

# **AN IDENTIFICATION OF PRAIRIE IN NATIONAL PARK UNITS IN THE GREAT PLAINS**



**NATIONAL PARK SERVICE OCCASIONAL PAPER NO. 7  
U.S. DEPARTMENT OF THE INTERIOR**

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AN IDENTIFICATION OF PRAIRIE  
IN NATIONAL PARK UNITS  
IN THE GREAT PLAINS

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PRAIRIE IS:

"....much more than land covered with grass. It is a slowly evolved, highly complex organic entity, centuries old. It approaches the eternal...."

"Each grass-covered hillside is a page on which is written the history of the past, conditions of the present, and predictions of the future. Some see without understanding; but let us look closely and understandingly, and act wisely."

Dr. J. E. Weaver

North American Prairie (1954)



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## ABSTRACT

Beginning in summer 1982, the Midwest, Southwest, and Rocky Mountain Regions of the National Park Service initiated a survey of prairie in national parks in the Great Plains. The purposes of the survey were to identify parks with prairie; to determine type, acreage, and condition of the prairies; and to identify and consolidate information on prairie management into references and guidelines useful to park resource managers. For the purposes of this survey, the Great Plains is broadly defined as the area of grassland extending from the Canadian to the Mexican borders and from the foothills of the Rocky Mountains to western Indiana. Survey results show that 32 parks within this area have prairie totalling about 117,000 ha. Approximately 1,200 ha of tallgrass, 94,000 ha of mixed grass, and 810 ha of shortgrass prairie are included. Ten of the 32 parks have restored prairie. For each of the 32 parks surveyed, additional information has been collected on current vegetation, past management, and adjacent land use. An annotated bibliography of research conducted in each park also has been assembled.

## INTRODUCTION

The purpose of this report is to provide a basic literature reference on prairie within National Park Service units in the Great Plains. It contains three sections. The first section describes the various prairie vegetation types as classified by Kuchler (1964). The second section includes information on prairies in each of 32 parks in the Great Plains (Figure 1). The third section provides a bibliographic list of prairie studies that will be of use to National Park Service managers, planners and scientists.

For the purpose of this study, the Great Plains is broadly defined as the areas of grassland extending from the Canadian to the Mexican borders and from the foothills of the Rocky Mountains to western Indiana. The eastern portions of this area are sometimes referred to as the Prairie Peninsula while southwestern areas may be referred to as the Llano Estacado. The area includes several types of grasslands (Figure 2).

Prairie is a complex vegetation type that has been defined and described in many ways. For the purposes of this report, it is broadly defined as a natural plant community that is dominated by grasses. Potential prairie will include areas undergoing succession towards prairie and areas that could develop towards prairie with proper management.

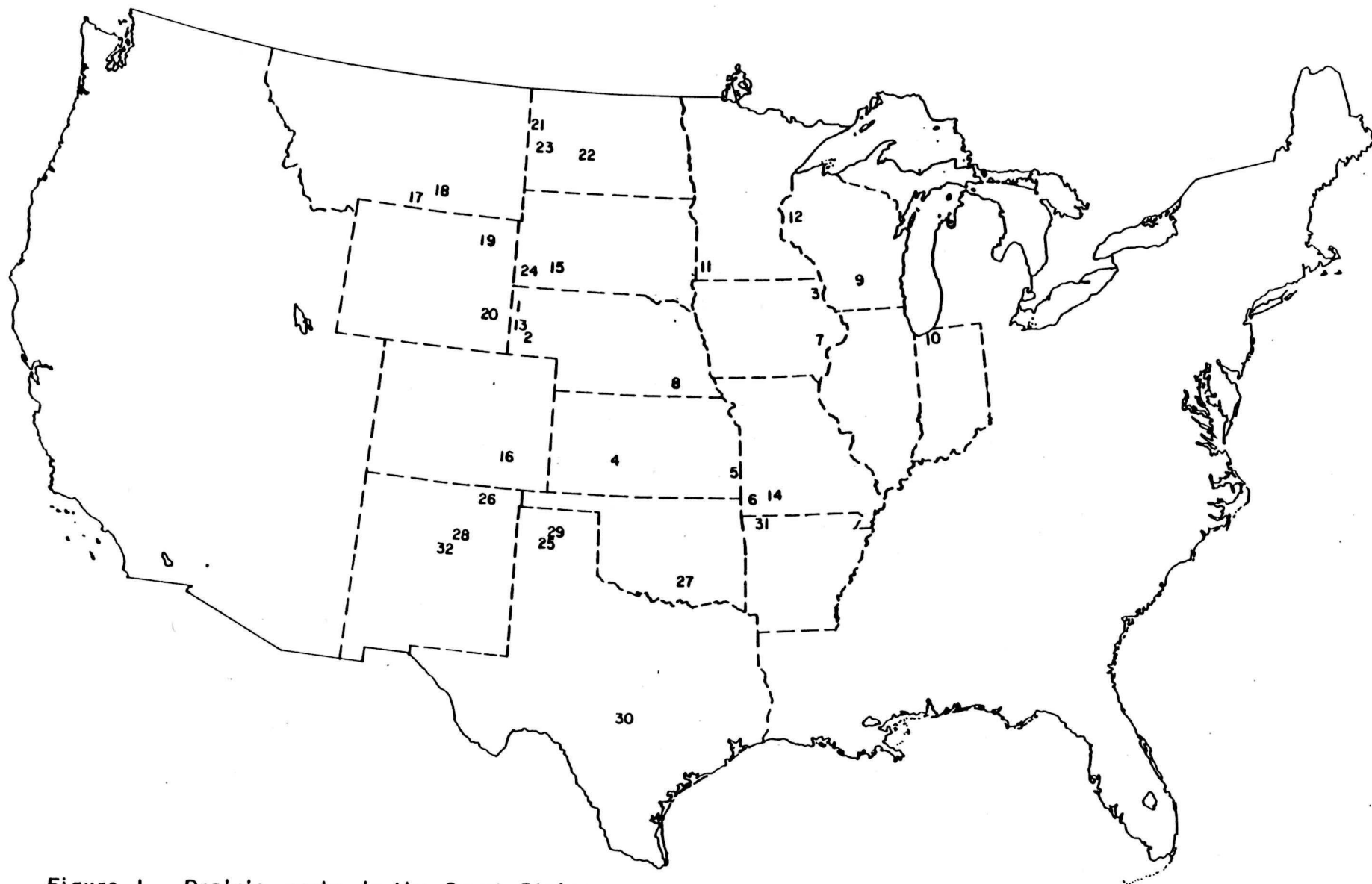


Figure 1. Prairie parks in the Great Plains.

## Legend for Figure 1

## Midwest Region:

- 1- Agate Fossil Beds National Monument (AGFO)
- 2- Chimney Rock National Historic Site (CHRO)
- 3- Effigy Mounds National Monument (EFMO)
- 4- Fort Larned National Historic Site (FOLS)
- 5- Fort Scott National Historic Site (FOSC)
- 6- George Washington Carver National Monument (GWCA)
- 7- Herbert Hoover National Historic Site (HEHO)
- 8- Homestead National Monument of America (HOME)
- 9- Ice Age National Scientific Reserve (ICAG)
- 10- Indiana Dunes National Lakeshore (INDU)
- 11- Pipestone National Monument (PIPE)
- 12- Saint Croix National Scenic Riverway (SACN)
- 13- Scotts Bluff National Monument (SCBL)
- 14- Wilson's Creek National Battlefield (WICR)

## Rocky Mountain Region:

- 15- Badlands National Park (BADL)
- 16- Bent's Old Fort National Historic Site (BEOL)
- 17- Bighorn Canyon National Recreation Area (BICA)
- 18- Custer Battlefield National Monument (CUST)
- 19- Devils Tower National Monument (DETO)
- 20- Fort Laramie National Historic Site (FOLA)
- 21- Fort Union Trading Post National Historic Site (FOUS)
- 22- Knife River Indian Villages National Historic Site (KNRI)
- 23- Theodore Roosevelt National Park (THRO)
- 24- Wind Cave National Park (WICA)

## Southwest Region:

- 25- Alibates Flint Quarries National Monument (ALFL)
- 26- Capulin Mountain National Monument (CAMO)
- 27- Chickasaw National Recreation Area (CHIC)
- 28- Fort Union National Monument (FOUN)
- 29- Lake Meredith Recreation Area (LAMR)
- 30- Lyndon B. Johnson National Historical Park (LYJO)
- 31- Pea Ridge National Military Park (PERI)
- 32- Pecos National Monument (PECO)



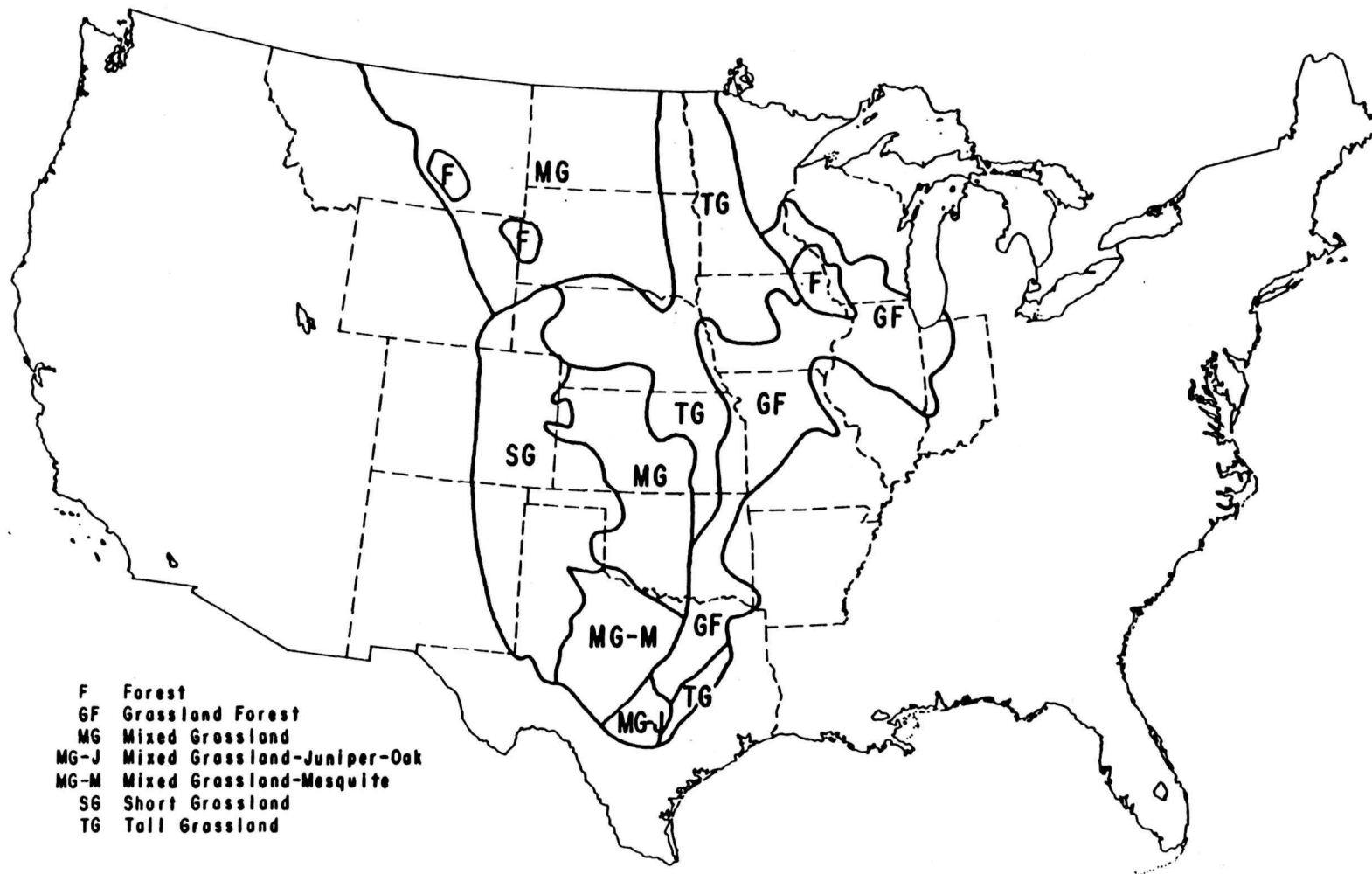


Figure 2. Prairie and grassland types in the central United States.

These definitions are purposely broad. The importance of plants other than grasses must be recognized. Topography cannot be totally ignored. Prairies do not have to be natural to fit these definitions. They could be areas seeded to native species which are developing towards a prairie climax.

Prairies evolved under and continue to be influenced by many environmental factors. Climatic factors such as temperature, humidity, etc. influence vegetation. The most important climatic factor is precipitation. Water is the most limiting factor on prairies, and precipitation, therefore, directly controls the type of vegetation a site will support. The eastern prairie areas obtain enough precipitation to support forests. Fire, the pyric factor, was responsible for maintaining the prairie vegetation because grasses and forbs are adapted to fire while woody vegetation is not. Physiographic factors, such as topography, locally influence vegetation. In addition, some ecologists feel that prairie can only be located on flat to rolling lands. Edaphic factors may control which species occur in an area. Fertility of the soil is directly related to the productive capacity of the area. Some important species are seldom found on coarse textured soils, such as sands. Others may be only found on sands. Soil texture and structure are also related to water infiltration and

water-holding capacity. Biotic factors influence the distribution of plants. A broad spectrum of living organisms are found in prairies. The presence or absence of certain organisms may directly influence the rate of succession. The final consideration is the anthropic factor. Man's activities are responsible for deterioration of many prairies. On the other hand, man has restored prairies that were previously destroyed or degraded. Prairies evolved over thousands of years with little influence from man. Now, the future of prairies is in the hands of man. Man must understand the other factors and know how to manipulate them if he is to become an effective prairie manager.

#### Section One

Section One includes descriptions of all of Kuchler's vegetation types represented in the 32 national park units. Descriptions were taken directly from Kuchler (1964). Both common and scientific names of plants are given. Plant nomenclature generally follows Kartesz and Kartesz (1980). Common names generally follow the Nebraska Statewide Arboretum (1982) and Stubbendieck, et al. (1986).

#### Section Two

The information presented in Section Two was taken from published and unpublished National Park Service reports and from additional material furnished by National Park Service personnel. Following a brief introduction, size of the

prairie is given. In most cases, the exact size is known. The prairie size for some parks, especially large parks, is only estimated.

Kuchler's classification map (Kuchler 1964) was used to type each park's potential natural vegetation. The Kuchler vegetation type number and descriptive title is given. The reader should refer back to Kuchler's vegetation types to obtain a description of the presettlement climax vegetation.

The subsection entitled, "Present Vegetation and Prairie Management History" includes a brief description of past management. In most cases, management has not been uniform across the whole unit, and differences between management within a unit are also outlined. Current vegetation and its condition are given when known. The next subsection entitled, "Land Use and Vegetation Within One Mile of the Park Boundary," indicates differences between park resources and those outside of park boundaries.

The following subsection, "Prairie Research," is an annotated bibliography of research conducted in the park. Literature citations are given if the research has been published. Additional sources of information used in preparation of the park report are listed in the General References section.

Maps are included for all of the parks. Prairie areas are designated on the maps, except for the large parks. In

these instances, a land classification or similar map is included.

A set of Summary Tables concludes Section Two. These tables include information on acreages, Kuchler's vegetation types, management history, and land use within one mile of the park boundaries.

### Section Three

The third section contains a bibliographic list of prairie studies that were conducted outside of National Park Service units. These literature citations are arranged alphabetically and are identified by key words. Most of the cited research was conducted in the Great Plains but applicable work from other areas was included.

SECTION ONE  
KUCHLER VEGETATION TYPES

EASTERN PONDEROSA FOREST (Map No. 16)<sup>1</sup>

Pinus

This is a medium dense to open forest of low to medium needleleaf evergreen trees with a fairly open ground cover of grasses. The dominant species is ponderosa pine (Pinus ponderosa). Other components are western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis), and needleandthread (Stipa comata).

BLACK HILLS PINE FOREST (Map No. 17)

Pinus

This type is characterized by dense to open forests of medium tall to tall needleleaf evergreen trees. On lower elevations the forest is open with much grass and an admixture of broadleaf deciduous trees in the east and shrubs in the western part. The dominant species is ponderosa pine (Pinus ponderosa). Other components include bearberry (Arctostaphylos uva-ursi), wildryes (Elymus spp.), common juniper (Juniperus communis), Kentucky bluegrass (Poa

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<sup>1</sup>Refers to map accompanying "Potential Natural Vegetation of the Conterminous United States" (Kuchler 1964).

pratensis), common chokeberry (Prunus americana), common snowberry (Symphoricarpos albus), western snowberry (Symphoricarpos occidentalis), western wheatgrass (Agropyron smithii), bluebunch wheatgrass (Agropyron spicatum), blue grama (Bouteloua gracilis), threadleaf sedge (Carex filifolia), prairie junegrass (Koeleria pyramidata), and needleandthread (Stipa comata).

#### JUNIPER-PINYON WOODLAND (Map No. 23)

##### Juniperus-Pinus

This type is characterized by open groves of needleleaf low trees with varying admixtures of shrubs and herbaceous plants. The dominant species are one-seed juniper (Juniperus monosperma), Utah juniper (Juniperus osteosperma), and pinyon pine (Pinus edulis). Other components include western wheatgrass (Agropyron smithii), sideoats grama (Bouteloua curtipendula), blue grama (Bouteloua gracilis), ceanothus (Ceanothus spp.), mountain mahoganies (Cercocarpus spp.), apache plume (Fallugia paradoxa), western juniper (Juniperus occidentalis), Indian ricegrass (Oryzopsis hymenoides), antelope bitterbrush (Purshia tridentata), oaks (Quercus spp.), and sand dropseed (Sporobolus cryptandrus).

## SALTBUSH-GREASEWOOD (Map No. 40)

Atriplex-Sarcobatus

The saltbush-greasewood vegetation type has open stands of low shrubs and dwarf shrubs. The dominants are shadscale (Atriplex confertifolia) and greasewood (Sarcobatus vermiculatus). Other components include budsage (Artemisia spinescens), saltbushes (Atriplex spp.), inland saltgrass (Distichlis spicata), winterfat (Ceratoides lanata), spiny hopsage (Grayia spinosa), greenmoly summercypress (Kochia americana), and seepweed (Suaeda torreyana).

## GRAMA-GALLETA STEPPE (Map No. 53)

Bouteloua-Hilaria

This type is a low to medium tall grassland with a few woody plants. The dominants are blue grama (Bouteloua gracilis) and galleta (Hilaria jamesii). Other components include sand bluestem (Andropogon hallii), little bluestem (Schizachyrium scoparium), big sagebrush (Artemisia tridentata), sideoats grama (Bouteloua curtipendula), hairy grama (Bouteloua hirsuta), green ephedra (Ephedra viridis), whipple cactus (Opuntia whipplei), indian ricegrass (Oryzopsis hymenoides), horsebrushes (Tetradymia spp.), and small soapweed (Yucca glauca).



## SAGEBRUSH-STEPPE (Map No. 55)

Artemisia-Agropyron

This type is a dense to open grassland with dense to open shrub synusia. The dominants are bluebunch wheatgrass (Agropyron spicatum) and big sagebush (Artemisia tridentata). Other components include black sagebrush (Artemisia nova), arrowleaf balsamroot (Balsamorhiza sagittata), Idaho fescue (Festuca idahoensis), gromwells (Lithospermum spp.), lupines (Lupinus spp.), indian ricegrass (Oryzopsis hymenoides), phloxes (Phlox spp.), bluegrasses (Poa spp.), antelope bitterbrush (Purshia tridentata), and squirreltails (Sitanion spp.)

## FOOTHILLS PRAIRIE (Map No. 63)

Agropyron-Festuca-Stipa

The Foothills Prairie is an open to fairly dense grassland of usually rather short grasses. The dominant plants are bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca idahoensis), rough fescue (Festuca scabrella), and needleandthread (Stipa comata). Other components include western yarrow (Achillea millefolium), western wheatgrass (Agropyron smithii), fringed sagewort (Artemisia frigida), blue grama (Bouteloua gracilis), threadleaf sedge (Carex filifolia), eriogonums (Eriogonum

spp.), prairie junegrass (Koeleria pyramidata), penstemons (Penstemon spp.), and sandberg bluegrass (Poa sandbergii).

#### GRAMA-NEEDLEGRASS-WHEATGRASS (Map No. 64)

##### Bouteloua-Stipa-Agropyron

This is a rather short, open to fairly dense grassland. The dominants are western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis), and needleandthread (Stipa comata). Other components include bluebunch wheatgrass (Agropyron spicatum), fringed sagewort (Artemisia frigida), threadleaf sedge (Carex filifolia), hairy goldaster (Chrysopsis villosa), prairie junegrass (Koeleria pyramidata), dotted gayfeather (Liatris punctata), plains muhly (Muhlenbergia cuspidata), sandberg bluegrass (Poa sandbergii), little bluestem (Schizachyrium scoparium), sand dropseed (Sporobolus cryptandrus), green needlegrass (Stipa viridula), and broom snakeweed (Xanthocephalum sarothrae).

#### GRAMA-BUFFALOGRASS (Map No. 65)

##### Bouteloua-Buchloe

This is a fairly dense grassland of primarily short grasses. The dominants are blue grama (Bouteloua gracilis) and buffalograss (Buchloe dactyloides). Other components

include western wheatgrass (Agropyron smithii), red threeawn (Aristida purpurea), hairy grama (Bouteloua hirsuta), scarlet gaura (Gaura coccinea), curlycup gumweed (Grindelia squarrosa), ironplant (Haploppus spinulosus), prickly pears (Opuntia spp.), woolly plantain (Plantago patagonica), slimflower scurfpea (Psoralea tenuiflora), upright prairieconeflower (Ratibida columinifera), senecios (Senecio spp.), scarlet globemallow (Sphaeralcea coccinea), sand dropseed (Sporobolus cryptandrus), and small soapweed (Yucca glauca).

#### WHEATGRASS-NEEDLEGRASS (Map No. 66)

##### Agropyron-Stipa

This is a moderately dense, short or medium tall grassland. The dominants are western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis), needleandthread (Stipa comata), and green needlegrass (Stipa viridula). Other components include slender wheatgrass (Agropyron trachycaulum), pussytoes (Antennaria spp.), fringed sagewort (Artemisia frigida), sedges (Carex spp.), prairie junegrass (Koeleria pyramidata), forget-me-nots (Mertensia spp.), indian ricegrass (Oryzopsis hymenoides), penstemons (Penstemon spp.), little bluestem (Schizachyrium scoparium), silky wormwood (Artemisia dracunculus), cudweed sagewort

(Artemisia ludoviciana), heath aster (Aster ericoides), black samson (Echinacea angustifolia), dotted gayfeather (Liatris punctata), silverleaf scurfpea (Psoralea argophylla), goldenrods (Solidago spp.), and porcupinegrass (Stipa spartea).

#### WHEATGRASS-GRAMA-BUFFALO GRASS (Map No. 68)

##### Agropyron-Bouteloua-Buchloe

This vegetation type is composed of short to medium grasses with occasional needleleaf evergreen shrubs or small trees. The dominants are western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis), and buffalograss (Buchloe dactyloides). Other components include fringed sagewort (Artemisia frigida), heath aster (Aster ericoides), sideoats grama (Bouteloua curtipendula), sedges (Carex spp.), black samson (Echinacea angustifolia), junipers (Juniperus spp.), dotted gayfeather (Liatris punctata), little bluestem (Schizachyrium scoparium), goldenrods (Solidago spp.), and needleandthread (Stipa comata).

#### BLUESTEM-GRAMA PRAIRIE (Map No. 69)

##### Andropogon-Bouteloua

The Bluestem-Grama Prairie is a dense, medium tall grassland with many forbs. The dominants are little bluestem

(Schizachyrium scoparium), sideoats grama (Bouteloua curtipendula), and blue grama (Bouteloua gracilis). Other components include western wheatgrass (Agropyron smithii), western ragweed (Ambrosia psilostachya), leadplant (Amorpha canescens), big bluestem (Andropogon gerardii), buffalograss (Buchloe dactyloides), fremont clematis (Clematis fremontii), slender dalea (Dalea enneandra), black samson (Echinacea angustifolia), western wallflower (Erysimum asperum), rough pennyroyal (Hedeoma hispida), dotted gayfeather (Liatris punctata), evening primrose (Oenothera serrulata), switchgrass (Panicum virgatum), james nailwort (Paronychia jamesii), slimflower scurfpea (Psoralea tenuiflora), resinous skullcap (Scutellaria resinosa), indianguass (Sorghastrum nutans), tall dropseed (Sporobolus asper), and stenosisiphon (Stenosiphon linifolius).

