for sedimentation, diminished water quality, and soil erosion in talussnail habitat resulting from uncontrolled fire.
- Managing for the protection and physical integrity of the EMA as a traditional cultural property in full partnership with the Western Apache tribes.
- Encouraging the Western Apache tribal members to pursue careers in the Forest Service and contribute to the Coronado National Forest's ability to adapt traditional knowledge to modern land management practices.
- Working with the University of Arizona and the Western Apache Tribes to mitigate or reduce the effects of the MGIO on the traditional cultural property.
- Encouraging scientific investigation of talussnail life history traits (including reproduction, recruitment, mortality, population trends, ecology, etc.) to increase understanding of, and the ability to manage, this unique taxon.
- Using education to improve understanding of special management areas.
- Acquiring and maintaining instream water rights on Wet Canyon Creek.
- Nominating the Pinaleño EMA for designation as a special area in recognition of its importance to the Western Apache tribes.
- Recommending areas of the EMA above 6,500 feet for withdrawal from mineral entry and mineral leasing, to protect habitat for federal and state-listed threatened and endangered species, and for astrophysical research operations.
- Collaborating with the Pinaleño Partnership in their area of interest.
- Planning the withdrawal from mineral entry for the Wet Canyon Talussnail Area.
-

Santa Teresa EMA

Santa Teresa Ecosystem Management Area

General Description

The 49,852-acre Santa Teresa Ecosystem Management Area comprises the Forest's most northerly administrative land unit, located just beyond and between the Galiuro and Pinaleño mountains. The EMA's Santa Teresa range is a network of rugged mountains with bald summits, deep canyons, and sprawling mesas. Extremely rugged Holdout Canyon typifies the Santa Teresa Mountains; abundant caves and alcoves hollow into eroded cliffs with picturesque formations. Vegetation is predominantly thick chaparral with forests of ponderosa pine occupying high ridges. A stand of Douglas-fir grows on the sheltered north slope of Cottonwood Peak, the highest in the range at 7,481 feet. The 26,780-acre Santa Teresa Wilderness encompasses more than half of the EMA.

Bordering the EMA to the north is the San Carlos Apache Reservation, also part of the Santa Teresa range. These mountains also lie within the aboriginal territories of the Western Apaches and the Four Southern Tribes, and may have been part of the migration routes used by ancestral pueblo groups. As one of the least-developed EMAs within the Coronado NF, access into Santa Teresa EMA

Geographic Areas
Safford Ranger District

is via gravel and dirt roads, or by hiking trails. There are no developed recreation areas, although opportunities for backcountry hiking, camping, and picnicking are abundant.

Santa Teresa EMA

Desired Conditions

The wild character of the Santa Teresa EMA is preserved, and there are ample opportunities for quiet recreation and solitude. Recreation opportunities are primarily undeveloped. The entire EMA is available for primitive and dispersed recreation. Permanent legal public vehicular access to NFS lands in the EMA is established and is easily accessible by public land and administrative users.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 40 percent of the Santa Teresa EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

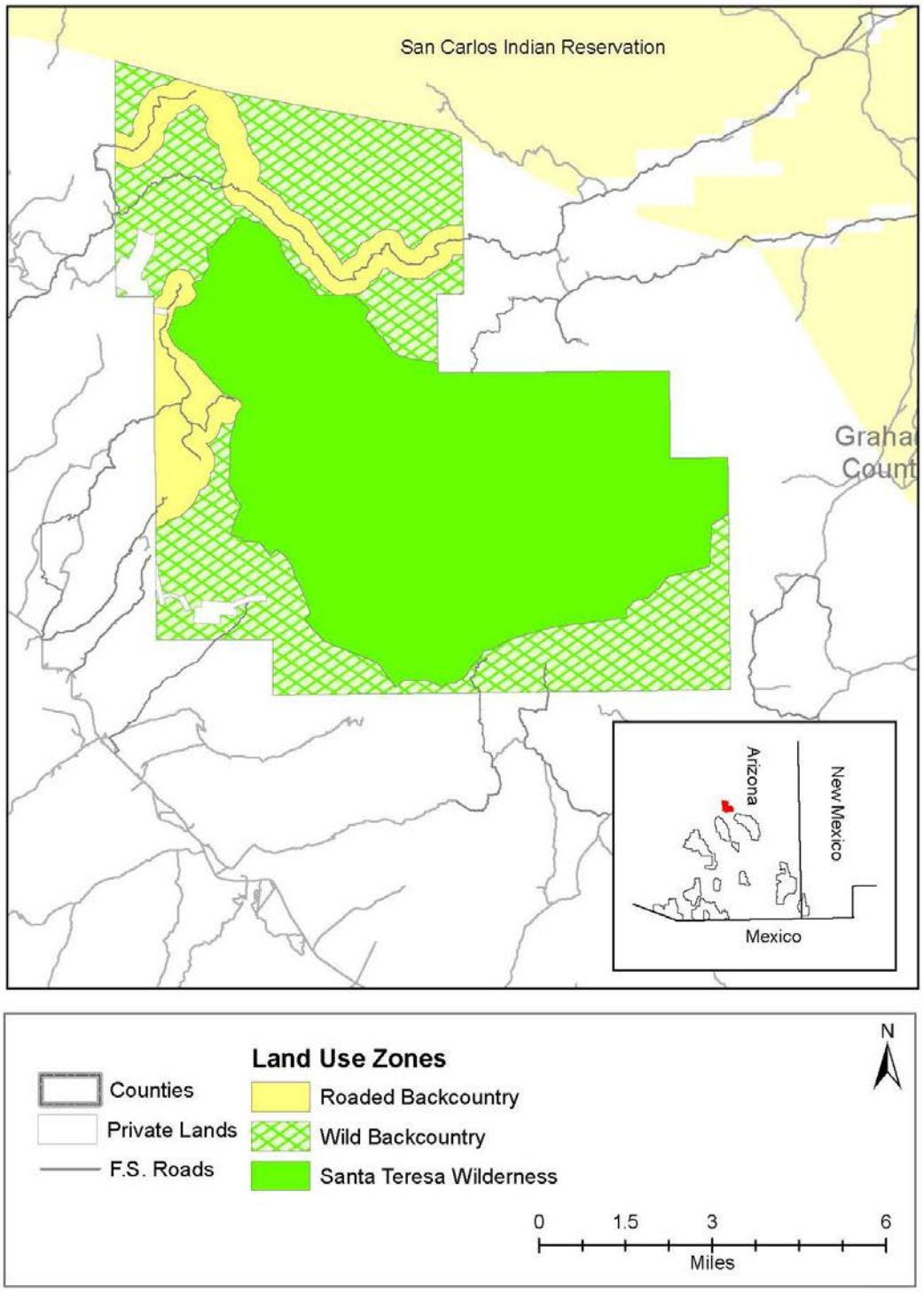

Figure 12. Santa Teresa EMA Land Use Zones and Special Area

Geographic Areas

Safford Ranger District

Winchester EMA

Winchester Ecosystem Management Area

General Description

Less than half the size of the next largest Ecosystem Management Area, Winchester EMA contains 19,272 acres. The administrative boundary is considerably larger, yet a significant portion of that acreage is owned by the State of Arizona. The mountains that give this EMA its name are a small range situated just southeast of the Galiuro Mountains; Rilay Peak forms the apex of the Winchester Mountains, rising to over 7,500 feet in elevation. Part of the Apache territory when Euro-Americans entered the region, this range was evidently visited by Native American groups for thousands of years. Winchester EMA offers opportunities for primitive recreation and solitude. Access is via primitive roads, with much of the EMA accessible only by hiking cross-country. There are no developed recreation areas in the EMA, although there are good opportunities for backcountry hiking, camping, and solitude.

Desired Conditions

The wild character of the Winchester EMA is preserved, and there are ample opportunities for quiet recreation and solitude. Recreation opportunities are primarily undeveloped. The entire EMA is available for primitive and dispersed recreation. Permanent legal public vehicular access to NFS lands in the EMA is established and is easily accessible by public land and administrative users.

Objectives

1. Within 10 years of plan approval, treat the vegetation on at least 10 percent of the Winchester EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

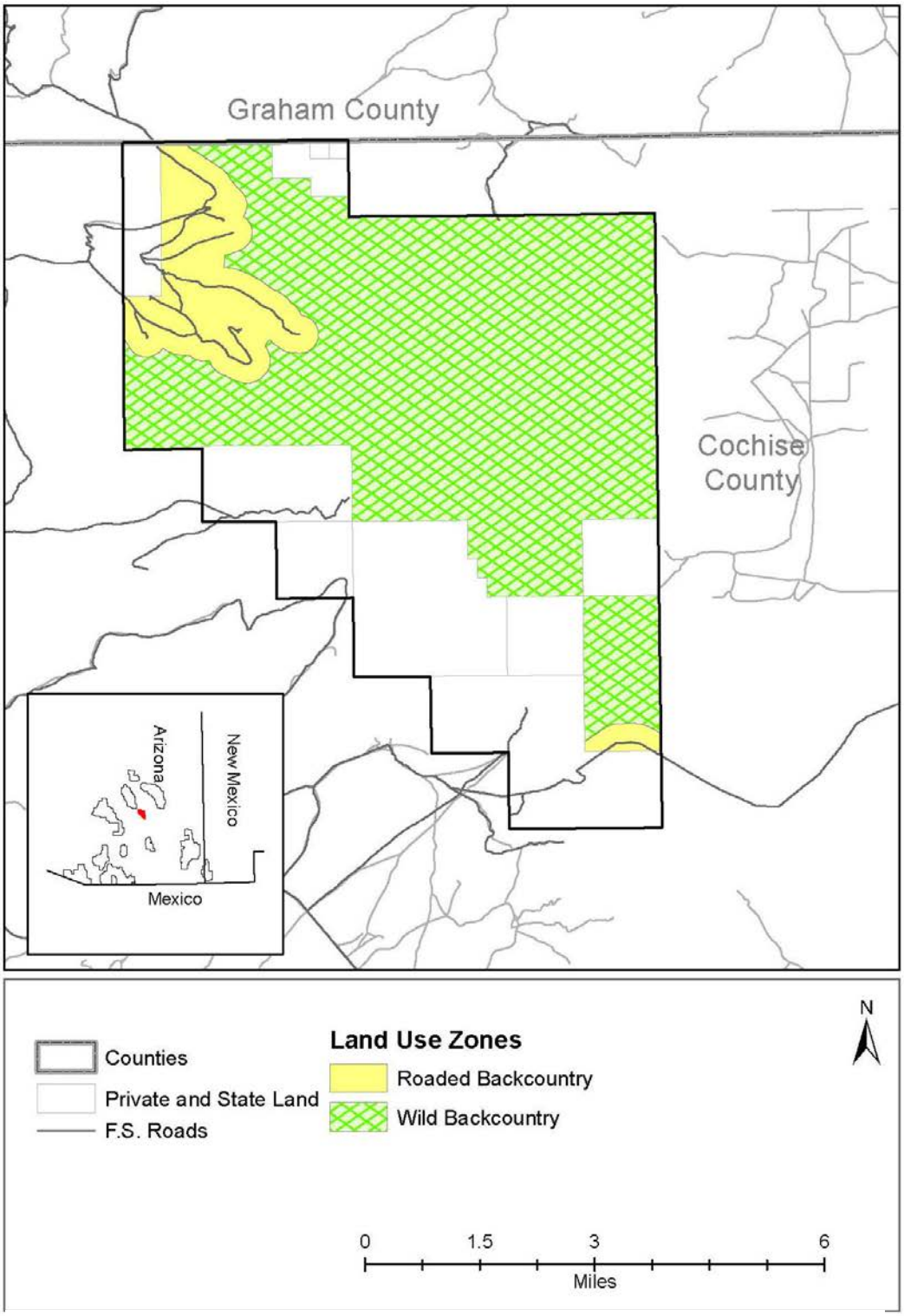

Figure 13: Winchester EMA Land Use Zones and Special Areas

Geographic Areas

Santa Catalina Ranger District

Santa Catalina EMA

Santa Catalina Ranger District

The Santa Catalina Ranger District consists of only one Ecosystem Management Area, the Santa Catalina.

Santa Catalina Ecosystem Management Area

General Description

The 265,142-acre Santa Catalina Ecosystem Management Area wraps around the northern and eastern sides of the Tucson basin, dominating the viewshed from most parts of the City of Tucson. Elevations range from 2,200 feet at the valley edges to 9,157 feet on Mount Lemmon. The EMA is comprised of two mountain ranges, the Rincon Mountains and Santa Catalina Mountains. Nearly all of the Forest's vegetation communities are represented within the Santa Catalina EMA. Historically, both ranges were within the aboriginal territories of the O'odham and the Apaches. Large archaeological sites in the foothills and small shrines atop peaks are important to the Zuni and the Hopi. There are two designated wilderness areas in the EMA, the 56,933-acre Pusch Ridge Wilderness in the Santa Catalina Mountains and the 38,590-acre Rincon Wilderness in the Rincon Mountains. The boundary of the Rincon Wilderness is shared with Saguaro National Park.

The north-facing portion of the Santa Catalina Mountains exhibits a number of natural features of interest; Samaniego Ridge and Reef of Rocks dramatically rise to the crest of the range, parallel ridges that harbor Santa Catalina's longest drainage, Canado del Oro, at nearly 25 miles in length. This canyon and Sabino Canyon are the only known drainages in this range to have historically contained native fishes. Alder Canyon, on the east slope of the Santa Catalina Mountains, is notable for its large deposits of limestone and dolomite, which are uncommon within the range at these concentrations. An interrupted perennial stream flows from multiple springs and seasonal snowmelt, making Alder Canyon particularly lush; it is probably second only to Sabino Canyon in terms of biological diversity. Lowland leopard frogs, canyon tree frogs, coatimundi, and riparian vegetation are abundant.

This EMA receives more visitors than any other area of the Coronado National Forest. It provides a sanctuary to desert dwellers during the intense heat of summer, and an opportunity to enjoy snow each winter. Mount Lemmon's Ski Valley is the southernmost ski area in the continental U.S., offering rare skiing opportunities and a popular "sky ride" during non-snowy months. Trails wander the many canyons, ridges, valleys, and forests of the Santa Catalina EMA, including the Arizona Trail that traverses both mountain ranges. The primary access route into the Santa Catalina Mountains is the Catalina (or General Hitchcock) Highway. The highway was designated a Scenic Route by Pima County, the "Sky Island Scenic Byway" by the Chief of the Forest Service in 1995, and "Sky Island Parkway" by the Federal Highway Administration (USDOT) in 2001. Visitor facilities are concentrated along the Catalina Highway, in Sabino Canyon, and in Catalina State Park, which is managed by the State of Arizona and administered by the Forest. Dispersed recreation is abundant within designated wilderness areas, as well as on the north and east aspects of the Santa Catalina Mountains and throughout the Rincon Mountains

Geographic Areas

Santa Catalina Ranger District

Santa Catalina EMA

Butterfly Peak Research Natural Area. One thousand acres of land at the head of Alder Canyon on the eastern slope of the Santa Catalina Mountains were set aside in 1935 as Butterfly Peak RNA. The area was noted to contain one of the largest varieties of trees and shrubs in any one place in the Southwest, including at least seven coniferous species, eleven broadleaf species, and a wide range of shrubs and herbs. Steep topography naturally limits timber harvest, livestock grazing, and mineral exploration, and the only trail that enters the area would be considered strenuous by most hikers. As such, visitation is low, making it an ideal place to conduct research within the ponderosa pine-evergreen shrub vegetation community.

Santa Catalina Research Natural Area. This area was designated in 1927 as the nation's first RNA. The original 4,464 acres were advocated by the Tucson Natural History Society for the study of flora as well as for appreciation of the outdoors and other purposes. Adjustments to the original size have been made since establishment. In 1962, a small reduction was made for special uses that were in conflict with RNA system intentions and the RNA was reduced to 4,131 acres. In 1986, it was recommended in the Forest Plan to reduce the RNA to 890 acres to eliminate a large area heavily used for dispersed recreation, and this size reduction is still recommended. Vegetation is dominated by widely-dispersed ponderosa pines. The Pusch Ridge Wilderness overlaps the area entirely.

Proposed Finger Rock Canyon Research Natural Area. The proposed RNA covers 1,103 acres and includes the five-mile Finger Rock Trail. It encompasses a xeroriparian system that is biologically rich, provides a corridor for wildlife movement, and is a refugium for rare flora and fauna. The Pusch Ridge Wilderness overlaps almost the entire proposed RNA. Wilderness management applies to the proposed RNA and recreational use within the area will continue.

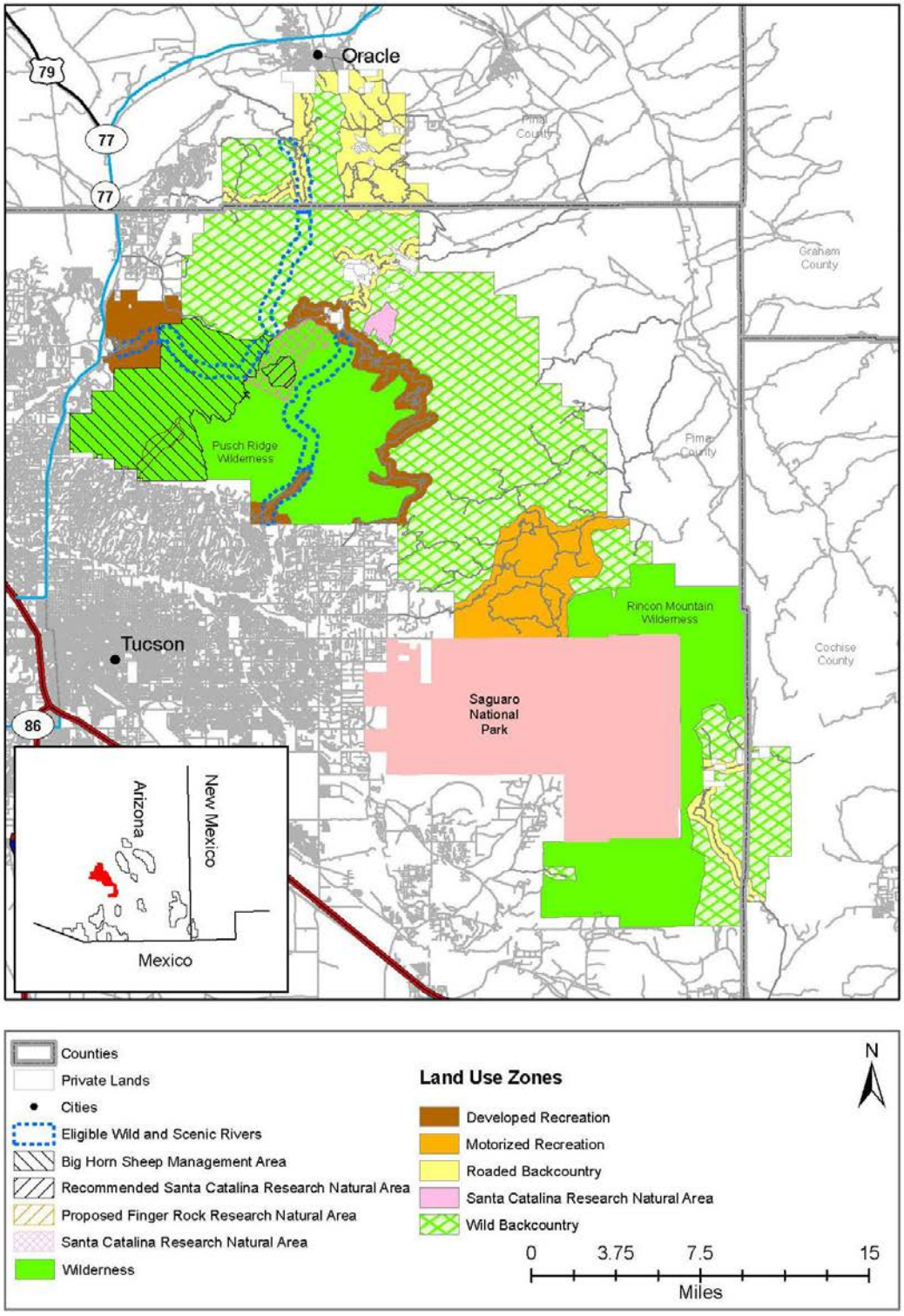

Figure 14. Santa Catalina EMA Land Use Zones and Special Areas

Geographic Areas

Santa Catalina Ranger District

Santa Catalina EMA

Desired Conditions

The Santa Catalina EMA offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain for primitive and dispersed recreation. In Sabino Canyon, developed recreation opportunities exist along the roadways, including access to the biologically rich Sabino Creek, and opportunities for dispersed and quiet recreation exist away from the main travel corridor. In Redington Pass, backcountry touring routes are available for visitors who operate OHVs and ATVs responsibly. Visitors to this area can enjoy the outdoors in clean, natural settings without conflicts with unsafe or illegal activities or exposure to excessive noise and disturbance. Recreational target shooting occurs in safe and well-monitored locations. The Sky Island Scenic Byway retains the qualities that earned national designation as a scenic byway. It provides year-round vehicular access to outstanding natural scenery and high elevations for a variety of developed and undeveloped recreational opportunities, as well as access to the community of Summerhaven. Interpretive signs help visitors learn about conservation of the natural and cultural resources in the area.

