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Land and Resource Management Plan for the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands

Cibola National Forest and National Grasslands

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Land and Resource Management Plan for the Kiowa, Rita Blanca, Black Kettle and McClellan Creek National Grasslands

Cibola National Forest and National Grasslands
Mora, Harding, Union, and Colfax Counties in New Mexico; Dallam, Hemphill, and Gray Counties in Texas; and Cimarron and Roger Mills Counties in Oklahoma

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Part 1: Introduction

Background

The Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands (herein collectively referred to as “the Grasslands”) have been under Federal ownership since the late 1930s and are currently administered by the Cibola National Forest and National Grasslands Supervisor’s Office located in Albuquerque, NM. The Kiowa National Grassland covers 137,537 acres and is located within Mora, Harding, Union, and Colfax Counties, NM, with the district office located in Clayton, NM. The Rita Blanca National Grassland covers 92,989 acres and is located within Dallam County, TX, and Cimarron County, OK, with the district office located in Clayton, NM. The Black Kettle National Grassland covers 31,286 acres and is located within Roger Mills County, OK, and Hemphill County, TX. The McClellan Creek National Grassland covers 1,449 acres and is located in Gray County, TX. The district office for both Black Kettle and McClellan Creek National Grasslands is located in Cheyenne, OK. The Kiowa National Grassland resides in the Third Congressional District of New Mexico, the Rita Blanca and Black Kettle in the 13th Congressional District of Texas and the third Congressional District of Oklahoma, and the McClellan Creek National Grassland in the 13th Congressional District of Texas.

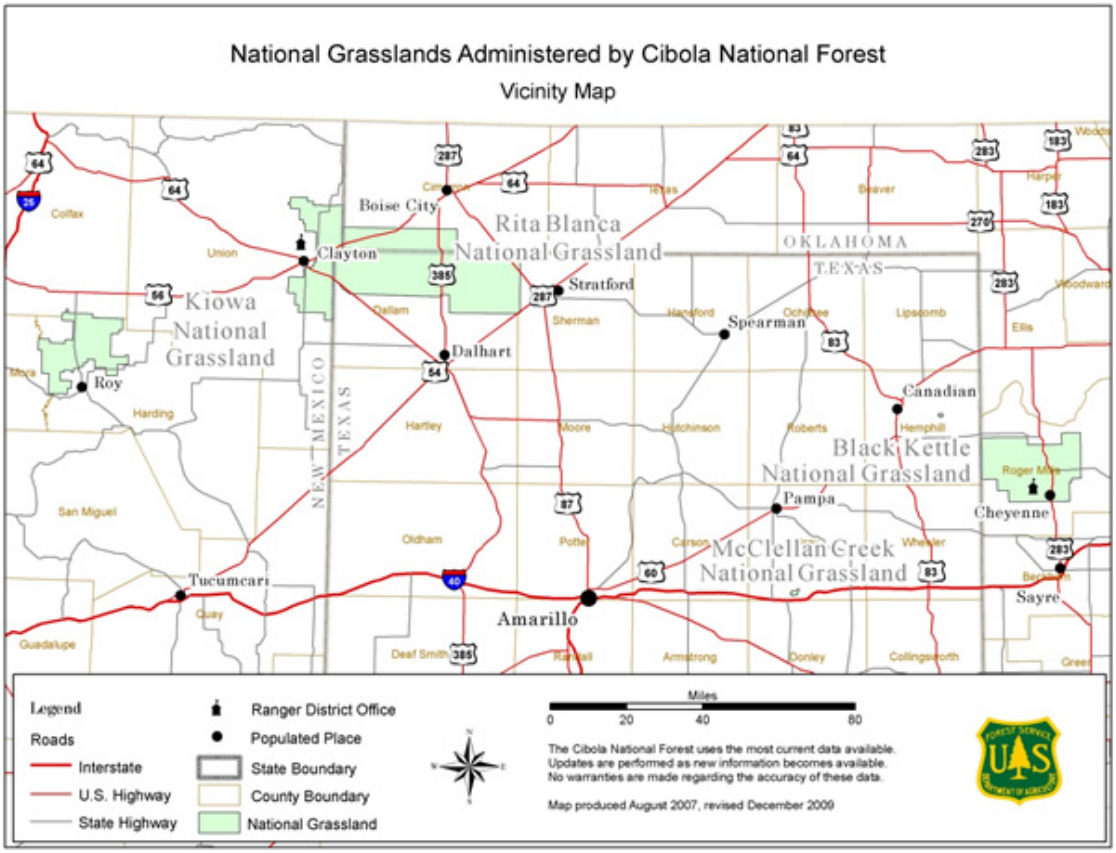

Figure 1. Vicinity map.

According to the National Forest Management Act of 1976 (NFMA), land and resource management plans are to be revised on a 10- to 15-year cycle. Management of the Grasslands has been directed from 1985 to the date of this document by the 1985 “Cibola National Forest Land

and Resource Management Plan," which combined the management direction for the Grasslands with that for the forested, mountain districts of the Cibola National Forest (the Forest). Upon signing of the record of decision by the regional forester for this new land and resource management plan (plan) for the Grasslands, this new plan will replace the direction formerly provided by the 1985 plan for all of the grasslands named above.

Preparation of the new plan was underway when the 2008 National Forest System Land Management Planning Rule was enjoined on June 30, 2009, by the United States District Court for the Northern District of California [Citizens for Better Forestry v. United States Department of Agriculture, 632 F. Supp. 2d 968 (N.D. Cal. June 30, 2009)]. On December 18, 2009, the department reinstated the previous planning rule (commonly known as the 2000 Planning Rule) in the Federal Register (Federal Register, Volume 74, No. 242, Friday, December 18, 2009, pages 67059 thru 67075). The transition provisions, 36 CFR 219.17(b)(3), of the 2012 Planning Rule (Vol. 77, No. 68 / April 99, 2012) allow use of the provisions of the planning rule commonly called the 1982 Planning Rule, to amend or revise plans. The Cibola National Forest has elected to use the provisions of the 1982 Planning Rule, including the requirement to prepare an EIS, to complete its plan development for the Grasslands.

Purpose of this Land Management Plan

The planning process that created this plan aims to produce responsible land management for the Grasslands based on useful and current information and guidance. Land management planning guides the Forest Service in fulfilling its responsibilities for stewardship of the Grasslands to best meet the needs of the American people.

This plan provides broad guidance and information for project and activity decisionmaking on the Grasslands for approximately the next 15 years. The plan is strategic in nature. It does not include project and activity decisions. Those decisions are made later—after specific proposals are made and analyzed—and there is additional opportunity for public involvement. Under the National Forest Management Act (NFMA) of 1976, projects and activities must be consistent with the plan. The plan provides a framework that contributes to sustaining native ecological systems by managing toward appropriate conditions that support native plant and animal diversity. The plan integrates ecological maintenance and restoration, watershed protection, climate resilience, wildlife conservation, and contributions to social and economic values, goods, and services. The plan honors the continuing validity of private, statutory, or preexisting rights.

Roles and Contributions of Grasslands

Ecosystems and Wildlife Habitat: The Grasslands contribute to the sustainability of diverse southern Great Plains grassland ecosystems and associated wildlife. The Grasslands demonstrate successful ecosystem restoration of lands that were degraded during the Dust Bowl era. Grasslands management contributes to the sustainability of productive soils, high quality water and riparian resources, and native prairie habitat and species. The Grasslands also include the shinnery oak vegetation type that is underrepresented on a landscape scale. The public values how Grasslands management demonstrates the coexistence of complementary land uses such as cattle grazing, hunting, and oil and gas production without compromising the ecological integrity of Grasslands habitat.

Recreation: Recreation opportunities on the Grasslands greatly contribute to the quality of life enjoyed by visitors. The Grasslands provide outstanding opportunities for hunting, fishing, camping, hiking, viewing birds and other wildlife, driving to enjoy the scenery and open spaces, and visiting historic sites. The developed recreation sites (particularly the lake-based recreation complexes on the Black Kettle and McClellan Creek National Grasslands and the developed sites in the Mills Canyon area) offer unique and significant features available for visitors to enjoy within this region. Outdoor recreational activities on the Grasslands are very important to the local tourism economy, in 2002 generating 75 jobs, $1.2 million in direct income, and $3 million in indirect income for local businesses (UNM-BBER, 2005).

Livestock Grazing: Livestock grazing on the Grasslands contributes to maintaining the ranching culture and lifestyle of these rural areas, improves the fiscal sustainability of local ranching operations, and contributes to historical disturbance processes. Over 96 percent of the Grassland units are used by permit holders to graze their cattle. This use of the Grasslands contributes to the social and economic well-being of this area while sustaining native prairie ecosystems. In 2002, livestock grazing on the Grasslands generated 106 jobs, $1.6 million indirect income, and $10 million on the final value of products from the industry (UNM-BBER, 2005).

Energy Development: The Grasslands provide opportunities for oil and natural gas extraction that contribute to meeting the Nation's energy needs. The Grasslands may also play an important future role for alternative energy developments such as wind. In 2002, gas and oil extraction generated 79 jobs, $3.5 million in direct income, and $11 million on the final value of products from the industry (UNM-BBER, 2005).

Scenic, Heritage, and Paleontological Resources: The Grasslands contain significant scenic, heritage (historic and prehistoric) and paleontological (fossil) resources. These offer opportunities for the public to learn about the past and appreciate the resources and beauty of the Grasslands. These important resources provide opportunities to base tourism businesses on bird watching, hunting, wildlife viewing, and visiting historic and cultural sites.

Scientific Investigations: The Grasslands provide opportunities for research and discovery on the role of fire and herbivory upon the Grasslands' vegetation types, as well as on the Grasslands' wildlife interactions.

Areas of Interest: Three features on the Grasslands are formally designated as "special areas" to highlight and preserve their unique historic and scenic characteristics. These special areas include the Santa Fe National Historic Trail and two scenic byways: The Santa Fe Trail National Scenic Byway and La Frontera del Llano Scenic Byway (State). Other areas of interest include the Canadian River Inventoried Roadless Area (IRA) and the Canadian River eligible scenic river corridor which attracts visitors for its remarkable historic, geologic, scenic, and recreation features.

Wildfire Prevention: The Forest Service plays a cooperating role in working with volunteer rural fire departments and others by contributing Federal firefighting resources to help protect valuable natural resources along with private properties and communities.

Planning Process

In the summer of 2006, the Forest Service announced the initiation of the revision process of the Grasslands portion of the 1985 "Cibola National Forest Land and Resources Management Plan." An analysis of the management situation (AMS) was initiated for the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands that provided the basis for the "needs for change" to the 1985 plan direction regarding future management of the Grasslands. Numerous public information meetings were held in communities in northeastern New Mexico, the Texas panhandle, and western Oklahoma to inform and gather input from the public regarding the need to change the current plan to specifically address the Grasslands. Input from the public meetings and evaluation by the Forest Service of the social, economic, and ecological sustainability of the Grasslands set the stage for developing this new plan.

The AMS suite of documents is composed of the following evaluation and sustainability reports:

- Grasslands Plan Revision Comprehensive Evaluation Report (CER), Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands. February 2011. USDA Forest Service, Cibola National Forest.
- Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands CER Supplementary Document to meet AMS Requirements. January 2010. USDA Forest Service, Cibola National Forest.
- Socioeconomic Sustainability Report, Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands. April 2011. USDA Forest Service, Cibola National Forest.
- Ecological Sustainability Report, Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands. April 2011. USDA Forest Service, Cibola National Forest.

Summaries of background information and needs for change from these AMS document are presented below by key, integrated themes.

Summary of the Analysis of the Management Situation

Background

Local community residents have expressed that the Forest Service is maintaining good relationships and open communications with interested residents. These positive relationships strengthen social cohesion and satisfaction with Forest Service actions within local communities. In addition, partnerships with other agencies and organizations have increasingly been used to meet Grasslands management objectives. Most partnership projects on the Grasslands are aimed at improving wildlife habitat and native ecosystem functions or recreation sites and tourism opportunities that will enhance social and economic conditions in local communities.

Based on social demographic data, the area surrounding the Grasslands is considered rural, with a few "urban clusters" of over 2,500 residents. Populations in all the rural areas around the Grasslands have been declining and are projected to continue to decline, while populations in the respective states and urban centers farther from the Grasslands will continue to increase. Partly due to limited economic opportunities and low income levels, most Grasslands counties have more people moving out than in, particularly in the 20- to 35-year-old age group. An aging population trend is influencing an increase in age related income disbursements (i.e. social security, retirement accounts) that will continue to comprise the largest proportion of income for area residents.

Based on economic data, the employment rate and per capita income level in Grasslands counties are expected to remain stable, with some periods of growth and decline. Job growth and income levels are expected to continue to lag behind the U.S. and the three states' averages. Over the last 34 years, job growth in the Grasslands counties has been slower than job growth for the States of Oklahoma, Texas, and New Mexico, and slower than national job growth. Most new jobs will continue to be low income, nonsalary, farming and ranching jobs, with incomes that fluctuate seasonally. Job opportunities are expected to continue the shift from agriculture and oil-gas toward service jobs in urban areas farther away from the Grasslands. The primary "industry" or economic activity in the area will continue to be livestock related operations run by small businesses with less than 10 employees. Some oil and gas industry jobs in the area are expected to be lost over the next 50 years but could be replaced by alternative energy jobs such as wind energy infrastructure development and maintenance.

Need for Change: Managed Recreation

The 1985 plan did not clearly and specifically address the issues related to recreation and scenic resources that play a vital role in supporting social and economic sustainability on the Grasslands. The new plan needs to provide direction that is more specific to the Grasslands for providing the following important rural economic development opportunities:

- The demand for day hiking, particularly on scenic and interpretive trails, continues to increase on the Grasslands.
- The new plan needs to provide more direction on management of dispersed recreation. There are components of the 1985 plan which are redundant with existing Forest Service Handbook and Manual direction. Redundancies will be absent from the new plan and current handbook and manual direction will be incorporated by specific reference.
- There is a need for the new plan to provide direction to manage for recreation opportunities in a variety of different settings and levels of development, from large, developed recreation settings with many facilities to primitive settings.
- There is a need for the new plan to provide direction that management of scenic resources be based on objectives for specific areas, particularly those areas identified as having high scenic quality.
- Plan direction addressing opportunities for visiting, touring, and enjoying guided and interpretive activities related to unique scenery, historic/cultural sites, wildlife, and formally designated sites such as eligible wild and scenic rivers, historic trails, and scenic byways, needs to be included in the new plan.
- Development of the new plan will assess the need for additional special area designations, such as potential wilderness or research natural areas (RNAs); and provide direction.

Need for Change: Human Influences

The 1985 plan did not clearly and specifically address the issues related to social demographics and economic conditions and trends, or maintaining consumptive and nonconsumptive land uses that play a vital role in supporting social and economic sustainability in the rural Grasslands areas. The new plan should provide direction that is more specific to the Grasslands for providing the following important land uses and economic opportunities:

- The new plan needs to provide management direction to the livestock grazing program that incorporates adaptive management toward ecosystem-based desired conditions.
- Because of increasing interest in alternative energy enterprises such as wind farms in the proximity of the Grasslands, the new plan needs to provide direction for guiding energy development on the Grasslands, while protecting natural resources, heritage sites, and scenery.
- There is a need to provide direction in the new plan for rehabilitation of disturbed sites (such as oil and gas pads and roads) after operations have ceased, in order to protect soil productivity and reestablish vegetative cover.
- The new plan needs to provide direction for the process of obtaining legal road access to Grassland units, access that meets public, private landowner, and management needs.
- Because of the projected increase and changes in the type of energy developments in the region and the land ownership pattern of the Grasslands, the new plan needs to provide direction on the permitting of utility easements and related special uses.
- There are many special uses of the Grasslands that provide economic support to local communities. The new plan needs to provide direction for accommodating the removal of miscellaneous products for commercial, noncommercial, and tribal use, such as wood products, plants, grass seed, or other materials.
- The new plan needs to provide direction on the noncommercial use of common mineral materials so that resources can be adequately protected.
- The new plan should provide direction on the management of firewood and firewood harvesting and gathering on the Grasslands.
- There is a need for the new plan to provide direction on opportunities to conduct research on the Grasslands, regardless of whether a research natural area is established.
- The checkerboard pattern of the Grassland units and private land, along with the types of fuels found on the Grasslands, create a fire environment which is very different from forests of the Intermountain West. The new plan needs to provide direction for applying management strategies for responding to wildland fires and using prescribed fire on Grassland units to avoid loss of life or significant property damage.
- The new plan needs to provide updated direction on the stabilization and preservation of historic structures and traditional cultural properties. The new plan should also provide direction on the role of heritage sites in economic development.

Need for Change: Ecosystem Diversity

The 1985 plan did not clearly and specifically address many of the concerns related to ecosystem restoration and maintenance specific to the Grasslands. The revised plan should provide direction that is more specific to the Grasslands in relation to ecosystem management, as follows:

- The vegetation types found on the Grasslands are altered remnants of what were once found across the southern Great Plains. In the new plan, there is a need to provide management direction that will move vegetation types toward reference condition, recognizing that past events may limit the ability to achieve full restoration.
- There are invasive plants present on the Grasslands that have the potential to affect ecosystem structure, composition, and processes. Currently, there are feral hogs that have the potential to negatively impact water resources, vegetation, and wildlife habitat. The

new plan needs to provide management direction addressing the unwelcome introduction, spread, and control of invasive plants and animals.

- There is a need to anticipate and strategize response to changes in climate relative to Grasslands management.

A brief explanation is given below of the process and logic behind how ecological and species diversity risk assessments were conducted and the results of such assessments; how biological diversity issues were identified, and how needs for change were determined and developed into ecological, futuristic plan component statements.

Ecosystem attributes for the Grasslands were analyzed to determine if sustainability of the vegetation types, soil, water, air, and animal and plant species richness and abundance are at risk. This assessment was based on current conditions, deviation from historical reference conditions, and projected future trends. If the ecosystem attribute is projected to depart from its reference condition, then the attribute was determined to be at risk. If the attribute is significantly departed from its reference condition and is stable (i.e., neither trending further away from nor toward the reference condition), then it was determined to be at risk; this scenario was not found for any of the ecosystem characteristics on the Grasslands. If current management activities are resulting in the ecosystem characteristic trending toward its reference condition, the characteristic was determined not to be at risk.

Four out of the seven vegetation types found on the Grasslands have greater representation on the Grasslands in comparison to the surrounding landscape within the Grasslands administrative boundary. These include shinnery oak, mixed hardwood riparian, cottonwood-willow, and sand sagebrush. Mixed grass and shortgrass prairie have less representation on the Grasslands in comparison to the surrounding landscape, and pinyon-juniper is equally represented.

All vegetation types on the Grasslands are in low departure from their reference condition for vegetation structure (USDA Forest Service 2011b, appendix F).

Some of the vegetation types, while in low departure from reference condition for vegetation structure overall, may not be able to make a full recovery to reference conditions. These include the shinnery oak areas that were once deeply plowed, as well as formerly cultivated old field sites in shortgrass prairie. The deep plowing practices on shinnery oak eliminated the species from some areas during the Dust Bowl era, and recovery does not readily occur. Soil movement that occurred during the Dust Bowl era also created conditions that facilitated mixed hardwood riparian establishment, a vegetation type not historically found on the Grasslands. Consequently, determining a departure from reference condition relative to structure for mixed hardwood riparian on Black Kettle and McClellan Creek entails comparing riparian woody vegetation structure and composition to the mixed hardwood plant communities in other areas with similar climate, elevation, rainfall, and growing season attributes. Some areas within the cottonwood-willow riparian may not have the capacity to fully recover to the reference condition due to disruption of natural hydrologic processes on and off of the Grasslands. While the reference condition for structure and composition may not be fully achievable on some areas within the shinnery oak, shortgrass prairie, mixed hardwood riparian, and cottonwood-willow riparian vegetation types, plan direction of the new plan should move these areas toward reference condition.

Over the past several decades watershed conditions have dramatically improved, especially compared to the extremely degraded condition that occurred during the 1940s and 1950s following the Dust Bowl era. Conservation practices across the southern Great Plains, and notably in the McClellan Creek drainage, have resulted in a substantial increase in infiltration and groundwater recharge and a subsequent reduction in surface runoff and associated sedimentation. Groundwater depletion is occurring and, although this is outside of the Agency's control, it has the potential to affect Grasslands management.

Species Viability Determination

The determination of species viability on the Grasslands is a culmination of assessing ecosystem characteristics (including vegetation type, soil, water, and air) found in the "Ecological Sustainability Report" (ESR) (USDA Forest Service 2011b). The reference condition of vegetation was used to assess current conditions and determine ecological sustainability. The ecological sustainability of vegetation and habitat leads up to determination of species viability.

The "Ecosystem Diversity" section of the ESR focuses on conditions and trends in the vegetation communities for shortgrass prairie, pinyon-juniper, cottonwood-willow riparian, sand sagebrush, mixed grass prairie, shinnery oak, and mixed hardwood riparian vegetation types. The species diversity section focuses on species found in Texas, New Mexico, and Oklahoma, on the Grasslands and finally those affected by Grasslands management that have population or habitat concerns.

Natural history and population information were gleaned from the references used in the screening process and from Grasslands biologists; States of Oklahoma, Texas, and New Mexico biologists; and U.S. Fish and Wildlife Service biologists. Viability risks were determined by individual species habitat and population evaluation.[1] The results of this process provided a numerical ranking of the viability of a species. Those species found to have high viability risk were further assessed for their likelihood of being affected by four hypothetical scenarios listed below:

- Widespread declines in population in the plan area and new isolation of populations within the area;
- Widespread population decline but without isolation of populations;
- Localized population declines that may be accompanied by some minor restrictions in population interactions; and
- Populations and their distribution are unstable.

Of the wildlife species identified as species at risk in plan development, plains leopard frog, Lesser Prairie-chicken, black-tailed prairie dog, Mountain Plover, and swift fox were assessed to be at high risk. The risks to these species are based upon threats from habitat fragmentation, disease, predation, and invasive species.

[1] "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired nonnative vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area..." Section 219.19 of the 1982 Planning Rule provisions.

Regional Forester's Grasslands Sensitive Species List

The Regional Forester's sensitive species program is the Forest Service's dedicated initiative to conserve and recover plant and animal species. Forest sensitive species (table 1) are those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by:

- Significant current or predicted downward trends in population numbers or density;
- Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

The Grasslands improve habitat and restore ecosystems for sensitive species through vegetation treatments and management practices**.**

Table 1. Regional Forester's Sensitive Species List

Sensitive Species List for Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands			
Common Name	**Taxon**	**Forest Status**	
		Black Kettle-McClellan Creek	**Kiowa-Rita Blanca**
Amphibians			
Plains leopard frog	*Rana blairi*	D	D
Great Plains narrow-mouthed toad	*Gastrophryne olivacea*	D	D
Fish			
Rio Grande chub	*Gila pandora*		D
Suckermouth minnow	*Phenacobius mirabilis*	D–but not rare in OK or TX	D
Birds			
Bald Eagle	*Haliaetus leucocephalus*	D	D
White-faced Ibis	*Plegadis chihi*		D
Zone-tailed Hawk	*Buteo albonotatus*		D
Swainson's Hawk	*Buteo swainsoni*	D	D
Ferruginous Hawk	*Buteo regalis*		D
American Peregrine Falcon	*Falco peregrinus (anatum)*		S
Lesser Prairie-chicken	*Tympanuchus pallidicinctus*	S	S
Mountain Plover	*Charadrius montanus*		D
Burrowing Owl	*Athene curnicularia (hypugaea)*	D	D
Loggerhead Shrike	*Lanius ludovicianus*	D	D
Mammals			

Sensitive Species List for Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands			
Common Name	**Taxon**	**Forest Status**	
		Black Kettle-McClellan Creek	**Kiowa-Rita Blanca**
Pale Townsend's big-eared bat	*Corynorhinus townsendii (pallescens)*		S
Black-tailed prairie dog	*Cynomys ludovicianus*		D
Sandhills white-tailed deer	*Odocoileus virginianus texana*		D
Reptiles			
Arid land ribbon snake	*Thamnophis proximus diabolicus*		D
Plants			
Greene milkweed	*Asclepias uncialis ssp. uncialis*		D
One-flowered milkvetch	*Astragalus wittmannii*		D
Spellingberg's groundsel	*Packera spellenbergii (=Senecio s.)*		D

D = Documented, reliable, recorded observation, in appropriate habitat within the Grassland boundary.
S = Suspected, likely to occur based on habitat availability to support individuals/breeding pairs/groups within the Grassland boundary.

Summary of Management Indicator Species (MIS) and Ecological Indicators (EI) and Monitoring

The transition provisions, 36 CFR 219.17(b)(3), of the 2012 Planning Rule (Vol.77, No. 68/April 9, 2012.) allow the use of the provisions of the 1982 Planning Rule to implement the NFMA requirement that management indicator species (MIS) be identified as part of the Forest plan. MIS serve multiple functions in forest planning: focusing management direction developed in the alternatives, providing a means to analyze effects on biological diversity, and serving as a reliable feedback mechanism during forest plan implementation. The latter is accomplished by monitoring population trends in relationship to habitat changes (1982 Planning Rule Provisions Section 219.19(a)(6)).

Management indicator species is a concept adopted by the Agency to serve, in part, as a barometer for species viability at the Forest level. The role of MIS in meeting viability mandates compliments that of several other approaches, particularly management of sensitive species. Ecological indicators (EI) are defined in FSM 2620.5-2 as "Plant or animal species, communities or special habitats that have a narrow range of ecological tolerance."

The monitoring protocol is a plan component that includes a discussion of data collection, data analysis, data storage, and reporting methods. This protocol covers frequency of measurement, expected precision and reliability of the system, and an indication of when the evaluation will be reported (1982 Planning Rule provision Section 219.12(k)).

Monitoring Burrowing Owl, Mountain Bluebird, and Rio Grande Turkey populations as management indicator species will allow trend information to be used to evaluate management direction on early successional stages of shortgrass prairie, all seral stages of pinyon-juniper, and

all seral stages in mixed hardwood riparian respectively. Monitoring the presence of undesirable woody species in cottonwood-willow riparian, shinnery oak, and mixed-grass prairie vegetation, and reference condition structure and composition on middle and late structural stages of shortgrass prairie will allow trend information to be used as ecological indicators to evaluate management direction.

Benchmarks

Benchmark analyses are one of the required components of the 1982 Planning Rule provisions pertaining to the AMS. Benchmarks define the high and low sideboards of economic goods and services and ecological tolerances within which plan alternatives are to be developed and analyzed in an environmental impact statement (EIS). Selection of benchmarks depends primarily on the topics to be addressed during new plan development. Assumptions, tables, and calculations regarding these benchmark sideboards are presented in appendix H.

Projections of Demand

This is a summary of the projections of demand analysis required under the 1982 Planning Rule provisions. Projected future demand for Forest resource use was estimated using existing data and reports from Federal, state, and Forest-specific sources. This analysis is primarily a qualitative description of possible future resource demands.

Demand for grazing was analyzed in the CER Supplementary document to meet AMS requirements dated January 2010. The percentage of total demand for grazing within the market area (as measured by cattle inventory) that could be supported by the level of permitted livestock use on the Cibola National Forest and National Grasslands has ranged from a high of 3.6 percent in 1999 to a low of 1.8 percent in 2004, 2006, and 2009. However, this does not consider effects on actual use due to factors such as drought, financial limitations on operators, and market conditions. In addition, the supply of the grazing resource is limited, and other resource considerations may limit grazing use in addition to these factors. While the share of total demand provided by the Forest and Grasslands is small, it may be more important for smaller areas within the market area. However, this trend is uncertain given the wide degree of variation in permitted use over the relatively short period examined. The 2011 CER (page 27) concluded that there is no indication that there will be a major increase or decrease in grazing on the Grasslands over the next 20 years; however, cattle numbers and management strategies are expected to continue to fluctuate in response to drought, wildfire, prescribed fire, and other factors that change range conditions, such as prairie dog colonies.

An analysis of the projected demand for recreation can be found on pages 21–27 of the “Socioeconomic Sustainability Evaluation Report for the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands” (USDA Forest Service 2011c). This analysis has been reviewed and is sufficient to meet the requirements for the AMS.

There are no lands suitable for commercial timber production on the Grasslands. Since no supply exists on these units, it was not necessary to project demand for commercial timber.

Plan Components

Plan components (goals/desired conditions (hereinafter referred to as desired conditions), objectives, suitability, guidelines, standards, monitoring elements, and special areas) are the

guidance, direction, and decisions set forth by the plan to guide future projects. Only plan components require plan amendments in order to change the plan.

Desired Conditions

Desired conditions are statements of the social, economic, and ecological outcomes to be achieved in the future. These outcomes relate to land and resource conditions and ecological and social processes. They are aspirations and strategic in nature, rather than project-specific commitments. Some desired conditions may be achieved within the 15-year life of the plan, and others may extend beyond that timeframe. Desired conditions strive to paint a picture of the future Grasslands so that every reader, be they manager or user, understands the same message. Desired conditions form the principal basis from which objectives are developed. Desired conditions ultimately serve to guide Grassland managers in planning and providing direction for future actions and in developing a meaningful monitoring program to determine progress toward achievement over the life of the plan.

Objectives and Suitability

Objectives are the proactive steps that the Grasslands expect to accomplish over the next 15 years to maintain or move toward the desired conditions of the plan. Objectives are measurable and time-specific outcomes. Any project or activity undertaken during the life of the plan must be consistent with objectives.

Variations in achieving objectives may take place during the next 15 years because of changes in environmental conditions, available budgets, catastrophic events, and other unforeseen factors.

For some resources or goods and services that a resource provides, there may not be proactive and measurable management activity that is necessary to maintain or move toward a desired condition; thus, not every desired condition has a related objective. In such cases where no objectives are explicitly stated, no unique or additive objectives exist for that desired condition. However, every stated objective does relate to one or more desired conditions within the respective resource, good or service, and geographic area.

Grasslands-wide objectives are applicable to the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands. Those objectives applicable to a desired condition on one or more grassland, but not all, are so specified. The reader should note that when percentages are specified characterizing the areal extent of an objective, the percentage is intended to apply across the landscape and is not necessarily site specific.

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

Guidelines and Standards

These criteria are applicable to project or activity design and execution on the Grasslands. They are sideboards for projects and activities to help achieve the desired conditions and objectives.

Guidelines contribute to maintaining or achieving desired conditions and objectives: they are specifications that a project or activity would adopt unless there is a compelling and defensible reason to vary from the guidelines. Such variances are only allowed without a plan amendment if the alternative approach provided by the variance meets the intent of the plan guideline. If such a variance is considered appropriate, the responsible official records in the project-level document the reasons for that variance, and no plan amendment is required. A project or activity should be consistent with guidelines.

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 in any way is not allowed.

In sum, a project or activity should meet the spirit, if not the letter, of a guideline, but must meet the letter of a standard.

Monitoring

Plan direction on monitoring and evaluation will provide a basis for a periodic determination and evaluation of the effects of management practices. More specifically, **monitoring and evaluation elements** of the plan will reveal how well objectives have been met and how closely management guidelines and standards have been applied. Based on this evaluation, the forest supervisor may make changes in management direction or revisions or amendments to the Grasslands plan as are deemed necessary.

Special Areas

Special areas are lands within the National Forest System that have been designated by Congress or by administrative action by a responsible official within the USDA. These lands have unique or special characteristics. Examples relevant to the Grasslands include state and national scenic byways and a national historic trail.

Non-plan Components

The reader will note several headings in the document that are not listed as plan components above. These are:

- Background and Description
- Management Approaches
- Other Sources of Information

Background and description headings and associated information are not plan components. They do not offer plan direction, but give the reader a brief sense of the history and/or description of the resource topic area being addressed as of the writing of the plan. The background and description information also provides a contrast to the desired condition that follows.

Management approaches headings and associated information are not plan components. They do not offer plan direction, but describe to the reader an approach or strategy to manage the unit to achieve a desired condition. Management approaches often convey how plan components work together to achieve the desired condition. They may also describe context, intent, priorities,

collaborations, needs for surveys, inventories or assessments, or approaches to risk and uncertainty. The reader may note that not every resource topic area has a management approach heading. Changes to management approaches do not require plan amendments.

Other sources of information (appendix D), include existing laws, regulations, memorandums of understanding (MOUs), and other guidance. These sources are important in designing projects and activities to achieve desired conditions. Most of these documents are available from Forest Service offices. Many are posted on the Cibola National Forest and Grasslands Internet Web site.

Project Consistency with the Grasslands Plan

During implementation, management activities (projects) affecting the Grasslands need to be consistent with the Grasslands plan. This consistency is achieved in the following ways: Management activities are developed specifically to achieve the desired conditions, goals, or objectives of the Grasslands plan. To the extent practicable, documentation for such projects should identify the elements of the desired conditions, goals, or objectives to be achieved by the project. It should not be expected that all projects or activities would contribute to all desired conditions, goals, or objectives, but rather to a limited subset. It should also be recognized that some projects designed to contribute to some desired conditions, goals, or objectives may have consequences considered adverse to the achievement of other desired conditions, goals, 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 not specifically related to one of these elements of the Grasslands 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, goals, or objectives.

In the implementation of the Grasslands plan, projects are expected to comply with suitability and standards and guidelines direction contained in the “Management Area Direction” sections of the Grasslands plan. Early in the project planning process, the applicable standards and guidelines and suitability considerations should be identified. To ensure compliance with the Forest plan, each project should document consistency with these standards and guidelines.

Transition in the Implementation of the Grasslands Plan

The Grasslands plan is used as a direction source for future projects, plans, and assessments. It is not expected that this new direction be used to reevaluate or change decisions that have been made under the previously existing Forest plan. A smooth and gradual transition to the new Grasslands 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 Grasslands Plan

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

- Administrative Corrections: are minor changes to the Grasslands plan that do not substantively affect the management direction or create additional environmental consequences. These minor changes include the following:
    - Elements of the Grasslands plan that are not plan decisions as described in the previous section, “Non-Plan Components.”
    - Corrections and updates of data published in the Grasslands plan and minor changes to maps of management areas, recreation opportunities, or scenery management.
    - 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 Cibola National Forest and Grasslands 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 period following publication. After reviewing the comments received, the final correction may be similarly published and the Grasslands plan corrected.
- Site-specific Grasslands Plan Amendments: occur to allow specific projects or other activities to deviate from certain Grasslands plan direction. These amendments occur only for a specific area or a specific project. They do not lead to changes in Grasslands 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.
- Programmatic Grasslands Plan Amendments: change the text and language of the Grasslands plan decisions identified in the earlier section, “Plan Components,” 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.

Organization of the Plan Document

The plan document is organized to address the many social, economic, and ecologic resources and the goods and services of the Grasslands and their companion desired conditions, objectives, and guidelines (and in a few cases, standards) within several tiered, geographical scales. Plan components that apply to all plan areas are referred to as “Grasslands-wide” and are found in part 2 of this document. Following these broadly applicable plan components are ones that are unique to a specific management area. Part 3 of the document contains management direction specific to the Black Kettle and McClellan Creek Management Area, the Kiowa and Rita Blanca Management Area, and the Mills Canyon Management Area, under separate headings.

Part 4 of the document contains management direction for the two scenic byways, the Santa Fe National Historic Trail, and the Canadian Eligible Scenic River.

Part 5 of the document addresses suitability of the land within the management areas for various uses, i.e., grazing, recreation, and timber. Part 6 provides programmatic direction for monitoring and evaluating plan implementation.

Appendices to the plan document provide supporting information relevant to the plan components. Appendix A contains maps of management areas, vegetation types, special areas, recreation and scenic integrity classes, and the Mills Canyon surface occupancy restrictions.

Appendix B contains a synthesis of Southwestern Region climate change trends and potential strategies for responding to climate change. This synthesis and suggested strategies are available for managers to reference when attempting to understand how climate change factors might be currently influencing or may impact ecological and socioeconomic systems of the Grasslands.

Appendix C contains a list of proposed and probable actions that will likely take place on the Grasslands at the project or activity level to maintain or move toward achievement of the desired conditions described in this plan.

Appendix D contains references to other sources of information, including applicable laws, regulations, MOUs, and other guidance relevant to designing projects and activities to meet desired conditions.

Appendix E presents disturbance factors and ecological processes referred to within the desired condition statements.

Appendix F presents species' legal status and at-risk rankings.

Appendix G presents a table of common and Latin names used in the document.

Appendix H summarizes key resource benchmarks. Benchmarks are the minimum and maximum range of outputs within which management direction offered by the proposed plan is intended to fall. This appendix identifies those benchmarks from the 1985 plan that are relevant to the Grasslands. It also identifies the benchmarks from the 1985 plan that are not relevant to the Grasslands.

Part 2: Grasslands-wide Management Direction

This part of the plan identifies the background and description of the various goods, services, and ecological resources produced or present on the Grasslands and, more importantly, the desired conditions, objectives, guidelines, standards, and management approaches that are common to all Grasslands management areas (i.e., Grasslands-wide).

The reader is reminded that:

Where there are no explicitly stated objectives, guidelines or standards, or management approaches given, then none exist at the Grasslands-wide scale; however, they may occur within part 3 at the management area scale.

Appendix C contains a list of proposed and probable actions that will likely take place on the Grasslands at the project or activity level to accomplish objectives and to maintain or move toward achievement of the desired conditions described in this plan.

Scenery

Background and Description

The scenery and rural setting of the Grasslands strongly shapes the experience of visitors. The Grasslands are generally characterized by pastoral agricultural landscape, from the vast open Grasslands of the Kiowa and Rita Blanca to the rolling hills of the Black Kettle. Views from Grassland units often include homes, barns, tractors, trucks, windmills, cattle, stock tanks, fences, and other private ranchland features, in addition to some oil and gas wells. Grasslands residents are accustomed to viewing these structures and features and see them as a highly valued part of the traditional landscape. Many visitors also have a deep appreciation of the rural character of the plains grasslands landscapes. The presence of farms and ranches contributes to the "sense of place" or "cultural identity" that these areas provide for residents and visitors alike.

The Grasslands are divided into three levels of scenic integrity: high, moderate, and low.[1] These levels set objectives for the amount of variation from the desired landscape character[2] that is expected within the respective scenic integrity levels, according to Agriculture Handbook Number 701, "Landscape Aesthetics: A Handbook for Scenery Management" (See appendix A for maps of scenic integrity). It is of interest to note that some parcels classified as having high or moderate scenic integrity currently have oil or gas wells. These wells are generally non-Federal wells where mineral rights were claimed prior to Federal ownership.

The following scenery desired conditions describe the desired landscape character that may be very similar to the existing landscape described above.

[1] Scenic integrity is a measure of the degree to which a landscape is visually perceived to be "complete." Scenic integrity levels are determined by three factors: dominance, degree of deviation, and intactness (see glossary for further information).

[2] The desired landscape character is the appearance of the landscape to be retained or created over time, recognizing that the landscape is a dynamic and constantly changing community.

Desired Conditions

- Grasslands scenery is predominantly characterized by pastoral agricultural landscapes that include vast open grasslands and rolling hills. Views from Grassland units often include homes, barns, tractors, trucks, agricultural windmills, livestock, stock tanks, fences, and other private ranchland features which contribute to rural landscapes. Interpretive activities emphasize the value of scenic areas within the context of patchwork land uses and a fragmented land ownership pattern in and around the Grasslands.
- High scenic quality features enhance the enjoyment and marketability of the Grasslands' scenic resources.

Objective

- Within 15 years of plan approval, all existing structures on Federal mineral leases in areas of high scenic integrity closely follow the form, line, color, texture, and pattern common to the valued landscape character.

Guidelines

- In areas with high scenic integrity objectives, only minimal[3] alterations[4] from landscape character goals described in the desired conditions should be allowed.
- In areas with moderate scenic integrity objectives, only slight alterations should be allowed, which ensure that deviations remain visually subordinate to the landscape character.
- In areas with low scenic integrity objectives, only moderate alterations should be allowed.
- Constructed features and management activities in high and moderate scenic integrity areas should closely follow the form, line, color, texture, and pattern common to the valued landscape character so that they are not evident.
- Infrastructure from new energy or special uses developments on the Grasslands should have minimal visual impacts on developed recreation sites.
- In high and moderate scenic integrity areas and their foregrounds, structures over 40 feet in height should not be built, unless they are considered a part of the valued landscape character described in the desired conditions.

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

[4] Alterations are long-term alterations to the landscape and are not intended to restrict short-term impacts to scenery from construction, fire management, drilling rigs, or other short-term activities.

Management Approach

The districts may take scenic integrity and scenic quality thresholds into consideration during project planning and implementation so as not to exceed those thresholds for, and therefore disturbance of, scenic quality. In prairie grassland settings, protecting views to emphasize the vast horizon is important to the scenic integrity. It is the Grasslands' intent that the best environmental design practices be used in order to harmonize changes in the landscape and to advance environmentally sustainable design solutions.

Where non-Federal mineral rights occur under Federal lands, managers may work with owners/developers to achieve scenic integrity objectives for the area.

It is also the Grasslands' intent that where agricultural influences dominate, patterns and architectural features valued by nearby communities (such as agricultural windmills and other constructed features) be reflected in project design and mitigation. Similarly, where the scenic resources are predominantly natural appearing, projects may be designed and mitigated to harmonize with the natural setting in areas of high and moderate scenic integrity.

General Recreation

Background and Description

Providing for outdoor recreation activities is one of the primary contributors to social cohesion, quality of life, and social and economic sustainability for Grasslands communities. The most popular recreation activities on the Grasslands include hunting, fishing, camping, picnicking, bird and wildlife watching, boating, hiking, horseback riding, exploring historic sites, and driving to enjoy the unique scenery and open spaces (USDA Forest Service 1999, 2000, 2005). The recreation opportunity spectrum (ROS) provides 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 or grassland might be able to provide.

Desired Conditions

- Recreation settings on the Grasslands provide a range of experiences. In the most remote areas, visitors are close to nature and are provided with a high degree of challenge and risk along with a sense of isolation. In areas nearer to roads and communities, visitors are likely to encounter others, sometimes large social groups such as hunting camps or family gatherings. In these areas, there are also opportunities for motorized recreation as well as nonmotorized recreation such as hiking or horseback riding. Throughout the Grasslands, developments and recreation activities are compatible with the recreation opportunity spectrum, as shown in appendix A, maps, "Recreation Opportunity Spectrum Classes."
- To respond to the increased visitor interest in safely experiencing the unique natural and cultural qualities of the Grasslands, interpretive and educational services are provided. The products to respond to this interest include an integrated program of brochures, signs, exhibits, trails, staff or volunteer-led talks, and auto tours. Interpretive services include topics such as viewing wildlife and birds, learning about scattered prehistoric and historic sites, environmental ethics, or enhancing appreciation for the scenery of vast open prairie. In cooperation with partners and adjacent land

managers, interpretive services and trail systems with opportunities for exploring the Grassland environment are provided. Educational media regarding encouraging appropriate visitor behavior, stewardship, and practices for leaving natural and cultural resources in good condition are also available. Opportunities for enjoying special natural and cultural features are available and provide an enhanced recreational experience. Access is designed so that visitors do not degrade the features.

Figure 2. The Black Kettle Ranger District office is colocated with the National Park Service's Washita Battlefield National Historic Site office. The building features an interpretive museum where visitors can learn more of the history of the region.

Developed Recreation

Background and Description

The Black Kettle and McClellan Creek National Grasslands manage six developed recreation sites and the Kiowa and Rita Blanca National Grasslands manage five; all sites are open year-round. Most are easily accessible by passenger car; however, roads into Mills Canyon can be difficult and may require a high-clearance vehicle. Reconstruction upgrades have begun at all of the sites, with toilets and other facilities being brought up to current standards, including accessibility. Visitor use does not exceed the design capacity at these sites.[5] Under current management, the projected trend is for developed recreation sites on the Grasslands to continue to contribute to the quality of life for local residents and visitors, stimulate the local rural economy, and satisfy the public demand for a variety of developed recreation sites. Outdoor recreational activities on the Grasslands are very important to the local tourism economy; in 2002 generating 75 jobs, $1.2 million in direct income, and $3 million in indirect income for local businesses (UNM-BBER, 2005).

[5] They generally do not exceed 70 percent of the capacity except during hunting seasons.

Desired Conditions

- There is a spectrum of developed recreation opportunities characterized by varying levels of development and amenities appropriate to the setting. Recreation sites and settings vary in level of development, from small capacity sites with few amenities to larger sites with facilities designed to accommodate large group activities. Recreation sites include amenities such as picnic sites, camping sites for tents and recreational vehicles, and managed parking lots. The variety and locations of recreation sites and their associated amenities add to the satisfaction of users in their recreation experiences by providing a variety of quality opportunities. Activities at developed sites include family and social gatherings, special community events, hunting camps, fishing, and interpretive tourism, all of which are harmonious with their settings.
- Developed recreation sites are in harmony with respect to their natural setting and integrate natural and cultural elements of the surrounding area and local communities. These sites emphasize efficiency of energy and materials consumption in construction and operation.
- Resource and facility deterioration or damage is mitigated, and changes in recreational use are accommodated as appropriate within the ROS setting. Developed recreation sites meet current standards (including accessibility) and accommodate use trends where feasible. This includes accommodation for modern trailers and motor homes at larger campgrounds and turnarounds to accommodate changes in vehicle sizes where necessary. Other sites offer a more primitive experience, such as tent camping. Potable water systems that comply with all safety and sanitation requirements are available where the Agency determines they are appropriate.
- All developed sites, visitor focused administrative facilities, and interpretive services are accessible unless it would substantially detract from the natural or cultural features of the site. Facilities are routinely maintained to preserve their accessibility. Visitor contact areas within administrative facilities are fully accessible.

Figure 3. The Thompson Grove Picnic Ground (left) and the Lake McClellan Group Site (right) show the variation in size and experiences available on the Grasslands. Thompson Grove is a smaller developed site that provides a shady respite and solitude for individuals and small groups most of the time, with larger groups in the area during hunting season. The Lake McClellan group site offers an area and facilities for large numbers of visitors at one time.

Objective

- Complete 20 percent of condition surveys and update inventories of developed sites annually.

Guidelines

- Construction of new developed camping and picnic sites should not occur within ½ mile of wind energy structures or oil and gas developments.
- Construction of new developed interpretive sites that are not colocated with campgrounds or picnic areas should not be built within 300 feet of wind energy or oil and gas developments.
- Public safety and stewardship information should be posted at developed recreation sites (including rules and regulations on recreational activities).
- In order to minimize soil compaction and erosion, surfaced pads beneath picnic tables and on walkways should be included in campground and picnic area construction and reconstruction, using durable materials that can withstand heavy traffic.
- Maintenance, construction, and design of facilities should be consistent with the development scale appropriate to the ROS class and most recent version of "The Built Environment Image Guide for the National Forests and Grasslands" (BEIG).
- New construction and reconstruction should harmonize with the surrounding landscape. Agency guidance such as the BEIG should be used in the design process.

Management Approach

Changes in use trends (including amount of use that sites receive, locations' surroundings, and settings) may be considered when reconstruction occurs or when designing new sites. Determination of use change when updating developed recreation sites can be made through various scientific assessments (such as national visitor use monitoring and the National Survey on Recreation and the Environment) and through district observations, in order to be responsive to use patterns. For example, if recreational vehicle use increases, larger parking spurs might be considered. Recreation sites considered for reconstruction may be prioritized based on site conditions and may be updated or reconstructed as funding levels allow.

Recreation site overflow may be allowed during periods of high use in areas where the short-term nature of the use is not likely to result in long-term resource damage and the use is not in conflict with active Grassland closure orders. The Grasslands may cooperate with local partners and maintain cooperative agreements regarding campgrounds, picnic areas, and other developed recreation facilities. Assistance from partnerships, grants, agreements, or other methods may be utilized to provide quality developed recreation opportunities. The Grasslands may be an active participant in all cooperative interpretive initiatives, such as byway corridor plans. As new signs and printed materials are developed, the Forest Service may ensure that they follow guidelines for visual accessibility. The Grasslands may provide for multilingual interpretation and look for opportunities to partner with local schools. Forest Service or other official presence may increase at fee sites.

Review and complete handicapped accessibility assessments on all developed recreation sites and upgrade sites accordingly.

Dispersed Recreation

Background and Description

Day hiking, hunting, and primitive camping (which mostly occur in undeveloped sites that can be driven to) are the most frequent dispersed recreation activities of local residents near the Grasslands. The Black Kettle and McClellan Creek National Grasslands currently contain a total of about 13.7 miles of short, nonmotorized hiking trails around the major recreation sites, each of which is less than 2 miles in length. The mixed land ownership pattern constrains the size of public land parcels and limits opportunities for long trail hikes through the Grasslands. The 2.4-mile portion of the Santa Fe National Historic Trail on the Kiowa National Grassland is becoming more popular for hikers, even though it is maintained as a historic site rather than a trail. These trails provide a mix of day hiking opportunities, and some provide cultural, historical, or ecological information (interpretation) as well. Bird and other wildlife viewing and photography are developing into very popular activities on the Grasslands.

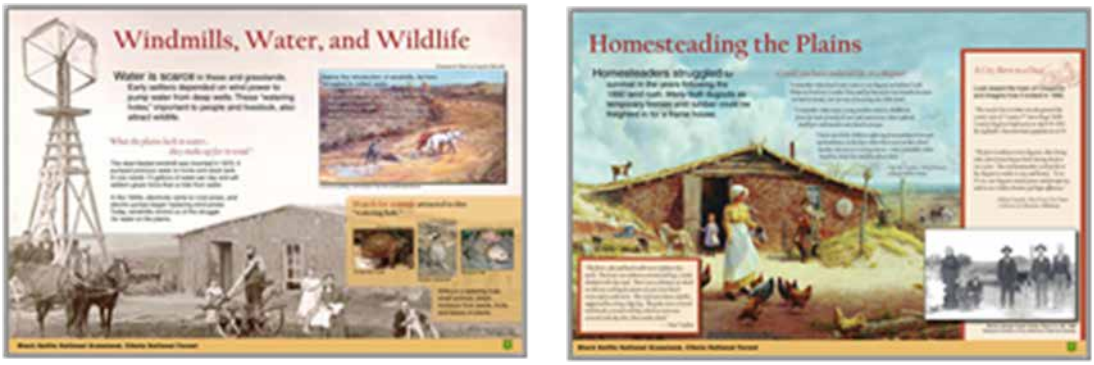

Figure 4. Black Kettle and McClellan Creek interpretive panels at the Black Kettle and McClellan Creek National Grasslands office.

Desired Conditions

- Dispersed recreation is maintained in a way that minimizes conflicts with other uses and facilitates compliance with the motor vehicle use map (MVUM) showing Grassland-specific restrictions. Camping and other site intensive recreation activities occur in areas where limited environmental impact occurs, where user conflict is minimized, and where safety concerns are alleviated, including in or near sites traditionally used for dispersed camping or related activities.
- Trails vary in length and challenge and connect up with other public or private lands. The design, construction, and maintenance of trails minimize damage to Grassland resources such as soil and water.
- The public has access to up-to-date information on uses and restrictions to help reduce potential conflicts. There is little vandalism, theft, illegal activity, or resource damage on the Grasslands from dispersed recreation activities.

Guidelines

- When closing or rehabilitating dispersed recreation sites due to resource conditions, native vegetation and natural barriers should be used. In addition, information should be posted to encourage public compliance in rehabilitation efforts.
- Property boundary signs should be posted a minimum of every half mile for newly constructed fences.
- On sites where dispersed recreation activities have contributed to bare mineral soil and accelerated erosion, impacts should be mitigated by redirecting use or rehabilitating the site to minimize erosion and offsite movement of soil.
- Dispersed camping should be restricted within 200 feet of historic sites, trailheads (except those trailheads with designated dispersed sites already in use), interpretive sites, or stock water.

Management Approach

Management strategies, such as limiting use in certain areas and emphasizing use in others or closing areas altogether, may be implemented when there is a need to respond to resource concerns, reduce user conflicts, or alleviate safety issues. Use of sites traditionally used for dispersed camping or related activities may minimize the need for disturbing additional areas.

The Grasslands may coordinate with partnering agencies or organizations at least annually and identify where new partnerships may exist to enable working with other landowners to expand hiking or other dispersed recreation opportunities, including interpretation.

Development of interpretive plans for each of the four grasslands may aid in achieving the desired conditions for dispersed recreation.

Motorized Recreation

Background and Description

The projected trend for the Grasslands is that demand for off-highway-vehicle (OHV) driving will continue to increase. The Grasslands may only be able to meet a portion of the demand for this activity due to the fragmented nature of Grasslands units and multiple-use management objectives. Some of the demand may need to be met on other private and public lands in the surrounding area.

Desired Conditions

- The designated road and trail system accommodates various classes of motor vehicles. The system provides a safe experience that minimizes impacts to soil, water, vegetation, wildlife, scenic, and heritage resources.
- Opportunities for OHV use occur where the motor vehicle use map (MVUM) shows designated roads, trails, and areas. The designated system reduces the impact of roads and trails to resource values by prohibiting unauthorized road and trail development and correcting or mitigating poorly located system roads and trails. Motor vehicle use

is especially limited in areas that provide outstanding nonmotorized recreation opportunities, such as in Mills Canyon and the Santa Fe National Historic Trail corridor. Where OHV opportunities are provided, routes occur in areas where natural resource impacts can be minimized. Conflicts with other uses are minimized. A range of experiences and challenge levels appropriate for the level of recreation opportunity spectrum exists, particularly in areas designated as roaded natural, rural, and semiprimitive motorized.

Objectives

Within 15 years of plan approval:

- Rehabilitate all unauthorized routes and decommissioned roads, where resource damage is occurring and as funds are available.
- Close or reconstruct all routes that are identified as having health and safety issues.

Figure 5. McClellan Creek Recreation Area has opportunities for motorized recreation visitors to ride on a designated system of trails.

Guidelines

- Motorized vehicles should be restricted from dry washes, creek draws, and dry swales to protect vegetation except at designated crossings.
- Motorized vehicles should be restricted from riparian areas to protect vegetation, water quality, and streambanks.
- When found to impact listed species, i.e. State and Federal threatened and endangered species, management indicator species (MIS), and Region 3 Grasslands sensitive species, existing road routes should be evaluated for closure to protect important species habitats; alternative travel routes should be developed where feasible that do not impact listed species.

Nature-Based Tourism

Background and Description

The Black Kettle and McClellan Creek National Grasslands have worked with partners to add unique nature-based tourism areas with interpretive nature trails that are popular with youth groups, schoolchildren, and wildlife and bird enthusiasts. The Kiowa and Rita Blanca National Grasslands have had two important bird areas (IBAs) identified by the National Audubon Society: Sauz Creek and Perico Creek. These sites provide important habitat to many bird species and are attractive areas for birders to visit. It is projected that as demand for wildlife viewing and birding increases, more interpretive sites may be needed in order to meet that demand.

Desired Conditions

- Opportunities for nature-based tourism are provided that emphasize particular Grassland areas or features such as playa lakes, bird watching and other wildlife viewing, and photography.
- Interpretive sites, nature trails, and outdoor classrooms for youth groups, schoolchildren, wildlife watchers, and bird enthusiasts are developed. Auto tour routes, developed recreation sites, and district offices provide interpretive media and programs that contribute to enhancing the overall tourism experience.

Objectives

- Offer annually one offsite educational/enrichment product such as classroom programs, publications, and field trips.
- Within 15 years of plan approval, create and maintain two to six stand-alone signs and interpretive materials outside of district offices or other community places to give off-hours tourists access to Grasslands information.

Management Approach

The Grasslands may participate with other agencies and nongovernmental organizations in planning for scenic byway corridors, important bird areas and bird trails, and watchable wildlife stations, in encouraging youth participation in natural resources, and in other special area and unique feature programs.

The Grasslands may respond to and interact with groups requesting interpretive services. Opportunities for tribal participation in resource conservation may be developed. The Grasslands will continue to collaborate with the National Park Service in providing interpretive services and facilities for the visitor center at the Washita Battlefield National Historic Site. Efforts to work with local museums to develop and supply interpretive information will continue. The Grasslands may also remain engaged in state planning for auto tour routes to ensure promotion of Grasslands visitation.

Heritage Resources

Background and Description

Many heritage resources that represent American Indian, Hispanic, and European Americans' adaptations to the high plains can be found on the Grasslands. Heritage resource sites include a 2.4-mile section of the historic Santa Fe National Historic Trail and the Mills Orchard and Ranch Site, a historic property on the New Mexico State Register of Cultural Properties. Activities protecting and mitigating impacts to heritage resources are well covered by existing law, regulation, and policy. However, the Grasslands also take proactive approaches to management of heritage resources which are strategically important for managing preservation, public education, and tribal uses.