#### SANDSAGE-BLUESTEM PRAIRIE (Map No. 70)

##### Artemisia-Andropogon

The Sandsage-Bluestem Prairie is a medium tall, medium dense grassland with a strong element of dwarf shrubs. The dominant plants are little bluestem (Schizachyrium scoparium), sand bluestem (Andropogon hallii), sand sagebrush (Artemisia filifolia), and hairy grama (Bouteloua hirsuta). Other components include blue grama (Bouteloua gracilis),

buffalograss (Buchloe dactyloides), prairie sandreed (Calamovilfa longifolia), sand lovegrass (Eragrostis trichodes), prairie sunflower (Helianthus petiolaris), foxtail barley (Hordeum jubatum), switchgrass (Panicum virgatum), blowoutgrass (Redfieldia flexuosa), sand dropseed (Sporobolus cryptandrus), needleandthread (Stipa comata), and small soapweed (Yucca glauca).

SHINNERY (Map No. 71)

Quercus-Andropogon

This is a midgrass prairie with open to dense broadleaf deciduous shrubs and occasional needleleaf low trees or shrubs. The dominant plants are little bluestem (Schizachyrium scoparium) and shin oak (Quercus mohriana). Other components include acacias (Acacia spp.), sand bluestem (Andropogon hallii), sand sagebrush (Artemisia filifolia), blue grama (Bouteloua gracilis), hairy grama (Bouteloua hirsuta), buffalograss (Buchloe dactyloides), netleaf hackberry (Celtis reticulata), sandburs (Cenchrus spp.), annual eriogonum (Eriogonum annuum), one-seed juniper (Juniperus monosperma), honey mesquite (Prosopis glandulosa), chicksaw plum (Prunus angustifolia), havard oak (Quercus havardii), fragrant sumac (Rhus aromatica), skunkbrush sumac (Rhus trilobata), indiagrass (Sorghastrum nutans), sand

dropseed (Sporobolus cryptandrus), and small soapweed (Yucca glauca).

#### BLUESTEM PRAIRIE (Map No. 74)

##### Andropogon-Panicum-Sorghastrum

The Bluestem Prairie is characterized by dense vegetation of tall grasses and many forbs. The dominants include big bluestem (Andropogon gerardii), little bluestem (Schizachyrium scoparium), switchgrass (Panicum virgatum), and indiangrass (Sorghastrum nutans). Other common components are leadplant (Amorpha canescens), field pussytoes (Antennaria neglecta), heath aster (Aster ericoides), blue aster (Aster laevis), Atlantic wildindigo (Baptisia leucantha), plains indigo (Baptisia leucophaea), sideoats grama (Bouteloua curtipendula), daisy fleabane (Erigeron strigosus), small bedstraw (Galium trifidum), sawtooth sunflower (Helianthus grosseserratus), prairie junegrass (Koeleria pyramidata), rough gayfeather (Liatris aspera), dotted gayfeather (Liatris punctata), scaly gayfeather (Liatris glabrata), leiberg panicum (Panicum leibergii), prairie phlox (Phlox pilosa), silverleaf scurfpea (Psoralea argophylla), slimflower scurfpea (Psoralea tenuiflora), upright prairieconeflower (Ratibida columnifera), grayhead prairieconeflower (Ratibida pinnata), wild rose (Rosa

arkansana), compassplant (Silphium laciniatum), goldenrods (Solidago spp.), prairie dropseed (Sporobolus heterolepsis), and porcupinegrass (Stipa spartea).

#### CROSS TIMBERS (Map NO. 84)

##### Quercus-Andropogon

This type is characterized by medium tall grass with broadleaf deciduous trees scattered singly or in extensive groves. The dominants are blackjack oak (Quercus marilandica), post oak (Quercus stellata), and little bluestem (Schizachyrium scoparium). Other species include big bluestem (Andropogon gerardii), sideoats grama (Bouteloua curtipendula), hairy grama (Bouteloua hirsuta), black hickory (Carya texana), hackberries (Celtis spp.), Canada wildrye (Elymus canadensis), purple lovegrass (Eragrostis spectabilis), sand lovegrass (Eragrostis trichodes), switchgrass (Panicum virgatum), indiagrass (Sorghastrum nutans), tall dropseed (Sporobolus asper), and Texas wintergrass (Stipa leucotricha).

#### JUNIPER-OAK-SAVANNA (Map No. 86)

##### Juniperus-Quercus-Andropogon

This vegetation type is classified as a savanna with a dense to very open canopy of broadleaf deciduous and



evergreen low trees and shrubs and needleleaf evergreen low trees and shrubs. The dominants are little bluestem (Schizachyrium scoaparium), ashe juniper (Juniperus ashei), and live oak (Quercus virginiana). Other components include big bluestem (Andropogon gerardii), reverchon threeawn (Aristida glauca), red threeawn (Aristida purpurea), intermediate threeawn (Aristida intermedia), sideoats grama (Bouteloua curtipendula), hairy grama (Bouteloua hirsuta), buffalograss (Buchloe dactyloides), redbud (Cercis canadensis), curly mesquite (Hilaria belangeri), green sprangletop (Leptochloa dubia), vine mesquite (Panicum obtusum), durand oak (Quercus durandii), shumard oak (Quercus shumardii), indiagrass (Sorghastrum nutans), tall dropseed (Sporobolus asper), and hairy tridens (Tridens pilosus).

#### NORTHERN FLOODPLAIN FOREST (Map No. 98)

##### Populus-Salix-Ulmus

This is a low to tall broadleaf deciduous forest, open to dense, often with lianas. The dominants are eastern cottonwood (Populus deltoides), black willow (Salix nigra), and American elm (Ulmus americana). Other components include boxelder (Acer negundo), red maple (Acer rubrum), sugar maple (Acer saccharinum), American bittersweet (Celastrus scandens), hackberry (Celtis occidentalis), white ash

(Fraxinus americana), green ash (Fraxinus pennsylvanica), honeylocust (Gleditsia triacanthos), black walnut (Juglans nigra), Virginia creeper (Parthenocissus quinquefolia), American sycamore (Platanus occidentalis), plains cottonwood (Populus deltoides var. occidentalis), poison ivy (Rhus radicans), peachleaf willow (Salix amygdaloides), sandbar willow (Salix interior), bristly greenbriar (Smilax hispida), buckbrush (Symphoricarpos orbiculatus) and red elm (Ulmus rubra).

#### MAPLE-BASSWOOD FOREST (Map No. 99)

##### Acer-Tilia

This vegetation type is a medium tall, broadleaf deciduous forest. The dominants are sugar maple (Acer saccharinum) and American basswood (Tilia americana). Other components include boxelder (Acer negundo), bitternut hickory (Carya cordiformis), green ash (Fraxinus pennsylvanica), American hophornbean (Ostrya virginiana), bur oak (Quercus macrocarpa), red oak (Quercus rubra), American elm (Ulmus americana), and red elm (Ulmus rubra).

#### OAK-HICKORY FOREST (Map No. 100)

##### Quercus-Carya

This is a medium tall to tall broadleaf deciduous forest. The dominants are bitternut hickory (Carya

cordiformis), shagbark hickory (Carya ovata), white oak (Quercus alba), red oak (Quercus rubra), and black oak (Quercus velutina). Other components include pignut hickory (Carya glabra), white ash (Fraxinus americana), black walnut (Juglans nigra), black cherry (Prunus serotina), chinkapin oak (Quercus muhlenbergii), American basswood (Tilia americana), and American elm (Ulmus americana).

#### NORTHERN HARDWOODS (Map No. 106)

##### Acer-Betula-Fagus-Tsuga

This is a tall, broadleaf deciduous forest with an admixture of needleleaf evergreen trees. The dominants are sugar maple (Acer saccharinum), yellow birch (Betula alleghaniensis), beech (Fagus grandifolia), and hemlock (Tsuga canadensis). Other components are striped maple (Acer pensylvanicum), red maple (Acer rubrum), mountain maple (Acer spicatum), white ash (Fraxinus americana), mountain laurel (Kalmia latifolia), eastern white pine (Pinus strobus), black cherry (Prunus serotina), American basswood (Tilia americana), and American elm (Ulmus americana).

SECTION TWO

IDENTIFICATION OF PRAIRIE  
IN NATIONAL PARK UNITS

## AGATE FOSSIL BEDS

## National Monument

## Nebraska

Agate Fossil Beds National Monument contains concentrations of animal fossils in beds of sedimentary rock, formed about 20 million years ago by the compression of mud, clay, and erosional materials. The beds, which acquired their name from their proximity to rock formations containing agates, are under prairie-covered hills. From the summits of Carnegie and University Hills, named by early collecting parties, one can look 200 feet (73 meters) down across grass-covered slopes to the narrow Niobrara River. The Niobrara Valley and surrounding prairie are also rich with American Indian and ranching history. The establishment of Agate Fossil Beds National Monument was authorized on June 5, 1965.

Agate Fossil Beds National Monument contains 3,055 acres (1,237 hectares), including the detached Stenomylus Quarry. Federal land totals 2,737.5 acres (1,108.3 hectares), and there are 317.7 acres (128.6 hectares) of nonfederal land. About 450 acres (182 hectares) is restricted to livestock use under scenic easement. A narrow corridor, estimated to contain no more than 300 acres (121 hectares) of floodplain with a marsh type of vegetation, occurs adjacent to the Niobrara River. Therefore, approximately 2,755 acres (1,115 hectares) are classified as prairie (Figure 3).

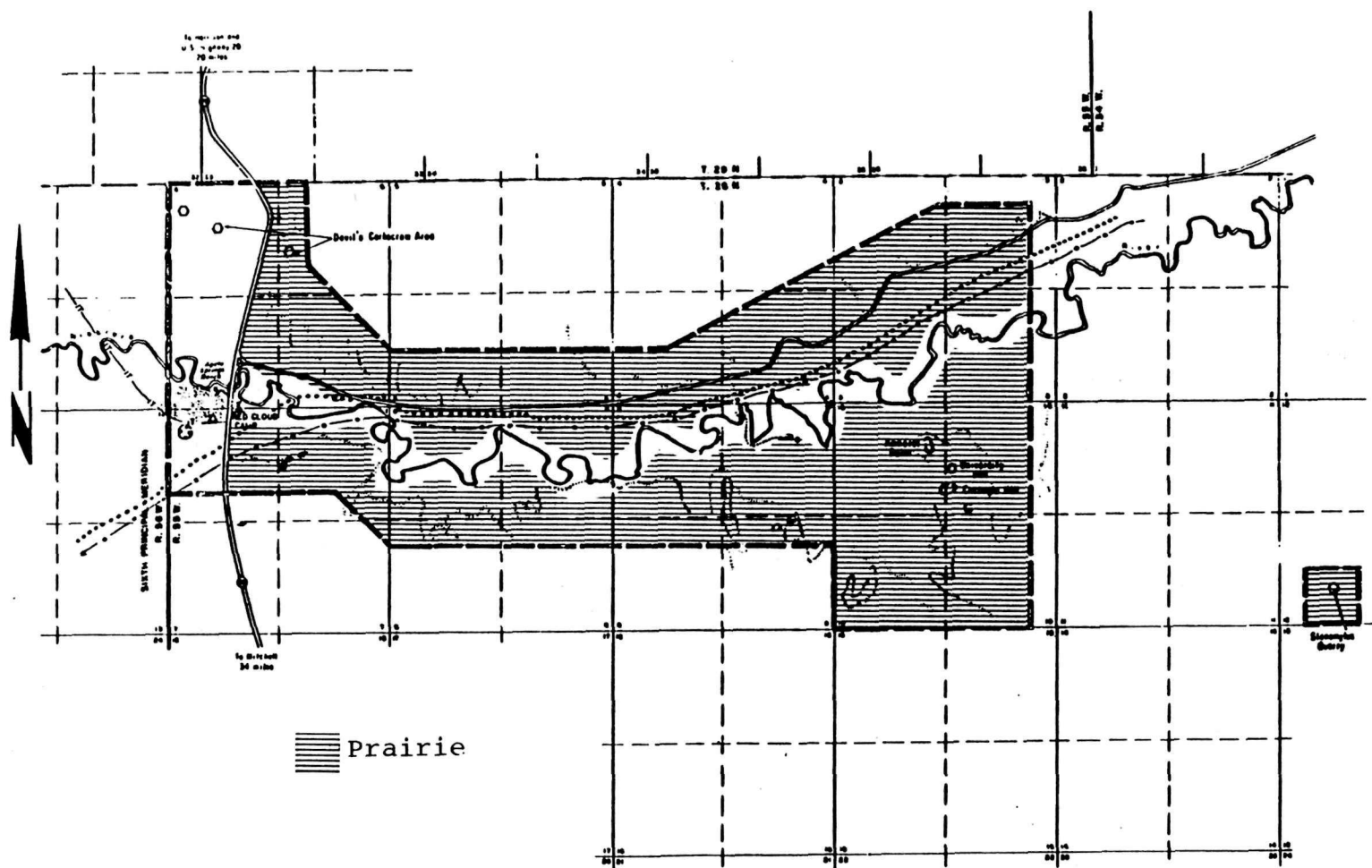


Figure 3. Prairie map, Agate Fossil Beds National Monument.

Kuchler Vegetation Type: Grama-Needlegrass-Wheatgrass  
(Bouteloua-Stipa-Agropyron) (Map  
No. 64)

Present Vegetation and Prairie Management History

Fire and grazing played important roles in the development of the prairie in this region. The area was moderately to heavily grazed by domestic livestock, primarily before the establishment of Agate Fossil Beds National Monument. The area has not been grazed since the mid-1960's, although the 450 acre (182 hectare) area under scenic easement is subject to livestock use.

Current vegetation is in excellent condition and is, therefore, similar to the historic climax plant communities. Primary species include needleandthread, blue grama, western wheatgrass, slender wheatgrass, prairie sandreed (Calamovilfa longifolia), indian ricegrass, rush skeletonplant (Lygodesmia juncea), fringed sagewort, and little bluestem. Sand dropseed, downy brome (Bromus tectorum), sunflowers (Helianthus spp.), sweet clovers (Melilotus spp.), and Rocky Mountain beeplant (Cleome serrulata) may be found on disturbed sites. Chokecherry (Prunus virginiana) and wild currants (Ribes spp.) are common shrubs.

A portion of the upper floodplain shows evidence of cultivation. Scattered plants of alfalfa (Medicago sativa)

are common. Other weedy species on formerly cultivated areas include Kentucky bluegrass (Poa pratensis), flodman thistle (Cirsium flodmani), and quackgrass (Agropyron repens).

#### Land Use and Vegetation Within One Mile of the Park Boundary

The area surrounding Agate Fossil Beds National Monument is classified as agricultural. Nearly all of the area is grazed by domestic livestock. Vegetation on the surrounding land is similar to that present within the boundary of the park.

#### Prairie Research

Dr. Ronald R. Weedon, Chadron State College, initiated a study of the vegetation of Agate Fossil Beds National Monument in 1983. A collection of vascular plants is being assembled, vegetation is being quantitatively sampled, and fixed point photographs are being made to document visual changes in the prairie.

Landers, Roger Q. 1975. A report on the status and management of native prairie areas in the National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa.

Dr. Landers described the prairie vegetation of Agate Fossil Beds and made management recommendations. He indicated that most the prairie was in excellent condition. The



exceptions were weedy areas near the former Hoffman Ranch and some of the upper floodplain areas.

#### General References

National Park Service. 1966. Master plan. Agate Fossil Beds National Monument/Nebraska. 33 pages.

National Park Service. 1976. Statement for management. Agate Fossil Beds National Monument/Nebraska. 12 pages.

National Park Service. 1978. Interpretive prospectus. Agate Fossil Beds National Monument/Nebraska. 21 pages.

CHIMNEY ROCK  
National Historic Site  
Nebraska

Chimney Rock was an important visual landmark for the mountain men on their seasonal travels in the early 1800's. It was named for its chimney-like shape in 1827. Its name and descriptions are found in the journals of hundreds of emigrants who crossed the plains in covered wagons. Its spire and solitary grandeur drew many travelers from the Oregon Trail who climbed to the tower and carved their names in the clay. The establishment of Chimney Rock National Historic Site was authorized on August 9, 1956. The State of Nebraska owns the site. It is jointly administered by the city of Bayard, the Nebraska State Historical Society, and the National Park Service. The National Park Service provides interpretive advice and professional assistance when requested. It does not manage the land resource.

The site is made up of 83.8 acres (34 hectares). Approximately 65 acres (26 hectares) are prairie, and the remaining 18 acres (7 hectares) are classified as badlands with little vegetation (Figure 4).

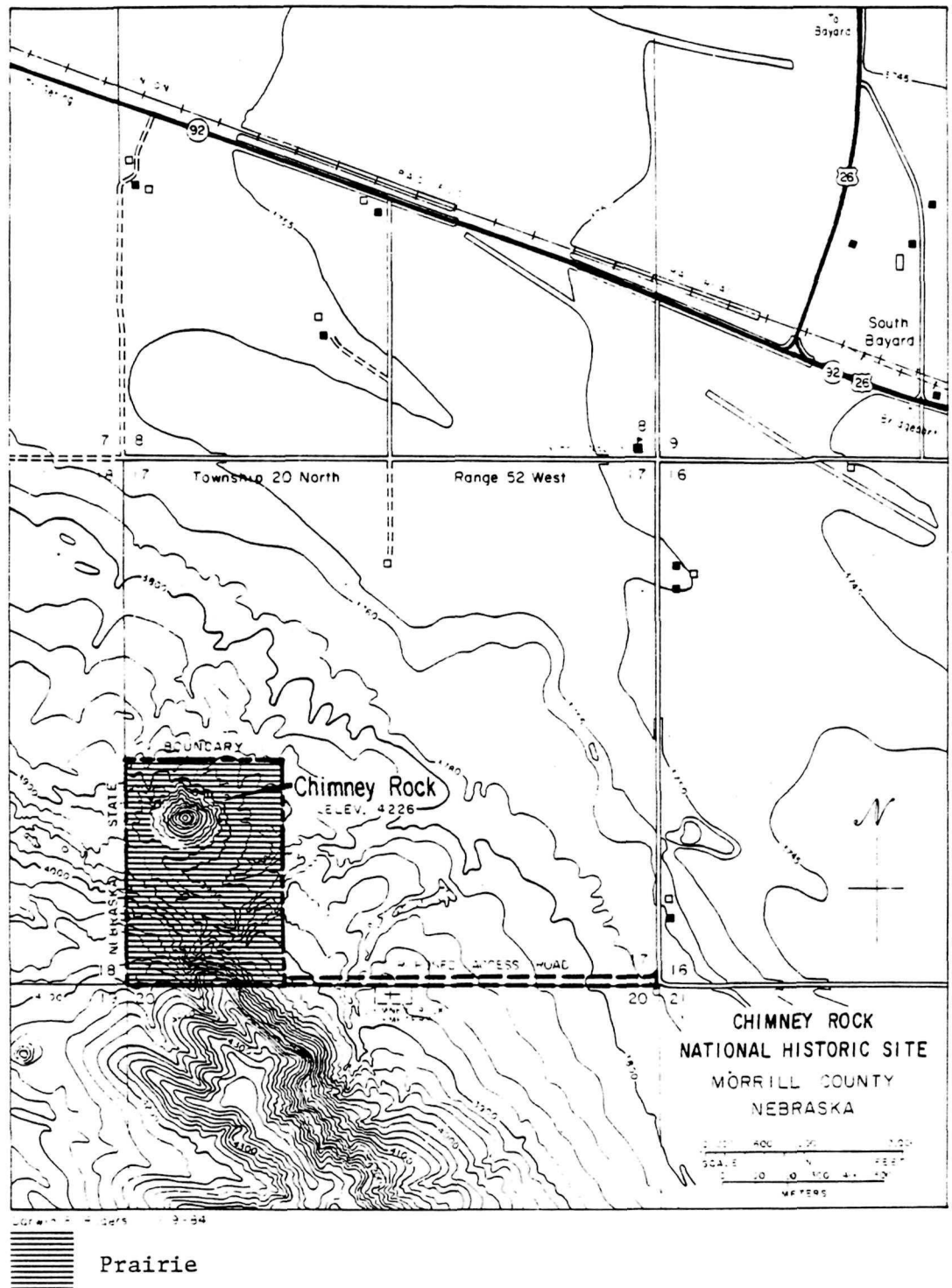


Figure 4. Prairie map, Chimney Rock National Historic Site.

Kuchler Vegetation Type: Grama-Buffer Grass

(Bouteloua-Buchloe) (Map No. 65)

Present Vegetation and Prairie Management History

The prairie on this site has never been plowed. Historically, it was heavily grazed by domestic livestock in a typical ranching program. Heavy grazing reduced or removed many of the taller species of plants, leaving a rather dense sod of short grasses. There has been no grazing in recent years. The primary grasses are blue grama and buffalograss. Other species include western wheatgrass, western ragweed (Ambrosia psilostachya), red threeawn, cudweed sagewort (Artemisia ludoviciana), sand sagebrush (Artemisia filifolia), annual erigonum (Erigonum annuum), scarlet gaura, senecios, sand dropseed, needleandthread (Stipa comata), and small soapweed. Protection from grazing is allowing some of the taller species to increase.

Land Use and Vegetation Within One Mile of the Park Boundary

All of the land surrounding Chimney Rock National Historic Site is classified as agricultural. The majority of the surrounding area remains in rangeland and is grazed by domestic livestock, primarily cattle. Some of the land is farmed. Prairie vegetation on grazed lands is similar to that within the boundaries of the park, but it is generally not in as good of condition.

### Prairie Research

No prairie research studies have been conducted at this location.

### General References

National Park Service. 1964. Chimney Rock National Historic Site/Nebraska. Brochure. 2 pages.

EFFIGY MOUNDS  
National Monument  
Iowa

Effigy Mounds National Monument was established to preserve Indian burial mounds in northeastern Iowa. Within the boundaries are 191 known prehistoric mounds. Twenty-nine are in the form of bear and bird effigies, and the remainder are conical or linear shaped. Effigy Mounds National Monument was established on August 10, 1949. Additional lands were added in 1951 and 1961 making a total of 1,474.6 acres (597 hectares), which is divided into three units. The main area is divided into the North Unit and the South Unit. About 120 acres (49 hectares) of the total is in the Sny Magill Unit which is located 11 miles (18 kilometers) south of the main units.

A prairie remnant of approximately 29 acres (12 hectares) is present in the South Unit (Figure 5). A small limestone outcrop and larger areas of old fields are present in the North Unit (Figure 6). The North Unit contains about 41 acres (17 hectares) within this category.

Kuchler Vegetation Type: A mosaic of Bluestem prairie  
(Andropogon-Panicum-Sorghastrum),  
Oak-Hickory Forest (Quercus-Carya),  
and Maple-Basswood Forest

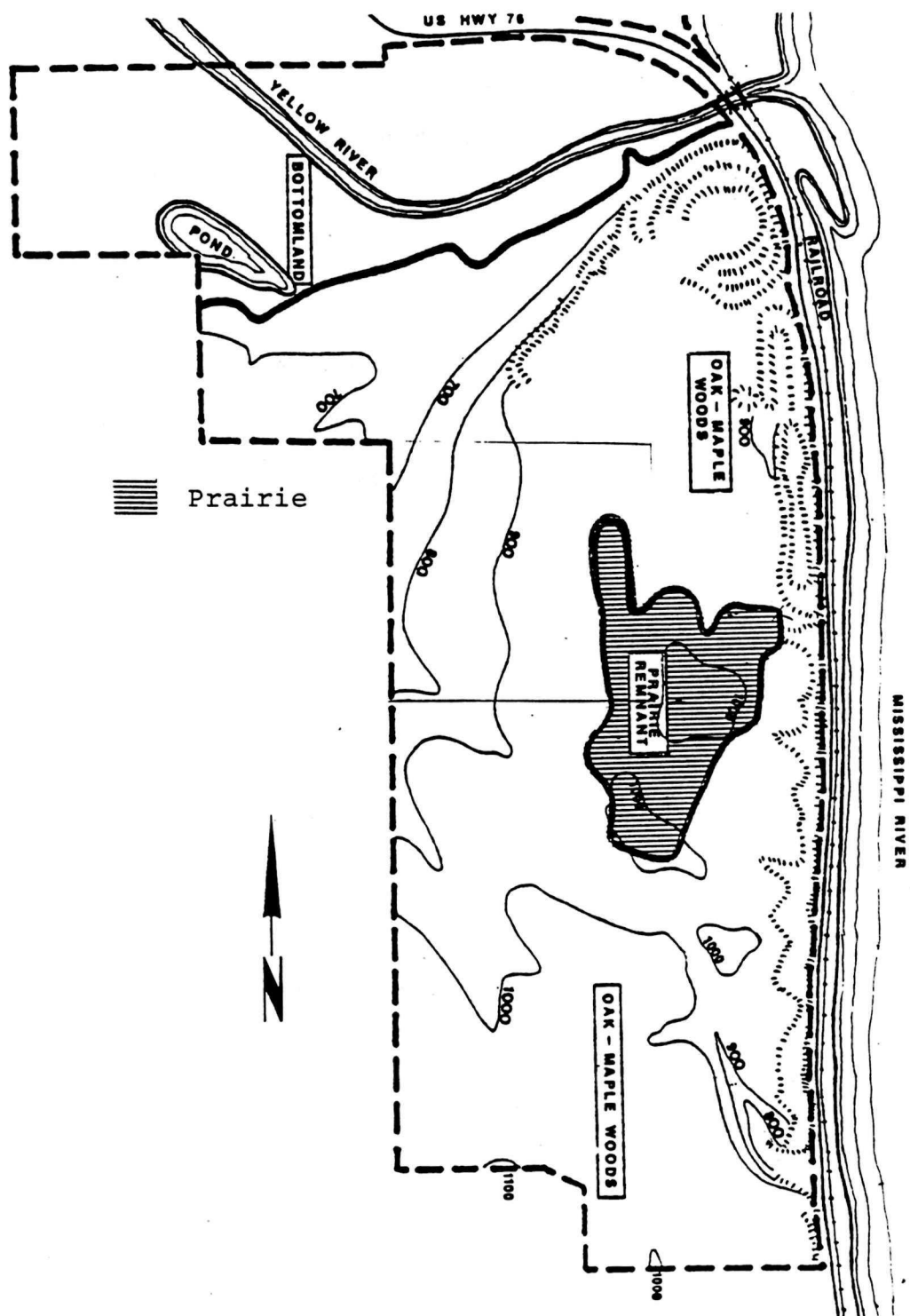


Figure 5. Prairie map, Effigy Mounds National Monument (South Unit).