Fishing opportunities at Rose Canyon Lake are available to the public. Water-based recreational activities do not contribute to the spread of invasive aquatic species. Up-to-date, locally-focused, and science-based natural and cultural information is available to visitors at the Palisades and Sabino Canyon Visitor Centers. Recreation residences and organization camps blend well with the natural landscape and do not expand beyond their authorized footprints. The geologic features and rock formations that dominate the Santa Catalina scenery sustain a rich heritage of rock-climbing. Rock climbers do not cause resource damage and abide by restrictions needed for wildlife protection. Ski Valley offers periodic snow-based and other year-round recreation opportunities. The Arizona Trail offers opportunities for hiking, cycling, and horseback riding across the EMA along a continuous north-south trending transect. Existing telescopes offer educational opportunities and promote scientific discovery.

Small stands of corkbark fir exist on cool, wet sites at the highest elevations. Buehman Canyon retains the characteristics required to be designated an "Outstanding Arizona Water" by Arizona Department of Environmental Quality. Sabino Creek supports a diverse assemblage of native aquatic species, including but not limited to Gila chub, Gila topminnow, longfin dace, Chiricahua leopard frog, Mexican garter snake, and Sabino Canyon damselfly. Habitat exists for bighorn sheep. Unique vegetation species are perpetuated in the Santa Catalina RNA, Butterfly RNA, and the proposed Finger Rock Canyon RNA. The unique values of Alder Canyon are perpetuated.

Objectives

1. Within 10 years of plan approval, treat vegetation on at least 25 percent of the Santa Catalina EMA to create resiliency to disturbances. Treatments will be consistent with the objectives for Forestwide vegetation communities and resources.

Geographic Areas

Santa Catalina Ranger District

Santa Catalina EMA

Guidelines

1. During vegetation treatments, mesic microenvironments for woodland and talus snails endemic to the Santa Catalina EMA should be protected (e.g., trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides).
2. Management activities involving ground disturbance and/or vegetation management should incorporate, site-specific design features to benefit habitat for, or mitigate impacts to, rare plant populations. For the Santa Catalina EMA, these species and associated management threats include, but are not limited to, the following:

Aravaipa woodfern: grazing, collecting, and spring development
Arizona eryngo: invasive weeds, and riparian degradation from grazing
Arizona manihot: habitat degradation from grazing and recreation
Rusby's hawkweed: fire

Standards

1. Within the Santa Catalina RNA and Butterfly RNA:
a. Livestock grazing will not be permitted.
b. Timber cutting is prohibited.

Management Approaches

- Developing a management plan for the Redington Pass Area in collaboration with the Friends of Redington pass and others. Collaborating with partner groups, including Sabino Canyon Volunteer Naturalists, the Friends of Sabino Canyon, Sabino Mounted Patrol, and Sabino Canyon Bicycle Patrol.

Monitoring and Evaluation

Chapter 6: Monitoring and Evaluation

Introduction

Introduction

Monitoring and evaluation are separate and sequential activities required by National Forest Management Act regulations to determine how well the Forest Plan is working. Monitoring[16] involves collecting data by observation or measurement. Evaluation involves analyzing and interpreting monitoring data.

Monitoring and evaluation activities provide on-going feedback about management effectiveness and are essential elements of an adaptive management cycle that includes problem identification, solution, and implementation. Monitoring and evaluation activities keep direction found in the Forest Plan up-to-date and relevant by being responsive to changing conditions and issues, including public desires, and to new information, such as research results or outcomes from management activities.

Monitoring Strategy

Monitoring Strategy

A strategy for Forest Plan monitoring and evaluation has been designed to answer these three basic questions:
Did we do what we said we were going to do? This question answers how well the direction in the Forest Plan is being implemented. Collected information is compared to objectives, standards, and guidelines.
Did it work how we said it would? This question answers whether the application of standards and guidelines is achieving objectives, and whether objectives are achieving desired conditions.
Is our understanding and science correct? This question answers whether the assumptions and predicted effects used to formulate the desired conditions and objectives are valid.

The following guiding principles are key elements of the monitoring strategy and serve as a framework for implementing an effective monitoring and evaluation program:

- Monitoring efforts are efficient, practical and affordable, make use of the best available science, and do not duplicate the collection of data already underway for other purposes.
- Monitoring tasks are scaled to the desired condition, objective, or management area direction to be monitored.
- Monitoring is not performed on every single activity, nor does it need to meet the statistical rigor of formal research.
-

[16] The general purpose of monitoring is to detect changes or trends in a resource. Detection of a change or trend may trigger a management action, or it may generate a new line of inquiry. Monitoring data are most useful when the same methods are used to collect data at the same locations over time. It is important to note that cause and effect relationships usually cannot be demonstrated with monitoring data, but monitoring data might suggest a cause and effect relationship that can then be investigated with a research study.

- A monitoring action plan is prepared each year to identify specific items that should be monitored in the coming year. The annual monitoring action plan identifies and schedules various site-specific, on-the-ground monitoring activities. It also describes the methods, locations, responsible persons, and estimated costs.
- Budgetary constraints may affect the level of monitoring that can be done in a particular fiscal year. If budget levels limit the Coronado NF's ability to perform all monitoring tasks, then those items specifically required by law are given the highest priority.
- Opportunities to complete monitoring and evaluation activities through partnerships and citizen collaboration are examined on a regular and on-going basis.
- A monitoring and evaluation report is prepared each year that summarizes the results of completed monitoring and evaluates the data for indicators of trends or effects.
- The forest supervisor annually evaluates the monitoring information displayed in the evaluation reports through a management review and determines if any changes are needed in management actions or the Forest Plan itself.
- The public is given timely, accurate information about Forest Plan implementation. This is done through the release of the annual monitoring and evaluation report.

The specific monitoring questions to evaluate movement toward Forest Plan desired conditions under this monitoring plan are displayed below in Table 14 and arranged according to six monitoring themes:

1. Legally required
2. Ecosystem restoration
3. Visitor experience
4. Preservation of open space
5. Partnerships and collaboration
6. Public access and travel patterns

In some cases, the monitoring question directly assesses accomplishment of desired conditions. In other cases, they gauge objectives or guidelines associated with the desired conditions.

For each monitoring question/performance measure listed in Table 6, additional monitoring descriptors are included to provide context for the type of information to gather and how often to gather it. These descriptors are defined here:

Unit of Measure: The data that will be used to answer the question.
Frequency of Monitoring: Describes how often information is gathered or measured such as annually, every five years, or every ten years.
Frequency of Evaluation: Defines how often the information is analyzed and reported. Depending upon the question being answered, analysis of the information may occur at longer time intervals than the frequency of monitoring. Some resources need to be monitored annually to produce trend data. Annually gathered data may be analyzed periodically (3, 5 or 10-year cycle), depending upon the time frame specified by each objective.

Monitoring and Evaluation

Monitoring Strategy

Data Precision and Reliability: Precision refers to how close to each other repeated measurements of the same quantity are. Accuracy is a measure of how close a measurement is to the actual value of the variable being measured. Two categories of precision and reliability are appropriate at the Forest Plan scale:

Class A: Methods generally are well accepted for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy and precision.

Class B: Methods or measurements are 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 still provide valuable data.

Table 14. Monitoring and Evaluation

Resource Area	Monitoring Question	Unit of Measure	Frequency of Monitoring (Years)	Frequency of Evaluation (Years)	Data Precision and Reliability
Desert Communities	How has the distribution of Bufflegrass changed?	Acres	2	2	A
Grassland Communities	How many acres have been treated with wildland fire and mechanical treatments?	Acres	Annually	Annually	A
Interior Chaparral	How many acres have been treated with wildland fire and mechanical treatments?	Acres	Annually	Annually	A
Madrean Encinal Woodland	How many acres have been treated with wildland fire and mechanical treatments?	Acres	Annually	Annually	A
Madrean Encinal Woodland	How have the native and non-native plant communities changed due to management actions, especially with regards to blue and sideoats grama?	Percent (of plots)	5	5	B
Madrean Pine-Oak Woodland	How many acres have been treated with wildland fire and mechanical treatments?	Acres	Annually	Annually	A
Madrean Pine-Oak Woodland	How have populations and distribution of acorn woodpeckers changes	Population: numbers; distribution: via habitat	5	5	B
Ponderosa Pine-Evergreen Shrub	How many acres have been treated with wildland fire and mechanical treatments?	Acres	Annually	Annually	A
Dry Mixed Conifer	How many acres have been treated with wildland fire and mechanical treatments?	Acres	Annually	Annually	A
Wet Mixed Conifer	How many acres have been treated with wildland fire and mechanical treatments?	Acres	Annually	Annually	A

Resource Area	Monitoring Question	Unit of Measure	Frequency of Monitoring (Years)	Frequency of Evaluation (Years)	Data Precision and Reliability
Wet Mixed Conifer	How has management affected the population of Mount Graham red squirrels?	Density estimate	1	5	A
Wildland–Urban Interface	How many acres of WUI have been treated to reduce the threat of wildland fire?	Acres	Annually	Annually	A
Natural Water Sources	How many springs have been developed for the recovery of taxa of conservation concern?	Number	5	5	A
Natural Water Sources	What has been the change in distribution and relative abundance of American bullfrogs?	Acres and number of localities	5	5	B
Natural Water Sources	How many stream restoration projects have been completed for the benefit of species of conservation concern?	Number	5	5	A
Natural Water Sources	What has been the change in distribution of Sonoran mud turtles.	Change in detections for number of localities	5	5	B
Constructed Waters	What percentage of the elevated artificial water sources have bat escape ramps?	Number added	2	5	A
Constructed Waters	What has been the change in distribution and relative abundance of American bullfrogs?	Acres and number of localities	5	5	B
Constructed Waters	What has been the change in distribution of Sonoran mud turtles?	Acres and number of localities	5	5	B

Resource Area	Monitoring Question	Unit of Measure	Frequency of Monitoring (Years)	Frequency of Evaluation (Years)	Data Precision and Reliability
Public Access	How many permanent access points have been established?	Points	5	10	A
Land Ownership Adjustments and Boundary Management	How many acres of nonfederal land within the property lines of the Coronado National Forest have been acquired?	Acres	5	10	A
Recreation	Is the Coronado NF providing high-quality and sustainable recreation opportunities? Is the Coronado NF meeting public recreation demand according to indicators and visitor satisfaction surveys?	Recreation Visits and Qualitative	5	5	B
Scenic Quality	What are the impacts and improvements to scenic quality across the Coronado NF?	ESI and/or Qualitative	10	10	B

Glossary

Administrative Use: Use by the Forest Service.

Air Quality Related Values: A feature or property of an area that is affected in some way by air pollution. Identified values are visibility, odor, flora, fauna, soil, water, geologic feature, and cultural resources

ATV Focused Recreation: Facilities, routes or events specifically for ATV users.

Basal area: 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 (π x radius2 = 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 (the part of a tree where the main roots join the trunk, usually at or near ground level) is used to calculate the cross-sectional area of multi-stemmed trees such as juniper and oak.

Class I airshed: An airshed classification where areas require the highest level of protection under the Clean Air Act of 1963.

Class II airshed: An airshed classification representing National Forest System land that is not classified as a Class I airshed. These areas may receive a greater amount of man-made pollution than Class I areas.

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

Coarse woody debris: Woody material, including logs, on the ground greater than three inches in diameter. A component of litter.

Colluvium (colluvia *plural*): a heterogeneous mixture of soil and debris that accumulates, typically at the base of a slope, as result of mass wasting, overland flow, sheet erosion, freeze-thaw cycles, or other erosional processes.

Concern Level: A measure of degree of public importance placed on landscapes (scenery) viewed from travelways (roads and trails) and use areas. There are 3 levels: Concern Level 1 (High), 2 (Moderate), and 3 (Low).

Communications site: An area of National Forest System land used for telecommunications services. A communications site may be limited to a single communications facility, but most often encompasses more than one facility.

Connectivity: The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation; the opposite of fragmentation.

Declining: The senescent (aging) period in the lifespan of plants that includes the presence of dead and/or dying limbs, snag-tops, and other characteristics that indicate the later life-stages of vegetation.

Defensible space: An area either natural or manmade where material capable of allowing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and property or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

Developed recreation site: A distinctly defined area where facilities are provided by the Forest Service for concentrated public use, e.g., campgrounds and picnic areas.

Diameter at breast height (DBH): The diameter of a tree at the bole or trunk typically measured at 4.5 feet above ground level.

Dispersed Motorized Camping: Camping with motorized vehicles outside of developed campsites.

Dispersed recreation: Recreation use which occurs outside developed recreation sites.

Ecosystem Management Area: Unique geographic areas based on the major mountain ranges that make up the Coronado NF.

Ecosystem: A spatially explicit, relatively homogeneous unit of the earth that includes all interacting organisms and components of the abiotic environment within its boundaries. An ecosystem is commonly described in terms of its: 1) Composition. Major vegetation types, rare communities, aquatic systems, and riparian systems; 2) Structure. Successional stages, water quality, wetlands, and floodplains; 3) Function. Ecological processes such as stream flows and disturbance regimes.

Ecosystem services: Ecosystem services are benefits that people obtain from ecosystems. The Coronado NF provides clean water and air, productive soil, riparian and aquatic resources, diverse wildlife habitats, educational and cultural values, scenery, recreation, timber, forage, and forest products.

Even-aged: Forests that are composed of one or two distinct age classes of trees. Managed even-aged forests are characterized by a distribution of stands of varying ages (and therefore, tree size) throughout the forest area. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Federally listed species: Threatened or endangered species listed under the Endangered Species Act of 1973, as amended.

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

Fire regime I: 0 to 35 year frequency. Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory.
Fire regime II: 0 to 35 year frequency. High-severity fires replacing greater than 75 percent of dominant overstory vegetation.
Fire regime III: 35 to 200 year frequency. Generally mixed severity; can also include low-severity fires.
Fire regime IV: 35 to 200 year frequency. High severity fires.
Fire regime V: 200+ year frequency. Generally replacement-severity; can also include any severity type in this frequency range.

Fire severity: In fire regime methology, this is the effect of fire in terms of upper layer canopy replacement. The severity classes are:
Low: 6-25 percent replacement
Mixed: 26-75 percent replacement
High/Replacement: > 75 percent replacement

Forest Product: Plants or plant part harvested under a forest products permit or contract.

Fuelwood Products: Wood removed for firewood.

Geographic area: Areas of the Coronado NF that have their own distinct characteristics and conditions reflected in geographic area specific plan components. The Coronado NF is divided into 12 geographic areas.

Goshawk foraging areas: The areas that surround goshawk PFAs (Post-fledging Family Areas) that northern goshawks use to hunt for prey. They are approximately 5,400 acres in size and do not include the PFA or nesting area acres.

Goshawk nest areas: The areas immediately around a nest that are used by northern goshawks in relation to courtship and breeding activities. They are approximately 30 acres in size and contain multiple groups or patches of large, old trees with interlocking crowns.

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.

Grass reserve: An area that is normally not allocated for livestock grazing, although may be used when an authorized pasture or allotment is unavailable.

Group: 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.

Herbivory: Loss of vegetation due to consumption by another organism.

Historic Range of Variation (HRV): A description of the change over time and space in the ecological condition of potential natural vegetation types, and the ecological processes that shape those types.

Instream flow: Stream flows needed for maintaining wildlife, visual quality, and recreational opportunities at an acceptable level. Aquatic and riparian ecosystems through maintenance of channels and floodplains also benefit.

Invasive species: Species that are not native to the ecosystem being described.

Leave No Trace: Guidelines that help protect the land and lessen the sights and sounds of forest visitors. http://www.lnt.org/

Litter: Litter consists of 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.

Livestock Grazing: Use of forage by domestic livestock, under a livestock grazing permit, in a designated grazing allotment.

Locatable minerals: In general, the hardrock minerals mined and processed for metals (for example: gold, silver, copper, uranium and some types of non-metallic minerals, such as sandstone). They are called 'locatable', meaning subject to mining claim location under the United States mining laws. Locatable minerals are limited to lands with "reserved public domain" status.

Mastication: Mechanical fuel treatment that changes the structure and size of fuels by grinding, shredding, chopping or chipping.

Mechanical treatments: are those projects involving the use of anything motorized such as chainsaws, dozers, mastication, and/or chippers.

Metapopulation: A set of partially isolated populations belonging to the same species that can interbreed and recolonize areas where the species has recently become locally extinct.

Middens: Red squirrel middens are accumulations of cone scales and debris left by feeding; middens may last several years and provide winter refugia.

Motorized Access (Motorized Routes): Use of motorized vehicles on National Forest system roads or trails that are designated for motor vehicle use.

National Forest System: As defined in the Forest Rangeland Renewable Resources Planning Act, the "National Forest System" includes all National Forest lands reserved or withdrawn from the public domain of the United States, all National Forest lands acquired through purchase, exchange, donation, or other means; the National Grasslands and land use projects administered under Title III of the Bankhead-Jones Farm Tennant Act (50 Stat. 525, 7 U.S.C. 1010-1012); and other lands, waters, or interests therein administered by the Forest Service or are designated for administration through the Forest Service as part of the system.

Old growth: Refers to a tree group, tree patch, or landscape composed of old trees, some of which are declining in vigor. In some forest types (e.g., ponderosa pine), old growth typically contains groups of younger trees interspersed with the old trees. However, patches of mainly old trees may exist, but are not sustainable without replacement by younger trees. Old growth forests typically support communities of plants and animals that are associated with or require large old trees. A single tree is not old growth. Although old trees must be present, "old" is a relative term that varies among species.

Openings: Spatial breaks between groups or patches of trees containing grass, forb, shrub, and/or tree seedlings but are largely devoid of big trees.

Patches: 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 10 to 1,000 acres. Patches and stands are generally synonymous term.

Planning period: The life of the Forest Plan, generally 10 to 15 years from plan approval.

Prescribed Fire: A fire intentionally ignited by management under an approved burn plan to meet specific objectives. (Synonym: planned ignition, prescribed burn, controlled burn).

Primitive Recreation: The reliance on personal, non-motorized, or non-mechanized skills to travel and camp in an area, rather than reliance on facilities or outside help.

Recreation Facilities: Facilities and structures that support recreational uses such as restroom buildings, picnic tables, and campfire grills.
Weird their
Recreation opportunity spectrum (ROS): A framework for defining the types of outdoor recreation opportunities the public might desire, and identifies that portion of the spectrum a given National Forest area might be able to provide. The broad classes are:
Primitive: 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 Non-Motorized (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 are subtle. Motorized use is generally permitted; roads are usually unpaved and often primitive. Moderate probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.
Roaded Modified (RM): Characterized by a predominately 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 are subtle. Roads are well maintained and provide easy access. Moderate probability of experiencing solitude, closeness to nature, 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 evidences usually harmonize 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.

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 or other human needs (such as astrophysical structures and electronic sites). 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.