Desired Conditions

Interpretation and Public Involvement

- Interpretive sites such as the Mills Canyon Orchard Ranch and Santa Fe Trail provide meaningful heritage experiences that help the public develop an appreciation and understanding of the human history of the southern Great Plains.
- Opportunities are provided for both visitor and local volunteers to participate in heritage resource preservation activities such as site rehabilitation and stabilization, and the Grasslands are more thoroughly experienced through these conservation projects.

Figure 6. Stabilization of Mills Orchard and Ranch Site. On the left is a historic photograph of the Mills Orchard and Ranch Site in Mills Canyon Management Area. Cooperative stabilization projects such as those shown in the right photograph use historically appropriate native materials and preserve the remaining standing structures.

Tribal Uses and Access

- The tribes have access to areas that provide them an opportunity to practice traditional activities (such as plant gathering) and other ceremonial activities that are essential in maintaining their cultural identity and continuity of their culture.

- Agency and public land use activities on the Grasslands are not causing damage to historic properties and places of religious and cultural significance or impacting tribal access to and use of those properties.

Stabilization

- All of the priority heritage resource sites[6] are stable and their significant values are protected.
- Vandalism, theft, and human-caused damage to heritage resources are rare due to enhanced public education and stewardship, presence of interpretive signs, and management control features that are installed or constructed near the most susceptible and significant heritage resource sites. Site significance and integrity are maintained through conservation and preservation efforts and receive minimal, if any, impact from visitors.

Objectives

- Complete one heritage resource project that involves the public every 5 to 10 years on either Grassland.
- Offer annually one offsite educational/enrichment product (such as classroom programs, heritage celebrations, publications, and field trips) on either Grassland.
- Stabilize one viable homestead site, other than the Mills Orchard Ranch site, within 5 years of plan approval on either Grassland.

Guideline

- Preservation and rehabilitation techniques should be implemented to current industry standards.
- Ground-disturbing activities should be avoided within 500 feet of sites that are listed or eligible for inclusion on the National Register of Historic Places.

Management Approach

A cultural resources overview for each Grassland may be created as funding and staffing allows.

Determine eligibilities for unevaluated archaeological sites on each Grassland as funding and staffing allows.

[6] Priority heritage assets (PHAs) are listed by the forest and grasslands for purposes of maintenance and reporting.

Roads and Access

Background and Description

The Kiowa and Rita Blanca National Grasslands have approximately 492 miles of inventoried roads,[7] while the Black Kettle and McClellan Creek National Grasslands contain roughly 119 miles of inventoried roads (USDA Forest Service 2006 and 2007). The majority of roads in Grassland units are unsurfaced roads suitable for high-clearance vehicles; their major contribution to the road network is to provide access to Grasslands units. Road density on the Grasslands has remained relatively stable on the Black Kettle and McClellan Creek National Grasslands where off-road driving is prohibited, but has substantially increased on the Kiowa and Rita Blanca National Grasslands due to the increase in off-highway-vehicle (OHV) use and user-created roads.

Many Grassland units on the Black Kettle and McClellan Creek National Grasslands and on the Kiowa and Rita Blanca National Grasslands are only accessible by crossing private lands. While many landowners allow access to Federal lands without impediment, some do not. To date, the Forest Service has not pursued legal easements, and this remains an important issue for the Grasslands.

Desired Condition

- Grasslands units are accessible for public enjoyment and resource management purposes, either through public road access or by privately owned roads with legal rights-of-way. Legal easements or land exchanges provide access to Grassland units surrounded by private land (also see the "Land Adjustments" section). Conversely, access to private land through Grasslands units is available when necessary. The public is aware of the considerations for driving on grazing allotments, such as appropriate behavior around livestock and correct closing of gates. Routes are maintained according to their road management objectives. Decommissioned routes are rehabilitated and physical barriers prevent inappropriate access.

Objectives

Within 15 years of plan approval:

- Maintain 10 percent of ownership boundary signing annually and when fences are reconstructed.
- Acquire legal access to four to six isolated Grasslands units, as opportunities arise.
- Pursue decommissioning of all roads no longer needed for the administration of National Forest System lands.
- Complete road management objectives (RMOs) for all NFS roads on the Grasslands.

[7] Inventoried roads include roads identified in the Cibola National Forest INFRA roads database, which includes roads constructed or authorized for construction by the Forest Service, roads that existed before Forest Service management of the Grasslands, and unauthorized roads or vehicle tracks that were found on the ground and added as "system" roads in this database. Inventoried roads have undergone analysis to create a "designated system" of motorized roads and trails, in accordance with the 2005 Travel Management Rule.

Guidelines

- Road features should be constructed or modified in accordance with the established RMOs for the road.
- When decommissioning roads, the methods used should be commensurate with the effort required to be effective.
- Roads should be designed, constructed, and maintained in a manner consistent with established best management practices (BMPs).[8]

Management Approach

The Grasslands may engage in cooperative agreements with local government transportation departments or other organizations when and where feasible to provide road maintenance. They may also pursue reciprocal easements for acquiring access.

Potential decommissioning methods appropriate for use on the Grasslands may include:

- Reclamation through reestablishment of vegetation;
- Removal of artificial structures such as cattle guards, gates, culverts, and bridges;
- Decompaction of road surface and ditches, to promote water infiltration and root growth for vegetation;
- Outsloping or ditching where necessary to ensure adequate surface drainage;
- Reshaping of draws to their original state to reestablish natural drainage patterns;
- Seeding and fertilizing disturbed ground to establish temporary cover to protect soil from erosion;
- Recontouring of the hillside to reestablish original slopes, thus restoring natural drainage patterns; and
- Individual site conditions may indicate that some combination of these decommissioning methods may be appropriate. Site conditions may also warrant the placement of some type of barrier, preferably a natural barrier such as boulders or fallen trees, to temporarily prevent motorized access on the decommissioned road until adequate vegetation has been established.

Land Adjustments

Background and Description

Within each of the four designated grasslands are small, noncontiguous parcels of Forest Service managed land that came into Federal ownership as homesteads were abandoned after the Dust Bowl. These parcels are surrounded mostly by private farm and ranch lands. The fragmented ownership pattern within the administrative boundaries consists of less than 24 percent federally managed land and approximately 75 percent in other ownership.

[8] Current BMPs are those found in the Region 3 Supplement to FSH 2509.22 and Office of Wetlands, Oceans, and Watersheds BMPs for Roadways (online at http://www.epa.gov/owow/nps/roadshwys.html). These are subject to change as better BMPs are identified by regional and forest engineering staffs.

Desired Conditions

- Lands acquired from willing sellers have qualities that improve the Agency's ability to carry out its mission on the Grasslands. The location or condition of the parcel being acquired contributes to the consolidation of the ownership pattern of the Grasslands; provides necessary road or trail access to National Forest System (NFS) lands; has unique or high quality natural or cultural resources; improves the management of a designated special area; contains important plant or animal habitats; contains or influences wetlands, flood plains, or riparian areas; or provides opportunities to rehabilitate or stabilize adjacent NFS land.
- Grasslands units available for exchange or purchase are generally isolated parcels and lack unique natural and cultural resources.

Minerals and Energy Development

Background and Description

Development of the oil and gas resource is an important economic activity for the region. In 2008, there were 37 active oil/gas wells on the Black Kettle and McClellan Creek National Grasslands (none on the Kiowa or Rita Blanca National Grasslands) (UNM-BBER 2005). Geologic analyses recently completed indicate that while there may be increases in the number of oil/gas wells on the Black Kettle for a few more years, oil/gas development in the area is expected to decline over the next 20 to 50 years as the wells lose productivity. However, in 2002, gas and oil extraction generated 79 jobs, $3.5 million in direct income, and $11 million on the final value of products from the industry (UNM-BBER, 2005). There is increasing potential for economically viable oil or gas development on the Kiowa and Rita Blanca National Grasslands as energy prices rise.

Since 1997, all new leases have had as a stipulation that closed-loop systems be used for all oil and gas drilling.

Desired Conditions

- Development of the oil and gas resource minimizes impacts to other resources, whenever possible. Oil and gas drilling sites are in compliance with their surface use plan of operation, application for permit to drill, conditions of approval, and best management practices. Erosion control measures prevent excessive erosion from occurring offsite. Roads are the minimum width necessary for safety and site protection.
- Retired oil and gas development sites resemble their predevelopment condition. Aboveground facilities that support resource management may remain after site rehabilitation. Associated infrastructure (such as fences, cattle guards, or roads) are retained or modified for resource management purposes when desirable.
- The Grasslands provide common minerals that are extracted for a public benefit without substantial harm to natural and cultural resources.

Figure 7. This photograph shows a well-designed and well-managed oil and gas pad in the production phase. The site has berms and gravel, which mitigate for erosion and spills. It is fenced and clearly marked for public safety. Site-specific elements used to meet the desired conditions may vary depending on site conditions and other factors.

Figure 8. This photo shows a successfully rehabilitated oil and gas pad. Some constructed features remain onsite to facilitate natural resource management, but most features have been removed and the site has been revegetated.

Objectives

- Of the oil and gas sites, 100 percent are rehabilitated to surface use plan of operations specifications within 1 to 3 years of the date the site goes out of production.

- Of the common variety mineral extraction sites, 100 percent are rehabilitated to surface use plan of operations specifications within 1 to 3 years of final excavations.

Guidelines

- Access roads to energy development sites should be crowned and hard surfaced (as a condition of approval at the time of a new application for permit to drill), and rolling dips should be used for drainage to mitigate erosion due to high use by heavy equipment. [9]
- Stockpiling of surface material for rehabilitation of oil and gas and common mineral extraction sites should be employed unless safety and/or logistical constraints prohibit.
- Where conditions require recontouring, mineral and energy development permit holders should recontour sites to the natural slope and grade of the surrounding landscape after production has stopped and permitted structures have been removed. Where the conditions do not necessitate recontouring, the permit holder should mitigate erosion concerns.
- The reclamation process should be initiated, where necessary, within 60 days of notification by the BLM that a well is out of production.

Standards for Oil and Gas Leasing[10]

Controlled Surface Use

- A closed-loop drilling system will be used for all oil and gas drilling. No open pits will be allowed.
- For Federal leases, all drilling fluids and drill cuttings shall be removed from the Grasslands and disposed of in an approved landfill.
- Mitigation for non-Federal minerals development on the Grasslands will meet best management practices.

No Surface Occupancy

- No surface occupancy is allowed within the boundaries of heritage resource sites that have been listed or determined eligible for inclusion on the National Register of Historic Places or whose eligibility remains undetermined. The minimum distance for surface occupancy will vary depending on the nature and setting of the site, and will be determined during site-specific analysis.
- No surface occupancy is allowed within 300 feet of riparian areas or wetlands, as determined by Grassland staff, and/or by onsite inspection by the Grassland authorized officer, and/or where the Forest's terrestrial ecosystem survey and vegetation data

[9] This guideline also applies to alternative energy developments such as wind farms.

[10] Except as noted, these standards only apply to leases issued after August 26, 2008. Leases issued prior to that date will use the stipulations in their lease.

indicate riparian or wetland conditions (hydrology, hydrophytic plants, hydric soil), including active flood plains.

- No surface occupancy is allowed in developed campgrounds, picnic grounds, recreational loading/unloading ramps, recreational buildings, shelters, and all other developed recreational facilities and interpretive sites.

Management Approach

Forest sensitive species rare plant surveys may be completed prior to issuing permits for removal of road building materials or for other ground-disturbing activities at Greenhorn limestone outcrops, and mining should not take place if rare plants are found.

Minerals and energy development managers should take note of the guidelines in the "Scenery" section of this plan, in particular, when designing projects.

Special Forest Products

Background and Description

The Grasslands provide firewood for personal and commercial uses from thinning operations in pinyon-juniper woodlands and through removal of black locust or other invasive and nonnative trees. The thinning and tree removal practices are designed to move the ecosystems closer to historical fuel loads, lessen the risk of uncharacteristic wildfire, control invasive tree species, and/or to increase the diversity and abundance of understory vegetation. The public demand for wood from the Grasslands is generally low. The supply of products made available from restoration projects typically exceeds demand.

Desired Conditions

- The Grasslands provide forest products such as posts and poles, firewood, grasses, and wildlings (e.g., nuts, cones, mushrooms, herbs, and transplants) within the capability of the land to produce these goods or as a means to remove invasive tree material (e.g., black locust or eastern red cedar). Silvicultural treatments mimic natural disturbance regimes and contribute to ecosystem sustainability.
- Forest products are available through either personal use permits or commercial sales.

Objective

- Forest products are offered to the public from control treatment on 1,000 to 2,000 acres of invasive tree species within the first 10 years after plan approval.

Guidelines

- Individual firewood permits for personal use should be limited to the amounts typically needed for domestic household use (12 cords) in a year's time if the firewood resource is limited.

- Firewood and other personal use forest products harvested to accomplish silvicultural improvement on the Grasslands should be offered for free when charge permits are not practical.

Management Approach

Managers recognize the rights of tribes to collect forest products for noncommercial traditional and cultural purposes.

Special Uses

Background and Description

Special use permits authorize services that support the Forest Service mission and meet the needs of the public. These permits are a partnership between the Forest Service and private businesses and individuals to provide services and facilities, such as recreation opportunities and infrastructure. In particular, the construction and use of utilities supporting rural residences and industry are part of the Grasslands contribution to economic growth and sustainability. Over half of the special use permits on the Black Kettle and McClellan Creek National Grasslands are related to oil and gas operations, and most permits on the Kiowa and Rita Blanca National Grasslands are for power lines and road easements. Direction regarding utility corridors and electronic sites is carried forward from the 1985 plan. There are also several research projects on the Grasslands, conducted by universities and other research institutes, which are authorized by special use permit. It is projected that the development of oil and gas and wind energy in the region may result in more requests for utility and pipeline special use permits.

Desired Conditions

- Activities authorized by special use permits provide goods and services that increase the public's enjoyment of the Grasslands and support nearby communities. Special use permits comply with Agency standards.
- Utility lines and other permitted infrastructure have minimal impacts on the scenic resources of the area by harmonizing with the landscape. Large vertical structures do not dominate the views from high scenic integrity areas and developed recreation sites.
- Research permitted on the Grasslands is focused on improving the general scientific understanding of natural and social systems. Research on the Grasslands does not negatively impact long-term vegetation structure and composition and does not introduce new invasive plants or animals.
- The location of new, large linear infrastructure such as power lines has minimal effects on wildlife and minimizes habitat fragmentation.
- The screening process for special use permits is available and understandable to the public.

Guidelines

- New utility construction and reconstruction of existing utility lines should use existing rights-of-way to the extent practical to provide utility access to private land.
- Ground-disturbing activities associated with new utility construction and reconstruction of existing utility lines should be avoided within 500 feet of sites eligible for the National Register of Historic Places.
- Raptor protection guidelines should be referenced and followed during construction and maintenance of power lines, wind energy, and communication sites.

Figure 9. Harmonizing infrastructures with the surrounding landscape. The Santa Fe National Historic Trail is a high scenic integrity area. The power line on the horizon is beyond the foreground of the trail and blends into the surroundings because of its neutral. nonreflective color, location, and distance from the site.

Wind Energy Development

Background and Description

Northeast New Mexico and the Texas and Oklahoma panhandles are all considered areas of high potential for wind energy generation. Several power transmission and wind energy development companies were beginning to work toward developing these areas in 2009.

Desired Condition

- The Grasslands support alternative energy production and facilitate their development while mitigating impacts to resources and values. Wind energy developments are

designed to minimize impacts to other uses and resources, in particular wildlife and scenic integrity.

Guidelines

- New utility construction and reconstruction of existing utility lines should use existing rights-of-way to the extent practical to provide utility access to private land.
- Ground-disturbing activities associated with wind energy development should be avoided within 500 feet of eligible National Historic Register sites.

Wind turbines should not be located within:

- One-half mile of developed recreation sites,
- Active prairie dog colonies, or
- One-half mile of local airport approach and departure flight paths.

Livestock Use

Background and Description

Large ungulate (bison, deer, elk, pronghorn, cattle) herbivory and animal impacts have long been factors in affecting the vegetative composition and structure of the southern Great Plains ecosystem. Most native plants have adapted to a combination of fire and grazing disturbance. Livestock use increases root production and water infiltration and absorption when it is properly managed. Prescribed livestock use successfully manipulates vegetation, riparian, and wildlife habitats and is used to target and control unwanted nonnative species on the landscape.

Over 96 percent of the Grasslands is used by permit holders to graze their cattle, excluding the areas where developed recreation, administrative, research sites, and exclosures designed to protect resource values are designated. There is no indication that there will be a major increase or decrease in grazing on the Grasslands over the next 20 years; however, cattle numbers and strategies are expected to continue to fluctuate in response to drought, wildfire, prescribed fire, and other factors that change range conditions. Grazing on the Grasslands contributes to the rural ranching lifestyle, culture, and economy while promoting ecosystem sustainability and trends toward reference conditions.

In 2002, livestock grazing on the Grasslands generated 106 jobs, $1.6 million indirect income, and $10 million on the final value of products from the industry (UNM-BBER 2005).

Desired Conditions

- The Grasslands contribute to local economies by offering livestock grazing permits and demonstrating grassland agriculture. By supporting ranches as working landscapes, the Grasslands contribute to preserving large areas of open space and preserving the rural and cultural heritage of the southern Great Plains.
- Livestock use provides for conditions that support the sustainability of diverse, healthy herbaceous and woody plant communities and animal populations (see “Vegetation Desired Conditions”).

- Wetlands do not suffer from trampling and compaction or excessive sediment deposition.

Guidelines

- Salting or mineral supplementation should not occur on or adjacent to known populations of rare plant species, unsatisfactory soils, watercourses, or wetlands.
- Permitted grazing should allow for residual ground cover levels to provide for plant physiological needs, soil protection, wildlife habitat, and vegetation desired conditions.

Management Approach

Livestock may be used to reduce fuels where feasible.

Where feasible and where congruent with water law, livestock water sources may be made available in upland areas to better manage impacts to soil, water, and vegetation resources.

Wildland-Urban Interface and Wildland Fire

Background and Description

Increasing development in the wildland-urban interface (WUI) is putting property, natural and cultural resources, and possibly lives at risk because of the potential for uncharacteristic wildfire. Current national, regional, and Cibola National Forest and National Grasslands strategic direction guides the Grasslands to reduce the wildfire hazard to and from communities and to natural resources.

The 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, 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 (FSM 5140 R3 Supplement).

Wildland fire includes both planned and unplanned ignitions. Amendment 4 to the 1985 Cibola National Forest plan provided direction for the use of planned and unplanned ignitions for the objectives of protection and/or resource benefits. That direction is carried forward here.

Desired Conditions

- As a result of Grasslands management, most wildland fires in WUI areas are low to mixed severity surface fires resulting in limited loss of structures or ecosystem functions.
- Visitors and residents within WUI areas are knowledgeable regarding wildfire protection of their homes and property, defensible spaces, and appropriate uses of the Grasslands.

- WUI areas are accessible and provide a safe fire suppression environment.

Objective

- Annually treat by mechanical methods, thinning, with planned ignitions or other means 2,000 to 3,000 acres in WUI areas to reduce fire hazard to communities and the Grasslands.

Standard for WUI and Wildland Fire

Response to unplanned ignitions shall be to meet either protection or resource objectives.

Guidelines for WUI and Wildland Fire

- Response to unplanned ignitions that cross jurisdictional boundaries should be coordinated and managed to meet the responsible agency's objectives.
- Planned ignitions should create conditions that enable future unplanned ignitions to mimic their historical role or to serve as a tool to achieve resource objectives.

General Ecological

Terrestrial and Aquatic

Background and Description

All the vegetation types found on the Grasslands are in low departure from reference condition for structure and occur on a diverse landscape where species composition and structure are determined by climate, elevation, landform, slope, and soil properties.

Aquatic habitat on the Grasslands is in an altered state from historical conditions. The Canadian River upstream of the Grasslands has been diverted for agricultural and domestic use purposes leaving areas such as Mills Canyon with diminished flows. Post Dust Bowl era watershed erosion reduction programs created areas of impounded water that produced lake and pond aquatic resources not available historically.

Desired Conditions

- Native ecosystems are present and sustainable across the Grasslands and are able to support a full complement of native species. There is a natural and nearly complete assemblage of native plants and animals, including important game species, distributed across the Grasslands.
- Natural corridors link habitats within Grassland units. Terrestrial ecosystems are resilient to disturbance and tolerate the effects of, and therefore benefit from, wildland fire in a near natural fire regime. Natural processes occur within the vegetative communities that enhance species richness and diversity.
- All natural aquatic habitats benefit and encourage populations of native species. Native species persist or become reestablished. Aquatic habitat for Conchas crayfish, Arkansas

River shiner, sucker-mouth minnow, arid land ribbon snake, and plains leopard frog is sustained.

- Forage use by grazing ungulates contributes to a diversity of healthy herbaceous and woody plant communities and supports continued viability of wildlife populations.

Guidelines

- Native seed mixes and plant species should be used for rehabilitation of sites, except in developed recreation sites, where nonreproducing, nonnative trees may be used to enhance shade and other aspects of the recreation experience.
- All successional stages of vegetation necessary to meet habitat requirements of management indicator species should be provided.
- Activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from approved recovery plans.

Management Approach

Because new scientific knowledge is continually considered in Grasslands management, managers are up-to-date in their understanding of resource management and effectively apply science-based strategies and techniques as staffing and budgets allow. Planned fire activities may be coordinated with state agencies, Federal agencies, and private landowners to achieve landscape scale objectives.

Climate Change

Background and Description

The climate of the Grasslands is very complex. Climate variability is the norm within this region, as temperature and precipitation fluctuate on time scales ranging from seasons to decades. Historically, the southern Great Plains experienced periods of short and long-term drought and other extreme weather events.

Climate scientists agree that average air temperatures across the globe are rising (IPCC 2007), and it is anticipated that continued warming will accentuate or exacerbate interactions among ecosystem components. For example, observed temperature increases across the western U.S. have been linked to increases in fire season length and severity, increases in total area burned, decreases in air quality, and the creation of new fire regimes (Forest Service 2009).

There is general agreement among climate modelers that by the end of the 21st century, the southern Great Plains are likely to experience (Forest Service 2010):

- Temperature increases of 5 to 8 degrees Fahrenheit (or about 0.5 °F per decade on average).
- An increase in the number of hot days, with summer heat waves lasting 2 weeks or longer.

- A 5 percent drop in precipitation in most of New Mexico, but wetter in other areas of the southern Great Plains.
- An increase in extreme flood events following an overall increase in tropical storms.

Climate may influence the distribution and abundance of plant and animal species through changes in resource availability, species productivity, and survivorship. Potential and likely ecological implications of climate change trends in the southern Great Plains are:

- More extreme disturbance events, including wildfires, flash floods, and damaging wind events (Swetnam, et al. 1999).
- Greater vulnerability of ecosystems to invasive species, including insects, plants, fungi, and vertebrates (Joyce et al. 2007).
- Long-term shifts in vegetation patterns (Westerling et al. 2006; Millar et al. 2007).
- Effects on biodiversity and wildlife populations and their distribution, viability, and migration patterns.

The following condition is desired to assist with building ecosystem resilience and capacity for plant and animal communities to withstand expected changes imposed by future climate trends for the Grasslands.

Desired Condition for Ecosystem Resilience to Climate Change

- Grasslands ecosystems are resilient to changing natural disturbance regimes as a result of climate change (e.g., drought, wind, fire, insects, and pathogens), allowing for shifting of terrestrial and aquatic plant communities, and associated habitats across the landscape.

Management Approach

Habitat management practices on the Grasslands are adaptive, adjusting to resource conditions and climate change[11], and such practices contribute to species sustainability based on the land's suitability and capability.

Soil, Water, Air

Soil

Background and Description

The loss of topsoil and productivity during the Dust Bowl era was extreme on what are now the Grasslands. Restoration management practices on the Grasslands over the past several decades have resulted in tremendous improvement in soil stability and vegetative recovery. A few units on the Black Kettle National Grassland were heavily plowed in the past, and some units on the Kiowa and Rita Blanca National Grasslands were extensively cultivated. These units do not appear capable of recovering to their productivity potential, although the soils are grass covered

[11] The state of knowledge needed to deal with climate change at the Grassland scale is evolving. Most global climate models are not yet precise enough to apply to land management at the ecoregional or Grassland scale. This limits regional and Grassland specific analysis of potential effects of climate change (see appendix B).

and stabilized. These soils are not likely to be restored to full productivity with native species composition and structure.

Authorized activities on the Grasslands units that contribute to a long-term loss of soil productivity include recreation developments, oil-gas operations, roads, caliche extraction pits, and water developments. These constitute small, localized areas scattered across large landscapes. After authorized activities are completed, the Forest Service requires the disturbed acreage to be rehabilitated to restore soil productivity.

When conducted as planned, prescribed burns do not typically pose a risk to sustaining soil conditions. Prescribed burns are ignited under very specific weather and fuel moisture conditions so that grass will reemerge more quickly than it does after a typical wildfire event. The faster green up results in less wind-driven soil erosion. In addition, prescribed burns reduce the fuel loads so that subsequent wildfires that burn through those areas do not burn as hot or cause as much soil damage.

The only public land use activity causing unacceptable impacts to soil conditions is the unmanaged motorized vehicle use and the resulting unauthorized roads and trails this off-road driving creates. This use has resulted in degraded soil conditions and a loss of soil productivity, particularly in Mills Canyon.

Desired Condition

- Soil conditions are satisfactory on the Grasslands. Areas with above natural levels of soil loss[12] rarely occur or are stabilized in the long term, with the exception of prairie dog towns.

Guidelines

- Soil-disturbing activities should be designed to prevent sediment discharge into streams, lakes, and/or wetlands, and to prevent soil loss.
- Restoration and rehabilitation of soil stability on construction sites should begin after authorized activities are completed.
- Site specific mitigations should be developed according to FSH 2509.22.
- Management activities that occur on unsatisfactory or impaired soils should incorporate practical opportunities for restoration to recover soil functions.
- Where gully erosion is occurring more than what naturally would occur, appropriate methods such as spreader dams should be used.

[12] A soil loss rate exceeding the predicted natural soil loss potential is a natural state for some soils (shortgrass and mixed-grass prairie). Small, localized areas may exceed the tolerable soil loss rate (the rate of soil loss that can occur while sustaining inherent soil productivity); these areas are associated with roads, off-road vehicles, areas where livestock congregate, recreation, oil and gas developments, and caliche extraction pits.

Water, Watershed, Perennial Streams, Reservoirs, Lakes, Wetlands, Ponds, and Playa Lakes

Background and Description

Creeks and rivers do not represent a large area on the Grasslands because of their linear shape and because ownership of Grasslands units is fragmented. The following surface water and riparian vegetation occurs on the Grasslands units, and additional water and riparian resources occur on adjacent private and state lands (based on TEUI data):

- 33 miles of perennial, mostly year-round streams, with 60 percent on the Kiowa and Rita Blanca National Grasslands and 40 percent on the Black Kettle and McClellan Creek National Grasslands.
- 5,003 acres of riparian area adjacent to creeks, rivers, reservoirs, and lakes.
- 1,300 acres of water in reservoirs, lakes, ponds, and rivers at normal pool levels.

Water quality conditions were extremely degraded during and immediately following the Dust Bowl era. These conditions have been dramatically improved by constructing erosion and flood control structures within watercourses and intentionally minimizing or avoiding any adverse effects from Grassland management activities. Recreation activities occurring adjacent to reservoirs, lakes, and ponds do cause some minor erosion and contribute some sediment into those impoundments. Roads contribute some sediment into streams. Typically, grazing activities are managed to limit erosion and trampling along perennial streams, but watering of livestock does contribute some sediment into waterways.

Most water developments, particularly on the Kiowa and Rita Blanca National Grasslands, rely on groundwater. Many of the wells on the Kiowa and Rita Blanca are drying or diminishing in their capacity due to aquifer depletion.

Wetlands[13] form and are supported by hydrological process in areas where the water table intersects the ground surface. The Grasslands water table fluctuates seasonally and annually, and is also subject to long-term fluctuations that vary with local climatic conditions. Wetland vegetation is obligate[14] to wetlands compared to the surrounding upland vegetation and is dominated by persistent plants that remain standing from one year to the next. Vegetation includes emergent, soft-stemmed aquatic plants such as arrowheads, cattails, and reeds. Grass and sedge species are present. The prediction of a warmer and drier climate in the Kiowa and Rita Blanca Management Area may further reduce the quality of wetlands that provide habitat for resident and migratory waterfowl and associated mammals, reptiles, and amphibians.

The wildlife associated with rivers, perennial streams, reservoirs, lakes, wetlands, ponds, and playa lakes includes the following: suckermouth minnow; Conchas crayfish; Rio Grande chub; Arkansas River shiner; interior least tern; White-faced Ibis; Bald Eagle; largemouth bass; Plains leopard frog; and ambersnail.

[13] Wetlands on the Grasslands are defined by the Cowardin classification of wetlands as palustrine (P) with emergent vegetation (EM), unconsolidated shore (US), or open water (OW) with variable presence of water and variable flooding.

[14] Obligate riparian plants are defined as those plant species found almost exclusively in wetlands or riparian areas.

Desired Conditions

- Watersheds are in Class I condition[15]. These watersheds meet water quality standards and support designated uses. Watersheds are characterized by high infiltration rates, low soil compaction, and minimal overland flow. Within the capability of the Grasslands, streams, springs, playa lakes, wetlands, and aquifers sustain water quantity and quality. Springs, wetlands, streams, and lakes are at proper functioning condition[16], and streams and lakes exhibiting unacceptable bank erosion are healed or healing. The miles of roads or trails contributing to increased sediment load are minimized.
- In perennial riverine habitats, native woody and herbaceous vegetation provide streambank stabilization and channel stability (such as bank cover and stream shading). Fluvial processes and flooding regimes sustain riparian and aquatic wildlife and plant species across the Grasslands. Sediment input to streams due to human activities (e.g., road building, recreation, mineral/gas exploration, firewood harvest, and riparian grazing) is minimized.
- The wetlands are well vegetated with soft stemmed aquatic plants such as cattails, arrowheads, reeds, grasses, sedges, and vascular emergent wetland species that can survive in saturated soil conditions. The surface water area and associated water table are within normal seasonal and annual variability. These areas provide important habitat for native aquatic species and provide a water source that supports species rich bird, wildlife, and invertebrate populations.

For both herbaceous and woody riparian areas, stream characteristics (including vegetation, woody debris, geomorphology, and hydrology) are sufficient to:

- Dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality.
- Capture and store sediment and aid in vertical channel stability and flood plain development.
- Improve floodwater retention and groundwater recharge.
- Develop root masses that stabilize streambanks against cutting action.
- Support biodiversity.

[15]Class 1 watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The drainage network is generally stable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are predominately functional in terms of supporting beneficial uses.

[16]Proper functioning condition – A condition when adequate vegetation, landform, or large woody debris is present to: dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality; filter sediment, capture bedload, and aid flood plain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses, and support greater diversity.

Guidelines

- Fish stocking should be conducted with desirable native and nonnative species.
- Public information, user education, and appropriate management tools should be used to limit the spread of nonnative exotics in aquatic systems.
- Manmade impoundments over 30 acres should be managed to support a viable fishery habitat.
- Springs and natural water sources should be managed for the maintenance of riparian habitat and water quality.
- OHV use should be restricted or damage mitigated in aquatic systems in order to protect vegetation, water quality, and streambanks.
- Designated motorized vehicle stream crossings should maintain or provide for aquatic passage.
- When planning and implementing watershed improvement activities, the cause of impairment should be addressed when feasible, in addition to the symptoms.

Figure 10. Palustrine emergent wetland on the Kiowa National Grassland depicts desired conditions for vegetative structure and composition surrounding pools.

Management Approach

Riparian Area Management TR 1737-15, 1998, "A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas" may be used by managers to assess the proper functioning condition of watercourses.

Riparian Area Management TR 1737-16, 1999, Revised 2003, "A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas" may be used by managers to assess the proper functioning condition of playas and wetlands.

Where adequate groundwater or surface hydrology exists, and if natural recruitment is not sufficient, managers may supplement natural recruitment with planting to reestablish native riparian vegetation to provide shading, bank cover, and streambank stability.

Catchment methods and groundwater wells may be utilized to provide water for livestock.

As a matter of policy, manage riparian areas under the principles of multiple use and sustained yield, while emphasizing protection and improvement of soil, water, and vegetation, particularly because of their effects upon aquatic and wildlife resources. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.

Air

Background and Description

There are no state sanctioned air quality monitoring stations in the area of the Grasslands. Nonetheless, the air quality data that has been collected in these areas (usually by national monitoring networks or at regional airports) indicates that air quality conditions over the Grasslands are within attainment standards for the six major air pollutants (ground-level ozone, particle pollution (particulate matter–PM_{10} and $PM_{2.5}$), carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead) regulated by the Clean Air Act, except when dust storms or wildland fires occur. Fugitive dust emanating from off the Grasslands as a result of agricultural practices and travel on county roads occasionally occurs and may worsen in droughts or changes in climate conditions. However, fugitive dust generally does not emanate from the Grasslands except for dust that occasionally emanates from vehicular use of unpaved National Forest System (NFS) roads during dry conditions. The Grasslands are meeting the air quality standards in each state in which they reside. Since the reference and current conditions are the same, the Grasslands are within the reference conditions for air quality.

Desired Condition

- Air quality conditions are at acceptable attainment levels on the Grasslands.

Invasive Plants and Animals (Native and Nonnative)

Background and Description

Currently, invasive plant and animal species, both native and nonnative, have high potential to produce negative ecological and/or economic impacts. Invasive plants and animals include noxious weeds, shrubs, trees, mammals, fish, insects, birds, amphibians, and reptiles.

Desired Conditions

- Tamarisk, noxious weeds, and undesirable invasive plant species—both native and nonnative—are low to nonexistent in abundance and distribution.

- Through information and awareness efforts, introduction of undesirable, predatory, invasive, nonnative fish and amphibians is minimized (except where they are already present in the Black Kettle and McClellan Creek lakes and in the Canadian River).
- The feral hog population is diminishing or nonexistent.

Objective

- Over the next 15 years after plan approval, use chemical or mechanical treatments, prescribed fire, or other tools to treat 90 to 100 percent of known populations of identified noxious weeds and invasive plant species, both native and nonnative.

Guidelines

- Only native species or sterile hybrids should be used in reclamation or stabilization activities on all vegetation types.
- Best management practices (based on best available science) that prevent establishment of noxious weeds on the Grasslands should be incorporated in permit modifications, contracts, scopes of work, annual operating instructions, and Agency activities.

Management Approach

Certain individuals or populations may be infeasible to treat due to other resource considerations.

Part 3: Management Area-Specific Management Direction

Black Kettle and McClellan Creek Management Area

The following plan components (desired conditions, objectives, guidelines, standards) and management approaches apply only to the Black Kettle and McClellan Creek National Grasslands, hereinafter referred to collectively as the Black Kettle and McClellan Creek Management Area. The plan components given below that address the ecological resources and social and economic goods and services unique to these two grasslands are in addition to the Grasslands-wide direction presented in part 2 of this document.

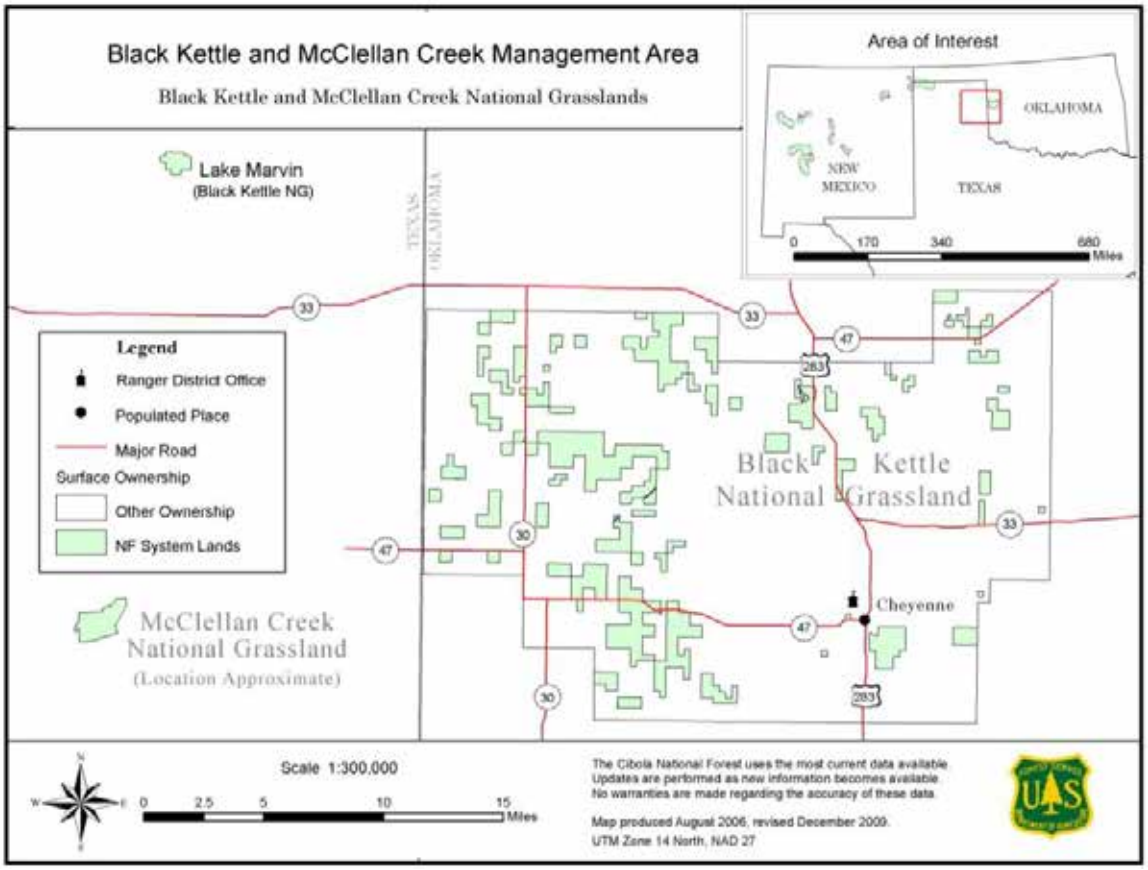

Figure 11. Black Kettle and McClellan Creek Management Area

The reader is reminded that:

Where there is no desired condition given for a social or economic good or service or ecological resource related to this management area, refer to the Grasslands-wide desired condition for the same topic in part 2; and

Where there are no explicitly stated, unique, or additive objectives, guidelines, or standards, or management approaches given, then none exist for this management area beyond those at the Grasslands-wide scale presented in part 2.

Appendix C contains a list of proposed and probable actions that will likely take place on the Grasslands at the project or activity level to accomplish objectives and to maintain or move toward achievement of the desired conditions described in this plan.

Scenery

Background and Description

Within the Black Kettle and McClellan Creek Management Area, the many lakes, ponds, wetlands, and riparian vegetation are wonderful surprises to prairie visitors and add to the rich scenic diversity of the rolling red hills, patches of oaks and shrubs, and other vegetation interspersed with the cultivated fields on surrounding private lands.

This management area provides views that are distinctive in the surrounding area or are unique to the southern plains grasslands, including the lakes and riparian areas, which primarily occur on Grasslands units rather than adjacent private lands. Areas of high scenic integrity are shown in appendix A, maps, "Proposed Scenic Integrity Objectives."

Figure 12. The Redbed Plains of the Black Kettle National Grassland are valued for their distinctive dark reddish-orange mounds and hills covered by contrasting light green grass during spring and summer that turns to gold in the fall and winter.

Desired Conditions

- Scenic viewsheds of the redbed plains, their unique shinnery oak motts, the patchy forested lowlands, and the occasional watercourse are available for the enjoyment of visitors and local residents alike.
- The area lakes are highly valued by the public and support recreation opportunities. While the landscape is natural in appearance, recreation developments are common

and are valued by Grasslands visitors. Recreation developments are in harmony with the scenic quality of the lakes.

- Scenic integrity is maintained on the units managed by the Black Kettle and McClellan Creek National Grasslands. Local interpretive and tourism marketing efforts (such as the Great Plains Trail of Oklahoma and the Oklahoma High Plains Bird Trail) attract visitors to area roads for the scenic quality of areas that surround them. Corridors along marketed tour routes that pass through Grassland units emphasize the scenic quality of the landscape through interpretive and recreation sites.

Developed Recreation

Background and Description

The Grasslands feature two major recreation complexes in Texas—McClellan Creek and Lake Marvin Recreation Areas—designed around highly scenic reservoirs. There is a high level of community interest in Pampa and Canadian, TX, in improving tourism to these areas. The Black Kettle National Grassland features three other popular and significant lake-based recreation areas that add to the diversity of the terrain and provide public recreational opportunities not usually found in the Grasslands region. The lakes attract high numbers of visitors year-round, with the highest use during spring and fall hunting seasons as well as during the hot summer months.

Desired Conditions

- The Black Kettle district's recreation sites are predominantly used for family outings, large social or group events, and camping for hunting trips. The more highly developed and larger group sites, McClellan Creek and Lake Marvin Recreation Areas, attract substantial numbers of local residents and out-of-area visitors that contribute to the local economy. Large gatherings allow for social interaction around a wide range of water-based activities. Activities include fishing, boating, and swimming, which often occur in conjunction with other site activities such as camping, hiking, and/or picnicking.
- The recreation sites in this management area have facilities and amenities that serve to create a user experience that includes an equal probability of interaction with or isolation from other users and a high degree of interaction with the natural environment. Water-based recreation facilities meet standards for visitor safety. New or renovated facilities incorporate changes in technology and vehicle types while being responsive to their natural setting. This includes accommodation for modern trailers and motor homes at larger campgrounds, such as electric hookups and dump stations at a few spurs and some individual sites and turnarounds to accommodate changes in vehicle sizes where necessary. Facilities such as boat ramps, fishing docks, fish cleaning stations, and swimming sites accommodate lake-based recreation where appropriate. Trails in these recreation sites are mostly short walking trails around water bodies and provide for fishing access and/or interpretive purposes.
- Visitors are informed about proper treatment of the natural surroundings and rules and restrictions of each site, and they are expected to act accordingly. High use that exceeds design capacities is accepted during hunting season and holidays, but does not lead to substantial resource impacts. Hunting camps serve as temporary staging sites

that are acceptable during times of high use and occur within or near developed recreation sites for offsite activities. Higher intensity use is mitigated. With larger numbers of visitors, official presence increases safety, civility, and security, particularly at fee sites.

- Fishing opportunities occur on the lakes of the Black Kettle and McClellan Creek Management Area.

Figure 13. Water-based recreation facilities on the Black Kettle National Grassland allows for fishing and boating opportunities.

Objective

- Maintain one-third of trail miles annually and according to development level and managed use.

Guideline

- Boating speeds should be limited to no-wake boating only (with the exception of McClellan Creek Recreation Area).

Management Approach

Coordination and meetings with the Texas Parks and Wildlife Department and Oklahoma Department of Wildlife Conservation may be ongoing to discuss fisheries management and occurs at least annually.

Dispersed Recreation

Background and Description

On the Black Kettle National Grassland, there are 32 designated dispersed sites accessible from public roads. These sites require hunters and other recreationists to camp and park in a confined area, which reduces the impacts of dispersed camping and recreation to the rest of the unit.

The Black Kettle National Grassland units in Oklahoma are nationally recognized public hunting areas in the Nation for Rio Grande Turkey and Northern Bobwhite quail. These areas attract hunters from across the Nation during the spring turkey season (UNM-BBER 2005).

Figure 14. Designated dispersed sites on the Black Kettle National Grasslands provide an area where hunters can safely pull off the road while protecting wildlife habitat for Rio Grande Turkey and other game species.

Desired Conditions

- Designated dispersed recreation sites (dispersed parking areas) provide safe off-road access for meeting public camping needs near popular hunting units. These designated dispersed sites occur near public and Grassland managed roads and concentrate use while minimizing resource damage outside of these areas and providing parking for access to nonmotorized Grassland units for hunters. These sites are available as hunting camps during hunting season. These sites provide a safe place to park and access the Grasslands for other activities such as viewing scenic features, wildlife, and birds. Trespass upon or other conflict with private landowners is minimal and mitigated.
- Hunting opportunities are available throughout the Grasslands, and particularly for the Black Kettle National Grassland. Habitat and recreation improvements enhance experiences for hunting small and large game species by providing for camping in developed and dispersed sites, providing information specific to hunting, and improving wildlife habitat. Dispersed campsites and transportation systems occur in areas where limited environmental impact occurs in order to protect the resources, provide a quality hunting experience, and improve wildlife habitat. These areas include sites traditionally used for dispersed camping or related activities.

- Some of the Black Kettle district's ponds are enjoyed by visitors as a recreational fishing alternative to the larger developed lake sites. Coordination occurs with partner agencies to occasionally stock these ponds with fish.

Management Approach

The district may continue working with partners, other jurisdictions, and surrounding communities. The district may coordinate and communicate with state wildlife agencies to manage habitat and impacts associated with hunting. The district will actively engage in partnerships with wildlife and hunting organizations to meet agency wildlife habitat and hunting management goals.

Motorized Recreation

Desired Conditions

See "Grasslands-wide Desired Condition" on page 24.

Objective

- Replace all gates in areas of high public use with cattle guards over the next 15 years.

Guideline

- Gates used by the public should have appropriate signage instruction on closing the gate when entering or exiting.

Heritage Resources

Desired Conditions

See "Grasslands-wide Desired Condition" on page 27.

Objective

- Establish a historic homestead interpretive site on the Black Kettle National Grasslands in the next 5 years[1].

Management Approach

The ranger district staff may continue to collaborate with the National Park Service in providing interpretive services and facilities for the Washita Battlefield National Historic Site Visitor Center.

[1]This objective relates to the Grasslands-wide desired condition for heritage resources but is specific to this management area only.

Minerals and Energy Development

Desired Conditions

See "Grassland-wide Desired Condition" on page 32.

Stipulations for Oil and Gas Leasing[2]

Standards

- No surface occupancy of Lake McClellan is allowed within 500 feet of the high water level, and for Lake Marvin, within 500 feet of the high water mark.
- No surface occupancy within 0.25 mile of known Bald Eagle roosting sites is in effect from November 1 through March 31.
- No surface occupancy is allowed within a minimum of 500 feet from the segment of the historic military trail between Fort Supply and Fort Elliot that traverses the Lake Marvin Unit. The distance will be determined during site-specific analysis.
- No surface occupancy is allowed on slopes over 30 percent. An exception, modification, or waiver may be granted if onsite inspection shows that unstable or steep slopes do not exist on a specific site, or if the operator can demonstrate in a surface use plan of operations that adverse effects can be minimized and activities safely conducted without loss of long-term site productivity.

Wildlife Habitat Improvement

Desired Conditions

- Constructed pond and lake habitats support recreational fisheries. Stocking of game fish, such as the largemouth bass, and desirable nonnative fish species occurs where appropriate for habitat enhancement and to support recreational fishing.
- Existing and new wildlife habitat structural improvements (such as rainfall catchments, fenced grazing exclosures, constructed fishing lakes, windmill overflow pits, and constructed ponds/dirt tanks) are functional. Water developments—such as drink tanks—provide access and escape avenues for wildlife and are accessible all year long.

Objectives

- Two to four existing fenced exclosures or wildlife habitat improvement plots are inventoried annually, evaluated for effectiveness and ecological functionality, and those determined viable are maintained.
- At least one structural improvement for fish habitat is put in each lake every 5 years.

[2] These standards only apply to leases issued after August 26, 2008. Leases issued prior to that date will use the stipulations in their lease. These standards set the sideboards for reaching the desired condition for Grasslands-wide minerals and energy development but should only be applied within this management area.

Guidelines

- Developed water sources should be equipped with wildlife escape structures.
- Windmills at water wells should be kept running all year long when water availability and mechanical function permit, for wildlife benefit.
- New fences should minimize adverse effects upon the free movement of wildlife.

Management Approach

The Black Kettle and McClellan Creek Management Area places strong emphasis on managing habitat and assessing opportunities to create wildlife habitat improvement plots to meet the high public use demand for important game species that occur on the Grasslands.

While Lesser Prairie-chickens, a candidate species under the Endangered Species Act, historically occurred on the Grasslands and is likely to occasionally use suitable habitat areas, currently there is no breeding population: however, there is potential habitat in all shinnery oak and mixed grass vegetation types on the Black Kettle National Grassland.

However, research suggests that Lesser Prairie-chickens are sensitive to and tend to avoid tall vegetation and manmade structures that can provide roosting areas for predators such as hawks and eagles. Forest Service biologists will continue to collaborate with other Federal and state biologists and researchers in determining if the species could be expected to return to the Grasslands and successfully fledge young and what management activities would benefit their recovery if they returned.

Trees and tall human-made structures will be evaluated for removal in areas important for recovery of Lesser Prairie-chicken habitat and where windbreaks and erosion control shelterbelts are no longer needed for soil stability.

Water, Watershed, Perennial Streams, Reservoirs, Lakes, and Ponds

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 43.

Objective

- All woody vegetation is removed from dams on lakes or impoundments 30 acres or larger over the next 15 years after plan approval.

Guidelines

- Submerged aquatic vegetation comprising up to 20 percent of the total lake area should be maintained to provide for largemouth bass habitat.
- Boat wakes should be restricted in shallow water (<4 feet deep) where largemouth bass spawning areas are likely to occur.

Invasive Plants and Animal Species (Native and Nonnative)

Background and Description

The Dust Bowl era resulted in a landscape with erosion and deposition conditions that required conservation measures to be implemented in order to stabilize the soil. One conservation measure was to divert the wind to reduce erosion. Windbreaks and soil erosion control shelterbelts were created by planting trees and shrubs in highly erodible areas. Windbreaks and erosion control shelterbelt areas tree species include black locust, Osage orange, eastern redcedar, green ash, cottonwood, pine species, Siberian elm, and honey locust.

Several of the species chosen for the windbreaks and shelterbelt areas are prolific and have dispersed over the landscape. In some areas, species composition and site potential have been altered significantly by black locust, eastern redcedar, and Siberian elm encroachment. On many sites, these tree species have transformed productive mixed grass or shinnery oak into woodland sites. These closed canopy woodland sites are generally a barrier to the spread of wildland and prescribed fire due to the annual cheat grass that dominates the understory and is green in winter and early spring.

There are some areas where introduced or planted tree species are desirable and provide beneficial wildlife habitat. Conversely, there are areas where the encroachment is detrimental for certain wildlife species and further conflicts with structure and composition objectives for mixed-grass prairie and shinnery oak areas.

Desired Conditions

- Invasive and/or undesirable trees[3] such as black locust, Siberian elm, and eastern redcedar, among others, are not present where they could negatively impact desired vegetation composition and structure.
- Historical burning regimes occur during the growing season that thin canopy cover and increase understory plant diversity.

[3]Undesirable trees are those trees that either did not occur historically within a Grasslands' vegetation type or had a much reduced presence, and their presence conflicts with other resource objectives on the Grasslands.

Guideline

- Suitable habitat determination (based on best available science for the life history of the Lesser Prairie-chicken) should be made on shinnery oak and mixed grass vegetation types on the Black Kettle National Grasslands, prior to removal of black locust tree encroachment.

Mixed-grass Prairie Vegetation

Mixed-grass Prairie

Background and Description

Mixed-grass prairie covers approximately 11,300 acres or 35 percent of the Black Kettle and McClellan Creek National Grasslands. The mixed-grass prairie on the red-shale soils is dominated by perennial grasses including blue grama, hairy grama, little bluestem, and purple threeawn. Forbs make up about 10 percent and woody species another 10 percent of the species composition of mixed-grass prairie. Prescribed fire and managed livestock grazing provide disturbance to this vegetation type, which evolved under disturbance regimes. This vegetation type is in low departure from reference condition for structure, and the desired condition is similar to the existing condition.

The wildlife associated with all vegetative stages of mixed-grass prairie habitat includes the following: Swainson's Hawk, Lesser Prairie-chicken (currently rarely seen or heard), Northern Bobwhite, Rio Grande Turkey, Grasshopper Sparrow, and Long-billed Curlew.

Desired Conditions

- Mixed-grass prairie is characterized by grasses and forbs without the presence of trees. The structure and composition of the mixed-grass prairie across the landscape maintains the treeless reference condition of the mixed-grass prairie ecological indicator.
- Mixed-grass prairie on the Black Kettle and McClellan Creek National Grasslands is a warm season, grass-dominated ecosystem. The codominant grasses include little bluestem, sideoats grama, smaller proportions of big bluestem, and blue grama. Forbs are present but are less abundant than grasses and include western ragweed, annual broom weed, tarragon, and baby aster, all providing food for wildlife species.
- The mixed-grass species composition provides vegetation structure and height relationships necessary for ground nesting bird cover and brood rearing habitat. Small areas of short structured herbaceous vegetation or patches of bare ground are available for Lesser Prairie-chicken leks and courtship areas. Small areas or patches of bare ground are present that provide wildlife travel corridors, escape routes, and annual plant germination sites for wildlife foraging habitat.
- Shrub species component is typically no less than 5 percent or more than 25 percent of the total mixed-grass ground cover. Species composition includes fragrant mimosa, skunkbush sumac, smooth sumac, and inland New Jersey tea, all contributing to retaining or improving foraging and escape habitat for Lesser Prairie-chicken and Northern Bobwhite.

- Disturbance processes (including drought, fire, and grazing) occur on the landscape at varying intervals and intensities, determined by climatic conditions and vegetative density respectively. Prescribed fire intervals occur on a 3- to 10-year regime.

Figure 15. The mixed-grass prairie depicting vertical structure on Unit 93 shown in these photographs is a fair representation of the structure and composition a mixed-grass prairie desired condition would resemble.

Objectives

- Using prescribed fire, reintroduce fire to 50 to 75 percent of the mixed-grass prairie over the next 15 years after plan approval.
- Mechanically or with prescribed fire, remove all undesirable trees on the mixed-grass prairie over the next 15 years after plan approval.
- Over the next 15 years after plan approval, retain shrubby cover across the landscape in patches that are no less than 5 percent or more than 25 percent of the total mixed-grass area.
- Within 10 years of plan approval, mark 25 to 50 percent of fences in suitable Lesser Prairie-chicken habitat to minimize collisions of the bird with fences.

Guidelines

- Trees in upland settings within landscapes suitable for Lesser Prairie-chicken habitat should be targeted for eradication.
- Prescribed fire should have a recurrence interval of 5 to 15 years, to encourage forb production; timing should consider adverse consequences to ground nesting birds.
- Shrubby cover should be retained across the landscape in patches that are approximately 100 to 400 square feet in size and 3 to 6 feet tall so that distribution is no less than 5 percent or more than 25 percent of the total mixed-grass area to provide loafing sites for quail.

Shinnery Oak Vegetation Type and Inclusions of Historically Deep Plowed Sites

Shinnery Oak

Background and Description

This vegetation type covers approximately 18,900 acres (59 percent) of the Black Kettle and McClellan Creek National Grasslands. About 45 percent of the shinnery oak vegetation is in the early to mid-open, postfire to 3 years postfire regime and dominated by tall grasses in shallower and more stable sandsheet areas. Grass cover is dominant with rapid recovery of shinnery oak resprouts. The late-closed successional stage structure and composition stage occur in the 3- to 10-year postfire timeframe. Shinnery cover is mostly dominant, although grasses remain codominant on about 55 percent of the vegetation type (see appendix A). Uncharacteristically tall hybrid tree/shrubs of shinnery and post oak occur in some motts. Most shinnery oak stands are burned on a 2- to 9-year cycle to maintain a codominant canopy cover of grasses intermixed with shinnery oak for wildlife habitat diversity and to resemble historical conditions. Current livestock grazing within the shinnery oak system is relatively light, with utilization levels retaining at least 50 percent of the current year's growth of vegetation, by weight, of forage species.

The wildlife associated with all vegetative stages of shinnery oak includes the following: Swainson's Hawk, Lesser Prairie-chicken (currently rarely seen or heard), Grasshopper Sparrow, Northern Bobwhite, and Rio Grande Turkey.

Figure 16. The shinnery oak on historically unplowed areas on Black Kettle Unit 12 shown above is a fair representation of the structure and composition a shinnery oak desired condition would resemble.

Desired Conditions

- Shinnery oak is characterized by shrubs, grasses, and forb species without the presence of trees. The structure and composition of shinnery oak across the landscape maintains the treeless reference condition of the shinnery oak ecological indicator.