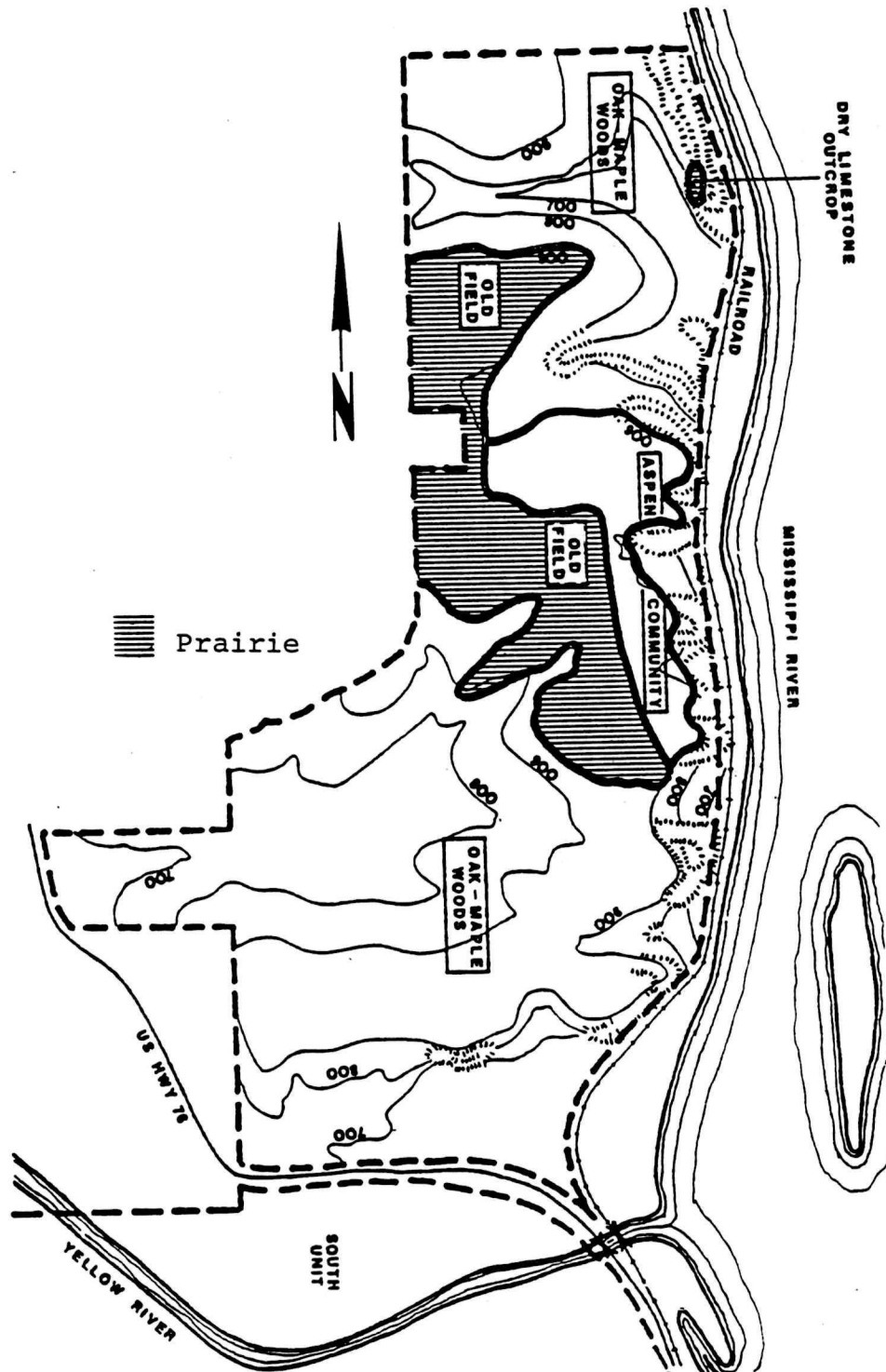


Figure 6. Prairie map, Effigy Mounds National Monument (North Unit).



(Acer-Tillia) (Map Nos. 74, 99, and 100)

The prairie remnant at Effigy Mounds National Monument would fit under the Bluestem Prairie vegetation type. Oak-Hickory Forest (Quercus-Carya) and Maple-Basswood Forest (Acer-Tillia) are common in the area.

#### Present Vegetation and Prairie Management History

The area was probably lumbered two or three times in the historic period. The oldest trees in the monument are only 60 to 70 years old. Level upland sites were cleared for farming. A complete removal of the forest for lumber occurred near the turn of this century. These areas are rapidly returning to trees, and much of the area has returned to dense forest cover. Historically, fires seldom occurred with enough force to damage the forest. However, fires commonly swept up the prairie openings and consumed trees on the ridges. Fire scars are evident on many of the old trees in the park, especially those adjacent to the prairie remnants and limestone outcroppings.

The level uplands in both the North and South Units were farmed until the 1940's and then allowed to revegetate naturally. Portions were grazed and mowed, but no attempt is currently being made to keep these areas open.

Vegetation of the prairie remnant is currently composed of approximately 40 species. Common species are New England

aster (Aster novae-angliae), smooth brome grass (Bromus inermis), staghorn sumac (Rhus typhina), and indiagrass. Prairie species intermediate in abundance include blue aster and goldenrods. Species rare at the site include big bluestem, little bluestem, heath aster, tick trefoil (Desmodium illinoense), Canada wildrye (Elymus canadensis), soapwort gentian (Gentiana saponaria), rough gayfeather, grayhead prairie coneflower, and prairie dropseed. Trees intermediate in abundance on the prairie are eastern redcedar (Juniperus virginiana), quaking aspen (Populus tremuloides), and black cherry (Prunus serotina). These groups of species and their relative abundances indicate that the prairie is not in good condition.

Species lists from the limestone outcrop at the North Unit show numerous prairie species including leadplant, big bluestem, little bluestem, hairy grama, Canada wildrye, and prairie dropseed. Species present on the old field on the North Unit include some prairie species. Introduced species are more common on the site, indicating that succession is not approaching a prairie climax.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Land use surrounding Effigy Mounds National Monument is primarily forest and pasture, with some agricultural production consisting mainly of corn. The Mississippi River is adjacent to the eastern boundary of the monument.

### Prairie Research

Landers, Roger Q. 1975. A report on the status and management of native prairie areas in National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Landers reported bluestem prairie on extreme south facing slopes and rocky bluffs. The open prairie areas were reported to be rapidly returning to forests. The prairie areas contained many characteristic grasses and forbs.

Howell, Evelyn, Darrel Morrison, and Gregg Moore. 1983. Vegetation survey of Effigy Mounds National Monument. Department of Landscape Architecture, University of Wisconsin, Madison, Wisconsin. 126 pages.

The following plant communities have been identified: Prairie Remnant, Old Field, Oak-Maple Woods, Bottomland, and Aspen. These researchers have also assembled species abundance lists for each plant community.

Blewett, Thomas J. 1985. A vegetation survey of grasslands and rare plants of Effigy Mounds National Monument. Progress report. Biology Department, Clarke College, Dubuque, Iowa.

Field surveys have located 6 state-listed rare species and 22 small prairie remnants.

### General References

National Park Service. 1973. Effigy Mounds National Monument/Iowa. Brochure. 2 pages.

National Park Service. 1977. Statement for management. Effigy Mounds National Monument/Iowa. 14 pages.

FORT LARNED  
National Historic Site  
Kansas

In the early 1860's, Fort Larned was the northern anchor of the line of forts that outlined the military frontier of the southwestern portion of the United States. Fort Larned was first charged with protecting the mail and travelers on the eastern segment of the Santa Fe Trail. Later it served as a base for military operations against the hostile Indians of the central Great Plains. By 1878 the fort was abandoned, and in 1884 the buildings and land were sold at public auction. It remained in private ownership until the establishment of Fort Larned National Historic Site was authorized on August 31, 1964.

The Fort Larned National Historic Site contains 718.4 acres (290.8 hectares) in two separate tracts (Figure 7). Much of the land is in scenic easement. The detached Santa Fe Trail Ruts tract of 44 acres (18 hectares) is located 5 miles (8 kilometers) southwest of Fort Larned. The Santa Fe Ruts tract is native prairie. Approximately 82 acres (33 hectares) of the main unit is classified as riparian. About 277 acres (121 hectares) have been reseeded to native prairie species and are in various stages of succession.

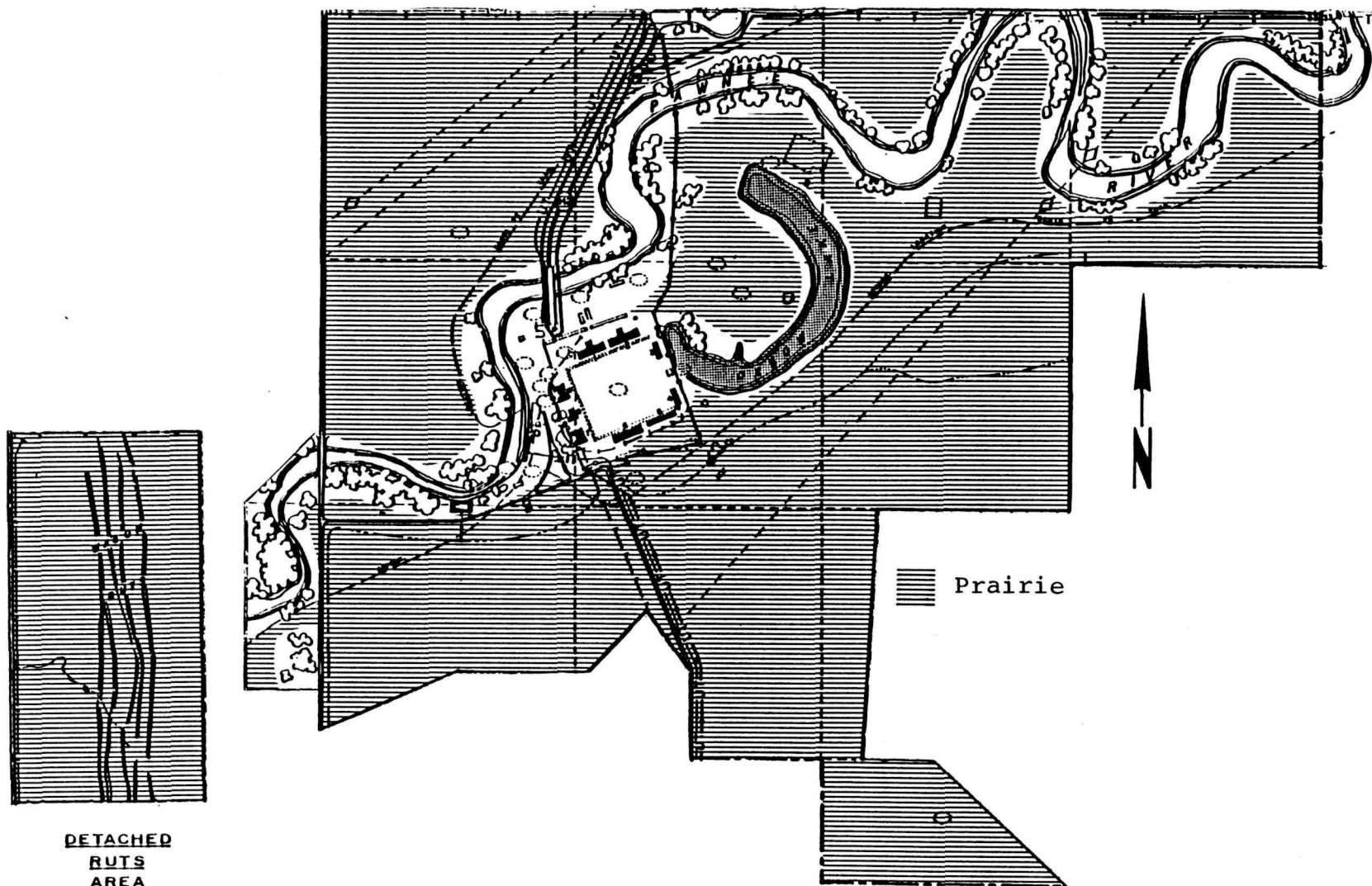


Figure 7. Prairie map, Fort Larned National Historic Site.

Kuchler Vegetation Type:   Bluestem-Grama Prairie  
                                  (Andropogon-Bouteloua) (Map No.  
                                  69)

Present Vegetation and Prairie Management History

The Fort Larned National Historic Site has been divided into 12 vegetation management units. It can be postulated that all of the site was grazed while Fort Larned was active. In all probability, areas close to the stables and pens received heavy grazing. Following abandonment and sale of the property, most of the land was farmed. Small fragments of the original prairie sod exist along the banks of the Pawnee River. A small area of native sod is also present near the former military dump in Unit 3.

The detached Santa Fe Trail Ruts Tract, Unit 12, is original prairie sod. Intensive grazing by domestic animals has removed most of the tall and mid-grasses. Grazing by domestic animals has been eliminated, but the plants on much of the area have been grazed or clipped near the soil surface by prairie dogs. Prairie dog control measures have recently been initiated.

In 1968, a project was initiated to convert the cultivated land back into native vegetation as a part of recreating the historic scene. Although the area had originally supported a mixture of tall, and mid-, and short

grasses, blue grama and buffalograss were the primary species selected for planting. The reason for this decision to use short grasses was the concern that taller grasses would constitute a fire hazard.

The original plan was to progressively seed portions of the area to grass during a five-year period. Two planting methods were employed: (1) planting native grasses directly into a prepared seedbed and (2) planting sudangrass (Sorghum vulgare) in the spring and harvesting in the fall, leaving a four-inch (ten-centimeter) stubble in which to seed the native grasses the following spring. All of the seedings were not completed during the proposed five-year period. Most of the vegetation management units were mowed for weed control through 1979. Herbicides were also occasionally used for weed control. Prescribed burning was initiated as a management tool in 1983 and mowing intensity has generally decreased.

At present cool season, weedy grasses dominate several of the units and weedy forbs are a problem in several areas. Noxious grasses and forbs are also present. Native short grass cover has appeared to be static for at least the last 5 years but mid-grass cover has increased slightly. Tall grass cover is sparse in most areas, but levels are increasing in several plots. Levels of both mid- and tall warm season grasses must increase several-fold before a desired climax prairie is reached. A summary of each unit follows:

Vegetation Management Unit 1. An excellent plant cover exists in this unit. It furnishes the historic site with an example of a western Kansas short grass prairie. The western 4.5 acres (1.8 hectares) were seeded to a slightly different mixture than the remaining area. Silver bluestem (Bothriochloa saccharoides), representative of southwestern prairies, may be found in this area. Blue grama and buffalograss account for the majority of the cover. Other important species are sideoats grama and little bluestem. Weedy species such as dandelion (Taraxacum officinale) and tall lettuce (Lactuca canadensis) are present. Hay was cut from the area in July 1981. A prescribed burn was conducted on this unit during the third week in April 1982.

Vegetation Management Unit 2. Species present in this unit are similar to those in Unit 1. Buffalograss and blue grama represent nearly half of the cover. Colonies of bur ragweed (Ambrosia grayi) remain from the period of cultivation. Forage and litter were removed by haying in April and July 1981 and July 1982. This unit was burned in 1985.

Vegetation Management Unit 3. Vegetation Management Unit 3 is composed of three distinct types of vegetation. Over one-fourth of the cover is western wheatgrass. This species occurs primarily on the slopes. Buffalograss was planted in 1980 on the disturbed sites, and a small amount of native sod exists on the top of a small hill along the south border of the Fort Larned National Historic Site. A prescribed burn was conducted in this unit in 1985.

Vegetation Management Unit 4. Unit 4 has an excellent cover of tall, mid-, and short grasses. Over 50% of the area is occupied with buffalograss and blue grama. Switchgrass, sideoats grama, silver bluestem, and sand dropseed (Sporobolus cryptandrus) are also common. Litter and forage were removed from this area by cutting and baling in April and July 1981 and July 1982. This unit was burned in 1984 and 1985.

Vegetation Management Units 5, 6 and 7. These Vegetation Management Units have similar vegetation. Vegetation was characterized in 1980 by large quantities of undesirable plants such as downy brome (Bromus tectorum) and kochia (Kochia scoparia). The highly fertile soils adjacent to the Pawnee River originally would have supported tall grasses such as big bluestem, switchgrass, and indiagrass. The seeded short grasses are unable to compete with the weedy species on this site. The east portion of Unit 5 and all of Units 6 and 7 were mowed and baled in April and July 1981 and July 1982. The west portion of Unit 5 was mowed with a flail



mower in 1981 and 1982. Portions of Units 5, 6, and 7 were burned in the period 1983-85. A 4 acre (1.6 hectare) area in the western part of Unit 5 was mowed, lightly disked, and planted to a mixture of prairie grasses and forbs in 1983.

Vegetation Management Unit 8. A large portion of Unit 8 has unsatisfactory vegetation which is similar in composition to that in Units 5, 6, and 7. Vegetation on this unit was cut and baled in April and July 1981. The area was burned during the third week of April 1982.

Vegetation Management Units 9 and 10. Units 9 and 10 are the two smallest units. Botanical composition data collected in 1980 indicate an abundance of weeds and few prairie species. These units were mowed with a flail mower in 1981. They were burned in April 1982.

Vegetation Management Unit 11. Vegetation Management Unit 11 is located in and around the building site. It has generally been closely mowed throughout the growing season. The resultant vegetation is primarily buffalograss with a few common lawn weeds.

Vegetation Management Unit 12. The detached Santa Fe Trail Ruts tract, or Vegetation Management Unit 12, has the greatest diversity of species on the Fort Larned National Historic Site. Many years of intensive grazing by domestic animals eliminated or greatly reduced many of the tall and midgrass species. The shortgrass sod is dominated by buffalograss, but numerous undesirable weedy species are present. The prairie dog population in this Unit was substantially reduced following control measures initiated in January and December of 1982. The unit was prescribed burned in 1984.

#### Land Use and Vegetation Within One Mile of the Park Boundary

The area surrounding the Fort Larned National Historic Site is almost exclusively classified as agricultural. Most of the land is used for the production of wheat (Triticum aestivum), alfalfa (Medicago sativa), and grain sorghum (Sorghum bicolor). Vegetation in the riparian area outside of the park boundary is similar to that within the boundary.

### Prairie Research

Landers, Roger Q. 1975. A report on the status and management of native prairie areas in National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Landers described the vegetation of 22 plots at Fort Larned National Historic Site. Some of these plots have now been combined to form the 12 Vegetation Management Units. Specific management recommendations were made concerning mowing, seeding, and burning.

Stubbendieck, J., Catherine Jo Wiederspan, and Kathie J. Kjar. 1980. Prairie restoration: an evaluation and specific recommendations for management. Natural Resources Enterprises. Lincoln, Nebraska. 95 pages.

Physical conditions, including climate and soils, of the area were described. The original vegetation of the bluestem prairie, floodplain forest, and freshwater marsh is characterized. The 12 vegetation management units of the historic site were delineated, and the management history of each was presented. The 1980 vegetation of each unit was described in terms of basal cover of individual species. A five-year management program, by units, was recommended. A second part of this research involved assembling an herbarium collection. More than 200 species were collected. This report listed the specimens by scientific name (including authority), common name, and lists the vegetation management

units in which they occur. Instructions for specimen preparation and herbarium maintenance are also included.

Becker, Donald A. 1985. Vegetation survey and prairie management plan for Fort Larned National Historic Site. Ecosystems Management. Elkhorn, Nebraska. 90 pages.

Dr. Becker placed transect lines across the vegetation management units and established permanent quadrats along these lines. He recorded density, frequency and cover data. Additional herbarium specimens were collected. He developed a prairie management plan which included options and opportunities for recreating the historic vegetation scene.

#### General References

National Park Service. 1978. Fort Larned. Fort Larned National Historic Site/Kansas. A brochure. 2 pages.

National Park Service. 1978. Master plan. Fort Larned National Historic Site/Kansas. 43 pages.

National Park Service. 1978. Statement for management. Fort Larned National Historic Site/Kansas. 30 pages.

FORT SCOTT  
National Historic Site  
Kansas

Fort Scott was established in 1842 as a base for U.S. Army peace-keeping efforts on the Indian frontier. It was abandoned in 1853 and became a civilian community. It was reactivated during the Civil War and also for a short period in the 1870's. The establishment of Fort Scott National Historic Site was authorized on October 19, 1978.

Fort Scott National Historic Site is located within Fort Scott, Kansas. Federal land totals 16.8 acres (6.8 hectares). It contains about 4 acres (1.6 hectares) of restored tallgrass or bluestem prairie.

Kuchler Vegetation Type: Mosaic of Bluestem Prairie  
(Andropogon-Panicum-Sorghastrum)  
and Oak-Hickory Forest  
(Quercus-Carya) (Map Nos. 74 and  
100)

Present Vegetation and Prairie Management History

Prairie was eliminated from the immediate area as the fort was being developed and occupied. A prairie

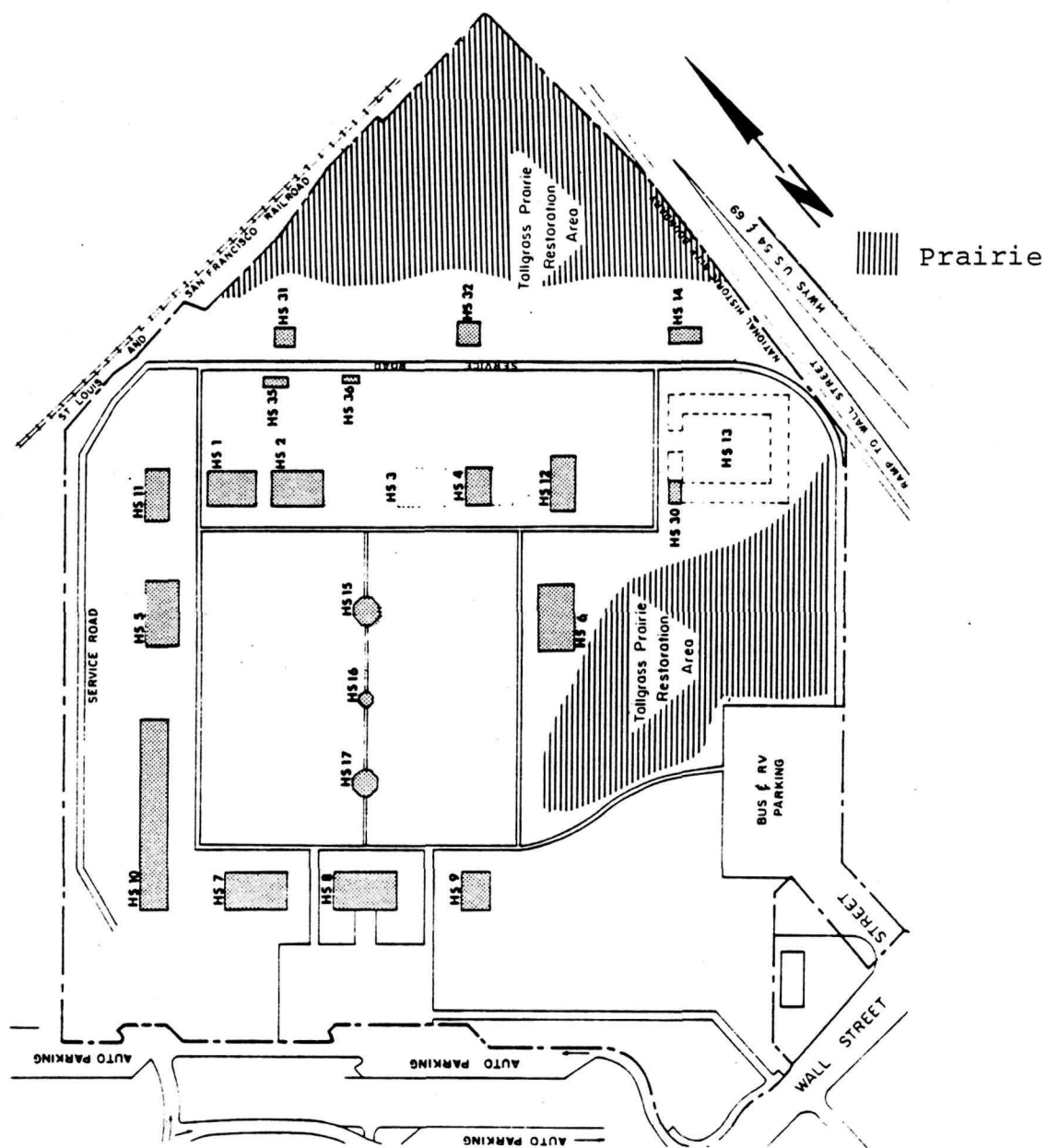


Figure 8. Prairie map, Fort Scott National Historic Site.

restoration project began in 1979 with the planting of a mixture of forbs and grasses. The grass mixture was big bluestem (16%), little bluestem (50%), sideoats grama (12%), switchgrass (8%), and indiagrass (14%). The forb mixture was leadplant (10%), Maxmillian sunflower (Helianthus maximiliana) (5%), tall gayfeather (Liatris scariosa) (11%), purple prairie clover (Petalostemum purpureum) (14%), grayhead prairieconeflower (30%), blackeyed susan (Rudbeckia hirta) (10%), pitcher's sage (Salvia pitcheri) (10%), and compassplant (10%). The two mixtures were combined before seeding. The restored prairie areas have been maintained by mowing. Sideoats grama, indiagrass, and little bluestem are well established in the area behind the carriage house and post bakery. Grayhead prairieconeflower, Maxmillian sunflower, indiagrass, sideoats grama, and big bluestem were noted in the area near the infantry barracks in 1983.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Historic Fort Scott sits on a low limestone bluff overlooking the Marmaton River. It is located totally within the city of Fort Scott. The principal fort area is level but the east side of the park slopes gently downhill. The surrounding terrain is relatively flat and is occupied with commercial and residential buildings. A portion of the area

is still classified as agricultural with cultivated farmland.