Research Natural Area: A physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. Research Natural Areas are principally for non-manipulative research, observation, and study. They are designated to maintain a wide spectrum of high quality representative areas that represent the major forms of variability found in forest, shrubland, grassland, alpine, and natural situations that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity

Reserve trees: Live trees, 6 inch DBH or larger, retained in either a dispersed or aggregated manner after the regeneration period: seed-tree with reserves, group selection with reserves, etc. Trees may be retained for resource purposes other than regeneration.

Resiliency: The capacity of a system to absorb disturbance (whether natural or human) and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.

Riparian area: Geographically delineable area with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems.

Scale: The aerial extent of certain plan components are described at various scales:

Fine Scale is composed of individual biophysical features, such as a group of trees or shrubs, natural springs, etc.
Mid-Scale is composed of assemblages of fine scale units which have similar biophysical conditions.
Landscape Scale is typically composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes. An area at this scale is comprised of multiple mid-scale units.

Scenic Class: A system of classification describing the importance or value of a particular landscape (scenery) or portions of that landscape.

Scenic integrity: 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 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.

Sense of place: The aesthetic, nostalgic, or spiritual effects of physical locations on humans based on personal, use-oriented or attachment-oriented relationships between individuals and those locations. The meaning, values, and feelings that people associate with physical locations because of their experiences there.

Seral: A plant and animal community which is transitional in stage of succession, being either short- or long-term. If left alone, the seral stage will pass, and another plant community will replace it. Aspen represents a seral stage that eventually is replaced by conifers such as spruce.

Snags: Standing dead trees 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.

Special use: A permit, term permit, temporary permit, lease, or easement, or other written instrument that grants rights or privileges of occupancy and use subject to specified terms and conditions on National Forest System land.

Stand: A contiguous group of trees generally uniform in age class distribution, composition, condition, and structure, and growing on a site of generally uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands. A stand is the fundamental unit of silviculture reporting and record-keeping.

Sustainability: 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.

Targeted grazing: Carefully controlled grazing of livestock to accomplish specific vegetation management objectives. Unlike conventional grazing management, livestock are used as a tool for improving land health by performing weed control, reducing wildland fire, and aiding in restoration projects.

Thinning: An intermediate treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, to recover potential mortality, or to emphasize desired tree species. Includes crown thinning (thinning from above, high thinning), free thinning, low thinning (thinning from below), mechanical thinning (geometric thinning), and selection thinning (dominant thinning). Thinning can be used with both even and uneven-aged management systems.

Timber Harvest: Removal of trees for the purposes other than timber production, such as ecosystem restoration, wildlife habitat improvement or watershed protection.

Timber Production: Growing, tending, harvesting, and regenerating crops of trees on a regulated basis to produce logs or other products for industrial or consumer use.

Tread Lightly!®: Outdoor ethics with a special focus on motorized and mechanized recreation. http://www.treadlightly.org

Unauthorized road or trail: A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas. Sometimes referred to as “user-created” road or trail.

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

Wildfire: An unplanned ignition caused by lightning, volcanoes, unauthorized, and accidental human caused actions and escaped prescribed fires. (Synonym: unplanned ignition)

Wildland Fire: A general term describing any non-structure fire that occurs in the vegetation and/or natural fuels. This includes both prescribed fire and wildfire.

Wildland-urban interface (WUI): Includes those areas of resident populations at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

Wildlife-friendly fence: 4 wires or less with bottom wire 16 inches off ground, top wire 12 inches above second wire, and fence height less than or equal to 42 inches.

Xeroriparian: A riparian-upland transition zone where upland vegetation takes advantage of the greater residence time of additional run-on water to grow larger and denser than it grows in the uplands or in ephemeral reaches. It is considered excellent habitat for wildlife and bird nesting.

References Cited

Clark, J. S. 1998. "Why trees migrate so fast: confronting theory with dispersal biology and the Paleorecord." The American Naturalist 152(2--August): 204-224.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. S. Solomon, D. Quin, M. Manninget al. Cambridge, United Kingdom, Cambridge University Press: 996.

Joyce, L., R. Haynes, et al., Eds. 2007. Bringing climate change into natural resource management: proceedings. General Technical Report PNW-GTR-706. Portland, OR, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Millar, C. I., N. L. Stephenson, et al. 2007. "Climate Change and Forests of the Future: Managing in the Face of Uncertainty." Ecological Applications 17(8): 2145-2151.

Swetnam, T. W., C. D. Allen, et al. 1999. "Applied Historical Ecology: Using the Past to Manage for the Future." Ecological Applications 9(4): 1189-1206.

United States Forest Service (USFS). 2005. Monitoring for Sustainability. Fort Collins, CO., US Department of Agriculture, Forest Service, Inventory and Monitoring Institute, 2005: 2.

United States Forest Service (USFS). 2009a. Coronado National Forest Social and Economic Sustainability Report.

United States Forest Service (USFS). 2009b. Coronado National Forest Ecological Sustainability Report.

United States Forest Service (USFS). 2009c. Coronado National Forest Comprehensive Evaluation Report.

United States Forest Service (USFS). 2010a. Coronado National Forest Comprehensive Evaluation Report Supplementary Document (Analysis of Management Situation).

United States Forest Service. (USFS). 2010b. "Climate Change Resource Center." from http://www.fs.fed.us/ccrc/.

Westerling, A. L., H. G. Hildalgo, et al. 2006. "Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity." Science 313: 940-943.

Appendix A: Climate Change Trends and Coronado NF Land Management Planning

Overview and Background

Climate scientists agree that the earth is undergoing a warming trend, and that human-caused elevations in atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases (GHGs) 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, affecting ecosystem structure, function, and productivity.

This section contains a description of the climate patterns and trends in the Southwestern United States followed by a description of how current climate models and predictions may generally affect those climate patterns in the near future. Then, a short, land management plan revision-oriented, synthesis of climate change literature follows. This review of current climate change-related scientific literature for the Southwestern United States focuses on how climate change might be currently influencing, and may in the future impact ecological and socioeconomic systems. The intent of the review is to examine those areas of climate change research that may have an impact on how the Coronado NF is managed. Specifically, this section summarizes current and future climate trends, at the regional and, if possible, the forest level. Possible effects of climate change on ecosystems, water abundance and quality, biodiversity and wildlife species, economic conditions, and social conditions in the Southwest, and a description of limitations and uncertainties inherent in projected future climate scenarios. Finally, this document discusses possible management issues that should be considered during land management planning.

Climate in the American Southwest and the Coronado NF

What is Climate?

Climate may be defined as the "average weather," or more rigorously, as the statistical description of weather in terms of the mean and variability of relevant quantities (e.g., temperature, precipitation, wind) over a period ranging from months to thousands or millions of years. The standard period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the statistical description of the state or condition of the climate system[1]. In contrast, weather describes the daily conditions (individual storms) or conditions over several days (e.g., a week of record-breaking temperatures), to those lasting less than two weeks[2]. Natural climate variability refers to variations due to natural internal processes (internal variability) in the climate system or natural external forcing (external variability), in the mean state and other statistics of the

[1] According to the World Meteorological Organization, the climate system is a highly complex arrangement consisting of 5 major components: the atmosphere, the hydrosphere, the cryosphere, and the land surface and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings as volcanic eruptions, solar variations and human-induced influences such as the changing composition of atmosphere and land use changes (WMO).

[2] The glossary of climate terms used in this report is drawn from A Glossary of Terms used in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (IPCC 2007).

climate on all spatial and temporal scales beyond that of individual weather events (IPCC 2007). Climate and climate variability are determined by the amount of incoming solar radiation, the chemical composition, and dynamics of the atmosphere, and the surface characteristics of the Earth. The circulation of the atmosphere and oceans influences the transfer of heat and moisture around the planet and thus strongly influences climate patterns and their variability in space and time. Much of the current climate change literature states that human activities such as fossil fuel burning, industrial activities, changes in land-use, animal husbandry, and fertilized and irrigated agriculture lead to increases in GHGs, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These increased GHGs contribute to the greenhouse effect and cause the surface temperature of the Earth to increase. Global atmospheric concentrations of CO_2, CH_4, and N_2O have increased markedly because of human activities since 1750, and now far exceed pre-industrial levels (IPCC 2007).

The climate of the southwestern U.S. is often referred to as dry and hot; however, it is very complex. While low deserts of the Southwest experience heat and drying winds in the early summer, forested mountain areas and plateaus may experience cold and drifting snow during winter. Climate variability is the norm within this region, as temperature and precipitation fluctuate on time scales ranging from seasons to centuries. Monsoon thunderstorms in July and August are often accompanied by flash flooding. From fall to spring, the weather can be warm with clear skies. The Southwest also experiences periods of short- and long-term drought. Indeed, severe regional floods or droughts have affected both indigenous and modern civilizations on time scales ranging from single growing seasons to multiple years, even decades (Hughes et al. 2002).

To a large degree, a quasi-permanent subtropical high-pressure ridge over the Southwest leads to the characteristically low annual precipitation, clear skies and year-round warm weather over much of the region. This high-pressure ridge is created through Hadley circulation[3]. Where the descending branch of Hadley circulation comes down, it tends to create a zone of atmospheric high pressure that makes it difficult for clouds to form. Much of the southwestern U.S. lies in the subtropical zone, where warm, dry air is flowing back down to Earth following its rain-inducing rise in the tropics. Descending air in the subtropics relates to an ongoing global pattern known as Hadley circulation.

In addition, the Southwest is located between the mid-latitude and subtropical atmospheric circulation regimes. This positioning, relative to shifts in these atmospheric patterns, is the main reason for the region's climatic variability. El Niño (also known as the El Niño Southern Oscillation or ENSO) is an increase in sea surface temperature of the eastern equatorial Pacific Ocean with an associated shift of the active center of atmospheric convection from the western to the central equatorial Pacific, ENSO has a well developed teleconnection[4] with the Southwest, usually resulting in wet winters. La Niña, the opposite oceanic case of El Niño, usually results in dry winters for the Southwest. Another important oceanic influence on winter climate of the Southwest is a feature called the Pacific Decadal Oscillation (PDO), which has been defined as temporal variation in sea surface temperatures for most of the

[3] Hadley circulation is a flow pattern that dominates the tropical atmosphere, beginning with warm, moist air rising near the equator, poleward movement 6-9 miles above the surface, descending motion in the subtropics, and equatorward movement near the surface. This circulation is intimately related to the trade winds, tropical rainbelts, subtropical deserts and the jet streams.

[4] Teleconnections: Atmospheric interactions between widely separated regions that have been identified through statistical correlations (in space and time). For example, the El Niño teleconnection with the Southwest U.S. involves large-scale changes in climatic conditions that are linked to increased winter rainfall.

northern Pacific Ocean. The major feature that sets climate of the Southwest apart from the rest of the U.S. is the North American Monsoon, which, in the U.S., is most noticeable in Arizona and New Mexico. Up to 50 percent of the annual rainfall of Arizona and New Mexico occurs as monsoonal storms from July through September (Hughes et al. 2002).

In summary, while many factors influence climate in the Southwest during a particular year or season, the region's overall climate is defined by predictable weather patterns that occur across the years and decades to define the region's climate. The region's overall aridity relates to a global circulation pattern known as Hadley circulation, which creates a semi-permanent high-pressure zone over the Southwest. Relatively high temperatures with dynamic daily swings define this geographic region. Mountains and other differences in elevation affect local climate patterns. The North American Monsoon works to bring moisture from the tropics into the region during the summer months.

Future Climate of the Southwest and the Coronado NF

Currently there appears to be broad agreement among climate modelers that the southwestern U.S. is experiencing a drying tend that will continue well into the latter part of 21st century (IPCC 2007; Seager et al. 2007). While the ensemble[5] scenario used by Seager et al. (2007) included two models with predictions of increased precipitation, the researchers concluded that the overall balance between precipitation and evaporation would still likely result in an overall decrease in available moisture. Regional drying and warming trends have occurred twice during the 20th century (1930s Dust Bowl, and the 1950s Southwest Drought), and were severe during what is known as the Medieval Climate Anomaly, an interval of warm, dry conditions with regional variability from A.D. 900 to 1350 (Hughes and Diaz 2008; Herweijer et al. 2007). The current drought conditions may very well become the new climatology of the American Southwest, including the Coronado NF, within a time frame of years to decades.

According to recent multi-model ensemble scenarios, the warming trend observed in the last 100 years in the Southwest is projected to continue and intensify (IPCC 2007). These climate models project temperatures rising approximately 5 to 8 degrees Fahrenheit by the end of the century in the Southwest, with the greatest warming projected to occur during summer (Lenart 2008c). This trend would increase pressures on the region's already limited water supplies, as well as increase energy demand, alter fire regimes and ecosystems, create risks for human health, and affect agriculture (Sprigg 2000).

The number of extremely hot days is also projected to rise during the 21st century. By the end of the century, parts of the Southwest, including the Coronado NF are projected to face summer heat waves lasting two weeks longer and a five-fold increase in unusually hot days compared to recent decades (Diffenbaugh et al. 2005). In effect, the high temperatures that formerly occurred on only the hottest 5 percent of days could become the norm for a quarter of the year-100 days or more-in much of the Southwest.

Observations based on measurements from weather stations indicate that the temperature rise projected for the future is on par with the rate of increase much of the Southwest has already registered in recent decades, particularly since the mid-1970s. Since 1976, the average annual temperature increased by 2.5 degrees Fahrenheit in Arizona (Lenart 2008c). The recent temperature increase is unusual, even in the context of records dating back more than 1,200 years that were compiled from tree rings and other natural archives of temperature for the

[5] Multi-Model ensembles: Researchers have found that the average of numerous available climate models--sometimes called the ensemble mean--almost always weigh in with more accuracy than any one model. This technique often uses 18 to 20 different coupled global circulation models, and combines the output from each to produce and ensemble output (CCSP 2008c).

northern hemisphere (Trouet et al. 2009; Hughes and Diaz 2008; Herweijer et al. 2007; Meko et al. 2007).

Warmer winter temperatures in the Southwest have serious implications for snow cover, an important natural reservoir of water in the West. In a study conducted on two watersheds in central Arizona, Svoma (2011) found that between water years 1934–2007 average snowpack elevation levels have increased with a decrease in snow amounts. In his study, he directly correlated this with increasing temperatures. Shorter winters, and less snowpack, also affect the timing of natural cycles such as plant dormancy and blooming, and peak river-flows. Throughout the West, the number of days in the frost-free season, which varies by location, has been increasing more rapidly than in the East (Lenart 2007). Summer temperatures have also climbed, especially since the mid-1970s. Maximum temperatures regularly reach above 100 degrees Fahrenheit daily for weeks on end in many southwestern cities (Lenart 2007). The temperature rise alone has some predictable effects on aridity in the region. For instance, higher temperatures increase evaporation rates. Higher temperatures and a drier landscape increase wildfire hazard and put extra stress on ecosystems (Lenart 2007).

Precipitation changes remain much more difficult to predict than temperature, because precipitation is more variable and operates on a smaller scale. Predicting future precipitation is difficult in the Southwest, due to added complexities such as topography, ENSO, and monsoonal timing. When comparing climate model simulations to what actually occurred, researchers found the results roughly matched 50 to 60 percent of the time for precipitation. This compares to about 95 percent of the time for temperature (Lenart 2007).

However, mean annual precipitation is projected to decline by about 10 percent by 2100 for Southern Arizona, based on modeling results from an ensemble of 18 general circulation models (Lenert 2008a).. Such a decrease in precipitation could have a more serious impact than the numbers suggest. The decrease of water draining from the landscape into rivers and reservoirs typically can be double or triple the proportional reductions in rainfall amounts, especially when combined with higher temperatures (Christensen and Lettenmaier 2006).

In another study, researchers using a multi-model ensemble of 19 models projected an increase in aridity for the American Southwest (Seager et al. 2007). Their study defined the Southwest as the land area stretching from east to west, from Houston to San Francisco and north to south from Denver to Monterrey, Mexico; this area includes the Coronado NF. Only two of the 19 climate models evaluated suggested a potential decrease in aridity for the southwestern quadrant of the country.

Earlier snowmelt can cause streamflows to deliver water to reservoirs and water users in greater quantities earlier in the spring season. Historically, snowmelt has occurred at the same time communities' ramp up their water consumption, which has drained reservoirs as they fill. When streamflows become elevated earlier in the year, however, reservoirs fill more quickly. Earlier future streamflows will likely increase the chance that spikes in river flows occur when the reservoirs are at full capacity, increasing the probability of flashfloods (Guido 2008).

It is likely that continued warming will accentuate the temperature difference between the Southwest and the tropical Pacific Ocean, enhancing the strength of the westerly winds that carry moist air from the tropics into the Southwest during the monsoon. This scenario may increase the monsoon's intensity, or its duration, or both, in which case floods will occur with greater frequency (Guido 2008). Projections of future climate also suggest a shift in the Monsoon season, with reductions in early season precipitation and increases later in the year (Grantz et al. 2007, Seth et al. 2011).

While the region is expected to dry out on average, it is also likely to see larger, more destructive flooding (Guido 2008a). For example, the largest flood in the 75-year instrumental record of

Sabino Creek in Tucson (which has headwaters in the Santa Catalina Ranger District) occurred in July 2006, and climate change was the likely contributor (Desilets and Desilets 2006). Along with storms in general, hurricanes and other tropical cyclones are projected to become more intense overall (IPCC 2007). Arizona and New Mexico typically receive ten percent or more of their annual precipitation from storms that begin as tropical cyclones in the Pacific Ocean. In fact, some of the largest floods in the Southwest have occurred when a remnant tropical storm hit a frontal storm from the north or northwest, providing energy to intensify a remnant tropical storm (Guido 2008a).

In summary, based on multi-model ensemble climate models, by the end of the 21st century, the Southwest is likely to experience the following conditions. Temperature increases of 5 to 8 degrees Fahrenheit. An increase in the number of extremely hot days, with summer heat waves lasting two weeks or more, accompanied by warmer winters with a reduced snowpack, and a later monsoonal season. A 10 percent drop in mean annual precipitation in southern Arizona and an increase in extreme flood events following an overall increase in tropical storms is expected.

Discussion

The state of knowledge needed to address climate change at the scale of the Coronado National Forest is still evolving. Because none of the current climate models adequately resolves important topographic variations (e.g., mountain ranges versus valleys) and occurrences such as ENSO (El Niño and La Niña), or the North American Monsoon, their results are imprecise and the subject of continuing research. However, these models do reproduce much of the underlying features of the Earth's climate, and their basic structure has been proven under countless experiments and forecasts of the weather systems from which climate is usually described. Therefore, these models remain a credible means of estimating potential future climate scenarios. Global climate models are at a much coarser scale than the scale of an individual National Forest. This limits, to some degree, regional and Coronado-specific analysis of potential effects from climate change, especially with respect to the influence of monsoons and ENSO.

Dynamical and statistical downscaling of the larger GCMs can provide additional information at scales more relevant to management decisions on the scale of the Coronado National Forest. Dynamical downscaling, also called regional climate modeling, can provide important information about regional climate patterns such as ENSO and the North American Monsoon that are not accounted for in the larger-scale GCMs. Regional climate modeling is currently underway for the Southwest and data should be available soon for the area including the Coronado National Forest (F. Dominguez, personal communication). Statistical downscaling is a method that uses statistical relationships between observed and modeled past climates to project future climates at finer resolutions. It is less computationally expensive than dynamical downscaling, but it does not fully account for patterns such as ENSO and the Monsoon. Statistically downscaled data is already available for the entire country, including the Coronado National Forest (e.g. Girvetz et al. 2009). These data can provide a general idea of temperature and precipitation trends, acknowledging that it does not fully account for some important regional climate patterns.

In summary, climate modeling is a developing science. General Circulation Models are constantly improving as are statistical and dynamical downscaling techniques. Dynamical downscaling, which incorporates jet stream activity, tropical storm and monsoon tracking, and regional elevation effects, has a high potential to improve localized climate projections. Despite the fact that some modeling data is not yet available and the uncertainty in future greenhouse gas emissions, we know enough about major trends in temperature and precipitation patterns to begin to assess impacts on the Coronado NF's resources and potential management

responses.

