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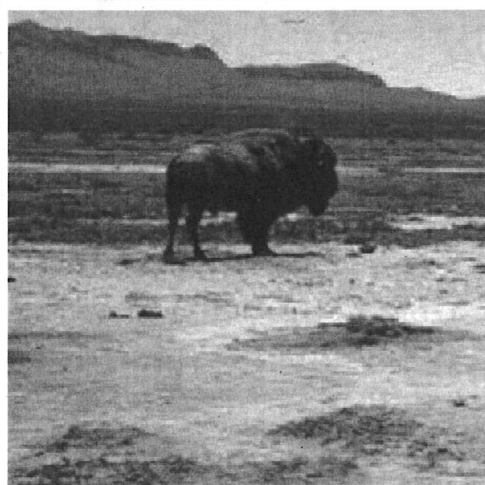
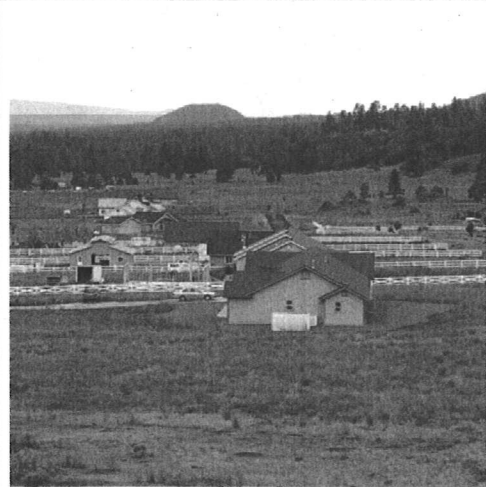
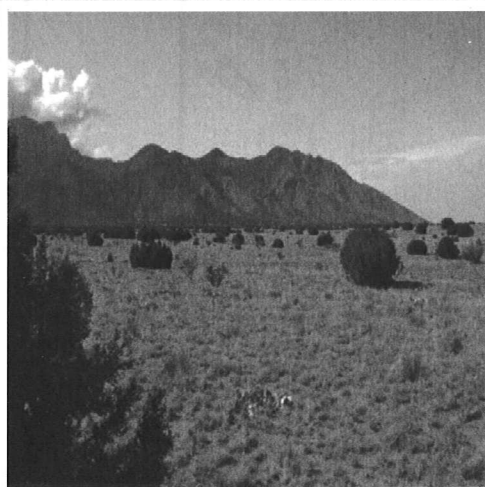
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Assessment of Grassland Ecosystem Conditions in the Southwestern United States

Volume 1

Editor
Deborah M. Finch



Abstract

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This report is volume 1 of a two-volume ecological assessment of grassland ecosystems in the Southwestern United States. Broad-scale assessments are syntheses of current scientific knowledge, including a description of uncertainties and assumptions, to provide a characterization and comprehensive description of ecological, social, and economic components within an assessment area. Volume 1 of this assessment focuses on the ecology, types, conditions, and management practices of Southwestern grasslands. The second volume, due to be published in 2005, describes wildlife and fish species, their habitat requirements, and species-specific management concerns, in Southwestern grasslands. This assessment is regional in scale and pertains primarily to lands administered by the Southwestern Region of the USDA Forest Service (Arizona, New Mexico, western Texas, and western Oklahoma). A primary purpose of volume 1 is to provide information to employees of the National Forest System for managing grassland ecosystems and landscapes, both at the Forest Plan level for Plan amendments and revisions, and at the project level to place site-specific activities within the larger framework. This volume should also be useful to State, municipal, and other Federal agencies, and to private landowners who manage grasslands in the Southwestern United States.

Key words: grasslands, ecological assessment, Southwestern United States, ecosystem conditions, Arizona, New Mexico, Texas, Oklahoma

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This project is a collaborative effort between the Rocky Mountain Research Station and the Southwestern Region of the U.S. Department of Agriculture, Forest Service. In early 2000, a Southwestern Grassland Ecosystem Sustainability Team was formed to determine the assessment approach and general content. By 2001, the team had evolved into a core group that finalized the assessment topics and authored the report. This current work is volume 1 of a two-volume report.

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Editor's Note

Although this report may be used as input in processes initiated under the National Environmental Policy Act (NEPA), National Forest Management Act (NFMA), and other applicable laws, it is not a decision document, does not allocate resources on public lands, and does not make recommendations to that effect. The information in this report is general in nature rather than site-specific. The opinions expressed by the authors do not necessarily represent the policy or position of the U.S. Department of Agriculture and the Forest Service.