#### Prairie Research

Dr. Jim Jackson, Missouri Southern State College is currently comparing the fort's restored prairie with a nearby native prairie. He will develop guidelines for future restoration.

#### General References

National Park Service. 1967. A master plan. Fort Scott Historical Park/Kansas. 71 pages.

National Park Service. 1981. Interpretive prospectus. Fort Scott National Historic Site/Kansas. 39 pages.

National Park Service. 1981. Statement for management. Fort Scott National Historic Site/Kansas. 14 pages.

National Park Service. 1982. Fort Scott National Historic Site/Kansas. A brochure. 4 pages.

## GEORGE WASHINGTON CARVER

## National Monument

## Missouri

George Washington Carver National Monument was authorized in 1943 and formally established in 1953 as a memorial to the accomplished scientist. He grew up on the Moses Carver farm during the 1860's and 1870's. Most of the farm is located within the current park's boundaries. The park contains 210 acres (85 hectares). Five prairie areas are located within its boundaries. Seeded and natural prairie occupies approximately 55 acres (22 hectares) (Figure 9).

Kuchler Vegetation Type: A mosaic of Bluestem Prairie  
(Andropogon-Panicum-Sorghastrum)  
and Oak-Hickory Forest  
(Quercus-Carya) (Map Nos. 74 and  
100)

Present Vegetation and Prairie Management History

Much of the land at George Washington Carver National Monument is relatively level and fertile and was once cultivated or used as pasture. Jackson and Bensing (1982) described five prairie areas totaling approximately 25.2



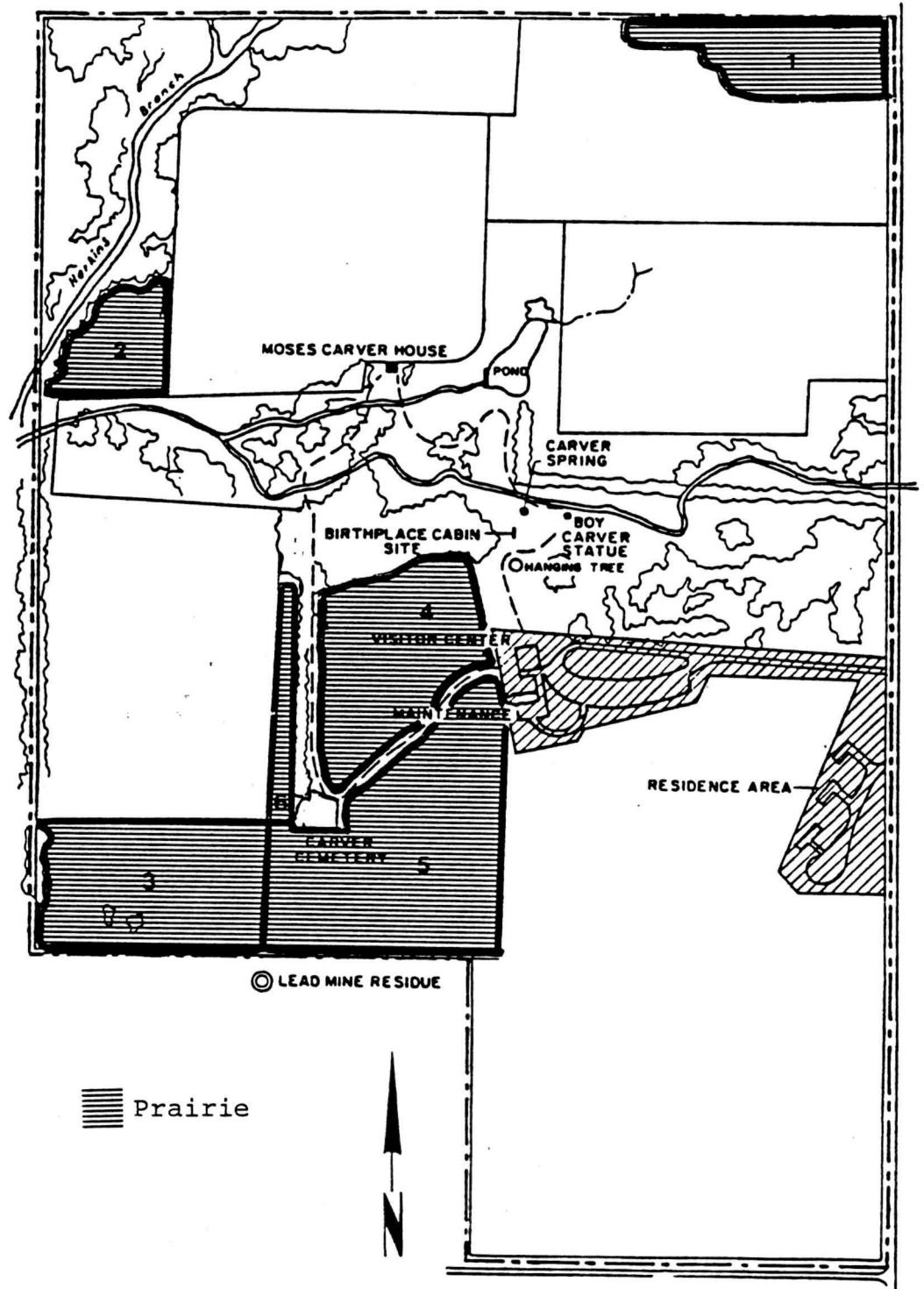


Figure 9. Prairie map, George Washington Carver National Monument.

acres (10.2 hectares). They were characterized on the basis of interviews, historical documents, aerial and ground photographs, vegetational plot sampling, compilation of a species list, soil classification and soil analysis. All five areas were originally native prairie at the time of Moses Carver's occupancy of the farm.

The primary park objective is to recreate the historic scene of the 1860's Moses Carver farm through the restoration and reestablishment of these native prairie areas.

Five management units have been established. All five units were burned in March 1982 and overseeded with a mixture of native grasses. Management Unit 6 was included within the restoration program in 1982.

Management Unit 1 (3.8 acres or 1.5 hectares) shows no evidence of tillage. It is in an early stage of natural prairie succession. The western one-third has been protected from grazing and fire, which has resulted in a dense, unnatural stand of woody plants. The eastern portion has been historically mowed in the spring and again in the late summer or early fall. Some light grazing has also occurred. In 1981, big bluestem and broomsedge (Andropogon virginicus) were the two most important species in this unit. Tall fescue (Festuca arundinacea) is an undesirable cool season invader, and it was fourth most important in Management Unit 1. This unit was burned on March 24, 1982, and was overseeded with a mixture of native grasses and forbs. Subsequent evaluation in July and September of 1982 indicated big bluestem and little bluestem have increased significantly. This unit was burned in April of 1983 and limited areas were seeded in May.

Management Unit 2 (2.8 acres or 1.1 hectares) shows evidence of tillage. Historical records indicate that it has been subjected to many years of severe overgrazing. Invading woody plants were removed in the spring of 1982. Species composition data in 1981 showed that it was dominated by weedy species. It was tilled and seeded to prairie species

in 1982. Evaluation of this seeding in July and September of 1982 indicated little bluestem seedlings ranked fourth in importance. This species was not present in the 1981 sampling. Poor growth resulted from undesirable weather conditions, and the area was reseeded in May 1983.

The eastern portion of Management Unit 3 was subjected to intensive tillage for many years before it was designated as a pasture. Total area of the unit is 4.3 acres (1.8 hectares). Broomsedge and tall fescue were the dominant species. The western portion has been protected from grazing and fire, which has resulted in a dense stand of woody plants. In 1982, a portion of the area was burned, and the rest was tilled. It was seeded to forbs and grasses in May 1982. Evaluation of the western portion in July and September of 1982 indicated that while woody species still dominate, little bluestem now ranks fourth in importance. Mowing has been used as a management tool because sufficient ground cover is not present for burning. A restoration program, which includes disking and reseeding, for the lower eastern portion was initiated in 1984.

Management Unit 4 (4.6 acres or 1.9 hectares) has had a diverse history. At various times it has been a barnyard, plowed field, and a site for a roadway. Several other uses have been made of the land. The dominant species was Kentucky bluegrass (Poa pratensis), which is an undesirable cool season invader. Various other species were also present. This unit was burned, disked, and seeded in the spring of 1982. The restoration success has been severely impeded by poor climatic conditions and competition from cool season exotic species. The eastern one-half of this unit was reseeded in May of 1983 and still represents a major management concern.

Management Unit 5 (9.7 acres or 3.9 hectares) contains several pure stands of big bluestem, little bluestem, and indiangrass. Annual mowing was the management practice for many years, but recently it was done on a three-year interval. This unit were burned, shallowly disked, and seeded to prairie species in 1982. In vegetative studies completed in September 1982, big bluestem was ranked first in importance. This unit was burned again in April of 1983, and selected areas were subjected to reseeding.

Management Unit 6 (1.5 acres or 0.6 hectares) was included within the restoration program in 1982. It was burned, disked, and seeded. Analysis of this unit in 1982 indicated that big bluestem and little bluestem were present in high frequencies.

Followup studies were conducted on these management units between 1982 and 1985. All units except four showed an increase in native prairie species and a decrease in noxious weedy plants. In unit 4 the vegetational composition improved but not as dramatically as in the other units.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Land use within one mile (1.6 kilometer) of the park is basically agricultural. A few cereal and row crops are produced and grazing occurs. Grazing is done on pastures seeded to tall fescue. Approximately 360 acres (146 hectares) of native prairie remain in the area. Woody plants commonly occur on lowlands and waste areas. To the southwest of the park, a small tailing pile remains from a previous mining operation.

#### Prairie Research

Landers, Roger Q. 1975. A report on the status and management of native prairie areas in National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Comments on George Washington Carver National Monument within this report are limited to the 19-acre (8 hectare) pasture west of the visitor center. It is not known if it was ever cultivated. The pasture was mowed twice yearly from 1952 through 1973. It was mowed once in 1974 and in 1975.

Dr. Landers indicated that this area was in excellent condition. He recommended continued mowing and did not recommend a prescribed burning program.

Jackson, James R. and Betty Bensing. 1982. A historic and vegetational survey of the five prairie areas at George Washington Carver National Monument. Unpublished.

This vegetation survey of the prairie areas of George Washington Carver National Monument was conducted in 1981. Relative frequency, relative density, relative cover, and importance values are given for individual species. Some of these data may be found in a later published report (Groves, et al. 1983).

Jackson, James R. and Betty Bensing. 1983. A management plan for the five prairie areas at George Washington Carver National Monument. George Washington Carver National Monument Research Bulletin. 1:1-15.

The five prairie management areas at George Washington Carver National Monument were assigned specific management practices based upon the history and present vegetational composition of each unit. Management tools such as reseeding, plowing, mowing, and prescribed burning were recommended.

Palmer, Ernest J. 1983. The flora and natural history of George Washington Carver National Monument. Research/Resources Report MWR-3. Midwest Region. National Park Service. 39 pages.

This manuscript was completed in 1960. Plant nomenclature was updated for this publication. It includes a brief narrative history of George Washington Carver and of the George Washington Carver National Monument. A list of the vascular flora is included and is arranged by family. Common and scientific names are given.

Stockham, Jim C. and Mark M. Mense. 1983. Woody plant communities of George Washington Carver National Monument. George Washington Carver National Monument Research Bulletin. 1:16-23.

This study indicated that the woodland area of George Washington Carver National Monument is a monocommunity area. This is based on diversity and frequency data from plot samples, elevation studies, and soil analyses. Due to severe disturbance it is possible, however, that there could have originally been more than one type of woodland community.

Houlhan, Theresa M. 1983. A small mammal survey on prairie management area four at George Washington Carver National Monument. George Washington Carver National Monument Research Bulletin. 1:47-64.

A small mammal study was initiated on prairie management unit number four at George Washington Carver National Monument during the fall of 1981. This was a pre-management mammal study. The four species of small mammals that were live trapped were the cotton rat, white-footed mouse, deer mouse, and least shrew. Home range and density values were also determined.

Stejskal, James and Tony Moeher. 1983. Biomass Survey of the six prairie management units of George Washington Carver National Monument. George Washington Carver National Monument Research Bulletin. 1:65-80.

A biomass survey was initiated in 1982. Past management of the prairie units is discussed. Biomass of grasses and forbs is related to the proportion of each in the seeding mixture. Biomass of the grasses varied from a low of 7.76 to a high of 34.00 grams/0.125 m<sup>2</sup>. Forb biomass varied from 1.77 to 30.85 grams/0.125 m<sup>2</sup>.

Castillon, Kim. 1983. A small mammal survey on prairie management area four at George Washington Carver National Monument. George Washington Carver National Monument Research Bulletin. 1:81-95.

A small mammal survey was conducted on an area that was subjected to burning, disking, and reseeding in the spring of 1982. The work was done in the fall of 1982 to evaluate the effects of these management tools on these rodents. Cotton rat and house mouse were the only species encountered in this study. Due primarily to the design of the study, few conclusions could be made. Home range and population density were also recorded.

Groves, Marylin, James R. Jackson, and Betty Bensing. 1983. George Washington Carver National Monument Prairie Management and monitoring program. Phase I report. Vegetational analysis and management recommendations. George Washington Carver National Monument Research Bulletin. 1:127-148.

The five prairie management areas at George Washington Carver National Monument were evaluated on the basis of their

vegetational response to the prairie management program implemented in 1982 by park officials. It was found that the importance of native species such as big bluestem and little bluestem increased during this period. Specific management problems were identified such as cool season grasses and the encroachment of woody species. Future management suggestions included burning, mowing, and limited herbicide use.

#### General References

National Park Service. 1977. Statement for management. George Washington Carver National Monument/Missouri. 9 pages.

National Park Service. 1979. Interpretive prospectus. George Washington Carver National Monument/Missouri. 32 pages.

National Park Service. 1982. Fire management plan. George Washington Carver National Monument/Missouri. 83 pages.

National Park Service. 1982. Resources management plan. George Washington Carver National Monument/Missouri. 103 pages.

National Park Service. 1983. Prairie restoration action plan. George Washington Carver National Monument/Missouri. 59 pages.



HERBERT HOOVER  
National Historic Site  
Iowa

The birthplace of Herbert Hoover was designated as a National Historic Site on August 12, 1965. It is situated within the incorporated limits of the community of West Branch, Iowa. The park contains 191.1 acres (73.32 hectares) of federal land and 5.7 acres (2.3 hectares) of nonfederal land for a total of 186.8 acres (75.6 hectares). The park is rectangular in shape and is cut diagonally by the West Branch of Wapsinonoc Creek. In the spring of 1971, 76 acres (31 hectares) of cultivated land lying to the south and west of the presidential gravesite were seeded back to native prairie grasses (Figure 10). The restored prairie was established both as a maintenance feature and as a representation of the environment characteristic of the landscape during the boyhood days of Herbert Hoover.

Kuchler Vegetation Type: A mosaic of Bluestem Prairie  
(Andropogon-Panicum-Sorghastrum)  
and Oak-Hickory Forest  
(Quercus-Carya) (Map Nos. 74 and  
100)

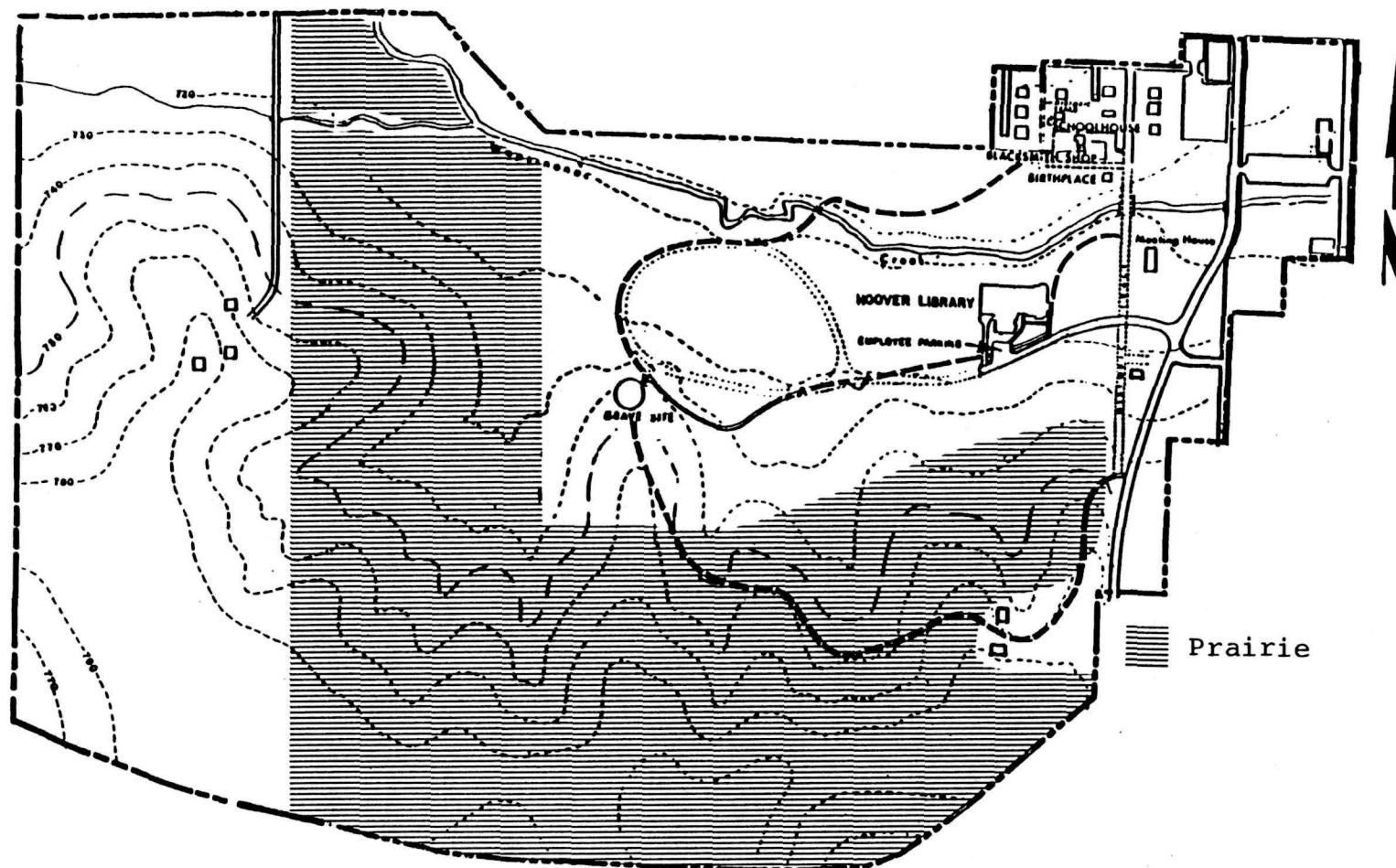


Figure 10. Prairie map, Herbert Hoover National Historic Site.

### Present Vegetation and Prairie Management History

A mixture of big bluestem, little bluestem, switchgrass, indiagrass, and sideoats grama was seeded on 65 acres (26 hectares) of upland in the spring of 1971. At the same time, big bluestem, switchgrass, and indiagrass were seeded on 11 acres (5 hectares) of wetter sites. No prairie forbs were included in the seeding mixture. Extensive annual weed growth occurred during the first growing season. The entire area was mowed in midsummer of 1971. It was burned in the spring of 1972 to stimulate the newly planted grasses and to reduce competition from weeds. Starting in 1977, 20 acres (8 hectares) were mowed each fall on a rotational basis. The hay was baled and hauled away to remove the excess organic matter which would be removed by fire in the natural ecosystem. Canada thistle (Cirsium arvense) infests portions of the area. Attempted control measures have included both mechanical removal and application of herbicides.

Mowing as a general management practice was stopped in 1980. In April 1984 approximately 40 acres were burned. Following the burn, 30 acres infested with Canada thistle were chemically treated, plowed, and reseeded to a mixture of prairie grasses and forbs.

Big bluestem, indiagrass, and switchgrass dominate the prairie, comprising nearly 70% of the relative cover. Small amounts of little bluestem, sideoats grama, and Canada

wildrye (Elymus canadensis) are also present. Numerous forbs have moved into the area. They include Canada goldenrod, asters, giant ragweed (Ambrosia trifida), common ragweed (Ambrosia artemisiifolia), lettuces (Lactuca spp.), dandelion (Taraxacum officinale), American burnweed (Erechtites hieracifolia), Platte groundsel (Senecio plattensis), alsike clover (Trifolium hybridum), white sweetclover (Melilotus alba), common milkweed (Asclepias syriaca), horsetail (Equisetum arvense), Pennsylvania smartweed (Polygonum pensylvanicum), hedge bindweed (Convolvulus sepium), field thistle (Cirsium discolor), and bull thistle (Cirsium vulgare). Woody plants are present, but are not dense in the area. Woody species include siberian elm (Ulmus pumila), elderberry (Sambucus canadensis), honeysuckles (Lonicera spp.), multiflora rose (Rosa multiflora), and dogwoods (Cornus spp.).

The prairie grasses are widely distributed across the area. The stand is sufficiently dense to dominate, but the growth of the native grasses is sometimes inhibited by accumulation of litter.

#### Land Use and Vegetation Within One Mile of the Park Boundary

The east and north sides of Herbert Hoover National Historic Site are bounded by the town of West Branch. Both residential and commercial structures are located near the

park. Interstate 80 runs along the south side of the park. Farmland occurs beyond the highway and on the west side of the park. Corn and soybeans are the most commonly produced crops. Vegetation along the West Branch of Wapsinonoc Creek is similar to that along the creek inside the park.

#### Prairie Research

Landers, Roger Q. 1975. A report on the status and management of native prairie in National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Landers traced the history of the prairie reestablishment and commented on its condition in 1975. The condition of the prairie varied from excellent to very weedy. Few woody species had invaded but herbaceous weeds were thought to be a problem.

Landers, Roger Q. 1977. Reestablishment and management of native prairie areas. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 34 pages.

Dr. Landers also conducted a portion of his research on establishment of forbs from seeds and transplants on this site in 1976 and 1977. He cautioned against drawing conclusions from his research because of extremely dry conditions during the study. Direct seeding of forbs was less costly but less successful than transplanting seedlings started in the greenhouse.

Christiansen, Paul. 1982. Prairie inventory: Herbert Hoover National Historic Site. Cornell College, Mount Vernon, Iowa. 22 pages.

Dr. Paul Christiansen conducted a prairie inventory in August 1982. Five transects were sampled at four-rod intervals with a 20 x 50 cm quadrat. The Daubenmire method was used to score cover in 95 plots. He also established permanent transects for future comparisons. Big bluestem, indiangrass and switchgrass dominated the prairie. He recorded seven grasses and over 20 forbs.

#### General References

National Park Service. 1970. Master plan. Herbert Hoover National Historic Site/Iowa. 31 pages.

National Park Service. 1977. A special master plan study. Herbert Hoover National Historic Site/Iowa. 24 pages.

National Park Service. 1979. Statement for management. Herbert Hoover National Historic Site/Iowa. 12 pages.