Southwestern Climate Change and Coronado NF Ecosystems

Water and Climate Change

The prospect of future drought becoming more severe and dimished water flows later in the season because of climate change is a significant concern, especially because the Southwest continues to lead the Nation in population growth. This signals a serious water supply challenge in the decades and centuries ahead. Water supplies are projected to become increasingly scarce, demanding trade-offs among competing uses, and potentially leading to conflict. Climate change, with both wet periods and droughts, has been a part of Southwestern climate for millennia. As of 2009, much of the Southwest remains in a drought that began about 1998 (McPhee et al. 2004). This event is the most severe western drought of the last 110 years, and was been exacerbated by record warming. The droughts of the last 110 years pale in comparison to some of the decades-long "megadroughts" that the region has experienced over the last 2,000 years (Seager et al. 2008). During the closing decades of the 1500s, for example, major droughts gripped areas of the Southwest.

Combined with the historical record of severe droughts and the current uncertainty regarding the exact causes and drivers of these past events, the Southwest must be prepared for droughts that could potentially result from multiple causes. The combined effects of natural climate variability and human-induced climate change could result in a challenging combination of water shortages for the region (Karl et al. 2009). A drier climate is very likely to decrease water supplies and increase demand for such uses as agriculture, recreation, aquatic habitat, and power, thus increasing competition for decreasing supplies (Joyce et al. 2001).In a five-year scenario modeled after the worst drought in the historical record, water demand in Arizona could exceed supply by 67 percent, and in a ten-year scenario, demand may exceed supply by 59 percent (Lenart 2007).

Development in the Southwest has been primarily dependent upon technology to deliver water resources. The locations of most snowpack and upland reservoirs are on national forests in the Southwest (Smith et al. 2001; State of New Mexico 2005). Some studies predict water shortages and lack of storage capabilities to meet seasonally changing river flow, and transfers of water from agriculture to urban uses, as critical climate-related impacts to water availability (Barnett et al. 2008).

While agriculture remains the greatest water user in the Southwest, there has been a decreased in the amount of water used by agriculture, as Arizona's and New Mexico's booming populations demand more water for municipal and other uses, and irrigation technologies improve; this has been an on-going trend and could affect future agricultural uses. Without upland reservoirs and watersheds from the Coronado NF important to one of Arizona's largest metropolitan areas, alternative water sources, water delivery systems, and infrastructure support for agriculture would need to be developed (Lenart 2007).

The potential for flooding is also likely to increase because of earlier and more rapid melting of the snowpack in spring and more frequent intense precipitation events. Flash flooding, occurring after extended drought, may increase the number and severity of floods; and accelerate rates of soil erosion. The timing and extent of storm-related precipitation will play a key role in determining the degree to which people and the environment are affected (Swetnam and Betancourt 1997; Swetnam et al. 1999; Lenart 2007.

Climate Change and Potential Ecosystem Impacts on the Coronado NF

Natural ecosystems are regulated by climate, and climate is to some degree determined by natural ecosystems. Long-term or short-term climate variability may cause shifts in the structure,

composition, and functioning of ecosystems, particularly in the fragile boundaries of the semiarid regions. These areas already contain plants, insects, and animals highly specialized and adapted to the landscape. A decrease in precipitation and an increase in temperature would alter their range, type, and number throughout the Southwest. Responding differently to shifts in climate, the somewhat tenuous balance among ecosystem components will also change. As phenology is altered, the overall effects among interacting species are difficult to predict, particularly given the rate of climate change and the ability of symbionts to adapt. As the health of the ecosystem is a function of water availability, temperature, carbon dioxide, and many other factors, it is difficult to determine accurately the extent, type, and magnitude of ecosystem change under future climate scenarios. Yet, should vegetation cover and moisture exchanging properties of the land change, important local and regional climate characteristics such as albedo[6], humidity, wind, and temperature will also change with potential compounding effects to vegetation (Sprigg et al. 2000).

Current research shows that climate is much more variable than is commonly understood and that this is expressed in nested temporal and spatial scales. Millar et al. (2007) provide an elegant summation of natural climatic variables and its implications for forest managers. These are three key points from that research which should be considered in Coronado NF management strategies:

1. The past record clearly shows that ecological conditions change constantly in response to climate. Plant and animal species will shift even in the absence of human influence (Millar et al. 2007)
2. Wet/dry oscillations associated with ocean-atmosphere patterns have driven regional and continental scale fire patterns for centuries. These patterns provide a basis for fire forecasting tools (Westerling et al. 2006)
3. Species ranges and demographics are expected to be highly unstable as the climate shifts (Millar et al. 2007)

Climate may influence the distribution and abundance of plant and animal species through changes in resource availability, reproduction, and survivorship. The potential ecological implications of climate change trends in the Southwest indicate:

More extreme natural ecological process events, including wildfires, intense rain, flash foods, and wind events (Swetnam et al. 1999)

Greater vulnerability to invasive species, including insects, plants, fungi, and vertebrates (Joyce et al. 2006)

Long-term shifts in vegetation patterns (Westerling et al. 2006; Millar et al. 2007)

Cold-tolerant vegetation moving upslope, or disappearing in some areas; migration of some plant species to the more northern portions of their existing range (Clark 1998)

Potential decreases in overall forest productivity due to reduced precipitation (U.S. Forest Service 2005)

[6] Albedo is the reflectance of a surface. Absorbed solar radiation warms the Earth's surface, whereas, reflected radiation does not. Albedo is one component of this energy feedback. Different land covers have varied albedo. Thus, land use change can influence albedo and whether a land surface has a warming or cooling effect. For example, snow has a very high albedo and thus has a cooling effect (negative feedback). Melting of snow or coverage of snow with vegetation or black carbon (from air pollution) results in a higher surface albedo and has a warming effect (positive feedback) (IPCC 2007).

Shifts in the timing of snowmelt (already observed) in the American West, which, along with increases in summer temperatures, has serious implications for the survival of fish species, and may challenge efforts to reintroduce species into their historic range (Joyce et al. 2006; Millar et al. 2007)

Effects on phenology and changes in the date of flowering and associated pollination and food food-chain disruptions (Guido 2008)

Vegetation Changes

A warmer climate in the Southwest is expected to affect ecosystems by altering the biotic and abiotic stresses that influence and affect the vigor of ecosystems, leading to increased extent and severity of disturbances on the Coronado NF. Decreasing water availability and higher temperatures will accelerate the stresses experienced in forests, woodlands, grasslands, chaparral, and riparian communities, which typically involve some combination of multi-year drought, insects, and fire. As has occurred in the past, increases in fire disturbance superimposed on ecosystems, with increased stress from drought and insects, may have significant effects on growth, regeneration, long-term distribution, and abundance of forest species (Williams et al. 2010).

Many Coronado NF ecosystems contain water-limited vegetation today (e.g., desert, semi-desert grassland, Madrean pine-oak and encinal woodlands, chaparral). Vegetation productivity on the Coronado NF may decrease with warming temperatures, as increasingly negative water balances constrain photosynthesis, although this may be partially offset if CO_2 fertilization significantly increases water-use efficiency in plants (Drake et al. 1997). Many vegetation types on the Coronado NF are sensitive to feedbacks from environmental fluctuations and existing canopy structure that may provide trees a buffer against drought. However, severe multi-year droughts periodically cause dieback of some species. Interdecadal climate variability strongly affects interior dry ecosystems, causing considerable growth during wet periods. This growth increases the evaporative demand, setting up the ecosystem for dieback during the ensuing dry period (Swetnam and Betancourt 1997).

For example, piñon pines recently experienced a severe dieback following extreme drought, both directly and from increased insect attacks (Breshears et al. 2005). The current dieback is historically unprecedented in its combination of fire suppression, low precipitation, and high temperatures. Increased drought stress via warmer climate is the predisposing factor, and piñon pine mortality and fuel accumulations are inciting factors (Williams et al. 2010). Ecosystem change may arise from large-scale severe fires that lead to colonization of invasive species, which further compromises the ability of piñon pines to re-establish. There continues to be no easy way to predict these changes at the forest planning scale, although the science community is working on single National Forest scale models that will assist forest managers in forecasting vegetation trends under different climate scenarios (Joyce et al. 2008).

Temperature increases are a predisposing factor causing often-lethal stresses on forest ecosystems of western North America, acting both directly through increasingly negative water balances, and indirectly through increased frequency, severity, and extent of disturbances--chiefly fire and insect outbreaks. Human development of the West has resulted in habitat fragmentation, creation of migration barriers such as dams, and introduction of invasive species. The combination of development, presence of invasive species, complex topography, and climate change is likely to lead to a loss of biodiversity in the region. However, some species may migrate to higher altitudes in mountainous areas. It is also possible that some ecosystems, especially at the highest elevations, would virtually disappear from the region (Joyce et al. 2008).

Natural ecological processes having the greatest impact on the Coronado NF include: insects, diseases, fires, droughts, inland storms caused by hurricanes, flash flooding, wind storms, and the introduction of non-native species. Climate variability and changes can alter the frequency, intensity, timing, and spatial extent of these natural events. Many potential consequences of future climate change are expected to be buffered by the resilience of Coronado NF plant and animal communities to natural climatic variation. However, an extensive body of literature suggests that new disturbance regimes under climate change are likely to result in significant disturbances to U.S. forests, with lasting ecological and socioeconomic impacts (Joyce et al. 2001).

Wildfire

Historically, wildfires have been a recurring natural ecological processes in dry mixed conifer forests, ponderosa pine-evergreen shrub communities, Madrean encinal and pine-oak woodlands, chaparral, and grassland ecosystems of the Coronado NF. An analysis of trends in wildfire and climate in the western United States from, 1974-2004, shows that both the frequency of large wildfires and fire season length increased substantially after 1985 (Westerling et al. 2006). These changes were closely linked with advances in the timing of spring snowmelt and increases in spring and summer air temperatures. Earlier spring snowmelt probably contributed to greater wildfire frequency in at least two ways; by extending the period during which ignitions could potentially occur, and by reducing water availability to ecosystems in mid-summer before the arrival of the summer monsoons, thus enhancing drying of vegetation and surface fuels (Westerling et al. 2006). These trends of increased fire size correspond with the increased cost of fire suppression.

In recent years, areas of western forests have been increasingly impacted by wildfires, burning homes and wildlands, and suppression costs have totaled more than $1 billion per year for Federal land-management agencies. Since about the mid-1970s, the total acreage of areas burned and the severity of wildfires in pine and mixed-conifer forests have increased. Fire frequency and severity may be exacerbated if temperatures increase, precipitation decreases, and overall drought conditions become more common. In addition, continued population growth will likely cause greater human-started fires, since humans start nearly half of the fires in the Southwest. In June 2003, for example, the 84,750-acre, human-caused Apsen fire on the Coronado NFs (the largest on record) occurred during one of the warmest years on record with one of the latest monsoons,

Insects and Pathogens

Insects and pathogens are significant natural occurring ecological processes within forest ecosystems in the U. S., costing 1.5 billion dollars annually (Dale et al. 2001). Extensive reviews of the effects of climate change on insects and pathogens have reported many cases where climate change has affected and/or will affect forest insect species range and abundance, as witnessed in the Southwest. Climate also affects insect populations indirectly through effects on hosts. Drought stress, resulting from decreased precipitation and/or warming, reduces the ability of a tree to mount a defense against insect attack, though this stress may also cause some host species to become less palatable to some types of insects. Fire suppression and large areas of susceptible trees, a legacy from logging may also play a role (Ryan et al. 2008).

Invasive Species

Disturbance may reset and rejuvenate some ecosystems in some cases, and cause enduring change in others. For example, climate change may favor the spread of invasive, non-native grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas

burn, they typically convert to non-native monocultures and the native vegetation is lost (Ryan et al. 2008). The Coronado suffers from many types of invasive species outbreaks, including plants (e.g., buffelgrass….), and animals (e.g.…). Invasive plants can alter landscapes by overtaking native species, facilitating fire outbreaks, and altering the food supply for herbivorous animals and insects.

Vulnerable Habitats on the Coronado NF

Our knowledge of possible climate change impacts on specific vegetation types remains limited. However, projected and observed climate change effects are being studied at the broad-scale habitat level throughout the Southwest. The mild nature of climate gradients among lower life zones of the Southwest and protracted ecotonal bands, make woodland plant communities particularly vulnerable (Allen and Breshears 1998; Adams et al. 2009). In addition, systems that rely on water are also vulnerable due to projected changes in precipitation and water inputs. Many of the region's plant and animal species are associated with these key habitats, and they are, therefore, important when considering the potential impacts of climate change on ecosystems managed by the National Forests in the Southwest.

Riparian

Riparian habitats are very important for wildlife on the Coronado NF;, as well as an unknown number of invertebrate and plant species that inhabit or use riparian areas at sometime during their life. The majority of models project declines in water inputs due to reduced precipitation, and subsequent reductions in water in riparian zones. Water losses are also likely to increase due to elevated evapotranspiration rates at higher temperatures and greater run-off losses associated with increased frequencies of high intensity convectional storms. Urban expansion will also increase human demand for water and further reduce water availability for wildland ecosystems. Decreased water availability would affect riverine and riparian ecosystem function, due to modifications in geomorphological processes and an overall reduction in the availability of moisture to plant communities. Although these areas comprise less than 1 percent of the Coronado NF lands, they provide critical habitat for vertebrates, invertebrates, migratory birds, and other riparian dependent species. Reduced water inputs will cause riparian ecosystems to contract in size. Furthermore, lowered water availability would stress riparian plants and increase the ecosystem susceptibility to invasion by non-native plants, such as salt cedar and Russian olive, which in turn could disrupt the natural wildlife community (Archer and Predick 2008).

Wetlands

Climate change is likely to affect native plant and animal species by altering key habitats such as wetland ecosystems (Karl et al. 2009). Wetlands create unique habitats and microclimates that support diverse wildlife and plant communities. Wetland habitats contain a distinctive native plant community typical of saturated soils. Plants may include sedges, rushes, mosses, monkey flowers, lilies, and algae. Common animal species occurring in the wetlands include Northern raccoon, Arizona treefrog, Northern Mexican gartersnake, and Huachuca springsnail among other specialized aquatic invertebrates.

Sky Islands

Mountainous "sky islands" of the Coronado NF are made up of forested ranges separated by expanses of desert and grassland plains, are among the most diverse ecosystems in the

world because of their great topographic complexity and unique location at the meeting point of several major desert and forest biological provinces. “Sky islands” refers to a particular area vs. the other habitats that essentially refer to life zones of the southwest (including those of sky islands). The patterns described here for sky islands are applicable to many areas of the southwest. The sky islands are particularly vulnerable to fragmentation, which may exacerbate the effects of climate change. These mountain ranges are isolated from each other by intervening valleys of grassland or desert. The valleys of these basins act as barriers to the movement of certain woodland and forest species. Species, such as mountain lions and black bears, depend on movement corridors between mountain islands to maintain genetic diversity and population size. The region is a blend of tropical and temperate, harboring well over half the bird species of North America, 29 bat species, over 3,000 species of plants, and 104 species of mammals, a diversity exceeding anywhere else in the U.S. Climate change poses a unique threat to sky islands. Temperature increases of as little as a few degrees could push sky island habitats to higher elevations, reducing their area and potentially causing local extinction of endemic taxa and divergent populations harboring unique genetic and phenotypic diversity (Kupfer et al. 2004). Sky islands in the Southwest and Mexico are already being affected by climate change, with increases in drought, fire, and outbreaks of invasive insects (Williams et al. 2010). Although these resilient systems have endured large-scale shifts in climate during and since the last ice age, the pace of human-induced climate change may represent an insurmountable challenge for sky islands, with potentially devastating consequences to their biodiversity and evolutionary potential (Sky Island 2007). A recent assessment of climate change in the Southwest found that many Sky Islands forest systems are among the most vulnerable to climate change because of the combination of most rapid recent temperature increases and a high number of species of conservation concern (Robles and Enquist 2010).

Aquatic Systems

There are already observed shifts in the timing of snowmelt in the American West, which, along with increases in summer air temperatures, have serious implications for the survival of fish species and may render some efforts useless to reintroduce species into their historic range (Millar et al. 2007). For cool and cold-water species a nearly 50 percent reduction in thermal habitat is projected with scenarios of increased water temperatures (Eaton and Scheller 1996). Predicted impacts to aquatic ecosystems include altered seasonal high-flow events, increases in drought severity during summer flows, and increasing temperatures in small streams and tributaries that further limit habitat during seasonal flows (Williams and Meka-Carter 2009).

The fundamental physiological components of growth and metabolism are strongly affected by temperature (Schmidt-Nielsen 1997). For fishes, this implies that populations highly adapted to local climates that experience increases in temperatures in excess of their optimum values for growth will reduce consumption rates and increase metabolic rates; this results in decreased growth. Fish increase feeding rates to compensate for poor growing conditions caused by increased temperature, which can lead to greater visibility and encounter rates with predators. Trout in whole lake experiments had lower survival at temperatures above optimum, and those populations with the highest temperatures and lowest food abundance experienced the lowest survival. The prediction is for an increasing frequency of poor or

failed year-classes where fish cannot escape the warmer conditions. Research, so far, reflects a basic understanding of the impacts of climate warming on individuals, but not on the outcomes at the population levels (Biro et al. 2007). Current stresses on native aquatic species, including heat-tolerant non-natives add to the complexity of managing and adapting to climate change.

Plant and Animal Species

Research suggests, large changes in the structure and species composition of plant communities due to the warming air temperatures and altered hydrological cycles. Many of the region's plant, animal, and insect species depend on precise phenological events based on climatic conditions for migration, flowering, and timing for foraging and reproductive activities. Climate thus influences their distribution and abundance through changes in resource availability, fecundity, and survivorship. It is currently unknown how many species will successfully adapt to changing conditions. The ability of plant and animal species to migrate under climate change is strongly influenced by their dispersal abilities and by disturbances to the landscape. Land use changes and habitat alterations around the Coronado NF will add to the challenge of plant and animal species adapting to climate change. Within an ecological context, wildlife and plant responses to climate change in the region are highly dependent on interaction between weather, land use, land cover, hydrology, fire, and stresses from invasive, non-native species**.**

Distribution

Many studies of species support the predictions of systematic shifts in distribution related to climate change, often via species-specific physiological thresholds of temperature and precipitation tolerance. Temperature is likely to be the main driver for different species, including possible shifts in a coordinated and systematic manner throughout broad regions (Rosenzweig et al. 2007). Species at the upper elevations are at greater risk of being extirpated since they may not be able to adapt to habitat changes. Such organisms face increased risk of extinction (Hoegh-Guldberg et al. 2008). In many instances, the impacts of range shifts will go far beyond the mere addition or subtraction of a species to or from a system. Some range shifts will have cascading effects on community structure and the functioning of ecosystems (Lawler et al. 2009).

Habitat Quality

Climate change may cause a host of physical consequences to the ecosystems, which may in turn affect the quality of plant and animal habitats. This may occur through a decrease in available water, changes in vegetation type through decline in vigor, severe drought or fire, or through changes in hydrology. Large areas of forest that were once suitable habitat for some species of wildlife may no longer be suitable, potentially leading to significant changes in species due to loss of needed habitat components (Karl et al. 2009).

Behavior and Biology

The timing of seasonal activities of plants and animals is perhaps the simplest process in which to track changes in the response of species to climate change. Observed phenological events include leaf unfolding, flowering, fruit ripening, leaf coloring, leaf fall of plants, bird migration, chorusing of amphibians, and appearance/emergence of insects (Rosenzweig et al. 2007).

Large herbivores, such as pronghorn, inhabiting highly seasonal temperate environments are subject to drastic daily and seasonal changes in environmental quality. During summer, they must acquire sufficient resources for growth, and reproduction; and to survive the following winter. Foraging behavior in summer is thus vitally important. Higher temperatures may reduce the daily activities of large herbivores. This may affect foraging, growth, reproduction, and overall health of animals. They may experience hardship during the winter and may not reproduce as successfully (Aublet et al. 2009). In reptiles and amphibians, increased temperatures, and changing precipitation could negatively affect reproduction, for many of the same reasons as with fish (Hulin et al. 2009). Impacts are also possible to the migration and dispersal routes of many species, including migratory songbirds, which are already of concern due to declines in abundance (Sillett et al. 2000).