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Volume 1

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Cover photos clockwise from upper left: A grassland-juniper ecotone, Bernalillo watershed, Cibola National Forest, New Mexico (photo by Rosemary Pendleton). Urban development of native grassland near Flagstaff, Arizona (photo by John Yazzie). Prescribed fire on the Sevilleta National Wildlife Refuge, New Mexico (photo by Burt Pendleton). Introduced bison coexist with reintroduced black-tailed prairie dogs on the Armendaris Ranch, New Mexico (photo by Paulette Ford).

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Chapter 2:

Grassland Assessment Categories and Extent

Introduction

This chapter establishes a general framework for describing the various kinds of grasslands outlined in subsequent chapters. This framework outlines the major categories or classes of grasslands that occur as part of Southwestern terrestrial ecosystems within National Forest System lands and provides an ecological and environmental context in regards to how they differ in their floristic, geographic, spatial, and climatic settings. More detailed information about these grassland systems is also presented in chapter 6.

Grasslands of the Southwest vary according to vegetation, climate, soils, and topography and disturbance regimes. They are distinctly different from other vegetation assemblages in that the dominant and codominant plants are graminoid species. For example, other forbs and shrub plant species occur within the grasslands but are subordinate to grass in the total cover and composition.

The major grassland categories used in this assessment—that is, those categories that represent the major grasslands formations in the Southwestern Region on National Forest System lands (Carleton and others 1991)—are Desert, Plains, Great Basin, Montane, and Colorado Plateau grasslands. These generalized groupings reflect the geographic and ecological differences that are determined by unique floristic, edaphic, physiographic, and climatic characteristics. Although not taxonomic with respect to any vegetation hierarchy, these categories are intended to aid the reader in understanding the uniqueness, distribution, and

extent of these systems. Other classification systems of Southwestern grasslands exist (Barbour and Billings 2000, Brown 1994, Dick-Peddie 1993, Küchler 1964) and emphasize biogeographic, ecological, and biophysical features that are consistent with the scale and level of generalization being used here. The general distribution of grasslands for this assessment is located on the National Forest System lands in Arizona, New Mexico, Texas, and Oklahoma (fig. 2-1).

Grassland Categories

Descriptions of each grassland assessment category follow.

The **Desert Grassland** encompasses annual and perennial graminoid and adjacent shrub communities at low elevations adjacent to the Chihuahuan, Mohave, and Sonoran deserts. These grasslands occur between the Great Basin grasslands, chaparral, and woodland ecosystems and have been commonly referred to as semidesert grasslands by Brown (1994). The distribution of these grasslands are mainly within the Basin and Range, Sonoran-Mohave Desert, Tonto Transition ecoregion sections, and limited areas within the White Mountain-San Francisco Peaks, Northern Rio Grande Intermontane, and Sacramento-Monzano Mountain ecoregion sections (McNab and Avers 1994). Desert grasslands intermingle with desert scrub communities (Dick-Peddie 1993) and have evolved through natural and anthropogenic successional disturbance processes. Grass species that are diagnostic to this category include