- The shinnery oak vegetation is a grass-dominated ecosystem with a shinnery oak shrub understory. The overstory is made up of warm season herbaceous species, including big bluestem, little bluestem, sideoats grama, sand lovegrass, Indiangrass, and switchgrass. Most of the warm season grass species have a dominant position in regard to canopy vertical structure. In a less dominant vertical structure position are shrubs and woody plants, including shinnery oak, sand sagebrush, Oklahoma plum, and yucca. Forbs such as western ragweed, Hartweg's sundrops, blacksampson echinacea (or narrowleaf purple coneflower), wax goldenweed, and Texas croton are located within this vegetation type and are found in lower quantities than herbaceous grasses or woody shrubs. There are few trees found within this vegetation type, although small clusters or motts of shinnery oak hybrids ranging in height from tall shrub to 20 feet or more may be found scattered throughout.
- The shinnery oak species composition provides vegetation structure and height relationships necessary for ground nesting bird cover and brood rearing habitat for the Lesser Prairie-chicken and other ground nesting birds such as the Rio Grande Turkey and Northern Bobwhite. Small areas of short structured herbaceous vegetation or patches of bare ground are available for Lesser Prairie-chicken leks and courtship areas; these areas also provide wildlife travel corridors, escape routes, and annual plant germination sites for wildlife foraging habitat. Trees are nonexistent and collision risks from fences, etc., are minimal in areas important for recovery of Lesser Prairie-chicken.
- Small thickets of hybridized tall oak shrubs (oak motts) provide overhead cover and production of secure forage crops for Rio Grande Turkey and Northern Bobwhite.
- Fire occurs on a 2- to 9-year cycle on the landscape at varying intervals and intensities determined by vegetative and climatic conditions. Ground cover provides soil stabilization and water infiltration and retains fine fuels.

Objectives

- Within 10 years of plan approval, mark 25 to 50 percent of fences in suitable Lesser Prairie-chicken habitat to minimize collisions of the bird with fences.
- Use prescribed fire twice on 80 percent of the shinnery oak within 15 years of plan approval.
- Mechanically or chemically, remove 80 to 100 percent of undesirable trees in shinnery oak areas within 15 years of plan approval.

Guidelines

- Trees in upland settings within landscapes suitable for Lesser Prairie-chicken habitat should be targeted for eradication.
- Timing of prescribed fire should consider adverse consequences to ground nesting birds.

- Prescribed fire should be used on 35 to 50 percent of the area so that ground cover is open with 25 to 50 percent vegetative cover to provide optimal habitat for quail chicks.

Figure 17. The shinnery oak motts on Black Kettle Unit 12 shown above represent the characteristic landscape change that oak motts bring to the structural height in a shinnery oak vegetation type.

Inclusions of Historically Deep Plowed Sites

Background and Description

The historically deep plowed sites represent 5,670 acres or 30 percent of the 18,900 acres of shinnery oak vegetation. The areas that were subjected to deep plowing practices prior to the Dust Bowl do not have the shinnery oak component. Where these conditions occur, species composition and site potential have been altered. Windbreaks and erosion control shelterbelt area tree species include black locust, Osage orange, eastern redcedar, green ash, cottonwood, pine species, Siberian elm, and honey locust.

Desired Conditions

- These sites are structurally close to the shinnery oak vegetation type, with the composition of plants dominated by warm season herbaceous grasses. In a less dominant vertical structure position are shrubs and woody plants such as sand sagebrush and Oklahoma plum that comprise 15 to 20 percent of the vegetation.
- Fire occurs on a 5- to 9-year cycle on the landscape at varying intervals and intensities determined by vegetative and climatic conditions.

Objective

- Within the deep plowed areas previously occupied by shinnery oak, develop—through artificial planting or natural recruitment—a shrub component to occupy 15 to 20 percent of the canopy within 10 years of plan approval.

Figure 18. The shinnery oak on the Black Kettle previously plowed areas of Unit 12 shown above is representative of the change brought to the structure and composition of shinnery oak by deep plowing in the past.

Mixed Hardwood Riparian Vegetation Type

Background and Description

This vegetation type covers approximately 1,946 acres or 6 percent of the Black Kettle and McClellan Creek Management Area. The early successional stage represents approximately 13 percent of this vegetation, with pioneer tree and shrub species of cottonwoods and willows with an herbaceous understory of sedges in wet areas. In this early stage, most of the area is bare sand dominated by a young canopy of tree saplings and shrubs. Species include false indigo bush and various grass, sedges, and rushes. The middle and late successional stage covers the remaining 87 percent. In the middle stage, developing stands start to mature. This community tends to be partially open with scattered cottonwoods and willows. The shrub layer is poorly developed and often consists of widely scattered patches of dogwood. The understory vegetation is highly variable with wildrye and muhly grass. In wetter, more shaded areas, Virginia creeper, nettles, and poison ivy are present. The late seral stage is a mature, closed canopy cottonwood flood plain forest. The canopy layer is dominated by cottonwood with box elder, hackberry, walnut, and elm occurring as well. Understory species include Virginia creeper and poison ivy, both found along the upper terrace that is protected from most flood events.

The wildlife associated with all vegetative stages of mixed hardwood riparian includes the following: Yellow-billed Cuckoo, Rio Grande Turkey, Red-headed Woodpecker, and Bell’s Vireo.

Desired Conditions

- Hardwood tree species (such as plains cottonwood, netleaf hackberry, little walnut, American elm, and wooly buckthorn or chittimwood) are found in scattered groupings, forming an open canopy mosaic of various age classes and structure. Black willow, common persimmon, and Western soapberry are present within the groupings. Eastern redcedar is a very minor species component.
- Shrubs and woody vines are prevalent and include buckbrush, riverbank grape, Chickasaw plum, Virginia creeper, and poison ivy. Also found on the perimeters of this vegetation type are skunkbush sumac and sand sagebrush. Switchgrass, little bluestem, inland saltgrass, and sand dropseed are herbaceous warm season grass species interspersed in the understory. A variety of forbs are found in the understory and include western ragweed, white sage, horehound, and stickseed. Wetland species include cattails, rushes, sedges, and smartweed.
- Mature hardwoods, shrubby understory or early successional growth, and woody debris as well as diverse riparian herbaceous vegetation on the margins of lakes or along streamsides are present to provide winter roosts for Bald Eagle and raptors.

Figure 19. The mixed hardwood riparian area with cottonwood gallery shown above depicts the linear growth patterns along a watercourse and is a fair representation of the structure and composition a mixed hardwood riparian desired condition would resemble.

Objectives

- Introduce prescribed fire into mixed hardwood areas once every 5 to 15 years after plan approval.
- Mechanically or chemically remove 100 percent of eastern redcedar around cottonwood galleries, generally within the mixed hardwood type, around roost trees within 10 years of plan approval.

Guidelines

- Grazing should be managed to promote or maintain riparian obligate vegetation.
- Timing of prescribed fire or other vegetation treatments should consider adverse consequences to ground nesting birds.
- Bald Eagle roosts should be protected by retaining, developing, or preserving mature trees and old growth cottonwood stands, particularly within ½ mile from lakes.
- Habitat should be managed for openings greater than 4 acres in size and for large snags that are available for cavity nesters and as foraging sites.

Kiowa and Rita Blanca Management Area

The following plan components (desired conditions, objectives, guidelines, standards) and management approaches apply only to the Kiowa and Rita Blanca National Grasslands, hereinafter referred to collectively as the Kiowa and Rita Blanca Management Area. The plan components and other strategic direction given below that address the ecological resources and social and economic goods and services unique to these two grasslands are in addition to the Grasslands-wide direction presented in part 2 of this document.

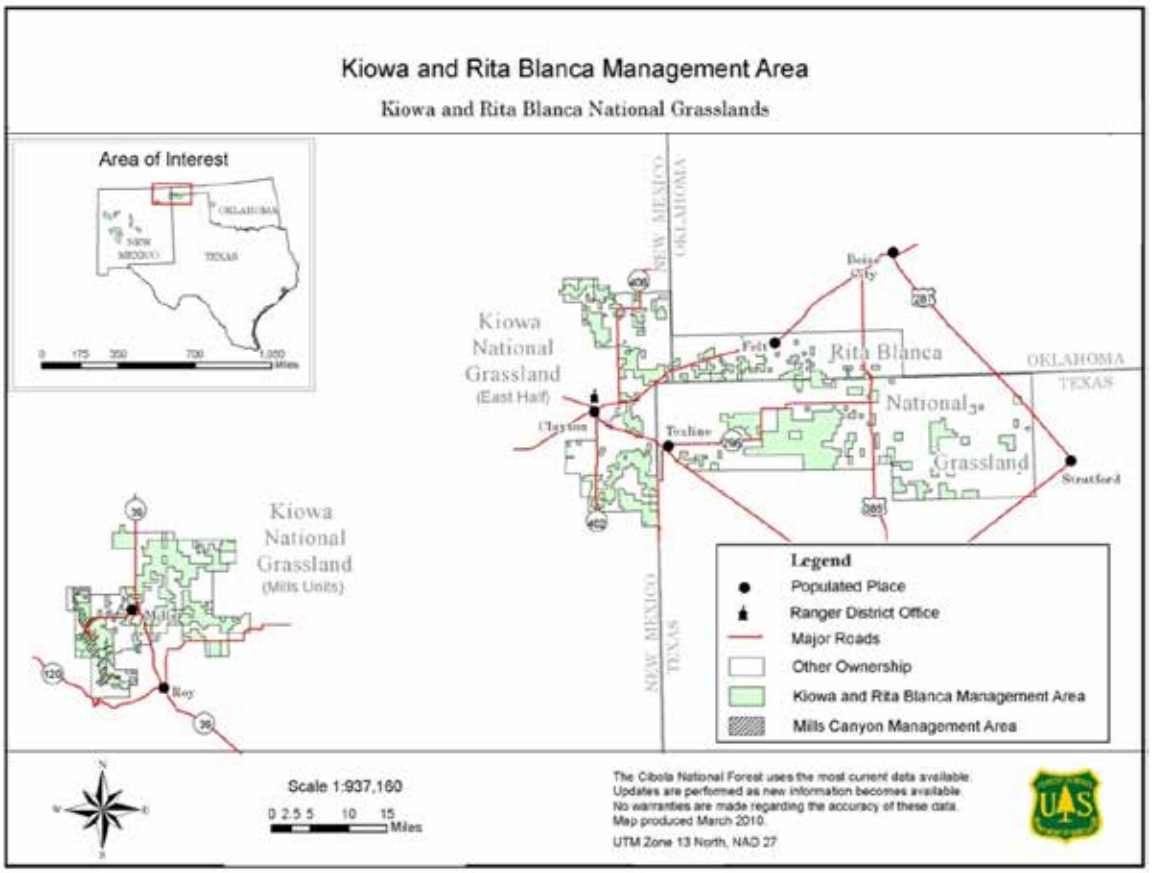

Figure 20. Kiowa and Rita Blanca Management Area.

The reader is reminded that:

Where there is no desired condition given for a social or economic good or service or ecological resource related to this management area, refer to the Grasslands-wide desired condition for the same topic in part 2; and

Where there are no explicitly stated, unique, or additive objectives, management approaches, guidelines, or standards given, then none exist for this management area beyond those at the Grasslands-wide scale presented in part 2.

Appendix C contains a list of proposed and probable actions that will likely take place on the Grasslands at the project or activity level to accomplish objectives and to maintain or move toward achievement of the desired conditions described in this plan.

Scenery

Background and Description

The Kiowa and Rita Blanca Management Area greets the traveler with the vast expanse of an undulating plain of grass punctuated by windmills and farmsteads. The High Lonesome area on the Rita Blanca National Grassland typifies the prairie of lore. Scattered around the area are playa lakes which are important habitats on the Grasslands. These depressions collect water after rains, forming shallow pools. Between rains, these areas dry in the sun and wind. Culturally, the area has a long history of ranching, as well as a period of homesteading until the Dust Bowl years, and agricultural features influence the views. See appendix A for maps showing scenic integrity objectives.

Desired Conditions

- The vast horizon of the Grasslands offers unique and highly valued scenic opportunities. Consideration of scenery is evident where wind energy infrastructure, transmission lines, and other constructed features occur. There are a number of landscape types that are especially highly valued for their scenic quality in this management area. The High Lonesome area reminds visitors of the high plains as they were when the early European settlers arrived, and the vistas American Indians had experienced for generations prior. Vast unbroken plains of grasses extend to the horizon. Roads and occasional fences are minor interruptions in the sweeping plain. The expansive sky dominates the views.
- Playa lakes attract a diversity of wildlife and are valued for wildlife viewing and bird watching. These are generally natural appearing landscapes, and their ever-changing views as the lakes appear and disappear are an integral part of their scenic quality.
- The vista around areas assigned a high scenic integrity objective, including the High Lonesome, Mills Canyon, and Canadian River corridor, the Santa Fe Trail corridor, and scenic byways are preserved. Management activities surrounding these areas are cognizant of scenic integrity and preserve scenic attributes.
- Riparian vegetation accents the Perico Creek channel, including cottonwoods and willows, with sumac and a variety of midsize grasses and forbs present on adjacent upland sites. This cliff-studded setting provides a view of a rich riparian and Grassland habitat that supports an abundance of diverse wildlife.
- The meandering Sauz Creek provides a scenic vista of wetlands with an abundance of sedges, reeds, and cattails, especially around the larger pools.

- The vast horizon of the Grasslands offers unique and highly valued scenic opportunities. In these scenic areas, planning for and design of wind energy, transmission lines, and other constructed features consider the scenic value of the horizon.

Figure 21. The Rita Blanca National Grassland has areas of sand sagebrush vegetation, which contributes depth and variety to the scenery of the area. It is a mosaic of shrubs and ankle-high forbs punctuated by sharp-tipped yucca and other dryland species.

Figure 22. The High Lonesome area on the Rita Blanca National Grasslands is a contiguous stretch of shortgrass prairie that extends to the horizon in all directions from its center. The unbroken horizon and vast skies are the main features of this high scenic integrity area.

Figure 23. Mills Canyon is one of several high scenic integrity areas on the Kiowa and Rita Blanca National Grasslands. Its varied topography and extensive riparian area are unique on the Grasslands.

Dispersed Recreation

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 23.

Guideline

- Dispersed camping should be restricted within 200 feet of developed campgrounds

Developed Recreation

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 21.

Motorized Recreation

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 24.

Heritage Resources

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 27.

Objective

- Establish a site steward program on the Kiowa and Rita Blanca Management Area within 5 years to protect sensitive cultural sites.

Lands Adjustment

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 30.

Management Approach

The Grasslands will set priorities and work with other agencies when necessary for acquiring access to previously inaccessible units.

Minerals and Energy Development

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 31.

Standards for Oil and Gas Leasing[1]

- No surface occupancy of slopes over 40 percent is allowed. An exception, modification, or waiver may be granted if onsite inspection shows that unstable or steep slopes do not exist on a specific site, or if the operator can demonstrate in a surface use plan of operations (SUPO) that adverse effects can be minimized and activities safely conducted without loss of long-term site productivity.
- No surface occupancy is allowed in Mills Canyon of the Canadian River.
- No surface occupancy is allowed within 500 feet of the canyon rims along a 17-mile segment of the Canadian River and its major side canyons[2]. See map in appendix A.
- No surface occupancy is allowed within 500 feet from the centerline of the Santa Fe Trail where it traverses East Kiowa. The distance will be determined during site-specific analysis.
- No surface occupancy is allowed on Mills Orchard and Ranch Site, a historic property on the New Mexico State Register of Cultural Properties, and Trujillo Homestead, a historic property eligible for listing on the National Register of Historic Places.
- No surface occupancy is allowed on playa lakes as determined by a Grassland staff line officer or designated representative.
- No surface occupancy is allowed within prairie dog towns as already delineated by Grassland staff and/or by onsite inspection by the Grassland authorized officer during site-specific analysis.
- Timing limitation on drilling operations and construction activities for Ferruginous and Swainson's Hawks and Burrowing Owl include the following: from March 1 to June 30 within 0.5 mile of any suitable nesting sites and/or April 1 to August 31 within 0.5 mile of any active nest.
- No surface occupancy is allowed within 0.25 mile of the Wanette Cemetery in Management Unit K-54.
- No surface occupancy is allowed on the Clayton Livestock Research Center in Management Unit K-41, within the administrative area, or in the cultivated area under irrigation.
- No surface occupancy is allowed within the Rocky Mountain Research Station Kiowa Long-term Experimental Fire Research Site in Management Unit K-46 within Section 2 of T. 26 N., R. 36 E.

[1] These standards only apply to leases issued after August 26, 2008. Leases issued prior to that date will use the stipulations in their lease. These standards set the sideboards for reaching the desired condition for Grasslands-wide minerals and energy development but should only be applied within this management area.

[2] The 17-mile segment of the Canadian River is the length of the river within the Forest Service administrative boundary where the river flows through Forest Service lands. Private and other agency ownership would be excluded from this calculation. The major side canyons are: Cañon Emplazado, Cañon de la Cueva, Cañon Mesteño, Cañon Vercere, Cañon Mesteñito, Cañon Colorado, Cañon Piedra Lumbre, Cañon Biscante, an unnamed canyon (spur) just south of Canon Mesteñito, which contains Rim Campground and the 600 Road (T21N, R24E, Section 11) to the intersection with Mills Canyon in the bottom; and another unnamed spur (T21N, R25E, Section 30) that cannot be logically "detached" from the larger Cañon Mesteño.

Livestock Use

Desired Conditions

See “Grasslands-wide Desired Conditions” on page 37.

Guidelines

- On recently burned areas where there is potential breeding habitat for Mountain Plover, livestock grazing pressure should be increased to improve habitat suitability. In adjacent unburned portions of the allotment, livestock grazing pressure should be reduced for other native bird species.
- Playa lakes should be deferred from livestock use between April 10 and July 31 when water is present.

Management Approach

On playas where water is present from April 10 to July 31, district biologists may determine the areal extent of the playa habitat and the timing for when livestock use is deferred.

Wildlife Habitat Improvement

Desired Condition

- Existing and new wildlife habitat structural improvements (such as rainfall catchments, fenced grazing exclosures, constructed fishing lakes, windmill overflow pits, and constructed ponds/dirt tanks) are functional. Water developments—such as drinking troughs—provide access for wildlife and have features that minimize occurrence of drowning and are accessible all year long where possible.

Objectives

- Within the first 5 years of plan implementation, designate two to three existing fenced exclosures that are effective and ecologically functional. Maintain the structure of those designated exclosures and remove those not designated during the life of the plan. Maintain all wildlife habitat improvement plots over the life of the plan.
- Provide two to four arrays (groups of six structures spaced no more than 550 yards apart) of artificial escape structures per 640 acres to improve escape cover for swift fox. Structures will be placed in suitable shortgrass prairie habitat with loamy soils on slopes less than 3 percent and along ridgetops, knolls, or the tops of rolling hills within 15 years after plan approval.
- Move all marginally used Ferruginous Hawk nesting platforms to more suitable Ferruginous Hawk habitat locations within 5 years of plan approval.
- Create 3 to 12 nesting platforms or natural structures in suitable Ferruginous Hawk habitat locations within 15 years after plan approval.

- On Grassland units with grazing allotments in Ferruginous Hawk habitat, annually protect three to six existing Ferruginous Hawk nest trees with tree cribs to keep livestock from impacting root zones.

Guidelines

- Developed water sources should be equipped with wildlife escape structures.
- Windmills at water wells should be kept running yearlong when water availability and mechanical functioning permit, for wildlife benefit.
- New fences should minimize adverse effects upon the free movement of wildlife.

Management Approach

The Grasslands are active in managing habitat and assessing opportunities to create wildlife habitat improvement plots to meet the high public use demand for important game species that occur on the Grasslands.

While Lesser Prairie-chickens, a candidate species under the Endangered Species Act, historically occurred on the Kiowa and Rita Blanca National Grasslands, currently there is no breeding population: however, there is potential habitat in the sand sagebrush vegetation type on the Kiowa and Rita Blanca National Grasslands.

Research suggests that Lesser Prairie-chickens are sensitive to and tend to avoid tall vegetation and manmade structures that can provide roosting areas for predators such as hawks and eagles. Forest Service biologists will continue to collaborate with other Federal and state biologists and researchers in determining if the species could be expected to return to the Grasslands and successfully fledge young and what management activities would benefit their recovery if they returned.

Trees and tall human-made structures will be evaluated for removal in areas otherwise suitable as Lesser Prairie-chicken habitat.

Water, Watershed, and Perennial Streams

Desired Condition

See “Grasslands-wide Desired Conditions” on page 44.

Objective

- Maintain an average of 40 to 75 percent of open water in existing pools in palustrine emergent wetlands at Sauz Creek over the life of the plan.

Shortgrass Prairie Vegetation Type and Inclusions

Background and Description

Shortgrass prairie covers approximately 181,900 acres, or 79 percent, of the Kiowa and Rita Blanca National Grasslands. The shortgrass prairie typically occurs on areas of level plains,

undulating hills and draws, or on gently rolling uplands of the southern Great Plains. The variable landscape gives rise to diversity in species composition and structure in different successional stages based on multiple factors, including drought, fire, and herbivory by ungulates and rodents (see appendix A, maps, "Kiowa and Rita Blanca National Grasslands, Vegetation Types").

Seventy percent of the shortgrass area is made up of shortgrass prairie species. The remaining 30 percent is made up of inclusions that have species composition and structure different from shortgrass. There are five inclusions in shortgrass prairie, as follows:

- Mixed grass prairie
- Cultivated sites plowed and reclaimed
- Playas
- Dry washes, dry swales, and seasonal depressional wetlands
- Greenhorn, sandy and chalky limestone hills, knolls, gravelly balds, and mesa rims

The wildlife associated with shortgrass prairie vegetation includes the following: Bald Eagle, Loggerhead Shrike, black-tailed prairie dog, Burrowing Owl, Ferruginous Hawk, Greene milkweed, Mountain Plover, one-flowered milkvetch, Spellenberg's groundsel, Long-billed Curlew, swift fox, dotted checkerspot, alpine fever-few, Rhena-crossline skipper, Andean Prairie-clover, Scaled Quail, Swainson's Hawk, and Grasshopper Sparrow.

Of the species listed above, black-tailed prairie dog, Mountain Plover, and swift fox were determined to have viability concerns and lack the necessary population size and distribution of reproductive individuals to be considered well distributed and have assured continued existence in the planning area. An ongoing program of dusting prairie dog burrows with insecticide for controlling sylvatic plague contributes to maintaining and increasing black-tailed prairie dog colonies. There is no ongoing program of poisoning prairie dogs on the Grasslands.

New Mexico, Oklahoma, and Texas have comprehensive wildlife conservation strategies (CWCS) that identified species of greatest conservation need (SGCN). All three states rank Mountain Plover as high priority SGCN, both New Mexico and Oklahoma list black-tailed prairie dog and swift fox as high priority SGCN, and Texas lists black-tailed prairie dog and swift fox as medium priority SGCN. Priority landscape shortgrass vegetation goals were developed in the CWCS as a means to benefit the habitat for the SGCN.

Shortgrass Prairie General Vegetation Type

Desired Conditions

- The middle and late successional stages of shortgrass prairie vegetation are characterized by grasses, forb, and shrub species that have composition and structure within low departure from reference condition.
- Grass generally less than 18 inches tall dominates the shortgrass ecosystem, with a mix of mid and shortgrass steppe grasses and a scarcity of shrubs and trees. Vegetation within this association is comprised of 20 to 70 percent grasses, up to 25 percent forbs (both annual and perennial), up to 15 percent shrubs, and a variable percentage of bare ground.

- The postfire and herbivory influenced early successional stage is dominated by grass seedlings and resprouts combined with post disturbance colonizers such as smooth brome, clover, ground cherry, ragweed, and sunflowers. As succession progresses, grasses such as buffalograss, blue grama, and vine mesquite become prevalent over the forb component.
- Once a successional stage reaches mid-open, herbaceous cover comprises up to 35 percent. Vegetation is low to medium in height. The abundance of annual forbs and grasses within the composition is dependent on the timing of precipitation events.
- In the mid-closed stage, the herbaceous cover comprises more than 35 percent and grass species dominance shifts to a diverse mosaic of cool and warm season grass species, including grama grasses, muhly, panicum, fescue, brome, dropseed, and bluestem.
- Fire occurs on the landscape at varying intervals and intensities determined by vegetative density and climatic conditions on a 3- to 10-year regime.
- Low structured vegetation representative of the early successional stage of shortgrass prairie is available for a keystone species[3] black-tailed prairie dog to colonize. The colonies provide habitat for swift fox, Mountain Plover, Golden Eagle, Ferruginous Hawk, and badger.
- Habitat for at least one complex[4] of black-tailed prairie dog colonies is available for potential future reintroduction to recover the endangered black-footed ferret, a predator dependent on the black-tailed prairie dog; impacts from plague outbreaks to black-tailed prairie dogs and potential reintroduced black-footed ferrets are minimal.

Objectives

- Reintroduce prescribed fire in 1 to 10 percent of the vegetation type over the next 15 years after plan approval.
- Mechanically, chemically, or with prescribed fire remove from 5 to 10 percent of native invasive plants such as cholla, juniper, pricklypear, mesquite, and yucca annually.

[3] A keystone species has a large overall effect on community or ecosystem structure or function, and this effect is disproportionately large relative to its abundance species (Power et al. 1996)

[4] Definition of a black-tailed prairie dog complex is “a group or cluster of prairie dog colonies.”

Figure 24. An example of the composition and structure of the shortgrass prairie component on the Rita Blanca National Grasslands.

Guidelines

- Prescribed fire and targeted grazing of suitable black-tailed prairie dog habitat should occur only on loamy uplands, loamy plains, limey uplands, alkaline plains, loamy bottomlands, basalt loam, and clayey soils on 0 to 5 percent slopes.
- Timing of prescribed fire or other vegetation treatments should consider adverse consequences to nesting birds.
- Special use activities should be limited in Ferruginous Hawk nesting areas during the nesting period from March 1 to June 30 within 0.5 mile of any suitable nesting sites and/or April 1 to August 31 within 0.5 mile of any active nest. Research under Agency control should occur outside early nesting and incubation periods.
- Improving habitat and maintaining corridors for swift fox should be accomplished through timely burning, mowing, livestock grazing, and seeding.
- Grazing management practices should maximize ground cover and promote cool season grasses and forbs.

Management Approach

The Kiowa and Rita Blanca National Grasslands will strive to contribute to implementation of the recommendations of the multistate conservation plan for the black-tailed prairie dog.

The Grasslands are cooperating with the New Mexico, Oklahoma, and Texas offices of Wildlife Services, USDA APHIS in a memorandum of understanding (MOU) that addresses sylvatic plague disease in mammals occurring on the shortgrass vegetation type for the purposes of protection of human health, other wildlife resources, and boundary control.

The Grasslands are cooperating, through a MOU involving Federal agencies, to achieve the conservation and management of black-tailed prairie dogs and their habitat. The U.S. Forest Service, Animal Plant Health Inspection Service, Natural Resources Conservation Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, National Park Service, U.S. Air Force, U.S. Army, U.S. Army Corps of Engineers (Civil Works), and U.S. Geological Survey agree that cooperative efforts will enhance conservation and management of the Nation's short and mid-grass prairie and desert grassland ecosystems for the benefit of the black-tailed prairie dog and other obligate and associated species of these ecosystems.

The Kiowa and Rita Blanca National Grasslands may undertake development of a black-tailed prairie dog management plan that addresses prairie dog colony expansion on the Grasslands, plague control measures such as burrow dusting, vaccine-laden bait delivery, and control tools to protect adjacent landowner property such as visual barriers, poisoning, and shooting.

Shortgrass Prairie Specific

Background and Description

Shortgrass vegetation is codominated by blue grama, needle-and-thread, buffalograss, and little bluestem, with intermingled forbs and scattered half-shrubs. The abundance of annual forbs and grasses within the composition is dependent on the timing of precipitation events. Blue grama and buffalograss are the main grasses present in all successional stages postfire. Postfire early successional stages are dominated by resprouts and seedlings of grasses, and postfire associated forbs cover approximately 2 percent of this vegetation type. In addition, 1 to 4 percent of the vegetation type is an early successional stage due to current and historical prairie dog activity. The mid-open stage covers 86–89 percent of the shortgrass vegetation with less than 35 percent herbaceous cover that is low to medium height. The mid-closed stage covers about 8 percent of this vegetation type with greater than 35 percent herbaceous cover.

Planned fire occurs, but on a small scale and generally not within the historical fire regime of 5 to 10 years.

Desired Conditions

Across approximately 70 percent of the shortgrass prairie type, herbaceous species (including blue grama, buffalograss, and galleta) codominate the vegetation. A variety of forbs are intermingled including species such as asters, milkweeds, groundsels, and primrose. The relationship between desired structure and species height is as follows:

- Short structure species such as buffalograss and purslane, generally 0 to 4 inches tall, comprise 40 to 60 percent of the total vegetation.
- Medium structure species such as blue grama and scarlet globemallow, generally 5 to 11 inches tall comprise 35 to 50 percent of the total vegetation.
- Tall structure species such as sand dropseed and green thread, generally 12 inches tall or greater comprise 8 to 15 percent of the total vegetation.

Other desired conditions are as follows:

- Some patches of taller structure shortgrass communities (8 to 20 inches) occur in the vicinity of localities with sparse, low structure vegetation (4 to 12 inches) within ¼ mile of a water source in order to provide breeding habitat for the Long-billed Curlew.
- Grasses such as western wheatgrass and vine mesquite are abundant in mesic areas.
- Various cacti species such as cholla, pricklypear, and barrel cacti are scattered and minimally present with less than 1 percent of the total basal area.
- Scattered clusters of low shrubs such as multistemmed or knotted rhatany and snakeweed provide foraging and escape habitat for upland game birds.
- Deciduous trees are present in isolated pockets along draws, shelterbelts, and around old homesteads to provide nesting habitat for raptors.
- The other 30 percent of the vegetation type is made up of five inclusions which support different species composition and/or structure, based on soils, topography, or human influence.

Mixed Grass Inclusion

Background and Description

Mixed grass is an ecotone between shortgrass and tallgrass prairie. These sites occur on areas of sandy loam soils. Midgrass and tallgrass species codominate, ranging in height from 2 to 4 feet. Midgrass prairie species such as New Mexico feathergrass, needle and thread, big bluestem, little bluestem, and hairy grama occur individually or in variable groupings with shortgrass species. Some sites support both sand sagebrush and soapweed.

Desired Condition

- Midgrass and tallgrass species codominate the mixed grass inclusion. Species present include: New Mexico feathergrass, needle and thread, big bluestem, little bluestem, and hairy grama, occurring individually or in variable groupings with shortgrass species. Some sites support sand sagebrush and soapweed.

Objective

- On 10 to 40 percent of the mixed grass area inclusion, implement grazing management practices that maximize ground cover and favor cool season grasses and forbs during the 15 years following plan approval.

Figure 25. This photograph provides an example of vegetative shift where mixed grass species and associated forbs achieve codominance.

Guidelines

- Pastures should be grazed only once during the growing season.
- Dormant season grazing should be emphasized to maximize ground cover.
- Growing season rest should be provided following a burn event.
- Timing of prescribed fire or other vegetation treatments should consider adverse consequences to nesting birds.

Cultivated Sites, Plowed and Reclaimed Inclusion

Background and Description

These areas are old fields that were in cultivation prior to the 1930's Dust Bowl. They were severely eroded, with most or all of the topsoil removed through wind erosion. Where these conditions occur, species composition and site potential have been altered. This historical species change is not reversible for the foreseeable future. In some areas, vegetation is limited to sideoats grama and lovegrass that were planted during reclamation. Soil fertility in these areas is very low, and both microorganisms and organic material are present in the soil in very limited quantities.

Figure 26. The elevation drop on the right side of this old shortgrass field on Rita Blanca in Unit 53 shows soil loss and reduction in soil productivity from the Dust Bowl era.

Desired Condition

- Plant diversity is consistent with soil and site potential, typified by communities of sideoats grama, lovegrass, and other species established during reclamation efforts. Vegetative cover is sufficient to protect the soil from wind erosion, with the exception of prairie dog towns.

Objective

- Implement grazing management practices to increase organic matter and improve site productivity on 10 to 40 percent of old fields during the 15 years following plan approval.

Guidelines

- Dormant season supplemental feeding of livestock should be limited to areas needing additional organic matter incorporated into the soil.
- Timing of prescribed fire or other vegetation treatments should consider adverse consequences to nesting birds.

Playa Lakes Inclusion

Background and Description

Playa lakes are bowl-shaped depressions that are dependent on rainfall and surface runoff for the water they impound. They are closed basins and usually do not overflow. They are mostly intermittent, with surface evaporation occurring at about 60 inches per year. Soils are mostly stable, although some wind erosion occurs. Vegetation, when present, consists of species adapted to mesic conditions, such as various annuals, milkweeds, western wheatgrass, and inland saltgrass. Upland shortgrass species are incidental. The adjacent watershed keeps the playas functioning properly during the periodic and natural inundation of the bottoms. When playas hold water, there is an increase in the shoreline vegetative diversity and density, and an increase in the extent of mudflat habitat for migratory waterfowl and shorebirds.

Wildlife associated with playa lakes includes the following: White-faced Ibis, plains leopard frog, Long-billed Curlew, and American Avocet.

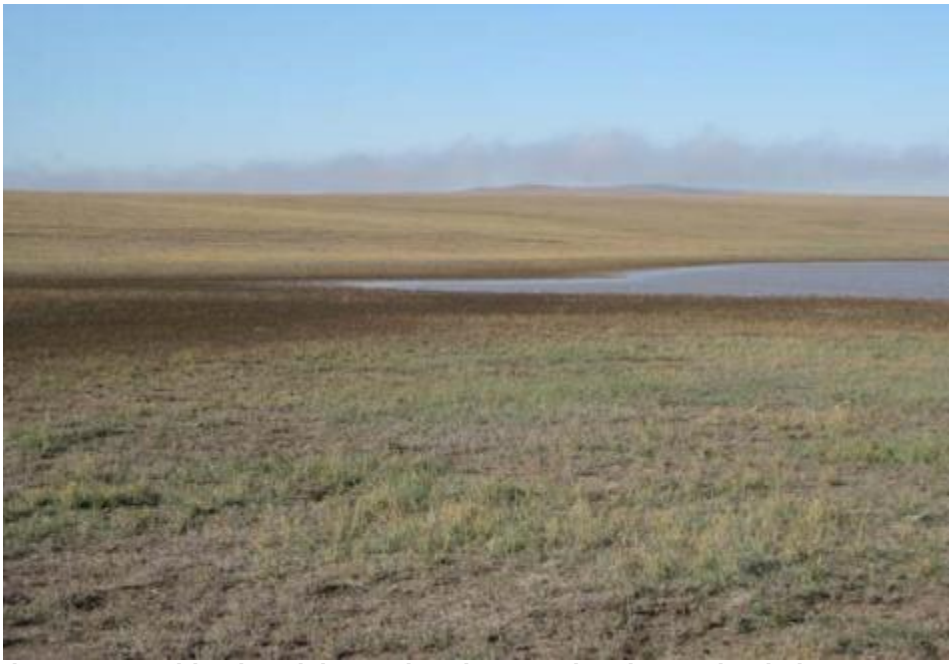

Figure 27. In this playa lake on the Kiowa National Grassland, the open water and mudflats provide important habitat for a variety of wildlife, birds, and other organisms.

Desired Conditions

- The desired condition for this playa lake inclusion is essentially the same as maintenance of the existing condition.
- Soils are mostly stable, although some wind erosion occurs. Vegetation, when sufficient moisture is present, consists of mesic-adapted species such as various annuals, milkweeds, western wheatgrass, and inland saltgrass, with incidental occurrence of upland shortgrass species.
- Playa lakes are connected to overland waterflows from the adjacent watershed during the periodic and natural inundation of the bottoms to support their inherent ecological qualities and hydrologic functions, and to provide for wildlife habitat. When playas hold water, there is an increase in the shoreline vegetative diversity and density and an increase in the extent of mudflat habitat for migratory waterfowl and shorebirds. Also during this time, they support aquatic life harboring a variety of vertebrate and invertebrate life forms.
- The integrity of the clay seals of playas is maintained and free from human influence. Playas altered through the construction of dugout pits are restored to their natural hydrologic function.

Objective

- Hydrologic functions are restored on 100 percent of altered and pitted playa lakes to better support their inherent ecological qualities and provide for wildlife habitat within 15 years of plan approval.

Guideline

- Activities should be restricted from playa lakes that would adversely impact the water-holding ability or capacity, and natural hydrologic function should be restored to those that have been altered. Any activities should contribute to the restoration of hydrologic function of those that have been altered.

Dry Washes, Dry Swales, and Seasonal Depressional Wetlands Inclusion

Background and Description

These areas include habitat associated with intermittent or ephemeral streams, draws and swales, or depressions between slopes of the gently sloping plain of grasslands. Soils are nonhydric (not formed in the presence of water) and are dry most of the year. The soil moisture is generally higher than the surrounding uplands as a result of storage and accumulation during rainfall events. However, there is no support by the water table during the long periods between precipitation events. Consistently high soil moisture levels are not present to support obligate riparian vegetation. Vegetation in and along intermittent or ephemeral drainages or seasonal depressions may be more dense or larger than their upland counterparts. However, the species are

generally upland species and are typically facultative[1] riparian or nonriparian plants, including western wheatgrass, alkali sacaton, blue grama, buffalograss, switchgrass, inland saltgrass, and a variety of forbs. The overall condition within these communities is stable.

Figure 28. Dry swales and seasonal depressional wetlands like this one on the Kiowa National Grassland are covered by shallow water for variable periods of time but may be completely dry for most of the year. Although generally isolated, these pools are connected to each other by a small drainage feature known as a swale.

Desired Conditions

- The grass component is a mix of cool and warm season grasses, including western wheatgrass, buffalograss, blue grama, vine mesquite, Indian grass, big bluestem, and switchgrass. There are some occurrences of woody species such as cottonwood, hackberry, willow, and sumac. Plant density and soil cover are adequate to slow water velocity during heavy rain events in dry swales, and water is ephemerally available in low lying, flooded depressions. The soil is highly permeable and does not show evidence of gully creation, expansion, or headcutting.
- Ephemeral wetland habitat is available for Great Plains narrow-mouthed toad to reproduce. Dry washes and draws support lichen, moss, and liverworts that provide habitat for ambersnail.

[1] Facultative riparian plants are defined as those plant species commonly found in both terrestrial upland and riparian areas.

Figure 29. Perico Creek on the Kiowa National Grassland is an example of a dry wash which supports a variety of vegetation adapted to moister conditions, though the wash does not usually contain standing water.

Objective

- Restore a minimum of 50 percent of the seasonal depressional wetlands that exhibit soil compaction and erosion within 10 years of plan approval.

Guidelines

- Activities that contribute to soil compaction and erosion should be excluded from seasonal depressional wetlands and associated swales during saturated soil conditions.
- Spreader dams and other erosion control methods should be constructed to disperse overland flow where gully erosion and headcuts are developing.

Greenhorn, Sandy and Chalky Limestone Hills, Knolls, Gravelly Balds, and Mesa Rims

Background and Description

Endemic to northeastern New Mexico, greenhorn, sandy and chalky limestone hills, and knolls occur in shortgrass prairie in elevations ranging from 5,900 to 6,600 feet. The gravelly balds and mesa rims occur in the shortgrass steppe elevations ranging from 5,400 to 5,800 feet. The outcrops are occasionally quarried for road base materials.

Desired Condition

- Limestone knolls, gravelly balds, and mesa rims support rare plant species such as Spellenberg's groundsel, one-flowered milkvetch, and Greene milkweed.

Management Approach

Forest sensitive species rare plant surveys may be completed prior to issuing permits for removal of road building materials or for other ground-disturbing activities at Greenhorn limestone outcrops, and mining should not take place if rare plants are found.

Pinyon-Juniper Vegetation Type and Juniper Grasslands Inclusion

Background and Description

The pinyon-juniper vegetation type is in low departure from reference condition for vegetation structure. This vegetation type covers approximately 21,700 acres or 10 percent of the Kiowa National Grassland. Pinyon-juniper generally occurs on shallow soil types, on rocky summits of high plains, and in drainages on slopes less than 20 percent.

The early successional stage occurs postfire and covers about 12 percent of the vegetation type with open areas of grasses, forbs, seedlings less than 4.5 feet in height, and saplings.

The middle to late successional stage covers about 88 percent of the vegetation type and includes a mix of pinyon and juniper trees in a variety of stages with varying canopy cover as follows:

- Mid-development stages average 10 percent of the vegetation type in relative abundance and have a dense canopy cover (31 to 70 percent) of pole size trees 5 to 9 inches in diameter and very little understory.
- Approximately 30 percent of the vegetation type has pole size trees with a mixed shrub-herbaceous understory, and canopy cover ranges from 0 to 30 percent.
- Approximately 40 percent in late development has medium size trees 9 to 21 inches in diameter and canopy cover of 0 to 40 percent.
- Approximately 10 percent has dense, old-growth characteristics with medium size trees and canopy cover of 41 to 70 percent.

Stands of pinyon-juniper that are overstocked or encroaching onto the shortgrass prairie are being treated with thinning and prescribed burning. Currently, the level of treatment is approximately 500 to 900 acres of thinning per year, followed by 1,000 to 1,800 acres of burning.

Juniper grassland trees occur as individuals or in smaller groups and range from young to old with snags scattered across the landscape. The understory includes scattered shrubs, native grasses, forbs, and annuals. Smaller groups of trees are found on slopes greater than 15 percent, on rocky outcrops, and adjacent to drainages.

The wildlife associated with pinyon-juniper and juniper grasslands inclusion includes the following: Greene or wheel milkweed, panhandle spurge, one-flowered milkvetch, Spellenberg's groundsel, and Mountain Bluebird.

Pinyon-Juniper Vegetation Type

Desired Conditions

The pinyon-juniper vegetation type is a mosaic of stand shape, size, spacing, and structural stages across the landscape reflecting the natural range of pinyon-juniper woodland. The tree component is largely composed of one-seed juniper and pinyon pine. Rocky Mountain juniper is well represented on mesic sites and pinyon pine is well represented over the whole vegetation type. The understory includes scattered shrubs, native grasses, forbs, and annuals. Shrub species present within a discontinuous layer include wavyleaf oak and mountain mahogany. Bare ground ranges from 5 to 55 percent depending on site potential. Snags are scattered across the landscape. Fires are of low severity, with a return interval ranging from 1 year to 35 years.

The early successional stage occurs postfire and covers about 10 percent of the vegetation type with open areas of grasses, forbs, shrubs, seedlings less than 4.5 feet in height, and saplings.

The middle to late successional stage covers about 90 percent of the vegetation type and includes a mix of pinyon and juniper trees in a variety of age classes with varying canopy cover as follows:

- Mid-development stages average 10 percent of the vegetation type in relative abundance and have a dense canopy cover (31 to 70 percent) of pole size trees 5 to 9 inches in diameter and very little understory.
- Approximately 30 percent of the vegetation type has pole size trees with a mixed shrub-herbaceous understory, and canopy cover ranges from 20 to 35 percent.
- Approximately 40 percent in late development has medium to large diameter size trees 9 to 21 inches in diameter and canopy cover of 40 to 70 percent.
- Approximately 10 percent has dense, old-growth characteristics containing larger diameter trees, some snags, partially dead and diseased trees, and canopy cover of 40 to 70 percent.

Objectives

- Over the life of the plan, burn and/or thin 5 to 10 percent of the pinyon-juniper to maintain successional stage conditions and increase understory components in the pinyon-juniper woodland.
- Mechanically, chemically, or with prescribed fire, control 5 to 10 percent of native invasive plants (such as cholla and mesquite) annually.
- Apply mechanical, chemical, and/or prescribed fire treatments to produce all middle to late structural stages that are proportionally present in the pinyon-juniper vegetation type with old growth representing 10 percent within 15 years of plan approval.
- Over the life of the plan, retain large stands of pinyon-juniper as contiguous patches of no less than 40 acres on 10 percent of this vegetation type on a landscape scale.

- Over the life of the plan, create openings in early and middle successional stage stands that lack a good shrub or grass component on up to 20 percent of the pinyon-juniper vegetation type at a landscape scale.

Guidelines

- When determining size of openings in early and middle successional stage pinyon-juniper stands, habitat requirements of big game species and fuels reduction needs should be considered. Three to five of the largest diameter trees should be retained per acre in the openings.
- All snags greater than 9 inches in diameter at the root crown should be retained.
- At least two pieces of large 9 to 12 inches in diameter down woody material 8 to 10 feet long should be retained per acre.
- Treatments or forest product removal should occur outside the nesting season (April 15th to July 31st) or be preceded by surveys for nesting birds to avoid adverse consequences to nest sites.

Juniper Grasslands Inclusion

Desired Condition

- Juniper grassland trees occur as individuals or in smaller groups and range from young to old. The smaller groups are maintained on slopes greater than 15 percent, on rocky outcrops, and adjacent to drainages. The understory is well represented and dominated by grasses and forbs, with a continuous understory that can include little bluestem, sideoats grama, blue grama, big bluestem, and/or galleta. The density of understory vegetation is sufficient to support frequent fire occurrence. The composition, structure, and function of vegetative conditions promote resilience to the frequency, extent, and severity of disturbances (e.g., erosion, insects, diseases, and fire) and climate variability. Fires that occur are of low severity with a frequency ranging from 1 to 35 years.

Objective

- Over the life of the plan, burn and/or thin 5 to 10 percent of the juniper grasslands to maintain open savanna-type conditions and increase understory components in the juniper grasslands inclusion.

Cottonwood and Willow Riparian Vegetation Type

Background and Description

This vegetation type covers approximately 1,370 acres or 1 percent of the Kiowa and Rita Blanca National Grasslands. The cottonwood and willow riparian vegetation associated with the Canadian River is described in the “Mills Canyon Management Area” section. The cottonwood and willow riparian communities are located within stream channels and on their associated flood plains and terraces. Riparian vegetation is common with sandy alluvial soil conditions. The early

successional stage is represented on about 16 percent of this vegetation type and is typically shrub-seedling dominated but grasses may codominate. The middle and late successional stage covers about 84 percent with a species composition of tall shrubs and small trees such as willows and cottonwoods. Late successional stage represents the mature, large cottonwood and willow riparian woodlands. Current management activities are targeting nonnative, invasive species in riparian areas, specifically, saltcedar. These activities are encouraging establishment of needed mid-successional conditions.

Fremont cottonwood dominates the tree layer, with peachleaf willow present in the subcanopy. Riparian dependent species include: narrowleaf cattail, common button bush, thinleaf or marsh alder, Rocky Mountain elderberry, and a variety of sedge and rush species. The primary shrub and vine species are sandbar willow, Virginia creeper, and riverbank grape. Native warm season grasses including blue grama, sideoats grama, sand dropseed, Virginia wildrye, and switchgrass are prominent in the ecosystem. Western wheatgrass is an important cool season species. Drier sites along or within ephemeral systems and upper terraces have New Mexico locust, choke cherry, hackberry, skunkbush sumac, and Apache plume.

The wildlife associated with all aspects of cottonwood-willow riparian include the following: Bald Eagle, Great Plains narrow-mouthed toad, plains leopard frog, Yellow-billed Cuckoo, white-tailed deer, arid land ribbon snake, Hobomok skipper, and Red-headed Woodpecker.

Desired Conditions

- Varied early, middle, and late successional stage structure (grasses, forbs, shrubs, trees) and varied species composition are present after major disturbance events or as a result of climate.
- Early successional stages within the riparian communities are present after disturbance. Cottonwood and willow seedlings are present on alluvial depositions. Sedges and rushes are the primary herbaceous species present in wet areas. Bare sand islands and point bars and gravel deposition areas are common. Grasses and young shrubs such as false indigo bush are present on less recent alluvial depositions. Remnant mature cottonwood and willow are infrequently present.
- Some mid-stage structure is present on depositional areas not recently disturbed. The mid-stage communities are partially open, with scattered cottonwoods and willows. The shrub layer is well developed, and herbaceous vegetation is highly variable, with Virginia wildrye and muhly grasses usually present. In wetter, more shaded areas, Virginia creeper is present.
- Late stage, mature, closed canopy cottonwood trees are present along the upper terraces that are protected from most flood events, except for rare, high-intensity flooding. Large mature trees, some with cavities, and dead but standing snags, dead and decadent branches, fallen limbs, and down trees, characterize the understory.
- Fire is infrequent and occurs at 5- to 50-year intervals, with intensities determined by vegetative and climatic conditions.

- Populations of native woody species (particularly the long-term presence of mature cottonwood stands and areas with regenerating cottonwood and willow saplings) provide habitat for wildlife species such as Bald Eagle, Rio Grande Turkey, and raptors. A diverse mix of native grasses and forbs adapted to abrupt fluctuations in moisture regimes occurs in the herbaceous portion of riparian areas. The meander scars and depressions in the riparian areas that retain water part or all year provide habitat for amphibians, reptiles, insects, snails, and invertebrates.

Figure 30. This reach of Corrumpa Creek, Kiowa National Grassland, has all the components of a cottonwood-willow riparian community.

Objective

- Restore 100 percent of the riparian areas to cottonwood-willow vegetation type species through plantings, seeding, and/or mechanical or chemical methods within 15 years of plan approval.

Guidelines

- All large native woody debris should be retained in the stream system to catch and store sediment.
- Grazing should be managed to promote or maintain riparian woody vegetation.
- Bald eagle roosts and nest sites should be protected by retaining, developing, or preserving mature trees and old-growth cottonwood stands, particularly within ½ mile of water.

Sand Sagebrush Vegetation Type

Background and Description

The sand sagebrush vegetation type covers approximately 22,651 acres (8 percent) of the Grasslands. Sand sagebrush typically occurs on areas of level plains, undulating hills and draws, or on gently rolling uplands of the southern Great Plains. The variable landscape gives rise to diversity in species composition and structure across the landscape.

The sand sagebrush prairie is dominated by mid-grasses and shrubs. The landscape includes a diversity of areas in different successional stages and with varying vegetative heights, as well as cool season grasses and a variety of forbs. The primary shrub species is sand sagebrush. Native, warm season perennial grasses (including big bluestem, little bluestem, sand dropseed, blue grama, and sideoats grama) are prominent in this ecosystem.

Figure 31. The sand sagebrush community produces a structural and compositional mosaic of vegetation as shown here with mixed grass on the Rita Blanca National Grassland.

One percent is in a postfire successional stage dominated by resprouts and seedlings of grasses and forbs with low to medium height having a variable canopy cover. This stage typically occurs where fires burn relatively hot.

The mid-open successional stage represents about 65 percent and has less than 35 percent herbaceous cover, medium to tall in height.

Mid-closed stage represents about 35 percent of the area with greater than 35 percent herbaceous cover, medium to tall in height.

Prescribed burning is currently being accomplished at a rate of approximately 500 acres every 3 to 5 years.

The wildlife associated with sand sagebrush includes the following: Lesser Prairie-chicken, dotted checkerspot, Scaled Quail, Grasshopper Sparrow, panhandle spurge, and Andean prairie-clover.

Figure 32. Sand sagebrush with mixed grass depicting vertical structure on Rita Blanca Unit 54 shows the structure and composition desirable for suitable Lesser Prairie-chicken habitat.

Desired Conditions

- Sand sagebrush vegetation is characterized by shrubs, grasses, and forb species with structure and composition across the landscape that maintains the reference condition and areal extent.
- Fire and grazing disturbance processes occur on the sand sagebrush landscape at varying intervals and intensities that are determined by climatic conditions and vegetative density, respectively. The disturbance processes contribute toward achieving desired vegetative structure and density, improve vigor of native grass, and provide diversity of native forb species that are represented by plant communities with intermingled patch sizes at scales on the order of 10 to 1,000 acres. The diverse, well-distributed plant communities provide conditions that contribute to the sustainability of insects and rare plant species, as well as to nonuniform vegetative structure across the landscape that provides habitat for a diversity of prey and predator species. Fire return occurs at 5- to 50-year intervals.

- The sand sagebrush prairie is dominated by mid-grasses and sand sagebrush, with cool season grasses and a variety of forbs present. Native, warm season perennial grasses (including big bluestem, little bluestem, sand dropseed, blue grama, and sideoats grama) are prominent in this ecosystem. Early successional sand dune habitat is present at acceptable rates.
- Varied representation of any successional stage structure and composition results after major disturbance events.
- Vegetation cover is generally comprised of 20 to 60 percent grasses, 2 to 15 percent forbs, greater than 15 percent shrubs, and a variable percentage of bare ground, dependent upon the site potentials of these areas.
- Less than 5 percent of the area is represented in an early successional stage dominated by resprouts and seedlings of grasses and forbs. Canopy cover within this stage is highly variable, forb dependent, and has a low to medium height structure of up to 11 inches.
- The mid-open successional stage is represented by less than 35 percent herbaceous cover and makes up on average less than 65 percent of the area. Total canopy cover within this stage is variable (25 to 75 percent) with medium to tall height structure (5 to 12 inches or greater).
- The mid-closed successional stage makes up on average more than 30 percent of the area and has greater than 35 percent herbaceous cover. Total canopy cover within this stage is generally greater than 50 percent, with height structure greater than 12 inches.

The relationship between desired structure and species height is as follows:

- Short structure species such as blue grama, generally 0 to 4 inches tall, comprise 40 to 60 percent of the total vegetation cover.
- Medium structure species such as squirreltail and lacy tansyaster, generally 5 to 11 inches tall, comprise 35 to 50 percent of the total vegetation cover.
- Tall structure species such as sand bluestem and bush morning glory, generally 12 inches tall or greater, comprise 8 to 15 percent of the total vegetation cover.
- The sand sagebrush species composition provides vegetation structure and height relationships necessary for ground nesting bird cover and brood-rearing habitat. Small areas of short structured herbaceous vegetation or patches of bare ground are present for Lesser Prairie-chicken leks and courtship areas. These patches also provide wildlife travel corridors, escape routes, and annual plant germination sites for wildlife foraging habitat.

Guidelines

- Management activities should be implemented that encourage forbs and cool season grasses.
- Pastures should be grazed only once during the growing season.
- Dormant season grazing should be emphasized to maximize ground cover.

- Timing of prescribed fire or other vegetation treatments should consider adverse consequences to nesting birds.
- Growing season recovery should be provided following a burn event.

Management Approach

In general, improving habitat and maintaining corridors for potential Lesser Prairie-chicken reoccupation and use may be accomplished through a blend of timely burning, mowing, livestock grazing, and seeding practices.

Mills Canyon Management Area

The Mills Canyon Management Area is located in Mora and Harding Counties, NM, is part of the Kiowa National Grassland, and is a unique subunit of the Kiowa and Rita Blanca Management Area. The following plan components (desired conditions, objectives, guidelines, standards) and management approaches apply only to the social and economic goods and services and ecological resources of the Mills Canyon Management Area. Because this management area is an overlay to the Kiowa and Rita Blanca Management Area, the direction given for the Kiowa and Rita Blanca Management Area in part 3 and the Grasslands-wide direction of part 2 apply as well.

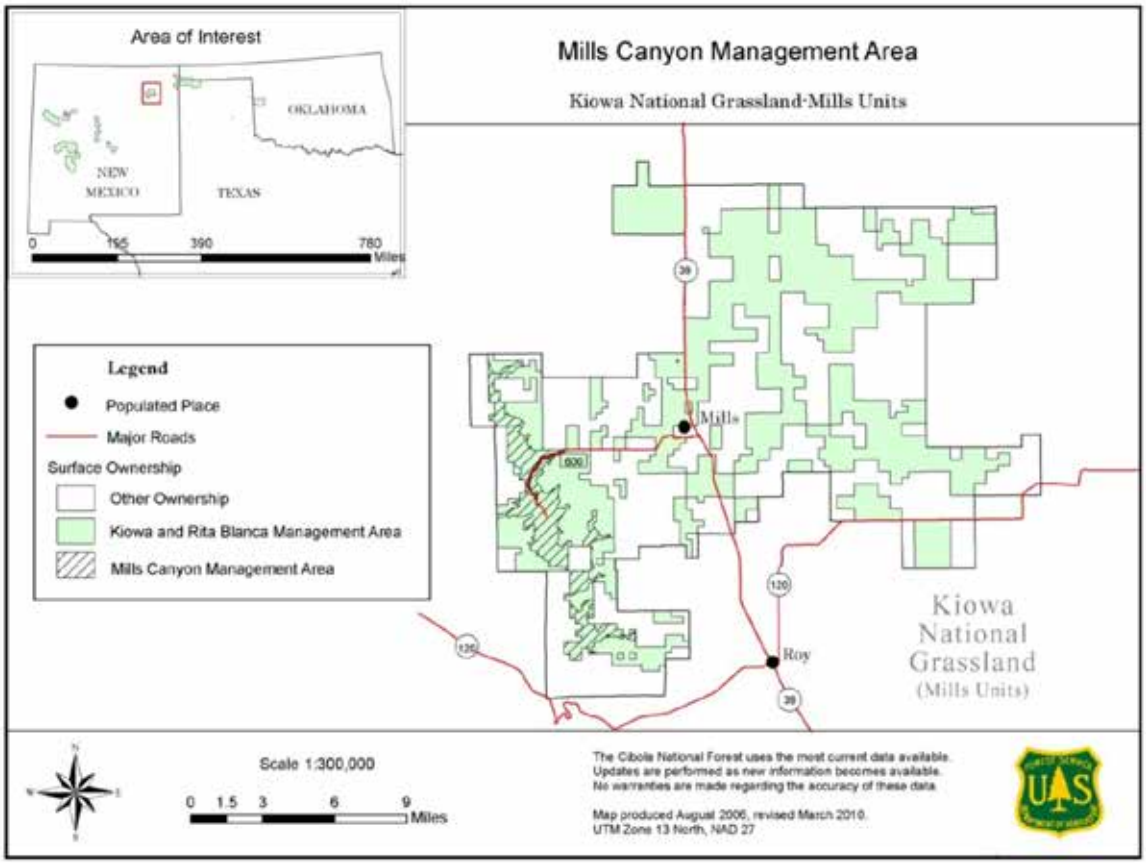

Figure 33. Mills Canyon Management Area.