Fragmentation and Isolation

The effects of fragmentation likely range across the full spectrum of biological diversity, from altering behavior of individuals, their genetics, and the demographic characteristics of populations, which can fundamentally change the structure and function of ecological communities (Lomolino and Perault 2007). Climate change may contribute to further fragmentation of habitat and to creating barriers to migration. Fragmentation and barriers are likely to impede elevational and/or northward migration of many species, resulting in decreases in their total range. Habitat loss and fragmentation may also influence shifts in a species distribution. Empirical evidence shows that the natural reaction of species to climate change is to redistribute to more favorable habitats. However, this redistribution may be hampered by fragmentation by simply isolating suitable areas for colonization, and preventing species movements, which may contribute to their extinction (Rosenzweig et al. 2007).

Southwestern Climate Change and Socioeconomic Effects

This review of the literature found few substantive studies of the possible social and economic effects that climate change might cause or exacerbate in the Southwest. Most climate-related socioeconomic studies are either heavily theoretical, or too broad and general to apply specifically to the region. Over thousands of years, societies in the Southwest have faced climate change repeatedly some successfully, some not so successfully (Dean 2000). It is often difficult to “draw a conceptual line between climate change and other kinds of environmental transformations: both affect human societies by changing the availability of resources” (Tainter 2000). How societies adapt to climate change is fundamentally dependant on how they approach problem-solving (Tainter 2000). However, some of the more general social and economic projections can help to inform us about climate change effects on the region.

Population distribution, economic activity, quality of life, and many other human values are influenced by changes in natural environments. Populations in Arizona and New Mexico are growing at unprecedented rates. The combination of population growth and climate change will likely exacerbate climatic effects, putting even greater pressure on water, forest, and other resources. Additionally, pressures put upon agriculture and other climate-sensitive occupations in neighboring Mexico may increase an already large migration of people into the Southwestern U.S., making disease surveillance increasingly difficult (Sprigg et al. 2000; Smith et al. 2001). While this is the current demographic trend in the Southwest, if conditions become too hot and dry, there may very well be a decrease in the number of people moving to the region.

Recent research in the Southwest shows that up to 60 percent of the climate-related trends of river flow, winter air temperature, and snow pack between 1950 and 1999 are human-induced. The study predicts water shortages, lack of storage capabilities to meet seasonally changing river flow, transfers of water from agriculture to urban uses, and other critical impacts (Barnett et al. 2008). The region's economy will likely continue to grow in the future. Increases in service-oriented sectors as well as the expanding high-tech industry may bring more jobs and employment opportunities for the growing population. Significant changes due to population pressures include the following: decreased forest cover; increased construction; additional Federal and State parks, wilderness areas, and wildlife refuges; more land utilized for national defense and industry; expanded urban areas; and decreased pasture and rangelands (Joyce and Birdsey 2000).

Forests significantly enhance the environment in which people live, work, and play. Population levels, economic growth, and personal preferences influence the value that is placed on forests, and consequently the resources demanded from forests. Changes caused by human use of forests could exceed impacts from climate change. According to U.S. Forest Service National Visitor Use Monitoring data, the majority of recreation visitors on the Coronado NF come from the Tucson metropolitan area. The Coronado received nearly 2.5 million visits in 2007, with the majority visits from local Pima county residents . Many Arizonans consider access to public lands a major contributor to the quality of life. Many southwestern forests as well as the Coronado NF are experiencing very high recreational use while urban expansion is decreasing the amount of available open space. Climate change could have long-term impacts on many of the amenities, goods, and services from forests, including, recreational opportunities, 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. Private agricultural, urban, and suburban areas are expanding and affecting Forest Service management. This expansion of human influences into the rural landscape alters natural ecological process patterns associated with fire, flooding, landslides, and native and introduced species. These land-use changes are very likely to interact with and potentially exacerbate stresses on forests associated with climate change (Joyce and Birdsey 2000).

Livestock Grazing

Livestock grazing is one of the management activities occurring on the Coronado NF. Ranching is a social, cultural, and agricultural activity throughout the rural Southwest. It is a major land-use in both Arizona and New Mexico, and its success depends on the natural vegetation accessible to grazing animals. The Coronado NF provide forage for livestock grazing, but they also provide crucial habitat for wildlife. Lands grazed on the Coronado NF are not irrigated and any variability in precipitation and temperature directly affects forage plant production and wildlife habitat. Changes in climate may affect the vigor and productivity of forage plants, and thus the overall conditions of both wildlife habitat and ecological conditions. It is possible that higher temperatures and decreased precipitation described for the next century will also decrease forage production and shorten the growing and grazing season, while flashfloods and increased risk of animal disease can adversely affect the livestock industry (Joyce et al. 2001) dependent upon the Coronado NF's forage resources. During drought years when forage is less available, ranchers may have to purchase supplementary feed or sell their livestock at reduced prices (Eakin and Conley 2002).

Coupled with poor forage conditions, there may be a general scarcity of water for livestock. For a pasture to be available for grazing, it not only has to have sufficient nutritious vegetation, but adequate water availability as well. Some allotments/pastures rely on wells and developed springs, but many often utilize dirt tanks to capture snowmelt and monsoon rainfall, and use

this water for livestock. During the recent droughts, many dirt tanks in Southern Arizona dried-up, making many pastures unusable for cattle even though forage may have been available (Eakin and Conley 2002). Ranching is in a vulnerable position, especially when viewed against a backdrop of changing climate, economic structure, urban expansion, increasing population, fluctuating market conditions, resource availability (Sprigg et al. 2000), and changing public policies.

Recreational Value

Climate change affects national forest ecosystems and the relationships people have with those places. Population distribution, economic activity, quality of life, and many other human values are influenced by changes in natural environments. The Coronado NF provides many recreational opportunities including hiking, camping, hunting, bird watching, skiing, and water-related activities such as fishing and boating. These activities provide income and employment in every forested region of the U.S. Outdoor recreation opportunities are likely to change, with resulting changes in public expectations and seasonality of use. Higher temperatures are very likely to result in a longer season for summer activities such as backpacking, but a shorter season for winter activities, such as skiing. Areas at low elevations and in more southern districts are very likely to be at particular risk from a shortening of the snow season and rising snowlines (Joyce et al. 2001; Svoma 2010). In areas of marginal annual snow pack, this reduction may result in the closure of some ski areas.

Urban and suburban expansion into undeveloped lands is likely to shift in response to climate change. Population shifts may cause new resource-related human conflicts, and create unforeseen impacts on already stressed urbanized ecosystems. As temperatures increase in lowland, urban areas, recreation is likely to increase on the Coronado NF, where cooler temperatures will attract people to higher elevations as a refuge from increasingly hot summers (Irland et al. 2001).

Health

Future climate scenarios will undoubtedly amplify current climatically driven human health concerns, with potential increased risk of dengue fever[7], encephalitis, and other diseases associated with warmer climes, and the northern movement of disease vectors, such as malaria-carrying mosquitoes. Diseases such as valley fever and Hantavirus pulmonary syndrome are endemic in the Southwest. The incidence of Hantavirus has been linked to seasonal and inter-annual patterns of rainfall (Eisen et al. 2007). Research strongly suggests that valley fever is connected to the sequence and pattern of precipitation and wind. Future climate scenarios will undoubtedly amplify current climatically-driven human health concerns. Projected temperature increases are anticipated to create greater numbers of heat-induced illnesses, reduced air quality, and increased cases of respiratory illness due to the presence and persistence of dust, allergens, and ozone (Wise 2009). Conversely, in many temperate areas, which include the Southwest, there is clear seasonal variation in mortality; death rates during the winter season are 10-25 percent higher than in the summer. Several studies cited by the IPCC indicate that decreases in winter mortality may be greater than increases in summer mortality under climate change (McMichael et al. 2001).The geographical range of disease-bearing vectors such as the mosquito would expand under the model scenarios for the 21st century (Liverman and Merideth 2002). Pressures put upon agriculture and other climate-sensitive occupations in neighboring Mexico may increase an already large migration of people into the southwestern United States, making disease surveillance increasingly difficult (Sprigg et al. 2000). This is of interest to the Coronado NF

[7] Dengue fever is a virus-based disease spread by mosquitoes.

and surrounding communities because the majority of forest users are from Pima county. Increased visitor use could be the vector necessary to spread any number of these health issues.

Energy

Higher air temperatures may increase the overall demand for energy within the region's urban areas; and this increasing energy demand could affect the Southwest's current socioeconomic environment (Sprigg et al. 2000; Smith et al. 2001). Electricity supports human activity and offers the possibility of economic growth. For much of the region, water delivery systems rely on electricity for pumping groundwater and for directing water throughout the system. Urban and agricultural uses of energy-driven water resources are essential in the region's current socioeconomic environment. During the warmest summer months, energy demands increase with the use of energy intensive air-cooling systems. Given population projections for the region, a greater number of electricity generating plants will be needed to handle the demands that follow. Climate warming contributes to increased energy demands and evaporative loss from reservoirs. All reasonable scenarios of future climate variability must be considered when anticipating the costly measures necessary to provide dependable, safe, and reasonable supplies of energy (Sprigg et al. 2000). Increasing energy demand and the ensuing demand for alternative energy, will likely impact the Coronado NF through growing need for new energy corridors, requests for wind and solar energy sites, and other special use-related requirements, as well as the current and ongoing demand for biomass supplies to existing electrical co-generation plants.

Key Climate Change Effects on the Coronado NF's Desired Conditions

Based on current climate model projections and research, the climate change factors that appear most likely to affect Southwestern Region and Coronado NF and affect desired conditions in the revised land management plan are ecological, weather-related disturbances, and socioeconomic demands, as described:

Projected increase in frequency of extreme weather events (intense storms)

Projected increase in wildfire risks

Projected increase in outbreaks of insects, diseases beyond endemic levels, and non-native invasive species

Projected increase in demand for deceasing upland water supplies

Projected increase in National Forest socioeconomic uses and demands

These natural ecological processes and human-caused disturbance factors and the potential impacts on desired conditions for the national forests in the Southwestern Region and the Coronado NF are described below.

Increased Extreme Weather Events

Climate change likely will increase flash floods, making the region's growing population more susceptible to loss of life and property. While the Southwest and Coronado NF are expected to become warmer and drier, they are 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 and New Mexico typically receive ten percent or more of their annual precipitation from tropical storms, it is likely that this change will also increase flooding. In Arizona and New Mexico, floods killed 57 people between 1995 and 2006, while hundreds of others have needed swift water rescues. The economic price tag is also high, costing Arizona, New Mexico, Colorado, and Utah approximately 5 billion dollars between 1972 and 2006. 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, timber loss, increasing damage to the forests' infrastructure such as trails, facilities, and roads, and loss of recreation opportunities. Natural ecological process events that exceed the historic range of natural variation can change the makeup, structure, and function of vegetation types and watersheds and could affect a number of desired conditions. Heavy rains and higher flood levels can affect maintenance and structural integrity of forest infrastructure and slow progress toward improvements. Flooding is a natural and beneficial process in many aquatic systems. However, damage to aquatic systems from flash flood-caused erosion, downed trees, and inundation from flooding can change streamside habitats, affect aquatic life, and impact proper functioning of stream channels. These processes could create challenges in the ability of a national forest to achieving plan objectives for aquatic habitat restoration. Overall, increasing weather-related disturbances can divert limited Coronado NF staff and funding to recovery efforts for extended periods and delay progress toward desired conditions, or it may require revaluation of desired conditions, to allow for a more dynamic resilience.

Wildfire

Wildfire is another climate-related impact to ecosystems in the Southwest. Historically, wildfires have played an important role in the vitality of fire-adapted ecosystems. Past management and fire suppression practices have changed the dynamics of fire on the landscape within the Coronado NF, resulting in greater fuel-loads and risk of wildfire. Fire suppression activities in the West, including those conducted by Federal land management agencies, routinely exceed expenditures of 1 billion dollars per year. Since about the mid-1970s, the total acreage area burned and the severity of wildfires in pine and mixed-conifer forests have increased on the Coronado NF. Fire frequency and severity will likely increase as temperatures rise and precipitation decreases. Population growth in the Southwest may also lead to greater numbers of human-started wildfires. In summary, an increase in wildfires will lead to an increase in expenditures, risks to life and property, and will likely divert resources and staff time to fire-related efforts on the Coronado NF. This may lead to a decrease in staff and resources for other efforts and delay or halt progress toward achieving desired conditions in some areas.

Outbreaks of Insects, Diseases, and Non-Native 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 non-native species. New environmental conditions can lead to a different mix of species and tend to be favorable to 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 affect the Coronado NF's desired conditions for healthy and diverse forests.

Diminishing Water Resources

As stated previously, locations of most snowpack and upland reservoirs are on national forests in the Southwest. In many western mountain ranges, less precipitation is falling as snow and spring melting is occurring earlier in the year. The Colorado, 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. Without upland reservoirs and watersheds, many managed by the U.S. Forest Service, elaborate water delivery systems, and other infrastructure support, agriculture, urbanization, and other development could be severely constrained. In the Southwest, intense debate will likely continue over resource allocation and conservation of available supplies. Increasing conflicts over water could lead to diminished supplies on the Coronado NF needed to achieve desired conditions related to vegetation, aquatic species, and recreation, among others.

Climate-Related Socioeconomic Demand

Populations in Arizona and New Mexico are growing at an unprecedented rate. As of the latest American Communities Survey (2009), Arizona's population was 6,595,778. The total increase for Arizona between 1980 and 2009 has been over 123 percent. New Mexico's current population of 2,009,671 represents a percent change of over 47 percent between 1980 and 2009. Currently, over 5 million people live within a five-hour drive of the Coronado NF. The combination of population growth and climate change will likely exacerbate climatic effects, such as increasing visitor use; putting even greater pressure or demand on water, recreational opportunities, and other resources on the Coronado NF. Climate change could have long-term impacts on many of the amenities, goods, and services from the Coronado NF. These include productivity of locally harvested plants such as berries or mushrooms, wildlife, 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, combined with increasing regional population also will likely increase demand for water-related recreation opportunities on the Coronado NF, as residents of urban areas seek relief from rising temperatures. The number of human-caused fire and wildlife human conflicts will likely increase as well. Greater recreation demands and use on the Coronado NF may also put additional strains on roads and trails, create greater needs for more facilities such as parking spaces and restrooms, and increase the use of dispersed campsites. Because of these stressors, it may be difficult for the Coronado NF to maintain places in their natural character and remote, undeveloped sites may be at risk for being lost.

Potential Climate Change Strategies for the Coronado NF

The five potential management strategies described below relate to the five projected, key climate change factors that are most likely to be a potential concern for the Southwestern Region and the Coronado NF in moving toward the desired conditions in the Plan. These are extreme weather events, wildfire and human-caused risks, insects, diseases, and invasive species, water use and demand, and increase in socioeconomic demands. These management strategies focus on ways to incorporate changes from disturbances into managed forests and enhance ecosystem resilience.

In developing strategies for managing future changes, the range of possible approaches could be quite broad, but the management strategies listed below are focused on recommendations from recent research studies, including the U.S. Climate Change Science Program, SAP 4.4 (CCSP 2008b), which are appropriate for the Southwestern Region and the Coronado NF, and

balance effectiveness, feasibility, and available resources. Although some strategies contain new ideas, most of these management options include practices that are already in effect, can serve multiple needs, and may just need to be adjusted or expanded to respond to climate changes during the next 5 to 15 years. Using an adaptive management approach will allow national forest managers to adopt and adjust strategies as new information is available, conditions change, and staff and resources are available.

The key climate change factors are addressed directly or indirectly through the Coronado NF's desired conditions, objectives, and management approaches:

- Enhancing adaptation by anticipating and planning for disturbances from intense storms
- Using a suite of adaptation options to manage ecosystems in the face of uncertainty
- Increasing water conservation and planning for reductions in upland water supplies
- Anticipating increased forest recreation use
- Monitoring climate change influences and the effectiveness of adaptation approaches

Enhancing Adaptation by Anticipating and Planning for Disturbances from Intense Storms

Although occurrences of storms and other disturbances cannot be precisely predicted, and are often beneficial types of disturbance, anticipatory planning may predict impacts and have adaptive guidelines in place to protect sensitive areas. Areas such as riparian zones, endangered species habitats, and special areas may require different approaches for reducing disturbances or recovering from damaging events. Management responses from previous events can provide guidance for similar situations and take advantage of prior learning experiences. Planning prior to disruptions can take advantage of disturbances when they eventually occur to convert vegetation to more resilient and desirable ecosystems, and reduce assessment and response time while ensuring that sensitive resources requiring special responses are protected.

With the projected increase in extreme weather events, management practices for reducing soil erosion may be even more critical in the future. For example, standard soil erosion best management practices such as buffers filter strips, broad-based dips, and piling slash down slope of skid trails and along streams, can help mitigate increased erosion conditions. Roads and trails close to streams may be closed, removed, revegetated, or relocated away from stream channels to reducing impacts to aquatic ecosystems and water quality. In another example, appropriately sized culverts at stream crossings should consider projections for future runoff in a changing climate as well as historic conditions. New recreation sites such as campgrounds and other facilities should be located well away from potential flashflood areas.

Using a Suite of Adaptation Options to Manage Ecosystems in the Face of Uncertainty

Managing ecosystems under uncertainty necessitates flexible and adaptive approaches that are reversible, are implemented in incremental steps, and which allow for new information and learning, and that can be modified with changing circumstances (Millar et al. 2007). Coronado NF 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, these plant and animal communities have a built-in resilience. Restoring and maintaining resilience in forest, woodland, chaparral, grassland, desert and riparian ecosystems are part of the basic elements of forest-wide desired conditions, objectives and management approaches. Risks of increased wildfire, outbreaks of

insects and disease, invasive species, and loss of habitat represent ongoing, broad-scale management challenges to management of the Coronado NF. These issues are nothing new. However, climate change has the potential to increase the impacts of these ecosystem risks.

Millar et al. (2007) break down potential ecosystem adaptation options into the following three categories:

Creating resistance to change: preventing disturbance through the creation of firebreaks and the removal of invasive species.

Promoting resilience to change: managing ecosystems so they may return to their previous state following a disturbance.

Enabling ecosystems to respond to change: includes increasing connectivity to allow migration of species to new areas, assisting migration of species and genotypes, and allowing new ecosystems to establish instead of restoring to historical conditions.

On-the-ground tactical approaches can often blur the lines between these adaptation options, especially between resistance and resilience strategies. Below are a few current management tools employed by the Coronado NF that will help achieve its desired conditions in the face of increased disturbances and changing climate.

Prescribed (planned ignition) fires are a current 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 for more frequent storms and other extreme weather events plus the potential for increased stresses from insects and diseases in a warmer, drier climate, planned and unplanned ignition burning will continue to be an important management strategy for the future.

Although current programs and guidance are already in place to limit the introduction of non-native species, treat invasive species, and manage insects and diseases, these efforts are likely to become more critical to maintaining desired conditions for healthy plant and animal communities under a changing climate. Due to the relationship of land ownership patterns, success in reducing forest pests requires going beyond Coronado NF's boundaries, and continued collaboration with partners will be needed. In addition, management practices (e.g. thinning for age class diversity and structure, and reclaiming and restoring native grasslands) that sustain healthy plant and animal communities, and provide adequate nutrients, soil productivity, and hydrologic function promote resilience and reduce opportunities for disturbance and damage.

Landscape connectivity is the degree to which the landscape facilitates or impedes movement of a species among habitats required for its persistence with few physical or biotic impediments to migration (Taylor et al. 1993; Millar et al. 2007). Connectivity has two components, structural and biological connectivity. 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). Large, interconnected blocks of habitat, support a wide array of species, and allow for genetic and behavioral interactions that are lacking with the creation of small patches (Robinson et al. 1995). Promoting connectivity in landscapes with flexible management goals that can be modified as conditions change may assist species to respond naturally to changing climates. Desired goals include reducing fragmentation and planning at large landscape scales to maximize habitat connectivity (Millar et al. 2007). The Coronado NF's desired conditions, objectives, and management approaches address the importance and need for connectivity for both terrestrial and aquatic habitats.