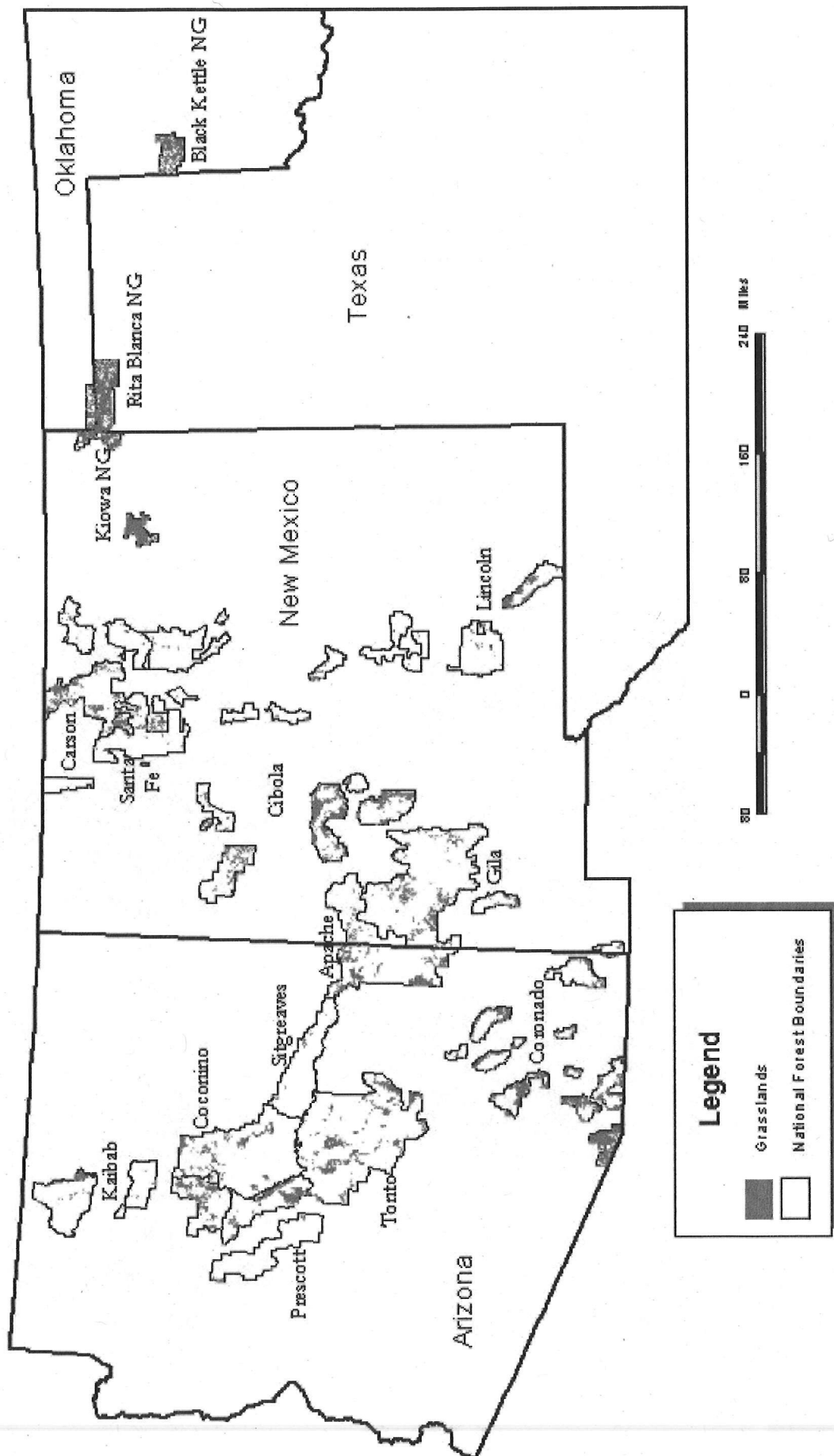


Figure 2-1. Grasslands of National Forest System lands in Arizona, New Mexico, Texas, and Oklahoma.

black grama (*Bouteloua eriopoda*), tobosa (*Pleuraphis mutica*), and curly mesquite (*Hilaria belangeri*). Other key graminoid species that occur within this formation include bushmuhly (*Muhlenbergia porteri*) and burrograss (*Scleropogon brevifolius*). Major shrubs that occur in association with these species include creosote bush (*Larrea tridentata*), velvet mesquite (*Prosopis velutina*) in Arizona, western honey mesquite (*Prosopis glandulosa* var. *torreyana*) in southern New Mexico, tarbush (*Flourensia cernua*), turpentine bush (*Ericameria laricifolia*), desert ceanothus (*Ceanothus greggii*), and soaptree yucca (*Yucca elata*).