> ***The reader is reminded that:***
>
> Appendix C contains a list of proposed and probable actions that will likely take place on the Grasslands at the project or activity level to accomplish objectives and to maintain or move toward achievement of the desired conditions described in this plan.

Integrated Recreation and Scenery

Background and Description

The Mills Canyon Management Area is located in the western portion of the Kiowa National Grassland. The rim of the canyon defines its eastern and western boundaries, and the northern and southern extents are defined by NFS property boundaries. The main road in the canyon is within a motorized corridor and provides vehicle access to trailheads. Nonmotorized trail access from the top of the canyon to the bottom is provided. Nonmotorized trails accommodate hiking and horseback riding.

The Forest Service intends to maintain a semiprimitive nonmotorized character for most of the management area to preserve its outstanding recreational and natural features. There are small areas of semiprimitive motorized character that provide access to two popular dispersed camp and picnic sites (See appendix A, maps, "Proposed Scenic Integrity Objectives and Recreation Opportunity Spectrum Classes"). Sand sagebrush with mixed grass depicting vertical structure on Rita Blanca Unit 54 shows the structure and composition desirable for suitable Lesser Prairie-chicken habitat.

Figure 34. The Mills Canyon Management Area is remarkable for its dramatic topography and has been a center of prehistoric and historic activities.

Desired Conditions

- The unique characteristics of Mills Canyon are apparent through views that are provided of the 800-foot-deep canyon. The Canadian River and the ribbons of willows and pockets of cottonwoods growing along the banks are central elements of the valued landscape. The presence of the invasive saltcedar tree is minimal or nonexistent. Along the rim there are coniferous trees and deciduous shrubs. The contribution of these scenic features allows the canyon to be predominantly a natural appearing landscape.
- The ruins of the Mills Orchard and Ranch near the campground and the remnant Osage orange trees provide a glimpse of the history of the canyon.

- A variety of nonmotorized recreation opportunities exist in a natural setting that offer opportunities for solitude. Concentration of users outside of developed recreation facilities is low. Dispersed camping occurs in areas appropriate for that use. Dispersed recreation areas offer unique hunting opportunities.
- Improvements such as trailheads, trails, signs, bridges, fences, primitive shelters, or water developments are present. The number of structures and facilities to support management activities is limited.
- A natural landscape with unobtrusive structural developments is maintained. Livestock grazing and recreation activities have minimal conflict. Vegetation management activity conforms to valued landscape characteristics of the eligible scenic river.
- Retain the undeveloped character of the inventoried roadless area (IRA), and retain the roadless character for that part of the management area within the IRA boundary.

Figure 35. The line of remnant Osage orange trees along the upper grassy area, draw a canyon viewer's attention to the ruins of buildings at the Mills Orchard and Ranch site, as well as to the contrast among meandering riparian vegetation, rolling terrain, trees, and shrubs.

Objectives

- Post signs and construct barriers to prevent dispersed camping immediately outside the perimeter of all developed sites within 10 years of plan approval.
- Successfully rehabilitate areas of past disturbance within 200 feet of all developed recreation sites within 10 years of plan approval.
- Construct two nonmotorized trails in the Mills Canyon Management Area within 15 years of plan approval.
- Perform maintenance on the Mills Canyon Orchard and Ranch site every 3 to 5 years to the conditions established by the 2005 rehabilitation.

- Rehabilitate all user-created routes and closed roads that are causing resource concerns within 15 years after a travel management decision is signed for the management area.

Vegetation in Canyon Lowlands, Woodland Pinyon-Juniper on Canyon Steep Slopes, Cottonwood-Willow Riparian, and Canadian River

Background and Description

The Mills Canyon Management Area is located on the Kiowa National Grassland in northeast New Mexico along the Canadian River about 55 river miles above Conchas Reservoir. It is defined geographically by the Canadian River gorge, with elevations ranging from 6,100 feet at the river to 6,800 feet at the canyon rim. The variable landscape gives rise to diversity in species composition and structure across the landscape.

Figure 36. The valley, river, and canyon walls in this photo of Mills Canyon and the Canadian River create a backdrop for the diverse vegetation growing in the riparian areas, flood plain terraces, and gently rolling valley floor areas.

The following pages describe vegetation composition and structure variations associated with the following topographical positions within the canyon:

- Canyon lowlands
- Woodland pinyon-juniper on canyon steep slopes
- Cottonwood-willow riparian and Canadian River

Canyon Lowlands

Background and Description

The canyon lowlands of the Canadian River valley include the gently sloping flood plains found between the riparian area of the Canadian River and side drainages. These flood plains are characterized by sloping terraces of less than 15 percent that transition into the nearly vertical side slopes that form the walls of the river canyon and the canyon stringer drainages that flow into the main channel of the river system. Much of the river bottom was formed by alluvial deposits and sloughing upper terraces. There are three distinct flood plains dependent upon and formed by the frequency of flooding events. They range from areas of historical (long-term) floods where vegetation can exhibit successional patterns (areas of 100- to 500-year flooding) and areas of 2- to 5-year flooding where the vegetation is comprised mostly of annuals and other riparian disturbance-dependent species. In the active flood plain, flooding frequency determines vegetation composition and successional patterns. The upper flood plain is a secondary successional pattern exhibited by a woodland community of one-seed juniper, pinyon pine, wavy leaf oak, cholla, and sumac with an herbaceous understory of silver bluestem, sand dropseed, vine mesquite, and blue grama. The woodland community advances onto the secondary flood plain near the water's edge, indicating a historical change in frequency of floods and/or fluvial processes.

Desired Condition

- The composition, structure, and function of vegetation promote resilience of the system to the frequency, extent, and severity of flood events. Vegetation is represented in a diverse composition and age class distribution. Species present within the 2- to 5-year flood plain indicate maintenance of riparian soil moisture characteristics. Vegetation within the secondary and tertiary flood plains is adequate to protect soils and dissipate energy during high flows. Early successional stage occurs postflood and covers 10 to 20 percent of the flood plain. Mid- to late-development stages cover 50 to 80 percent of the flood plain in relative abundance, with a mixture of upland and riparian dependent species present.

Objective

- Use prescribed fire at least once within 15 years of plan approval to rejuvenate the browse component on the canyon lowlands.

Pinyon-Juniper Woodland on Canyon Steep Slopes, Cliffs, and Rock Outcrops

Background and Description

Canyon side slopes are directly associated with drainages and range from steep to very steep with gradients greater than 20 percent. The dominant vegetation on canyon slopes varies depending on aspect, with pinyon pine, juniper, and Gambel oak as the principal tree species. The area is wetter than upland areas, and northerly slopes support dense stands of juniper, ponderosa pine, mountain mahogany, and oak. Slopes with more southerly aspects support relatively dense stands of pinyon pine and juniper with mixed oak (primarily comprised of wavyleaf oak). The vegetation on cooler, moister side drainages and on the edge of the canyon rim is generally comprised of ponderosa pine stringers. Fire-influenced areas are often characterized by dense stands of Gambel and wavyleaf oak thickets.

Figure 37. The slopes of Mills Canyon support ponderosa pine and relatively dense stands of pinyon pine and juniper with a wavyleaf oak and Gambel oak understory.

The wildlife and plants associated with pinyon-juniper on canyon steep slopes, cliffs, and rock outcrops includes the following: Zone-tailed Hawk, American Peregrine Falcon, Pale Townsend's Big-eared Bat, Rocky Mountain dagger, and horrid herrickia.

Desired Conditions

- The side slopes support dense, mixed, and occasionally pure stands of juniper, ponderosa pine, mountain mahogany, and oak. Slopes with more southerly aspects support relatively dense stands of pinyon pine and juniper with mixed oak (primarily comprised of wavyleaf oak). Vegetative cover is present to maintain erosion at natural rates. Fire regimes are within 1 to 35 years with a range of variation and intensity. Fire-influenced areas are characterized by dense stands of Gambel and wavyleaf oak thickets and vegetative cover is present to maintain erosion at natural rates. The risk of

losing key ecosystem components (species composition, structure, and pattern) due to severe wildfire is low.

- Woodland canyon side slopes provide key ecosystem components such as older age class ponderosa pine to provide nesting habitat for raptors and roost or nursery habitat for bats. Cliffs support nesting raptors.
- Browse on side slopes provides habitat for mule deer.

Objective

- Use prescribed fire at least once over the life of the plan to rejuvenate the browse component on the canyon side slopes.

Cottonwood-Willow Riparian and Canadian River

Background and Description

The Canadian River flows from its headwaters in the Sangre de Cristo Mountains in far southern Colorado and meanders through the semiarid landscape in the central part of northeastern New Mexico. Snowmelt and seasonal rains are the major flow sources: both of which are diverted for irrigation and other uses before the waters reach the Mills Canyon area. The upstream water diversion has altered seasonal base flows in the Mills Canyon portion of the Canadian River, thereby reducing water availability for adjacent riparian area vegetation.

Along the canyon bottom, within the river flood plain, vegetation is dominated by riparian species, including willow and cottonwood. The cottonwood-willow riparian communities are located within stream channels and include the associated flood plains and terraces. Riparian vegetation is common with sandy alluvial soil conditions. The early successional stage is represented on about 16 percent of this vegetation type and is typically shrub-seedling dominated, but grasses may codominate. The middle and late successional stage covers about 84 percent of the species composition that includes tall shrubs and small trees such as willows and cottonwoods. The late successional stage represents the mature, large cottonwood and willow riparian woodlands. Much of the native riparian vegetation has been replaced by saltcedar. Current management activities are targeting nonnative, invasive species in riparian areas. These activities are encouraging establishment of needed mid-successional conditions. In the Mills Canyon Management Area of the Canadian River, upstream diversions and invasion of saltcedar have altered hydrological processes and geomorphology.

Cottonwood-willow riparian trees support nesting and foraging for birds such as the Red-headed Woodpecker in early/mid- and late-successional stages and Bald Eagle in the late-successional stage during winter migration. Wildlife that utilize the adjacent riparian habitat and other riparian wet mesic areas include invertebrates, such as Conchas crayfish and ambersnail, and reptiles such as the arid land ribbon snake.

Desired Conditions

- Cottonwood-willow riparian vegetation is characterized by trees, shrubs, grasses, and forb species without the presence of invasive species such as saltcedar. The structure and composition closely resembles the reference condition of the cottonwood-willow riparian vegetation type.
- Fremont cottonwood dominates the tree layer with peachleaf willow present in the subcanopy. Riparian dependent species includes: narrowleaf cattail, common button bush, thinleaf or marsh alder, Rocky Mountain elderberry, and a variety of sedge and rush species. The primary shrub and woody vine species are sandbar willow and riverbank grape. Native warm season grasses including blue grama, sideoats grama, sand dropseed, vine mesquite, Virginia wildrye, and switchgrass are prominent in the riparian ecosystem. Western wheatgrass is an important cool season species. Drier sites along or within ephemeral systems and upper terraces have New Mexico locust, choke cherry, hackberry, skunkbush sumac, and Apache plume.
- Populations of native woody species, particularly the long-term presence of mature cottonwood stands and areas with regenerating cottonwood and willow saplings, provide habitat for wildlife species such as the Bald Eagle and Red-headed Woodpecker. A diverse mix of native grasses and forbs adapted to abrupt fluctuations in moisture regimes occurs in the herbaceous portion of riparian areas and provides habitat for the arid land ribbon snake and ambersnail. The meander scars and depressions in the riparian areas that retain water part or all of the year provide habitat for amphibian species such as the plains leopard frog.

For both herbaceous and woody riparian areas, stream characteristics including vegetation, geomorphology, and hydrology are sufficient to:

- Dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid flood plain development;
- Allow floodwater retention and groundwater recharge; and
- Develop root masses that stabilize streambanks against cutting action.

Guidelines

- Restore 100 percent of the riparian areas to cottonwood-willow vegetation type species through plantings, seeding, and/or mechanical or chemical methods within 15 years of plan approval.
- Conchas crayfish habitat of sandy substrate and shallow shoreline should be maintained.
- Habitat should be managed for open forest fragments and large snags should be available for cavity-nesting birds.

Part 4: Special Areas and Eligible Scenic River

The Kiowa and Rita Blanca Management Area has four special features that attract many visitors. There are two scenic byways, the Santa Fe Trail National Scenic Byway and La Frontera del Llano Scenic Byway; one historic trail, the Santa Fe National Historic Trail; and a segment of eligible scenic river on the Canadian River. The location and boundaries of these areas are shown on the special areas map in appendix A, maps, "Special Areas and Eligible Scenic River."

All of these special areas have high scenic integrity that helps preserve their context; therefore, some of the applicable management direction associated with these areas can also be found in the "Scenery" plan components.

The reader is reminded that:

Where there is no desired condition given for a social or economic good or service or ecological resource related to this management area, refer to the Grasslands-wide desired condition for the same topic in part 2; and

Where there are no explicitly stated, unique, or additive objectives, management approaches, guidelines, or standards given, then none exist for this management area beyond those at the Grasslands-wide scale presented in part 2.

Appendix C contains a list of proposed and probable actions that will likely take place on the Grasslands at the project or activity level to maintain or move toward achievement of the desired conditions described in this plan.

National Trails and Scenic Byways

Background and Description

Santa Fe National Historic Trail

The Santa Fe National Historic Trail is a national historic landmark with a 2.4-mile trail segment located on the Kiowa National Grassland. In 2001, the Forest Service developed an interpretive kiosk and day-use/picnic site near the historic trail route in accordance with the National Park Service's "Santa Fe National Historic Trail Comprehensive Management and Use Plan." Management objectives for the Santa Fe National Historic Trail center on four general subject areas: protect resources from overuse, vandalism or inappropriate use; visitor use with an emphasis on interpretive activities; development including standardized signage and restoration; and management and cooperation between the National Park Service and other managing entities.

This section of the Santa Fe National Historic Trail is valued because the landscape remains similar to the landscape viewed by American Indians prior to arrival of European settlers, as well as when the trail was in use in the 1800s as an international commercial wagon route. The only conflict to maintaining the historic and scenic qualities of the trail area is unregulated motorized use that occurs there and evidence of that use.

Santa Fe Trail National Scenic Byway

The Santa Fe Trail National Scenic Byway is a roadway that was designated to highlight areas of the Santa Fe National Historic Trail that are accessible by vehicle. Since most of the trail is on

private land, the byway is an essential link for tourism and economic development associated with the trail and its history. It follows U.S. 56 and NM 406 in the vicinity of the Kiowa National Grassland.

Figure 38. The Santa Fe Trail National Scenic Byway offers high-quality views of landmarks that are part of the trail's history, including Rabbit Ears and historic homesteads.

La Frontera del Llano Scenic Byway

La Frontera del Llano Scenic Byway passes through Quay, Harding, and Colfax Counties. It follows NM 39 through the Mills units of the Kiowa National Grassland. Mills Canyon is a major feature that is expected to be promoted along this route.

Desired Conditions

Santa Fe National Historic Trail

- The segments of the Santa Fe National Historic Trail identified on the Kiowa National Grassland demonstrate the inherent physical integrity, and cultural, natural, and scenic resources of the trail. This is consistent with the "Santa Fe National Historic Trail Comprehensive Management and Use Plan" (USDI National Park Service 1990) and the Memorandum of Understanding between the National Park Service and the Pike-San Isabel National Forests and Cimarron-Comanche National Grasslands signed March 6, 1991 (USDA Forest Service and USDI National Park Service 1991).
- Developments are limited to a few fences, roads, and ranching-related tanks and windmills; the broad grasslands extend to the distant hills. The ruts are still prominent, and visitors can follow the trail and experience a landscape similar to the travelers of the 1800s.

- The Santa Fe National Historic Trail is a nonmotorized corridor that promotes conservation of the historic features and setting of the trail. Ruts and other remnant evidence are interpreted and protected from modern human impacts. The landscape is reminiscent of the time when the trail was used actively as a wagon route, and of the time when American Indians were the predominant human inhabitants. Trail signs and interpretive materials are consistent with the symbols and appearance of other developed sites along the trail. Visitors experience outdoor recreation, public enjoyment, appreciation, and learning about the Santa Fe National Historic Trail.

Figure 39. The marker for the Santa Fe National Historic Trail on the Kiowa National Grassland displays a standardized emblem as part of the comprehensive management and use plan prepared by the National Park Service.

Santa Fe Trail National Scenic Byway

- The byway provides access to remnant portions of the Santa Fe National Historic Trail and is the major corridor by which visitors find the Santa Fe National Historic Trail interpretive site. Outdoor recreation and public appreciation for the history of the Santa Fe National Historic Trail are experienced along the routes. The scenery is reminiscent of the open grassland and sweeping plains seen when the trail was active. Quality views of landmarks on the horizon are enjoyed along the byway, particularly Rabbit Ears Mountain, Round Mound, Turkey Creek, and McNees Crossing.

La Frontera del Llano Scenic Byway

- Mills Canyon and other historic and scenic attractions along the route are connected to the byway through signs and other directional material. The scenic quality of the vast open spaces includes plains and mesas, grasslands, and rivers, with abundant wildlife that are visible from the byway. The grasslands bordering Mills Canyon are gently rolling hills blanketed with grasses and punctuated with pockets of pinyon and juniper.

Low mesas, tablelands, and occasional ridges of lava beds define the landscape of the Grasslands. Nearing the canyon rim, the pinyon and juniper form more continuous bands. The social history of the frontier life in New Mexico is preserved and interpreted for visitor enjoyment and appreciation.

Objectives

Santa Fe National Historic Trail

- Within 5 years of plan approval, close and rehabilitate or obliterate all Forest Service roads which cross the Santa Fe National Historic Trail and which are not necessary for administrative uses.

La Frontera del Llano Scenic Byway

- Construct at least one sign that links Mills Canyon and the Kiowa National Grassland to La Frontera de Llano Scenic Byway within 10 years of approval of the byway's management plan.
- Develop at least one interpretive site related to La Frontera de Llano Scenic Byway within 10 years of plan approval.

Management Approach

National Trails and Scenic Byways

Scenic byways and national trails are linear special areas which cross multiple jurisdictions. Supporting activities and enhancement of these trails and byways is an important part of the Grassland's economic contribution to local communities. Because of the multijurisdictional nature of this type of special area, trail or byway associations may be a close partner in activities and projects related to the respective trail or byway. The Grasslands may work with these associations to support their economic goals and to protect the resources for which the trail or byway was designated. The Grasslands may coordinate to maintain consistency in signage and appearance of the trail and associated features.

Eligible Scenic River

Background and Description

The segment of the Canadian River within the Mills Canyon Management Area was classified as an eligible scenic river under the Wild and Scenic River Act in 2002. The corridor is approximately 20 miles long, with 17 miles on Forest Service land, and 3 miles on other jurisdiction with a half mile buffer —1/4 mile wide on either side of the river. Even though the river is properly classified as free flowing, it is periodically intermittent due to climatic events such as large-scale drought and upstream diversions. In addition, the canyon walls display geological formations and dramatically rise several hundred feet above the canyon floor. These features are unique across the adjacent Grassland units. The area was considered eligible for four outstanding and remarkable values: scenery, geology, recreation, and history. Management of the eligible scenic river corridor is intended to enhance and protect these values; however, there is

some intrusion into the area by user-created roads. The standard for managing the eligible scenic river has been carried over from the 1985 plan.

Figure 40. The Canadian River is an eligible scenic river under the Wild and Scenic Rivers Act of 1968. The outstanding remarkable values of the corridor are scenery, recreation, geology, and history.

Desired Conditions

- The Canadian River within Agency ownership is a free-flowing river, free of impeding structures. The stream exists in a state of balance where the stream geomorphology (slope, width, depth, and sinuosity) adjusts to changes in sediment and waterflow. The riparian vegetation at the river's edge is dominated by cottonwood and willow communities, and the stream is allowed to meander. The four outstanding and remarkable values of the river: scenery, recreation, geology, and history are protected and preserved for future generations.
- Visitors consider scenery in the river corridor as beautiful, primitive, and natural. The major features of the canyon's scenery are the cottonwood-willow riparian vegetation running down the center of the canyon, the pinyon-juniper woodlands on upper slopes of the canyon, and the occasional ponderosa pine in wet drainages. The geology and history of the canyon are interpreted for visitors. Interpretive connections between La Frontera del Llano Scenic Byway and the river corridor emphasize the canyon's uniqueness compared to the surrounding landscape and its importance to local communities. Public access in the corridor does not conflict with the outstanding and remarkable scenic values for which the area was determined to be an eligible scenic river.

Objective

- Close or rehabilitate all unauthorized motorized vehicle stream crossings in the corridor within 10 years of plan approval.

Standard

- Manage the Canadian River to preserve its wild, scenic, or recreation river potential.

Management Approach

As opportunities become available, private lands may be acquired within the river corridor to preserve the unique qualities.

Part 5: Suitability of Areas

Suitability

Introduction to Suitability of Areas

The Grasslands are generally suitable for a variety of uses. The three broad use categories (grazing, recreation, and timber) on the following pages are not intended to be all inclusive. Some uses, such as energy development or mineral extraction, are guided by desired conditions, guidelines, and standards found in parts 2 and 3 of this document, but in general, the Grasslands are suitable for those uses.

The identification of an area as suitable for various uses is guidance for project and activity decisionmaking and is not a commitment or a final decision approving projects and activities. Uses that are not specifically identified as suitable would be evaluated in terms of the desired conditions. Uses that are neutral to or help move the Grasslands toward the desired conditions may be allowed. Particular uses that are suitable in an area must also be consistent with other plan components and laws and regulations.

Areas that are not suitable for a particular use are those where the use is not compatible with desired conditions for the area. This does not mean the use is prohibited in that area, but the activity or project would require a NEPA decision.

Grazing Suitability

The 1982 Planning Rule provisions require that the suitability and capability of National Forest System lands for producing forage for grazing and browsing animals be determined in forest planning. Suitability is determined based on compatibility with desired conditions and objectives in the plan area, including wildlife habitat needs. The identification of an area as suitable for various uses guides project and activity decisionmaking and is not a commitment or a final decision approving projects and activities. For example, the identification of lands suitable for livestock grazing within the revised plan is not a decision to authorize livestock grazing; the final decision to authorize livestock grazing would be made at the project (allotment) level.

The 1985 “Cibola National Forest Land and Resource Management Plan” (LRMP), as amended, is the starting point for identifying suitability of land use on the Grasslands. The analysis and subsequent identification of lands as suitable for livestock grazing is carried forward from that plan as the existing suitability determination. No need for change was identified.

Capability of Cibola National Forest and National Grasslands lands to produce forage was determined in the 1980s as part of forest planning. Capability is the potential of an area of land to produce resources and supply goods and services. It depends upon site conditions such as climate, slope, landform, soils, and geology. Most of these landscape-scale conditions have not changed significantly since then; therefore, capability determined in the 1985 LRMP is likely still at the strategic planning level, but it should be considered when making project-level decisions.

Current Condition

Over 96 percent of the Grasslands is used by permit holders to graze their cattle. Livestock are excluded from developed recreation areas, administrative sites, research sites, and exclosures designed to protect various resource values. There is no indication that there will be a major increase or decrease in grazing on the Grasslands over the next 20 years; however, cattle numbers

and management strategies are expected to fluctuate in response to drought, wildfire, prescribed fire, and other factors that change range conditions.

Annual range monitoring has shown that annual fluctuations in weather patterns continue to be the most frequent reasons for adjusting grazing management strategies through adaptive management processes. Monitoring is done on an annual basis and reports can be found at http://www.fs.fed.us/r3/cibola/projects/index.shtml.

Table 2. Livestock grazing – all Grasslands

Suitability Determination		
Area	**Suitable**	**Not Suitable**
General Grasslands	X	
Slopes over 40 percent		X
Developed recreation areas		X
Administrative sites, research sites, exclosures designed to protect resource values		X
Areas with "No Grazing" decisions		X
Areas with soil condition of unsuited or inherently unstable soil function		X

Recreation Suitability

The Recreation Opportunity Spectrum (ROS) is a planning tool used to identify the supply of outdoor recreation settings on national forests in support of recreation activities. ROS includes seven possible setting classifications. Four settings are assigned on the Grasslands: roaded natural (RN), semiprimitive motorized (SPM), semiprimitive nonmotorized (SPNM), and rural (R). (See the "Recreation Opportunity Spectrum" maps in appendix A.)

The ROS makes broad assumptions about what recreation activities are compatible within a given recreation setting. Based upon the ROS settings, the plan revision team determined suitability within the four ROS classes described above. Only dispersed uses would be suitable in areas classified as semiprimitive nonmotorized. All recreation uses would be suitable in areas classified as semiprimitive motorized and roaded natural. Areas (1,409 total acres) on the Kiowa and Rita Blanca National Grasslands inventoried as rural are unsuitable for recreation uses. The 36 acres of NFS land classified as rural surrounding the district office on the Black Kettle National Grassland contains short trails and interpretive exhibits associated with the Battle of the Washita. Those acres are suitable for dispersed recreation.

Table 3. Suitability of recreation activities by ROS classification

Recreation Activities	Recreation Opportunity Spectrum			
	SPNM	**SPM**	**RN**	**R**
Developed		X	X	
Dispersed	X	X	X	X
Motorized		X	X	

The Kiowa and Rita Blanca National Grasslands contain 230,526 acres of NFS lands. Of those, 8,121 acres assigned a ROS setting of semiprimitive nonmotorized would be unsuitable for developed and motorized recreation for resource protection. These areas are within the Mills Canyon Management Area and in the vicinity of the Santa Fe National Historic Trail on the Kiowa and Rita Blanca Management Area.

On the Kiowa and Rita Blanca National Grasslands, 1,409 acres of land have been assigned a ROS setting of rural, and determined to be unsuitable for recreation uses due to nearby industrial and commercial developments.

The Black Kettle and McClellan Creek National Grasslands contain 32,735 acres of NFS lands. Of those, 36 acres are assigned a ROS setting of rural. Those 36 acres would be unsuitable for developed and motorized uses due to proximity of the district administrative site; however, dispersed uses are acceptable.

Timber Suitability

The National Forest Management Act (NFMA) of 1976 requires that National Forest System lands be classified as to their suitability for various uses, including timber harvest and timber production. National Forest System lands were reserved with the intent of providing goods and services to satisfy public needs over the long term; among those needs is a sustainable supply of forest products.

The 1982 Planning Rule provisions require the responsible official to identify lands not suitable for timber production within the plan area (1982 Rule provision Section 219.14). Based upon the definition of “forest land” and other criteria for determining suitability of forest land (FSH 2409.13, Chapter 20), all land on the Grasslands is considered unsuitable for commercial timber production.

The Forest Service Manual (FSM 1900) defines timber production as, “The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees for cutting into logs, bolts, or other round sections for industrial or consumer use.” For purposes of forest planning, timber production does not include firewood or harvests from unsuitable lands. FSM 1900 defines forest land as land at least 10 percent occupied by forest trees or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential or administrative areas, improved roads of any width, and adjoining road clearing and powerline clearing of any width.

Unsuitable forest land is forest land not managed for timber production because (a) Congress, the Secretary, or the Chief has withdrawn it; (b) it is not producing or capable of producing crops of industrial wood; (c) technology is not available to prevent irreversible damage to soil productivity or watershed conditions; (d) there is no reasonable assurance based on existing technology and knowledge that it is possible to restock lands within 5 years after final harvest, as reflected in current research and experience; (e) there is, at present, a lack of adequate information about responses to timber management activities; or (f) timber management is inconsistent with or not cost efficient in meeting the management requirements and multiple-use objectives specified in the Forest plan.

Tables 4 and 5 summarize the timber suitability classification and area descriptions for the Black Kettle and McClellan Creek National Grasslands and the Kiowa and Rita Blanca National Grasslands, respectively.

Table 4. Black Kettle and McClellan Creek timber suitability classification and area descriptions

Category	Description	Acres
Total NFS Lands (Forest or Grassland)		32,735
Non-forested land (not suitable for timber production)	<10% occupied by trees	31,105
Forested land—not suitable for timber production because:		
Withdrawn from timber production		0
Irreversible resource damage likely	Soils may be damaged by erosion or nutrient removal	779
Adequate restocking not assured		0
Forested land *tentatively* suitable for timber production (all forested land minus sum of 3 rows above)		851
Forested land tentatively suitable for timber production—not *appropriate* for timber production because:		
Forested lands where resource management prescriptions preclude timber production		0
Forested lands where management objectives limit timber harvest		0
Forested lands that are not economically cost efficient	Shelterbelt and riparian woodland, not capable of producing crops of commercial wood	851
Forested—lands not appropriate for timber production (sum of 3 rows above)		851
Forested—lands suitable for timber production		0
Lands not suitable for timber production (not suitable or appropriate for timber production)		32,735

Adapted from Tidwell 1998 and updated to reflect current acreages; FSH 2409.13, Sec. 26 and Sec.28.

Table 5. Kiowa and Rita Blanca National Grasslands timber suitability classification and area descriptions

Category	Description	Acres
Total NFS Lands (Forest or Grassland)		230,526
Non-forested land (not suitable for timber production)	<10% occupied by trees	221,458
Forested land—not suitable for timber production because:		
Withdrawn from timber production		0
Irreversible resource damage likely		0
Adequate restocking not assured		0
Forested land *tentatively* suitable for timber production (all forested land minus sum of 3 rows above)		9,068
Forested land tentatively suitable for timber production—not *appropriate* for timber production because:		
Forested lands where resource management prescriptions preclude timber production		0
Forested lands where management objectives limit timber harvest		0
Forested lands that are not economically cost efficient	Pinyon-juniper and riparian woodland, not capable of producing crops of commercial wood	9,068
Forested—lands not appropriate for timber production (sum of 3 rows above)		9,068
Forested—lands suitable for timber production		0
Lands not suitable for timber production (not suitable or appropriate for timber production)		230,526

Adapted from Tidwell 1998 and updated to reflect current acreages; FSH 2409.13, Sec. 26 and Sec.28.

Part 6: Monitoring Elements

Monitoring

This section provides programmatic direction for monitoring and evaluating plan implementation. Monitoring is the process of taking measurements or observations periodically in order to detect changes and/or trends in ecological, social, and economic conditions. However, not all desired conditions or objectives require monitoring. Evaluation entails the analysis of the data collected. Resource monitoring and evaluation help keep the land and resource management plan (LRMP) up-to-date and responsive to changing issues.

General Purpose

Monitoring and evaluation are components of adaptive management; they are sequential activities designed to determine how well plan objectives are being met, as well as how closely management standards and guidelines have been applied on the ground. As resource conditions change, ongoing monitoring and evaluation help identify the need to adjust desired conditions, objectives, standards, and guidelines. This process will help the Grasslands and public decide how the plan is being implemented, and if implementation is achieving the desired outcomes.

Evaluation of data collected during monitoring forms a basis for adaptively managing public lands within the planning area. Consistent monitoring and evaluation will allow the Grasslands to incorporate new technology, changes in law or policy, and changes in ecological conditions or social values into land management planning. This process accomplishes these goals by verifying the effectiveness of plan objectives and guidelines and provides reference information for LRMP amendments.

Table 6 identifies the social, economic, and ecological elements to be monitored and ties monitoring questions and measures back to the desired conditions and objectives established within the plan. The questions have been developed to ensure that monitoring efforts produce relevant data that can be successfully used to assess the accomplishments and effectiveness of various land management activities. The monitoring table identifies areas of concern or interest, and the evaluative process helps determine whether observed changes are consistent with desired conditions and objectives. The table dictates the frequency of reporting, which includes the timing of monitoring and evaluation efforts. For example, most data will be collected annually, with reporting or evaluation of the data conducted at different intervals, such as annually or every 5 years depending on the resource. The indicator, statistic, or metric used to gauge program performance and answer monitoring questions is defined within the table. Where possible, these measures are based upon standardized data stored in Forest Service corporate data systems (Natural Resource Manager) or official sources from other public agencies. The precision and reliability with which monitoring data is collected depend upon the activity and associated issues (Sauer et al. 2008).

This chapter describes how monitoring and evaluation requirements will be met. Monitoring and evaluation ensure that Forest plan direction is being carried out and assesses the quality of forest plan implementation (table 6). In the process of evaluating the plan, we also become aware of some modifications and changes needed. Monitoring results may be the catalysts for plan revisions or amendments.

The chapter also briefly discusses future research needs on the Forest.

Monitoring

Monitoring is carried out to observe or record the results of management actions. This consists of collecting information from selected sources, usually on a sample basis. There are three levels of monitoring:

1. Monitoring Implementation – This determines if prescriptions, projects, and activities are implemented as designed and in compliance with Forest plan goals and guidance;
2. Monitoring Effectiveness – This determines if prescriptions, projects, and activities are effective in meeting management goals and direction; and
3. Validation Monitoring – This determines if the initial data and assumptions used in developing the plan were correct, or if there is a better way to meet forest planning regulations, policies, and goals.

The monitoring requirements in the Forest plan are designed to meet the legal requirements of the 1982 Planning Rule. As the Forest plan is implemented, more specific monitoring direction will be included in the annual program of work and project plans. This program will be responsive, dynamic, and updated annually as projects are proposed and added to the program of work for a particular fiscal year.

The monitoring program will be conducted to include a consideration of the effects of national forest management on land, resources, and communities adjacent to or near the Forest, and the effect upon national forest management from activities on nearby lands managed by other government agencies or under the jurisdiction of local governments. Reports will be written annually and the program will be reevaluated at least every 5 years (1982 Rule Provisions Section 219.7(f)). Monitoring and evaluation requirements will provide a basis for a periodic determination of the effects of management practices (1982 Rule Provisions Section 219.11(d)).

Evaluation

An evaluation and summary of monitoring results will be written annually and published in an annual evaluation report. The report includes:

- A concise display of the results of monitoring and a statement of recommended actions, including changes in management direction, revisions, or amendments to the Forest plan.
- A summary of available information on management indicator species (MIS) or comparable species.
- A summary of other agency monitoring activities which have a bearing on Forest management.
- A summary of accomplishments and expectations for future activities.
- An update of research needs and accomplishments.
- A summary of large-scale or significant projects or programs such as storm recovery.

The annual report will be made available to the public. Public participation is encouraged in monitoring programs including involvement of volunteers and partners in the actual monitoring procedures.

Five years after the Forest plan is approved, the forest supervisor will review the land conditions to determine whether conditions or demands of the public have changed significantly (1982 Rule Provisions, section 219.10 (g)). Significant changes would trigger a plan amendment or revision.

In 10 to 15 years, during the next revision of the Grasslands plan, an overall review of the annual evaluation reports will be used as one measure to analyze the management situation and identify possible needs for change in management direction. This analysis will be submitted to the regional forester for review prior to plan revision.

Management reviews are also an important part of the monitoring and evaluation process. Interdisciplinary teams, the forest supervisor, and the regional forester perform management reviews periodically. These reviews may focus on information which surfaces through the monitoring and evaluation process.

Table 6. Monitoring elements

Scenery
Grasslands-wide Desired Condition: Grasslands scenery is predominantly characterized by pastoral agricultural landscapes that include vast open grasslands and rolling hills. Views from Grassland units often include homes, barns, tractors, trucks, agricultural windmills, cattle, stock tanks, fences, and other private ranchland features which contribute to rural landscapes. Interpretive activities emphasize the value of scenic areas within the context of patchwork land uses and a fragmented land ownership pattern in and around the Grasslands. High scenic quality features enhance enjoyment and the marketability of the Grasslands' scenic resources. **Black Kettle Desired Condition:** There are landscape types that are highly valued for their scenic quality. The redbed plains are valued for their distinctive dark reddish-orange mounds and hills covered by contrasting light green grass during spring and summer that turns to gold in the fall and winter. Streams and rivers flow through the landscape, bounded by cottonwoods and other hardwoods. These areas are predominantly rural and agricultural, and the patches of mown fields and agricultural home sites on private lands contribute to the scenic quality. Also unique to this landscape are the shinnery oak motts and patchy forested lowlands. The area lakes are highly valued by the public and support recreation opportunities. While the landscape is natural in appearance, recreation developments are common and are valued by Grasslands visitors. Recreation developments are in harmony with the scenic quality of the lakes. Scenic integrity is maintained on the units managed by the Black Kettle and McClellan Creek National Grasslands. Local interpretive and tourism marketing efforts (such as the Great Plains Trail of Oklahoma and the Oklahoma High Plains Bird Trail) attract visitors to area roads for the scenic quality of areas that surround them. Corridors along marketed tour routes that pass through Grassland units emphasize the scenic quality of the landscape through interpretive and recreation sites. **Kiowa and Rita Blanca Desired Condition:** Scenery desired conditions describe valued landscape features that may be very similar to the existing features described here. The vast horizon of the Grasslands offers unique and highly valued scenic opportunities. Consideration of scenery is evident where wind energy infrastructure, transmission lines, and other constructed features occur. There are a number of landscape types that are especially highly valued for their scenic quality in this management area. The High Lonesome area reminds visitors of the high plains as they were when early European settlers arrived and the vistas American Indians had experienced for generations prior. Vast unbroken plains of grasses extend to the horizon. Roads and occasional fences are minor interruptions in the sweeping plain. The expansive sky dominates the views. Playa lakes attract a diversity of wildlife and are valued for wildlife viewing and bird watching. These are generally natural appearing landscapes, and their ever-changing views as the lakes appear and disappear are an integral part of their scenic quality. The vista around areas designated as high scenic integrity, including the High Lonesome area, Mills Canyon and the Canadian River corridor, the Santa Fe Historic Trail corridor, and scenic byways are preserved (see appendix A, maps, "Kiowa and Rita Blanca National Grasslands Proposed Scenic Integrity Objectives"). Management activities surrounding these areas are cognizant of scenic integrity and preserve scenic attributes. In addition, some of the most attractive features are within designated special areas (see descriptions of desired conditions in the

"Special Areas" section).

Perico Creek and all the other canyons incised upon the canvas of the Grasslands give no prior notice of their presence, but reveal themselves suddenly. Perico is a wide but shallow canyon, carved out of colorful Dakota Sandstone laid down more than a hundred million years ago. Water flows down the creek intermittently, but usually there are several pools of residual water at the base of several cliffs and there is riparian vegetation along this channel, including cottonwoods and willows. Sumac is present on adjacent upland sites. That, together with a variety of midsize grasses and forbs in a cliff-studded setting, has produced a rich grassland habitat that supports an abundance of diverse wildlife.

Sauz Creek meanders through a rolling shortgrass prairie. Within the intermittent watercourse are wetlands characterized by an abundance of sedges, reeds, and cattails, especially around the larger pools.

The vast horizon of the Grasslands offers unique and highly valued scenic opportunities. In these scenic areas, planning for and design of wind energy, transmission lines, and other constructed features consider the scenic value of the horizon.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Grasslands-wide	Within 15 years of plan approval, all existing structures on Federal mineral leases in areas of high scenic integrity closely follow the form, line, color, texture, and pattern common to the valued landscape character.	Is scenic integrity being maintained in high scenic integrity areas?	Every 5 years Photo points

Developed Recreation

Grasslands-wide Desired Conditions: There is a spectrum of developed recreation opportunities characterized by varying levels of development and amenities appropriate to the setting. Recreation sites and settings vary in level of development, from small capacity sites with few amenities to larger sites with facilities designed to accommodate large group activities. Recreation sites include amenities such as picnic sites, camping sites for tents and recreational vehicles, and managed parking lots. The variety and location of recreation sites and their associated amenities adds to the satisfaction of users in their recreation experiences by providing a variety of quality opportunities. Activities at developed sites include family and social gatherings, special community events, hunting camps, fishing, and interpretive tourism, all of which are harmonious with their settings.

Developed recreation sites are in harmony with respect to their natural setting and integrate natural and cultural elements of the surrounding area and local communities. These sites emphasize efficiency of energy and materials consumption in construction and operation.

Resource and facility deterioration or damage is mitigated and changes in recreational use are accommodated as appropriate within the ROS setting. Developed recreation sites meet current standards (including accessibility) and accommodate use trends where feasible. This includes accommodation for modern trailers and motor homes at larger campgrounds, and turnarounds to accommodate changes in vehicle sizes where necessary. Other sites offer a more primitive experience, such as tent camping. Potable water systems that comply with all safety and sanitation requirements are available where the Agency determines they are appropriate.

All developed sites, visitor focused administrative facilities, and interpretive services are accessible unless it would substantially detract from the natural or cultural features of the site. Facilities are routinely maintained to preserve their accessibility. Visitor contact areas within administrative facilities are fully accessible.

Black Kettle and McClellan Creek Desired Condition: The Black Kettle district's recreation sites are predominantly used for family outings, large social or group events, and camping for hunting trips. The more highly developed and larger group sites, McClellan Creek and Lake Marvin Recreation Areas, attract substantial numbers of local residents and out-of-area visitors that contribute to the local economy. Large gatherings allow for social interaction around a wide range of water-based activities. Activities include fishing, boating, and swimming, which often occur in conjunction with other site activities such as camping, hiking, and/or picnicking.

The recreation sites in this management area have facilities and amenities that serve to create a user experience that includes an equal probability of interaction with or isolation from other users and a high degree of interaction with

the natural environment. Water-based recreation facilities meet standards for visitor safety. New or renovated facilities incorporate changes in technology and vehicle types while being responsive to their natural setting. This includes accommodation for modern trailers and motor homes at larger campgrounds, such as electric hookups and dump stations at a few spurs and some individual sites and turnarounds to accommodate changes in vehicle sizes where necessary. Facilities such as boat ramps, fishing docks, fish cleaning stations, and swimming sites accommodate lake-based recreation where appropriate. Trails in these recreation sites are mostly short walking trails around water bodies and provide for fishing access and/or interpretive purposes.

Visitors are informed about proper treatment of the natural surroundings and rules and restrictions of each site and act accordingly. High use that exceeds design capacities is accepted during hunting season and holidays, but does not lead to substantial resource impacts. Hunting camps serve as temporary staging sites that are acceptable during times of high use and occur within or near developed recreation sites for offsite activities. Higher intensity use is mitigated. With larger numbers of visitors, official presence increases safety, civility, and security, particularly at fee sites.

Fishing opportunities occur on the lakes of the Black Kettle and McClellan Creek Management Area.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Grasslands-wide	Complete 20 percent of condition surveys and update inventories of developed sites annually.	Are recreation facilities in adequate condition to provide for the level of use appropriate under the ROS?	Annual Percentage of sites surveyed that meet national standards
Black Kettle and McClellan Creek	Maintain one-third of trail miles annually and according to development level and managed use.	Are objectives for recreation opportunity settings being achieved?	Every 5 years Miles and type of trails provided (INFRA)

Heritage

Grasslands-wide Desired Condition:

Interpretation and Public Involvement

Interpretive sites such as the Mills Canyon Orchard Ranch and the Santa Fe Trail provide meaningful heritage experiences that help the public develop an appreciation and understanding of the human history of the southern Great Plains.

Opportunities are provided for both visitor and local volunteers to participate in heritage resource preservation activities such as site rehabilitation and stabilization, and the Grasslands are more thoroughly experienced through these conservation projects.

Tribal Uses and Access

The tribes have access to areas that provide them an opportunity to practice traditional activities (such as plant gathering) and other ceremonial activities that are essential in maintaining their cultural identity and the continuity of their culture.

Agency and public land use activities on the Grasslands are not causing damage to historic properties and places of religious and cultural significance or impacting tribal access to and use of those properties.

Stabilization

All of the priority heritage resource sites are stable and their significant values are protected.

Vandalism, theft, and human-caused damage to heritage resources are rare due to enhanced public education and stewardship, presence of interpretive signs, and management control features that are installed or constructed near the most susceptible and significant heritage resource sites. Site significance and integrity are maintained through conservation and preservation efforts and receive minimal, if any, impact from visitors.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Grasslands-wide	Stabilize one viable homestead site, other than the Mills Orchard Ranch site, within 5 years of plan approval on either Grassland.	Which eligible heritage/cultural resources are in critical need of being protected/preserved/ stabilized?	Every 3 years The number of sites protected/preserved/ stabilized.
Kiowa and Rita Blanca	Establish a site steward program on the Grasslands within 5 years to protect sensitive prehistoric sites.	Is the site stewardship program adequately supported in order to monitor sensitive heritage/cultural resources?	Every 3 years Level of vandalism observed at monitored sites.

Roads and Access

Grasslands-wide Desired Condition: Grasslands units are accessible for public enjoyment and resource management purposes, either through public road access or by privately owned roads with legal rights-of-way. Legal easements or land exchanges provide access to Grassland units surrounded by private land (also see the "Land Adjustments" section). Conversely, access to private land through Grasslands units is available when necessary. The public is aware of the considerations for driving on grazing allotments, such as appropriate behavior around livestock and correct closing of gates. Routes are maintained according to their road management objectives. Decommissioned routes are rehabilitated and physical barriers prevent inappropriate access.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Grasslands-wide	Pursue decommissioning of all roads no longer needed for the administration of National Forest System lands within 15 years of plan approval.	Are user-created and NFS roads being decommissioned to prevent resource damage?	Every 3 years Miles of road decommissioned; roads rehabilitated and miles of road obliterated (INFRA).

Black Kettle and McClellan Creek Management Area Vegetation Types Represented by Ecological Indicators

Mixed-grass Prairie Ecological Indicator (presence of undesirable trees)

Desired Condition: Mixed grass prairie is characterized by grasses and forbs without the presence of trees. The structure and composition of the mixed-grass prairie across the landscape maintains the treeless reference condition of the mixed-grass prairie ecological indicator.

Mixed grass prairie on the Black Kettle and McClellan Creek National Grasslands is a warm season, grass-dominated ecosystem. The codominant grasses include little bluestem, sideoats grama, smaller proportions of big bluestem, and blue grama. Forbs are present but are less abundant than grasses and include western ragweed, annual broom weed, tarragon, and baby aster, all providing food for wildlife species.

The mixed grass species composition provides vegetation structure and height relationships necessary for ground nesting bird cover and brood rearing habitat. Small areas of short structured herbaceous vegetation or patches of bare ground are available for Lesser Prairie-chicken leks and courtship areas. Small areas or patches of bare ground are present that provide wildlife travel corridors, escape routes, and annual plant germination sites for wildlife foraging habitat.

Shrub species component is typically no less than 5 percent or more than 25 percent of the total mixed grass ground cover. Species composition includes fragrant mimosa, skunkbush sumac, smooth sumac, and inland New Jersey tea, all contributing to retaining or improving foraging and escape habitat for Lesser Prairie-chicken and

Northern Bobwhite.

Disturbance processes (including drought, fire, and grazing) occur on the landscape at varying intervals and intensities, determined by climatic conditions and vegetative density respectively. Prescribed fire intervals occur on a 3- to 10-year regime.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Black Kettle and McClellan Creek	Mechanically or with prescribed fire, remove undesirable trees on the mixed-grass prairie over the next 15 years after plan approval.	Are undesirable trees present? Is fire occurring on 50 to 75 percent of the vegetation type over the life of the plan?	Annual Document undesirable tree treatment and postfire mortality. Change in species composition within burned areas. Document planned or unplanned fire occurrences.

Shinnery Oak and Deep Plowed Inclusion Ecological Indicator (presence of undesirable trees)

Desired Condition: Shinnery oak is characterized by shrubs, grasses, and forb species without the presence of trees. The structure and composition of shinnery oak across the landscape maintains the treeless reference condition of the shinnery oak ecological indicator.

The shinnery oak vegetation is a grass-dominated ecosystem with a shinnery oak shrub understory. The overstory is made up of warm season herbaceous species, including big bluestem, little bluestem, sideoats grama, sand lovegrass, Indiangrass, and switchgrass. Most of the warm season grass species have a dominant position in regard to canopy vertical structure. In a less dominant vertical structure position are shrubs and woody plants, including shinnery oak, sand sagebrush, Oklahoma plum, and yucca. Forbs such as western ragweed, Hartweg's sundrops, blacksampson echinacea (or narrowleaf purple coneflower), wax goldenweed, and Texas croton are located within this vegetation type and are found in lower quantities than herbaceous grasses or woody shrubs. There are few trees found within this vegetation type, although small clusters or motts of shinnery oak hybrids ranging in height from tall shrub to 20 feet or more may be found scattered throughout.

The shinnery oak species composition provides vegetation structure and height relationships necessary for ground nesting bird cover and brood rearing habitat for the Lesser Prairie-chicken and other ground nesting birds such as the Rio Grande Turkey and Northern Bobwhite. Small areas of short structured herbaceous vegetation or patches of bare ground are available for Lesser Prairie-chicken leks and courtship areas; these areas also provide wildlife travel corridors, escape routes, and annual plant germination sites for wildlife foraging habitat. Trees are nonexistent and collision risks from fences, etc., are minimal in areas important for recovery of Lesser Prairie-chicken.

Small thickets of hybridized tall oak shrubs (oak motts) may occur in areas not suitable for Lesser Prairie-chicken, to provide overhead cover and production of secure forage crops for Rio Grande Turkey and Northern Bobwhite.

Fire occurs on a 2- to 9-year cycle on the landscape, at varying intervals and intensities determined by vegetative and climatic conditions. Ground cover provides soil stabilization and water infiltration and retains fine fuels.

Desired Condition on Inclusion of Historically Deep Plowed Sites: These sites are structurally close to the shinnery oak vegetation type, with the composition of plants dominated by warm season herbaceous grasses. In a less dominant vertical structure position are shrubs and woody plants such as sand sagebrush and Oklahoma plum that comprise 15 to 20 percent of the vegetation.

Fire occurs on a 5- to 9-year cycle on the landscape, at varying intervals and intensities determined by vegetative and climatic conditions.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Black Kettle	Use prescribed fire twice on 80 percent of the shinnery oak within 15 years of plan approval. Mechanically or chemically remove undesirable trees in shinnery oak areas within 15 years of plan approval.	Are undesirable trees present in shinnery oak? Is prescribed fire occurring at the objective level? Does fire occurrence promote a grass-dominated overstory with a shinnery oak shrub understory?	Annual Document undesirable tree treatment and postfire mortality. Change in species composition within burned areas. Document planned or unplanned fire occurrences.

Kiowa and Rita Blanca Management Area Vegetation Types Represented by Ecological Indicators

Shortgrass Prairie Mid- and Late-Successional Stages on Kiowa and Rita Blanca Landscape Ecological Indicator (Range Vegetation Trend Monitoring)

Desired Condition: The mid- and late-successional stages of shortgrass prairie vegetation are characterized by grasses, forb, and shrub species that have composition and structure in low departure from reference condition for vegetation structure.

Grass generally less than 18 inches tall dominates the shortgrass ecosystem, with a mix of mid- and shortgrass steppe grasses and a scarcity of shrubs and trees. Vegetation within this association is comprised of 20 to 70 percent grasses, up to 25 percent forbs (both annual and perennial), up to 15 percent shrubs, and a variable percentage of bare ground.

The postfire and herbivory-influenced early successional stage is dominated by grass seedlings and resprouts combined with postdisturbance colonizers such as smooth brome, clover, ground cherry, ragweed, and sunflowers. As succession progresses, grasses such as buffalograss, blue grama, and vine mesquite become prevalent over the forb component.

Once a successional stage reaches mid-open, herbaceous cover comprises up to 35 percent. Vegetation is low to medium in height. The abundance of annual forbs and grasses within the composition is dependent on the timing of precipitation events.

In the mid-closed stage, the herbaceous cover comprises more than 35 percent and grass species dominance shifts to a diverse mosaic of cool and warm season grass species including grama grasses, muhly, panicum, fescue, brome, dropseed, and bluestem.

Fire occurs on the landscape at varying intervals and intensities determined by vegetative density and climatic conditions on a 3- to 10-year regime.

Low structured vegetation representative of the early successional stage of shortgrass prairie is available for a keystone species black-tailed prairie dog to colonize. The colonies provide habitat for swift fox, Mountain Plover, Golden Eagle, Ferruginous Hawk, and badger. The early successional stage of shortgrass prairie specific vegetation provides requisite habitat for the management indicator species, Burrowing Owl.

Habitat for at least one complex of black-tailed prairie dog colonies is available for potential future reintroduction to recover the endangered black-footed ferret, a predator dependent on the black-tailed prairie dog; impacts from plague outbreaks to black-tailed prairie dogs and potential reintroduced black-footed ferrets are minimal.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Kiowa and Rita Blanca	Reintroduce prescribed fire in 1 to 10 percent of the vegetation type over the next 15 years after plan approval. Mechanically, chemically, or with prescribed fire remove from 5 to 10 percent of native invasive plants such as cholla, juniper, pricklypear, mesquite, and yucca annually.	Effectiveness Monitoring: Are plan objectives and desired conditions being achieved? Did fire occur over 1 to 10 percent of the vegetation type? Do blue grama, buffalograss, and galleta dominate the shortgrass prairie? Do mid and tall grass species codominate on the mixed grass inclusion?	Every 5 years The ecological indicator of middle and late successional shortgrass prairie will be determined by spatial analysis of the areal extent of plant communities. Middle and late successional shortgrass prairie will be monitored for range vegetation trends based on the area within the proclaimed boundary of the Kiowa and Rita Blanca National Grasslands. Document planned or unplanned fire occurrences. Document vegetation composition and structure for different successional stages, including mesic or xeric areas.

Sand Sagebrush on Kiowa and Rita Blanca
Landscape Ecological Indicator (Range Vegetation Trend Monitoring)

Desired Condition: Sand sagebrush vegetation is characterized by shrubs, grasses, and forb species with structure and composition across the landscape that maintains the reference condition and areal extent.

Fire and grazing disturbance processes occur on the sand sagebrush landscape at varying intervals and intensities that are determined by climatic conditions and vegetative density, respectively. The disturbance processes contribute toward achieving desired vegetative structure and density, improve vigor of native grass, and provide diversity of native forb species that are represented by plant communities with intermingled patch sizes at scales on the order of 10 to 1,000 acres. The diverse, well-distributed plant communities provide conditions that contribute to the sustainability of insects and rare plant species, as well as to nonuniform vegetative structure across the landscape that provides habitat for a diversity of prey and predator species. Fire return occurs at 5- to 50-year intervals.

The sand sagebrush prairie is dominated by mid-grasses and sand sagebrush, with cool season grasses and a variety of forbs present. Native, warm season perennial grasses (including big bluestem, little bluestem, sand dropseed, blue grama, and sideoats grama) are prominent in this ecosystem. Early successional sand dune habitat is present at acceptable rates.

Varied representation of any successional stage structure and composition results after major disturbance events.

Vegetation cover is generally comprised of 20 to 60 percent grasses, 2 to 15 percent forbs, > 15 percent shrubs, and a variable percentage of bare ground, dependent upon the site potentials of these areas.

Less than 5 percent of the area is represented in an early successional stage dominated by resprouts and seedlings of grasses and forbs. Canopy cover within this stage is highly variable, forb dependent, and has a low to medium height structure up to 11 inches.

The mid-open successional stage is represented by less than 35 percent herbaceous cover and makes up on average less than 65 percent of the area. Total canopy cover within this stage is variable (25 to 75 percent) with medium to tall height structure (5 to 12 inches or greater).

The mid-closed successional stage makes up on average more than 30 percent of the area and has greater than 35 percent herbaceous cover. Total canopy cover within this stage is generally greater than 50 percent, with height structure greater than 12 inches.

The relationship between desired structure and species height is as follows:

Short structure species such as blue grama, generally 0 to 4 inches tall, comprise 40 to 60 percent of the total vegetation.

Medium structure species such as squirreltail and lacy tansyaster, generally 5 to 11 inches tall comprise 35 to 50 percent of the total vegetation.