Changes in disturbance regimes and underlying climate may result in conditions where it is no

longer possible to maintain existing genotypes, species, or even ecosystems in some places. When this occurs, one option is to intentionally introduce species or genotypes (or mixtures of species or genotypes) into new areas that may be better suited to the current conditions. For example, spruce aphid has been devastating to Engelmann spruce in the Coronado's spruce-fir forests and may possibly become more problematic under future climate change. Options that may facilitate transitions to more adapted ecosystems may include introducing aphid-resistant genotypes or possibly finding a substitute species that serves in a similar functional role to Engelmann spruce in some areas. The Coronado NF's desired conditions, objectives, and management approaches are flexible enough to allow consideration of these tactics should they become the most viable option.

These tactics are just a few of many possible management approaches that may be employed to allow ecosystems on the Coronado NF to adapt to a changing climate. As new challenges arise, the Coronado will have to be flexible and creative in its approaches to maintain healthy, functioning ecosystems.

Increasing Water Conservation and Planning for Reductions in Upland Water Supplies

As mentioned earlier, aquatic and riparian ecosystems may be negatively impacted by increasing temperatures and reduced precipitation. Too much water arriving at once, in the form of severe storm events, also has the capacity to affect these water dependent ecosystems. Water amount, availability, distribution, and allocation, for a variety of ecological, wildlife and aquatic species, as well as for human uses, needs to be considered in planning.

Municipal water supplies of Arizona are dependent on these upland sources. In many western mountain ranges, including those on the Coronado NF, less precipitation is falling as snow, and spring melting is occurring earlier in the year. These water sources and associated water rights have always been important and contentious areas of concern for public land managers in the Southwest and Coronado NF. With climate change, planning for water quantity and quality may become even more important. To address such concerns, planners may wish to consider some of the following measures:

Determining the water rights status of water resources, for range, wildlife, public drinking systems, water for fire-fighting, recreational uses, and aquatic habitats

Reviewing current status of State and regional water plans, forest and watershed health plan, integrated regional water planning efforts

Anticipating Increased Forest Recreation Use

The use of the Coronado NF as a haven from summer heat and for water-related recreation continues to grow with population increases throughout the region. Planning for recreation should take into account the possible expansion of demand as temperatures increase and precipitation decreases because of climate change. This may affect recreation facilities, like campgrounds and boating facilities, as well as access to lakes and other water features. Analysis of both potential snowfall and future winter temperature changes may need to be conducted for consideration of additions to, or new construction of, skiing and other snow-based recreation activities.

Monitoring Climate Change Influences and the effectiveness of adaptation strategies

It is not recommended that the Coronado NF create a completely new initiative or program of work solely for monitoring climate change. However, consideration of appropriate adjustments to the monitoring program to improve understanding of the relationships of key plan components and climate change may be needed. As the Coronado NF reviews their

existing and potential research natural areas (RNAs), monitoring of climate change affects on specific ecosystems should be part of the research goals considered when building the RNA establishment record.

When new tactics are employed to address climate change-related issues, it is also important to monitor the effectiveness of these actions. Monitoring information on the effectiveness of adaptation strategies can help the Coronado NF make adjustments when necessary or determine if a tactic might be worth replicating elsewhere.

References Cited

Adams, H.D., M. Guardiola-Claramontea, G.A. Barron-Gafforda, J.C. Villegasa, D.D. Breshearsa, C.B. Zoug, P.A. Trocha, and T.E. Huxmana. (2009). Temperature sensitivity of drought-induced tree mortality portends increased regional die-off under global change-type drought. Proceedings of the National Academy of Sciences 106(17): 7063-7066.

Allen, C.D., and D.D. Breshears. (1998). Drought-induced shift of a forest-woodland ecotone: Rapid landscape response to climate variation. Proceedings of the National Academy of Sciences 95(25): 14839-14842.

Archer, S.R., and K.I. Predick. (2008). Climate change and ecosystems of the southwestern United States. *Rangelands*, June 2008: 23-28.

Arizona Game and Fish Department (AZGFD). (2007). Wildlife 2012 strategic plan. Arizona Game and Fish Department, Phoenix, AZ.

Aublet, J.F., M. Festa-Bianchet, D. Bergero, and B. Bassano. (2009). Temperature constraints on foraging behaviour of male Alpine ibex (Capra ibex) in summer. *Oecologia,* 2009 159(1): 237-247.

Barnett, T.P., D.W. Pierce, H.G. Hidalgo, C. Bonfils, B.D. Santer, T. Das, G. Bala, A.W. Wood, T. Nozawa, A.A. Mirin, D.R. Cayan, and M.D. Dettinger. (2008). Human-induced changes in the hydrology of the western United States. *Science,* 319: 1080-1083.

Biro, P.A, J.R. Post, and D.J. Booth. (2007). Mechanisms of climate-induced mortality of fish populations in whole-lake experiments. Proceedings of the National Academy of Sciences 104(23): 9715-9719.

Breshears, D.D., N.S. Cobb, P.M. Rich, K.P. Price, C.D. Allen, R.G. Balice, W.H. Romme, J.H. Kastens, M.L. Floyd, J. Belnap, J.J. Anderson, O.B. Myers, C.W. Meyer. (2005). Regional vegetation die-off in response to global-change-type drought. *Proceedings Of The National Academy Of Sciences* 102:15144-15148.

Brooks, C.P. (2003). A scalar analysis of landscape connectivity. *Oikos*, 102: 466-439.

CCSP. (2008a). The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Walsh, M.K., G. Guibert, and R. Hauser (eds.), P. Backlund, A. Janetos,D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T.

Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman,G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (Authors)]. U.S. Department of Agriculture, Washington, DC.

CCSP. (2008b). Preliminary review of adaptation options for climate-sensitive ecosystems and resources. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius, S.H., J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (Authors)]. U.S. Environmental Protection Agency, Washington, DC.

CCSP. (2008c). Reanalysis of Historical Climate Data for Key Atmospheric Features: Implications for Attribution of Causes of Observed Change. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Dole, R., M. Hoerling, and S. Schubert (eds.), P. Arkin, J. Carton, E. Kalnay, R. Koster, R. Pulwarty, G. Hegerl, D. Karoly, A. Kumar, D. Rind, J. Carton, E. Kalnay, and D. Karoly (Authors)]. National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Christensen, N., and D.P. Lettenmaier (2006). A multimodel ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River basin. *Hydrology and Earth System Sciences*, 3: 3727-3770.

Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.-T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr, and P. Whetton. (2007). Regional climate projections, Chapter 11, Pp 847-940. In: Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.). Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, New York, NY.

Clark, J.S. (1998). Why trees migrate so fast: Confronting theory with dispersal biology and the paleorecord. *The American Naturalist*, 152(2): 204-224.

Coe, S., D. Finch, and M. Friggens. 2011. Applying a Decision-Support Tool for Assessing Vulnerability of Wildlife to Climate Change: A Case Study on the Coronado National Forest, Arizona. *In review.*

Conley J., H. Eakin, T.E. Sheridan, and D. Hadley. (1999). CLIMAS ranching case study: Year 1. Report Series: CL3-99. Institute for the Study of the Planet Earth. Arizona State University, Tucson, AZ.

Dale, V.H, L.A. Joyce, S. McNulty, R.P. Neilson, M.P. Ayers, M.D. Flannigan, P.J. Hanson, L.C. Irland, A.E. Lugo, C.J. Peterson, D. Simberloff, F.J. Swanson, B.J. Stocks, and B.M. Wotton. 2001. Climate change and forest disturbances. BioScience 51(9): 723-734.

Dean, J.S. 2000. Complexity theory and sociocultural change in the American southwest. Chapter 3, Pp. 89-118. In: McIntosh, R.J., J.A. Tainter, and S.K. McIntosh, (eds.). The way the wind blows: Climate, history, and human action. Columbia University Press, New York, NY.

Desilets, D. and S.L. Desilets. 2006. Magnitude of flash floods on the rise in the Sabino Creek. Arizona Geophysical Union, Fall Meeting 2006, abstract with programs: H21B-1369.

Diffenbaugh, N., J. Pal, R. Trapp, and F. Giorgi. 2005. Fine scale processes regulate the response of extreme events to global climate change. *Proceedings of the National Academy of Sciences*, 102:1574–1578

Drake, B.G., M.A. Gonzalez-Meler, and S.P. Long. (1997). More efficient plants: A consequence of rising atmospheric CO_2? *Annual Review Of Plant Physiology And Plant Molecular Biology* , 48:609-639 .

Eakin, H., and J. Conley. (2002). Climate variability and the vulnerability of ranching in southeastern Arizona: a pilot study. *Climatic Research*, 21: 271–281.

Eaton, J.G., and R.M. Scheller. (1996). Effects of climate warming on fish thermal habitat in streams of the United States. *Limnology and Oceanography*, 41(5): 1109-1115.

Eisen, R.B., G.E. Glass, L. Eisen, J. Cheek, R.E. Enscore, P. Ettestad, and K.L. Gage. (2007). A spatial model of shared risk for plague and Hantavirus Pulmonary Syndrome in the southwestern United States. *American Journal of Tropical Medicine and Hygiene*, 77: 999-1004.

Enquist, C., and D. Gori. (2008). Implications of recent climate change on conservation priorities in New Mexico. A climate change vulnerability assessment for biodiversity in New Mexico, Part 1. The Nature Conservancy and Wildlife Conservation Society, Tucson, AZ.

Farber, S.C., R. Costanza, and M.A. Wilson. (2002). Economic and ecological concepts for valuing ecosystem services. *Ecological Economics*, 41: 375-392.

Girvetz, E.H., C. Zganjar, G.T. Raber, E.P. Maurer, P. Kareiva, and J.J. Lawler. (2009). Applied climate-change analysis: The climate wizard tool. *PLoS ONE* 4: 1–19.

Gonzalez, G.A. (2005). Urban sprawl, global warming and the limits of ecological modernisation. *Environmental Politics*, 14(3): 344-362.

Grantz, K., B. Rajagopalan, M. Clark, and E. Zagona, 2007: Seasonal Shifts in the North American Monsoon. *Journal of Climate*, 20:1923–1935.

Guido, Z. (2008a). Climate and Floods in the Southwest. The University of Arizona, From, The University of Arizona

Guido, Z. (2008b). Fire: Frequency and size. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ. From,

http://www.southwestclimatechange.org/impacts/land/fire

Herweijer, C., R. Seager, E.R. Cook, and J. Emile-Geay. (2007). North American droughts of the last millennium from a gridded network of tree-ring data. *Journal of Climate,* 20: 1353-1376.

Hoegh-Guldberg, O., L. Hughes, S. McIntyre, D.B. Lindenmayer, C. Parmesan, H.P. Possingham, and C.D. Thomas. (2008). Assisted colonization and rapid climate change. *Science,* 321(5887): 345-346.

Hoffmeister, D.F. (1986). Mammals of Arizona. University of Arizona Press, Tucson, AZ.

Hughes, M.K., P.R. Sheppard, A.C. Comrie, G.D. Packin, and K Angersbach. (2002). The climate of the U.S. Southwest. *Climate Research,* 21(3): 219-238.

Hughes, M.K., and H.F. Diaz. (2008). Climate variability and change in the drylands of western North America. *Global and Planetary Change,* 65: 111-118.

Hulin, V., V. Delmas, M. Girondot, M.H. Godfrey, and J-M. Guillon. (2009). Temperature-dependent sex determination and global change: Are some species at greater risk? *Oecologia,* 160(3): 493-506.

Inouye, D.W. (2008). Effects of climate change on phenology, frost damage, and floral abundance of montane wildflowers. *Ecology,* 89(2): 353-362.

IPCC. (2007). Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, New York, NY.

Irland, L.C., D. Adams, R. Alig, C.J. Betz, C-C. Chen, M. Hutchins, B.A. McCarl, K. Skog, and B.L. Sohngen. (2001). Assessing socioeconomic impacts of climate change on US forests, wood-product markets, and forest recreation. *BioScience,* 51(9): 753-764.

Ironside, K.E., N.S. Cobb, K.L. Cole, M. Peters, J. Eischeid, and G. Garfin. (2010). Plausible future effects of climate change on ponderosa pine. Presentation at the Flagstaff Climate Adaptation Workshop of April 2010. The Nature Conservancy, Flagstaff, AZ.

Joyce, L., J. Aber, S. McNulty, V. Dale, A. Hansen, L. Irland, R. Neilson, and K. Skog. (2001). Potential consequences of climate variability and change for the forests of the United States. Chapter 19, Pp. 489-522. In: Climate change impacts on the United States: The potential consequences of climate variability and change. National Assessment Synthesis Team (ed.). A Report for the US Global Change Research Program. Cambridge University Press. New York, NY.

Joyce, L., R. Haynes, R. White, and R.J. Barbour, (tech. coords.). (2006). Bringing climate change into natural resource management: Proceedings. Gen. Tech. Rep.

PNW-GTR-706. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.

Joyce, L.A., and R. Birdsey, (tech coords.). (2000). The impact of climate change on America's forests. A technical document supporting the 2000 U.S. Forest Service RPA Assessment. Gen. Tech. Rep. RMRS-GTR-59. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Joyce, L.A., G.M. Blate, J.S. Littell, S.G. McNulty, C.I. Millar, S.C. Moser, R.P. Neilson, K. A. O'Halloran, and D.L. Peterson. (2008). National forests. Chapter 3, Pp. 1-127 In: Preliminary review of adaptation options for climate-sensitive ecosystems and resources. Julius, S.H., and J.M. West (eds.). A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington, DC.

Karl, T.R, J.M. Melillo, and T.C. Peterson, (eds.). (2009). Global climate change impacts in the United States. Cambridge University Press. New York, NY.

Kupfer, J.A., J. Balmat, and J.L. Smith. (2005). Shifts in the potential distribution of sky island plant communities in response to climate change. *In* Gottfried, G.J., B.S. Gebow, L.G. Eskew, C.B. Edminster, compilers. 2005. Connecting mountain islands and desert seas: biodiversity and management of the Madrean Archipelago II. 2004 May 11-15; Tucson, AZ. Proceedings RMRS-P-36. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Stations, 631 p.

Lawler, J.J., S.L. Shafer, D. White, P. Kareiva, E.P. Maurer, A.R. Blaustein, and P.J. Bartlein. (2009). Projected climate-induced faunal change in the Western Hemisphere. *Ecology*, 90(3): 588-597.

Lenart, M. (2007). Global warming in the Southwest: Projections, observations, and impacts. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ.

Lenart, M. (2008a). Precipitation Changes. Southwest Climate Change Network. From, http://www.southwestclimatechange.org/climate/southwest/precipitation-changes

Lenart, M. (2008b). Regional climate modeling. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ. From, http://www.southwestclimatechange.org/contributors/melanie-lenart

Lenart, M. (2008c). Temperature Changes. Southwest Climate Change Network. From, http://www.southwestclimatechange.org/climate/southwest/temperature-changes#references

Lenihan et. al (2008). Response of vegetation distribution ecosystem productivity & fire to climate change scenarios for CA. *Climatic Change*, (2008) 87 (Suppl 1):S215–S230.

Liverman, D.M., and R. Meredith. (2002). Climate and society in the US Southwest: the context for a regional assessment. *Climate Research*, 21: 199–218.

Lomolino, M.V., and D.R. Perault. (2007). Body size variation of mammals in a fragmented, temperate rainforest. *Conservation Biology*, 21(4): 1059-1069.

Maurer, E.P., and H.G. Hidalgo (2008). Utility of daily vs. monthly large-scale climate data: An intercomparison of two statistical downscaling methods. *Hydrology and Earth System Science*, 12: 551-563.

McMichael, A., A. Githeko, R. Akhtar, R. Carcavallo, D. Gubler, A. Haines, R.S. Kovats, P. Martens, J. Patz, A. Sasaki, K.L. Ebi, D. Focks, L. Kalkstein, E. Lindgren, S. Lindsay, and R. Sturrock. (2001). Human health. Chapter 9, Pp. 451-485. In: McCarthy, J.J., O.F. Canziani, N.A. Leary, D.J. Dokken, and K.S. White, (eds.). Climate change 2001: Impacts, adaptation, and vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Published for the Intergovernmental Panel on Climate Change. Cambridge University Press. New York, NY.

McPhee, J.C., A.C. Comrie, and G.G. Garfin. (2004). A Climatology of drought for Arizona. Drought: Variability monitoring, impacts, and prediction. University of Arizona, Tucson, AZ (Joint with the 15th Symposium on Global change and Climate Variations and the 14th Conference on Applied Climatology: Hall 4AB) Joint Poster Session 3, Monday, 12 January 2004, 2:30 PM-4:00 PM. The 84th American Meteorological Society Annual Meeting, Seattle, WA.

Meko, D.M., C.A. Woodhouse, C.A. Baisan, T. Knight, J.J. Lukas, M.K. Hughes, and M.W. Salzer. (2007). Medieval drought in the upper Colorado River basin. *Geophysical Research Letters*, 34(L10705): 1-5.

Millar, C.I., N.L. Stephenson, and S.L. Stephens. (2007). Climate change and forests of the future: Managing in the face of uncertainty. *Ecological Applications*, 17(8): 2145-2151.

Owen, G. (2008). Invasive species. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ. From http://www.southwestclimatechange.org/impacts/land/invasive-species

Robinson, S.K., F.R. Thompson, T.M. Donovan, D.R. Whitehead, and J. Faaborg. (1995). Regional forest fragmentation and the nesting success of migratory birds. *Science*, 267(1): 1987-1990.

Robles, M.D. and C. Enquist. 2010. Managing changing landscapes in the Southwestern United States. The Nature Conservancy. Tucson, Arizona. 26 pp.

Rosenzweig, C., G. Casassa, D.J. Karoly, A. Imeson, C. Liu, A. Menzel, S. Rawlins, T.L. Root, B. Seguin, and P. Tryjanowski, (2007). Assessment of observed changes and responses in natural and managed systems. Chapter 1, Pp. 79-131. In: M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson, (eds.). Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. New York, NY.

Ryan, M., S. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, and W. Schlesinger. (2008). Land resources. Chapter 3, Pp. 75-121. In: The effects of climate change on agriculture, land resources, water resources, and biodiversity. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, DC.

Sammis, T. (2001). Current, past, and future climate of New Mexico. New Mexico Climate, The Climate Center, Las Cruces, NM. From http://weather.nmsu.edu/News/climatefall01.pdf

Schmidt-Nielsen, K. (1997). Animal physiology: Adaptation and environment. Cambridge University Press. New York, NY.

Seager, R., M. Ting, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H-P. Huang, N. Harnik, A. Leetmaa, N-C. Lau, C. Li, J. Velez, and N.Naik. (2007). Model projections of an imminent transition to a more arid climate in southwestern North America. *Science*, 316(5828): 1181-1184.

Seager, R., R. Burgman, Y. Kushnir, A. Clement, E. Cook, N. Naik, and J. Miller. 2008. Tropical Pacific forcing of North American medieval megadroughts: Testing the concept with an atmosphere model forced by coral-reconstructed SSTs. *Journal of Climate*, 21: 6175-6190.

Seth, A., S.A. Rauscher, M. Rojas, A. Giannini, and S. J. Camargo. 2011. Enhanced spring convective barrier for monsoons in a warmer world? *Climatic Change*, 104: 403-414.

Sillett, T.S., R.T. Holmes, and T.W. Sherry. (2000). Impacts of a global climate cycle on population dynamics of a migratory songbird. *Science*, 288: 2040-2042.

Sky Island Alliance. (2007). Restoring connections: Climate change. *Newsletter of the Sky Island Alliance*, 10(2): 1-15.

Smith, J.B., R. Richel, and B. Miller. (2001). The potential consequences of climate variability and change: The western United States, Chapter 9, Pp. 219-245. In: Climate change impacts on the United States: The potential consequences of climate variability and change. National Assessment Synthesis Team (ed.). A Report for the US Global Change Research Program. Cambridge University Press. New York, NY.

Sprigg, W. A., T. Hinkley, et al. (2000). Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change: Southwest. A Report of the Southwest Regional Assessment Group. University of Arizona. The Institute for the Study of Planet Earth, Tucson, AZ, US Global Change Research Program: 66.

State of New Mexico. (2005). Potential effects of climate change on New Mexico. Agency Technical Work Group. [Musick, B. (ed.), J. Allen, T. Darden, R.Floyd, M. Gallaher, D. Jones, K. Kostelnik, K. Kretz, R. Lucero, R. Romero, B. Toth, M. Uhl, and L. Weaver (contribs.)]. NM.