The **Great Basin Grassland** occurs within the White Mountain-San Francisco Peaks, Saramento-Manzano Mountains, Central Rio Grande Intermontane, and higher elevations of Basin and Range and Sonoran Desert ecoregion sections (McNab and Avers 1994) of the Southwestern region. These grasslands are higher in elevation and climatically cooler and moister than desert grasslands and are adjacent to and intermingle with juniper (*Juniperus* spp.) savanna ecosystems. The Great Basin grasslands are similar to Brown's (1994) Plains and Great Basin grasslands and Dick-Peddie's (1993) Plains-Mesa grasslands except the geographic range of this category for this assessment is restricted to the Basin and Range Physiographic province (Fenneman 1928). Diagnostic plant species include blue grama (*Bouteloua gracilis*), galleta (*Pleuraphis jamesii*), Indian ricegrass (*Achnatherum hymenoides*), and sideoats grama (*Bouteloua curtipendula*). Some dropseeds, (*Sporobolus* spp.) and wolftail (*Lycurus phleoides*) are codominant and add to the diversity of this category. The Great Basin grasslands tend to be drier than the Shortgrass Steppe grasslands and have a blend of warm and cool season graminoid and forb species. Shrubs that are present in association with grassland vegetation of this category include fourwing saltbush (*Atriplex canescens*), sacahuista (*Nolina microcarpa*), small soapweed yucca (*Yucca glauca*), skunkbush sumac (*Rhus trilobata*), and cat-claw mimosa (*Mimosa biuncifera*). As this grassland integrates with savanna ecosystems, minor amounts of trees such as emory oak (*Quercus emoryi*), alligator juniper (*Juniperus deppeana*), and Utah juniper (*Juniperus osteosperma*) dominated woodlands are evident.

The **Colorado Plateau Grassland** is located in northern Arizona above the Mogollon Rim and northern New Mexico in association with the Colorado Plateau and adjacent to small areas of the Rocky Mountain physiographic provinces (Fenneman 1928). It occurs within the Grand Canyonlands, Painted Desert, Tonto Transition, White Mountains-San Francisco Peaks, Navajo Canyonlands, Southcentral Highlands, South-Central Highlands, Southern Parks and Ranges, and Upper Rio Grande Basin ecoregion sections (McNab and Avers 1994). Colorado Plateau Grasslands—a new category of Southwestern grassland—primarily splits

the expansive Great Basin Grassland category based upon recent ecological mapping (Laing and others 1986, Miller and others 1995, Robertson and others 2000) and what Kuchler (1970) referred to as the Galleta-Threeawn Shrub Steppe. These grasslands occur on nearly level, wind-desiccated geomorphic surfaces of sedimentary and igneous origin. Grass species that characterize this category include western wheatgrass (*Pascopyrum smithii*), needle and thread (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), galleta (*Pleuraphis jamesii*), and New Mexico feathergrass (*Hesperostipa neomexicana*), and various species of three-awn (*Aristida* spp). Common shrubs include big sagebrush (*Artemisia tridentata*), black sagebrush (*Artemisia nova*), fourwing saltbush (*Atriplex canescens*), and Mormon tea (*Ephedra trifurca*). Oneseed juniper (*Juniperus monosperma*) and Utah juniper (*Juniperus osteosperma*) woodlands and savannas are adjacent to Colorado Plateau grasslands.

The **Plains Grasslands** consist of the shortgrass, midgrass, and tallgrass prairies of the National Grasslands. These grasslands extend throughout the Great Plains physiographic province (Fenneman 1928) and occur within the Southern High Plains, Pecos Valley, Redbed Plains, and Texas High Plains ecoregion sections (McNab and Avers 1994). Climate ranges from subhumid to semiarid as these grasslands extend from east to west. The characteristic plant species that are abundant throughout the shortgrass prairie include blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). The midgrass prairie ecosystem is codominated by little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*), and plains bristlegrass (*Setaria vulpiseta*). The tallgrass prairie is dominated by big bluestem (*Andropogon girardii*). These different prairie ecosystems are aggregated and reduced to one category for this assessment and reflects a wide range of ecological properties and processes.

The **Montane Grasslands** category includes the montane, subalpine and alpine meadows, valleys, and high elevation grasslands that occur throughout the Grand Canyonlands, Painted Desert, Tonto Transition, White Mountain-San Francisco Peaks, Basin and Range, Central Rio Grande Intermontane, South-Central Highlands, Sacramento-Manzano Mountain, Southern Parks and Ranges, and Upper Rio Grande Basin ecoregion sections (McNab and Avers 1994). These grasslands are similar to Subalpine-Montane Grasslands described by Dick-Peddie (1993) and the Alpine and Subalpine and Montane Meadow grasslands of Brown (1994). Carleton and others (1991) classified montane, subalpine and alpine terrestrial ecosystems as edaphic-fire and topo-edaphic-zootic disclimaxes with temperate continental climates. Diagnostic plant species that characterize these ecosystems include Arizona fescue (*Festuca arizonica*), mountain muhly (*Muhlenbergia montanus*), Kentucky bluegrass (*Poa*

pratensis), timber oatgrass (*Danthonia intermedia*), Thurber fescue (*Festuca thurberii*), tufted hairgrass (*Deschampsia caespitosa*), alpine avens (*Geum rossii*), and Bellardi bog sedge (*Kobresia myosuroides*).