Tall structure species such as sand bluestem and bush morning glory, generally 12 inches tall or greater comprise 8 to 15 percent of the total vegetation.

The sand sagebrush species composition provides vegetation structure and height relationships necessary for ground nesting bird cover and brood rearing habitat. Small areas of short-structured herbaceous vegetation or patches of bare ground are present for Lesser Prairie-chicken leks and courtship areas. These patches also provide wildlife travel corridors, escape routes, and annual plant germination sites for wildlife foraging habitat.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Kiowa and Rita Blanca	There are no specific objectives for this vegetation type outside the "Desired Conditions" stated above.	Effectiveness Monitoring: Are plan objectives and desired conditions being achieved? Are different plant communities represented in intermingled patches at variable scales from 10-10,000 acres? Is the shrub component > 15 percent? Is the areal extent of the sand sagebrush vegetation stable or increasing?	Every 5 years The ecological indicator of sand sagebrush will be determined by spatial analysis of the areal extent of plant communities. Sand sagebrush will be monitored for range vegetation trends based on the area within the proclaimed boundary of the Kiowa and Rita Blanca National Grasslands. Document planned or unplanned fire occurrences.

Cottonwood-Willow (Canadian River) Ecological Indicator (presence of undesirable trees)

Desired Condition: Cottonwood-willow riparian vegetation is characterized by trees, shrubs, grasses, and forb species without the presence of invasive species such as saltcedar. The structure and composition maintains the reference condition of the cottonwood-willow riparian without the presence of undesirable species such as saltcedar as the ecological indicator.

Fremont cottonwood dominates the tree layer with peachleaf willow present in the subcanopy. Riparian dependent species include narrowleaf cattail, common button bush, thinleaf or marsh alder, Rocky Mountain elderberry, and a variety of sedge and rush species. The primary shrub and woody vine species are sandbar willow and riverbank grape. Native warm season grasses including blue grama, sideoats grama, sand dropseed, vine mesquite, Virginia wildrye, and switchgrass are prominent in the riparian ecosystem. Western wheatgrass is an important cool season species. Drier sites along or within ephemeral systems and upper terraces have New Mexico locust, choke cherry, hackberry, skunkbush sumac, and Apache plume.

Populations of native woody species, particularly the long-term presence of mature cottonwood stands and areas with regenerating cottonwood and willow saplings, provide habitat for wildlife species such as the Bald Eagle and Red-headed Woodpecker. A diverse mix of native grasses and forbs adapted to abrupt fluctuations in moisture regimes occurs in the herbaceous portion of riparian areas and provides habitat for the arid land ribbon snake and ambersnail. The meander scars and depressions in the riparian areas that retain water part or all of the year provide habitat for amphibian species such as the plains leopard frog.

For both herbaceous and woody riparian areas, stream characteristics including vegetation, geomorphology, and hydrology are sufficient to:

- Dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid flood plain development;

- Allow floodwater retention and groundwater recharge; and
- Develop root masses that stabilize streambanks against cutting action.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Kiowa and Mills Canyon Area	Restore 100 percent of the riparian areas to cottonwood-willow vegetation type species through plantings, seeding and/or mechanical or chemical methods within 15 years of plan approval. Habitat should be managed for open forest fragments and large snags should be available for cavity-nesting birds.	Effectiveness Monitoring: Are undesirable trees present?	Monitor 3 to 5 years. Document undesirable tree treatment.

Kiowa and Rita Blanca Management Area Vegetation Types Represented by Management Indicator Species

Pinyon-Juniper and Juniper Grasslands

Desired Condition: The pinyon-juniper vegetation type is a mosaic of stand shape, size, spacing, and structural stages across the landscape reflecting the natural range of pinyon-juniper woodland. The tree component is largely composed of one-seed juniper and pinyon pine. Rocky Mountain juniper is well represented on mesic sites and pinyon pine is well represented over the whole vegetation type. The understory includes scattered shrubs, native grasses, forbs, and annuals. Shrub species present within a discontinuous layer include wavyleaf oak and mountain mahogany. Bare ground ranges from 5 to 55 percent depending on site potential. Snags are scattered across the landscape. Fires are low severity, with a return interval ranging from 1 to 35 years.

The early successional stage occurs postfire and covers about 10 percent of the vegetation type with open areas of grasses, forbs, shrubs, seedlings less than 4.5 feet in height, and saplings.

The mid-late successional stage covers about 90 percent of the vegetation type and includes a mix of pinyon and juniper trees in a variety of age classes with varying canopy cover as follows:

- Mid-development stages average 10 percent of the vegetation type in relative abundance and have a dense canopy cover (31 to 70 percent) of pole size trees 5 to 9 inches in diameter and very little understory.
- Approximately 30 percent of the vegetation type has pole size trees with a mixed shrub-herbaceous understory, and canopy cover ranges from 20 to 35 percent.
- Approximately 40 percent in late development has medium to large diameter size trees 9 to 21 inches in diameter and canopy cover of 40 to 70 percent.
- Approximately 10 percent has dense, old-growth characteristics containing larger diameter trees, some snags, partially dead and diseased trees, and canopy cover of 40 to 70 percent.

Complete representation of all successional stages of pinyon-juniper vegetation within reference condition provides requisite habitat for the management indicator species, Mountain Bluebird.

Juniper Grasslands Inclusion Desired Condition: Juniper grassland trees occur as individuals or in smaller groups and range from young to old. The smaller groups are maintained on slopes greater than 15 percent, on rocky outcrops, and adjacent to drainages. The understory is well represented and dominated by grasses and forbs, with a

continuous understory that can include little bluestem, sideoats grama, blue grama, big bluestem, and/or galleta. The density of understory vegetation is sufficient to support frequent fire occurrence. The composition, structure, and function of vegetative conditions promote resilience to the frequency, extent, and severity of disturbances (e.g., erosion, insects, diseases, and fire) and climate variability. Fires that occur are of low severity with a frequency ranging from 1 to 35 years.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Kiowa	Over the life of the plan, burn and/or thin 5 to 10 percent of the pinyon-juniper to maintain successional stage conditions and increase understory components in the pinyon-juniper woodland. Mechanically, chemically, or with prescribed fire control 5 to 10 percent of native invasive plants (such as cholla and mesquite) annually. Apply mechanical, chemical, and prescribed fire treatments to produce replacement structural stages that are proportionally present in the pinyon-juniper vegetation type with old growth representing 10 percent within 15 years of plan approval. Over the life of the plan, retain large stands of pinyon-juniper as contiguous patches of no less than 40 acres on 10 percent of this vegetation type on a landscape scale. Over the life of the plan, create openings in early and mid-successional stage stands that lack a good shrub or grass component on up to 20 percent of the pinyon-juniper vegetation type at a landscape scale.	Effectiveness Monitoring: Are plan objectives and desired conditions being achieved? Are species composition and percent bare ground consistent with desired conditions? Is the understory well represented and dominated by grasses and forbs such as little blue stem, sideoats grama, and blue grama? Are shrub species present within a discontinuous layer? Is pinyon-juniper density being maintained or reduced by management activities?	Annual Use breeding bird survey to monitor *Sialia currucoides*, Mountain Bluebird as a management indicator species.

Shortgrass Prairie Early Successional on Kiowa and Rita Blanca National Grassland

Desired Condition: Across approximately 70 percent of the shortgrass prairie type, herbaceous species (including blue grama, buffalograss, and galleta) codominate the vegetation. A variety of forbs are intermingled including species such as asters, milkweeds, groundsels, and primrose. The relationship between desired structure and species height is as follows:

- Short structure species such as buffalograss and purslane, generally 0 to 4 inches tall, comprise 40 to 60 percent of the total vegetation.
- Medium structure species such as blue grama and scarlet globemallow, generally 5 to 11 inches tall comprise 35 to 50 percent of the total vegetation.
- Tall structure species such as sand dropseed and green thread, generally 12 inches tall or greater comprise 8 to 15 percent of the total vegetation.

Low structured vegetation is available for black-tailed prairie dog colonies. The colonies provide habitat for swift fox, Mountain Plover, Golden Eagle, Ferruginous Hawk, badger, and Burrowing Owl.

Habitat for at least one complex of black-tailed prairie dog colonies is available for potential future reintroduction of the black-footed ferret, a predator of black-tailed prairie dogs. Impacts from plague outbreaks to black-tailed prairie dogs and potential reintroduced black-footed ferrets are minimal.

Some patches of taller structure shortgrass communities (8 to 20 inches) occur in the vicinity of localities with sparse, low structure vegetation (4 to 12 inches) within ¼ mile of a water source in order to provide breeding habitat for the Long-billed Curlew.

Grasses such as western wheatgrass and vine mesquite are abundant in mesic areas.

Various cacti species such as cholla, pricklypear, and barrel cacti are scattered and minimally present with less than 1 percent of the total basal area.

Scattered clusters of low shrubs such as multi-stemmed or knotted rhatany and snakeweed provide foraging and escape habitat for upland game birds.

Deciduous trees are present in isolated pockets along draws, shelterbelts, and around old homesteads to provide nesting habitat for raptors.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Kiowa and Rita Blanca Area	Reintroduce prescribed fire in 1 to 10 percent of the vegetation type over the next 15 years after plan approval. Mechanically, chemically, or with prescribed fire remove from 5 to 10 percent of native invasive plants such as cholla, juniper, pricklypear, mesquite, and yucca annually.	Effectiveness Monitoring: Are plan objectives and desired conditions being achieved? Is expanision of black-tailed prairie dog colonies on the Kiowa and Rita Blanca National Grasslands happening?	Annual Early successional shortgrass prairie on the Kiowa and Rita Blanca associated with black-tailed prairie dogs will be monitored through the use of breeding bird surveys to track, *Athene cunicularia hypugaea* or Burrowing Owl as a management indicator species.

Black Kettle Management Area Vegetation Types Represented by Management Indicator Species

Mixed Hardwood Riparian

Desired Condition: Hardwood tree species (such as plains cottonwood, netleaf hackberry, little walnut, American elm, and wooly buckthorn or chittimwood) characterize the area and are found in scattered groupings, allowing for an open canopy mosaic of various age classes and structure. There are lesser quantities of black willow, common persimmon, and Western soapberry. Eastern redcedar is a very minor species component.

Shrubs and woody vines are prevalent and include buckbrush, riverbank grape, Chickasaw plum, Virginia creeper, and poison ivy. Also found to a lesser degree on the perimeters are skunkbush sumac and sand sagebrush. Switchgrass, little bluestem, inland saltgrass, and sand dropseed are herbaceous warm season grass species interspersed among the understory. A variety of forbs is found in the understory and includes western ragweed, white sage, horehound, stickseed, and a variety of others found in lesser quantities. Wetland species include cattails, rushes, sedges, and smartweed.

Mature hardwoods, shrubby understory or early successional growth, and woody debris as well as diverse riparian herbaceous vegetation on the margins of lakes or along streamsides are present to provide winter roosts for Bald Eagle and raptors, and roost, feeding, and nesting habitat for the management indicator species, Rio Grande Turkey.

Scale	Objective	Monitoring Question	Monitoring Frequency and Measure
Black Kettle	Reintroduce prescribed fire into mixed hardwood areas once every 5 to 15 years after plan approval. Mechanically or chemically remove 100 percent of Eastern redcedar around cottonwood galleries, generally within the mixed hardwood type, around roost trees within 10 years of plan approval.	Effectiveness Monitoring: Are plan objectives and desired conditions being achieved? Are species composition and percent bare ground consistent with desired conditions?	Annual Use breeding bird survey to monitor *Meleagris gallopavo intermedia*, Rio Grande Turkey as a management indicator species.

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Glossary

Access – Road or trail route over which a public agency claims a right-of-way for public use; a way of approach.

Accessibility – According to Section 504 of the Rehabilitation Act of 1973, all Federal programs and facilities are required to be "to the highest degree feasible, readily accessible to and useable by all persons who have a disability, including mobility, visual, hearing, or mental impairments."

Active flood plain – The area of alluvial soils adjacent to rivers or streams that is flooded on a periodic basis. There is evidence of recently rafted debris or fluvial sediments deposited on the soil surface or on trees or other vegetation, or recent scarring of trees or shrubs by material moved by flood waters.

Adaptive management – A system of management practices based on clearly identified outcomes and monitoring to determine if management actions are meeting desired outcomes and, if not, to facilitate management changes that will best ensure that outcomes are met or reevaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain (1982 Rule Provisions, Section 219.27; FSM 1905).

Administrative boundary – Administrative boundaries describe the spatial location of the lands managed by a forest supervisor's office; an area encompassing all NFS lands administered by an administrative unit. The area encompasses private lands, other governmental lands, and may contain NFS lands within the *proclaimed* boundaries of another administrative unit. An example of this is the Valle Vidal section of the Carson National Forest. It was donated to the government after the proclaimed boundary was established. The Valle Vidal Unit is within the administrative boundary of the Carson, but not within the proclaimed boundary.

Administrative site – A site which primarily exists for general administrative purposes. It normally will include office, warehouse, outside storage, and parking areas. It may include housing and pasture for livestock. A work center may be part of an administrative headquarters site.

Age class – Interval of years, commonly 20, into which trees are grouped for management. Example: 1 to 20 years, 21 to 40 years.

Allotment – A designated area available for livestock grazing upon which a specified number, kind of livestock, and season of use may be grazed under a term grazing permit. The basic land unit used to facilitate management of the range resource on National Forest System and associated lands administered by the Forest Service.

Alluvial deposits – Clay, silt, sand, gravel, or other rock materials transported by flowing water and deposited in comparatively recent geologic time as sorted or semisorted sediment in riverbeds, estuaries, flood plains, lakes, shores, and in fans at the base of mountain slopes.

Alternative energy – Methods of energy production that do not rely on traditional sources such as fossil fuels.

Amenity – The pleasurable, educational, or aesthetic features of the land or resources.

Application for Permit to Drill (APD) – An application to drill a well submitted by a lessee or operator to the BLM. The APD consists of a drilling plan that discusses downhole specifications

and procedures (reviewed by the BLM) and a surface use plan of operations (SUPO) that examines surface uses, including roads, well site layout, cut/fill diagrams, reclamation procedures, production facility locations, etc. (reviewed by the Forest Service). The approved APD is a contract between the operator and the Federal government and cannot be changed or modified unless authorized by the BLM and FS.

Aquatic ecosystem – The stream channel or lakebed, water, or biotic communities and the habitat features that occur there.

Aquatic passage – A road crossing whose design, construction, and maintenance do not disrupt the migration or other movement of those species of aquatic life inhabiting the water body.

Aquifer – A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

At-risk community – An area that is comprised of (1) an interface community as defined in the notice entitled "Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk from Wildfire" issued by the Secretary of Agriculture and the Secretary of the Interior in accordance with title IV of the Department of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed. Reg. 753, January 4, 2001); or a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land; an area in which conditions are conducive to a large-scale wildland fire disturbance event; an area for which a significant threat to human life or property exists as a result of a wildland fire disturbance event.

Authorized officer – Any Forest Service officer to whom authority for disposal of mineral materials has been delegated (36 CFR 228.42).

Auto tour routes – An audio-guided tour by vehicle, which follow the route of a national historic trail or scenic byway. These types of tours are generally provided by other agencies such as the state or the National Park Service and are provided in an electronic file format or on CD.

Bald – Sparsely vegetated knoll.

Bank cover – Anything, usually vegetation, that provides protection from erosive effects on the land rising from and bordering a water body such as a stream or lake.

Bank erosion – The removal of soil and rocks by running water, wind, or waves from the land rising from and bordering a water body such as a stream or lake.

Bankhead-Jones Farm Tenant Act – Authorizes the Secretary of Agriculture to develop a program of land conservation and utilization in order to correct maladjustments in land use and to assist in controlling soil erosion, promoting reforestation, preserving natural resources, protecting fish and wildlife, developing and protecting recreational facilities, mitigating floods, preventing impairment of dams and reservoirs, conserving surface and subsurface moisture, protecting the watersheds of navigable streams, and protecting the public's health, safety, and welfare.

Bedload – Sand, silt, gravel, soil, or detritus carried by a stream on or immediately above the bottom.

Best management practice (BMP) – The method, measure, or practice selected by an agency to meet its nonpoint-source pollution control needs. BMPs include, but are not limited to, structural controls, operations, and maintenance procedures. BMPs can be applied before, during, or after pollution-producing activities to reduce or eliminate the introduction of pollutants into the water.

Biodiversity – The range of organisms present in a particular ecological community or system. It can be measured by the numbers and types of different species, or by the genetic variations within and between species.

Caliche – A sedimentary rock; a hardened deposit of calcium carbonate. This calcium carbonate cements together other materials including gravel, sand, clay, and silt. It is found in aridisol and mollisol soil orders. Caliche occurs worldwide, generally in arid or semiarid regions.

Canopy – (1) The vertical projection downward of the aerial portion of vegetation, usually expressed as a percent of the ground so occupied. (2) A generic term referring to the aerial portion of vegetation (USDA NRCS 2003).

Canopy cover – The percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included (USDA NRCS 2003).

Cavity tree – A tree with a hollow space that provides potential nesting habitat for birds or small mammals.

Channel – A passage, either naturally or artificially created, that periodically or continuously contains moving water, or that forms a connecting link between two bodies of water. River, creek, stream, run, branch, and tributary are some of the terms used to describe natural channels. Natural channels may be single or braided. Canal and floodway are some of the terms used to describe artificial channels.

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 30 years or longer). Climate change may be due to natural internal processes or external forces, 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.”

Closed basin – An enclosed region having no drainage outlet and from which water escapes only by evaporation or infiltration.

Closed-loop drilling system – A drilling system that collects lubricants, fluids, drilling mud, and other additives in a tank, as opposed to an open pit.

Codominant – One of two or more species that are equally dominant in a biotic community.

Common mineral – Also known as mineral materials. A collective term used to describe petrified wood and common varieties of sand, gravel, stone, pumice, pumicite, cinders, clay, and other similar materials. Common varieties do not include deposits of those materials which are valuable because of some property giving them distinct and special value (36 CFR 228.42). The determination of which minerals are considered common variety is made by the Bureau of Land Management.

Condition survey – A tool used to document the condition of a given facility. The facilities are measured against maintenance objectives and standards for health and safety.

Conditions of Approval (COA) – Site-specific mitigation which is applied at the time of the approval of the surface use plan of operations (SUPO). Mitigation under COA cannot move an operation more than 200 meters, or site operations off of a leasehold, or prohibit new surface-disturbing operations for a period of more than 60 days in any 1 year (43 CFR 3101.1-2.). If COA mitigation is within this parameter, it is considered consistent with lease rights. Mitigation more restrictive than this cannot be applied using a COA and requires a lease stipulation.

Constructed feature – Anything constructed by the Forest Service or by a permittee for use in administering the Grasslands. When used in the context of scenery, the term refers to anything that is built on the landscape.

Controlled surface use (CSU) – Allowed use and occupancy, unless restricted by another stipulation, with identified resource values requiring special operational constraints that may modify the lease rights. CSU is used as an operating guideline, not as a substitute for no surface occupancy (NSO) or timing stipulations.

Corridor – A band of forest, shrub, or native grassland connecting discontinuous patches of same which enhance connectivity and facilitate the movement of animals and plants that have a limited cruising range. See “wildlife corridors,” “forest fragmentation.”

Creek draw – Usually a dry creekbed or gulch that temporarily fills with water after a heavy rain, or fills seasonally. The term usually applies to a mountainous desert environment.

Crowned – Shaped to provide for proper drainage away from the center toward the outside of the road.

Depressional wetland (seasonal and perennial) – Depressional wetlands are places where runoff accumulates in a topographic depression. Water either does not flow through the wetland or the flow is essentially imperceptible. Ponds on fault traces, valley bottoms, and on broad saddles along ridges are examples of natural depressional wetlands. Depressional wetlands can be perennial or seasonal. Perennial depressional wetlands have some amount of standing water for at least 9 months during most years. Seasonal depressional wetlands have no standing water, or it lasts for less than 9 months during most years.

Design capacity – The maximum number of visitors that can be accommodated by the facilities at a particular site.

Designated road, trail, or area – Routes and areas designated on the motor vehicle use map and established by a decision that is compliant with the 2005 Travel Management Rule.

Designated dispersed sites – Sites where vehicles may pull off local roads but may not access the entire unit for motorized dispersed activities because of the use of fences and/or barriers.

Desired landscape character – "The most complete, attractive and sustainable expression of the valued landscape character which is compatible with that landscape's fully integrated set of desired conditions" (SMS Handbook (USFS 1995) definition page 5-5 expanded). Desired landscape character represents the most "ideal" and attractive scenic identity that is possible, given the limitations of the ecosystem and achievement of other resource objectives as defined in the desired conditions.

Developed recreation – Recreation that occurs at manmade developments such as campgrounds, picnic grounds, resorts, ski areas, or trailheads. Facilities might include roads, parking lots, picnic tables, toilets, drinking water, ski lifts, and buildings. Campgrounds and picnic areas are examples of developed recreation sites.

Developed recreation site – A distinctly defined area where facilities are provided for concentrated public use, e.g. campgrounds, picnic areas, or swimming areas.

Dispersed camping – Camping outside of a developed camping facility.

Dispersed recreation – That type of outdoor recreation that tends to be spread out over the land and in conjunction with roads, trails, and undeveloped waterways. Activities are often day-use oriented and include hunting, fishing, boating, hiking, off-road-vehicle use, cross-country skiing, motorbiking, and mountain climbing.

Ditching – Constructing a roadside ditch to carry surface runoff from the road surface away from the road.

Dormant season grazing – Removal of plant material by ungulates when no physiological plant activity is occurring.

Dry swale – A low lying depression between slopes that provides for drainage during storm events.

Dry wash – The dry bed of an intermittent stream, such as those found at the bottom of a canyon.

Dust Bowl – A historic drought which affected the southern Great Plains, primarily from 1931 to 1939. The drought was characterized by large clouds of moving dust and coincided with the Great Depression.

Easement – The right-of-use over the property of another. The land having the right-of-use is known as the dominant estate, and the land that is subject to the easement is known as the servient estate.

Ecosystem – The system formed by the interaction of a group of organisms and their environment.

Ecotone – A transition zone between two distinct ecological communities.

Ecotourism – Environmentally responsible travel to natural areas in order to enjoy and appreciate nature (and accompanying cultural features, both past and present) that promote

conservation, have a low visitor impact, and provide for beneficially active socioeconomic involvement of local peoples (World Conservation Union).

Eligible scenic river – A river that meets the eligibility criteria for a scenic river but has not been evaluated for its suitability. Such rivers are managed to maintain the outstandingly remarkable values for which they were determined to be eligible until a suitability evaluation is completed.

Emergent – Aquatic plants with some or most of the leaf area extending out of the water.

Employment rate – The proportion of the civilian noninstitutional population aged 16 years and over that is employed; also known as the employment-population ratio (USDL 2010).

Endemic – Native or confined to a certain region; having a comparatively restricted distribution.

Erosion – The wearing away of the land's surface by running water, wind, ice, or other geological agents. It includes detachment and movement of soil or rock fragments by water, wind, ice, or gravity.

Escape structure – A structure built out of small buried culverts open at both ends, primarily sized for swift fox, which provides shelter to escape from predators.

Exclosure – a fence used to keep certain animals from grazing and browsing in a given area, usually to exclude cattle or big game species.

Facility – Structures needed to support the management, protection, and use of the national forests, including roads, trails, buildings, utility systems, dams, and other construction features. There are three types of facilities: recreation, administrative, and permittee.

Federally listed species – A species listed under the provisions of the Endangered Species Act.

Flight path –In this plan, flight path refers to the low-flying areas around an airport where the effects of an aircraft taking off or landing can be expected.

Flooding regime – The timing, spatial extent, depth, and response to runoff associated with the overflowing of water from the normal confines of a stream or other body of water.

Flood plain – That portion of a river or stream valley, adjacent to the channel, which is covered with water when the river or stream overflows its banks at flood stages.

Fluvial processes – The mechanisms which occur when running water causes erosion, transport, and deposition.

Food plot – An area sown or planted annually with grains, legumes, berries, or other plants to provide food for wildlife; or openings that are mowed or otherwise cultivated to maintain natural herbaceous vegetation.

Forage – (1) browse and herbage which is available and can provide food for animals or be harvested for feeding; or (2) to search for or consume forage (Coulloudon et al. 1999).

Forb – Any herbaceous broad-leaved plant species.

Foreground – The area within half a mile of a site or boundary.

Forest (wood) products – Any resource derived from trees except lumber. This includes seeds, nuts, firewood, biomass, and other related products.

Forest Service Handbook – Forest Service Handbooks (FSH) are the principal source of specialized guidance and instruction for carrying out the direction issued in the Forest Service Manual. Specialists and technicians are the primary audience of handbook direction. Handbooks may also incorporate external directives with related USDA and Forest Service directive supplements.

Forest Service Manual – The Forest Service Manual (FSM) contains legal authorities, objectives, policies, responsibilities, instructions, and guidance needed on a continuing basis by Forest Service line officers and primary staff in more than one unit to plan and execute assigned programs and activities.

Fragmentation – Habitat fragmentation is a process that occurs wherever a large, contiguous habitat is transformed into smaller patches that are isolated from each other by a landscape matrix unlike the original. This matrix can differ from the original habitat in either composition or structure. The crucial point is that it functions as either a partial or total barrier to dispersal for species associated with the original habitat. A clear threat to population viability exists when the process of fragmentation occurs that isolates pairs and populations versus fragmentation within the home range of the individual pairs.

Free flowing – Defined by the Wild and Scenic River Act as, "existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. The existence, however, of low dams, diversion works, and other minor structures at the time any river is proposed for inclusion in the national wild and scenic rivers system shall not automatically bar its consideration for such inclusion."

Geomorphology – The classification, description, nature, origin, and development of present landforms and their relationships to underlying structures; and of the history of geologic changes as recorded by these surface features.

Grazing – Consumption of range or pasture herbaceous forage by animals.

Grazing permit – Any document authorizing livestock to use National Forest System or other lands under Forest Service control for the purpose of livestock production. CFR 222.1(a)(5)

Grazing permittee – An individual who has been granted written permission to graze livestock for a specific period on a range allotment; the recipient of a grazing permit.

Great Plains – The large grassland in the rain shadow of the Rocky Mountains, approximately 2,500 miles from north to south and 600 miles wide from east to west. In the United States, it covers the eastern portions of Montana, Wyoming, Colorado and New Mexico, the western portions of North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma, and the panhandle of Texas. It extends north into the Canadian provinces of Alberta, Saskatchewan, and Manitoba.

Greenhorn – Mineral consisting predominantly of dark colored, chalky limestone and calcareous shale.

Groundwater – Water within the earth that supplies wells and springs. Specifically, water in the zone of saturation where all openings in soils and rocks are filled. The upper surface level forms the water table.

Ground cover – Anything which covers the ground surface or topsoil and has the effect of reducing erosion. Preferably, this would be a vegetative layer of grasses and/or other low-growing plants but may also include plant residues such as leaf litter and tree debris as well as various forms of rock.

Ground-disturbing activities – Any activity which moves soil to the extent that an archaeological site may be impacted.

Groundwater depletion – Groundwater depletion occurs when aquifer discharge exceeds recharge.

Groundwater discharge – Discharge areas are the opposite of recharge areas. They are the locations at which groundwater leaves the aquifer and flows to the surface. Groundwater discharge occurs where the water table intersects the land surface. Where this happens, springs or seeps are found.

Groundwater recharge – Recharge is the process by which groundwater is replenished. A recharge area is where water from precipitation percolates downward to an aquifer. Recharge is promoted by vegetation cover, flat topography, permeable soils, a deep water table, and the absence of impermeable substrate.

Group site – A recreation site designed to accommodate group events such as family gatherings.

Growing season – The period when plants actively photosynthesize and put on vegetative growth in preparation for seed production.

Gully erosion – Gully erosion is the process by which gullies are formed. Hillsides are more prone to gullying when they are cleared of vegetation through deforestation, overgrazing, or other means. The eroded soil is easily carried by flowing water after being dislodged from the ground, normally when rainfall falls during short, intense storms such as during thunderstorms.

Habitat – The natural conditions and environment in which a plant or animal lives, e.g. forest, desert, or wetlands.

Habitat niche – The locality where the organism may generally be found and where all essentials for its development and existence are present. Habitat niches are described by their geographical boundaries or with such terms as “shady woodlands,” “banks of streams,” “dry hillsides,” etc.

Headcut – A headcut is the sudden change in elevation or knickpoint at the leading edge of a gully. Headcuts can range from less than an inch to several feet in height, depending on several factors. The formation and movement of a gully headcut are often the dominant forms of damage observed in an earth spillway.

Herbaceous plant – Plants that have nonwoody stems and die back at the end of the growing season.

Herbivory – The consumption of herbaceous vegetation by animals.

Heritage resources – Buildings, sites, areas, architecture, memorials, and objects having scientific, prehistoric, historic, or social values.

High-clearance vehicle – A vehicle greater than 60 inches in width designed or modified for use "off road" with appropriate clearance, tires, suspension, and undercarriage protection.

High Plains – The High Plains are a subregion of the Great Plains in the central United States, generally encompassing the western part of the Great Plains before the region reaches the Rocky Mountains. The High Plains are located in eastern Colorado, western Kansas, western Nebraska, central and eastern Montana, eastern New Mexico, western Oklahoma, northwestern Texas, and southeastern Wyoming. From east to west, the High Plains rise in elevation from around 750 m (2,500 feet) to over 1,800 m (6,000 feet).

Historical extent – The geographic area that a vegetation type covered in the past.

Homestead – Land claimed by a settler, particularly under the Homestead Act of 1862.

Hydric soil – A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper horizon. Hydric soils along with hydrophytic vegetation and wetland hydrology are used to define wetlands.

Hydrologic function – Hydrologic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as groundwater recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

Hydrology – The study of the behavior of water in the atmosphere, on the earth's surface, and underground.

Hydrophytic plant – A plant characterized by its adaptations to a water saturated environment.

Important birding area (IBA) – Sites that provide essential habitat for one or more species of birds. IBAs include sites for breeding, wintering, and/or migrating birds. IBAs may be a few acres or thousands of acres, but usually they are discrete sites that stand out from the surrounding landscape. IBAs may include public or private lands, or both, and they may be protected or unprotected. The criteria for and selection of IBAs is administered by the Audubon Society.

Improvement – Manmade developments, such as roads, trails, fences, stock tanks, pipelines, power and telephone lines, survey monuments, and ditches.

Inclusion – A variance in vegetation within a vegetation type due to landform, moisture regime, soil type, erosion, or past disturbance.

Income – When "income" is used in this document, it is equivalent to the USDC Bureau of Economic Analysis' definition of personal income (USDC 2010), which states, "Personal income is the income received by persons from participation in production, plus transfer receipts from government and business, plus government interest (which is treated like a transfer receipt). It is defined as the sum of wage and salary disbursements, supplements to wages and salaries, proprietors' income with inventory valuation and capital consumption adjustments, rental income

of persons with capital consumption adjustment, personal dividend income, personal interest income, and personal current transfer receipts, less contributions for government social insurance."

Indicator species – A species whose presence, absence, or relative well-being in a given environment is indicative of the health of its ecosystem as a whole.

Infiltration – Infiltration is the process of water entering the soil. The rate of infiltration is the maximum velocity at which water enters the soil surface.

Infrastructure – The facilities, utilities, and transportation system needed to meet public and administrative needs.

Intermittent/ephemeral stream – An ephemeral stream or stretch of a stream is one that flows only in direct response to precipitation or intermittent springs. It receives no water from perennial springs and no long-continued supply from melting snow or other source. Its stream channel is at all times above the water table. The term may be arbitrarily restricted to streams or stretches of streams that do not flow continuously during periods of as much as 1 month.

Interpretive services – Information services designed to present inspirational, educational, and recreational values to forest visitors to provide the utmost in understanding, appreciation, and enjoyment from their forest experience.

Invasive species – A species, including its seed, spores, or other biological material, whose introduction does cause or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

Inventoried roadless area – Areas, typically of 5,000 acres or greater, which were identified in the Roadless Area Review and Evaluation in 1979.

Isolated parcel – A parcel of land that is typically the size of a section or less and which is discontinuous to the rest of the National Forest System lands that are within the administrative boundary of the unit.

Job growth – The number of jobs gained by an area over a period of time. Jobs are counted in the same way the Bureau of Economic Analysis (USDC 2010) counts employment: "a count of jobs, full-time plus part-time, by place of work. Full-time and part-time jobs are given equal weight. Employees, sole proprietors, and general partners are included, but unpaid family workers and volunteers are not."

Lake-based recreation complexes – A recreation facility that is located near or adjacent to a lake or reservoir and supports access to and protection of the recreational opportunities of the lake.

Land adjustment – Lands acquired through purchase, donation, exchange, transfer, sale, grant, or selection.

Land exchange – The conveyance of non-Federal land or interest in the land to the United States in exchange for National Forest System land or interest in the land.

Land purchase – The conveyance of non-Federal land or interest in the land to the United States by fee-simple purchase.

Large woody debris – Dead wood left on the ground, including logs, stumps, and limbs contribute to the structural diversity of the Forest and biotic diversity of the ecosystem by hosting fungi, insects, invertebrates, small mammals, and birds. They also have a critical role in the larger Forest because of their importance to nutrient cycling.

Leasing (oil and gas) – A contract right granted by the United States allowing a lessee the right of holding a record title and operating right to the leased oil and/or gas in exchange for rent and royalty payments. Oil and gas leases will expire in 10 years if they are not put into production; otherwise, leases do not expire as long as they are "held by production."

Litter – The uppermost layer of organic debris on the ground, composed mainly of fresh or slightly decomposed leaves, bark, twigs, flowers, fruits, and other vegetative matter.

Management indicator species – Plant or animal species or habitat components selected during the alternatives analyses stage of an environmental impact statement that are used to monitor the effects of planned management activities on populations of wildlife and fish, including those that are socially or economically important.

Mast – The flowers, fruits, or seeds of plants, especially of trees and shrubs that are eaten by animals. Hard mast includes hard-shelled seeds such as acorns and hickory nuts. Soft mast includes flowers and seeds with a fleshy cover (for example berries, wild cherries, and maple seeds).

Memorandum of understanding (MOU) – A legal agreement between the Forest Service and other agencies resulting from consultation between agencies that states specific measures the agencies will follow to accomplish a large or complex project. A MOU is not a fund-obligating document.

Mesic (adapted) species – Plant species adapted to mesic environmental conditions are ones with medium moisture requirements. Mesic soil is a medium type of soil that drains well, yet retains some water.

Minerals, common variety – see "Common mineral" (above).

Monitoring – Collecting information to track system conditions and their response to management.

Motor vehicle use map – A map displaying designated roads, trails, and areas for motor vehicle use on an administrative unit or a ranger district of the National Forest System.

Mott – A small group of trees usually in grassland or shrubland setting.

National Environmental Policy Act (NEPA) – An act declaring a national policy to encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality.

National Forest Land and Resource Management Plan – A plan developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974, as

amended, that guides all resource management activities and establishes management standards and guidelines for the National Forest System lands of a given national forest.

National Forest System (NFS) land – Federal lands that have been designated by Executive Order or statute as national forest, national grassland, or purchase units, or other lands under the administration of the Forest Service.

National historic trail – National historic trails were authorized under the National Trails System Act of 1968 (Public Law 90-543), along with national scenic trails and national recreation trails. National scenic trails and national historic trails may only be designated by an act of Congress.

National Register of Historic Places – A list of heritage resources that have local, state, or national significance maintained by the Secretary of the Interior.

National Wild and Scenic River System – Rivers with outstanding scenic, recreational, geological, fish and wildlife, historic, cultural, or other similar values; designated by Congress under the Wild and Scenic Rivers Act for preservation of their free-flowing condition.

National Wilderness Preservation System – Pristine Federal lands designated by the Wilderness Act of 1964 and subsequent wilderness legislation. Generally, these lands are untouched by "works of man."

Natural recruitment – The unaided settlement and proliferation of a species in a suitable habitat.

Nesting platform – An artificial nest structure employed as a habitat improvement practice when quality nest sites are a limiting factor to raptor density.

Nongovernmental organization (NGO) – is a term that has become widely accepted as referring to a legally constituted entity created by natural or legal persons with no participation or representation of any government. NGOs exist for a variety of reasons, usually to further the political or social goals of their members or funders. Examples include improving the state of the natural environment, encouraging the observance of human rights, improving the welfare of the disadvantaged, or representing a corporate agenda.

No surface occupancy – A fluid mineral leasing stipulation that prohibits occupancy or disturbance on all or part of the land surface to protect special values or uses. The NSO stipulation includes stipulations that may have been worded as "No Surface Use/Occupancy," "No Surface Disturbance," "Conditional NSO," and "Surface Disturbance or Surface Occupancy Restriction by Location." Lessee may exploit the oil and gas or geothermal resources under leases restricted by this stipulation through use of directional drilling from sites outside the NSO area.

Non-salary income – Income from employment that does not pay a wage or salary, such as a small business or farm.

No-wake boating – The slowest speed at which it is still possible to maintain steering and which does not produce a wake.

Noxious weed – A legal term applied to plants regulated by Federal and state laws, such as plants designated as noxious weeds by the Secretary of Agriculture or by the responsible state official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insect or disease, and

being not native or new or not common to the United States or parts thereof. (Forest Service Manual 2080.5, Federal Noxious Weed Act of 1974, PL 93-629, as amended.)

Off-highway vehicle – Any motorized vehicle capable of or designed for travel on or immediately over land, water, or other natural terrain with a vehicle width of less than 50 inches.

Off-road motorized vehicle – Any motorized vehicle capable of or designed for travel on or immediately over land, water, or other natural terrain. This includes all mechanical means of transportation: passenger cars, 4-wheel drive pickups or sport utility vehicles, trail bikes, snowmobiles, or other ground transportation vehicles that are capable of traveling overland where no roads exist.

Open pit – A shallow manmade open pond or pit used on a drill site or production pad to hold produced water or fluids from drilling. “Closed” pits refer to the use of tanks to store these types of fluids.

Outdoor classrooms – Areas that are designed and managed for use by local schools and other educational institutions.

Outsloping – Shaping the road surface with a continuous cross slope to carry surface water off the fill side of the road.

Outstandingly remarkable values – Scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values which make a river eligible for designation as a wild or scenic river.

Overland flow – A condition in which precipitation rate is faster than infiltration rate, and excess water runs over the surface of the land.

Overlay – A management area or special area that provides more specific direction for a small geographic location within a larger management area. The management direction given for the larger management area continues to apply. For example, if proposing a project next to the Canadian River, a specialist would have to look at the direction for the eligible scenic river and the Mills Canyon Management Area, which are both overlays, as well as the direction for the Kiowa and Rita Blanca Management Area.

Overstory – That portion of a plant community consisting of the taller plants on the site; the forest or woodland canopy.

Paleontological resources – Fossils and other resources related to the natural history of an area.

Palustrine wetland – Relating to a system of inland, nontidal wetlands characterized by the presence of trees, shrubs, and emergent vegetation (vegetation that is rooted below water but grows above the surface). Palustrine wetlands range from permanently saturated or flooded land (as in marshes, swamps, and lake shores) to land that is wet only seasonally (as in vernal pools). See “Emergent” above.

Pasture – A grazing area enclosed and separated from other areas by fencing or other barriers.

Patch (size) – A relatively homogeneous nonlinear area that differs from its surroundings. It can specifically describe forested patches, non-forest vegetation patches, rock/barren patches, or water patches.

Per capita income – This measure of income is calculated as the total personal income of the residents of an area divided by the population of the area. Per capita personal income is often used as an indicator of consumers' purchasing power and of the economic well-being of the residents of an area.

Perennial stream – Permanently inundated surface stream course. Surface water flows throughout the year except in years of prolonged drought.

Playa lakes – Bowl-shaped depressions that are dependent on rainfall and surface runoff for the water they impound. They are closed basins and usually do not overflow. They are mostly intermittent, with lake evaporation occurring at about 60 inches per year.

Potential natural vegetation type – The plant community that would become established if all successional sequences were completed without human interference under present environmental and floristic conditions, including those created by man.

Potential wilderness area – An area that meets the criteria for the inventory phase of wilderness evaluation as described in FSH 1909.12, Chapter 71.

Prescribed burn – Fire burning under conditions specified in an approved plan to dispose of fuels, control unwanted vegetation, stimulate growth of desired vegetation, change successional stages, etc., to meet range, wildlife, recreation, wilderness, watershed, or timber management objectives. Prescribed burns occur under specified environmental conditions that allow the fire to safely be confined to a predetermined area and produce the fireline intensity and rate of spread required to meet management objectives.

Proclamation boundary – The proclaimed boundary depicts the boundaries encompassing NFS lands within the original proclaimed national forests along with Executive Orders, proclamations, public laws, public land orders, Secretary of Agriculture Orders, and Secretary of Interior Orders. A proclaimed boundary is created by an act of Congress. The proclaimed boundary and administrative boundaries can be different, depending on how the land came to the government. An example of this is the Valle Vidal Unit of the Carson National Forest. It was donated to the government after the proclaimed boundary was established. The Valle Vidal Unit is within the administrative boundary of the Carson, but not within the proclaimed boundary.

Proper functioning condition – A condition when adequate vegetation, landform, or large woody debris is present to: dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality; filter sediment, capture bedload, and aid flood plain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; and develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses, and support greater diversity.

Quality of life – A term used to refer to the social, economic, and health related values that compose the overall satisfaction and general well-being of an individual or community.

Recreation opportunity spectrum (ROS) – A framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities. The settings, activities, and opportunities for obtaining experiences have been arranged along a continuum or spectrum divided into six classes: primitive, semiprimitive nonmotorized, semiprimitive motorized, roaded natural, rural, and urban.

Recreation settings – The combination of physical, biological, social, and managerial conditions that give value to a place for recreation opportunities.

Recreational fisheries – A water body that supports fish which are managed for sport fishing.

Reference condition – The environmental conditions that imply ecological sustainability, represented by the characteristic range of variation (when available), not the total range of variation, prior to European settlement and under the current climatic period. At landscape scales, presettlement human-caused effects are inherent to the reference condition, particularly where there are fire-adapted systems. It may be necessary to refine reference conditions according to climate change projections and permanent environmental changes (e.g., invasive species). Reference conditions are best suited for analysis when quantified by amount, condition, spatial distribution, and temporal variation.

Research – Activities undertaken for the purpose of formal scientific inquiry by the Forest Service, other Federal agencies, universities, or an individual researcher.

Research natural area (RNA) – An area set aside by the Forest Service to preserve a representative sample of an ecological community, primarily for scientific and educational purposes. Commercial exploitation is not allowed and general public use is discouraged.

Research site – A site that is limited in its ability to be used for other management purposes and is part of an active research project.

Residual ground cover – Plant material remaining onsite after grazing activity has ended.

Right-of-way – A linear strip of land defined for the present or future location of transportation or utility right-of-way within its boundaries.

Riparian – An area of vegetation adjacent to an aquatic ecosystem distinguished by a high water table, certain soil characteristics, and some vegetation that requires free water or moist soil conditions.

Riparian area – Geographically delineable areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems.

Riparian dependent resources – Resources that owe their existence to the riparian area.

Riparian ecosystem – A terrestrial ecosystem characterized by hydric soils and plant species that are dependent on the water table or its capillary fringe zone.

Riverine – Relating to a system of inland wetlands and deep water habitats, characterized by the absence of trees, shrubs, or emergent vegetation associated within a channel which periodically or continuously contains nontidal flowing water.

Road – A motor vehicle route over 50 inches wide, unless identified and managed as a trail (36 CFR 212.1, FSM 7705).

Road abandonment – A method of road decommissioning whereby the road receives no physical treatment.

Road decommissioning – Activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1).

Road management objectives (RMOs) – RMOs document the intended purpose of an individual road in providing access to implement a land and resource management plan as well as decisions about applicable standards for the road. RMOs should be based on management area direction and access management objectives. RMOs contain design criteria, operation criteria, and maintenance criteria (FSM 7709.59.11).

Roaded natural ROS – Characterized by a predominantly natural appearing environment with moderate evidence of human activity. Resource modification and utilization practices are evident but harmonize with the natural environment. May have a mosaic of highly modified areas to pockets of unmodified lands. Developed sites provide for some user comfort as well as site protection, but harmonize with the natural environment.

Roadway – Portion of the road that includes everything from the top of the cut slope to the bottom of the fill slope.

Rolling dips – Shallow depressions built diagonally across a road to divert surface water runoff from the road.

Roost – A support such as tree limbs, thick tree bark, or brush piles which birds or bats use to rest upon or use for cover.

Rural ROS – A substantially modified natural environment. There is evidence of resource modification and utilization practices, and facilities are often designed for larger numbers of people. Campgrounds often include paved roads, electricity, and other conveniences.

RV – Abbreviation for recreational vehicle, which is a vehicle that contains living quarters for recreational purposes.

Salting/mineral supplementation/supplemental feeding – Providing necessary nutrients that are not naturally provided to grazing animals.

Savanna – A grassy plain typified by the presence of a low density of open grown trees and which is usually maintained by periodic fire.

Scenery – General appearance of a place, landscape, and/or its visible features (definition per SMS Handbook Glossary (USFS 1995), slightly revised and shortened for clarity).

Scenery management system – A process for the inventory and analysis of the aesthetic values of national forest lands providing for integration of these values with other biological, physical, and social/cultural resources in the planning process.

Scenery objectives – Also known as "scenic integrity objectives," which set guidelines to manage the degree that management or other projects may negatively impact the desired landscape character (USDA Forest Service 1995).

Scenic – Of or relating to landscape scenery; pertaining to natural, natural appearing or other valued scenery; constituting or affording pleasant views of natural landscape attributes or positive cultural elements (definition per SMS Handbook Glossary (USFS 1995), slightly revised for clarity).

Scenic integrity (high, medium, and low) – A measure of the degree to which a landscape is visually perceived to be "complete," and is determined by three factors: dominance, degree of deviation, and intactness of the desired landscape character established based on the existing condition. Scenic integrity disturbances most typically result from human activities, but can also result from natural events which exceed the landscape's historical range of variability in terms of magnitude, duration, or intensity. An exception to this is direct human alterations that have become accepted over time as positive landscape character attributes (e.g., historic cabins, farms, and ranches).

- **High scenic integrity** – The valued scenery "appears natural or unaltered," yet visual disturbances are present; however, they remain unnoticed because they repeat the form, line, color, texture, pattern, and scale of the valued scenery. When used as a standard or guideline, this level should be achieved as soon after project completion as possible or within 3 years, maximum.
- **Moderate scenic integrity** – The valued scenery "appears slightly altered." Noticeable disturbances are minor and visually subordinate to the valued scenery because they repeat its form, line, color, texture, pattern, and scale. When used as a standard or guideline, this level should be achieved as soon after project completion as possible or within 3 years, maximum.
- **Low scenic integrity** – The valued scenery "appears moderately altered." Visual disturbances are codominant with the valued scenery and may create a focal point of moderate contrast. Disturbances may reflect, introduce, or "borrow" valued scenery attributes from outside the landscape being viewed (such as the size, shape, edge effect, and pattern of natural openings; vegetative type changes or socially valued architectural styles). Scenery attributes borrowed from outside the viewed landscape appear compatible with or complimentary to those within. When used as a standard or guideline, this level should be achieved as soon after project completion as possible or within 3 years, maximum.

Scenic quality – Degree to which the appearance of a place, landscape, or feature can elicit psychological and physiological benefits to individuals and, therefore, to society in general (definition per SMS Handbook Glossary (USFS 1995), revised). Scenic quality is described and measured through the landscape character inventory information and the cumulative conditions of the two primary SMS indicators described in this appendix, "scenic integrity" and "scenic stability."

Scenic river – Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Seasonal depressional wetland – See "Depressional wetland."

Sediment – Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Sediment load – Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from site of origin by air, water, gravity, or ice.

Sedimentation – The deposition or settling of soil particles suspended in water.

Semiprimitive motorized ROS – Similar setting to the SPNM below, except this area provides a motorized backcountry experience where trails and primitive roads are designed for high-clearance, four-wheel-drive vehicles. There is a moderate probability of experiencing solitude. High degree of self-reliance and challenge in using motorized equipment. These areas are predominantly natural, lacking some human modification, except when necessary for site protection.

Semiprimitive nonmotorized (SPNM) ROS – A nonmotorized backcountry area with a predominantly natural appearing environment, without evidence of resource modification and utilization practices. This type of area provides opportunities for self-reliance and challenge, with a low concentration of users and high degree of interaction with the natural environment. Recreation developments are rustic and rudimentary and primarily provided for the protection of the resources rather than the convenience of users.

Shelterbelt – A shelterbelt is a windbreak plantation made up of one or more rows of trees or shrubs planted in such a manner as to provide shelter from the wind and to protect soil from erosion. The Great Plains Shelterbelt was a project used to create windbreaks in the Great Plains states that was launched in 1934. President Franklin D. Roosevelt initiated the project in response to the severe dust storms of the Dust Bowl which resulted in significant soil erosion and drought. The Great Plains Shelterbelt was authorized under the 1924 Clarke-McNary Act and was carried out by the Works Projects Administration (WPA). By 1942, 30,233 shelterbelts had been planted, which contained 220 million trees and stretched for 18,600 miles (29,900 km).

Snag – A standing, dead tree from which the leaves and most of the branches have fallen.

Soil compaction – Soil compaction occurs when soil particles are pressed together, reducing the pore space between them. This increases the weight of solids per unit volume of soil (bulk density). Soil compaction occurs in response to pressure (weight per unit area) exerted by field machinery or animals. The risk for compaction is greatest when soils are wet.

Soil condition – An evaluation of soil quality based on an interpretation of factors which affect three primary soil functions: soil hydrology, soil stability, and nutrient cycling.

Soil condition category – An indication of the status of soil functions. (Ecological land units are assigned a soil condition category.) Soil condition categories reflect soil disturbances resulting from both planned and unplanned events. Current management activities provide opportunities to maintain or improve soil functions that are critical in sustaining soil productivity.

- **Satisfactory** – Indicators 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.
- **Impaired** – Indicators signify a reduction of soil function. The ability of soil to function properly has been reduced and/or there exists an increased vulnerability to degradation. An impaired category should signal land managers that there is a need to further investigate the ecosystem to determine causes and degrees of decline in soil functions. Changes in management practices or other preventative actions may be appropriate.
- **Unsatisfactory** – Indicators signify that loss of soil function has occurred. Degradation of vital soil functions result in the inability of soil to maintain resource values, sustain outputs, and recover from impacts. Soils rated in the unsatisfactory category are candidates for improved management practices or restoration designed to recover soil functions.

Soil fertility – Soil fertility deals with the nutrient status, or ability of soil to supply nutrients for plant growth under favorable environmental conditions such as light and temperature, and the physical conditions of the soil.

Soil productivity – The capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. Soil productivity may be expressed in terms of volume or weight per unit, area per year, percent plant cover, or other measures of biomass accumulation.

Special areas – Certain limited areas of National Forest System lands not designated as wilderness and containing outstanding examples of plant and animal communities, geological features, scenic grandeur, or other special attributes that merit special management. These areas are designated by law, or may be designated administratively, as special areas. Areas so designated are managed to emphasize recreational and other specific related values. Other uses are permitted in the areas to the extent that these uses are in harmony with the purpose for which the area was designated. The law or order designating each area provides specific objectives and guidelines for management of each area.

Special use – Those uses and occupancy occurring on more than a transient basis except those covered by mining laws, or those associated with harvesting timber or grazing livestock. These uses include roads, all types of utilities, ski areas, cemeteries, electronic sites, and recreation residences. Uses are ordinarily covered by either an annual or term permit. Annual permits are for relatively short-term use and are revocable by the Forest Service. They are renewable each year by the payment of a fee. Term permits are used to cover uses of a longer time period (up to 30 years) and having a large economic investment. Examples of this permit include large electric transmission lines and large recreation resorts and ski areas.

Species abundance – Relative species abundance and species richness describe key elements of biodiversity. Relative species abundance refers to how common or rare a species is relative to other species in a given location or community.

Species composition – The proportions of various individual plant species in relation to the total in a given area.

Species diversity – The number of different species in a particular area (species richness) weighted by some measure of abundance such as number of individuals or biomass.

Species richness – Species richness is the number of species present in a sample, community, or taxonomic group. Species richness is one component of the concept of species diversity.

Species structure – The physical height of a plant species in a vegetation community.

Species viability – Capability to possess the necessary population size and distribution of reproductive individuals for the well-distributed, continued existence in the planning area.

Spreader dam – A structure designed to dissipate surface flow.

Stand – A group of trees sufficiently uniform in species composition, size, age, structure, spatial arrangement, and condition to be distinguished from surrounding stands and managed as a single unit.

Streambank – The sides of a channel that hold or carry water.

Structure – The presence, size, and physical arrangement of vegetation in a stand. Vertical structure refers to the variety of plant heights, from the canopy to the forest floor. Horizontal structure refers to the types, sizes, and distribution of trees and other plants across the land surface. Forest lands with substantial structural diversity provide a variety of niches for different wildlife species.

Successional stage – A stage of development of a plant community as it moves from bare ground to climax.

Surface runoff – Refers to the loss of water from an area by flow over the land surface.

Surface use plan of operation (SUPO) – A plan of operations covering proposed surface-disturbing activities that must be approved by the Forest Service prior to any surface-disturbing activities occurring.

Sustainability – Sustainability is a goal for economic development and natural resource management. Ecosystem sustainability is the capacity of an ecosystem for long-term maintenance of ecological processes and functions, biological diversity, and productivity. Social and economic sustainability generally refers to land management practices that provide goods and services from a resource without degradation of the site quality, and without a decline in the yield of goods and services over time.

Sustained yield – The achievement and maintenance in perpetuity of an annual or periodic output of the various renewable resources of the National Forest System without impairment of the productivity of the land.

Terrace – A leveled section of a hill cultivated area, designed as a method of soil conservation to slow or prevent rapid surface runoff.

Terrestrial ecosystem survey (TES) and terrestrial ecological unit inventory (TEUI) – A classification of ecological types and mapped terrestrial ecological units using a consistent standard throughout National Forest System lands (NFS). Ecological units are categorized to

identify land and water areas at different levels of resolution based upon similar capabilities and potentials for response to management and natural disturbances. Capabilities and potentials derive from multiple elements, such as climate, geomorphology, geology, soils, water, and potential vegetation.

Topsoil – The upper, outermost layer of soil, usually the top 2 inches (5.1 cm) to 8 inches (20 cm). It has the highest concentration of organic matter and microorganisms and is where most of the Earth's biological soil activity occurs.

Trail – A route 50 inches or less in width or a route over 50 inches wide that is identified and managed as a trail (36 CFR 212.1).

Travel Management Rule – Located in 36 CFR 212, Subpart B, "Designation of Roads, Trails, and Areas for Motor Vehicle Use." The rule requires each national forest or ranger district to designate those roads, trails, and areas open to motor vehicles. Designation will include class of vehicle and, if appropriate, time of year for motor vehicle use. A given route, for example, could be designated for use by motorcycles, ATVs, or street legal vehicles. Once designation is complete, the rule will prohibit motor vehicle use off the designated system or inconsistent with the designations. Designations will be shown on a motor vehicle use map. Use inconsistent with the designations will be prohibited.

Tree guard (crib) – A structure placed around trees for protection against cattle rubbing and root trampling.

Understory – Plants growing beneath the canopy of other plants. Usually refers to grasses, forbs, and low shrubs under a tree or shrub canopy.

Ungulate – A hoofed mammal, such as deer, elk, mountain goats, bighorn sheep, moose, antelope, caribou, and bison. Grazing animal that has hooves (e.g. cattle, antelope).

Urban cluster – The Census Bureau delineates urban cluster boundaries to encompass densely settled territory, which consists of core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile. In addition, under certain conditions, less densely settled territory may be part of the urban cluster.

Utility corridors – The linear space needed to bury or suspend a produced water line, gas pipeline, oil pipeline, electric, or other line(s). It is often, but not always, located along a road.

Valued landscape – Those attributes that make the landscape valuable to people. These attributes may include parts of the built environment.

Watershed condition – The state of a watershed based upon physical and biological characteristics and processes affecting hydrologic and soil functions.

- **Class 1** watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The drainage network is generally stable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are predominately functional in terms of supporting beneficial uses.

- **Class 2** watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the watershed may exhibit an unstable drainage network. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are at risk in being able to support beneficial uses.
- **Class 3** watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. A majority of the drainage network may be unstable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems do not support beneficial uses.

Wetland – Habitat that is transitional between terrestrial and aquatic where the water table is usually at or near the land surface, or the land is covered by shallow water. Wetlands have one or more of the following characteristics: (1) at least periodically, the land supports predominantly hydrophytic plants; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (FSM 2600).