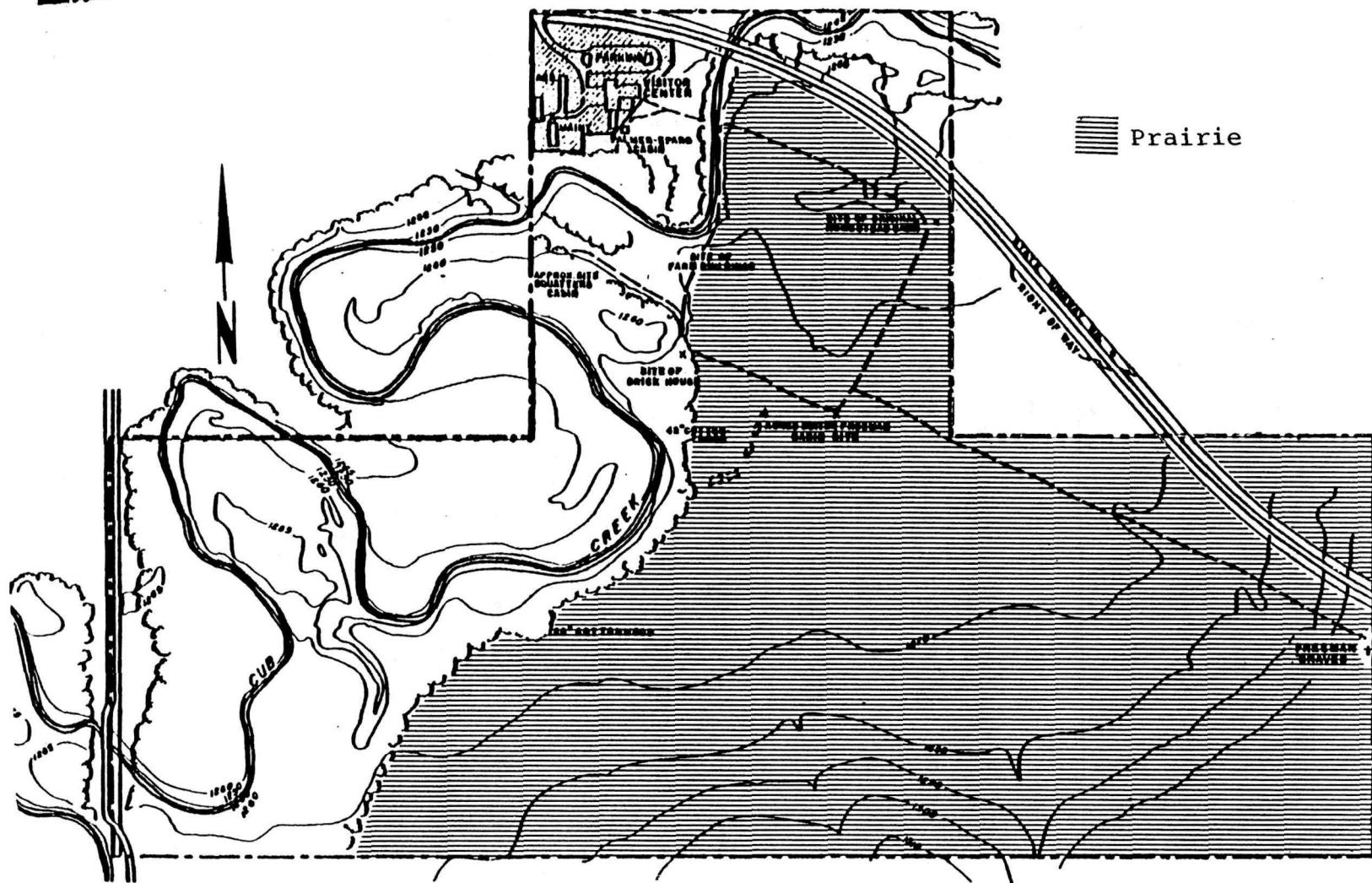
National Park Service. 1982. Herbert Hoover National Historic Site/Iowa. A brochure. 4 pages.

National Park Service. 1982. Natural resources management plan. Herbert Hoover National Historic Site/Iowa. 10 pages.

HOMESTEAD  
National Monument of America  
Nebraska

Homestead National Monument of America is located on the claim of Daniel Freeman, one of the first applicants to file under the Homestead Act of 1862. Originally, the Homestead Act made it possible for settlers to claim farms of 160 acres (64 hectares) by paying a minor filing fee, building a house, living on the land, and cultivating it for five years. The monument commemorates the influence of the homestead movement on American history. It is also a memorial to the pioneers who braved the rigors of the prairie frontier to build their homes and fortunes in the new land. Homestead National Monument of America was established in 1936.

The monument consists of 194.6 acres (78.8 hectares). Federal land makes up 182.1 acres (73.7 hectares) and there are 12.5 acres (5 hectares) of nonfederal land. The park contains about 95 acres (38 hectares) of restored prairie (Figure 11). A detached area of school grounds, which is included in the total acreage, contains 1.2 acres (0.5 hectares) with approximately 0.7 acre (0.3 hectare) of prairie.



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Kuchler Vegetation Type: Bluestem Prairie  
(Andropogon-Panicum-Sorghastrum)  
(Map No. 74)

Present Vegetation and Prairie Management History

Most of the nonwooded areas of what is now Homestead National Monument of America were plowed within a few years after being claimed by Daniel Freeman in 1863. These areas remained in cultivation through 1937. Undoubtedly, significant amounts of topsoil were lost through erosion during the seven decades of cultivation.

The area was seeded in 1939 to native grasses harvested in Gage County. This was one of the first, if not the first, attempt at revegetation with prairie species on National Park Service property. Few details were assembled concerning establishment following the first planting. Records show that a "good establishment" was obtained, and prairie sod was brought in to use on severely eroded spots. These spots were primarily in gullies on the hillside.

Records indicate a steady improvement in the prairie vegetation. Prairie hay and little bluestem seed were harvested in the early 1950's. Mowing and herbicides were used for weed control in the mid-1950's. Mowing was conducted every two to three years after seed maturity. A contract for prairie hay in 1965 allowed the entire prairie,

except the southeastern corner, to be mowed. That was the last year that the entire area was mowed. Mowing and spot treatment with herbicides were used for weed control until 1978. No herbicides are presently in use.

Following unsuccessful attempts of weed control by mowing in 1967 and 1968, two attempts have been made to revegetate portions of the area. Approximately 10 acres (4 hectares) were seeded to prairie dominants in 1969 in an area southeast of the footbridge across Cub Creek. A portion of this area was reseeded and replanted in 1975. Weedy species still dominated the area in 1983.

A prescribed burn was conducted on April 24, 1970 to control woody species and remove accumulated litter. The fire destroyed 70-75% of the eastern redcedar (Juniperus virginiana) trees. Vigorous resprouting of many of the hardwood trees was an indication that one fire was not an adequate control measure. Some retrogression in the prairie vegetation occurred during the next 10 to 12 years. A 17 acre (7 hectare) portion of the area was burned by a wildfire in 1980. A second prescribed burn covering 8 acres (3 hectares) was conducted in the spring of 1982. On April 26, 1983, a prescribed burn covering over 100 acres (40 hectares) resulted in the successful removal of 90 to 95% of the accumulated litter and ground cover. Woody growth in the thickets was severely retarded.

The prairie can be separated into three general areas: (1) slopes to the south and southeast, (2) areas most recently planted on the level areas, and (3) the remainder of the level area. The slopes to the south and southeast contain good examples of prairie communities. Big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass are common grasses. Forbs include prairie rose, whorled milkweed (Asclepias verticillata), prairie clovers (Petalostemum spp.), slimflower scurfpea, and ground cherries (Physalis spp.). The prairie communities have had time to evolve. It is difficult, except for an experienced individual, to distinguish this area from an unplowed prairie.

A portion of the more recently planted area has never developed beyond the weedy stage. It contains only a scattering of prairie grasses. More common are weedy species such as prickly lettuce (Lactuca scariola), common milkweed (Asclepias syriaca), nettle (Urtica dioica), smooth brome grass (Bromus inermis), bristlegasses (Setaria spp.), and horseweed (Conyza canadensis).

The level areas are dominated by big bluestem, indiangrass, switchgrass, Canada wildrye (Elymus canadensis), prairie cordgrass (Spartina pectinata), and other prairie grasses. Common forbs include goldenrods, wild licorice

(Gylcyrrhiza lepidota), and roundhead lespedeza (Lespedeza capitata).

Woody plants are abundant (before the 1983 fire) on the level areas and, to some extent, on the slopes. Woody species include wild plum (Prunis americana), smooth sumac (Rhus glabra), eastern redcedar (Juniperus virginiana), dogwoods (Cornus spp.), buckbrush (Symphoricarpos orbiculatus), elms (Ulmus spp.), green ash (Fraxinus pennsylvanicus), and mulberry (Morus alba).

#### Land Use and Vegetation Within One Mile of the Park Boundary

The majority of the land surrounding Homestead National Monument of America is classified as agricultural. It is used primarily for the production of corn, wheat, alfalfa, grain sorghum, and soybeans. Vegetation along Cub Creek adjacent to the park is similar to the woody first and second growth within the park. A portion of the area bounding the northeast corner of the park is classified as residential.

#### Prairie Research

Landers, Roger Q. 1975. A report on the status and management of native prairie areas in National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Landers described the management history of the restored prairie at Homestead National Monument of America. He indicated that increasing woody species reduced the condition of the prairie. The southern slopes were considered to be the best example of prairie. Recommendations for management were included.

Stubbendieck, J., Richard Sutton, and Jayne Traeger. 1984. Vegetation survey and management recommendations for Homestead National Monument of America. Natural Resources Enterprises, Inc. Lincoln, Nebraska. 85p.

These researchers conducted a vegetation survey of the monument in 1982-84. The work included collecting species composition data, establishing photographic points, and establishing an herbarium. The information collected will be used to formulate long- and short-term management plans.

#### General References

National Park Service. 1978. Homestead National Monument/Nebraska. A brochure. 2 pages.

National Park Service. 1979. Interpretive prospectus. Homestead National Monument/Nebraska. 19 pages.

National Park Service. 1979. Assessment of alternatives. Natural resources management. Homestead National Monument of America/Nebraska. 68 pages.

National Park Service. 1980. Natural resources management plan. Homestead National Monument of America/Nebraska. 59 pages.

National Park Service. 1982. Resource management plan and environmental assessment. Homestead National Monument of America/Nebraska. 87 pages.

ICE AGE  
National Scientific Reserve  
Wisconsin

Ice Age National Scientific Reserve was established in 1971 to assure the protection, preservation, and interpretation of various nationally significant land forms that were shaped by the last stage of continental glaciation. It is composed of nine separate units spread across the State of Wisconsin from Lake Michigan to Minnesota. It is authorized to include 32,500 acres (13,158 hectares) of land to be managed by the Wisconsin Department of Natural Resources. The wide geographical distribution and variety of physiographic conditions of the Ice Age units makes possible a diverse plant population. Three of the nine units are thought to include prairie or prairie remnants. These units are Cross Plains, Kettle Moraine, and Devils Lake State Park (Figures 12, 13, and 14). Perhaps only 15 acres (6 hectares) of prairie occur in the Ice Age National Scientific Reserve.

Kuchler Vegetation Type: A mosaic of Maple-Basswood Forest  
(Acer-Tilia) and Northern  
Hardwoods (Acer-Betula-Abies-Tsuga)  
(Map Nos. 99 and 106)

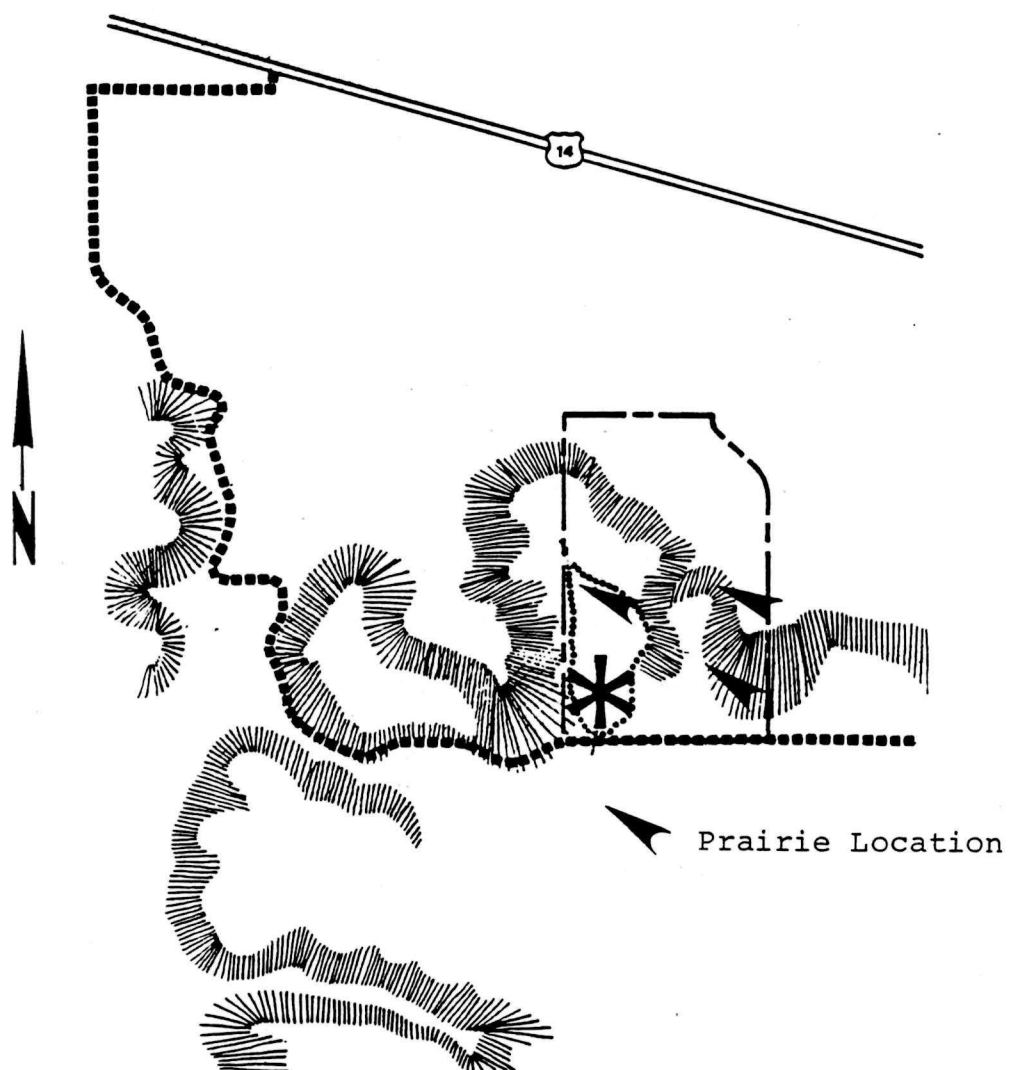


Figure 12. Prairie map, Ice Age National Scientific Reserve (Cross Plains Unit).

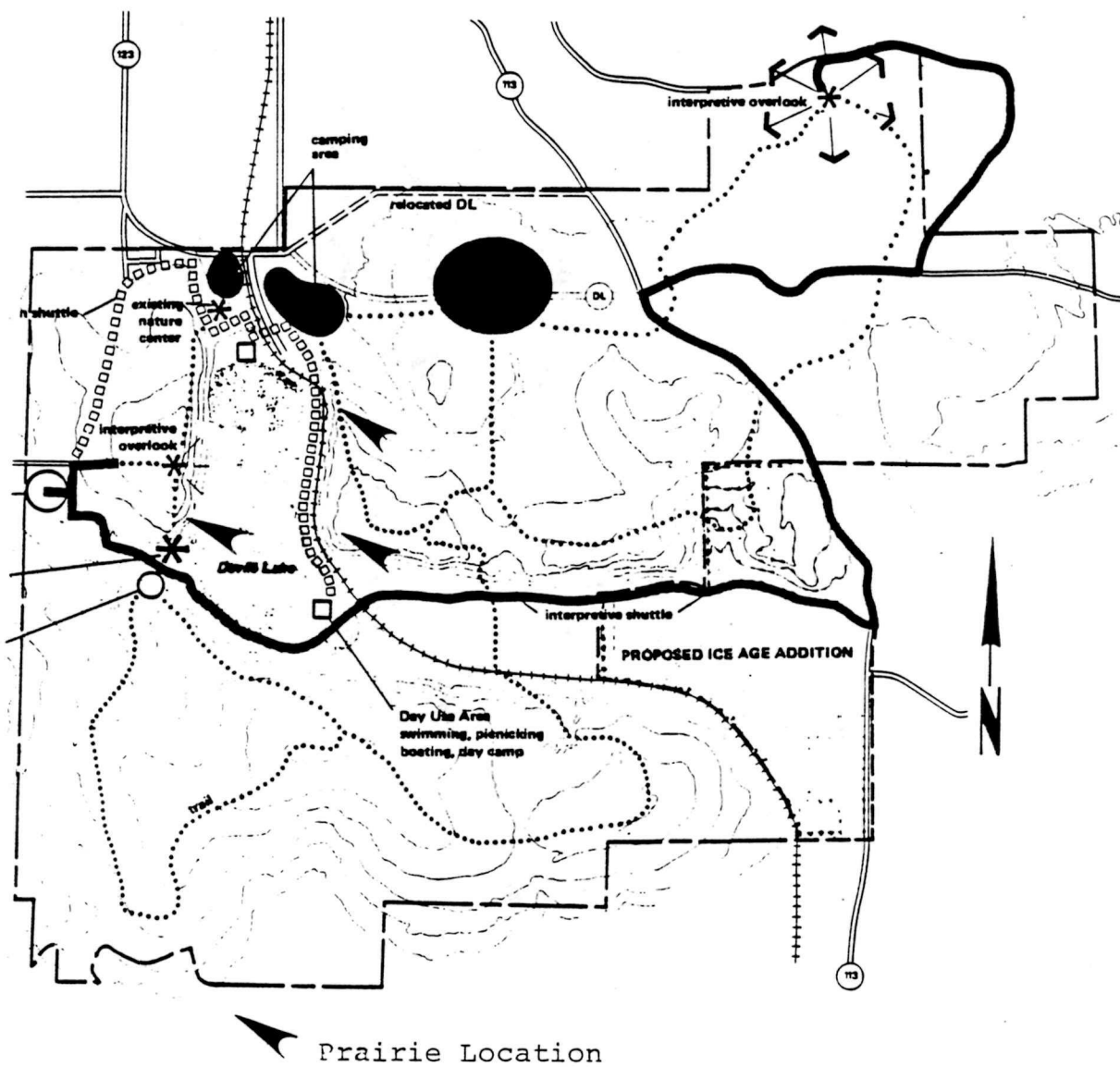


Figure 13. Prairie map, Ice Age National Scientific Reserve (Devils Lake Unit).



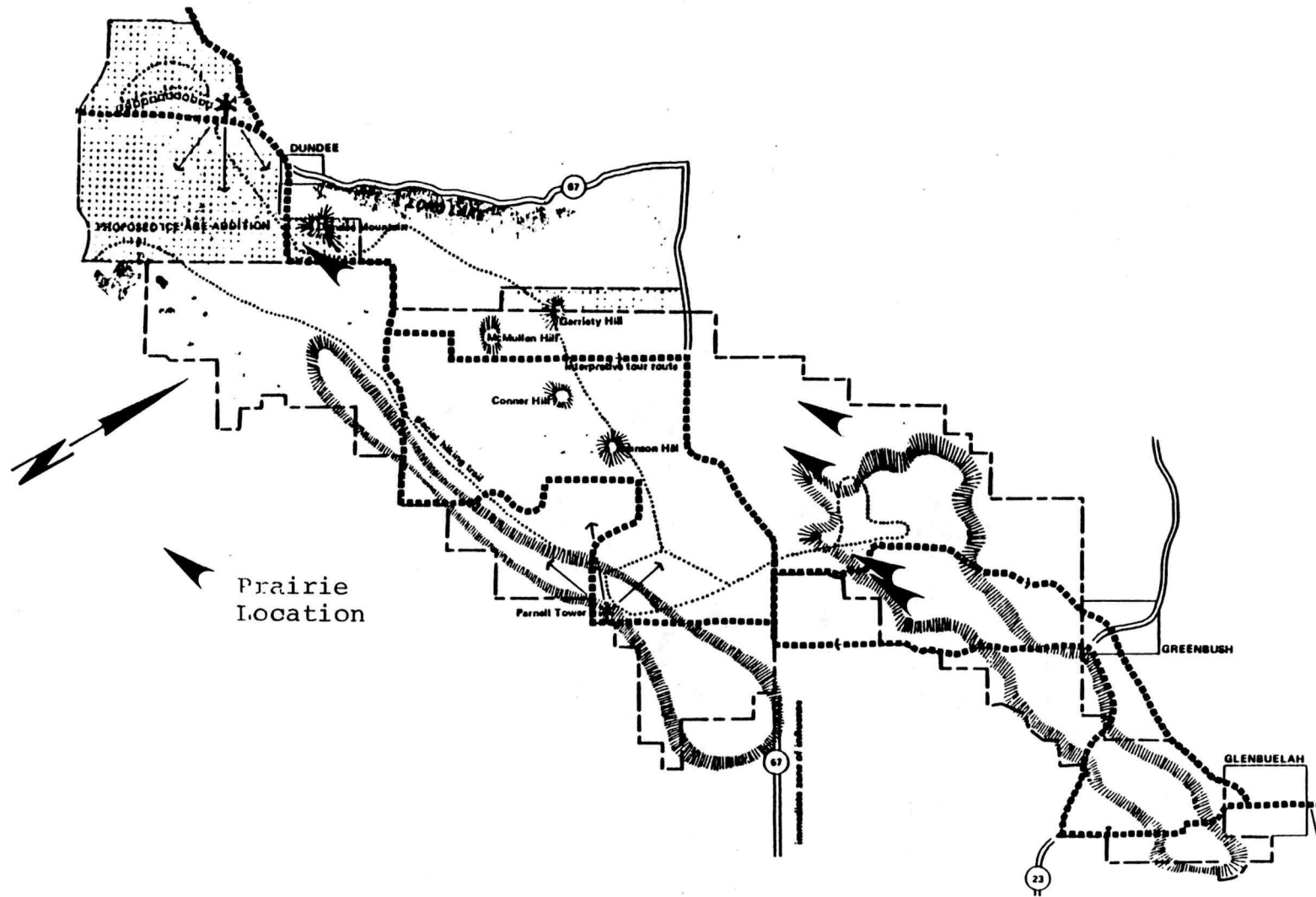


Figure 14. Prairie map, Ice Age National Scientific Reserve (Kettle Moraine Unit).

### Present Vegetation and Prairie Management History

Devils Lake State Park. A dry prairie on the top of the south end of the east bluff is the site of a prairie restoration project where trees were cut and the stumps treated to prevent sprouting. It is an area of about 5 acres (2 hectares) bordering the edge of the bluff. Big and little bluestem are common on the site. Numerous prairie forbs are also present.

Cross Plains. About 2 acres (0.8 hectares) of prairie are present in three scattered areas in association with oaks and open fields with oaks. These areas were formerly crop and pasturelands. Big bluestem is the most common grass in the prairie areas.

Kettle Moraine. Kettle Moraine contains about 8 acres (3.2 hectares) of prairie in association with open fields and upland brush. These are areas of abandoned croplands on which the vegetation has evolved to the point where grasses are dominant.

### Land Use and Vegetation Within One Mile of the Park Boundary

Land use within one mile (1.6 kilometers) of the boundaries is primarily agricultural. Portions of the areas are cultivated for crop production, and some are grazed by domestic livestock. Forest species outside the boundaries are similar to those inside the boundaries.

### Prairie Research

No prairie research has been conducted in Ice Age National Scientific Reserve.

### General References

National Park Service. 1973. Master plan. Ice Age National Scientific Reserve/Wisconsin. 93 pages.

INDIANA DUNES  
National Lakeshore  
Indiana

Indiana Dunes National Lakeshore preserves an important remnant of what was once a vast and unique lakeshore environment resulting from the retreat of the last great continental glacier some 11 thousand years ago. The park contains 15 miles (24 kilometers) of the Lake Michigan shoreline and 12,534.8 acres (5,074.8 hectares). Federal land totals 6,395.2 acres (2,589.2 hectares), and nonfederal land totals 6,139.6 acres (2,485.7 hectares). Immediately inland from the beaches, sand dunes rise to almost 200 feet (61 meters) in a series of ridges, blowouts, and valleys.

The Indiana Dunes National Lakeshore was authorized in 1966 and formally established in 1972. Upland prairie exists in several units (Figure 15). Total area of prairie is estimated to be 989 acres (400 hectares). Prairie is located in the Cowles Unit, 570 acres (230.5 hectares); West Unit, 48 acres (19.6 hectares); and the East Unit, 36 acres (14.7 hectares). The Hooser Prairie Unit is about 335 acres (136 hectares) in size and contains excellent prairie. It is owned by the State of Indiana but is included within the authorized boundaries of the park.