Mapping

The delineation of grasslands for this assessment involved integrating and cross-walking the categories of vegetation types within existing land cover classes and ecological units from five main sources: (1) General Terrestrial Ecosystem Survey (GTES) (Carleton and others 1991), (2) New Mexico Gap Analysis Project (Thompson and others 1996), (3) Texas Gap Analysis Project (Parker 2001), (4) Oklahoma Gap Analysis Project (Fisher 2001), and (5) Arizona GAP Analysis Project (Thomas 2001). These five primary sources were used for assessing distribution and extent of the five grasslands assessment categories.

The University of New Mexico, Earth Data Analysis Center, Albuquerque, performed data processing and geographic information system analysis.

The grassland assessment categories were nested within the Ecoregion and Subregions map of ecological units (Bailey and others 1994, McNab and Avers 1994). The Ecoregion and Subregions map and descriptions contain integrated biophysical information about broadscale ecological characteristics including climate, soils, geomorphology, potential natural vegetation, surface water characteristics, disturbance regimes, and land use. This integrated approach to regionalization of ecosystems allows managers, planners, and scientists to study management issues on a multi-Forest and Statewide basis. More mapping particulars are given in figures 2-2 and 2-3.

GAP land cover classes and GTES vegetation taxa (series) were combined through a process of correlation (table 2-1). This process involved aggregating categories with similar physiognomic, floristic, and geographic ranges into the five assessment classes. Differences occur between nomenclature and image resolution of land cover classes for each State GAP product. Furthermore, some States had broader land cover classes that include plant communities of adjacent vegetation formations. Consequently, the spatial resolution as predicted by the map may depict grasslands to be of more variable extent than what would be evident at finer scales with higher resolution. This is particularly true for the Desert and Great Basin grasslands where these communities integrate and commingle with adjacent shrubland steppe communities. Conversely, some areas of known grasslands on National Forest lands in Arizona and New Mexico failed to be recognized and delineated because of map scale limitations based upon a 200-ha threshold that excluded these smaller isolated areas that were eliminated to maintain cartographic integrity and utility of the map product. These areas

typically occurred at the edges of the National Forest System boundary.

Practical Application

The categorization of grasslands into generalized vegetation types assists natural resource managers in understanding the geographic variability and spatial distribution across National Forest Lands in the Southwestern Region. This understanding will potentially lead to progressive management actions to maintain and restore these grasslands to ensure their ecological sustainability.

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GRASSLANDS OF NATIONAL FOREST SYSTEMS Arizona