Stevens, L.E. (2007). A review of invertebrate species of management concern on five northern Arizona forests: Final Report. Unpublished report to five National Forests in Southwestern Region.

Svoma, B.M. 2011. Trends in snow level elevation in the mountains of central Arizona. *International Journal of Climatology* 31: 87–94.

Swetnam, T.W., C.D. Allen, and J.L. Betancourt. (1999). Applied historical ecology: Using the past to manage for the future. *Ecological Applications,* 9(4): 1189-1206.

Swetnam, T.W., and J.L. Betancourt. (1997). "Mesoscale disturbance and ecological response to decadal climatic variability in the American Southwest. *Journal of Climate,* 11: 3128-3147.

Tainter, J.A. (2000). Global change, history, and sustainability. Chapter 12, Pp. 331-356. In: McIntosh, R.J., J.A. Tainter, and S.K. McIntosh, (eds.). The way the wind blows: Climate, history, and human action. Columbia University Press. New York, NY.

Taylor, P.D., L. Fahrig, K. Henein, and G. Merriam. (1993). Connectivity is a vital element of landscape structure. *Oikos*, 68: 571-573.

Trouet, V., J. Esper, N.E. Graham, A. Baker, J.D. Scourse, and D.C. Frank. (2009). Persistent positive North Atlantic oscillation mode dominated the medieval climate anomaly. *Science,* 324(5923): 78-80.

U.S. Census Bureau. (2006). United States census, 2000. U.S. Department of Commerce, Washington DC. From http://www.census.gov/

Vander Lee, B., R. Smith, and J. Bates. (2006). Ecological & biological diversity of the Apache-Sitgreaves National Forests (Chapter 7). In: Ecological and biological diversity of National Forests in Southwestern Region. Southwest Forest Assessment Project. The Nature Conservancy, Tucson, AZ.

Westerling, A.L., H.G. Hildalgo, and T.W. Swetnam. (2006). Warming and earlier spring increase western U.S. Forest wildfire activity. *Science,* 313: 940-943.

Whitlock, C. (2008). Turning up the heat...on a bubbling cauldron of forest threats. *Compass,* 10: 27-28.

Williams, J.E., and J.M. Carter. (2009). Managing native trout past peak water. *Southwest Hydrology,* 8(2): 26-34.

Williams, A.P., C.D. Allen, C.I. Millar, T.W. Swetnam, J. Michaelsen, C.J. Still, and S.W. Leavitt. (2010). Forest responses to increasing aridity and warmth in the southwestern United States. *Proceedings of the National Academy of Sciences* 107(50): 21289–21294.

Wise, E.K. (2009). Climate-based sensitivity of air quality to climate change scenarios for the southwestern United States. *International Journal of Climatology.* 29 (1):

87-97.

Specific Web Pages:

American Communities Survey (2009), From http://factfinder.census.gov/
Climate Assessment for the Southwest (CLIMAS), From http://www.climas.arizona.edu/
Climate Wizard Web Page, From http://www.climatewizard.org/
Intergovernmental Panel on Climate Change (IPCC), From http://www.ipcc.ch/
NatureServe 2007, 2008, 2009. From http://www.natureserve.org
Past Global Change Web Page (PAGES) From http://www.pages.unibe.ch/
Pew Center on Global Climate Change, From http://www.pewclimate.org/
The Southwest Climate Change Network, From http://www.southwestclimatechange.org/climate/southwest/
The Western Regional Climate Center, From http://www.wrcc.dri.edu/
The Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT), From http://www.fs.fed.us/psw/cirmount/
The Nature Conservancy Climate Wizard, From http://www.climatewizard.org/
USGCRP-US Global Change Research Program, From http://www.usgcrp.gov/usgcrp/default.php/
U.S. Forest Service Climate Change Resource Center, From http://www.fs.fed.us/ccrc/

Climate Change Glossary

The following terms have been gathered by U.S. Forest Service researchers from numerous sources including the National Oceanic and Atmospheric Administration (NOAA), Intergovernmental Panel on Climate Change (IPCC), and others. Included are the most commonly referred to terms in climate change literature and news media. This is only a partial list of terms associated with climate change. See other NOAA or IPCC documents for full glossaries associated with this topic.

Anthropogenic: Resulting from or produced by human beings.

Anthropogenic emissions: Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities. These include burning of fossil fuels for energy, deforestation, and land use changes that result in net increase in emissions.

Arid regions: Ecosystems with less than 250 mm precipitation per year.

Atmosphere: The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1 percent volume mixing ratio) and oxygen (20.9 percent volume mixing ratio), together with a number of trace gases, such as argon (0.93 percent volume mixing ratio), helium, and radiatively active greenhouse gases such as carbon dioxide (0.035 percent volume mixing ratio) and ozone. In addition, the atmosphere contains water vapor, whose amount is highly variable but typically 1 percent volume mixing ratio. The atmosphere also contains clouds and aerosols.

Biodiversity: The numbers and relative abundances of different genes (genetic diversity), species, and ecosystems (communities) in a particular area.

Carbon dioxide (CO_2): A naturally occurring gas, and also a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas

against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1.

Carbon dioxide (CO_2) fertilization: The enhancement of the growth of plants as a result of increased atmospheric carbon dioxide concentration. Depending on their mechanism of photosynthesis, certain types of plants are more sensitive to changes in atmospheric carbon dioxide concentration.

Climate: Climate may be defined as the "average weather," or more rigorously, as the statistical description of weather in terms of the mean and variability of relevant quantities (e.g., temperature, precipitation, wind) over a period ranging from months to thousands or millions of years. The standard period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the statistical description of the state or condition of the climate system.

Climate change: Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines "climate change" as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." The UNFCCC thus makes a distinction between "climate change" attributable to human activities altering the atmospheric composition, and "climate variability" attributable to natural causes. See also climate variability.

Climate feedback: An interaction mechanism between processes in the climate system is called a climate feedback, when the result of an initial process triggers changes in a second process that in turn influences the initial one. A positive feedback intensifies the original process, and a negative feedback reduces it.

Climate model (hierarchy): A numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. The climate system can be represented by models of varying complexity—that is, for any one component or combination of components a "hierarchy" of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical or biological processes are explicitly represented, or the level at which empirical parametrizations are involved. Coupled atmosphere/ocean/sea-ice general circulation models (AOGCMs) provide a comprehensive representation of the climate system. There is an evolution towards more complex models with active chemistry and biology. Climate models are applied, as a research tool, to study and simulate the climate, but they are also for operational purposes including monthly, seasonal, and inter-annual climate predictions.

Drought: There is no definitive definition of drought based on measurable processes. Instead, scientists evaluate precipitation, temperature, and soil moisture data for the present and recent past to determine drought status. Very generally, it refers to a period of time when precipitation levels are low, impacting agriculture, water supply, and wildfire hazard.

El Niño: In its original sense, El Niño is warm water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. This oceanic event is associated with a fluctuation of the inter-tropical surface pressure pattern and circulation in the Indian and Pacific Oceans, called the Southern Oscillation. This coupled atmosphere-ocean phenomenon is collectively known as El Niño Southern Oscillation, or ENSO. During an El Niño event,

the prevailing trade winds weaken and the equatorial countercurrent strengthens, causing warm surface waters in the Indonesian area to flow eastward to overlie the cold waters of the Peru current. This event has great impact on the wind, sea surface temperature, and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world. The opposite of an El Niño event is called La Niña.

Extreme weather event: An extreme weather event is an event that is rare within its statistical reference distribution at a particular place. Definitions of "rare" vary, but an extreme weather event would normally be as rare as or rarer than the 10^{th} or 90^{th} percentile. By definition, the characteristics of what is called extreme weather may vary from place to place. An extreme climate event is an average of a number of weather events over a certain period of time, an average, which is itself extreme (e.g., rainfall over a season).

Greenhouse effect: Greenhouse gases effectively absorb infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases, and by clouds. Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus greenhouse gases trap heat within the surface-troposphere system. This is called the "natural greenhouse effect." Atmospheric radiation is strongly coupled to the temperature of the level at which it is emitted. In the troposphere, the temperature generally decreases with height. Effectively, infrared radiation emitted to space originates from an altitude with a temperature of, on average, -19° C, in balance with the net incoming solar radiation, whereas the Earth's surface is kept at a much higher temperature of, on average, +14° C. An increase in the concentration of greenhouse gases leads to an increased infrared opacity of the atmosphere, and therefore to an effective radiation into space from a higher altitude at a lower temperature. This causes a radiative forcing, an imbalance that can only be compensated for by an increase of the temperature of the surface-troposphere system. This is the "enhanced greenhouse effect."

Greenhouse gas (GHG): Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the greenhouse effect. Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine¬and bromine-containing substances, dealt with under the Montreal Protocol. Besides CO_2, N_2O, and CH_4, the Kyoto Protocol deals with the greenhouse gases sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Radiative Forcing: Changes in the energy balance of the earth-atmosphere system in response to a change in factors such as greenhouse gases, land use change, or solar radiation. The climate system inherently attempts to balance incoming (e.g., light) and outgoing (e.g., heat) radiation. Positive radiative forcings increase the temperature of the lower atmosphere, which in turn increases temperatures at the Earth's surface. Negative radiative forcings cool the lower atmosphere. Radiative forcing is most commonly measured in units of watts per square meter (W/m^2).

Rangeland: Undeveloped land that is suitable for use by wildlife and domestic ungulates.

Rapid climate change: The non-linearity of the climate system may lead to rapid climate change, sometimes called abrupt events or even surprises. Some such abrupt events may be imaginable, such as a dramatic reorganization of the thermohaline circulation, rapid deglaciation, or massive melting of permafrost leading to fast changes in the carbon cycle. Others may be truly unexpected, as a consequence of a strong, rapidly changing, forcing of a non¬linear system.

Regeneration: The renewal of a stand of trees through either natural means (seeded onsite or adjacent stands or deposited by wind, birds, or animals) or artificial means (by planting seedlings or direct seeding).

Teleconnections: Atmospheric interactions between widely separated regions that have been identified through statistical correlations (in space and time). For example, the El Niño teleconnection with the Southwest United States involves large-scale changes in climatic conditions that are linked to increased winter rainfall.

Weather: Describes the daily conditions (individual storms) or conditions over several days (week of record-breaking temperatures) to those lasting less than two weeks.

Appendix B: Communications Sites

The following are designated communications sites to be administered per Forest Service Manual direction. Some sites are for governmental administration and not for commercial use. Future development at all sites should adhere to direction in the Communications Site Plan approved for each site.

Table 15. Communications Sites on the Coronado National Forest

Site Name	District	Administrative	Commercial	Low Power (LP) or High Power (HP)
Dragoon	Douglas		X	LP
Elephant Head	Nogales		X	HP
Melendrez Pass	Nogales		X	LP & HP
Mt. Hopkins	Nogales	X	X	LP
Red Mountain	Sierra Vista	X		LP
Heliograph	Safford		X	LP
Ladybug	Safford		X	LP
GATR	Santa Catalina	X		LP
Mt. Bigelow	Santa Catalina		X	HP
Radio Ridge	Santa Catalina	X	X	LP
Soldier Peak	Santa Catalina	X		LP

Appendix C: Animal and Plant Species

Table 16. Plant and Animal Species Common and Scientific Names

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
	Mannia californica	Mosses & Liverworts
	Plagiochasma wrightii	Mosses & Liverworts
cave-obligate pseudoscorpion	Tuberochernes ubicki	Invertebrate
Abert's squirrel	Sciurus aberti	Mammal
acalypha	Acalypha amentacea Roxb. ssp. wilkesiana	Plant
acorn woodpecker	Melanerpes formicivorus	Bird
agave	Agave spp.	Plant
alder	Alnus spp.	Plant
Allen's big-eared bat	Idionycteris phyllotis	Mammal
alligator juniper	Juniperus deppeana Steud.	Plant
alpine clover	Trifolium spp.	Plant
American badger	Taxidea taxus	Mammal
American black bear	Ursus americanus	Mammal
annual sunflower	Helianthus annuus	Plant
Apache pine	Pinus engelmannii Carrière	Plant
Aravaipa woodfern	Thelypteris puberula var. sonorensis	Plants
Arizona ash	Fraxinus spp.	Plant
Arizona black rattlesnake	Crotalus cerberus	Reptile
Arizona cypress	Cupressus arizonica	Plant
Arizona eryngo	Eryngium sparganophyllum	Plants
Arizona eyed click beetle	Alaus lusciosus	Invertebrate
Arizona fescue	Festuca arizonica Vasey	Plant
Arizona gray squirrel	Sciurus arizonensis	Mammal
Arizona madrone	Arbutus arizonica	Plant
Arizona Manihot	Manihot davisiae	Plants
Arizona muhly	Muhlenbergia arizonica	Plant
Arizona oak	Quercus arizonica	Plant
Arizona sycamore	Platanus wrightii	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
Arizona treefrog	Hyla wrightorum	Amphibian
Arizona walnut	Juglans major	Plant
Arizona white oak	Quercus arizonica Sarg	Plant
Arizona wildrye	Elymus arizonicus	Plant
arroyo willow	Salix lasiolepis	Plant
aspen	Populus tremuloides	Plant
Atlantis fritillary butterfly	Speyeria altantis	Invertebrate
ayenia	Ayenia spp.	Plant
bahia	Bahia spp.	Plant
banana yucca	Yucca baccata	Plant
barking frog	Craugastor augusti	Reptile
barrel cactus	Ferocactus spp.	Plant
bats	Order Chiroptera	Mammal
beardless chinch weed	Pectis imberbis	Plants
beargrass	Nolina spp.	Plant
beggartick threeawn	Aristida Orcuttiana	Plant
big bursage	Ambrosia ambrosioides	Plant
bigtooth maple	Acer granditentatum	Plant
birchleaf buckthorn	Frangula betulifolia	Plant
birchleaf mountain mahogany	Cercocarpus montanus Raf. var. glaber	Plant
black grama	Bouteloua eriopoda	Plant
black-necked gartersnake	Thamnophis cyrtopsis	Reptile
black-tailed jackrabbit	Lepus californicus	Mammal
black-tailed rattlesnake	Crotalus molossus	Reptile
black-throated sparrow	Amphispiza bilineata	Bird
bladderpod	Lesquerella spp.	Plant
blue curls	Trichostema spp.	Plant
blue grama	Bouteloua gracilis	Plant
blue paloverde	Parkinsonia florida	Plant
blue penstemon	Penstemon cyaneus	Plant
blue threeawn	Aristida purpurea Nutt. var. nealleyi	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
bluedicks	Dichelostemma capitatum	Plant
border pinyon	Pinus discolor	Plant
Botteri's sparrow	Aimophila botterii	Bird
bottlebrush squirreltail	Elymus elymoides ssp. elymoides	Plant
bouvardia	Bouvardia salisb.	Plant
box elder	Acer negundo L.	Plant
brittlebush	Encelia Adans.	Plant
broad-billed hummingbird	Selasphorus platycercus	Bird
broad-leaf ground-cherry	Physalis latiphysa	Plants
brown creeper	Certhia americana	Bird
buffalo gourd	Cucurbita foetidissima	Plant
bufflegrass	Pennisetum ciliare	Plant
bulb panic	Panicum bulbosum Kunth	Plant
bullgrass	Muhlenbergia emersleyi Vasey	Plant
bulrush	Scirpus L.	Plant
bundleflower	Desmanthus Willd.	Plant
burrobrush	Hymenoclea salsola var. salsola	Plant
bush muhly	Muhlenbergia porteri Scribn. ex Beal	Plant
cactus wren	Campylorhynchus brunneicapillus	Bird
California brickellbush	Brickellia Californica	Plant
camphor weed	Pluchea camphorata	Plant
canaigre	Rumex hymenosepalus Torr.	Plant
cane beardgrass	Bothriochloa barbinodis	Plant
canyon spotted whiptail	Aspidoscelis burti	Reptile
canyon wren	Catherpes mexicanus	Bird
catclaw acacia	Acacia greggii A. Gray	Plant
catclaw mimosa	Mimosa aculeaticarpa	Plant
ceanothus	Ceanothus L.	Plant
checkered gartersnake	Thamnophis marcianus	Reptile
Chihuahuan pine	Pinus leiophylla Schiede & Deppe	Plant
Chiricahua leopard frog	Lithobates chiricahuensis	Amphibian

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
Chiricahua fleabane	Erigeron kuschei	Plants
Chiricahua gentian	Gentianella wislizeni	Plants
Chiricahua mudwort	Limosella pubiflora	Plants
Chiricahua white	Neophasia terlootii	Invertebrate
Chisos coralroot	Hexalectris colemanii	Plants
cholla	Cylindropuntia spp.	Plant
Clark's nutcracker	Nucifraga columbiana	Bird
Clark's spiny lizard	Sceloporus clarkii	Reptile
clematis	Clematis spp.	Plant
cliff muhly	Muhlenbergia polycaulis Scribn.	Plant
cliffrose	Purshia spp.	Plant
club moss	Lycopodium	Plant
Cochise woolwort	Laennecia eriophylla	Plants
collared peccary	Pecari tajacu	Mammal
columbine	Aquilegia L.	Plant
common hog-nosed skunk	Conepatus leuconotus	Mammal
condalia	Condalia spathulata A. Gray	Plant
copper mine milk-vetch	Astragalus cobrensis var. maguirei	Plants
coralbean	Erythrina flabelliformis Kearney	Plant
cordilleran flycatcher	Empidonax occidentalis	Bird
corkbark fir	Abies lasiocarpa var. arizonica	Plant
Couch's spadefoot	Scaphiopus couchii	Amphibian
Coues’ white-tailed deer	Odocoileus virginianus couesii	Mammal
coursetia	Coursetia glandulosa	Plant
coyote melon	Cucurbita palmata	Plant
coyote willow	Salix exigua	Plant
creeping mahonia	Mahonia repens	Plant
creosote bush	Larrea tridentata	Plant
crinkleawn	Trachypogon	Plant
croton	Croton	Plant
curly mesquite	Hilaria belangeri	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
dalea	Psorothamnus Rydb.	Plant
deergrass	Muhlenbergia rigens	Plant
desert bighorn sheep	Ovis canadensis mexicana	Mammal
desert broom	Baccharis sarothroides A. Gray	Plant
desert ceanothus	Ceanothus greggii A. Gray	Plant
desert grassland whiptail	Aspidoscelis uniparens	Reptile
desert hackberry	Celtis L.	Plant
desert honeysuckle	Anisacanthus Nees	Plant
desert ironwood	Olneya tesota A. Gray	Plant
desert orangetip	Anthocharis cethura	Invertebrate
desert senna	Senna armata	Plant
desert spiny lizard	Sceloporus magister	Reptile
desert tortoise	Gopherus agassizi	Reptile
desert willow	Chilopsis linearis	Plant
desert zinnia	Zinnia acerosa	Plant
dock	Rumex L.	Plant
dogweed	Adenophyllum Pers.	Plant
Douglas-fir	Pseudotsuga menziesii	Plant
eared quetzal	Euptilotis neoxenus	Bird
eastern patch-nosed snake	Salvadora grahamiae	Reptile
elegant trogon	Trogon elegans	Bird
Elusive browallia	Browallia eludens	Plants
Emory oak	Quercus emoryi Torr.	Plant
Engelmann spruce	Picea engelmannii Parry ex Engelm	Plant
evergreen sumac	Rhus virens Lindh. ex A. Gray	Plant
evolvulous	Evolvulus arizonicus	Plant
false hellebore	Veratrum L.	Plant
false mesquite	Calliandra eriophylla Benth.	Plant
feather dalea	Dalea formosa	Plant
Fendler’s buckbrush	Ceanothus fendleri	Plant
ferns	Pterophyta	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
flame sumac	Rhus glabra L.	Plant
flammulated owl	Otus flammeolus	Bird
fluff grass	Dasyochloa pulchella	Plant
foothill paloverde	Parkinsonia L	Plant
Fremont cottonwood	Populus fremontii S. Watson	Plant
frogs and toads	Order Anura	Amphibian
Gambel oak	Quercus gambelii Nutt.	Plant
Gambel's quail	Callipepla gambelli	Bird
gentian	Gentiana L.	Plant
geranium	Geranium L.	Plant
giant hairy scorpion	Hadrurus arizonensis	Invertebrate
giant water bug	Lethocerus medius	Invertebrate
Gila monster	Heloderma suspectum	Reptile
Gila spotted whiptail	Aspidoscelis flagellicauda	Reptile
Gila woodpecker	Melanerpes uropygialis	Bird
globe mallow	Sphaeralcea ambigua A. Gray	Plant
goldeneye	Viguiera Kunth	Plant
goldenrod	Oreochrysum Rydb.	Plant
Goodding willow	Salix gooddingii C.R. Ball	Plant
goosegrass	Eleusine Gaertn.	Plant
Gould’s wild turkey	Meleagris gallopavo mexicana	Bird
Grace's warbler	Dendroica graciae	Bird
gray fox	Urocyon cinereoargenteus	Mammal
gray hawk	Asturina nitida	Bird
gray oak	Quercus grisea Liebm.	Plant
graythorn	Ziziphus obtusifolia	Plant
Great Plains skink	Plestiodon obsoletus	Reptile
Great Plains toad	Anaxyrus cognatus	Amphibian
great purple hairstreak	Atlides halesus	Invertebrate
greater short-horned lizard	Phrynosoma hernadesi	Reptile
green ratsnake	Senticolus triaspis	Reptile