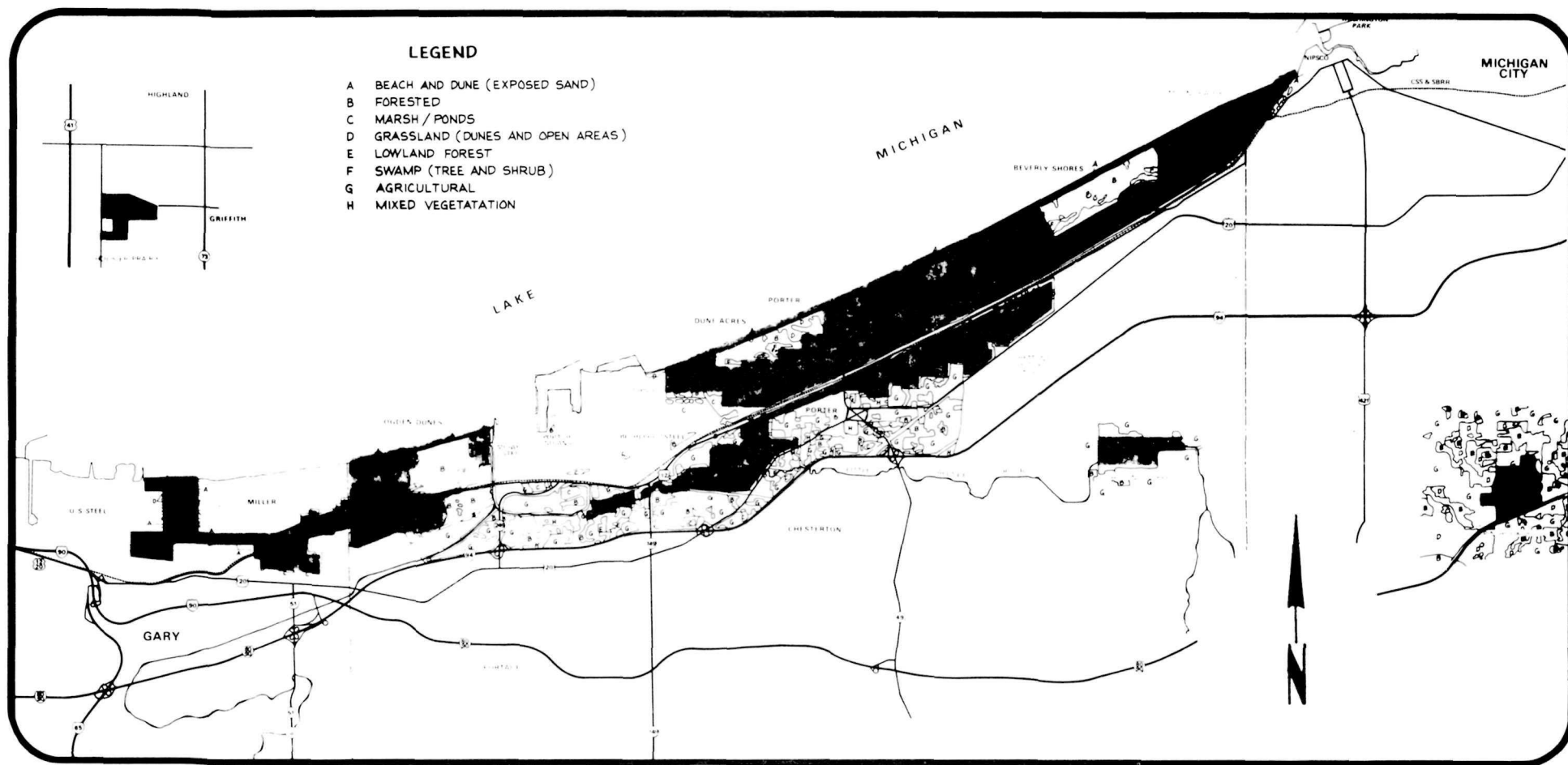


Figure 15. Vegetation map, Indiana Dunes National Lakeshore.

Kuchler Vegetation Type: A mosaic of Bluestem Prairie  
 (Andropogon-Panicum-Sorghastrum)  
 and Oak-Hickory Forest  
 (Quercus-Carya) (Map Nos. 74 and  
 100)

#### Present Vegetation and Prairie Management History

Where the dunes have been stabilized for some time, the predominant vegetation is oak forest. In the beach zone, however, some dunes are still active and all stages of vegetative succession can be seen.

The high, dry prairies include indicator species such as little bluestem and silky aster (Aster sericeus). Other species are Indian paintbrush (Castilleja coccinea), tick trefoil (Desmodium illinoense), prairie junegrass, false boneset (Kuhnia eupatorioides), slender yellow flax (Linum virginanum) and porcupinegrass. More mesic prairies contain indicator species such as big bluestem, compassplant, prairie dock (Silphium terebinthinaceum), and purple prairie clover (Petalostemon purpureum). Other species include leadplant, butterfly milkweed (Asclepias tuberosa), blue aster, Atlantic indigo, rattlesnake master (Eryngium yuccifolium), white prairie clover (Petalostemum candidum), prairie phlox, indiagrass, porcupinegrass, and prairie dropseed.

Little active management of prairie has occurred at Indiana Dunes National Lakeshore. Some protection from

vehicles has been provided. Fire has played a major role in maintaining prairies in a climatic region supporting forest growth. Accidental and natural fires have burned large areas of the park. The Hoosier Prairie Unit is managed by the State of Indiana and is burned on a rotating basis.

Encroachment of woody species has been and will continue to be the most serious threat to the prairies. Use of mowing or herbicides for management has not been recorded. None of the prairies have been replanted.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Complex patterns of land use surround Indiana Dunes National Lakeshore. Three residential communities are completely surrounded by the park. Major industrial complexes physically divide the park and flank it on both the west and east. Few significant prairie areas exist outside of the boundary. Common crops in the area are corn and soybeans.

#### Prairie Research

Research on the vegetation in what is now Indiana Dunes National Lakeshore dates back to the turn of the century. The early research was summarized in a literature review by Reshkin, et al. in 1975. The following is taken from that review (complete citations may be found in Section III of this report):

"As is commonly known, investigations in the Indiana Dunes played an important role in making ecology a modern dynamic science. Pioneering studies were made by Prof. Henry Chandler Cowles of the University of Chicago of the dunes along the southern and eastern shores of Lake Michigan. In his analysis published at the turn of the century Cowles (1899, 1901) presented evidence that plant communities of the dunes follow one another in a recognizable pattern: the dynamic concept of succession. One of Cowles' colleagues, Victor E. Shelford, an animal ecologist, soon followed up on this work (Shelford 1907, 1912a, 1912b) and described in detail how animals are intimately involved in this process of succession as well as exhibiting a successional pattern themselves. Virtually every American textbook in ecology, and many introductory biology books at both the high school and college level, describe the pattern of succession revealed in these studies and often include diagrams...."

"Being near to Chicago and offering a variety of unusual habitats, the dunes area was, and continues to be a mecca for naturalists. Particularly noticeable, both to the amateur and professional, was the unusual diversity of plant species in the dune region, and early papers noting this fact (Peattie 1922, 1926; Lyon 1927, 1930) were soon followed by a book by Peattie (1930) cataloging these plants. Numerous additions and updatings have since been made (Bush 1934, 1935; Hull 1937, 1938; Tryong, 1936; Laughlin, 1953)...."

"Concurrent with the semipopular natural history interest there has continued a more scientifically oriented ecological interest. A series of publications by Fuller (e.g. 1911, 1925, 1934, and 1935) considered the relationship of succession to evaporation, adaptations of dune plants, and the general pattern of succession in the dunes area...."

"Some of the most recent work, and at the same time a much needed modern review of the general aspects of succession in the dunes area, is that of Olson (1958). A concern underlying his work is that the pattern of succession described by Cowles, while carefully qualified by Cowles himself, had in its transmission over the years been highly oversimplified. Subjected to question in the first paper listed, in particular, is the commonly

expressed view that the substrate is modified by succeeding communities so as to be able eventually to support a mesophytic community dominated by beech and maple, the community usually considered climax for the area. Careful analysis of soils whose ages were determined by modern-day methods rather clearly discredits this notion. At the same time Olson uses modern sampling techniques to describe the dunes communities. Analysis of these descriptions in combination with age determinations reveal that there are many paths that succession may follow in the dunes with many variables influencing the pattern...."

Jackson, Marion T. 1973. Evaluation of Hoosier Prairie, Lake County, Indiana, for eligibility for Registered Natural Landmark. Indiana State University, Terre Haute, Indiana. 346 pages.

This report describes the physical, climatic, and vegetational features of the Hoosier Prairie. Special attention is given to the uniqueness of the prairie and of the prairie species.

Landers, Roger Q. 1975. Indiana Dunes National Lakeshore, In A report on the status and management of native prairie areas in National Parks and Monuments in the Midwestern Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Landers delineated four types of prairie; prairie marsh, low prairie, mesic prairie, and high and dry prairie. He described the vegetation for each of these types. Six prairie areas were selected and included in a section of status of the prairies. The importance of fire as a management tool was discussed.

Wilhelm, Gerould S. 1980. Report on the special vegetation of the Indiana Dunes National Lakeshore. Research Program Report 80-01. National Park Service. 262 pages.



Vegetation is described. Individual species are listed by common and scientific name.

Krekeler, Carl H. 1981. The biota of the Indiana Dunes National Lakeshore. In Ecosystem study of the Indiana Dunes National Lakeshore. Volume Two. Research Program Report 81-01. National Park Service. 340 pages.

This report summarizes the historical biological studies that were conducted in the area. The report also reports on the field studies conducted to obtain baseline data for the park. Methods are presented and plant communities are discussed.

Henderson, Norman R. 1982. A comparison of stand dynamics and fire history in two black oak woodlands in northwestern Indiana. Master of Science Thesis. Utah State University, Logan, Utah. 57 pages.

This research was conducted within the park boundaries. Differences in fire frequency and intensity were found to cause differences between two black oak (Quercus velutina) areas. Fire history in each area was determined through tree ring analysis of cross sections and wedges of fire scarred black oaks. Percentage cover and frequency of shrubs and herbaceous plants are listed by species.

Kerr, Kathryn, and John White. 1982. A vegetation research and monitoring program for a fire plan at Indiana Dunes National Lakeshore. National Park Service. 101 pages.

A program to monitor vegetation and fuel was established at the park during 1981. The program includes permanent

vegetation sampling transects, photographic stations, and information for developing and applying a fire management plan and to provide baseline data for a long-term study of vegetation changes. This program will provide information on areas before they are burned. It also provides a means for making future comparisons regardless of whether the sites are burned. Methods are discussed and preliminary data are presented.

Reshkin, Mark, Herman Feldman, Wayne E. Kiefer, and Carl H. Krekeler. 1975. Basic ecosystem studies of the Indiana Dunes National Lakeshore. Indiana University Northwest, Gary, Indiana.

These studies were limited to the park boundaries. Descriptions of the plant communities are detailed. Vegetation sampling procedures are explained.

#### General References

National Park Service. 1971. Interpretive prospectus. Indiana Dunes National Lakeshore/Indiana. 22 pages.

National Park Service. 1984. Environmental assessment. Improvements to headquarters area and horse trail. Indiana Dunes National Lakeshore/Indiana. 35 pages.

National Park Service. 1976. Interpretive prospectus. West beach. Indiana Dunes National Lakeshore/Indiana. 28 pages.

National Park Service. 1978. Preliminary information base. Indiana Dunes National Lakeshore/Indiana. 178 pages.

National Park Service. 1980. General management plan. Indiana Dunes National Lakeshore/Indiana. 63 pages.

National Park Service. 1981. Indiana Dunes National Lakeshore/Indiana. A brochure. 8 pages.

PIPESTONE  
National Monument  
Minnesota

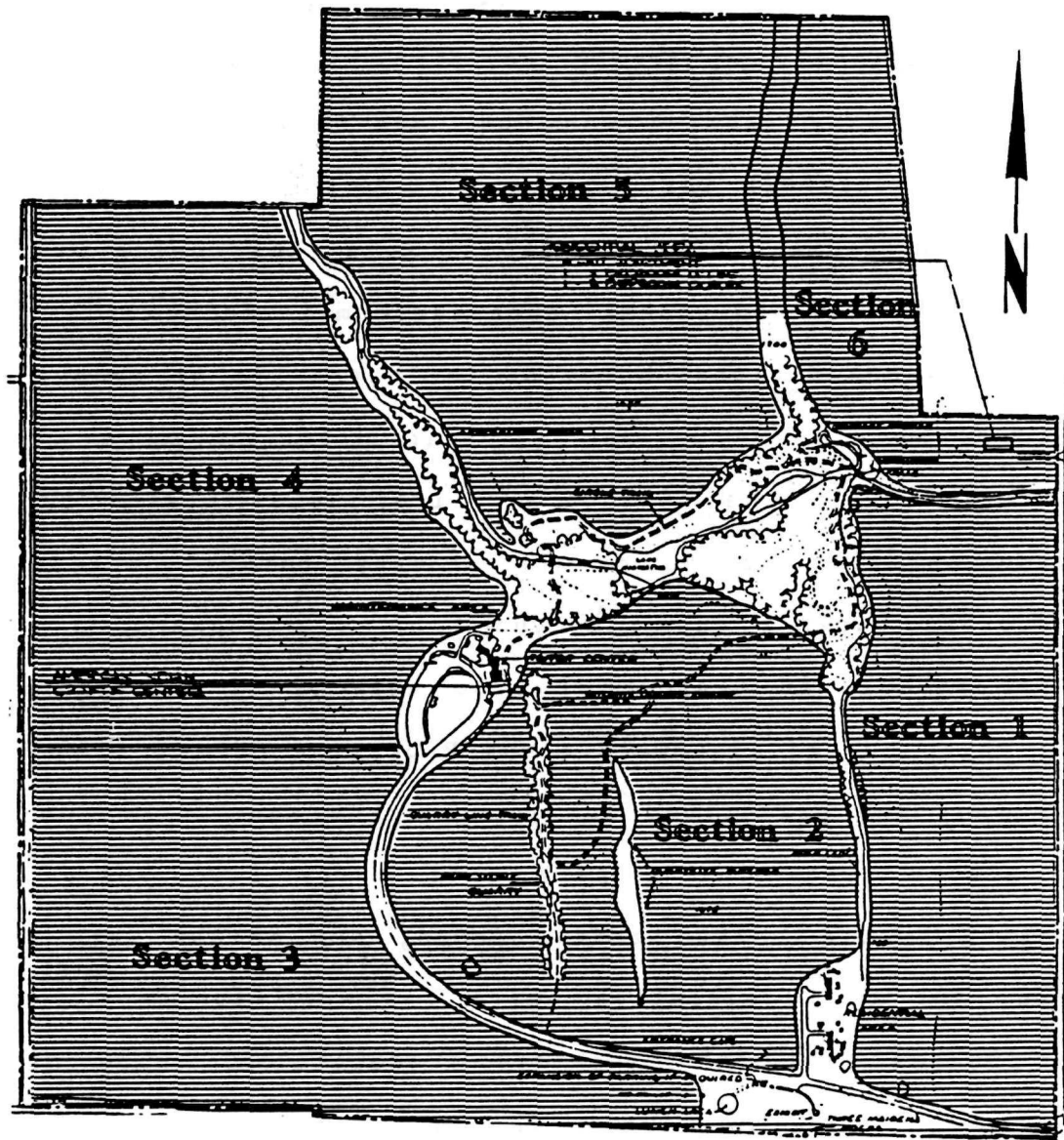
Long before European man reached the northern plains, Indians of many tribes were traveling as many as 1,000 miles (1,600 kilometers) to quarry pipestone. This soft red stone is relatively easy to carve, even with primitive tools. The artist George Catlin visited the quarries in 1836. He was the first person to describe the quarries in print, and his pipestone sample was the first to be scientifically studied. Pipestone is called catlinite in his honor.

The Pipestone National Monument was established on August 25, 1937. On that date, the right to quarry pipestone was granted to Indians of all tribes. The park contains 281.8 acres (114 hectares) of federal land. About 260 acres (105 hectares) are managed as prairie, although this area includes about 20 acres (8 hectares) of rock outcrops (Figure 16). About 160 acres (65 hectares) is native prairie. The remaining 80 acres (32 hectares) are composed of go-back land that is undergoing succession towards a prairie climax.

Kuchler Vegetation Type: Bluestem Prairie

(Andropogon-Panicum-Sorghastrum)

(Map No. 74)




 Prairie

Figure 16. Prairie map, Pipestone National Monument.

### Present Vegetation and Prairie Management History

Management history of the Pipestone National Monument is rather sketchy. Prior to 1937, the vegetation would have been periodically subjected to fire, mowing for hay, and grazing. Heavy grazing was not uncommon. The western 80 acres (32 hectares) was subjected to cultivation until 1957. After establishment of the National Monument, mowing was used for weed control and general appearance maintenance.

Pipestone National Monument is located in an area where, historically, fire has had a great effect on the prairie vegetation. In the absence of fire, woody plants tend to invade prairie and to crowd out the natural vegetation. Prescribed burning was introduced as a management tool in 1973, probably in response to the effects of a wildfire in 1971 which burned southward along Pipestone Creek. The basic design of the prescribed burning program was to burn all of the grass areas of the park once every five years on a rotating basis. Mixed grass, woods, and shrubs were to be burned for two consecutive years in each five-year period. The program has been extremely successful on many of the areas, especially the virgin prairie. Dominance of the native species was rapidly reestablished.

Pipestone National Monument is divided into 6 sections for the purpose of management. A brief description of the vegetation and burning management by section is as follows:

Section 1. This section is located in the southeastern portion of the park. It is native prairie, but it has been invaded by smooth brome grass (Bromus inermis) and Kentucky bluegrass (Poa pratensis). It contains many other invaders, including yellow sweetclover (Melilotus officinalis), white sweetclover (Melilotis alba), quackgrass (Agropyron repens), Canada thistle (Cirsium arvense), and red clover (Trifolium pratense). It was burned in the springs of 1974, 1977, 1981, and 1982.

Section 2. Section 2 is located along the southeastern and south central portions of the monument. It is native Bluestem Prairie, and it contains a few plants classified as negative indicators. Smooth brome grass is common along the trail. The eastern portion was burned in 1973, 1976 and 1983. The western portion was burned in 1974, 1976, and 1983.

Section 3. Section 3 is located in the southwestern corner of the monument. The dominant plant species is smooth brome grass. This area was cultivated before acquisition in the 1950's. There is no indication that this section was seeded back to native prairie species. Some scattered prairie plants are present, but the succession toward climax will be slow when smooth brome grass is present, even with the use of prescribed burning. The southeast portion of this section was burned in 1984 and 1985 and all of this section was burned in 1974, 1978, and 1982.

Section 4. Section 4 is located in the northwest area of the monument. Smooth brome grass and Kentucky bluegrass are the dominant species. Scattered prairie plants are present. This section has a history similar to that of Section 3. It was burned in 1974 and 1983.

Section 5. Section 5 is located in the north central portion of the monument. It is native prairie. It was burned in 1975, 1976, 1980, 1981, and 1985.

Section 6. This section is located in the northeast portion of the monument. It is also native prairie, and it was burned in 1976, 1981, and 1982.

Bluestem Prairie vegetation predominates in Sections 1, 2, 5, 6, and the eastern portions of 3 and 4. Occasional patches of smooth brome grass and successional species are found in disturbed areas such as old road beds, the old railroad right-of-way, and formerly cultivated land. The

existing native vegetation approximated the original prairie except for the presence of woody vegetation such as buckbrush (Symphoricarpos occidentalis), smooth sumac (Rhus glabra), wild black currant (Ribes americanum), chokecherry (Prunus virginiana), American plum (Prunus americana), sand cherry (Prunus besseyi), hackberry (Celtis occidentalis), grey dogwood (Cornus racemosa), green ash (Fraxinus pennsylvanica), bur oak (Quercus macrocarpa), and American elm (Ulmus americana). These woody plants are now starting to be controlled by burning.

The general status of the native prairie is good to excellent. Tall grasses and forbs are vigorous and produce many seeds. However, some of the exotic plants are not reduced and maintained by prescribed burning. Canadian thistle and sweetclovers are particularly difficult to control. Sweetclovers are currently cut or pulled. Spot applications of the herbicide Roundup (glyphosate) is used for Canadian thistle control. The go-back land is not in high condition. Complete restoration by seeding has been recommended for this area.

#### Land Use and Vegetation Within One Mile of the Park Boundary

The city of Pipestone is located on the southern edge of Pipestone National Monument. City property and the Pipestone

Area Vo-Tech School bound the northeast side of the monument. A KOA Campground is located on the east side of the area, and the Hiawatha Club property is located on the southeastern portion of the boundary. Farmland is located on the southwestern and western boundaries. A State of Minnesota game refuge is located on the north boundary. National Park Service personnel have assisted the Minnesota Department of Natural Resources with prescribed burning of this area. Vegetation surrounding Pipestone National Monument varies with the diverse land use. Some prairie exists directly outside the boundaries, but it is in inferior condition when compared to that within the boundaries.

#### Prairie Research

Dr. Donald Becker, Ecosystems Management Inc., is currently conducting research on the prairie vegetation of Pipestone National Monument. A plant collection is also being assembled.

Moore, John W. 1956. A provisional list of the flora of Pipestone National Monument. University of Minnesota. Manuscript. 8 pages.

This list of plants was based upon Dr. Moore's "Provisional List of the Flowering Plants, Ferns, and Fern Allies of Pipestone County, Minnesota." The checklist contains both scientific and common names. Grasses are excluded.



Disrud, Dennis T. 1966. Plant collections, Pipestone National Monument. Manuscript. National Park Service. 3 pages.

Mr. Disrud was a seasonal employee during 1966. He made an extensive collection of vascular plants during the period of June 20 through September 6, 1966. His report indicates that ten species of fungi were also collected and identified. The presence of galls on various plants is also noted.

Holden, Max M. 1975. The importance of fire in maintaining native prairie vegetation in north central United States. Manuscript. 30 pages.

Mr. Holden assembled a literature review on the effects of fire on prairie. Pipestone National Monument is only mentioned in the manuscript. The manuscript contains ten photographs that were taken in conjunction with the 1973 prescribed burn at Pipestone National Monument. A sequence of photographs shows the development of the vegetation after the fire.

Landers, Roger Q., Jr. 1975. Pipestone National Monument, In A report on the status and management of native prairie areas in National Parks and Monuments in the Midwestern Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Landers presented a rather complete review of the how the natural history of the area is related to the current prairie. Management history and the status of the prairie were discussed. He emphasized the importance of fire in

maintaining prairie and reducing the woody plants. Dr. Landers' management recommendations included the reestablishment of a prescribed burning program, methods to reduce invaders and methods to restore the prairie in Sections 3 and 4.

Landers, Roger Q., Jr. 1979. A report on management of native prairie areas, Pipestone National Monument. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 34 pages.

History of the area surrounding Pipestone National Monument is outlined. Ages of the trees are discussed in relation to history and past management. Discussion of the prairie vegetation is divided into bluestem prairie, smooth brome and bluegrass successional, xeric, marsh, oak-elm woodland, and shrub. Prairie management recommendations are discussed. This report contains numerous color photographs.

Willson, G. D. and T. W. Vinyard. 1986. Changes in the lichen flora of Pipestone National Monument/Minnesota.

During September 1983 and July 1984, the authors collected and identified 65 lichens from the quartzite ridge at Pipestone National Monument, Minnesota. Forty-three of the 65 lichens were saxicolous (rock-growing) or terricolous (soil-growing), 21 species were corticolous (bark-growing), and one species was found on trees and rocks. They collected 35 new species and all but one of the species collected by Fink in 1899. They detected changes in the lichen flora by comparing their collections with those made before the area

was forested. They believe corticolous lichens, which were not present in 1899, colonized the area from an eastern source. In contrast, they found the saxicolous/terricolous lichen flora had changed little during the past 84 years.

#### General References

Murray, Robert A. 1965. Pipestone-a history. Pipestone Indian Shrine Association. 60 pages.

National Park Service. 1971. Statement for management and planning. Pipestone National Monument/Minnesota. 7 pages.

National Park Service. 1976. Plan for the management of vegetation of the resource management plan. Pipestone National Monument/Minnesota. 6 pages.

National Park Service. 1976. Environmental assessment. Management of vegetation section, resources management plan. Pipestone National Monument/Minnesota. 21 pages.

National Park Service. 1978. Statement for management. Pipestone National Monument/Minnesota. 15 pages.

National Park Service. 1979. Pipestone National Monument/Minnesota. A brochure. 4 pages.

National Park Service. 1982. Resource management plan and environmental assessment. Pipestone National Monument/Minnesota. 54 pages.

Pipestone Indian Shrine Association. 1959. Circle trail. National Park Service. 15 pages.

Soubier, Clifford. 1971. Pipestone-a path, a stream, a wooded place. Pipestone Indian Shrine Association. 23 pages.