Wilderness area – An area of undeveloped Federal land that Congress designated as wilderness and that retains its primeval character and influence, is without permanent improvements or human habitation, and is protected and managed to preserve its natural conditions. An area that (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) comprises at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value (Wilderness Act, 1964).

Wildlife corridors – Strips of trees, shrubs, and/or understory vegetation that provide cover and habitat for wildlife and serve as travel lanes for movement between isolated patches of habitat.

Wildlife habitat improvement – Establishment of trees, shrubs, grasses, legumes, and/or forbs to increase or improve wildlife habitat. Wildlife water development habitat improvements might include ponds, windmills, solar pumps, and guzzlers designed to benefit wildlife.

Wind farm – A large group of wind turbines.

Wind turbine – A turbine which transforms the kinetic energy of the wind into mechanical or electrical energy that can be harnessed for practical use.

Woody plant community – A group of tree or shrub plant populations.

Woodland – A plant community in which trees are often small, characteristically with a greater proportion of their total height being crown more so than clear bole, and having trees spaced far enough apart that the canopies of adjacent trees usually do not touch and with the ground vegetation being mostly herbaceous, commonly grass (USDA Forest Service, 2004).

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[2] Contains current information and associated financial data on the inventory of constructed features such as buildings, dams, bridges, water systems, roads, trails, developed recreation sites, range improvements, administrative sites, heritage sites, general forest areas, and wilderness.

Appendix
A: Maps

The maps appear in the following order:

National Grasslands Administered by Cibola National Forest Vicinity Map

Black Kettle and McClellan Creek Management Area

Black Kettle and McClellan Creek Proposed Scenic Integrity Levels

Black Kettle and McClellan Creek Recreation Opportunity Spectrum Classes

Black Kettle and McClellan Creek Vegetation Types

Kiowa and Rita Blanca Management Area

Kiowa and Rita Blanca Proposed Scenic Integrity Levels

Kiowa and Rita Blanca Recreation Opportunity Spectrum Classes

Kiowa and Rita Blanca Vegetation Types

Mills Canyon Management Area

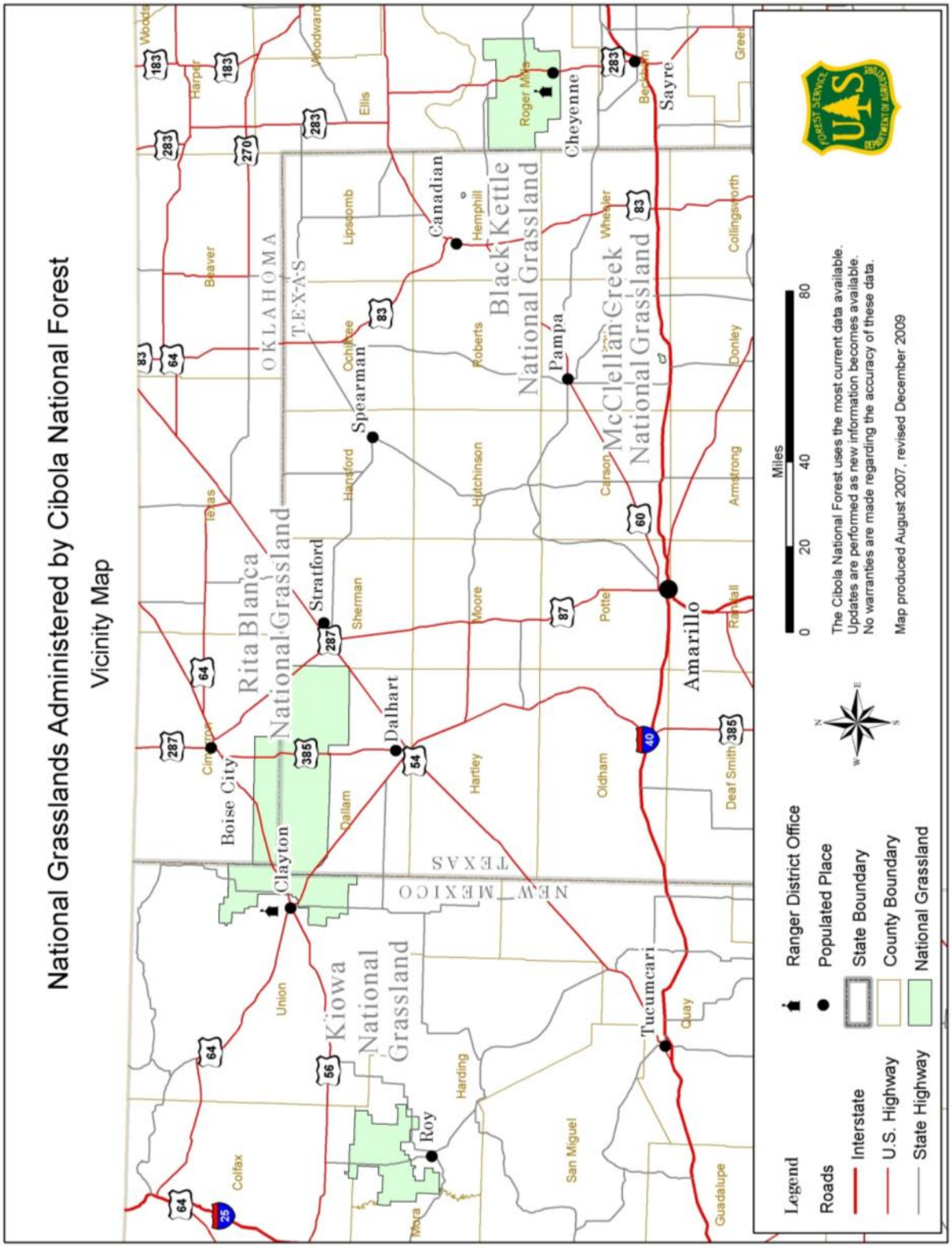
Mills Canyon Proposed Scenic Integrity Levels

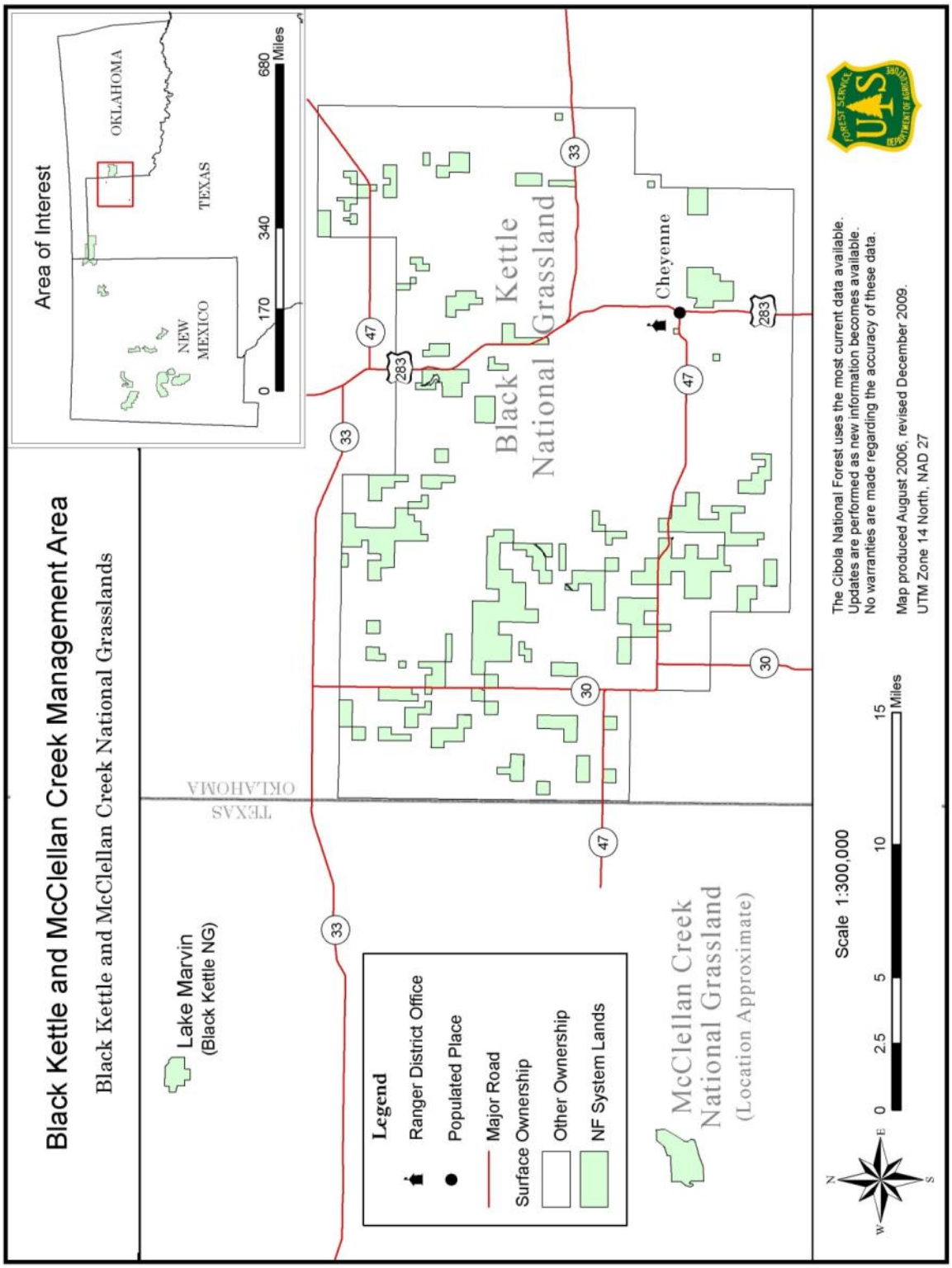
Mills Canyon Recreation Opportunity Spectrum Classes

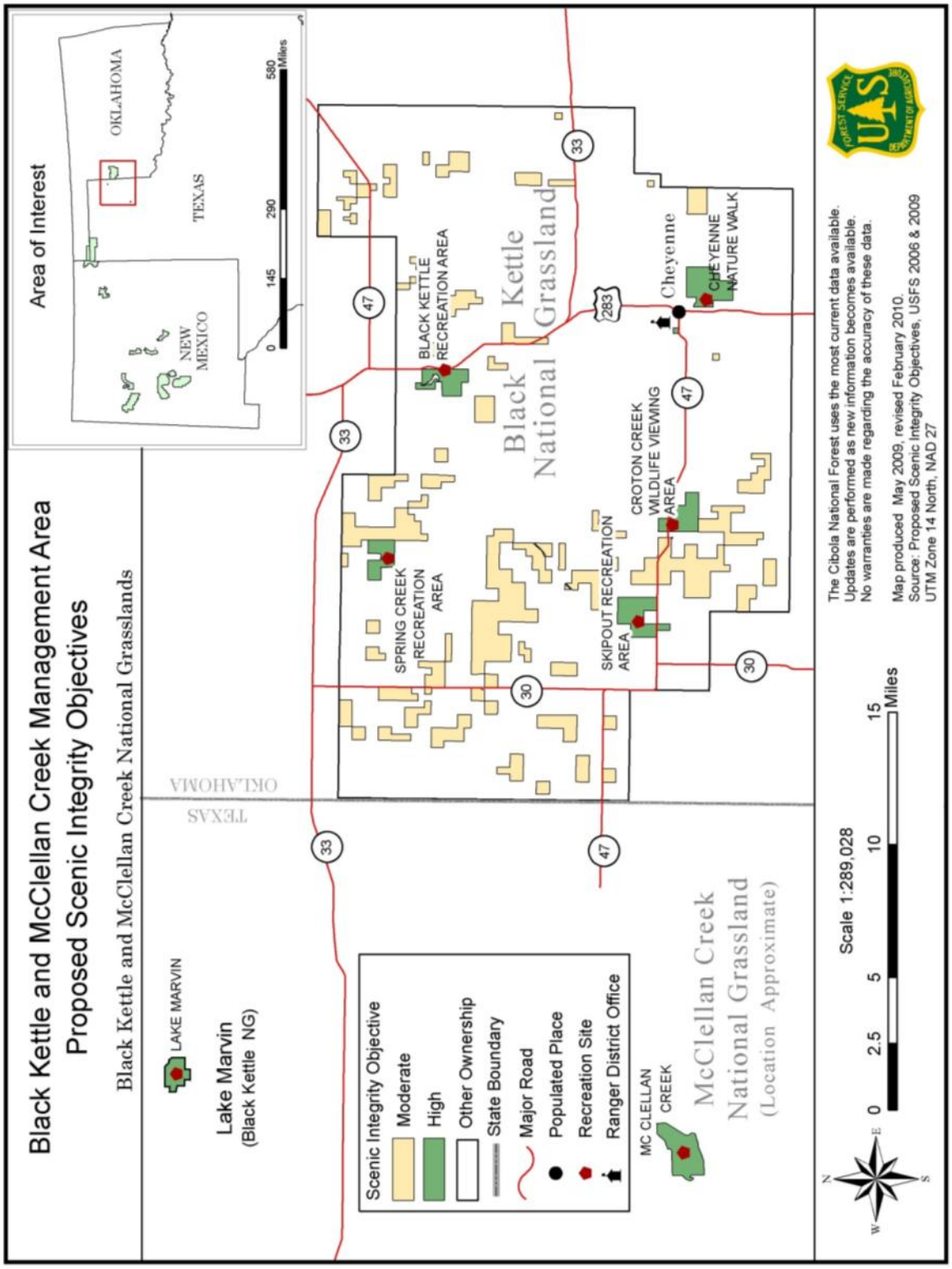
Mills Canyon Vegetation Types

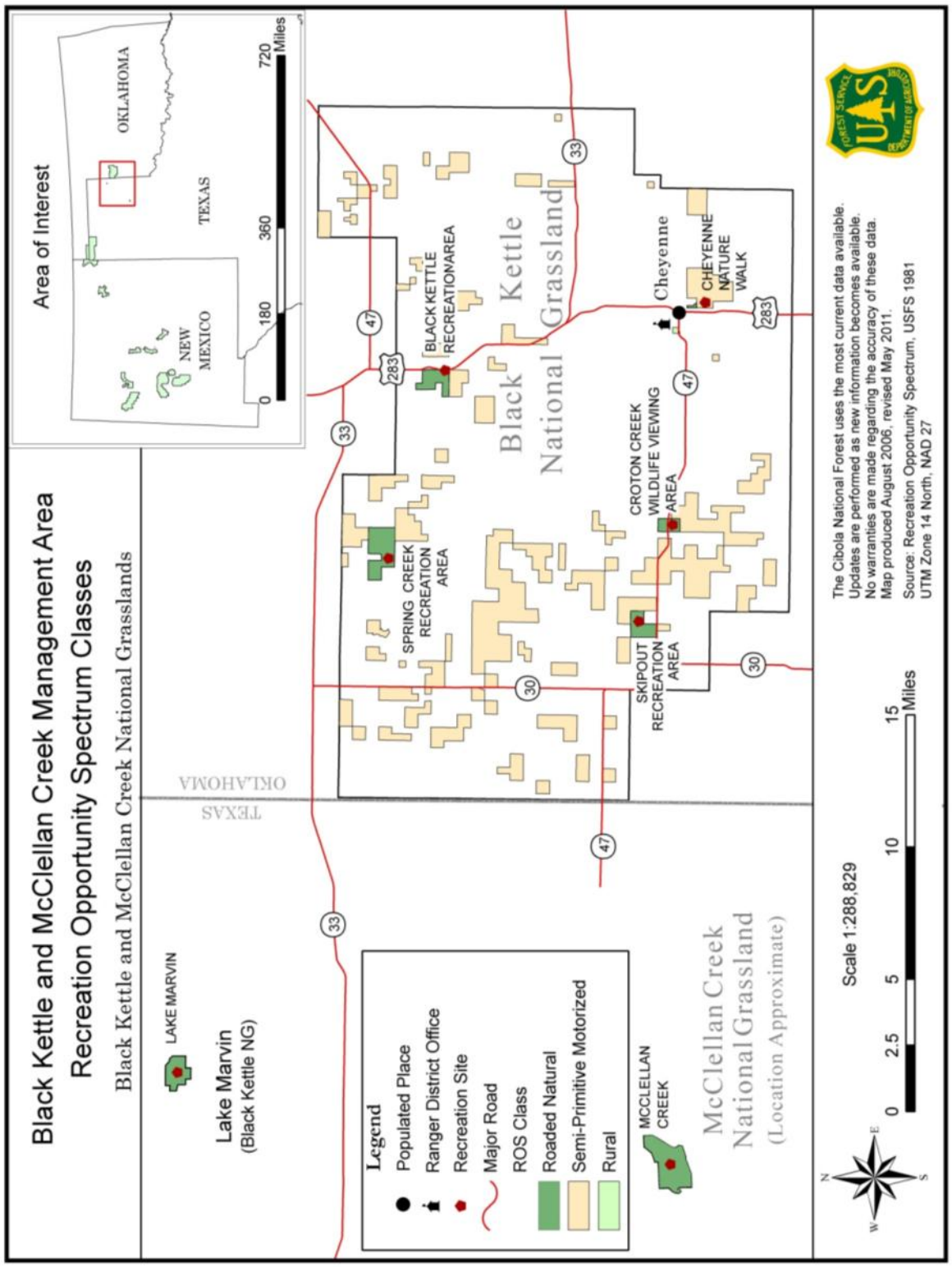
Special Areas and Eligible Scenic River

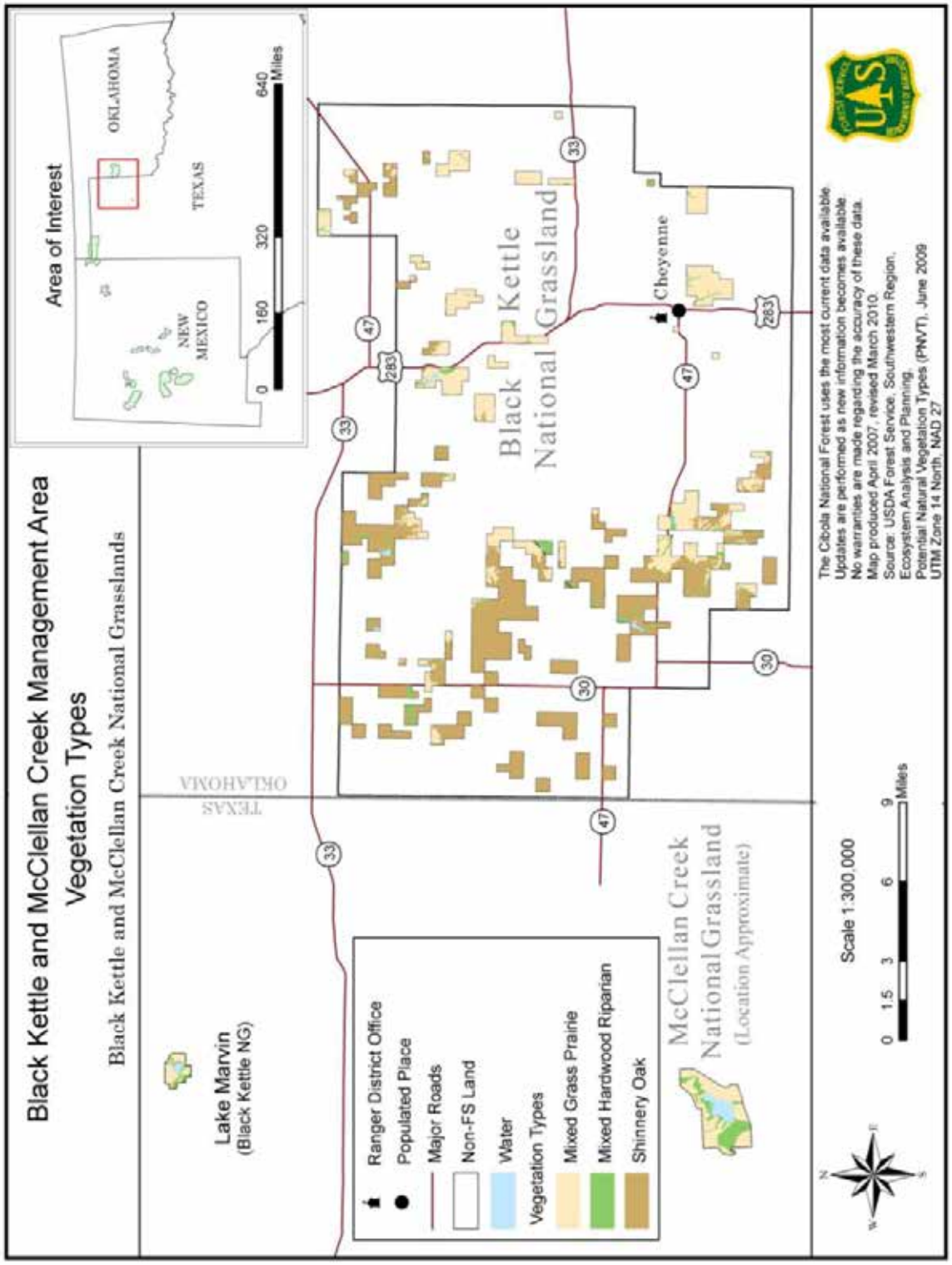
Mills Canyon Gas and Oil Surface Occupancy Restrictions

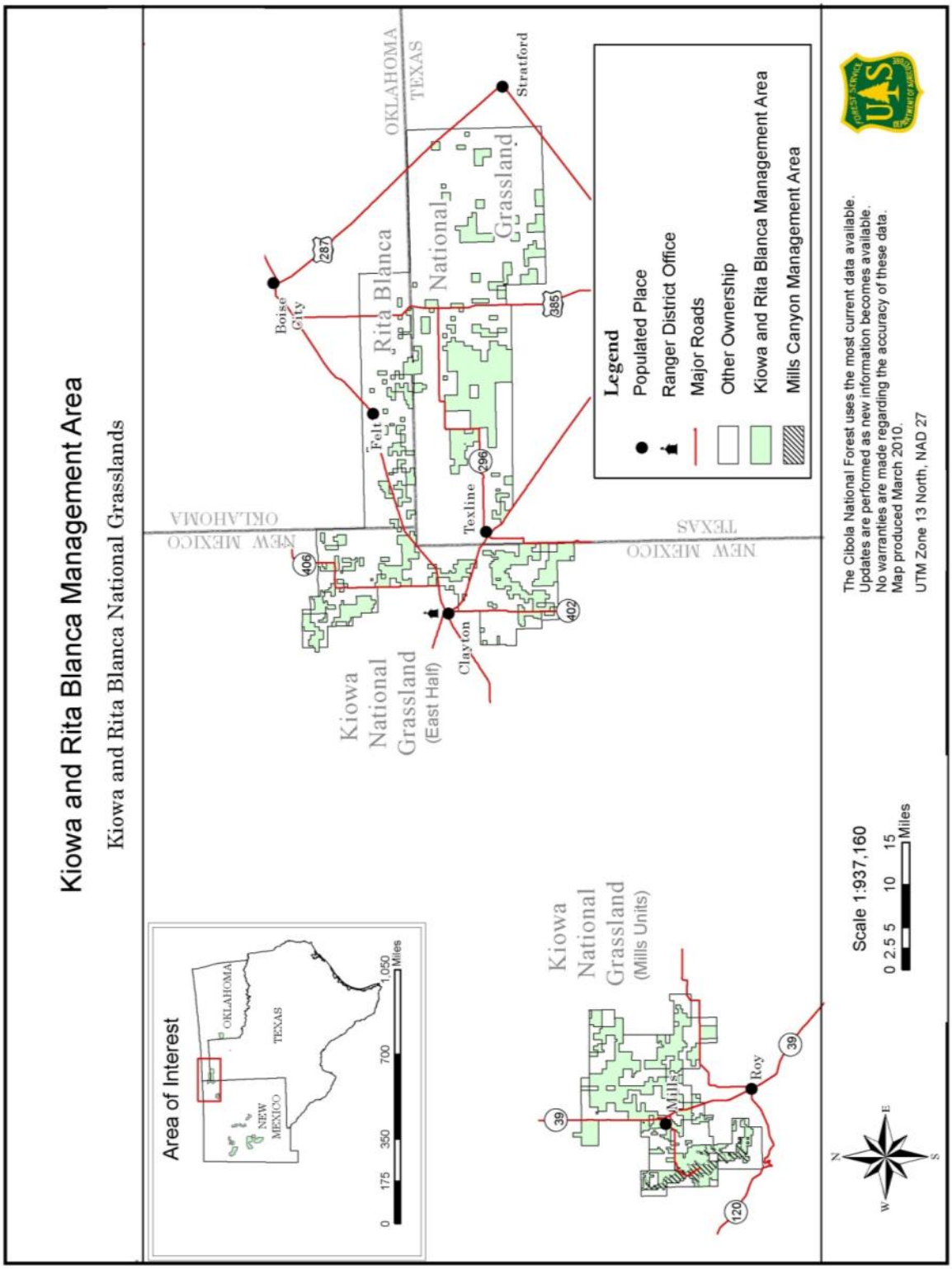

National Grasslands Administered by Cibola National Forest
Vicinity Map
Legend
Roads
Interstate
U.S. Highway
State Highway
Ranger District Office
Populated Place
State Boundary
County Boundary
National Grassland
Miles
0
20
40
80
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced August 2007, revised December 2009
Rita Blanca National Grassland
Kiowa National Grassland
Black Kettle National Grassland
McClellan Creek National Grassland
OKLAHOMA
TEXAS
NEW MEXICO
Boise City
Clayton
Dalhart
Stratford
Spearman
Canadian
Cheyenne
Roger Mills
Pampa
Amarillo
Sayre
Tucumcari
Roy
Woods
Harper
Woodward
Ellis
Beaver
Lipscomb
Ochiltree
Hemphill
Roberts
Wheeler
Collingsworth
Hansford
Hutchinson
Carson
Donley
Armstrong
Texas
Sherman
Moore
Potter
Randall
Cimarron
Dallam
Hartley
Oldham
Deaf Smith
Union
Harding
San Miguel
Quay
Guadalupe
Colfax
Mora

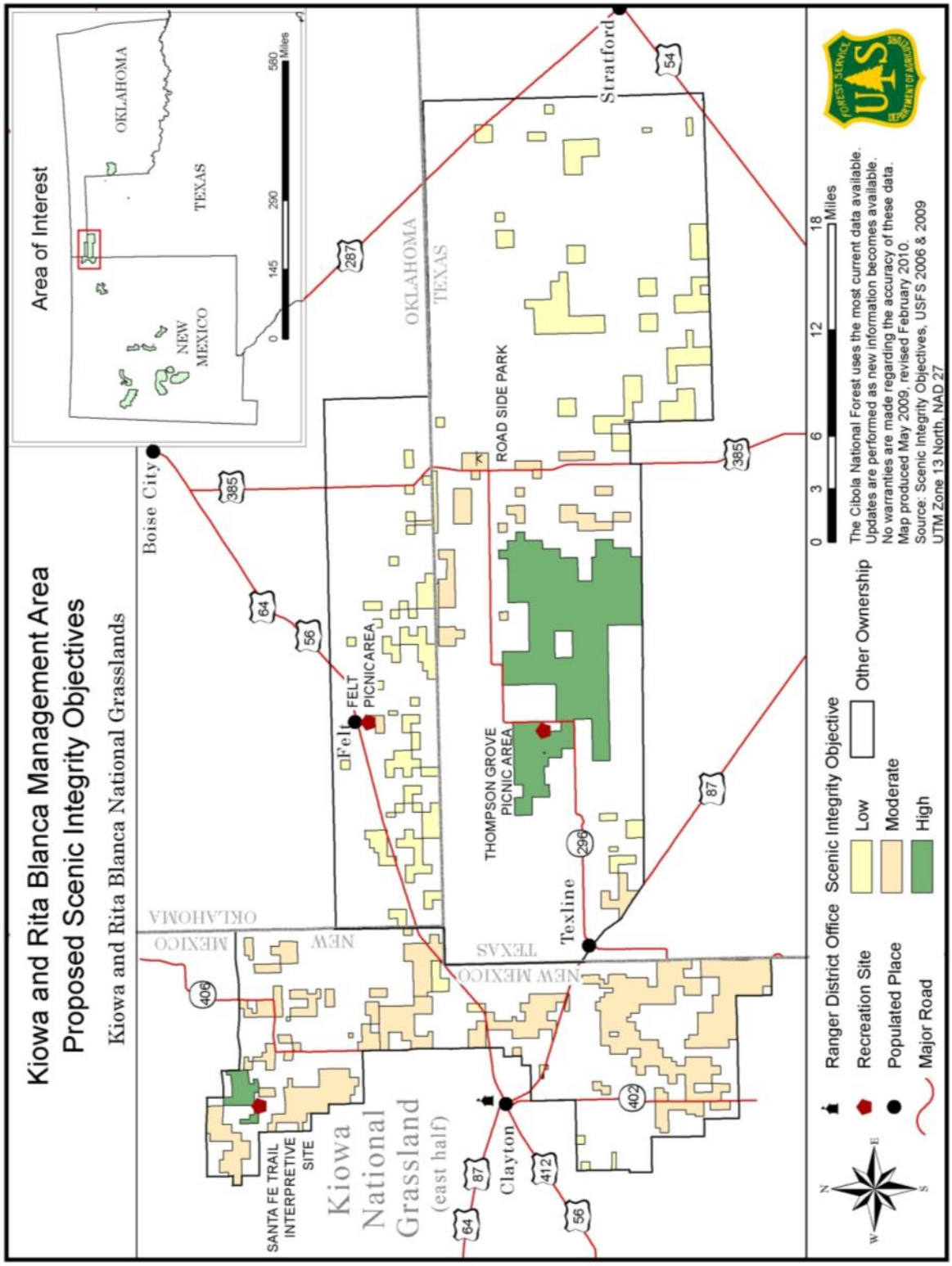

Black Kettle and McClellan Creek Management Area
Black Kettle and McClellan Creek National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0
170
340
680
Miles
Lake Marvin
(Black Kettle NG)
TEXAS
OKLAHOMA
Black Kettle National Grassland
Cheyenne
McClellan Creek National Grassland
(Location Approximate)
33
47
283
30
Legend
Ranger District Office
Populated Place
Major Road
Surface Ownership
Other Ownership
NF System Lands
Scale 1:300,000
0
2.5
5
10
15
Miles
N
S
E
W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced August 2006, revised December 2009.
UTM Zone 14 North, NAD 27

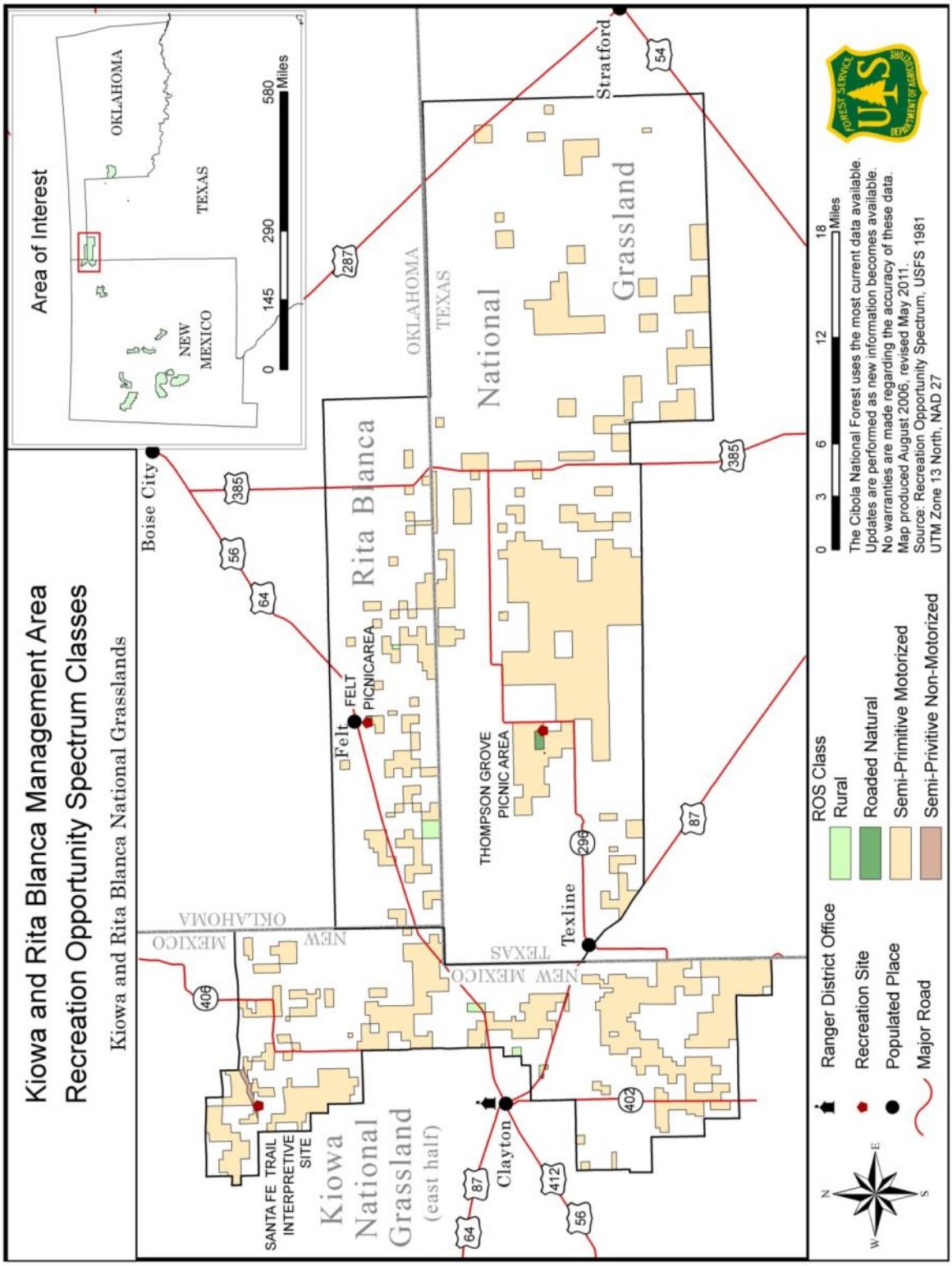

Black Kettle and McClellan Creek Management Area
Proposed Scenic Integrity Objectives
Black Kettle and McClellan Creek National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 145 290 580 Miles
Lake Marvin
(Black Kettle NG)
LAKE MARVIN
Black Kettle National Grassland
McClellan Creek National Grassland
(Location Approximate)
MC CLELLAN CREEK
BLACK KETTLE RECREATION AREA
SPRING CREEK RECREATION AREA
SKIPOUT RECREATION AREA
CROTON CREEK WILDLIFE VIEWING AREA
Cheyenne
CHEYENNE NATURE WALK
33
47
283
30
Scenic Integrity Objective
Moderate
High
Other Ownership
State Boundary
Major Road
Populated Place
Recreation Site
Ranger District Office
Scale 1:289,028
0 2.5 5 10 15 Miles
N
S
E
W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced May 2009, revised February 2010.
Source: Proposed Scenic Integrity Objectives, USFS 2006 & 2009
UTM Zone 14 North, NAD 27

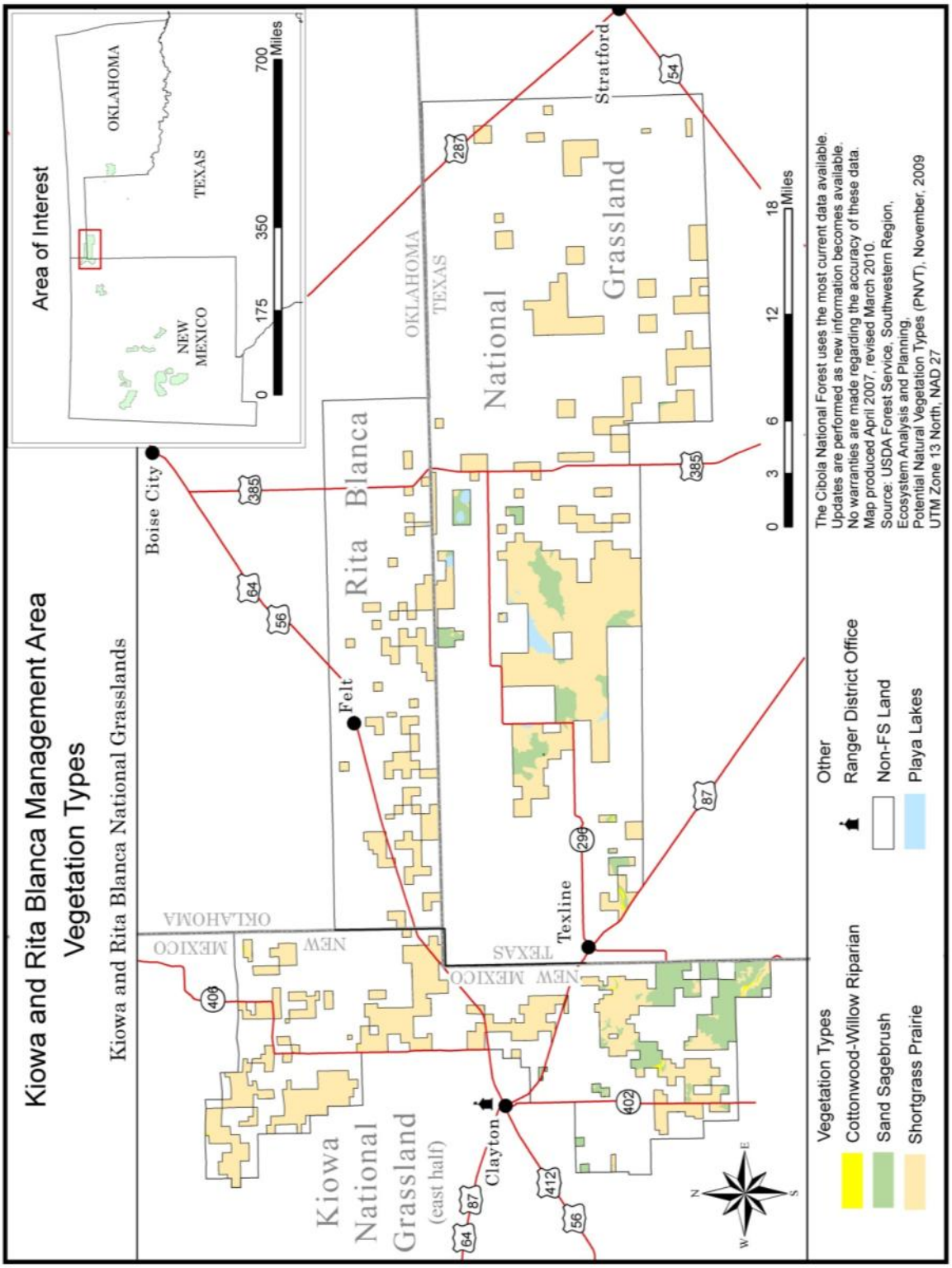

Black Kettle and McClellan Creek Management Area
Recreation Opportunity Spectrum Classes
Black Kettle and McClellan Creek National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0
180
360
720
Miles
Lake Marvin
(Black Kettle NG)
LAKE MARVIN
Legend
Populated Place
Ranger District Office
Recreation Site
Major Road
ROS Class
Roaded Natural
Semi-Primitive Motorized
Rural
MCCLELLAN CREEK
McClellan Creek
National Grassland
(Location Approximate)
Black Kettle
National Grassland
BLACK KETTLE RECREATION AREA
SPRING CREEK RECREATION AREA
CROTON CREEK WILDLIFE VIEWING AREA
SKIPOUT RECREATION AREA
Cheyenne
CHEYENNE NATURE WALK
33
47
283
30
Scale 1:288,829
0
2.5
5
10
15
Miles
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced August 2006, revised May 2011.
Source: Recreation Opportunity Spectrum, USFS 1981
UTM Zone 14 North, NAD 27

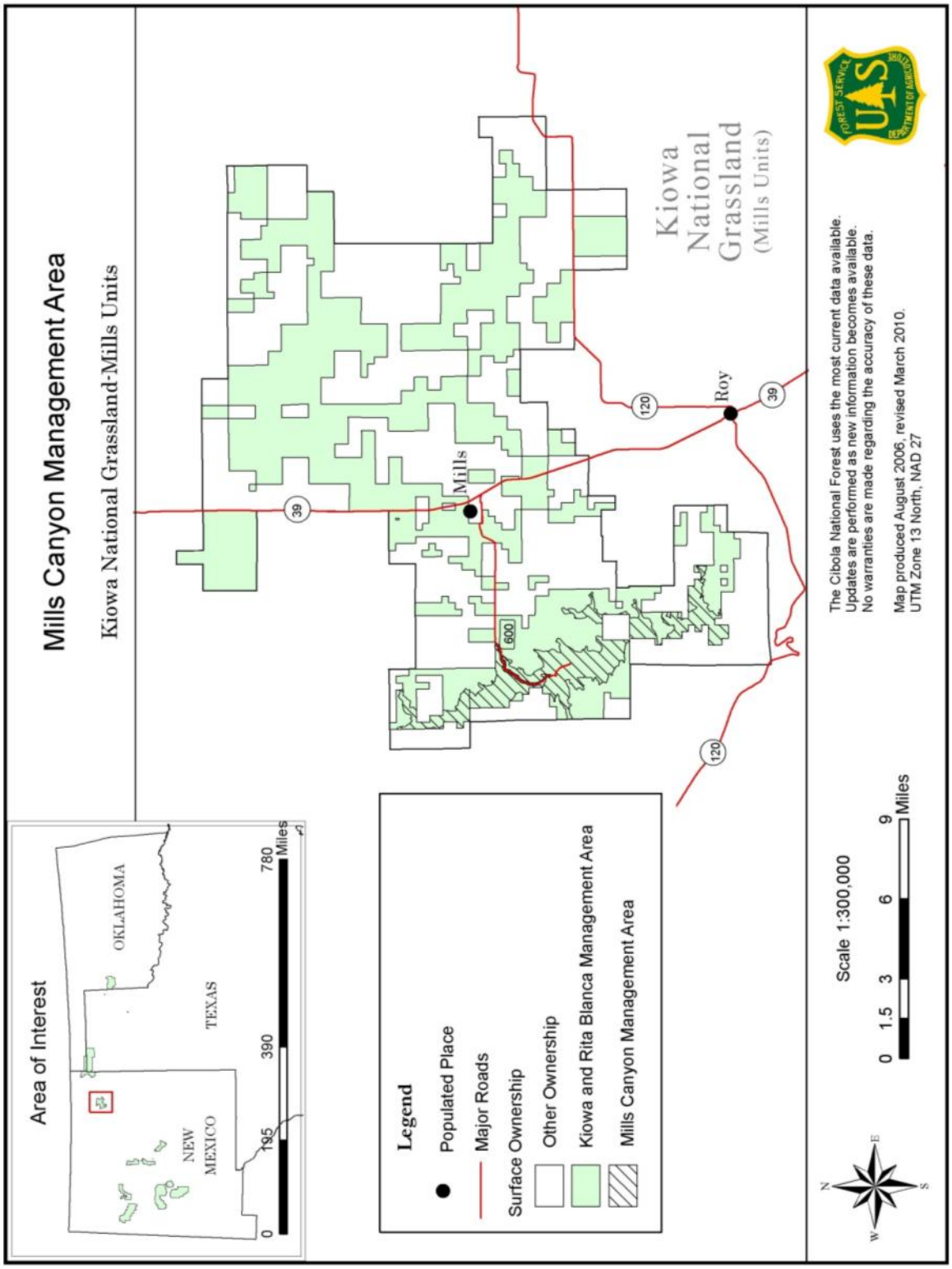

Black Kettle and McClellan Creek Management Area
Vegetation Types
Black Kettle and McClellan Creek National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0
160
320
640
Miles
Black Kettle National Grassland
Cheyenne
Lake Marvin
(Black Kettle NG)
McClellan Creek National Grassland
(Location Approximate)
TEXAS
OKLAHOMA
Ranger District Office
Populated Place
Major Roads
Non-FS Land
Water
Vegetation Types
Mixed Grass Prairie
Mixed Hardwood Riparian
Shinnery Oak
Scale 1:300,000
0 1.5 3 6 9
Miles
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced April 2007, revised March 2010.
Source: USDA Forest Service, Southwestern Region,
Ecosystem Analysis and Planning.
Potential Natural Vegetation Types (PNVT), June 2009
UTM Zone 14 North, NAD 27

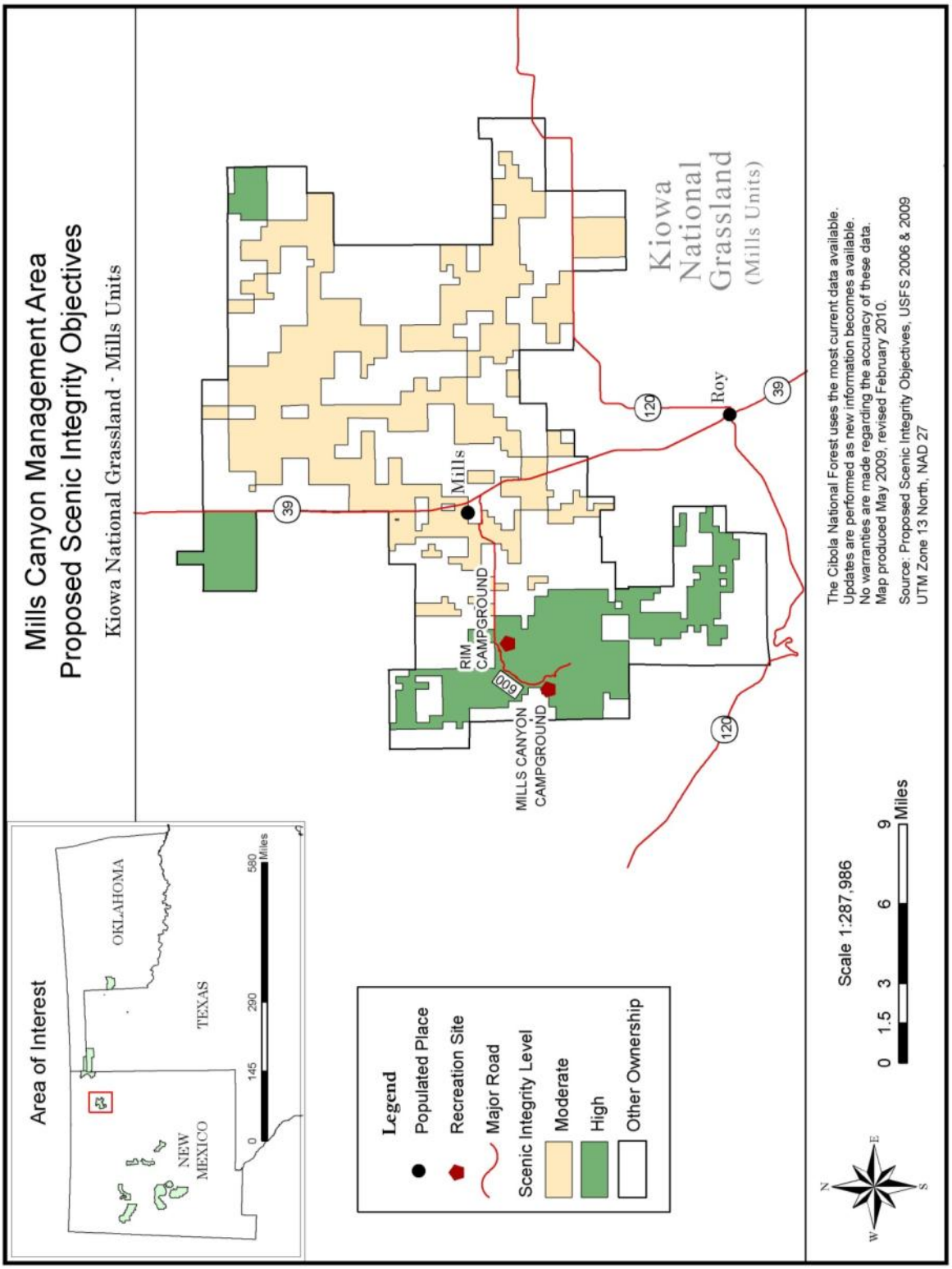

Kiowa and Rita Blanca Management Area
Kiowa and Rita Blanca National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 175 350 700 1,050 Miles
Kiowa National Grassland (East Half)
Rita Blanca National Grassland
Kiowa National Grassland (Mills Units)
Boise City
Felt
Texline
Clayton
Stratford
Mills
Roy
287
385
296
406
402
39
120
Legend
Populated Place
Ranger District Office
Major Roads
Other Ownership
Kiowa and Rita Blanca Management Area
Mills Canyon Management Area
Scale 1:937,160
0 2.5 5 10 15 Miles
N
S
E
W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced March 2010.
UTM Zone 13 North, NAD 27

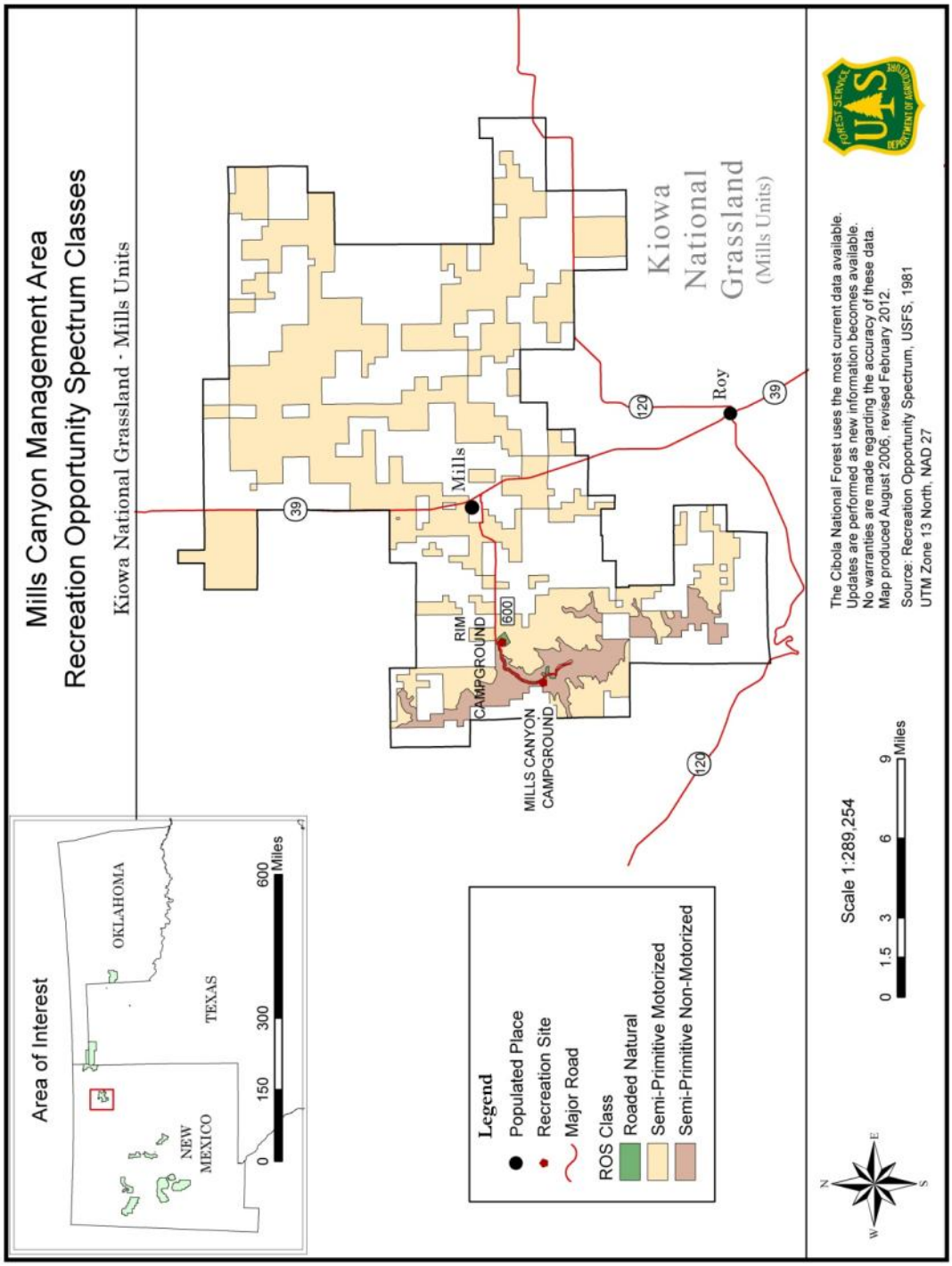

Kiowa and Rita Blanca Management Area
Proposed Scenic Integrity Objectives
Kiowa and Rita Blanca National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 145 290 580 Miles
Boise City
Stratford
Texline
Clayton
Kiowa National Grassland (east half)
ROAD SIDE PARK
FELT PICNIC AREA
THOMPSON GROVE PICNIC AREA
SANTA FE TRAIL INTERPRETIVE SITE
385
64
56
287
54
87
296
406
402
412
Ranger District Office
Recreation Site
Populated Place
Major Road
Scenic Integrity Objective
Low
Moderate
High
Other Ownership
0 3 6 12 18 Miles
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced May 2009, revised February 2010.
Source: Scenic Integrity Objectives, USFS 2006 & 2009
UTM Zone 13 North, NAD 27

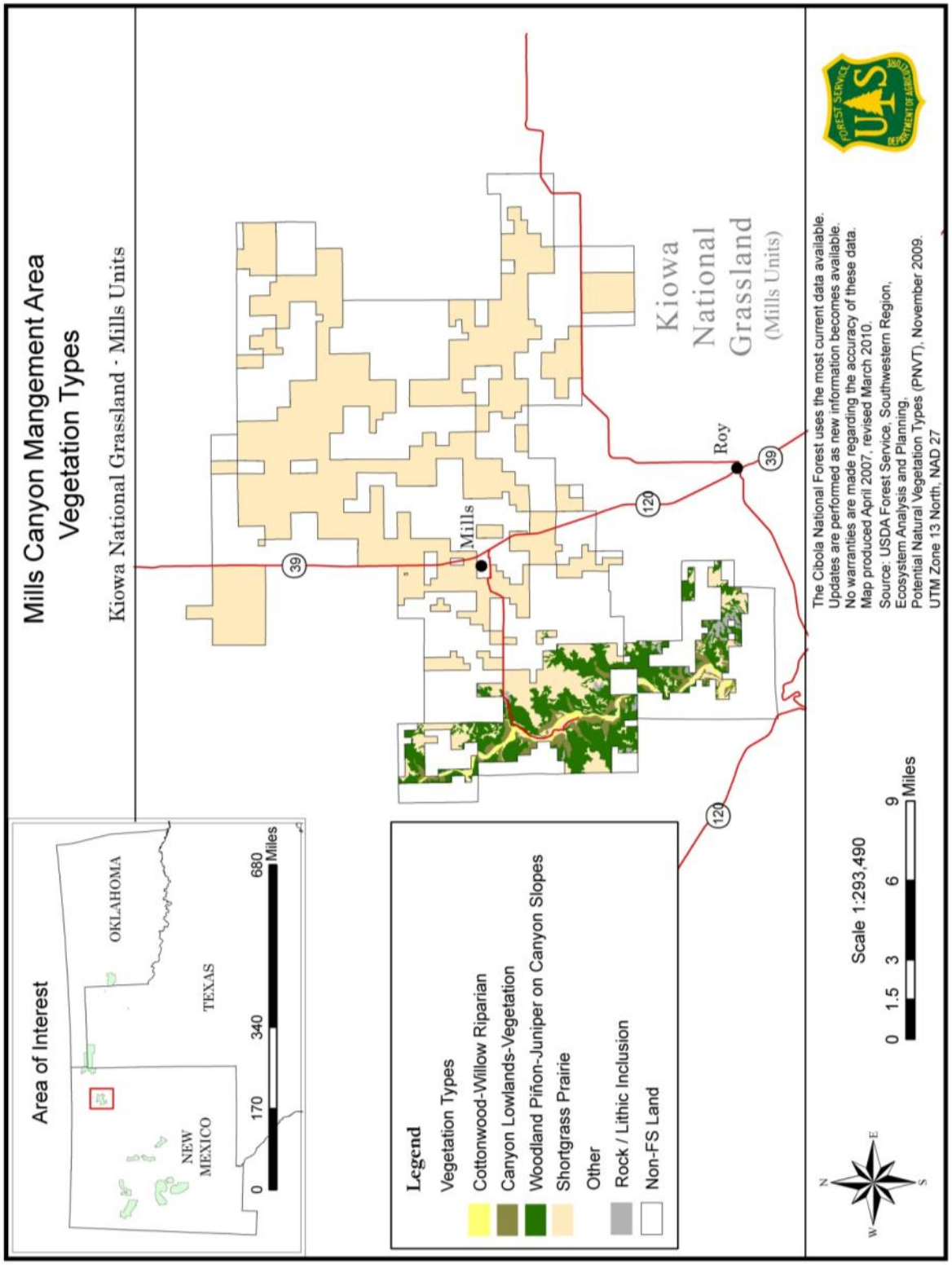

Kiowa and Rita Blanca Management Area
Recreation Opportunity Spectrum Classes
Kiowa and Rita Blanca National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 145 290 580 Miles
Boise City
Stratford
Felt
FELT PICNICAREA
THOMPSON GROVE PICNIC AREA
Texline
Clayton
SANTA FE TRAIL INTERPRETIVE SITE
Kiowa National Grassland (east half)
Rita Blanca National Grassland
OKLAHOMA
TEXAS
NEW MEXICO
385
56
64
287
54
406
87
296
402
412
ROS Class
Rural
Roaded Natural
Semi-Primitive Motorized
Semi-Privitive Non-Motorized
Ranger District Office
Recreation Site
Populated Place
Major Road
0 3 6 12 18 Miles
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced August 2006, revised May 2011.
Source: Recreation Opportunity Spectrum, USFS 1981
UTM Zone 13 North, NAD 27