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
green sprangletop	Leptochloa dubia	Plant
Gregg’s dalea	Dalea versicolor Zucc.	Plant
groundsel	Roldana Llave ex Lex.	Plant
hairy goldaster	Heterotheca villosa	Plant
hairy grama	Bouteloua hirsuta Lag.	Plant
Hall’s panic	Panicum hallii Vasey	Plant
hedgehog cactus	Echinocereus Engelm	Plant
hemlock-parsley	Conioselinum Hoffm.	Plant
hepatic tanager	Piranga flava	Bird
Hinkley's Jacob's ladder	Polemonium pauciflorum hinckleyi	Plants
honeysuckle	Anisacanthus Nees	Plant
Hopi tea	Thelesperma megapotamicum	Plant
horse lubber grasshopper	Taeniopoda eques	Invertebrate
Huachuca cinquefoil	Potentilla rhyolitica var. rhyolitica	Plants
Huachuca giant skipper	Agathymus evansi	Invertebrate
Huachuca milkvetch	Astragalus hypoxylus	Plants
Huachuca springsnail	Pyrgulopsis thompsoni	Invertebrate
Huachuca water umbel	Lilaeopsis schaffneriana var. recurva	Plants
hummingbirds	Family Trochilidae	Bird
iris (native)	Iris L.	Plant
jaguar	Panthera onca	Mammal
janusia	Janusia A. Juss.	Plant
junegrass	Koeleria Pers.	Plant
kidneywood	Eysenhardtia Kunth	Plant
kit fox	Vulpres macrotis	Mammal
leafy Jacob’s ladder	Polemonium foliosissimum var. flavum	Plants
lesser long-nosed bat	Leptonycteris yerbabuenae	Mammal
lilies	Lilium L.	Plant
limber bush	Jatropha cuneata	Plant
littleleaf paloverde	Parkinsonia L.	Plant
littleleaf sumac	Rhus microphylla Engelm. ex A. Gray	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
long-legged myotis	Myotis volans	Mammal
long-tailed vole	Microtus longicaudus	Mammal
longtongue muhly	Muhlenbergia longiligula Hitchc.	Plant
lotus	Nelumbo lutea	Plant
lowland leopard frog	Lithobates yavapaiensis	Amphibian
Madrean alligator lizard	Elgaria kingii	Reptile
manzanita	Arctostaphylos Adans.	Plant
mariola	Parthenium incanum Kunth	Plant
mat muhly	Muhlenbergia richardsonis	Plant
meadowrue	Thalictrum	Plant
Mearn's sumac	Rhus virens var. choriophylla	Plant
mesa threeawn	Aristida ternipes var. gentilis	Plant
mesquite	Prosopis L.	Plant
Mexican blue oak	Quercus oblongifolia Torr.	Plant
Mexican fox squirrel	Sciurus nayaritensis	Mammal
Mexican gartersnake	Thamnophis eques	Reptile
Mexican hog-nosed snake	Heterodon kennerlyi	Reptile
Mexican jay	Aphelocoma ultramarina	Bird
Mexican spotted owl	Strix occidentalis lucida	Bird
mimosa	Mimosa aculeaticarpa Ortega	Plant
monkey flowers	Mimulus L.	Plant
Montezuma quail	Cyrtonyx montezumae	Bird
mormon tea	Ephedra viridis Coville	Plant
morning-glory	Ipomoea L.	Plant
mosses	Bryophyta	Plant
mountain mahogany	Cercocarpus Kunth	Plant
mountain muhly	Muhlenbergia montana	Plant
mountain skink	Plestiodon callicephalus	Reptile
mountain snowberry	Symphoricarpos oreophilus A. Gray	Plant
mountain snails	genus Oreohelix	Invertebrate
Mount Graham red squirrel	Tamiasciurus hudsonicus grahamensis	Mammal

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
mule ears	Wyethia Nutt.	Plant
muttongrass	Poa fendleriana	Plant
narrowleaf hoptree	Ptelea trifoliata ssp. pallida	Plant
netleaf hackberry	Celtis laevigata Willd. var. reticulata	Plant
netleaf oak	Quercus rugosa Née	Plant
New Mexico bitterweed	Hymenoxys ambigens var. neomexicana	Plants
New Mexico feathergrass	Hesperostipa neomexicana	Plant
New Mexico locust	Robinia neomexicana A. Gray	Plant
nodding brome	Bromus anomalus Rupr. ex Fourn.	Plant
North American porcupine	Erethizon dorsatum	Mammal
Northern goshawk	Accipiter gentilis	Bird
Northern Mexican gartersnake	Thamnophis eques megalops	Reptile
Northern raccoon	Procyon lotor	Mammal
ocotillo	Fouquieria splendens Engelm.	Plant
onion (native)	Allium L.	Plant
Orcutt’s threeawn	Aristida schiedeana Trin. & Rupr. var. orcuttiana	Plant
painted redstart	Myioborus pictus	Bird
Palmer oak	Quercus palmeri	Plant
Palmer’s agave	Agave palmeri	Plant
paperflower	Psilostrophe DC	Plant
Parry's agave	Agave parryi Engelm.	Plant
pectis	Pectis angustifolia Torr. var. angustifolia	Plant
penstemon	Penstemon spp.	Plant
pigweed	Amaranthus L.	Plant
Pima pineapple cactus	Coryphantha scheeri var. robustispina	Plants
pine dropseed	Blepharoneuron tricholepis	Plant
pine satyr	Paramacera allyni	Invertebrate
pinyon ricegrass	Piptochaetium fimbriatum	Plant
plains bristlegrass	Setaria vulpiseta	Plant
plains harvest mouse	Reithrodontomys montanus	Mammal
plains lovegrass	Eragrostis intermedia Hitchc.	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
plains muhly	Muhlenbergia cuspidata	Plant
plains spadefoot	Spea bombifrons	Amphibian
pointleaf manzanita	Arctostaphylos pungens Kunth	Plant
poison ivy	Toxicodendron radicans	Plant
ponderosa pine	Pinus ponderosa C. Lawson	Plant
Porsild's starwort	Stellaria porsildii	Plants
prairie junegrass	Koeleria macrantha	Plant
predaceous diving beetle	Family Dytiscidae	Invertebrate
prickly pear	Opuntia Mill.	Plant
pringle manzanita	Arctostaphylos pringlei Parry	Plant
pringle needlegrass	Piptochaetium pringlei	Plant
pronghorn	Antilocapra americana	Mammal
psoralea	Sphaeralcea psoraloides S.L. Welsh	Plant
purple grama	Bouteloua radicosa	Plant
purple muhly	Muhlenbergia rigida	Plant
purple-spike coralroot	Hexalectris warnockii	Plants
purple threeawn	Aristida purpurea Nutt.	Plant
ragweed	Ambrosia L.	Plant
range ratany	Krameria L	Plant
recurved corycactus	Coryphantha recurvata	Plants
red-breasted nuthatch	Sitta canadensis	Bird
red-faced warbler	Cardellina rubrifrons	Bird
redosier dogwood	Cornus sericea L.	Plant
red-spotted toad	Anaxyrus puncatatus	Amphibian
ridge-nosed rattlesnake	Crotalus willardi	Reptile
ringtail	Bassariscus astutus	Mammal
rock rattlesnake	Crotalus lepidus	Reptile
rock wren	Salpinctes obsoletus	Bird
Rocky Mountain maple	Acer glabrum Torr.	Plant
rosary bean	Rhynchosia senna var. texana	Plant
rose-throated becard	Pachyramphus aglaiae	Bird

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
rosewood	Vauquelinia californica	Plant
rough tridens	Tridens muticus var. muticus	Plant
round-tailed ground squirrel	Spermophilus tereticaudus	Mammal
round-tailed horned lizard	Phrynosoma modestum	Reptile
Rusby's hawkweed	Hieracium rusbyi	Plants
rushes	Juncus L.	Plant
sacaton	Sporobolus airoides	Plant
saguaro	Carnegiea gigantea	Plant
sand dropseed	Sporobolus cryptandrus	Plant
sandpaper bush	Mortonia scabrella	Plant
Santa Rita grama	Bouteloua eludens	Plant
Santa Rita yellowshow	Amoreuxia gonzalezii	Plants
Schott’s yucca	Yucca ×schottii Engelm.	Plant
screwleaf muhly	Muhlenbergia straminea Hitchc.	Plant
scurfpea	Psoralidium Rydb.	Plant
sedges	Carex L.	Plant
shin-dagger	Agave schottii	Plant
shortleaf tridens	Erioneuron avenaceum	Plant
shrub live oak	Quercus turbinella	Plant
shrubby buckwheat	Eriogonum wrightii	Plant
shrubby deervetch	Lotus rigidus	Plant
sida	Rhynchosida Fryxell	Plant
sideoats grama	Bouteloua curtipendula	Plant
silktassel	Garrya Douglas ex Lindl.	Plant
silverleaf oak	Quercus hypoleucoides	Plant
single-seed juniper	Juniperus monosperma	Plant
skunkbush	Rhus trilobata Nutt.	Plant
skunkbush sumac	Rhus trilobata Nutt.	Plant
slender grama	Bouteloua repens	Plant
slim tridens	Tridens muticus	Plant
smooth baby-bonnets	Coursetia glabella	Plants

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
snake cotton	Froelichia spp.	Plant
sneezeweed	Achillea ptarmica L.	Plant
soft Mexican-orange	Choisya dumosa var. mollis	Plants
Sonoran coralsnake	Micruroides euryxanthus	Reptile
Sonoran desert toad	Ollotis alvaria	Amphibian
Sonoran mountain kingsnake	Lampropeltis pyromelana	Reptile
Sonoran spotted whiptail	Aspidoscelis sonorae	Reptile
sotol	Dasylirion spp.	Plant
Southwest monkeyflower	Mimulus dentilobus	Plants
southwestern stipa	Achnatherum eminens	Plant
southwestern white pine	Pinus strobiformis Engelm.	Plant
spidergrass	Aristida ternipes Cav.	Plant
spike dropseed	Sporobolus contractus	Plant
spike moss	Selaginella arizonica	Plant
spike pappusgrass	Enneapogon desvauxii	Plant
spreading ratany	Krameria lanceolata	Plant
sprucetop grama	Bouteloua chondrosioides	Plant
Stellar's jay	Cyanocitta stelleri	Bird
Stephan's riffle beetle	Heterelmis stephani	Invertebrate
striped plateau lizard	Sceloporus virgatus	Reptile
striped skunk	Mephitis mephitis	Mammal
sulphur-bellied flycatcher	Myiodynastes luteiventris	Bird
talinum	Talinum aurantiacum	Plant
talussnails	genus Sonorella	Invertebrate
tanglehead	Heteropogon contortus	Plant
Tarahumara Frog	Lithobates tarahumarae	Amphibian
tarantulas	Family Theraphosidae	Invertebrate
Texas bluestem	Schizachyrium cirratum	Plant
thimbleberry	Rubus parviflorus	Plant
threeawn grasses	Aristida L.	Plant
tickclover	Desmodium	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
tiger salamander	Ambystoma mavortium	Amphibian
Toumey oak	Quercus toumeyi	Plant
trailing fleabane	Erigeron flagellaris	Plant
trailing four o'clock	Allionia incarnata	Plant
triangle bursage	Ambrosia deltoidea	Plant
triangleleaf bursage	Ambrosia deltoidea	Plant
turbinella oak	Quercus turbinella	Plant
turpentine bush	Ericameria laricifolia	Plant
twinberry	Myrcianthes fragrans	Plant
twin-spotted rattlesnake	Crotalus pricei	Reptile
velvet ash	Fraxinus velutina	Plant
velvet-pod mimosa	Mimosa dysocarpa	Plant
verbena	Verbena L.	Plant
vetch	Vicia	Plant
vine mesquite	Panicum obtusum	Plant
Virginia creeper	Parthenocissus quinquefolia	Plant
wandering gartersnake	Thamnophis elegans	Reptile
warbling vireo	Vireo gilvus	Bird
wavyleaf oak	Quercus X pauciloba	Plant
wax currant	Ribes cereum	Plant
Weidemeyer's Admiral	Limenitis weidemeyerii	Invertebrate
western soapberry	Sapindus saponaria var. drummondii	Plant
whiskered screech-owl	Megascops trichopsis	Bird
white fir	Abies concolor	Plant
whiteball acacia	Acacia angustissima	Plant
white-breasted nuthatch	Sitta carolinensis	Bird
white-flowered cinquefoil	Potentilla albiflora	Plants
white-nosed coati	Nasua narica	Mammal
whitethorn acacia	Acacia constricta	Plant
whortleberry	Vaccinium myrtillus	Plant
wild grape	Vitis vulpina	Plant

Plant or Animal Common Name	Plant or Animal Scientific Name	Taxa Group
wild rose	Rosa arkansana	Plant
wild turkey	Meleagris gallopavo	Bird
wire lettuce	Stephanomeria pauciflora	Plant
wishbone-bush	Mirabilis bigelovii var. retrorsa	Plant
wolfberry	Lycium L.	Plant
wolftail	Lycurus phleoides	Plant
wood sorrel	Oxalis L.	Plant
wooly bunchgrass	Elionurus barbiculmis	Plant
Wright’s beebrush	Aloysia wrightii	Plant
xanthocephalum	Xanthocephalum gymnospermoides	Plant
Yarrow's spiny lizard	Sceloporus jarrovii	Reptile
yellow leaf silktassel	Garrya flavescens	Plant
yellow-nosed cotton rat	Sigmodon onchrognathus	Mammal
yerba de pasmo	Baccharis pteronioides	Plant
yerba mansa	Anemopsis Californica	Plant
yewleaf willow	Salix taxifolia	Plant
zebra-tailed lizard	Callisaurus draconoides	Reptile

Appendix D: Consistency with Plan Decisions

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

Ensuring Project or Activity Consistency with the Forest Plan
The responsible official has the following options to ensure a proposed project or activity would be consistent with a plan decision:

- Modify the proposal so that the project or activity will be consistent;
- Reject the proposal; or
- Amend the Forest Plan with the approval of the project or activity. The amendment may be limited to applying only to the project or activity.

The following paragraphs describe how a project or activity is consistent with plan decisions and the requirements for documenting consistency.

Desired conditions - Because of the many types of projects and activities that can occur over the life of a plan, it is not likely that a project or activity can maintain or contribute to the attainment of all desired conditions. Most projects and activities are developed specifically to maintain or move conditions toward one or more of the desired conditions of a plan. It should not be expected that a project could clearly point to a specific desired condition as the reason the project was proposed. There will also be instances when negative effects related to a specific desired condition are appropriate, either for long-term progress toward that same desired condition, or for progress toward or maintenance of another desired condition. It is also important that project consistency with a desired condition be assessed at the appropriate scale. To be consistent with the desired conditions of the Forest Plan, a project or activity, when assessed at the appropriate spatial scale described in the Forest Plan, must be designed to meet one or more of the following conditions:

- Maintain or make progress toward one or more of the desired conditions of a plan without adversely affecting progress toward, or maintenance of other desired conditions, or
- Be neutral with regard to progress toward plan desired conditions, or
- Maintain or make progress toward one or more of the desired conditions over the long-term, even if the project or activity would adversely affect progress toward or maintenance of one or more desired conditions in the short-term, or
- Maintain or make progress toward one or more of the desired conditions over the long-term, even if the project or activity would adversely affect progress toward other desired conditions in a negligible way over the long-term.

The project documentation should explain how the project is consistent with desired conditions and describe any short-term, or negligible long-term, adverse effects the project may have on the maintenance or attainment of any desired condition.

Objectives - A project or activity is consistent with the objectives of the Forest Plan if it contributes to or does not prevent the attainment of any applicable objectives.

The project documentation should identify any applicable objective(s) to which the project contributes and document that the project does not prevent the attainment of any objectives. If there are no applicable objectives, the project is consistent with the objectives of the Forest Plan, and the project documentation should state that fact.

Standards - A project or activity must be consistent with all standards applicable to the type of project or activity and its location in the Forest Plan area. A project or activity can be consistent with a standard when it is designed exactly in accord with the standard. When the project varies from the exact words of the standard, a plan amendment is needed.

Guidelines - A project or activity must be consistent with all guidelines applicable to the type of project or activity and its location in the Forest Plan area. A project or activity can be consistent with a guideline in either of two ways:

- A project or activity is designed exactly in accord with the guideline, or
- A project or activity design varies from the exact words of the guideline but is as effective in meeting the purpose of the guideline to contribute to the maintenance or attainment of relevant desired conditions and objectives.

The project documentation should describe how the project is consistent with the guidelines. When the project varies from the exact words of the guideline, the documentation must specifically explain how the project design is as effective in contributing to the maintenance or attainment of relevant desired conditions and objectives.

Suitability - A project or activity can be consistent with Forest Plan suitability determinations in either of two ways:

- The project or activity is a use identified in the Forest Plan as suitable for the location where the project or activity is to occur, or
- The project or activity is not a use identified in the Forest Plan as suitable for the location, but the responsible official determines the use to be appropriate for that location's desired conditions and objectives.

The project documentation should describe that the project or activity is either (1) a use for which the area is specifically identified in the Forest Plan as suitable, or (2) not a use for which the area is specifically identified in the Forest Plan as suitable, but is nonetheless appropriate for that location.

Appendix E: Other Sources of Information

Use the following references for additional information on effective resource management.

Recreation

- Recreation Facility Analysis Program of Work
- 1986 Recreation Opportunity Spectrum Book
- The Built Environment Image Guide (FS-710)
- Architectural Guidelines for Recreation Residences
- Forest Service Outdoor Recreation Accessibility Guidelines
- Forest Service Trail Accessibility Guidelines
- USDA Forest Service Exhibit Accessibility Checklist
- Accessibility Guidebook for Outfitter/Guides Operating on Public Lands (FS-757)
- Accessibility Guidebook for Ski Areas Operating on Public Lands (FS-703)
- Coronado National Forest Transition Plan
- Cave Creek Recreation Concept Plan
- Patagonia-Sonoita Scenic Road Corridor Management Plan
- Swift Trail Parkway Corridor Management Plan
- Sky Island Scenic Byway Corridor Management Plan
- Sabino Canyon Recreation Concept Plan
- Sabino Canyon Interpretive Plan
- Management Guidelines for OHV Recreation by the National Off-Highway Vehicle Conservation Council
- Arizona Statewide Comprehensive Outdoor Recreation Plan (SCORP)
- Arizona Trail Management Guide
- Pusch Ridge Wilderness Management Plan

Scenic Quality

- Landscape Aesthetics, A Handbook for Scenery Management (FSH 701)
- The Built Environment Image Guide (FS-710)
- Architectural Guidelines for Recreation Residences
- Patagonia-Sonoita Scenic Road Corridor Management Plan
- Swift Trail Parkway Corridor Management Plan
- Sky Island Scenic Byway Corridor Management Plan