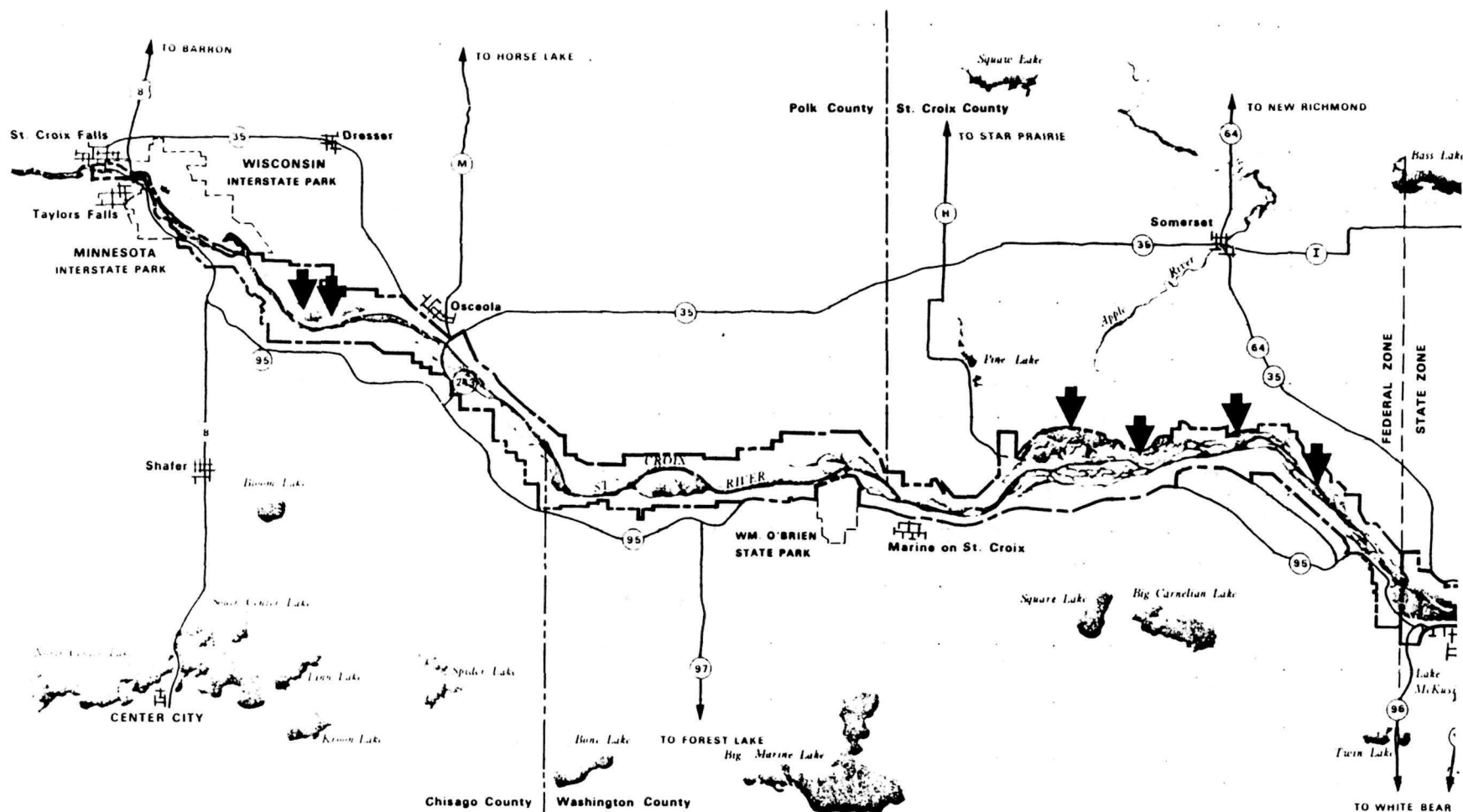
## SAINT CROIX

## National Scenic Riverway

## Minnesota-Wisconsin

Free flowing and unpolluted, the Namekagon and St. Croix Rivers flow through some of the most scenic country in the upper Midwest. The Upper St. Croix and Namekagon portion of the Riverway is 200 miles (320 kilometers) long. It was established in 1968 as one of the original eight rivers under the National Wild and Scenic Rivers Act. The Lower St. Croix was added to the National Park System in 1972. It is 52 miles (83 kilometers) long. The park consists of 62,695.9 acres (25,383.0 hectares) in the St. Croix National Scenic Riverway and 8,670.00 acres (3,510.12 hectares) in the Lower St. Croix National Scenic Riverway. This figure does not take the islands into consideration.

The vegetation of the area has not been thoroughly studied. Prairie is present but it is not common (Figure 18). Prairie remnants are known near Hudson and Black Bass Bar on the lower river and near Cedar Bend and Interstate State Park on the upper river. A study to characterize the prairies of the park was initiated in 1985. Acreage probably totals less than 50 acres (20 hectares).



↓ Indicates location of prairie

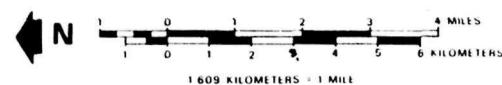


Figure 18. Prairie map, Saint Croix National Scenic Riverway.

Kuchler Vegetation Type: A mosaic of Northern Floodplain Forest (Populus-Salix-Ulmus), Maple-Basswood Forest (Acer-Tilia), and Bluestem Prairie (Andropogon-Panicum-Sorghastrum) (Map Nos. 74, 98, and 99)

#### Present Vegetation and Prairie Management History

Much of the land along the rivers is vegetated with a relatively mature second-growth hardwood forest. Low, marshy areas and sections of brush and bottomland timber are scattered along the Namekagon River.

The timbered swamps and islands are covered with mixed deciduous trees, such as silver maple, American elm, and ashes (Fraxinus spp.). The understory beneath these taller trees includes elderberry (Sambucus canadensis), pin cherry (Prunus pensylvanica), and raspberry (Rubus idaeus). An occasional area of arborvitae (Thuja occidentalis), tamarack (Larix laricina), and spruces (Picea spp.), associated with willows (Salix spp.) and speckled alder (Alnus rugosa), occurs along this lowland in the upper reaches of the river. On the higher ground on the valley walls where the soil is lighter, picturesque white pine (Pinus strobus) and red pine (Pinus resinosa) are commonly mixed with upland hardwoods such as basswood, oaks (Quercus spp.), sugar maple, paper birch (Betula papyrifera), and aspen (Populus tremuloides).

The prairie community occurs in isolated patches on the lower river and rarely on small, dry hilltops on the upper portion of the river. Prairie vegetation is usually found on steep, sandy south to southwest slopes with maximum exposure and minimum moisture. Common species are big bluestem, little bluestem, sideoats grama, and flowering spurge (Euphorbia corollata).

#### Land Use and Vegetation Within One Mile of the Park Boundary

A large portion of the lands within one mile (1.6 kilometers) of the boundaries is used for agriculture. Farmland generally exists beyond the bluff line where productive soil is available. Two farming practices occur or have occurred within the visual corridor of the riverway. These are silvicultural operations, chiefly the commercial production of conifer trees and the grazing of woodlots by cattle. Grazing of woodlots is not common today. Residential development occurs at varying densities along the entire river. Some areas receive little or no use. The intensity of recreational use is increasing.

#### Prairie Research

Dr. David C. Glenn-Lewin, Iowa State University, is conducting an inventory of prairie sites in the park. He is mapping potential sites from aerial photos and then visiting

those sites to characterize the vegetation. A total of 81 sites were mapped in 1985. Somewhat over 250 plant specimens were collected from these sites.

University of Wisconsin. 1978. Lower St. Croix Riverway: User and resource conditions. College of Agricultural and Life Sciences and Institute for Environmental Studies. Madison, Wisconsin.

This report describes the Lower St. Croix River in terms of its natural and physical features. Locations of prairie are identified, and the vegetation is briefly described. References are made to a study by Read (1976).

#### General References

National Park Service. 1976. Final master plan. St. Croix National Scenic Riverway/Minnesota-Wisconsin. 59 pages.

National Park Service. 1978. Interpretive prospectus. St. Croix and Lower St. Croix National Scenic Riverways/Minnesota-Wisconsin. 71 pages.

National Park Service. 1980. Statement for management. St. Croix National Scenic Riverway/Minnesota-Wisconsin. 22 pages.

National Park Service. 1981. St. Croix National Scenic Riverway/Wisconsin-Minnesota. A brochure. 2 pages.



SCOTTS BLUFF  
National Monument  
Nebraska

Scotts Bluff is a massive promontory rising 800 feet (245 meters) above the floor of the North Platte Valley. Named for Hiram Scott, a trapper who died in the vicinity about 1828, the bluff has long been a landmark. The bluff was once part of the ancient High Plains. Erosion over long periods has cut down the surrounding valleys to their present level, leaving Scotts Bluff and the adjoining hills as remnants of the unbroken plains which now lie farther to the west. The Oregon Trail and Pony Express Route passed through Mitchell Pass, a part of the Scotts Bluff National Monument. The establishment of Scotts Bluff National Monument was authorized on December 12, 1919.

A total of 2,053 acres (831 hectares) was included in the original withdrawal. Natural vegetation on approximately 1,226 acres (496 hectares) of the area is prairie, and 534 acres (216 hectares) is classified as badlands with little vegetation (Figure 17). Ponderosa pine (Pinus ponderosa) forest occurs on top of the bluffs. Since the original withdrawal in 1919, additional lands have been added, bringing the total to 2,988.0 acres (1,209.7 hectares). A total of 2,720.8 acres (1,101.5 hectares) are federal land and 267.17



Figure 17. Prairie map, Scotts Bluff National Monument.

acres (108.2 hectares) are nonfederal. Most of the additional land was seeded to native grasses and is undergoing succession toward prairie.

Kuchler Vegetation Type: A mosaic of Grama-Buffalo Grass  
(Bouteloua-Buchloe),  
Grama-Needlegrass-Wheatgrass  
(Bouteloua-Stipa-Agropyron),  
Wheatgrass-Needlegrass  
(Agropyron-Stipa),  
Sandsage-Bluestem Prairie  
(Artemisia-Andropogon) and  
Eastern Ponderosa Forest  
(Pinus) (Map Nos. 16, 64, 65, 66,  
and 70)

#### Present Vegetation and Prairie Management History

Grazing and fire had undoubtedly important effects on the vegetation. The area was probably heavily grazed from the late 1800's until acquisition in 1919. It was partially opened for grazing again during World War II. Otherwise, the area has been fully protected from grazing by domestic animals.

The prairie is a medium tall, medium dense grassland with a strong element of small shrubs. Dominants consist of

little bluestem, and sand bluestem, fringed sagewort, sand sagebrush (Artemisia filifolia), and blue grama. Other important components include hairy grama, buffalograss, prairie sandreed (Calamovilfa longifolia), sand lovegrass (Eragrostis trichodes), sunflower (Helianthus petiolaris), foxtail barley (Hordeum jubatum), switchgrass (Panicum virgatum), sand dropseed, needleandthread, and small soapweed. Skunkbrush sumac (Rhus trilobata), buffaloberry (Shepherdia argentea), currants (Ribes spp.), buckbrush (Symphoricarpos orbiculatus), mountain-mahogany (Cercocarpus betuloides), and chokecherry (Prunus virginiana) are commonly occurring shrubs. An increasing percentage of woody plants in the grassland areas has been observed.

Two shrubs found on Scotts Bluff National Monument are near their eastern range. Winterfat (Ceratoides lanata) and fourwing saltbush (Atriplex canescens) are common on the monument, but both are quite rare on the grazed prairie outside of the boundaries.

Management history of the prairie at the Scotts Bluff National Monument is complex. Tree planting and erosion control practices were started by the CCC in the 1930's. Planting of eastern redcedar (Juniperus virginiana) and Rocky Mountain juniper (Juniperus scopulorum) was conducted in the 1950's. Additional tree planting was conducted during 1963-1965. Native grasses have been seeded on a number of disturbed areas and on formerly cultivated areas.

Grazing or mowing have not been used for prairie management since World War II. Occasionally, an accidental fire burned relatively small areas. Prescribed burning was introduced as a management tool in the spring of 1983. A total of 825 acres (334 hectares) was burned southeast of the headquarters and west of Mitchell Pass.

Generally, the prairie at the Scotts Bluff National Monument is in excellent condition. Some increase in the density of woody species has been noted. Woody species should be kept under control if prescribed burning continues to be used as a management tool. Some of the more recent native grass seedings are still in developmental stages. These stages are characterized by the presence of weeds.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Land use surrounding the Scotts Bluff National Monument is 90% agricultural. A large portion is rangeland, while some areas are farmed. Approximately 10% of the area adjacent to the boundary is in residential use including housing and a golf course.

#### Prairie Research

Dr. Ronald R. Weedon, Chadron State College, initiated a study of the vegetation of Scotts Bluff National Monument in 1983. A collection of vascular plants is being assembled, vegetation is being quantitatively sampled, and fixed point

photographs are being made to document visual changes in prairie. In addition, an estimate of the natural fire frequency of the prairie will be made based upon available literature and the possible occurrence of fire scarred pines.

Landers, Roger Q. 1975. A report on the status and management native prairie areas in National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Landers described the prairie areas at the Scotts Bluff National Monument as fitting the Wheatgrass-Needlegrass type. He outlined the management history of the prairie and the condition in 1975. Increases of trees and shrubs were noted. Management recommendations were made.

Merserve, Peter L. 1969. Some aspects of the ecology of the prairie vole, Microtus ochrogaster, in western Nebraska. M.S. Thesis. University of Nebraska, Lincoln, Nebraska.

Research on the prairie vole was conducted at the Scotts Bluff National Monument in 1968 and 1969. Densities were found to be lower at this location than in the more mesic tall grass prairie to the east. Summer food was primarily needleandthread, gramas, bromes, western wheatgrass, and prairie sandreed. Winter food did not change significantly, indicating a dependence on underground roots and cached food.

General References

National Park Service. 1976. Master plan. Scotts Bluff National Monument/Nebraska. 36 pages.

National Park Service. 1977. Statement for management. Scotts Bluff National Monument/Nebraska. 9 pages.

National Park Service. 1981. Scotts Bluff National Monument/Nebraska. A brochure. 2 pages.

WILSON'S CREEK  
National Battlefield  
Missouri

The Battle of Wilson's Creek, named for the stream that crosses the area, was a bitter struggle that occurred on August 10, 1861, between Union forces and Confederate forces for the control of Missouri. Union forces did not win the battle, but they ultimately succeeded in keeping the state of Missouri under Union control. This accomplishment strengthened the hand of the Unionists in Kentucky who also kept much of their state loyal in the face of Confederate invasion. Had Missouri and Kentucky seceded, chances for Southern victory during the Civil War would have been greatly enhanced. Wilson's Creek Battlefield National Park was authorized on April 22, 1960. Additional legislation was passed on December 16, 1970, providing additional funds and a name change to Wilson's Creek National Battlefield.

The park contains 1,749.9 acres (708.4 hectares) of rolling, hilly terrain. All but 0.50 acres (0.20 hectares) is federal land. Reestablished prairie, totalling 146 acres (59 hectares), is present in three areas of the park (Figure 19). Extensive reestablishment of prairie is planned. A two-year cropping sequence before seeding was started on 148



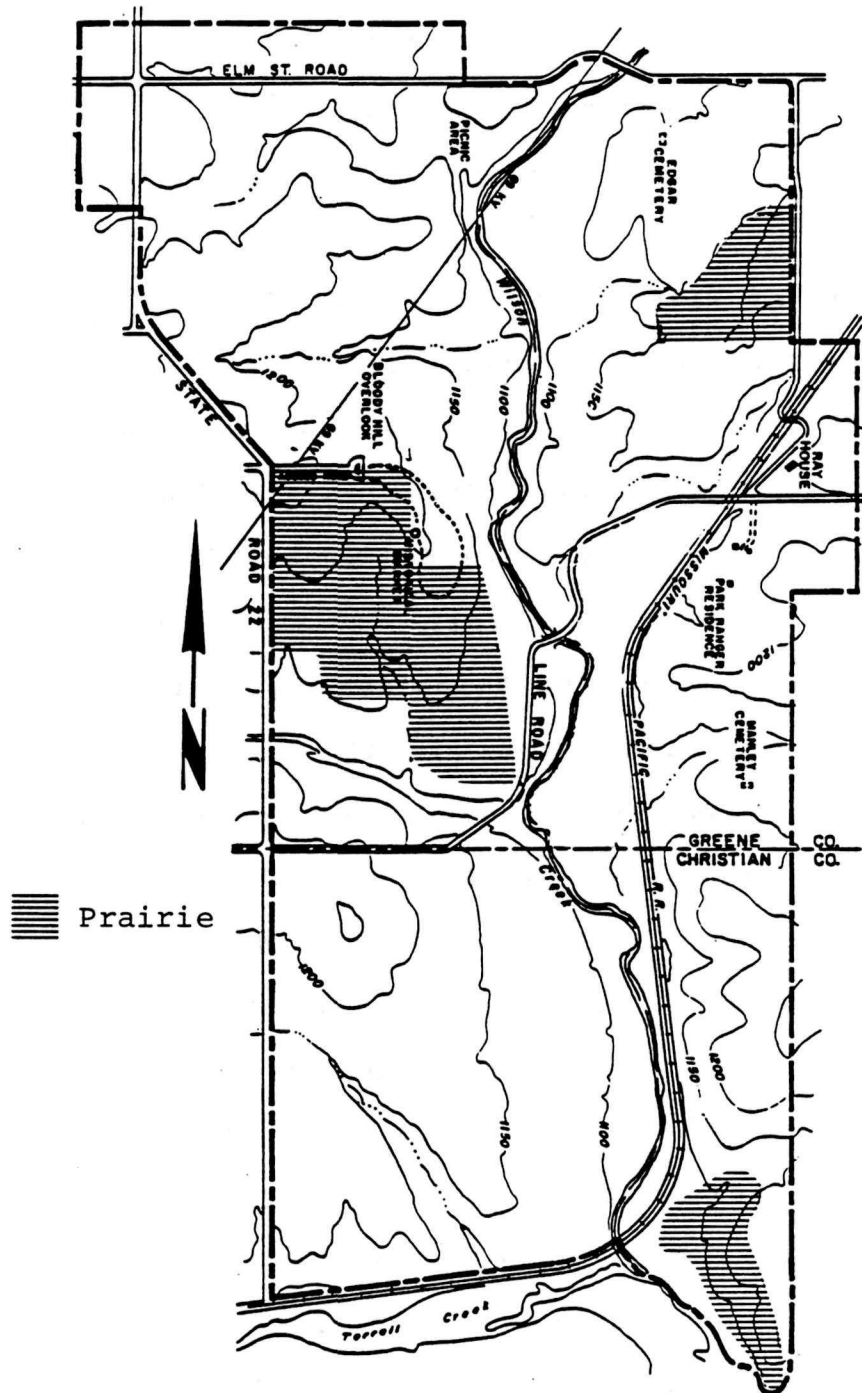


Figure 19. Prairie map, Wilson's Creek National Battlefield.

acres (60 hectares) in 1982. Reestablishment is planned on an additional 658 acres (277 hectares) in 3-5 years.

Kuchler Vegetation Type: A mosaic of Bluestem Prairie  
(Andropogon-Panicum-Sorghastrum)  
and Oak-Hickory Forest  
(Quercus-Carya). (Map Nos. 74 and  
100)

#### Present Vegetation and Prairie Management History

The area is probably less forested today than it was at the time of the Wilson's Creek Battle. Reports from the battle indicate that the men marched through a park-like forest. This would be typical of mature oak-hickory forest or savanna, but this is uncommon anywhere in the vicinity today. The Bloody Hill forest was selectively cut for timber in the 1930's and much of the area is a regrowth of small trees and shrubs.

Prairie restoration started in 1967 when some of the old fields south of Bloody Hill were seeded to a mixture of little bluestem (43%), big bluestem (37%), indiagrass (10%), and switchgrass (10%). The area south of the entrance road to Bloody Hill was plowed and seeded with an identical mixture in 1968. Fields northeast of the Ray House were overseeded without preparation of a seedbed. Other areas have been

seeded to tall fescue (Festuca arundinacea), an introduced grass.

The condition of the restored area is generally excellent, except that there is a vigorous invasion of woody species such as blackberries (Rubus spp.), multiflora rose (Rosa multiflora), eastern redcedar (Juniperus virginiana), dogwoods (Cornus spp.), wild grapes (Vitis spp.), smooth sumac (Rhus glabra), buckbrush (Symphoricarpos orbiculatus), sassafras (Sassafras albidum), persimmon (Diospyros virginiana), and black cherry (Prunus serotina). Without prescribed burning as a management technique, woody vegetation may be an increasing problem on the restored prairies. Since 1980, mowing and haying have been used as management tools on the restored areas.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Land use is primarily for agriculture. Corn and soybeans are the primary row crops, and tall fescue is grazed by cattle. Some of the surrounding area has been divided into small acreages for retirement acreages.

#### Prairie Research

A herbarium collection has been initiated by Dr. James Key. It has been filed at the park. Mr. Edwin C. Bearss prepared a historical base and ground cover map.

A small mammal study was conducted in 1983 by Sean Donegan, Linda Forbes, and Kevin Hedgpeth, students at Southwest Missouri State University. Objectives of the work were to establish a mammal checklist, to determine species diversity and population densities, and describe habitat and its relationship with the species present. An interim report indicated six species of small mammals and a density of 69 animals per acre (170 animals per hectare).

The Missouri Department of Conservation is currently conducting a study to ascertain vegetative conditions at the time of the battle. They will compare the vegetation at the time of the battle to the present vegetation for the purpose of directing restoration of the historic scene.

Landers, Roger Q. 1975. A report of the status and management of native prairie in National Parks and Monuments in the Midwest Region. Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa. 126 pages.

Dr. Roger Q. Landers traced the history of the prairie restoration at Wilson's Creek National Battlefield and commented on its condition in 1975. He pointed out that most areas were in excellent condition, but there was a problem with invasion of woody species.

Morgan, Sharon W. 1983. A natural history study of (Lesquerella filiformis). Research proposal. Natural History Section, Missouri Department of Conservation, Jefferson City, Missouri.

Ms. Morgan proposed to study the population of Lesquerella filiformis, an annual plant species of the mustard family that is endemic to the State of Missouri, at the Wilson's Creek National Battlefield for a period of three years. Information to be collected would include data on phenology, flowering, fruiting and vigor of plants; observations of insects; and observations of soils, geology, topography, associated species and community type.

#### General References

National Park Service. 1977. Final environmental statement. Wilson's Creek National Battlefield/Missouri.

National Park Service. 1977. Final master plan. Wilson's Creek National Battlefield/Missouri. 38 pages.

National Park Service. 1982. Wilson's Creek National Battlefield/Missouri. A brochure. 4 pages.

BADLANDS  
National Park  
South Dakota

Badlands National Monument was authorized in 1929, but it was not established until January 25, 1939. The name was changed to Badlands National Park in 1978. The park contains unique geological formations and many different species of wildlife. It preserves the scenic and scientific values of a portion of the White River Badlands and makes them accessible for public enjoyment.

The Badlands National Park is made up of a North Unit and a South Unit which together contain a total of 243,302.2 acres (98,502.9 hectares). A total of 152,689.6 acres (61,817.6 hectares) is federal land. Approximately 70% of the park, or 171,000 acres (69,231 hectares), is classified as prairie (Figure 20). These areas are generally flat to rolling in topography.