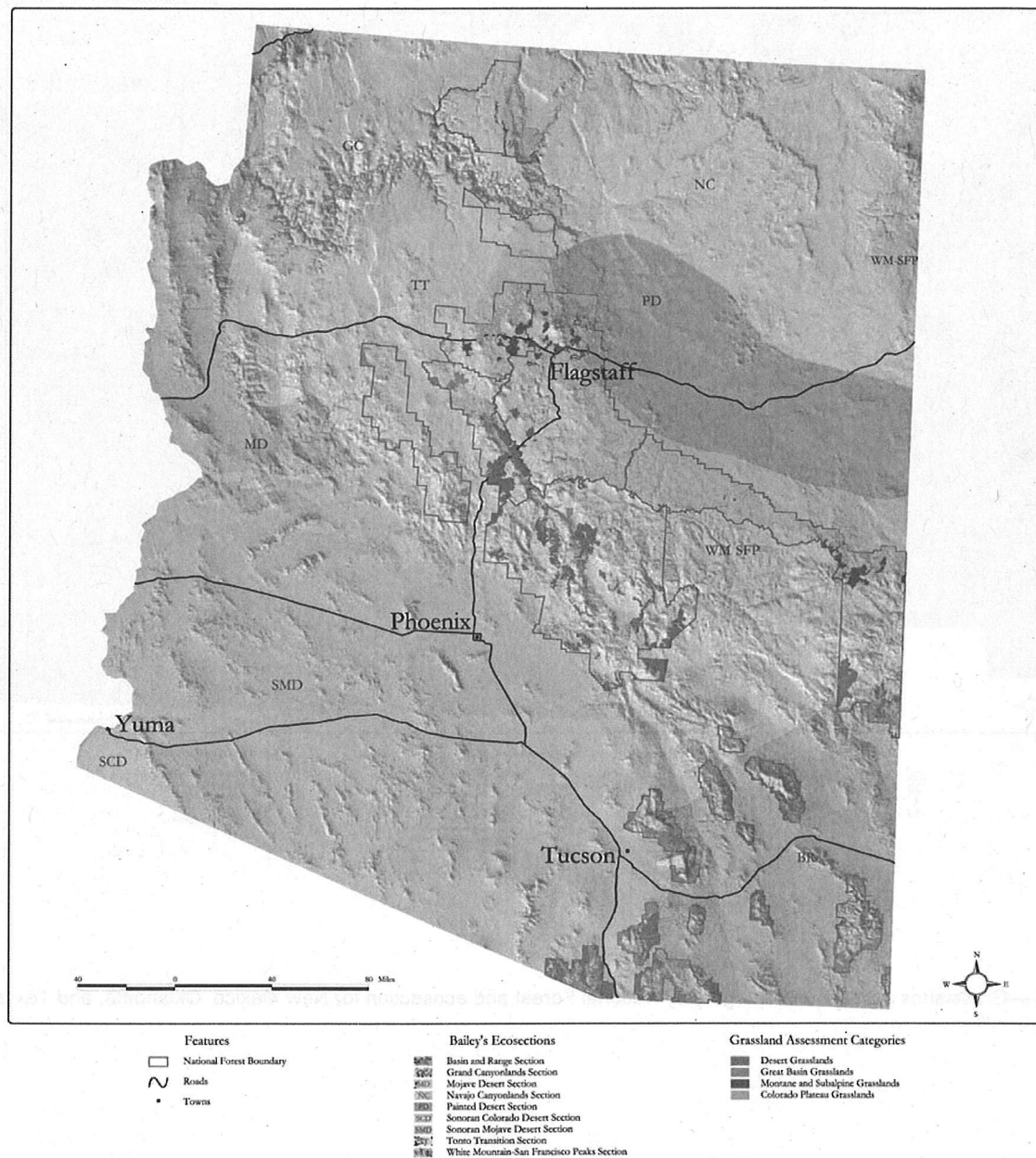


Figure 2-2.—Grasslands assessment category by National Forest and ecosection for Arizona.