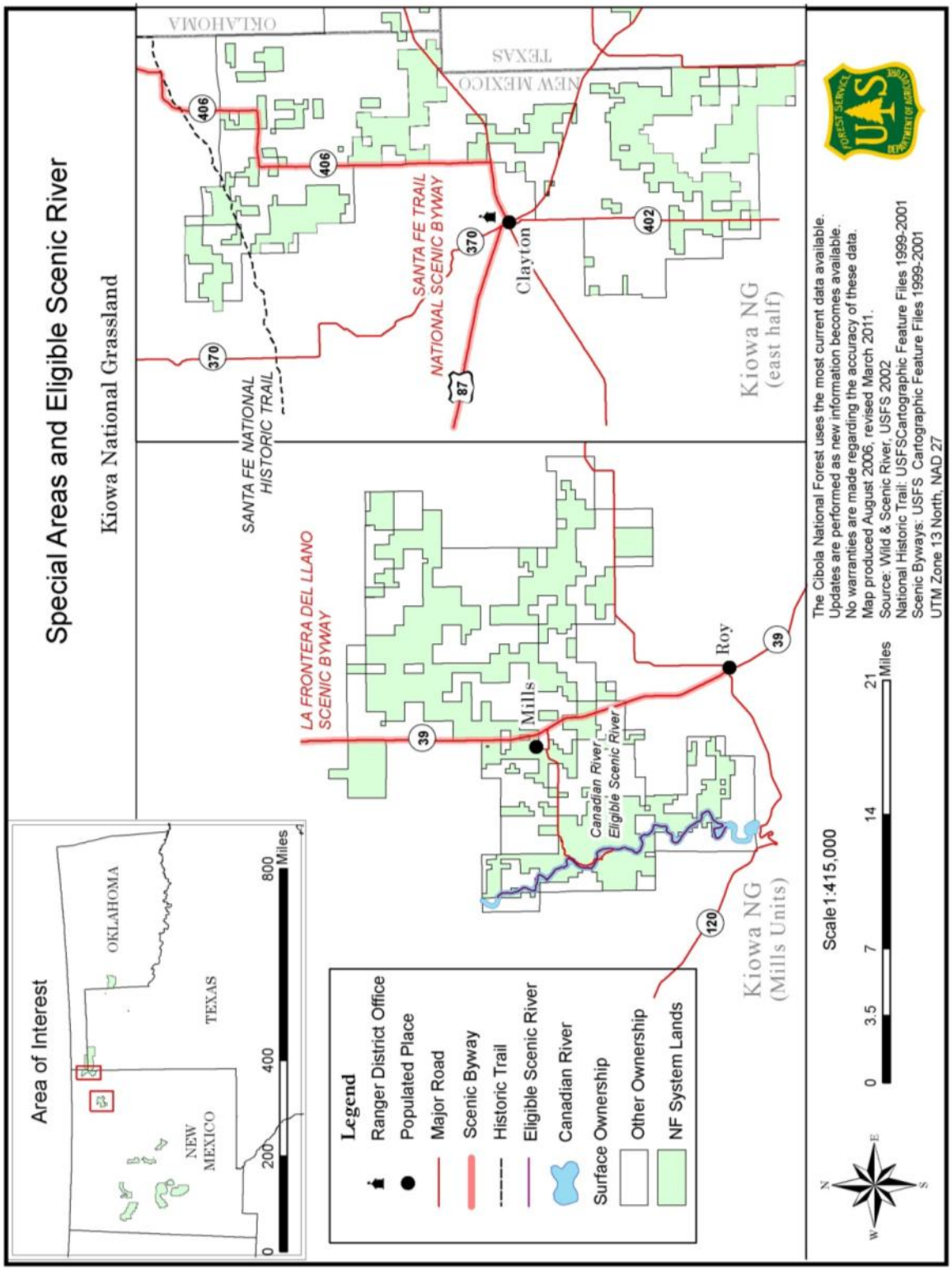

Kiowa and Rita Blanca Management Area
Vegetation Types
Kiowa and Rita Blanca National Grasslands
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0
175
350
700
Miles
Boise City
Felt
Texline
Clayton
Stratford
Rita Blanca
National Grassland
Kiowa National Grassland (east half)
OKLAHOMA
TEXAS
NEW MEXICO
385
64
56
287
54
87
296
402
412
408
64
87
56
0
3
6
12
18
Miles
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced April 2007, revised March 2010.
Source: USDA Forest Service, Southwestern Region,
Ecosystem Analysis and Planning,
Potential Natural Vegetation Types (PNVT), November, 2009
UTM Zone 13 North, NAD 27
Vegetation Types
Cottonwood-Willow Riparian
Sand Sagebrush
Shortgrass Prairie
Other
Ranger District Office
Non-FS Land
Playa Lakes
N
E
S
W

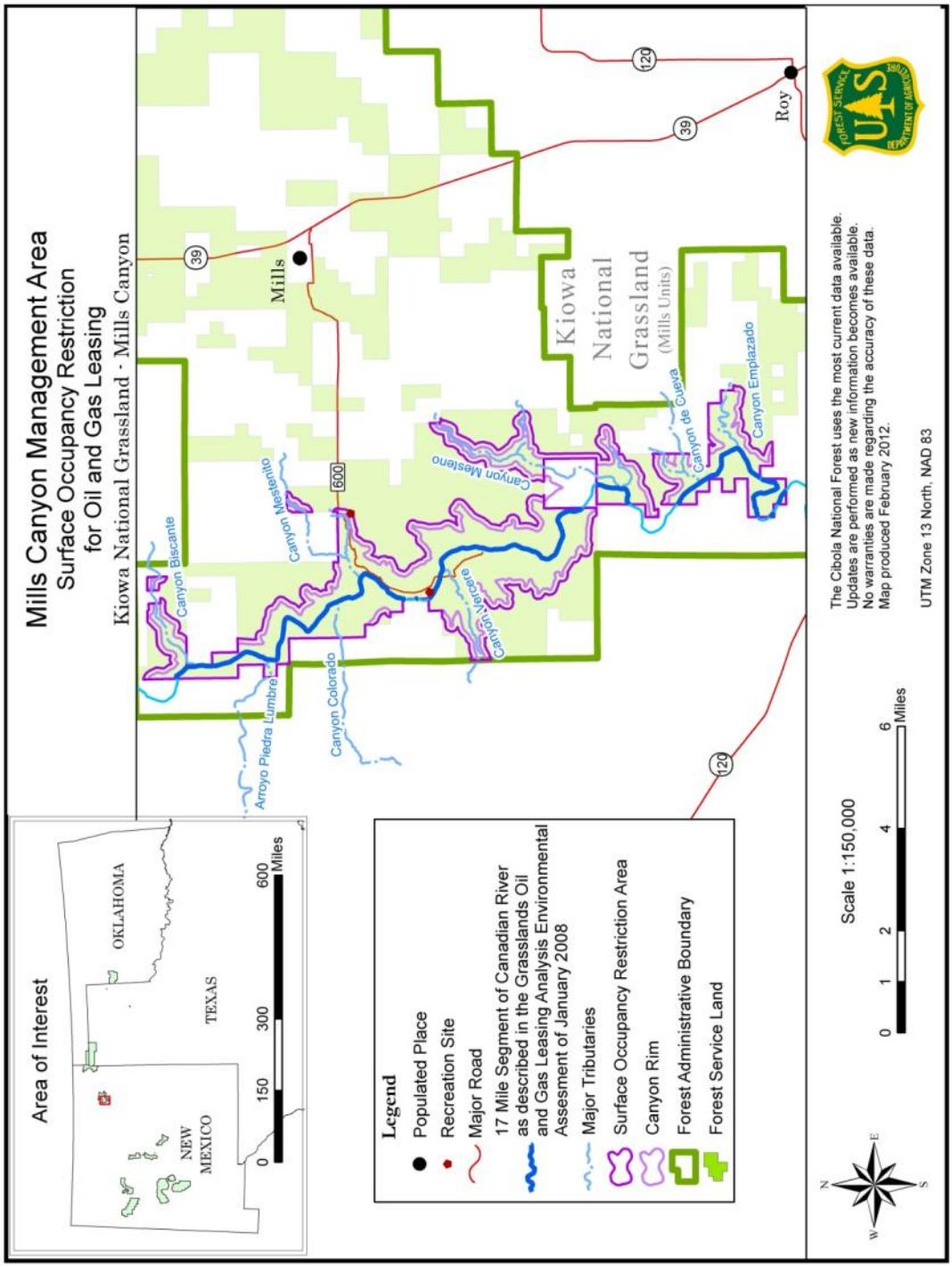

Mills Canyon Management Area
Kiowa National Grassland-Mills Units
Kiowa National Grassland (Mills Units)
Mills
Roy
39
120
600
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0
195
390
780
Miles
Legend
Populated Place
Major Roads
Surface Ownership
Other Ownership
Kiowa and Rita Blanca Management Area
Mills Canyon Management Area
Scale 1:300,000
0 1.5 3 6 9
Miles
N
E
S
W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced August 2006, revised March 2010.
UTM Zone 13 North, NAD 27


Mills Canyon Management Area
Proposed Scenic Integrity Objectives
Kiowa National Grassland - Mills Units
Kiowa National Grassland (Mills Units)
Mills
Roy
RIM CAMPGROUND
MILLS CANYON CAMPGROUND
39
120
009
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 145 290 580 Miles
Legend
Populated Place
Recreation Site
Major Road
Scenic Integrity Level
Moderate
High
Other Ownership
Scale 1:287,986
0 1.5 3 6 9 Miles
N E S W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced May 2009, revised February 2010.
Source: Proposed Scenic Integrity Objectives, USFS 2006 & 2009
UTM Zone 13 North, NAD 27


Mills Canyon Management Area
Recreation Opportunity Spectrum Classes
Kiowa National Grassland - Mills Units
Kiowa National Grassland (Mills Units)
Mills
Roy
39
120
RIM CAMPGROUND
600
MILLS CANYON CAMPGROUND
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 150 300 600 Miles
Legend
Populated Place
Recreation Site
Major Road
ROS Class
Roaded Natural
Semi-Primitive Motorized
Semi-Primitive Non-Motorized
Scale 1:289,254
0 1.5 3 6 9 Miles
N
E
S
W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced August 2006, revised February 2012.
Source: Recreation Opportunity Spectrum, USFS, 1981
UTM Zone 13 North, NAD 27


Mills Canyon Mangement Area
Vegetation Types
Kiowa National Grassland - Mills Units
Kiowa National Grassland (Mills Units)
Mills
Roy
39
120
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 170 340 680 Miles
Legend
Vegetation Types
Cottonwood-Willow Riparian
Canyon Lowlands-Vegetation
Woodland Piñon-Juniper on Canyon Slopes
Shortgrass Prairie
Other
Rock / Lithic Inclusion
Non-FS Land
Scale 1:293,490
0 1.5 3 6 9 Miles
N E S W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced April 2007, revised March 2010.
Source: USDA Forest Service, Southwestern Region,
Ecosystem Analysis and Planning,
Potential Natural Vegetation Types (PNVT), November 2009.
UTM Zone 13 North, NAD 27


Special Areas and Eligible Scenic River
Kiowa National Grassland
OKLAHOMA
TEXAS
NEW MEXICO
406
370
SANTA FE NATIONAL HISTORIC TRAIL
SANTA FE TRAIL NATIONAL SCENIC BYWAY
87
Clayton
402
Kiowa NG (east half)
LA FRONTERA DEL LLANO SCENIC BYWAY
39
Mills
Canadian River Eligible Scenic River
Roy
120
Kiowa NG (Mills Units)
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 200 400 800 Miles
Legend
Ranger District Office
Populated Place
Major Road
Scenic Byway
Historic Trail
Eligible Scenic River
Canadian River
Surface Ownership
Other Ownership
NF System Lands
Scale1:415,000
0 3.5 7 14 21 Miles
N E S W
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced August 2006, revised March 2011.
Source: Wild & Scenic River, USFS 2002
National Historic Trail: USFSCartographic Feature Files 1999-2001
Scenic Byways. USFS Cartographic Feature Files 1999-2001
UTM Zone 13 North, NAD 27


Mills Canyon Management Area
Surface Occupancy Restriction
for Oil and Gas Leasing
Kiowa National Grassland - Mills Canyon
Kiowa National Grassland (Mills Units)
Mills
Roy
Canyon Biscante
Canyon Mestenito
Canyon Colorado
Arroyo Piedra Lumbre
Canyon Mestena
Canyon Venadero
Canyon de Cueva
Canyon Emplazado
Area of Interest
OKLAHOMA
TEXAS
NEW MEXICO
0 150 300 600 Miles
Legend
Populated Place
Recreation Site
Major Road
17 Mile Segment of Canadian River as described in the Grasslands Oil and Gas Leasing Analysis Environmental Assesment of January 2008
Major Tributaries
Surface Occupancy Restriction Area
Canyon Rim
Forest Administrative Boundary
Forest Service Land
Scale 1:150,000
0 1 2 4 6 Miles
The Cibola National Forest uses the most current data available.
Updates are performed as new information becomes available.
No warranties are made regarding the accuracy of these data.
Map produced February 2012.
UTM Zone 13 North, NAD 83
N
E
S
W

B: Southwestern Region Climate Change Trends and Potential Climate Change Strategies for Southwestern Region National Forests

Overview and Background

This section contains a description of the climate patterns and trends in the southwestern United States followed by descriptions of how current climate models and predictions may generally affect those climate patterns in the near future. Then, a short forest plan revision oriented synthesis of climate change literature is provided. 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 Southwestern Region forests and grasslands are 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 characterization of limitations and uncertainties inherent in projected future climate scenarios. Finally, this document discusses possible management issues that should be considered during forest plan revision.

A broad variety of sources was reviewed in this summary. Numerous national and regional synthesis documents, including those compiled by the U.S. Climate Change Science Program, were utilized. Review included, for example, the Synthesis and Assessment Products (SAP) 4.3—"The Effects of Climate on Agriculture, Land Resources, Water Resources, and Biodiversity" (CCSP 2008a), and SAP 4.4—"Preliminary Review of Adaptive Options for Climate-Sensitive Ecosystems and Resources" (CCSP 2008b). Other large syntheses reviewed included the U.S. Global Change Research Program (USGCRP) report, "Global Climate Change Impacts in the United States" 2009 (Karl et al. 2009), "Climate Change 2007: The Physical Basis" (IPCC 2007), and USGCRP report, "Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change-Southwest 2000" (Sprigg et al. 2000). In addition, a number of regional Internet resources were utilized, including: Climate Assessment for the Southwest (CLIMAS), The Southwest Climate Change Network, The Western Regional Climate Center, the Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT), The Nature Conservancy Climate Wizard tool, and the U.S. Forest Service Climate Change Resource Center (Web pages provided in the "References Cited" section). State and local government climate change resources were also reviewed. Finally, peer reviewed climate change literature, at more regional and localized scales were reviewed to include up-to-date climate modeling and a better understanding of possible impacts on specific resources. All of the sources used are based on peer reviewed documents, or on synthesis documents which were themselves based on an extensive peer reviewed literature.

Climate in the American Southwest

What is Climate?

Climate may be defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period ranging from months to thousands or millions of years. The classical 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. In contrast, weather describes the daily conditions (individual storms) or conditions over several days (a week of record-breaking temperatures), to those lasting less than 2 weeks[1]. Natural climate variability refers to variations due to natural internal processes in the climate system or natural external forcing, in the mean state and other statistics of the 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, land use change, animal husbandry, and fertilized and irrigated agriculture lead to increases in greenhouse gases (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 as a result of human activities since 1750, and now far exceed preindustrial values (IPCC 2007).

Southwest Climate Influences

While many factors influence climate in the Southwest during a particular year or season, predictable patterns hold across the years and decades to define the region's climate.

- The overall aridity relates to a global circulation pattern known as Hadley circulation, which creates a semipermanent 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.

The climate of the southwestern United States 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, while from fall to spring, the weather can be

[1] 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).

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 (Sheppard et al. 2002).

To a large degree, a quasi-permanent subtropical high pressure ridge over the region 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[2]. 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), which 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, has a well-developed teleconnection[3] 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 Northern Pacific Ocean. The major feature that sets climate of the Southwest apart from the rest of the United States 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 (Sheppard et al. 2002).

Future Climate of the Southwest

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 the 21st century (IPCC 2007; Seager et al. 2007). While the ensemble[4] scenario used by Seager et al. 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

[2] Hadley circulation is a circulation pattern that dominates the tropical atmosphere, with rising motion near the equator, poleward flow 10-15 kilometers above the surface, descending motion in the subtropics, and equator-ward flow near the surface. This circulation is intimately related to the trade winds, tropical rainbelts, subtropical deserts, and jet streams.

[3] 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.

[4] Multimodel 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).

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 within a timeframe of years to decades. According to recent multimodel ensemble scenarios, the slight warming trend observed in the last 100 years in the Southwest may continue into the next century, with the greatest warming to occur during winter. These climate models depict temperatures rising approximately 5 to 8 degrees Fahrenheit by the end of the century (IPCC 2007). 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). Southern areas of the Great Plains (i.e., Kiowa, Rita Blanca and Black Kettle National Grasslands) are projected to experience increased temperatures, similar to the Southwest (Karl et al. 2009).

The number of extremely hot days is also projected to rise during the first 100 years of the 21st century. By the end of the century, parts of the Southwest are projected to face summer heat waves lasting 2 weeks longer than those occurring in recent decades. Some climate model downscaling results also suggest a fivefold increase in unusually hot days by the end of the century, compared to 1961–1985. 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 (IPCC 2007).

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 and 1.8 degrees Fahrenheit in New Mexico. 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 northern hemisphere (Trouet et al. 2009; Hughes and Diaz 2008; Herweijer et al. 2007; Meko et al. 2007).

Climate Change

Based on multimodel ensemble climate models, by the end of the century, the Southwest is likely to experience:

- Temperatures increases of 5 to 8 degrees Fahrenheit.
- An increase in the number of extremely hot days, with summer heat waves lasting 2 weeks or longer.
- Warmer winters and reduced snowpack, and a later monsoonal season.
- A 5 percent drop in precipitation in most of Arizona and New Mexico; possible 10 percent drop in southern Arizona.
- An increase in extreme flood events following an overall increase in tropical storms.

Warmer winter temperatures in the Southwest have serious implications for snow cover, an important natural reservoir of water in the West. Shorter winters and less snowpack also affect the timing of natural cycles such as plant blooming and peak riverflows. 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 complex in the Southwest, due to added complexities such as topography and monsoonal timing. When comparing climate model simulations of climate 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, precipitation is projected to drop by 5 percent by 2100 for much of Arizona and New Mexico, based on modeling results from an ensemble of 18 general circulation models. A 10 percent decline could be in store for the southern half of Arizona, while northeastern New Mexico is projected to remain roughly stable, based on these estimates. 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). Southern areas of the Great Plains (i.e., Kiowa, Rita Blanca, and Black Kettle National Grasslands) are projected to experience decreased precipitation, similar to the Southwest (Arizona and New Mexico) (Karl et al. 2009).

In another study, researchers using a multimodel ensemble of 19 models, projected an increase in aridity for the American Southwest. Their study defined the Southwest as the land area stretching from east to west, from Houston to San Francisco and north-south from Denver to Monterrey, Mexico. Only 2 of the 19 climate models evaluated suggested a potential decrease in aridity for the southwestern quadrant of the country (Seager et al. 2007).

Snowpack measurements suggest that rising temperatures are melting winter snow progressively earlier in the year, and causing 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

Climate Modeling is a Developing Science

- Newer multimodel ensembles are “better than the sum of their parts,” and are used increasingly for projecting climate change in the Southwest.
- Downscaling techniques, including statistical downscaling, dynamical downscaling, and sensitivity analysis, are improving.
- Regional modeling, which incorporates jet stream activity, tropical storm and monsoon tracking, and regional elevation effects, has a high potential to improve localized climate projections.
- As yet, there are no reliable climate models at the forest scale.

spikes in river flows occur when the reservoirs are at full capacity, increasing the probability of flash floods (Guido 2008).

Average air temperatures are rising, and 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).

While the region is expected to dry out, it is likely to see larger, more destructive flooding. Along with storms in general, hurricanes and other tropical cyclones are projected to become more intense overall. Arizona and New Mexico typically receive 10 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 empower a remnant tropical storm (Guido 2008).

Discussion

The state of knowledge needed to address climate change at the national forest scale is still evolving. Because none of the current climate models, including multimodel ensembles, adequately resolves important topographic variations (mountain ranges) and phenomena such as ENSO (El Niño) 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. Most global climate models are not yet precise enough to apply to land management at the ecoregional or national forest scale. This limits regional and forest-specific analysis of potential effects from climate change. Additionally, industrial society during the past 200 years has likely placed unprecedented pressures on ecosystems, increasing the unpredictable quality of future environmental change (Millar et al. 2007).

Improvement in regional-level models has increased with refinement of global climate modeling techniques. As climate model resolution increased to about 4,000 square miles per grid square, regional models may eventually be considered reliable at resolutions of about 350 square miles, which is nearly double the area of Albuquerque (Lenart 2008). These model improvements also may provide researchers the information they need to downscale results to the local level of national forest. Research efforts in this area have been successful in capturing fine-scale details of historical climate, suggesting that regional methods can add value for assessments of the impacts of climate change projections (Maurer and Hidalgo 2008). Researchers at The Nature Conservancy are currently downscaling multimodel ensemble climate projections to spatial resolutions between 1 and 12km (Enquist and Gori 2008). In another effort, scientists used statistical downscaling of multimodel ensemble to consider how the Colorado River streamflow might alter with climate (Christensen and Lettenmaier 2007).

On a more local scale, paleoenvironmental studies of the changing Southwestern climate may provide at least a limited historical ecological context for ecosystem variability and climate change. Such studies can provide a limited range of knowledge about past climate change,

strengthening or weakening El Niño or La Niña events, patterns of precipitation, drought severity, and changes in vegetation patterns (Swetnam and Betancourt 1997, Swetnam et al. 1999). A recurrent trend in the literature suggests that predicting the future effects of climate change and subsequent challenges to land management in the Southwest remains inexact, and will require a combination of approaches.

Southwestern Climate Change and Ecosystems

Water and Climate Change

Changes in water distribution, timing of precipitation, availability, storage, watershed management, and human water uses may present some of the most important challenges of climate change and national forest management in the Southwest. Terrestrial and aquatic ecosystems and all human socioeconomic systems in the Southwest depend on water. In this section, we set the stage of this review of climate change by briefly discussing water in the Southwest, its overall importance to ecological and socioeconomic systems, and the possible impacts to this resource by potential changes in climate.

The prospect of future droughts becoming more severe because of global warming is a significant concern, especially because the Southwest continues to lead the Nation in population growth. Recent warming in some areas of the Southwest is occurring at a rate that is among the most rapid in the Nation (Seager et al. 2007), significantly higher than the global average in some areas. This is driving declines in spring snowpack and Colorado River flow. Further water cycle changes are projected which, when combined with increasing temperatures, signal a serious water supply challenge in the decades and centuries ahead. Water supplies are projected to become increasingly scarce, demanding tradeoffs 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. 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 2000 years (Seager et al. 2008). During the closing decades of the 1500s, for example, major droughts gripped areas of the Southwest. As of 2009, much of the Southwest remains in a drought that began about 1999. This event is the most severe western drought of the last 110 years, and is being exacerbated by record warming. Projections for this century point to an increasing probability of drought for the region, made more probable by warming temperatures. The most likely future for the Southwest is a substantially drier one. 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).

Development in the Southwest has been primarily dependent upon technology to deliver the water resource. In the Forest Service's Southwestern Region, 13 municipal watersheds in New Mexico and 19 municipal watersheds in Arizona are located on national forest administered lands. Additionally, 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 riverflow, 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 user of water in the Southwest, there has been a decreased 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 ongoing trend and could affect future agricultural uses. Without upland reservoirs and watersheds, often managed by the Forest Service, alternative water sources, water delivery systems, and infrastructure support for agriculture would need to be developed (Lenart 2007).

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). In a drought of the magnitude of the worst 1-year drought on record, water demand may exceed supply by 68 percent. In the 5-year scenario modeled after the worst drought in the historical record, water demand in Arizona could exceed supply by 67 percent, and in the 10-year scenario, demand may exceed supply by 59 percent (Lenart 2007). In the Southwest, intense debate will likely continue over water allocation. Add to this mix a highly variable climate, over time and occurring on a large, landscape scale, and the situation becomes even more conflict prone (Lenart 2007).

In the realm of human health, a sequence of rain-drought-rain can trigger outbreaks of Hantavirus, and there is evidence linking unusually wet seasons with an increase in reported cases of valley fever. In both instances, the distribution of precipitation over time and space are important factors.

The potential for flooding is very likely to increase because of earlier and more rapid melting of the snowpack, with more intense precipitation. Even if total precipitation increases substantially, snowpack is likely to be reduced because of higher overall temperatures. However, it is possible that more precipitation would also create additional water supplies, reduce demand, and ease some of the competition among competing uses (Joyce et al. 2001; Smith, et al. 2001).

In contrast, 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). Overall, these trends would increase pressures on the already limited water supplies in the Southwest, as well as increase energy demand, alter fire regimes and ecosystems, create risks for human health, and affect agriculture in the region (Swetnam and Betancourt 1997, Sprigg et al. 2000).

Climate Change and Potential Ecosystem Impacts

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 changing climate of wetter, warmer winters, and overall temperature increases, 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[5], humidity, wind, and temperature will also change with potential compounding effects to vegetation (Sprigg et al. 2000).

Climate and Southwestern Ecosystems

- Projected decreases in precipitation, reduced snowpack, and overall water availability.
- Increased risk from wildfire, insects and disease, invasive species.
- Potential decrease in ecosystem productivity from water limitations and increased heat.
- Potential impacts to alpine, riparian, wetland, sky island, and aquatic habitats.

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 national forest management strategies:

- 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).
- 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).
- Species ranges and demographics are expected to be highly unstable as the climate shifts (Millar et al. 2007:30).

Climate may influence the distribution and abundance of plant and animal species through changes in resource availability, fecundity, and survivorship. The potential ecological implications of climate change trends in the Southwest indicate:

- More extreme disturbance events, including wildfires and intense rain and flash floods and wind events (Swetnam et al. 1999).
- Greater vulnerability to invasive species, including insects, plants, fungi, and vertebrates (Joyce et al 2007).
- 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 tree species to the more northern portions of their existing range (Clark 1998).

[5] 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).

- Potential decreases in overall forest productivity due to reduced precipitation (USDA Forest Service 2005).
- Shifts in the timing of snowmelt (already observed) in the American West which, along with increases in summer temperatures, have serious implications for the survival of fish species and may challenge efforts to reintroduce species into their historical range (Joyce et al. 2007, Millar et al. 2007).
- Effects on biodiversity, pressure on wildlife populations, distribution, viability, and migration patterns, because of increasing temperatures, water shortages, and changing ecological conditions.

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. Decreasing water availability will accelerate the stresses experienced in forests, which typically involve some combination of multiyear 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 and carbon sequestration. Many Southwestern ecosystems contain water limited vegetation today. Vegetation productivity in the Southwest may decrease further 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. Pinyon-juniper woodlands, a key Southwestern vegetation type, are clearly water limited systems, and pinyon-juniper ecotones are sensitive to feedbacks from environmental fluctuations and existing canopy structure that may provide trees a buffer against drought. However, severe multiyear droughts periodically cause dieback of pinyon pines, which may overwhelm local buffering. 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). 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 pinyon pine mortality and fuel accumulations are inciting factors. Ecosystem change may arise from large-scale severe fires that lead to colonization of invasive species, which further compromises the ability of pinyon pines to reestablish. There continues to be no easy way to precisely 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, such as alpine ecosystems, would virtually disappear from the region (Joyce et al. 2008).

Natural disturbances having the greatest impact on forests include: insects, diseases, introduced species, fires, droughts, inland storms caused by hurricanes, flash flooding, landslides, windstorms, and ice storms. Climate variability and changes can alter the frequency, intensity, timing, and spatial extent of these disturbances. Many potential consequences of future climate change are expected to be buffered by the resilience of forests to natural climatic variation. However, an extensive body of literature suggests that new disturbance regimes under climate change are likely to result in significant perturbations to U.S. forests, with lasting ecological and socioeconomic impacts (Joyce et al. 2001).

Wildfire

Historically, wildfires have been a recurring disturbance in conifer forests, pinyon-juniper woodlands, chaparral shrublands, and grassland ecosystems of the Southwest. An analysis of trends in wildfire and climate in the western United States from 1974 to 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, with suppression costs of more than $1 billion per year from 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. If temperatures increase, precipitation decreases, and overall drought conditions become more common, fire frequency and severity may be exacerbated. In addition, continued population growth will likely cause greater human-started fires, since humans start nearly half of the fires in the Southwest. In 2002, for example, the Rodeo-Chediski Fires in northern Arizona were both started by humans and combined to burn nearly half a million acres, becoming the largest fire on record in Arizona (Joyce et al. 2008).

Insects and Disease

Insects and pathogens are significant disturbances to forest ecosystems in the United States, costing $1.5 billion 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 more palatable to some types of insects. Fire suppression and large areas of susceptible trees, a legacy from logging in the late 1800s and early 1900s, 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 may favor the spread of invasive exotic grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas burn, they typically convert to nonnative monocultures and the native vegetation is lost (Ryan et al. 2008). The Southwest suffers from many types of invasive species outbreaks, including plants (buffelgrass, cheatgrass, saltcedar, and red brome) and animals (bullfrogs, cowbirds, quagga mussels, and crayfish). Invasive plants can alter landscapes by overtaking native species, facilitating fire outbreaks, and altering the food supply for herbivorous animals and insects. Buffelgrass was introduced to the region for cattle feed in the mid-1900s, but has since traveled from ranchlands into the desert ecosystem. Subsequently, these grasses have increased fuel loads in the Sonoran Desert, a region where native plants are not adapted to frequent fires. Buffelgrass-induced fires tend to burn faster, for longer periods, at high temperatures, and cause more plant and animal deaths than fires involving only native plants. After a fire, buffelgrass seeds sprout quickly, often within a few days, while many native desert plants, like saguaro cactus or palo verde trees, take months to years to reestablish themselves (Owen 2008).

Specific Habitats

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). Many of the region's plant and animal species are associated with these key habitats and are, therefore, important when considering the potential impacts of climate change on ecosystems managed by the national forests in the Southwest.

Alpine

Alpine habitat is very susceptible to climate change in the Southwest, given its limited extent and marginal existence. Analyses of the results of ecological models when driven by different climate scenarios indicate changes in the location and area of potential habitats for many tree species and plant communities. For example, alpine and subalpine habitats, and the variety of species dependent upon them, are likely to be greatly reduced in the conterminous U.S. Alpine ecosystems are projected to all but disappear from the western mountains and perhaps overtaken by encroaching forests (Joyce et al. 2001). Increasing temperatures and shifting precipitation patterns will drive declines in high elevation ecosystems such as alpine forests and tundra because alpine and subalpine plants are isolated on high mountains (Horikawa et al. 2009, Karl et al. 2009).

Upward shifts of plants in the alpine ecotones of mountains have been increasing in North America. Some researchers have reported the upward shifts in alpine vegetation due to climate. Assessing the vulnerability of species and locations in alpine zones to climate change is an important issue for their conservation (Horikawa et al. 2009), and for the wildlife species that depend on alpine habitats. Alpine species are at higher risk of extinction as suitable habitats rapidly disappear from mountaintops (Christensen et al. 2007). Some wildlife may be reliant upon

melting of the snowpack to set phenological[6] clocks (Inouye 2008), and the warm summer temperatures may force a reduction in daytime foraging for large herbivores, whose tolerance for heat is lower than for species adapted to warmer weather (Aublet et al. 2009).

Riparian

Riparian habitats are very important for wildlife in the national forests in the Southwestern Region; approximately 69 percent (461 species, 15 amphibian, 252 birds, 153 mammals, and 41 reptiles) of terrestrial vertebrates inhabit riparian areas at some time during the year. Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation, consequently reducing water in riparian zones. Water losses are also likely to increase due to elevated evapotranspiration rates at higher temperatures and greater runoff 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 will 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 a small fraction of arid lands, they provide critical habitat for arid land vertebrates, migratory birds, and riparian dependent species. Reduced water inputs will cause riparian ecosystems to contract in size. Furthermore, lowered water availability will stress riparian plants and increase the ecosystem susceptibility to invasion by nonnative plants, such as saltcedar and Russian olive, which in turn will disrupt the natural wildlife community (Archer and Predick 2008).

Wetlands and Playas

Climate change is likely to affect native plant and animal species by altering key habitats such as the wetland ecosystems known as prairie potholes or playa lakes (Karl et al. 2009). Playa lakes create unique microclimates that support diverse wildlife and plant communities. A playa can lie with little or no water for long periods, or have several wet/dry cycles each year. When it rains, what appeared to be only a few clumps of short, dry grasses just a few days earlier suddenly teems with frogs, toads, clam shrimp, and aquatic plants. The playas provide a perfect habitat for migrating birds to feed, mate, and raise their young (Karl et al. 2009).

Sky Islands

Mountainous “sky islands” of southeastern Arizona are made up of forested ranges separated by expanses of desert and grassland plains, and 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

[6] Phenology is the study of periodic plant and animal life cycle events, and how these are influenced by seasonal and interannual variations in climate.

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. Sky islands in the Southwest and Mexico are already being affected by climate change, with increases in drought, fire, and outbreaks of invasive insects. 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).

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 useless some efforts to reintroduce species into their historical 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 discharge 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 foraging 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. We have 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 nonnatives, add to the complexity of managing and adapting to climate change.

Plant and Animal Species

The Southwestern Region includes a high degree of biodiversity and an unusually large number of plant and animal species that are endemic (found nowhere else). The Regional Forester's Sensitive Species List identifies over 215 species, including highly endemic or restricted salamanders, shrews, and freshwater springsnails. The majority of the sensitive species are mammals (70 species) including 2 species of pika, followed by birds (41 species), snails (38 species), insects (21 species), fish (16 species), reptiles (16 species), amphibians (11 species), and clams (3 species). There are 167 plant species on the Regional Forester's Sensitive Species List, the majority of which occur only on the Coronado National Forest.

We can expect 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 phonological 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 national forests 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 feedbacks among weather, land use, land cover, hydrology, fire, and stresses from invasive 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, such as the pika (*Ochotona princeps*), with habitat in talus slopes of alpine and subalpine areas of the Santa Fe and Carson National Forests, are at great risk of being extirpated since they may not be able to adapt to habitat changes. Other species such as endemic squirrels that depend on high elevation forest habitat on the Lincoln and Coronado National Forests are also at extreme risk with potential loss of habitat.

It already appears that some species are unable to disperse or adapt fast enough to keep up with the high rates of climate change. Endemic salamanders, such as the Jemez Mountain salamander (*Plethoodon neomexicanus*) are an example of a species subject to this type of risk. 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 habitat. This may occur through a decrease in available water, changes in vegetation type through 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, 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 (Sinett 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 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 2000:335). How societies adapt to climate change is fundamentally dependent 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. As of the latest American Communities Survey (U.S. Census 2006), Arizona’s population was 6,056,817. The total increase for Arizona between 1980 and 2006 has been 123 percent. In New Mexico, the change in total population between 1980 and 2006 shows a 47 percent increase. Some counties in both states have seen population increases of between 300 and 500 percent (U.S. Census 2006, Sammis 2001, Farber et al. 2002, Gonzalez 2005). 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 United States, 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 riverflow, winter air temperature, and snowpack between 1950 and 1999 are human induced. The study predicts water shortages, lack of storage capabilities to meet seasonally changing riverflow, transfers of water from agriculture to urban uses, and other critical impacts (Barnett et al. 2008:1082). 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).

Socioeconomic Impact

- Climate impacts are exacerbated by increasing populations in the region.
- Limitations in water supplies could affect most social systems and economic sectors.
- Potential impacts to alpine, riparian, wetland, sky island, and aquatic habitats.
- Ranching, recreation, wood products, urban expansion, health, and energy may be affected by changing climate.

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. However, climate change could have long-term impacts on many of the amenities, goods, and services from forests, including productivity of locally harvested plants such as berries or ferns; local economics through land use shifts from forest to other uses; forest real estate values; and tree cover and composition in urban areas and associated benefits and costs. Agricultural, urban, and suburban areas are expanding into forest land. This expansion of human influences into the rural landscape alters disturbance 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 key economic uses occurring on Southwestern national forests. Ranching is a key agricultural, economic, and social activity throughout the rural Southwest. It is a dominant land use in both Arizona and New Mexico, and its success depends on the natural

vegetation accessible to grazing animals. Rangelands[7] not only support livestock grazing and ranching, but also provide crucial habitat for wildlife. As the majority of rangelands in the region are not irrigated, any variability in precipitation and temperature can directly affect rangeland plant production and wildlife habitat. Changes in climate may affect the vitality and productivity of rangeland plants and, thus, the overall conditions of both wildlife habitat and range conditions. It is possible that higher temperatures and decreased precipitation depicted for the next century will also decrease forage production and lengthen the growing and grazing season for ranching, while flash floods and increased risk of animal disease can adversely affect the industry (Joyce et al. 2001). Coupled with poor forage conditions, there may be a general scarcity of water for cattle. For a pasture to be available for grazing, it not only has to have sufficient nutritious vegetation, but also it must have adequate water supplies. Some ranchers rely on well water, but often ranchers use dirt tanks to capture summer monsoon rainfall and use this water for their cattle over the winter. During recent droughts, these dirt tanks dried prematurely, making many pastures useless for cattle even though forage was still available (Conley et al. 1999). Ranching is in a vulnerable position, especially when viewed against a backdrop of changing climate, economic structure, urban expansion, increasing population, fluctuating market conditions, and environmental protection measures (Sprigg et al. 2000).

Recreational Value

Climate change affects forest and range 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. Forests provide many recreational opportunities including hiking, camping, hunting, bird watching, skiing, autumn leaf tours, and water related activities such as fishing, boating, and swimming. 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. Ski areas at low elevations and in more southern parts of the region are very likely to be at particular risk from a shortening of the snow season and rising snowlines (Joyce et al. 2001). In areas of marginal annual snowpack, the inability to maintain downhill skiing may result in closure of some ski areas.

Urban and suburban expansion into forests and rangelands are 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 (Langner 2007). As temperatures increase in lowland, urban areas, recreation may increase in mountainous areas where cooler temperatures will attract people to higher elevations, with national forests possibly becoming refugia from increasingly hot summers (Irland et al. 2001).

Wood and Paper Products

Changes in climate and the consequent impacts on forests will very likely change market incentives for investment in biomass technology and in wood conservation techniques. The market for wood products in the U.S. is highly dependent on the area and species composition of forests, supplies of wood, technological change in production and use, availability of wood

[7] Rangelands are lands that support livestock grazing and ranching, and can be comprised of several different ecosystems.

substitutes, demand for wood products, and international competition. Rising atmospheric CO_2 will increase forest productivity and carbon storage in forests if sufficient water and nutrients are available. Any increased carbon storage will be primarily in live trees. However, in the Southwest, as discussed above, overall production may be limited by a decrease in available water. While increases in wildfire may decrease some available wood supply, treatment of wildland-urban interface and restoration of the fire-adapted ecosystems in Southwestern national forests may actually increase the overall availability of small diameter timber and related wood products (Joyce et al. 2001).

Multiple socioeconomic impacts often follow severe insect outbreaks. Timber production, manufacturing, and markets may not be able to take advantage of vast numbers of killed trees, and beetle-killed timber has several disadvantages from a manufacturing perspective. Perceived enhanced fire risk and views about montane aesthetics following beetle-caused mortality have an influence on public views of insect outbreaks, which could drive future public policy (Ryan et al. 2008). Wood supply will no doubt vary by forest and ecosystem (Sprigg et al. 2000, Joyce et al. 2001).

Health

Future climate scenarios will undoubtedly amplify current climatically driven human health concerns, with potential increased risk of dengue fever, 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 interannual 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 and allergens. Conversely, in many temperate areas—which includes the American Southwest—there is clear seasonal variation in mortality; death rates during the winter season are 10 to 25 percent higher than those 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 and Githeko 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).

Urban Areas

Already setting a nationwide pace for growth, urban expansion in the Southwest is expected to continue in the coming century. Growing population centers will be vulnerable to climate influenced natural hazards. Overall decreases in precipitation, but increases in severe weather events and flash floods depicted in future climate scenarios could lead to property loss, and contribute to premature decay of sewage systems, pipelines, roadways, and other urban infrastructure. Rising temperatures will add to the energy demand for cooling, intensify the urban heat island effect, and reduce air quality within the region’s urban areas (Sprigg 2000). Additionally, we need to remember that as temperature increases and large urban areas become

less hospitable, there may indeed be a slowing or reduction in the number of people moving to Southwestern cities. Until such reversals in in-migration into the Southwest become evident, population growth, increased forest use, wildland-urban interface, and higher demand for water and other resources will likely continue to place increased demand on national forests' resources.

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 national forests through the growing need for new energy corridors, wind and solar energy sites, and other special use-related requirements.

Key Climate Change Factors for Southwestern Region National Forests

Based on current projections, the primary regional-level effects of climate change most likely to occur in the Southwest include: (1) warmer temperatures, (2) decreasing precipitation, (3) decreased water availability with increased demand, (4) increased extreme disturbance events, and (5) increased use of national forests for relief from increased temperatures.

Based on current climate model projections and research, the climate change factors that appear most likely to affect Southwestern Region national forests and affect desired conditions in the revised forest plans 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, and nonnative invasive species;
- Projected increase in demand for decreasing upland water supplies; and
- Projected increase in national forest socioeconomic uses and demands.

These disturbance factors and the potential impacts on desired conditions for forests in the Southwestern Region 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 is expected to become warmer and drier, it is 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 10 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 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 infrastructure such as trails, facilities, and roads; and loss of recreation opportunities. Disturbances that exceed the historical range of natural variation can change the makeup, structure, and function of watersheds and some vegetation types, could affect a number of desired conditions. Heavy rains and higher flood levels can affect maintenance and structural integrity of built infrastructure and slow progress toward improvements. Flooding is a natural and beneficial disturbance 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 disturbances could create challenges in the ability of a forest to achieving plan objectives for aquatic habitat restoration. Overall, increasing weather-related disturbances can divert limited forest staff and funding to recovery efforts for extended periods and delay progress toward desired conditions, or require reconsideration 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 forest management and fire suppression practices have changed the dynamics of fire on the landscape within the Southwestern Region's national forests, resulting in greater fuel loads and risk of wildfire. A combination of fire suppression and Federal land management agencies in the West routinely exceed expenditures of over $1 billion per year for wildfire suppression. Since about the mid-1970s, the total acreage of area burned and the severity of wildfires in pine and mixed-conifer forest have increased.

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. The 2002 Rodeo-Chediski Fires in Arizona were both started by humans and combined to burn nearly half a million acres, the largest fire on record in Arizona (Joyce et al 2008).

Outbreaks of Insects, Diseases, and Nonnative Invasive Species

Disturbances associated with climate change can have secondary impacts indirectly caused by wildfire and climate related extremes. Increased variation in temperature and moisture can cause stress and increase the susceptibility of forest ecosystems to invasions by insects, diseases, and nonnative species. New environmental conditions can lead to a different mix of species 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 desired conditions for healthy and diverse forests.

Desired conditions for healthy forests include resilience to dramatic changes caused by abiotic and biotic stressors and mortality agents (pine beetle), and a balanced supply of essential resources (light, moisture, nutrients, growing space). Insects and diseases typically invade in cycles followed by periods of relative inactivity. Nonnative invasive species, such as buffelgrass and saltcedar, are expected to continue to increase in numbers and extent. Vulnerabilities to forest threats from an environment that may be much different from the historical range of natural variability is an active area of research, and includes developing new management approaches for changing conditions.

Diminishing Water Resources

In the Forest Service's Southwestern Region, 13 municipal watersheds in New Mexico and 19 municipal watersheds in Arizona are located on national forest administered lands. Additionally, the 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 River, Rio Grande, and several other Southwestern rivers have streamflows that appear to be peaking earlier in the year, suggesting that the spring temperatures in these regions are warmer than in the past, causing snow to melt earlier. Water supplies are projected to become increasingly scarce, calling for tradeoffs among competing uses, potentially leading to conflict. Without upland reservoirs and watersheds, many managed by the 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.

Climate Related Socioeconomic Demand

Populations in Arizona and New Mexico are growing at an unprecedented rate. As of the latest American Communities Survey in 2006, Arizona's population was 6,056,817. The total increase for Arizona between 1980 and 2006 has been 123 percent. In New Mexico, the change in total population between 1980 and 2006 shows a 47 percent increase. The combination of population growth and climate change will likely exacerbate climatic effects, putting even greater pressure on water, forest, and other resources. Climate change could have long-term impacts on many of the amenities, goods, and services from forests, including productivity of locally harvested plants such as berries or ferns; local economics through land use shifts from forest to other uses; forest real estate values; and tree cover and composition in urban areas and associated benefits and

costs. Climate, combined with increasing regional population also will likely increase demand for water-related recreation opportunities on the national forests, as residents of urban areas seek relief from rising temperatures.

Potential Climate Change Strategies for Southwestern Region National Forests

The potential management approaches described below relate to the five projected, key climate change factors that are most likely to be a potential concern for Southwestern Region national forests in moving toward the desired conditions in the forest plan (extreme weather events, wildfire risks, insects, diseases, and invasive species, water use and demand, and increase in socioeconomic demands). These 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 strategies which follow 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 Southwestern Region national forests 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 can be addressed through five management strategies:

1. Enhance adaptation by anticipating and planning for disturbances from intense storms;
2. Reduce vulnerability by maintaining and restoring resilient native ecosystems;
3. Increase water conservation and plan for reductions in upland water supplies;
4. Anticipate increase in forest recreation use, utilize markets and demand for small diameter wood and biomass for restoration, renewable energy, and carbon sequestration; and
5. Monitor climate change influences.

These management strategies should be considered as suggestions and a place to begin addressing climate change while revising forest plans. They are broad and general in scope, and are not meant to be prescriptive. One size does not fit all. You may wish to use these as a basis from which to build forest-specific strategies. Conversely, when developing forest-specific strategies, keep in mind that the climate change science is evolving and adding to our body of knowledge, which in turn can result in changes in recommended management approaches to climate change. With this in mind, try to keep your overall strategies general and not overly specific.

Enhance 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 management practices such as buffers, filter strips, broad-based dips, and piling slash downslope of skid trails and along streams can help mitigate increased erosion conditions. Trails close to streams may need to be relocated further away from stream channels as part of improving and maintaining the recreation trails system and 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 historical conditions. New recreation sites, such as campgrounds, ski areas, and other facilities should be located well away from potential flash flood areas.

Reduce Vulnerability by Maintaining and Restoring Resilient Native Ecosystems

Managing ecosystems under uncertainty necessitates flexible and adaptive approaches that are reversible, are implemented in incremental steps, which allow for new information and learning, and that can be modified with changing circumstances (Millar et al. 2007). Southwestern ecosystems have evolved under a long and complex history of climate variability and change. Taking into consideration the number of mega-droughts, and other climate related variation, through time, these Southwestern systems have a built-in resilience. Restoring and maintaining resilience in forest and grassland ecosystems should be part of the basic elements of forest-wide desired conditions. Risks of increased wildfire, outbreaks of insects and disease, and invasive species, represent ongoing, broad-scale management challenges. These issues are nothing new. However, climate change has the potential to increase or augment the impacts of these ecosystem risks.

Restoring and maintaining resilience will likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change related impacts and variability. Managing for resistance (e.g., maintenance thinning to prevent catastrophic fire, forest insect or disease pandemics) or resilience (e.g., noxious weed control), both traditional sustainability themes, offer common ground and present opportunities for meaningful response to climate change. Of the themes of resistance[8] or resilience identified by Millar and others (2007), the following may be useful for planning:

[8] Resistance – The capacity of an organism or a system to withstand the effects of an environmental agent.

- Manage for asynchrony[9], promoting diversity
- Promote connected landscapes
- Reset significantly disrupted animal and plant communities

Prescribed 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 of storms that are more frequent, and other more extreme weather events, plus the potential for increased stresses from forest pests in a warmer, drier climate, continued prescribed burning will continue to be an important management strategy for the future.

Although current programs and guidance are already in place to limit introduction of nonnative species, treat invasive species, and control insects and diseases, these efforts are likely to become more critical to maintaining desired conditions for healthy forests under a changing climate. Due to the fragmented land ownership patterns, success in reducing forest pests requires going beyond national forest boundaries, and continued collaboration with partners will be needed. In addition, management practices (such as thinning for age class diversity) that sustain healthy forests and provide adequate nutrients, soil productivity, and hydrologic function promote resilience and reduce opportunities for disturbance and damage.

For wildlife and plant species that are dependent on forest ecosystems, planning may want to address:

- **Fragmentation:** Conservation strategies should consider preservation and restoration of large, unfragmented areas (Robinson et al. 1995), and avoid creating small patches.
- **Promote Connectivity:** 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, and through which species can readily move (Taylor et al., 1993, Millar et al. 2007). Connectivity has two components, structural and biological connectivity and biological components. Structural connectivity, the spatial structure of a landscape, can be described from map elements. Biological connectivity is the response of individuals to the scale of landscape features (Brooks 2003).

  Promoting connectivity in landscapes with flexible management goals that can be modified as conditions change may assist species to respond naturally to changing climates. Desired goals include reducing fragmentation and planning at large landscape scales to maximize habitat connectivity (Millar et al. 2007).
- **Riparian:** Riparian areas, respective uplands, and watersheds need to be protected from degradation, be enhanced where possible, and maintained in order to maintain proper hydrologic functions.

[9] Asynchrony, in the general meaning, is the state of not being synchronized. In this usage, asynchrony refers to the promotion of diversity by managing for a range of conditions, occurring at different times, within a given ecosystem.

- **Maintain Biodiversity:** If the above recommendations are implemented, biodiversity will be maintained as much as possible as climate change occurs.

Increase Water Conservation and Plan for Reductions in Upland Water Supplies

In the Southwestern Region, mountain snowpack and the headwaters of river systems are located on national forest lands. 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 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 watersheds in New Mexico and Arizona are dependent on these upland sources. In many western mountain ranges, 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. 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:

- Determine the water rights status of water resources, for range, wildlife, public drinking systems, water for firefighting, recreational uses, and aquatic habitats;
- Assess and maintain infrastructure that could be affected by flooding (dams, bridges, roads, culverts);
- Review current status of state and regional water plans, forest and watershed health plan, integrated regional water planning (IRWP) paradigm; and/or
- Plan for extreme events, e.g., flooding and/or drought.

Anticipate Increase Forest Recreation Use, Utilize Markets and Demand for Small Diameter Wood and Biomass for Restoration, Renewable Energy, and Carbon Sequestration

The use of Southwestern national forests as havens 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, rivers, 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 ski areas.

Salvaging and converting biomass into boards and other wood products can help reduce carbon loss from fire, as a byproduct of forest restoration. Another consideration may be to use biomass that cannot be converted to wood products (such as from clearing roads and trails) for bioenergy production. Bioenergy production would be carbon neutral and could not only replace the use of fossil fuels in generators, but mobile generation facilities could also provide power to schools, hospitals, command centers, and other immediate needs.

Monitor Climate Change Influences

It is not recommended that planning units create a completely new initiative or program of work solely for monitoring climate change. However, consider appropriate adjustments to the monitoring program that will improve understanding of the relationships of key plan components and climate change. As forests review their existing and potential research natural areas (RNAs), monitoring of climate change affects on specific ecosystems may be part of the research goals considered when building the RNA establishment record.

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Specific Web Pages

Climate Assessment for the Southwest (CLIMAS) http://www.climas.arizona.edu/

Climate Wizard Web Page

Climate Wizard

IPCC

IPCC - Intergovernmental Panel on Climate Change

Past Global Change Web Page

PAGES - Past Global Changes

Pew Center on Global Climate Change

Homepage | Pew Center on Global Climate Change: The Pew Center on Global Climate Change

The Southwest Climate Change Network http://www.southwestclimatechange.org/climate/southwest

The Western Regional Climate Center http://www.wrcc.dri.edu/

The Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT) http://www.fs.fed.us/psw/cirmount/

The Nature Conservancy Climate Wizard http://www.climatewizard.org/

USGCRP-U.S. Global Change Research Program

U.S. Global Change Research Program

U.S. Forest Service Climate Change Resource Center http://www.fs.fed.us/ccrc/

Climate Change Glossary

The following terms have been gathered by Forest Service researchers from numerous sources including NOAA, 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 envelop 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 byproduct 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 in a narrow sense is usually defined as the "average weather" or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, 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 toward more complex models with active chemistry and biology. Climate models are applied, as a research tool, to study and simulate the climate, but also for operational purposes, including monthly, seasonal, and interannual climate predictions.

Drought: There is no definitive definition of drought based on measurable processes; 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, is a warmwater 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 intertropical 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 counter current 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 10th or 90th 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: Greenhouse gases are those 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 (SF6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Radiative forcing: The term radiative forcing refers to 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/m2).

Rangeland: Unimproved grasslands, shrublands, savannahs, and tundra.

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).

Rapid climate change: The nonlinearity 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 nonlinear system.

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 2 weeks.

C: Proposed and Probable Management Practices

Introduction

This appendix describes proposed and probable practices that may subsequently take place on the Grasslands at the project or activity level to help maintain existing conditions or achieve the desired conditions described in the plan. Included are items such as program strategies; inventories, assessments, resource analyses, and other planning needs; and ongoing work with partners and cooperating agencies anticipated during the next 15 years.

The listed proposed and probable practices are not intended to be all inclusive, nor are they intended to be decisions. They are simply projections of what actions may take place in the future. A plan amendment is not required to change or modify any of the proposed and possible actions. The list of these actions can be updated at any time through an administrative correction of the plan.

Scenery

- Development of mitigation measures for existing and new manmade sites, features, and facilities using the information from the scenic class and existing scenic integrity maps from the scenery management system prepared for the Grasslands.
- Creation of an inventory of existing structures that do not meet plan desired conditions and guidelines from photopoint monitoring.
- Modification of structures resulting in adverse scenery impacts to meet desired conditions and guidelines.

Recreation

- Vegetation management in developed recreation sites, including periodic reviews of vegetation health and opportunities for vegetation to provide screening or manage recreation site concerns. Following the protocol for removing hazard trees where needed. Continuation of active tree planting or a regeneration program where old, diseased, or damaged trees exist to provide shade and scenic quality.
- Improvement of operating efficiency and sustainability of facilities through new construction and repairs. Consideration of energy efficiency through implementation of recycled or renewable resources aimed at producing a smaller carbon footprint.
- Accessibility assessments on developed recreation sites.
- Trails maintenance according to development level and managed use.
- Development of interpretive plans for each grassland.
- Outdoor classrooms for school groups and other opportunities to partner with local schools.
- Active participation in all cooperative interpretive initiatives.
- Education and outreach programs and/or signs to help reduce user conflicts, such as conflicts between motorized and nonmotorized users.

- Where gates are in use, installation of appropriate signs to remind users to close them.
- Coordination with partnering agencies or organizations at least annually, and identification where new partnerships may exist to enable working with other landowners to expand hiking or other dispersed recreation opportunities, including interpretation.
- Improvement of field presence of Agency personnel and maintenance or development of agreements with local law enforcement. Working toward having the level of presence of law enforcement (either Forest Service or partner agency) be sufficient to address public and community concerns.
- Coordination with state wildlife agencies to manage habitat and impacts associated with hunting and partnerships with wildlife and hunting organizations to meet agency wildlife habitat and hunting management goals.
- Management actions to discourage illegal activity and/or creation of unauthorized routes.
- Management strategies to reduce user conflicts and address resource concerns.
- Rehabilitation, closure, or reconstruction of motorized routes that are causing resource damage or have issues that may negatively impact health and safety.
- In areas of high public recreation, replacement of gates with cattle guards.