GRASSLANDS OF NATIONAL FOREST SYSTEMS New Mexico, Oklahoma, and Texas

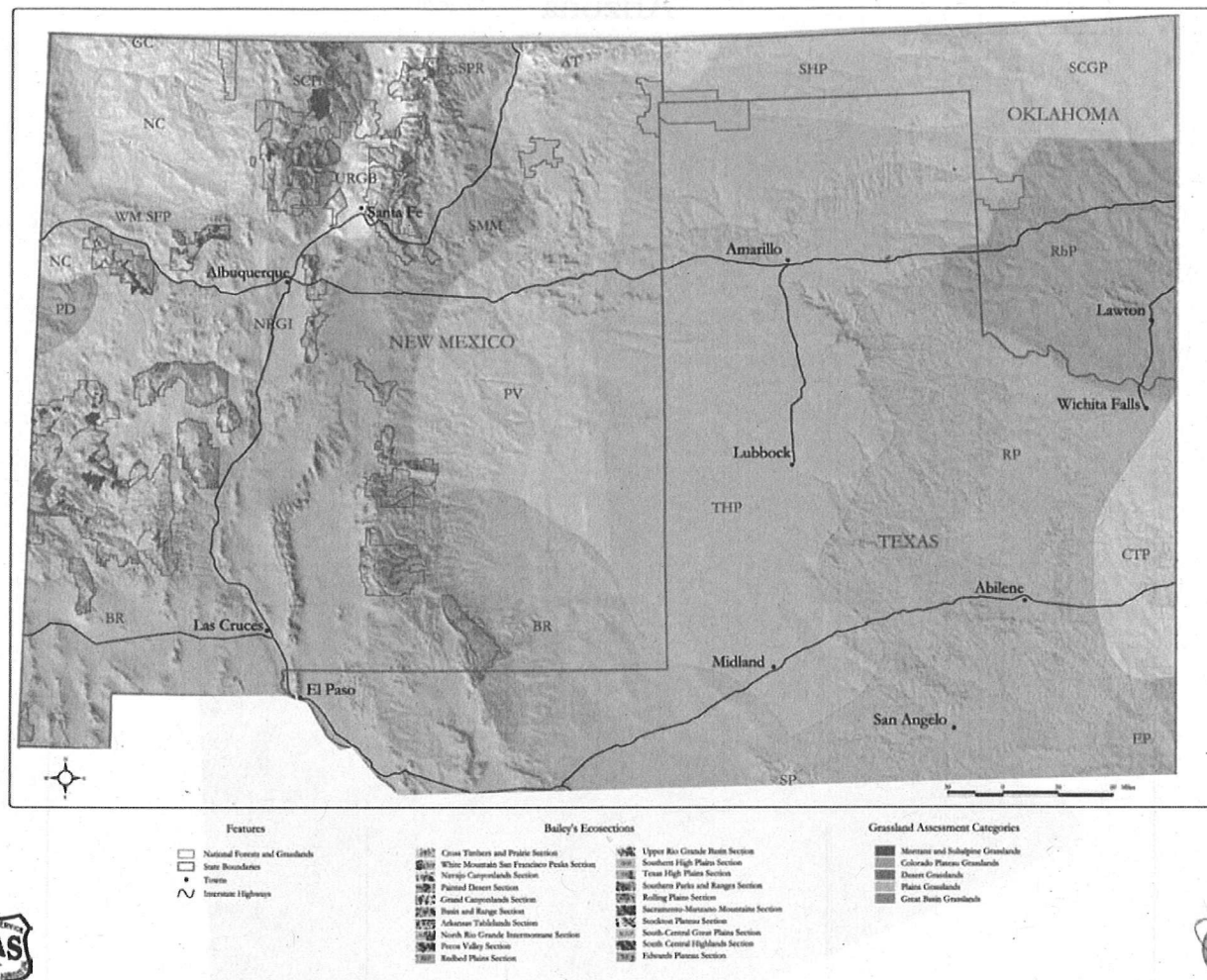


Figure 2-3.—Grasslands assessment category by National Forest and ecosection for New Mexico, Oklahoma, and Texas.

Table 2-1. Crosswalk of grassland assessment categories, Arizona and New Mexico GAP landcover classes and general terrestrial ecosystem survey vegetation categories.

Grassland assessment categories	Arizona GAP landcover classes	New Mexico GAP landcover classes	General terrestrial ecosystem survey vegetation classes
Montane	Rocky Mountain-Great Basin Dry Meadow	Rocky Mountain Alpine Forb Tundra Grasslands Rocky Mountain Alpine Graminoid Tundra Grasslands Rocky Mountain Subalpine and Montane Grasslands	<i>Kobresia myosuroides</i> <i>Festuca thurberi</i> <i>Festuca arizonica</i> <i>Bromus anomalus</i> <i>Poa pratensis</i>
Colorado Plateau	Great Basin Mixed Grass Great Basin Grass-Mixed shrub Great Basin Grass-Mormon tea Great Basin Grass- Saltbush Great Basin Riparian/Sacaton Grass scrub Great Basin Riparian/Wet Mountain Meadow Great Basin Sagebrush-Mixed Grass- Mixed Scrub Great Basin Shadscale-Mixed Grass-Mixed Scrub	Great Basin Foothill-Piedmont Grassland Great Basin Lowland/Swale Grassland Shortgrass Steppe	<i>Artemisia tridentata</i> <i>Bouteloua gracilis</i> <i>Hesperostipa neomexicana</i> <i>Pleuraphis jamesii</i>
Great Basin	Semidesert Mixed Grass-mesquite Semidesert Mixed Grass- mixed scrub Semidesert Mixed Grass- Yucca-Agave Semidesert Tobosa Grass Scrub	Great Basin Foothills-Piedmont Grassland Great Basin Lowland/ Swale Grassland	<i>Bouteloua curtipendula</i>
Plains	Not described	Midgrass prairie Shortgrass steppe	Not described
Desert	Sonoran Paloverde-Mixed Cacti Semidesert Grassland	Chihuahuan Foothill-Piedmont Desert Grassland Chihuahuan Lowland/ Swale Desert Grassland	<i>Prosopis glandulosa</i> <i>Prosopis velutina</i>