Black Kettle and McClellan Creek Management Area

- Monitoring areas of designated dispersed recreation (dispersed parking areas) to look for opportunities to add new sites when they are desirable on the Black Kettle and McClellan Creek National Grasslands.

Natural Tourism

- Development of interpretive sites as opportunities become available and in conjunction with partners.
- Development of interpretive services appropriate to the features of the area and the surrounding landscape.
- Maintenance of interpretive signs and exhibits.
- Creation of stand alone signs to provide interpretive material for off-hours tourists.

Heritage Resources

- Stabilization of historic structures as funds become available.
- Completion of heritage resource projects that involves the public.
- Offsite educational/enrichment products such as classroom programs, heritage celebrations, publications, and field trips.
- Creation of a cultural resources overview for each grassland’s approval.
- Creation of a historic homestead interpretive site on the Black Kettle McClellan Creek National Grasslands.

- Establishment of a site steward program for the Kiowa and Rita Blanca National Grasslands.

Roads and Access

- Maintenance of ownership boundaries.
- Acquisition of legal access as opportunities arise.
- Decommissioning of roads that are no longer needed for the administration of National Forest System lands.
- Enforcement of decisions made under the 2005 Travel Management Rule.

Land Adjustments

- Land adjustments where feasible and advantageous to the Grassland.

Minerals and Energy Development

- Rehabilitation of common variety mineral sites and oil and gas sites no longer in use.

Special Uses

- Rehabilitation of existing special use sites that do not meet the scenery guidelines, as they are brought up for reauthorization or are no longer required.

Wind Energy Development

- Coordination and participation in research on the effects of wind farms on wildlife.
- Engagement in community discussions on the future of wind energy development in the region.
- Coordination with Federal and state wildlife agencies on the development of wind energy guidelines and policies.

Vegetation Management

- Use of livestock grazing as a tool to manage vegetative conditions and wildlife habitat.
- Coordination of planned fire activities with state agencies, Federal agencies, and private landowners to achieve landscape-scale objectives.
- Use of planned fire and herbivory on the landscape at varying intervals and intensities, as determined by vegetative and climatic conditions, to resemble natural processes.
- Treatment of WUI areas to reduce fire hazards to communities and the Grasslands.
- In appropriate ecosystems, retention of patchy shrub cover component across the landscape to provide cover for wildlife.

Soil, Water, and Air

- Where adequate groundwater or surface hydrology exists, and if natural recruitment is not sufficient, supplementation of natural recruitment with planting to reestablish riparian areas with young cottonwood and willow trees years to provide shading, bank cover, and streambank stability.

Wildlife, Fish, and Rare Plants (Natives)

- Management of Grasslands through fire and grazing to create heterogeneity in grassland structure and species composition.
- Assessment of opportunities to create wildlife habitat improvement plots to meet the high public use demand for important game species that occur on the Grasslands.
- Collaboration with other Federal and state biologists and researchers in determining if breeding populations of the Lesser Prairie-chicken could be expected to return to the Grasslands and successfully fledge young and what management activities would benefit their recovery if they returned.
- Evaluation of trees and tall human-made structures for removal in areas important for recovery of Lesser Prairie-chicken habitat and where windbreaks and erosion control shelterbelts are no longer needed for soil stability.
- Marking fences in potential Lesser Prairie-chicken habitat to minimize collisions.
- Inventory and evaluation of fenced exclosures and wildlife habitat improvement plots for effectiveness and ecological functionality.

Rio Grande Turkey

- Maintenance of large cottonwood and other trees along streamsides for roosting and escape cover.
- Maintenance and release of mast-producing trees and shrubs such as oaks and plum, as needed.
- Reintroduction of prescribed burning as a tool, as needed, to increase available green forage in the spring, open the understory in shrub stands, and increase forb production in rangeland.

Northern Bobwhite

- Management techniques that are important in developing quail habitat, as needed, including prescribed burning, disking, mowing, planting of food plots, legume seeding, and shrub planting.

Invasive Plants and Animals (Native and Nonnative)

- Monitoring and management of populations of invasive species that occur within the Grasslands boundaries. There is a working interagency plan to manage and eradicate these species at a landscape scale.

- Control of native invasive plants, such as cholla, eastern redcedar, and mesquite, to the extent practical.
- Treatment of areas containing saltcedar to restore native riparian vegetation.

Mills Canyon

- Creation of signs and barriers to prevent camping immediately outside of developed sites and areas of past disturbance within 200 feet of developed sites and rehabilitation.
- Construction of nonmotorized trails in Mills Canyon.
- Continued stabilization of the Mills Canyon Orchard and Ranch site.
- Rehabilitation of closed and user-created routes that are causing resource concerns.
- Prescribed fire to rejuvenate the browse component on the canyon lowlands and side slopes.

Special Areas

- Maintenance of signage that links the Santa Fe National Historic Trail interpretive site to the Santa Fe Trail National Scenic Byway.
- Construction of a sign and an interpretive site to link Mills Canyon and the La Frontera del Llano Scenic Byway.
- Closure or rehabilitation of all unauthorized motorized vehicle stream crossings on the eligible scenic river.

D: Other Sources of Information, Regulations, MOUs, Guidance

Other sources of information include existing laws, regulations, MOUs, Forest Service policy, and references to best management practices and best available science. These sources are important in designing projects and activities to achieve desired conditions. They are organized by management area and resource topic area below. Most, if not all of these relevant documents are available from Forest Service offices. Many are posted on the Cibola National Forest and Grasslands Internet Web site.

Grasslands-Wide

Scenery

FSM 2380.13 Landscape Management, Scenic Trails and Byways; FSM 2380.6- 2380.62 Technical Publications and References, Current Publications, Superseded Reference; FSM 2380.14 Landscape Management, Wild and Scenic Rivers; FSM 2380.18 Landscape Management, Landownership Adjustments ; FSM 2380.3 Landscape Management, Policy; FSM 2380.31 Landscape Management, Resource Planning and Management; FSM 2380.43 Landscape Management, Responsibility, Forest Supervisor; FSM 2382.1 Landscape Management, Scenery Management, Scenery Management System; Landscape Aesthetics Handbook (U.S. Forest Service Agriculture Handbook No. 701); 36 CFR 213.3 Part B Administration of Lands under Title III of the Bankhead-Jones Farm Tenant Act by the Forest Service: Protection, occupancy, use, administration, and exercise of reservations.

Developed Recreation

36 CFR 213 Administration of Lands under Title III of Bankhead-Jones Farm Tenant Act by the Forest Service; 36 CFR 261Prohibitions; EO 11988 Floodplain Management; R3 Supplement to FSM 2300 Recreation, Wilderness, and Related Resource Management; FSM 2310 Planning and Data Management; FSM 2311 Resource Opportunities in Recreation Planning; FSM 2330.3 Publicly Managed Recreation Opportunities, Policy; FSM 2353.16 Trail, River and Similar Recreation Opportunities; Cooperative Agreements and Rights-of-Way; FSM 2390 Interpretive Services; FSM 5340.2 Law Enforcement, Objectives; FSM 5420 Land Purchases and Donations; FSM 7151.02 Land Surveying, Objectives; FSM 7312.1 and 7312.2 Facility Planning, Plans, and Preliminary Project Analysis; FSH 7309.11 Ch 40 Buildings and Related Facilities, Management; Forest Service Outdoor Recreation Accessibility Guidelines; FSM 7400 Public Health and Pollution Control Facilities; FSH 7409.11, Sanitary Engineering and Public Health Handbook; Forest Service Outdoor Recreation Accessibility Guidelines, 5/22/2006; FSM 2303 Recreation, Wilderness and Related Resource Management, Policy; FSM 2334 Recreation, Wilderness, and Related Resource Management, Campgrounds and Picnic Grounds; National Trails System Act, 2009; The Built Environment Image Guide for National Forests and Grasslands, 2001.

Dispersed Recreation

FSM 1802 and 1803 Senior, Youth and Volunteer Programs, Objectives and Policy; FSH 2309.18.4Trails Management Handbook; FSM 2300, Recreation, Wilderness, and Related Resource Management. 1985 Cibola National Forest Land and Resource Management Plan; Amendment #10, 2002, Wild, Scenic/Recreation Eligible River Areas.

Motorized Recreation

36 CFR 212, Travel Management; 36 CFR 251, Land Uses; 36 CFR 261, Prohibitions;36 CFR 294, Special Areas; Black Kettle McClellan Creek National Grasslands Motor Vehicle Use Map; Kiowa Rita Blanca National Grasslands Motor Vehicle Use Map. Travel Management Rule, 2005.

Heritage Resources

National Historic Preservation Act Sections 106 and 110; 36 CFR 800 Protection of historic Properties; 36 CFR 60.4 National Register of Historic Places, Criteria for Evaluation; FSM 2360 Heritage Program Management; The Native American Grave Protection and Repatriation Act; EO 13175 Consultation and Coordination with Indian Tribal Governments; EO 13007 Indian Sacred Sites; Santa Fe National Historic Trail Comprehensive Management and Use Plan (USDI National Park Service 1990) and the Memorandum of Understanding between the National Park Service and the Pike-San Isabel National Forests and Cimarron-Comanche National Grasslands signed March 6, 1991 (USDA Forest Service and USDI National Park Service 1991); General Agreement Between the U.S. Department of Interior, National Park Service and the U.S. Department of Agriculture, U.S. Forest Service, Region 3, Concerning the Santa Fe National Historic Trail, Agreement # 02-MU-11031600-022, dated Feb. 25, 2002; Region 3, First Amended Programmatic Agreement Regarding Historic Property protection and Responsibilities (and associated appendices), December 2003; EO 11593 Protection and Enhancement of the Cultural Environment; FSM 2360.7 Heritage Program Management, Program Funding Structure; FSM 2364.03 Protection and Stewardship, Policy; FSM 2364.02 Objectives, American Indian Religious Freedom Act, 1978; Archaeological Resources Protection Act, 1979; Food Conservation and Energy Act of 2008 (The Farm Bill); EO 13287 Preserve America, (Partnering to Promote Heritage Tourism in Communities: Guidance for Federal Agencies, 2003); U.S. Forest Service Tribal Relations Strategic Plan.

Roads and Access

36 CFR 212 Travel Management; 36 CFR 261 Prohibitions; FSM 5460 Right-of-Way Acquisition; FSM 7701.2 Travel Management; FSM 7702 Travel Management, Objectives; FSM 7703 Travel Management, Policy; FSM 7710 Travel Management, Travel Planning; FSM 7730 Road Operation and Maintenance; FSH 2509.22 Soil and Water Conservation Handbook; FSH 7709.55 Travel Planning Handbook; FSH 7709.56 Road Preconstruction Handbook; FSH 7709.59 Road System Operations and Maintenance Handbook; Forest Service Washington Office correspondence dated November 10, 2010, RE: Travel Management, Implementation of 36 CFR, Subpart 212, Subpart A (36 CFR 212.5(b); Forest Service Washington Office correspondence RE: Fiscal Year 2010 Final Program Direction.

Land Adjustments

36 CFR 254 Landownership Adjustments; FSM 5400 Landownership; FSH 5409.12 Appraisal Handbook; FSH 5409.13 Land Acquisition Handbook; FSH 5409.17 Rights-of-Way Acquisition Handbook; FSH 5509.11Title Claims, Sales, and Grants Handbook; FSM 2354.51(a) Fee Title Acquisition on Designated Rivers; FSM 2354.6 Non-designated Rivers.

Minerals and Energy Development

36 CFR 228 Subpart E, Oil and Gas Resources; FSM 2320 Wilderness Management; FSM 2802 and 2803 Minerals and Geology, Objectives and Policy; FSM 2814 Mining Claims, Rights, and Obligations of the United States; FSM 2822.41 Mineral Licenses, Permits, and Leases Administer by the Department of the Interior, Forest Service Evaluation and Report; 36 CFR 228 Minerals; FSM 2850 Mineral Materials; Surface Occupancy Standards and Guidelines for Oil and Gas Exploration and Development (the Gold Book) published by BLM; FSM 2822.62, Actions by Forest Service; FSM 2814.01, Mining Claims, Rights of United States; FSM 2814.23 Prevent Violations of Laws and Regulations; FSM 2822.02 Mineral Leases, Permits, and Licenses, Objective; FSM 2822.04 Responsibility; FSM 2880.3 Geologic Resources, Hazards and Services, Policy; NEPA Air Quality Memorandum of Understanding (MOU) for Oil and Gas Decisions on Federal Lands, June 23, 2011.

Special Forest Products

FSH 2409.18, Timber Sale Preparation; FSH 2409.18-2009-2, Section 82.5 Trees, Portions of Trees, or Forest Products Free of Charge for Indian Tribes for Non-Commercial Traditional and Cultural Purposes; FSM 2000, Chapter 2020.12(5), Ecological Restoration and Resilience, Executive Orders; Chapter 2020.3(2) Policy; FSM 2400, Timber Management, Chapter 2462, Free Use of Timber; Chapter 2463, Administrative Use; 36 CFR 223.5 through 36 CFR 223.10 Parks, Forests, and Public Property, Scope of Free-Use Granted to Individuals, Cutting and Removal of Timber in Free-Use Areas, Permission for Free-Use of Timber Outside Free-Use Areas, Delegations of Authority to Approve Free Use by Individuals, Free-Use to Owners of Certain Mining Claims, Free-Use to Alaskan Settlers, Miners, Residents, and Prospectors; FSM 2400, Chapter 2467 Sales of Special Forest Products, 36 CFR 223.1 Authority to Sell Timber; FSM 2400, Chapter 2431 Management of Timber Sale Program; 36 CFR 223.2 Disposal of Timber for Administrative Use; 7 CFR 2.60 Agriculture, Chief, Forest Service; FSH 2409.19 Renewable Resources Handbook; 36 CFR 223.12 Permission to Cut, Damage, or Destroy Trees without Advertisement; 16 U.S.C.2104 Note Stewardship End Result Contracting Projects; Forest Service National Resource Guide to American Indian and Alaska Native Relations, 12/05/1997; 36 CFR 800, National Historic Preservation Act; FSH 2409.19, Timber Sale Administration Handbook; National Environmental policy Act of 1969;National Forest Management Act of 1976; Tribal Consultation on Section 8105 of the Food, Conservation and Energy Act of 2008 (The Farm Bill); 36 CFR 223.261 Sale and Disposal of National Forest System Timber; Special Forest Products and Forest Botanical Products. FSH 1909.15, Environmental Policy and Procedures Handbook.

Special Uses

Suggested Practices for Raptor Protection on Power Lines: Utility line, transformer, and conductor locations recommendations of The State of the Art in 2006, Avian Powerline Interaction Committee (APLIC) 2006.

Access recent information on communication towers at:
http://www.fws.gov/southwest/es/oklahoma/sect7.htm, or call (918) 581-7458.

Wind Energy Development

36 CFR 251 Subpart B Land Uses, Special Uses; FSM 2700 Special Uses Management; FSM 2700, Chapter 2720 Special Uses Administration; FSH 2709.11, Chapters 40 and 70, Special Uses Handbook; FSH 2609.13, Wildlife and Fisheries Program Management Handbook, Chapter 80, Wildlife Monitoring at Wind Energy Facilities; Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 2006, Avian Power line Interaction Committee (APLIC) 2006; Edison Electric Institute, Washington D.C. Standard Guidance for Towers with Potential Impacts to Federally-Listed Species and Migratory Birds (document prepared by the U.S. Fish and Wildlife Service, Oklahoma Ecological Services Field Office, 9014 East 21st Street, Tulsa, Oklahoma 74129-1428).

Livestock Use

FSM 2202 Range Management, Objectives; FSM 2203.2 Range Management, Policies – National Grasslands; FSM 2230.2 and 2230.3 Grazing and Livestock Use Permit System, Objective and Policy; FSM 2231.02 Grazing and Livestock Use Permit System, Requirements for Permits with Term Status; FSM 2240.2 and 2240.3 Range Improvements, Objective and Policy; FSM 2242.02 Structural Range Improvements, Objective; FSM 2242.03 Policy; FSM 2243.02 Nonstructural Range Improvements, Objective; FSM 2243.03 Policy; FSM 2250.2 and 2250.3 Range Cooperation, Objective and Policy; FSM 2270.3 Information Management and Reports, Policy; FSH 2209.13, Chapter 12.31 Grazing Permit Administration Handbook, Permits with Term Status, Upper Limits; Bankhead Jones Farm Tenant Act of 1937; 36 CFR 213 Administration of Lands under Title III of the Bankhead-Jones Farm Tenant Act by the Forest Service; FSM 2237.03 Range Management, Policy; FSM 2541.03 Water Uses and Development, Policies; FSM 2253.4 Range Cooperation, Cooperation with Others; FSM Information Management and Reports, Policy; Interagency Technical Reference (USDA, USDOI), Utilization Studies and Residual Measurements,1996; Technical Reference 4400-5 Rangeland Inventory & Monitoring, Supplemental Studies, 1992; Technical Reference 4400-7 (BLM) Rangeland Monitoring Analysis, Interpretation, and Evaluation, 1985; Technical Reference 4400-8 (BLM) Rangeland Monitoring, Statistical Considerations, 1992; FSH 2209.13 Chapter 90 Rangeland Management Decision Making; Environmental Assessment of Livestock Grazing and Associated Vegetation Management: Black Kettle National Grassland-Roger Mills County, Oklahoma, November 1999. Black Kettle National Grassland, Cibola National Forest, Cheyenne, Oklahoma; Environmental Assessment for Selected Range Units in Dallam Co., Texas: Term Permit Modification and Range Unit Management Plans, November 2003. USDA Forest Service, Cibola National Forest Rita Blanca National Grassland, Kiowa and Rita Blanca National Grasslands Ranger District, Clayton, N.M.; Environmental Assessment of Livestock Grazing on the Kiowa National Grassland in Union Co., N.M. August 1999. USDA Forest Service Cibola National Forest Kiowa National Grassland, Clayton, N.M.; Environmental Assessment of Livestock Grazing in the Mills Area of the Kiowa National Grassland: Harding, Colfax, and Mora Counties, N.M. September 1998. USDA Forest Service Cibola National Forest Kiowa National Grassland, Clayton, N.M.; Environmental Assessment for Selected Range Units in Dallam Co., Texas: Term Permit Modification and Range Unit Management Plans. January 2004. USDA Forest Service, Cibola National Forest Rita Blanca National Grassland, Kiowa and Rita Blanca National Grasslands Ranger District, Clayton, N.M.; Environmental Assessment of Livestock Grazing and Management on the Rita Blanca National Grassland in Cimarron Co., Okla. September 2002, USDA Forest Service Cibola National Forest Rita Blanca National Grassland, Clayton, N.M.

Wildland-Urban Interface

FSM 5110.2 Fire Management, Wildfire Prevention, Objective; FSM 5120 Fire Management, Preparedness; FSM 5130.2 Wildland Fire Suppression, Objective; The 1995/2001 Federal Wildland Fire Management Policy and Program Review; FSH 5109.19 Chapter 50 Fire Management Analysis and Planning Handbook, Fire Management Planning; The Wildland and Prescribed Fire Management Policy and Implementation Procedures Reference Guide; Managing Impacts of Wildfires on Communities and the Environment, and Protecting People and Sustaining Resources in Fire Adapted Ecosystems – A Cohesive Strategy (FSM 5101, 5103, and 5108); The Interagency Fire Management Plan template by the Fish and Wildlife Service, 2006 www.fws.gov/fire/fmp/development/July08_FWS_template_guidance.doc; The Cibola National Forest and National Grasslands Fire Management Plan, 2010; Community Wildfire Protection Plans (CWPP) for Harding, Mora, and Union Counties, NM (no CWPPs currently exist for the counties occupied by the grasslands in Texas or Oklahoma, but future CWPPs for these counties are hereby incorporated by reference); FSM 5171, Agreements with Federal Agencies; Interagency Prescribed Fire, Planning and Implementation Procedures Guide, Element 19-Smoke Management & Air Quality (USDA, USDOI) 2008; FSM 5140.2 Fire Use, Objectives; FSM 5140.3 Fire Use, Policy; Guidance for Implementation of Federal Wildland Fire Management Policy, 2009; FSM 3110.2 Cooperative Forest Fire Prevention, Objective; FSM 3110.3 Policy (Smokey Bear); USDOI, National Fire Plan, 2001, National Environmental Policy Act of 1969; National Forest Management Act of 1976; FSM 2324.2 Wilderness Management, Management of Fire; FSM 5100, Fire Management.

Special Areas

Research Natural Areas (RNA)

FSM 4063.02 Research Natural Areas, Objectives & FSM 4063.03 Research Natural Areas, Policy; FSM 4000 Research and Development, Chapter 4060, Research Facilities and Areas, Policy.

General Ecological

Bankhead-Jones Farm Tenant Act of 1937; Multiple-Use Sustained-Yield Act of 1960; National Forest Management Act of 1976; 1982 Rule Provisions, Sections 219.13-219.26; 36 CFR 241.2 Parks, Forests, and Public Property, Fish and Wildlife, Cooperation in Wildlife Management; Endangered Species Act of 1973; Migratory Bird Treaty Act of 1918; EO 13186 Responsibility of Federal Agencies to Protect Migratory Birds; Sikes Act of 1960; FSM 2402 Timber Management, Objectives; FSM 2470.2 - 2470.3 Timber Management, Chapter 70 Silvicultural Practices, Objectives and Policy; FSM 2670-2671Wildlife, Fish, and Sensitive Plant Habitat Management, Chapter 70, Threatened, Endangered, and Sensitive Plants and Animals, Cooperation; FSM 2671.45 C & F 2671Wildlife, Fish, and Sensitive Plant Habitat Management, Interim Directives; FSM 3110.2 State and Private Forestry, Cooperative Forest Fire Prevention, Objectives; 3150.2 State and Private Forestry, Rural Community Fire Protection Program, Objectives; Federal Noxious Weed Act of 1975;

Soil

FSM 2550 Watershed and Air Management, Chapter 50, Soil Management; FSH 2509.18; Soil Management Handbook; FSH 2509.22, Soil and Water Conservation Handbook;

Multiple Use Sustained Yield Act of 1960; Bankhead-Jones Farm Tenant Act of 1937 as Amended.

Water, Watershed, Perennial Streams, Reservoirs, Lakes, Wetlands, Ponds, and Playa Lakes

FSH 2509.16 Water Resource Inventory Handbook; FSH 2509.22 Soil and Water Conservation Handbook, Region 3, Chapter 10 - 40, FSH 2509.23 Riparian Area Handbook; FSM 2510-2520 Watershed and Air Management, Watershed Planning and Watershed Protection and Management; FSM 2530 Water Resource Management; FSM 2540 Water Uses and Development, Regional Supplement No. 2500-2001-1; Federal Water Pollution Control Act of 1956 and Amendments of 1972 (Clean Water Act); FSM 2502-2503 Watershed and Air Management, Objectives and Policy; FSM 2541.03 Water Uses and Developments, Policy; FSM 2541.12 Instream and Standing Water Requirements; FSM 2521 Watershed Protection and Management, Watershed Condition Assessment; FSM 2502 & 2503 Watershed and Air Management, Objectives and Policy; FSH 2509.13 Burned-Area Emergency Rehabilitation Handbook; FSM 2526, Watershed and Air Management, Riparian Area Management; FSM 2521.11(b) Watershed Condition Assessment, Priority Setting;

EO 11990, 1977 Wetlands Management; EO 11998, 1977 Floodplain Management; Organic Administration Act, 1897 as Amended; National Forest Management Act, 1976; Safe Drinking Water Act, 1977.

Air

Clean Air Act of 1990, Regional Haze Rule to meet PM 2.5 and ozone standards; New Mexico Air Quality Bureau Smoke Management Plan; New Mexico Administrative Code (NMAC), Environmental Protection, Title 20, Chapter 2, Part 3 (20.2.3) Ambient Air Quality Standards, and NMAC 20.2.72 Permitting; Texas Emissions Reduction Plan (SB 5 2001); FSM 2580.2 - 2580.3 Watershed and Air Management, Chapter 80 Air Resource Management, Objectives and Policy; Oklahoma Department of Environmental Quality, Air Quality Division, Open Burning Rules Section; Forest and Rangeland Renewable Resource Planning Act of 1974; NEPA Air Quality Memorandum of Understanding (MOU) for Oil and Gas Decisions on Federal Lands, June 23, 2011.

Invasive Plants and Animals (Native and Nonnative)

Federal Noxious Weed Act of 1975; FSM 2080.2, Noxious Weed Management; FSM 2150, Pesticide-Use Management and Coordination; New Mexico Executive Order 00-22, Office of the Governor, 2000; Noxious Weed Act of 1963 (New Mexico); Oklahoma Noxious Weed Law of 2000; Texas Agriculture Code, Chapter 78.003: Noxious Weed; Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947.

Management Area-Specific Other Sources of Information

Black Kettle and McClellan Creek Management Area

The following other sources of information apply only to the Black Kettle and McClellan Creek National Grasslands, referred to collectively as the Black Kettle and McClellan Creek Management Area. These references to law, regulation and policy, MOUs, and other guidance are in addition to the Grasslands-wide direction presented above.

Developed Recreation

FSM 7509.11 Dams Management Handbook

Wildlife Habitat Improvement

Management guidelines for Lesser Prairie-chicken populations and their habitats, Hagen et al. 2004, Wildlife Society Bulletin 32:69-82; Habitat Evaluation Guide for the Lesser Prairie-chicken, Pub. # E-1014, from Oklahoma State University Extension, by OSU , TNC and Sutton Avian Research; Ecology and Management of the Lesser Prairie-chicken in Oklahoma, Oklahoma Cooperative Extension Service Division of Agricultural Sciences and Natural Resources, Oklahoma State University; Revised Regional Forester's Sensitive Species List of Plants and Animals, October 1, 2007, Cibola National Forest and Grasslands Sensitive Species Evaluations; U.S. Fish and Wildlife Service National Bald Eagle Management Guidelines, May 07; FSM 2610.1 Wildlife, Fish and Sensitive Plant Habitat Management, Authority; FSM 2602 & 2603 Objectives and Policy; FSM 2202 & 2203 Range Management, Objectives and Policy; FSM 2240.3 Range Improvements, Policy; FSM 2671.1 Wildlife, Fish and Sensitive Plant Habitat Management, Cooperation with State Agencies; 36 CFR 241.2 Fish and Wildlife, Cooperation in Wildlife Management; FSM 2242 Range Management, Structural Range Improvements; FSM 2243 Nonstructural Range Improvements; FSM 2240.5 Definitions; FSM 2630 Wildlife, Fish and Sensitive Plant Habitat Management, Management of Wildlife and Fish Habitat; FSM 2670 Threatened, Endangered and Sensitive Plants and Animals; USDA Environmental Compliance Fish and Wildlife Policy Departmental Regulation (DR) 9500-4, Fish and Wildlife Policy.

Invasive Plants and Animal Species (Native and Nonnative)

Environmental Assessment for Invasive Plant Management, Cibola National Forest, Black Kettle Ranger District, Cheyenne, Oklahoma, 2007

To determine suitable habitat, The Oklahoma Lesser Prairie-chicken Spatial Planning Tool (OLEPCSPT 2009) is a useful spatially explicit model designed to assist development planning by avoiding, minimizing, and mitigating negative effects of development on the Lesser Prairie-chicken in Oklahoma. The model and all associated products are specific to the Lesser Prairie-chicken and Oklahoma.

Lesser Prairie Chicken Development Planning webpage, December 10, 2009
http://www.wildlifedepartment.com/lepcdevelopmentplanning.htm

Kiowa and Rita Blanca Management Area

The following other sources of information applies only to the Kiowa and Rita Blanca National Grasslands, referred to collectively as the Kiowa and Rita Blanca Management Area. These references to law, regulation, policy, MOUs, and other guidance are in addition to the Grasslands-wide direction presented above.

Wildlife Habitat Improvement

Management guidelines for Lesser Prairie-chicken populations and their habitats. Hagen et al. 2004, Wildlife Society Bulletin 32:69-82; Habitat Evaluation Guide for the Lesser Prairie-chicken, Pub. # E-1014, from Oklahoma State University Extension, by OSU, TNC and Sutton Avian Research; Ecology and Management of the Lesser Prairie-chicken in

Oklahoma, Oklahoma Cooperative Extension Service Division of Agricultural Sciences and Natural Resources, Oklahoma State University; Revised Regional Forester's Sensitive Species List of Plants and Animals, October 1, 2007, Cibola National Forest and Grasslands Sensitive Species Evaluations; U.S. Fish and Wildlife Service National Bald Eagle Management Guidelines, May 07; FSM 2610.1 Wildlife, Fish and Sensitive Plant Habitat Management, Authority; FSM 2602 & 2603 Objectives and Policy; FSM 2202 & 2203 Range Management, Objectives and Policy; FSM 2240.3 Range Improvements, Policy; FSM 2671.1 Wildlife, Fish and Sensitive Plant Habitat Management, Cooperation with State Agencies; 36 CFR 241.2 Fish and Wildlife, Cooperation in Wildlife Management; FSM 2242 Range Management, Structural Range Improvements; FSM 2243 Nonstructural Range Improvements; FSM 2240.5 Definitions; FSM 2630 Wildlife, Fish and Sensitive Plant Habitat Management, Management of Wildlife and Fish Habitat; FSM 2670 Threatened, Endangered and Sensitive Plants and Animals; USDA Environmental Compliance Fish and Wildlife Policy Departmental Regulation (DR) 9500-4, Fish and Wildlife Policy.

Invasive Plants and Animal Species (Native and Nonnative)

FEIS for Canadian River Tamarisk Control, Cibola National Forest, Harding and Mora County New Mexico, May 2007; Environmental Assessment for Integrated Pest Management of Noxious/Invasive Plants, Cibola National Forest, Catron, Cibola, Colfax, Harding, Lincoln, McKinley, Mora, Sandoval, Sierra, Socorro, Torrance, Union, and Valencia Counties in NM, Cimarron County in Oklahoma, and Dallam County in Texas, June 2010.

Shortgrass Prairie General Vegetation Type

Luce, R. J. 2003. A Multi-State Conservation Plan For The Black-tailed Prairie Dog, *Cynomys ludovicianus*, in the United States – an addendum to the Black-tailed Prairie Dog Conservation Assessment and Strategy, November 3, 1999. http://wildlife.state.co.us/NR/rdonlyres/EAA036FD-A82A-4E8C-8D87-9B56BA7CF1E7/0/BTPD_Final.pdf

Memorandum of Understanding among: New Mexico; Oklahoma; and Texas offices of Wildlife Services; USDA APHIS to address sylvatic plague disease in mammals occurring on the shortgrass vegetation type for the purposes of protection of human health, other wildlife resources, and boundary control.

Memorandum of Understanding September 26, 2001, among: The U.S. Forest Service; Animal Plant Health Inspection Service; Natural Resources Conservation Service, Bureau of Land Management; U.S. Fish and Wildlife Service; Bureau of Indian Affairs; National Park Service; U.S. Air Force; U.S. Army; U.S. Army Corps of Engineers (Civil Works); and U.S. Geological to collaborate on benefits to the black-tailed prairie dog and other obligate and associated species of these ecosystems.

Special Areas

National Trails and Scenic Byways

National Historic Preservation Act Sections 106 and 110; 36 CFR 800 Parks, Forests, and Public Property, Advisory Council on Historic Preservation; 36 CFR 60.4 National Register of Historic Places, Criteria for Evaluation; FSM 2300 Recreation, Wilderness, and Related Resource Management; Santa Fe National Historic Trail Comprehensive Management and

Use Plan (USDI National Park Service 1990) and the Memorandum of Understanding between the National Park Service and the Pike-San Isabel National Forests and Cimarron-Comanche National Grasslands signed March 6, 1991 (USDA Forest Service and USDI National Park Service 1991); National Trails System Act of 1968; FSM 2353.11 Recreation, Wilderness, and Related Resource Management, Chapter 50 Trail, River, and Similar Recreation Opportunities, Relationship Between National Recreation, National Scenic, and National Historic Trails and NFS Trails.

Scenic Byways

Transportation Equity Act for the 21st Century of 1998, or most recent reauthorizing legislation; FSM 2380.13 Landscape Management, Scenic Trails and Byways.

Eligible Scenic River

Wild and Scenic Rivers Act of 1968; FSM 2354.02 Trail, River, and Similar Recreation Opportunities, Objective; FSM 2354.03 Trail, River, and Similar Recreation Opportunities, Policy; FSM 2354.04 Trail, River, and Similar Recreation Opportunities, Responsibility; FSM 2354.21 Recreation, Wilderness, and Related Resource Management, Management of Study Rivers; FSM 2354.42 (a-p) Wild and Scenic River Resource Protection and Management; FSM 1924.03 Land Management Planning, Policy; FSH 1909.12 Chapter 80, Section 82, Wild and Scenic River Evaluation, Assessment of Study Rivers; 36 CFR228, Parks, Forests, Public Property, Minerals; EA, Cibola national Forest Amendment #10, Protection of Eligible Wild, Scenic, or Recreation Rivers, June 2002.

E: Disturbance Factors and Ecological Processes

Historical natural disturbances and ecological processes such as fire, climate variability, flooding, and native herbivory, in conjunction with human-caused disturbances such as cattle grazing and altered hydrology, have notable effects on the Grasslands' vegetation, including composition and structure. These historical natural disturbances influence the composition and structure of the Grassland vegetation types. In addition, invasive species and motorized and off-road travel are now recognized as having disturbance-like effects on the Grasslands vegetation.

Following is a list of current and historical disturbances that occur on the Grasslands affecting all identified soil resource characteristics, including soil condition, soil loss, soil productivity, and organic matter.

Fire: Historically, lightning-caused fires, and fires set by humans burned across extensive areas of the plains grasslands, and ecosystems adapted to the periodic fires. The plains grasslands had a historical fire regime of 3 to 10 years. This was disrupted by Euro-American settlements in the late 1800s, primarily by overgrazing and fire suppression. Contemporary residential development and growth led to widespread fire suppression, with roads often serving as firebreaks. Fire suppression allowed trees and other woody vegetation to increase their dominance over the landscape while reducing the abundance of fire-adapted native grasses. With the exclusion of wildfire throughout most vegetation types in the last 70 years, fuel loading has increased in woodland and forest vegetation types, resulting in a high risk of accelerated erosion, loss of soil and vegetative productivity, and sediment transport to connected streams following wildfires in areas with moderate and high erosion hazard on the Grasslands. High levels of sediment can reduce fishery and aquatic habitat and those species that rely on it for their survival.

Grasslands managers have increasingly used prescribed burns to eliminate excess woody trees and shrubs (including invasive trees like black locust and eastern redcedar), improve the diversity of structural stages, and restore fire-adapted ecosystems. Over the past 10 to 12 years, approximately 80 percent of the Black Kettle and McClellan Creek National Grasslands have been burned, with some units burned two to four times. About 2 percent of the Kiowa and Rita Blanca National Grasslands units have been burned, mostly in the pinyon-juniper ecosystem. In addition, approximately 7,300 acres burned in wildfires on all four grasslands in the 10 years from 1995 to 2005. The 2006 wildfire season was especially unique due to prolonged drought and burned over 3,700 acres of the Black Kettle, 1,500 acres of the McClellan Creek, and 850 acres of the Kiowa and Rita Blanca National Grasslands.

Grazing/herbivory: Grazing by herbivores such as bison and black-tailed prairie dog played a very important role in development of the current grazing-adapted Grasslands. For millennia, unconfined herds of bison moved over extensive grasslands year-round, reducing grass cover and changing the dominance of certain plant species. Prairie dogs once inhabited millions of acres of the Great Plains and played an important role in modifying grasslands and providing habitat for numerous species. Black-tailed prairie dogs removed tall herbaceous and shrubby vegetation to provide unobstructed viewing for predator surveillance and, like the bison, changed the dominant vegetation type. The burrowing activities of prairie dogs mixed the soil and added nutrients from waste products as well.

Herbivory can directly reduce vegetative cover by affecting a change in vegetation composition and structure and, as a consequence, may inadvertently select for plants that have roots less

capable of holding soil. In addition, soil trampling by large ungulates creates trails, which can also lead to accelerated erosion rates. High levels of livestock, pronghorn, and prairie dog grazing have been observed to reduce effective vegetative ground cover and potentially contribute to accelerated erosion, soil compaction, and declined soil productivity, which is exacerbated during periods of drought.

The Forest Service has adopted an adaptive management approach and completed an environmental analyses and allotment management plans on every active grazing allotment on the Grasslands. The adaptive management approach now in place allows for adjustments in numbers of livestock and seasons of use through the annual operating instructions, in order to respond to changing conditions and achieve management objectives. The intensity of livestock grazing is substantially lower on the Grassland units than on adjacent private lands, averaging half the stocking rate found on private land. Current livestock management trends indicate that grazing on the Grasslands is currently sustainable.

Invasive species: Before European settlement, there were no invasive species found on the Grasslands; however, that is no longer the case. Invasive species disrupt natural ecosystem functions and negatively affect both ecological and socioeconomic conditions. Invasive species can displace desirable native species, reduce the quality of wildlife habitat, damage sensitive riparian and watershed areas, increase wildfire risk, and increase erosion. Invasive species cause major modifications in ecological processes and soil microflora, affecting nutrient cycling and decomposition rates. Changes to Grassland habitat by nonnative species introduction can be beneficial to some game species (such as whitetail deer and Rio Grande Turkey) and tree-dependent bird species that can utilize the altered habitat.

Grasslands managers have greatly increased the emphasis on preventing and controlling invasive plants by developing cooperative agreements with adjacent landowners to actively control invasive plants on “both sides of the fence;” engaging in cooperative interagency programs such as the saltcedar control project along the Canadian River; conducting some small-scale control treatment for invasive species; and developing environmental analyses needed to implement more invasive plant control projects.

Climate variability: The Grasslands evolved with severe droughts and other extreme climatic events. Native grasslands are extremely well adapted to tolerate and resist the impacts of drought. They regularly experience extreme fluctuations in climate conditions and extreme weather events such as prolonged droughts, flooding, hail, blizzards, tornadoes, and dust storms. Precipitation has a significant influence on ecological conditions and processes in the Great Plains. Evaporation typically exceeds precipitation and water is the primary factor limiting vegetative growth and the type of vegetation a site will support.

The Grasslands have experienced multiple years of drought since about 1999, with occasional normal levels of seasonal moisture. Reduced precipitation results in reduced vegetative growth, reduced surface organic matter and productivity, and ineffective vegetative ground cover, putting the soil at risk of accelerated erosion and compaction during storm events and subsequent loss of soil productivity. As vegetation dries out, there is increased risk of wildfire spread and subsequent accelerated erosion and watershed degradation.

It is projected that the Southwest will be warmer/wetter with climate change and, as a consequence, may include the invasion of woody species as a function of increased carbon

dioxide concentration and a change in seasonal precipitation patterns. Both these factors favor the establishment of vegetation such as woody shrubs at the expense of warm season perennial species of grasses.

Flooding: Frequent flooding is a natural process and disturbance within the Grasslands and affects the riparian vegetation types as well as unmapped stream courses throughout all the vegetation types. Flooding may cause unacceptable soil loss in the stream channel, streambanks, and flood plains if not well protected with deep rooted vegetative ground cover. Flash flooding can occur in perennial, intermittent, and ephemeral streams in all vegetation types, especially in large watersheds where short duration, high-intensity storms occur. Flooding processes produce scouring and sedimentation, and the entire range of flood magnitudes contribute to ecological processes such as nutrient cycling, recruitment, and species composition. Two- to 10-year events primarily impact herbaceous vegetation and 7- to 50-year events result in patchy removal of shrubs and saplings. Fifty-plus-year events will remove stands of larger trees. Cottonwoods return to pole size within 10 years of disturbance and are considered mature at around 60 years. Maintaining native vegetation described in the potential plant community of the TEUI provides channel stability, functional riparian areas, and good water quality for wildlife and aquatic species.

Motorized travel and user-created roads: On the Kiowa and Rita Blanca National Grasslands, off-road driving is not prohibited and is particularly prevalent in the popular hunting areas. Most of the Kiowa and Rita Blanca National Grasslands are not highly desired by off-road driving enthusiasts because of the mixed ownership pattern, abundance of fences, and relatively even and homogenous terrain. However, where the off-road driving and user-created roads are prevalent (such as in Mills Canyon and the uplands), use has resulted in a loss of vegetative productivity and species diversity, long-term soil compaction and erosion, water quality degradation, and impacts to scenery, historical resources, and other social values.

The Black Kettle and McClellan Creek National Grasslands prohibit driving off designated roads or trails, so effects of off-road motorized travel on ecological sustainability are not an issue on that district.

F: Species Status of Risk Rankings

Common Name	Ranger District	Viability Overall Risk	Reason for Listing (see note below)		
			Viability Listing Source	Forest Sensitive List	MIS and at-Risk Species
Mixed-grass Prairie					
Lesser Prairie-chicken	BKMC	High	B, J	K	N
Swainson's Hawk	BKMC	Low	B, C	K	
Shinnery Oak					
Lesser Prairie-chicken	BKMC	High	B, J	K	N
Swainson's Hawk	BKMC	Low	B, C	K	
Bell's Vireo	BKMC	Moderate	B, C, E		
Mixed Hardwood Riparian					
Rio Grande Turkey	BKMC	Low	L		M
Bell's Vireo	BKMC	Moderate	B, C, E		
Shortgrass Prairie					
Black-footed ferret	KRB	Extirpated	F&WS T&E		
Black-tailed prairie dog	KRB	High	I-NM	K	N
Mountain Plover	KRB	High	A, B, C, J	K	N
Swift fox	KRB	High	G		N
Loggerhead Shrike	KRB	Low	A, C	K	
Long-billed Curlew	KRB	Low	A, B, C, D	K	
Swainson's Hawk	KRB	Low	B, C	K	
Burrowing Owl	KRB	Moderate	B, C, D	K	M
Ferruginous Hawk	KRB	Moderate	B, C, D	K	
Greene milkweed	KRB	Moderate	H, I-NM & OK	K	
One-flowered milkvetch	KRB	Moderate	H, I-NM	K	
Spellenberg's groundsel	KRB	Moderate	H, I-NM	K	
Playa Inclusion					
Plains leopard frog	KRB	High	B	K	N
White-faced Ibis	KRB	Low	A, B	K	
Long-billed Curlew	KRB	Moderate	B, C, D	K	

Common Name	Ranger District	Viability Overall Risk	Reason for Listing (see note below)		
			Viability Lising Source	Forest Sensitive List	MIS and at-Risk Species
Pinyon-Juniper and Juniper Grasslands Inclusion					
Mountain Bluebird	KRB	Low			M
Zone-tailed Hawk	KRB	Moderate		K	
Cottonwood-Willow Riparian					
Plains leopard frog	KRB	High	B	K	N
Yellow-billed Cuckoo	KRB	Low	A		
Sandhill white-tailed deer	KRB	Low		K	
Bald Eagle	KRB	Moderate	A, D, E, F	K	
Arid land ribbon snake	KRB	Moderate	A, D	K	
Sand Sagebrush					
Lesser Prairie-chicken	KRB	High	B, J	K	N
Black-tailed prairie dog	KRB	High	I-NM	K	N
Woodland Pinyon-Juniper on Canyon Steep Slopes, Cliffs, and Rock Outcrops					
Zone-tailed Hawk	KRB	Moderate		K	
American Peregrine Falcon	K	Low	D	K	
Pale Townsend's Big-eared Bat	K	Low	B	K	
Great Plains narrow-mouth toad	KRB	Moderate	D	K	
Canyon Lowlands and Canadian River Cottonwood-Willow Riparian					
Plains leopard frog	KRB	High	B	K	N
Yellow-billed Cuckoo	KRB	Low	A		
Sandhill white-tailed deer	KRB	Low		K	
Bald Eagle	KRB	Moderate	A, D, F	K	
Arid land ribbon snake	KRB	Moderate	A, D	K	
Rivers					
Rio Grande chub	KRB	Low	H, I-TX	K	
Suckermouth minnow	KRB	Moderate	E	K	
Aquatic Lakes					
Plains leopard frog	BKMC	Low	B	K	
Bald Eagle	BKMC	Moderate	A, D, E, F	K	

Alphabetic code for Reason for Listing is as follows: A = NM CWCS, B = TX CWCS, C = OK CWCS, D = NM T&E, E = TX T&E, F = OK T&E, G = Nature Serve N, H = Nature Serve G, I = Nature Serve State, J = F&WS NBC Candidate, K = Regional Forester's Grasslands Sensitive Species, L = Important Game Species, M = Management Indicator Species, N = Viability High At-Risk Species

G: Common and Latin Names Used in Desired Conditions

Common Name	Scientific Name
Alkali sacaton	*Sporobolus airoides*
American elm	*Ulmus americana*
Annual broomweed	*Amphiachyris dracunculoides*
Apache plume	*Fallugia paradoxa*
Arrowhead	*Sagittaria* spp.
Baby aster/rose heath	*Chaetopappa ericoides*
Barrel cactus	*Ferocactus* spp.
Big bluestem	*Andropogon gerardii*
Black locust	*Robinia pseudoacacia*
Black willow	*Salix nigra*
Blacksampson echinacea/narrowleaf purple coneflower	*Echinacea angustifolia*
Blue grama	*Bouteloua gracilis*
Squirreltail	*Elymus elymoides*
Box elder	*Acer negundo*
Buffalograss	*Buchloe dactyloides*
Bush morning-glory	*Ipomoea leptophylla*
Pricklypear	*Opuntia* spp.
Chickasaw plum	*Prunus angustifolia*
Choke cherry	*Prunus virginiana*
Cholla	*Opuntia imbricata*
Clover	*Dalea* spp.
Common button bush	*Cephalanthus occidentalis*
Common hackberry	*Celtis occidentalis*
Common persimmon	*Diospyros virginiana*
Eastern redcedar	*Juniperus virginiana*
False indigo bush	*Amorphous fruticosa*
Fragrant mimosa	*Mimosa borealis*
Fremont cottonwood	*Populus fremontii*
Galleta	*Pleuraphis jamesii*

Common Name	Scientific Name
Gambel oak	*Quercus gambelii*
Green ash	*Fraxinus pennsylvanica*
Green thread	*Thelesperma megapotamicum*
Ground cherry	*Physalis caudella*
Gum bully/wooly buckthorn/chittimwood	*Sideroxylon lanuginosum* var. *lanuginosu.*
Hairy grama	*Bouteloua hirsuta*
Hartweg's sundrops	*Calylophus hartwegii*
Honey locust	*Gleditsia triacanthos*
Horehound	*Marrubium vulgare*
Indian grass	*Sorghastrum nutans*
Inland New Jersey tea	*Ceanothus americanus*
Inland saltgrass	*Distichlis spicata*
Lacy tansyaster	*Machaeranthera pinnatifida*
Little bluestem	*Schizachyrium scoparium*
Little walnut	*Juglans microcarpa*
Lovegrass	*Eragrostis* spp.
Many stemmed rhatany/knotted rhatany	*Krameria ramosissima*
Mountain mahogany	*Cercocarpus intricatus*
Narrowleaf cattail	*Typha angustifolia*
Needle-and-thread grass	*Hesperostipa comata comata*
Netleaf hackberry	*Celtis laevigata* var. *reticulata*
New Mexico feathergrass	*Hesperostipa neomexicana*
New Mexico locust	*Robinia neomexicana*
Peachleaf willow	*Salix amygdaloides Andersson*
Pine	*Pinus* spp.
Plains cottonwood	*Populus deltoides*
Poison ivy	*Toxicodendron radicans*
Ponderosa pine	*Pinus ponderosa*
Plains pricklypear	*Opuntia polycantha*
Purple three awn	*Aristida purpurea*

Common Name	Scientific Name
Purslane	*Portulaca* spp.
Reed	*Calamagrostis* spp.
Riverbank grape	*Vitis riparia*
Rocky Mountain elderberry	*Sambucus racemosa*
Saltcedar	*Tamarix ramosissima*
Sand bluestem	*Andropogon hallii*
Sand dropseed	*Sporobolus cryptandrus*
Sand sagebrush	*Artemisia filifolia*
Scarlet globemallow	*Sphaeralcea coccinea* ssp. *coccinea*
Sandbar willow	*Salix exigua*
Sedge	*Carex* spp.
Siberian elm	*Ulmus pumila*
Sideoats grama	*Bouteloua curtipendula*
Skunkbush sumac	*Rhus trilobata*
Smartweed	*Polygonum* spp.
Smooth brome	*Bromus inermis*
Smooth sumac	*Rhus glabra*
Snakeweed	*Gutierrezia sarothrae*
Soapweed	*Yucca glauca*
Stickseed	*Lappula* spp.
Sunflower	*Helianthus praecox*
Switch grass	*Panicum virgatum*
Tarragon	*Artemisia dracunculus*
Texas croton	*Croton texensis*
Thinleaf alder	*Alnus incana*
Vine mesquite grass	*Panicum obtusum*
Virginia creeper	*Parthenocissus quinquefolia*
Virginia wildrye	*Elymus virginicus*
Wavyleaf oak	*Quercus pauciloba*
Wax goldenweed	*Grindelia papposa*

Common Name	Scientific Name
Western ragweed	*Ambrosia psilostachya*
Western soapberry	*Sapindus saponaria* var. *drummondii*
Western wheatgrass	*Pascopyrum smithii*
White sage	*Artemisia ludoviciana*

H: Benchmarks

All national forests and grasslands in the Southwestern Region identified benchmarks during development of their original plans. Benchmarks were established for timber resources, livestock grazing, recreation, wildlife, wilderness, and other key resources. They were evaluated for their physical and biological production potential, and monetary benchmarks were developed for those resources having an established market value.

In the 1985 "Final Environmental Impact Statement for the Cibola National Forest Plan" (the 1985 plan), the Forest established 14 economic benchmarks to set a minimum and maximum range for outputs for the development of alternatives. These benchmarks were developed cumulatively for the mountain districts and the Grasslands. Of these 14 benchmarks, 5 do not apply to the Grasslands, 6 have been adjusted for the smaller geographic extent of the Grasslands alone, and 3 have been reviewed and deemed adequate to set the range of the alternatives that may be developed as part of the Grasslands plan revision.

Benchmarks from the 1985 plan that have been determined not to apply to the Grasslands include the following:

Net merchantable timber volume (thousand cubic feet (MCF)) – There are no areas suitable for timber production on the Grasslands.

Net sawtimber value (thousand board feet (MBF)) – There are no areas suitable for timber production on the Grasslands.

Long-term sustained yield capacity (MCF) – There are no areas suitable for timber production on the Grasslands.

Wilderness recreation (thousand recreation visitor days (MRVD)) – Currently, there are no designated wilderness areas on the Grasslands.

Water yield (acre feet (ACFT)) – Water yield is more relevant to the mountain districts of the Cibola National Forest than the Grasslands because of the steeper topography of the mountain districts. Changes in management approach on the Grasslands are not likely to have a measureable effect on water yield and, therefore, it is not a meaningful way to bound alternatives.

The following benchmarks have been reviewed, validated, and found appropriate to be carried forward from the 1985 plan into this new Grasslands plan, because it is unlikely that an alternative would be developed that falls outside of their minimum and maximum values:

Developed recreation (MRVD)

Grazing capacity – Non-priced output (thousand animal unit months (MAUM))

Permitted livestock use (MAUM)

Benchmarks that need to be modified from Forest-wide values to fit the Grasslands alone include the following:

Dispersed recreation (MRVD) – The minimum level benchmark for dispersed recreation far exceeds the number of recreation visitor days on the Grasslands according to the 2005 National Visitor Use Monitoring surveys.[37] Using the data in the survey, it was determined

[37] Even though the upper bound is very high, it is not necessary to change it because all the alternatives developed will easily fall within it.

that the average duration of visit to the Grasslands was 46.9 hours, and there were 56,600 visits estimated for 2005. Of those visits, approximately 50.6 percent were dispersed recreation. Therefore, there were approximately 111.9 MRVDs of dispersed recreation on the Grasslands:

(56,600 visits) X (46.9 hours/12 hours) = 221,211.7 Recreation Visitor Days[38]

221,211.7 RVDs X 50.6%[39]=111,933 RVDs or 111.9 MRVDs

Because there is good evidence that this number is realistic for the number of dispersed recreation visits to the Grasslands, it was selected as the minimum benchmark for the Grasslands. It is expected that there would be at least 109.3 MRVDs in future years because the year the data was collected had several lengthy fire closures and a fire which burned over one of the most popular recreation sites on the Grasslands.

Wildlife recreation (MRVD) – Because there is not enough information to adjust this benchmark separately from dispersed recreation, it will be folded into the figures for dispersed recreation.

Soil loss (thousand tons (MTONS)) – The minimum level benchmark given for soil loss of 2,102.5 MTONs in the 1985 plan is too high for the Grasslands because it includes all the Cibola National Forest System lands (1,875,597 acres), of which the Grasslands are only a portion (262,232 acres). Although the rate of soil loss implicit in the minimum benchmark is reasonable, the fact that it accounts for approximately seven times as many acres as exist on the Grasslands makes it too high to be used. Therefore, the minimum level soil loss benchmark was adjusted as a proportion of the total acres of the Cibola National Forest to 294 MTONS on average per year:

(262,232 acres/1,875,597 acres) X 2102.5 MTONs = 294.0 MTONs

Net products value, firewood sold, and personal use (free) firewood (MBF) – These three benchmarks in the 1985 plan are not distinct in terms of outputs on the Grasslands. Therefore, the Grasslands combined these into one forest products benchmark using the more contemporary measure of hundreds of cubic feet (CCF). The vegetation types that were included in the calculation of these benchmarks were the pinyon-juniper stands on the Kiowa and Rita Blanca National Grasslands (excluding the inventoried roadless area) and black locust on the Black Kettle National Grassland. These vegetation types are the only ones where harvest of forest products is expected to be used as a means of achieving plan goals.

The maximum benchmark was calculated assuming that the average stand volume in black locust was 9.41 CCF per acre and that at most, 1,000 acres would be treated for each of the first two 10-year time periods and 500 acres in the third time period. It was further assumed that most of the black locust would be removed over the cumulative 2,500 acres, with a few possible exceptions. This calculation resulted in an average annual output of 941 CCF for the first two periods and 470.5 CCF for the third period.

[38] A recreation visitor day is a visit of 12 hours. The average visitor to the Grasslands spends 3.9 RVDs but makes only one visit.

[39] The percentage of visitors who used dispersed recreation sites according to the 2005 NVUM.

(9.41CCF/acre) X (2,000 acres) / 20 years = 941 CCF

(9.41CCF/acre) X (500 acres) / 10 years = 470.5 CCF

For pinyon-juniper, it was assumed that the average stand volume removed by thinning would be 2.01 CCF per acre and that 2,500 acres would be treated every 10 years. This calculation resulted in an average annual output of 502.5 CCF.

(2.01 CCF/acre) X (2500 acres) / 10 years = 502.5 CCF

The range of expected alternatives developed during Grasslands plan and EIS development should fall within the maximums and minimums established by the benchmarks shown in the table below. If, in the process of alternative development, it is discovered that an alternative falls outside the range of the benchmarks, then the affected benchmark will need to be reevaluated and reestablished as necessary.

Table 7. Benchmarks for Grasslands plan revision—average annual output

Type of Benchmark		Time Period [1]		
		2006–2015	2016–2025	2026–2035
Forest products (CCF) [2]	Max	1,443.5	1,443.5	973
	Min	0	0	0
Developed recreation (MRVD) [4]	Max	1,702.1	2,042.9	2,249.1
	Min	0	0	0
Grazing capacity (MAUM) – nonpriced output [4]	Max	230.3	236.8	241.0
	Min	0	0	0
Permitted livestock use (MAUM) [4]	Max	214.7	227.3	236.9
	Min	0	0	0
Dispersed recreation (MRVD) [3]	Max	939.0	1,127.4	1,281.1
	Min	111.9	111.9	111.9
Soil loss (MTONS)	Max	5,643.4	5,676.8	5,717.2
	Min	294	294	294

[1] The time periods shown were established in the 1985 plan and were kept for this analysis.

[2] This benchmark combines the original benchmarks of net products value, firewood sold, and personal use (free) firewood.

[3] This benchmark combines the original benchmarks of dispersed recreation, wildlife recreation, and any potential wilderness recreation that may occur in an alternative when analyzed in an environmental impact statement.

[4] These benchmarks are unchanged from the existing Forest plan.