Kuchler Vegetation Type: Wheatgrass-Grama-Buffalograss  
(Agropyron-Bouteloua-Buchloe) (Map  
No. 68)

A question exists in regard to the exact Kuchler Vegetation Type. National Park Service and United States Forest Service personnel surveyed portions of the park in 1983

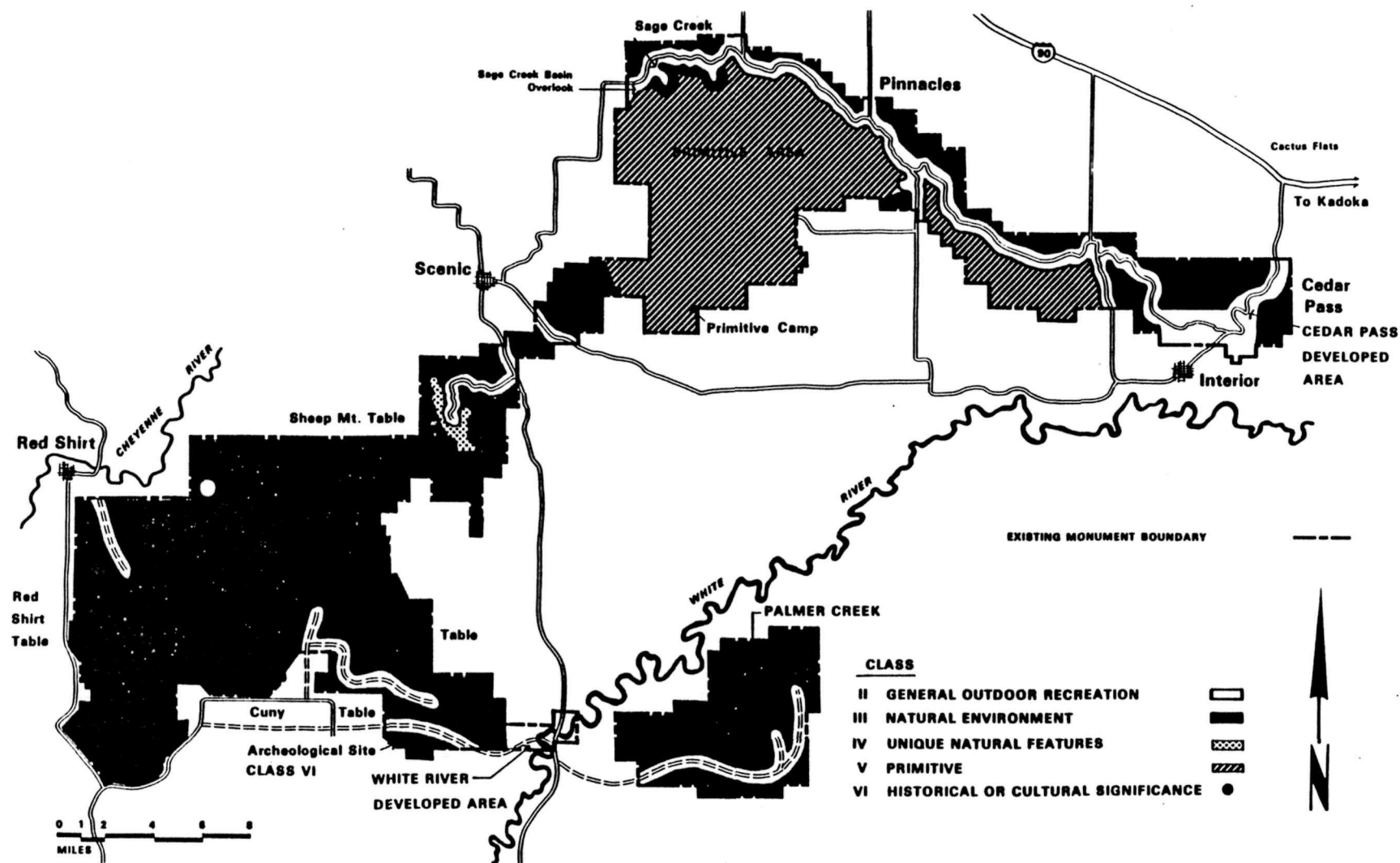


Figure 20. Land classification map, Badlands National Park.

to designate a research natural area in the Wheatgrass-Grama-Buffalograss Type. This type was not located, although the complete park was not surveyed. The sites surveyed more closely resembled the Wheatgrass-Green Needlegrass Type. The original designation might have been due to a response to drought and heavy grazing, and the Wheatgrass-Green Needlegrass Type may be more representative of normal conditions.

#### Present Vegetation and Prairie Management History

Due to the large size of the Badlands National Park, the prairie has been exposed to a varied management history. After European settlement, the large native herbivores were eliminated and replaced by domestic livestock. Heavy overgrazing reduced plant species diversity and plant density. These factors, along with soil compaction, caused accelerated erosion and runoff, reducing the productivity of the land. Some areas were plowed and seeded to small grains during the Homestead Era. During the 1930's Dust Bowl period, portions of the land in the North Unit were acquired by the government for restoration and reclamation. Following the establishment of the park, these lands were turned over for management by the National Park Service. Domestic livestock grazing was allowed in the park from 1942-1944 under the World War II "Beef for Victory" program.



Plant cover was restored sufficiently in the North Unit through the removal of domestic livestock, rest, and plant succession. Mule deer and antelope naturally returned to the area, while bison and bighorn sheep were reintroduced by the National Park Service. A grazing regime has been reestablished with 300 bison in the western portion of the North Unit. The eastern portion is only lightly used by deer and antelope. A major problem that has complicated the goal of grassland vegetation has been the rapid invasion of prairie dogs on sites that were previously farmed or overgrazed. Measures have been introduced to control these rodents.

All wildfires have been suppressed since the establishment of the park. The result has been that the grassland complex of the North Unit has been allowed to progress to an unknown ecological condition in relation to what it would have been under a natural fire regime. Invasion of exotic weeds has also been a problem.

Management of the South Unit of Badlands National Park is a separate program. Portions of the old Rapid City Aerial Gunnery Range were added to the park as the South Unit in 1968 for their scenic and geologic values. Agricultural use, primarily livestock grazing, is allowed and continues under the terms of the memorandum of agreement with the Oglala Sioux Tribe. Much of the vegetation in this area is not

pristine. The dry years of the late 1970's and early 1980's resulted in overgrazing in some areas. Tribal regulations allow hunting by tribal members year-around with no bag limits. Hunting and grazing have resulted in low numbers of native herbivores.

Present vegetation is as varied as past management. Some areas are in excellent condition, while others are only in the beginning stages of succession. Vegetation is also related to soil type, which varies from sand to clay. At least 12 range sites are present within the park. Vegetation on the clayey soils is predominantly western wheatgrass and green needlegrass (Stipa viridula) in undisturbed areas. Buffalograss and blue grama replace these grasses with over grazing. Continued disturbance is followed by increases in prickly pear cacti (Opuntia spp.), Japanese brome (Bromus japonicus), and little barley (Hordem pusillum). Vegetation on sandy soils in excellent condition include sand bluestem (Andropogon hallii), prairie sandreed (Calamovilfa longifolia), and little bluestem. Woody plants such as leadplant (Amorpha canescens), roses (Rosa spp.), sand cherry (Prunis besseyi), and small soapweed (Yucca glauca) are common. Overuse and disturbance will be followed by decreases in the desirable species and increases in sand dropseed (Sporobolus cryptandrus), sedges, blue grama, and western ragweed (Ambrosia psilostachya).

### Land Use and Vegetation Within One Mile of the Park Boundary

Vegetation immediately outside of the boundary is not different from that found within the boundary. Land use is primarily agricultural, with approximately 80% of the land being used for grazing and 20% for dryland farming.

### Prairie Research

Albertson, F. W. 1953. Report of study of grassland areas of Badlands National Monument, South Dakota; Fort Robinson Military Reservation in Nebraska; North and South Units of Theodore Roosevelt National Memorial Park, North Dakota; and Wind Cave National Park, South Dakota. A Report to the NPS.

The purposes of Dr. Albertson's research were to determine the presence of unique grassland areas that would warrant preservation and to assess the grasslands from the standpoint of their importance to the economy of the overall livestock industry. He determined range sites and the density, composition, and recommended carrying capacities of each site. He identified the following range sites: ordinary upland, sandy, clay, thin clay, lowland, shallow, and very shallow. Vegetation on each site was described. Basal cover, percent species composition of grasses, and carrying capacity were presented in tables. A list of forbs found in the various areas was also presented in tabular form.

Lindstrom, Lester. 1959. The flora of the Badlands National Monument of South Dakota. Proceedings of the South Dakota Academy of Sciences. 38:163-173.

This publication includes a list of all plants found at the park. Due to the year of the publication, the nomenclature is not up to date.

Radeke, Robert E. and Ralph S. Cole. 1969. Soils and vegetation of the Badlands National Monument. Pages 89-98. In: Natural resources basic data for Badland National Monument. James W. Larson, ed. National Park Service.

Vegetation was described in terms of range site. These researchers separated the range sites somewhat differently than did Dr. Albertson. The range sites covered were clayey overflow, sands, sandy, silty, dense clay, shallow, shallow clay, thin upland, claypan, and thin claypan. These sites are a more modern classification than was available for use by Dr. Albertson. Vegetation on each site was briefly described. Suggested starting stocking rates for bison are presented for several areas.

Stiegers, William O. 1981. Habitat use and mortality of mule deer fawns in western South Dakota. Ph.D. Thesis. Brigham Young University, Provo, Utah. 200 pages.

Dr. Stiegers included a description of the vegetation of the area in this thesis. Use of habitat by mule deer was detailed.

Agnew, William. 1983. Flora and fauna associated with prairie dog ecosystems. M.S. Thesis. Colorado State University, Fort Collins, Colorado.

This publication includes a detailed view of the flora associated with prairie dog towns.

General References

National Park Service. 1973. Master plan. Badlands National Monument/South Dakota. 58 pages.

National Park Service. 1985. Environmental assessment. Memorandum of agreement. South Unit. Badlands National Monument/South Dakota. 61 pages.

National Park Service. 1975. Statement for management. Badlands National Monument/South Dakota. 11 pages.

National Park Service. 1976. Environmental analysis. Badlands National Monument/South Dakota. 27 pages.

National Park Service. 1981. Badlands National Park/South Dakota. A brochure. 4 pages.

BENT'S OLD FORT  
National Historic Site  
Colorado

Bent's Old Fort on the Arkansas River in southeastern Colorado was once the frontier hub from which American trade and influence radiated south into Mexico, west into the Great Basin (and beyond to the Pacific), and north to southern Wyoming. It was built in 1833-34 by the brothers Charles and William Bent and Ceran St. Vrain and became the most important port of call and depot between Independence, Missouri, and Santa Fe, New Mexico. The establishment of Bent's Old Fort National Historic Site was authorized on June 3, 1960.

Approximately 638 acres (258 hectares) of the 800.0 acres (323.9 hectares) of the park is in prairie or some stage of succession leading toward prairie (Figure 21). These areas are further described under the section on Present Vegetation and Prairie Management History. Federal land totals 178.0 acres (72.1 hectares), and nonfederal land totals 622.0 acres (251.8 hectares).

Kuchler Vegetation Type: Grama-Buffalo Grass

(Bouteloua-Buchloe) (Map No. 65)

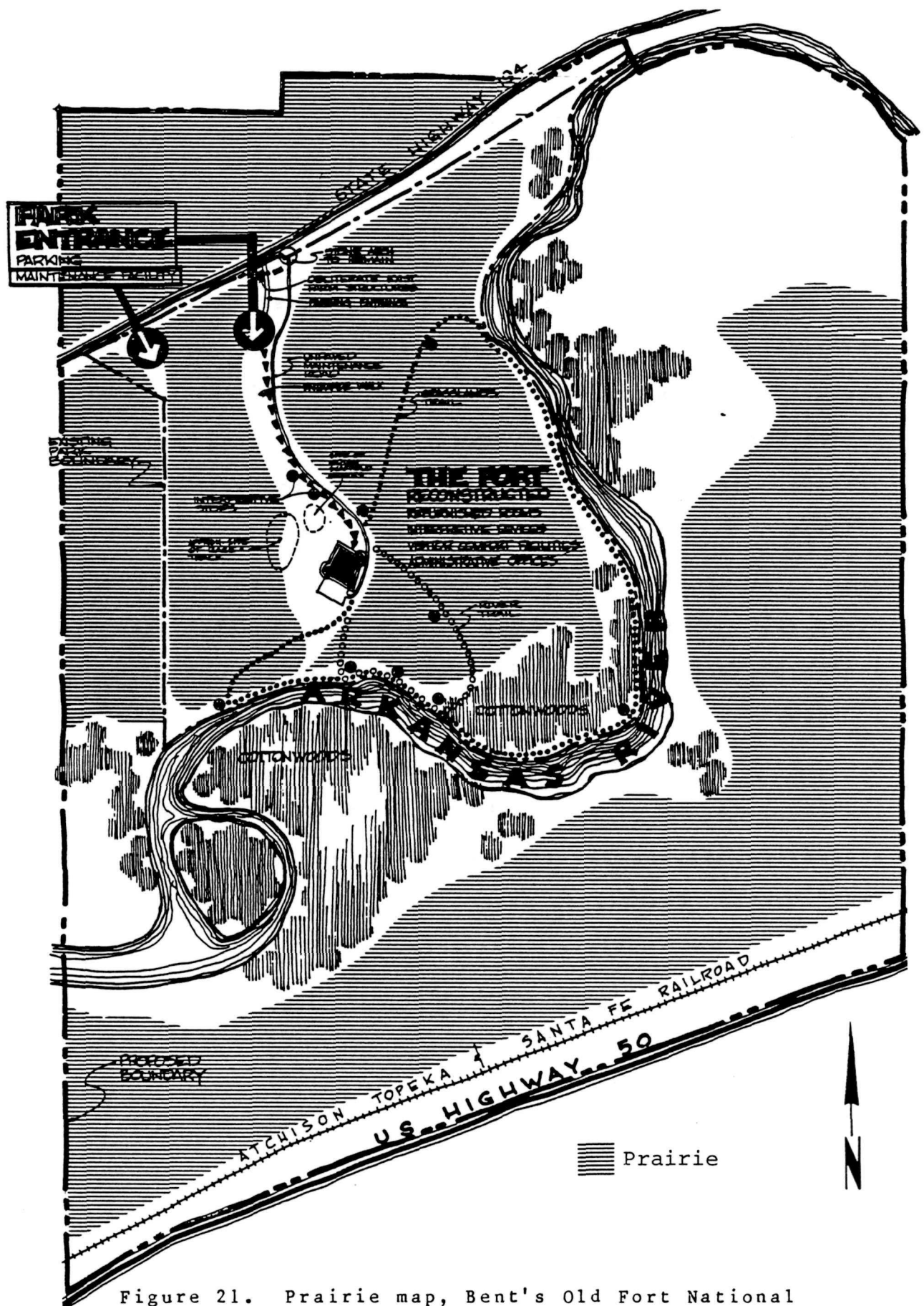


Figure 21. Prairie map, Bent's Old Fort National Historic Site.

### Present Vegetation and Prairie Management History

The site shows the effects of cultivation and heavy grazing. All of the area near the fort was compacted and denuded by a dense population of livestock, by men, and by wagons during its historically active period. Heavy grazing and cultivation were also present after that period.

Vegetation at the Bent's Old Fort National Historic Site has been recently classified into eight types. The four types which may be considered to be prairie or potential prairie sites include: Type 1 - Cultivated fields; Type 2 - Reseeded grama grass; Type 3 - Saltgrass/Alkali sacaton meadow; and Type 8 - Old fields and pasture.

Type 1. Cultivated Fields Unit. Vegetation in this unit is in rather poor condition and the whole unit should be considered to be potential prairie. It includes approximately 50 acres (20 hectares) recently acquired along the west boundary and 15 acres (6 hectares) north of State Route 194. Cultivated lands and native vegetation are mixed within this unit. Dominants include blue grama, western wheatgrass, and sideoats grama.

Type 2. Reseeded Grama Grass Unit. This unit is composed of 30 acres (12 hectares) and is located just west and north of the fort site. A largely unsuccessful attempt was made in the 1970's to reseed this unit to blue grama and buffalograss. Poor germination and slow growth were due to inadequate moisture. Much of the area is now bare. Principal vegetation is kochia (Kochia scoparia), Russian thistle (Salsola iberica), and devil's claw (Martynia louisianica) with only a few grasses. The area is currently being grazed.

Type 3. Salt Grass/Alkali Sacaton Unit. This type is located in the meadows on the east side of the fort in the area between the highway and the river. The dominants are saltgrass (Distichlis spicata) and alkali sacaton (Sporobolus airoides). The area has been heavily grazed, and there has been a downward trend in range condition. Numerous invaders have become prominent. Type 3 makes up a total of 143 acres (58 hectares).



Type 8. Old Fields and Pasture Unit. Included in this area are approximately 400 acres (162 hectares) of the Forrest Harmon Ranch located south of the river. The natural vegetation has been highly disturbed either through cultivation or improper grazing. Portions of the area are subjected to periodic flooding and there is some encroachment of tamarisk or salt cedar (Tamarix pentandra). Native vegetation includes sideoats grama, blue grama, and western wheatgrass.

#### Land Use and Vegetation Within One Mile of the Park Boundary

The area surrounding Bent's Old Fort Historic Site is classified as agricultural. Some portions of the area are farmed, while others are grazinglands. Vegetation on the grazinglands is similar to that present within the boundary of the park. Vegetation along the Arkansas River is also similar to that along the river and within the park. The major species include cottonwood (Populus sargentii), willow (Salix interior), and tamarisk.

#### Prairie Research

No prairie research has been conducted at this location.

#### General References

National Park Service. 1974. Environmental impact statement. Bent's Old Fort National Historic Site/Colorado. 50 pages.

National Park Service. 1975. Final master plan. Bent's Old Fort National Historic Site/Colorado. 48 pages.

National Park Service. 1982. Management plan and environmental assessment. Bent's Old Fort National Historic Site/Colorado. 39 pages.

National Park Service. 1982. Statement for management.  
Bent's Old Fort National Historic Site/Colorado. 6 pages.

BIGHORN CANYON  
National Recreation Area  
Wyoming-Montana

Bighorn Canyon National Recreation Area lies within a region of great scenic diversity, where the middle Rocky Mountains spill out onto the Great Plains. Bighorn Canyon National Recreation Area in southeastern Montana and north central Wyoming encompasses 120,157.9 acres (48,646.9 hectares). It was established on October 15, 1966, in order to provide for public outdoor recreation use and enjoyment of the Bighorn Reservoir and adjacent lands.

The park consists of 65,617.4 acres (26,565.8 hectares) of federal land and 54,540.4 acres (22,081.1 hectares) of nonfederal land (Figure 22). Approximately 1,560 acres (632 hectares) are classified as grassland or sagebrush/grassland.

Kuchler Vegetation Type: A mosaic of Saltbush-Greasewood  
(Atriplex-Sarcobatus),  
Sagebrush-Steppe  
(Artemisia-Agropyron),  
Foothills Prairie  
(Agropyron-Festuca-Stipa), and  
Grama-Needlegrass-Wheatgrass  
(Bouteloua-Stipa-Agropyron) (Map  
Nos. 40, 55, 63, and 64)

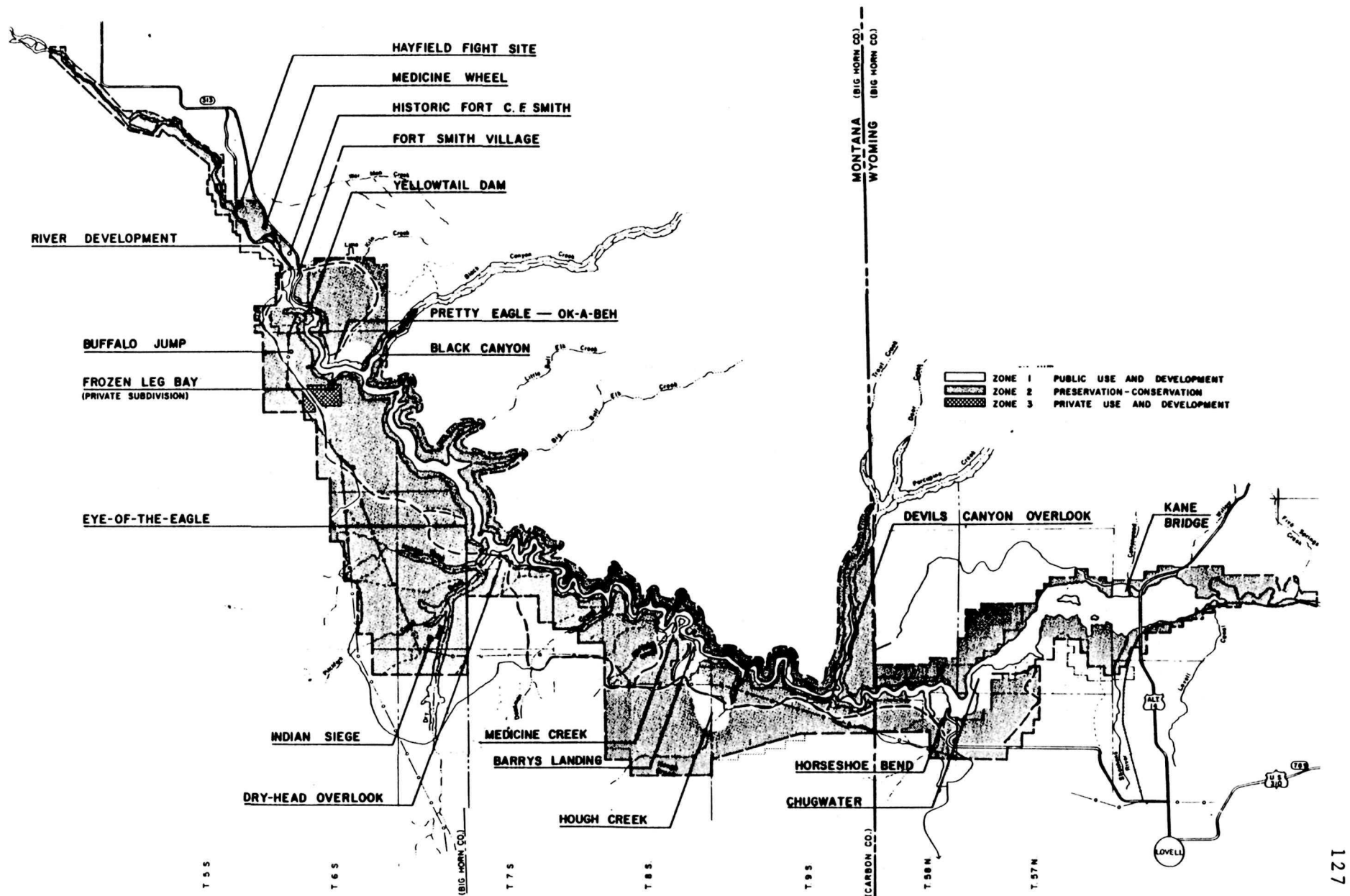


Figure 22. Land classification map, Bighorn Canyon National Recreation Area.

### Present Vegetation and Prairie Management History

The first permanent settlers came to the area around 1880. They were primarily cattlemen and often had large herds. Sheep raising first started in 1901. Most of the prairie within the boundaries was subjected to grazing, often heavy, by domestic animals until acquisition by the National Park Service. Some of the land was broken for farming in the early portion of this century. Some irrigated farmland is present in the area.

Although much of the area was overgrazed, it is possible that small remnants of relatively undisturbed prairie may remain due to the inaccessibility provided by the extreme topography surrounding Bighorn Lake. Fires have also been controlled. Condition of the vegetation of the prairies, therefore, varies greatly. Because of the wide variety of ecological zones, over 800 identified species of grasses, forbs, and woody plants have been found to date.

Grazing of domestic animals occurs in several areas. Cattle grazing the 9,815 acres (3,974 hectares) of the Dryhead Common Allotment, Carbon County, Montana (Townships 7 and 8, Ranges 28 and 29 East). Horses graze the 9,100 acres (3,684 hectares) of the Pryor Mountain Wild Horse Range, Carbon County, Montana and Big Horn County, Wyoming (Township 9, Range 28 East). Small, disjunct parcels of the Yellowtail Wildlife Habitat are intermittently grazed by cattle.

### Land Use and Vegetation Within One Mile of the Park Boundary

Land use near the boundary is primarily grazing of domestic livestock. Small acreages of alfalfa, corn, and wheat are also produced near the boundaries.

### Prairie Research

No prairie research has been conducted within Bighorn Canyon National Recreation Area. A vascular plant inventory was recently completed as a part of the initial resources basic inventory. A preliminary vegetation map was completed in 1985.

Collins, Don D. 1968. The study of plant communities of the Big Horn National Recreation Area in relation to the impact of concentrations of people. Department of Botany and Microbiology, Montana State University, Bozeman, Montana. 36 pages.

This project did not concentrate on prairie vegetation, but a grassland community and a shrub-grassland community are described. This report discusses differences in vegetation between the north and south ends. The list of species contains many prairie plants.

Patterson, Craig T. 1985. Bird and mammal inventory for the Bighorn Canyon National Recreational Area. Wyoming Cooperative Fishery and Wildlife Research Unit. Laramie, Wyoming. 84 pages.

The purpose of this study was to develop a list of birds and mammals occurring in the park and to describe habitat requirements of these species.

#### General References

National Park Service. 1969. Bighorn Canyon National Recreation Area/Wyoming-Montana. A brochure. 2 pages.

National Park Service. 1971. Master plan. Bighorn Canyon National Recreation Area/Wyoming-Montana. 51 pages

National Park Service. 1977. Environmental analysis. Draft master plan/draft development concept plans. Volume 1. Bighorn Canyon National Recreation Area/Wyoming-Montana. 187 pages.

National Park Service. 1980. Statement for management. Bighorn Canyon National Recreation Area/Wyoming-Montana. 36 pages.

## CUSTER BATTLEFIELD

## National Monument

## Montana

Custer Battlefield National Monument memorializes the Battle of the Little Big Horn, one of the last armed efforts of the Northern Plains Indians to preserve their ancestral way of life. Here, in the valley of the Little Bighorn River, several thousand Sioux and Cheyenne warriors defeated the command of Lt. Col. George A. Custer. Over 260 soldiers and attached personnel of the U.S. Army met death on June 25-26, 1876. The battlefield was designated as a National Cemetery in 1879. Several boundary changes occurred over the years until the area was redesignated as the Custer Battlefield National Monument on March 22, 1946.

Custer Battlefield National Monument is composed of two units totalling 765.3 acres (309.9 hectares) of federal land. Custer Battlefield contains 603 acres (244 hectares), and the Reno-Benteen Defense Site contains 162 acres (66 hectares). About 25 acres (10 hectares) are occupied by the National Cemetery, parking lots, roadways, and buildings. The remaining 740 acres (300 hectares) are native prairie (Figure 23).

Kuchler Vegetation Type: Grama-Needlegrass-Wheatgrass

(Bouteloua-Stipa-Agropyron) (Map

No. 64)



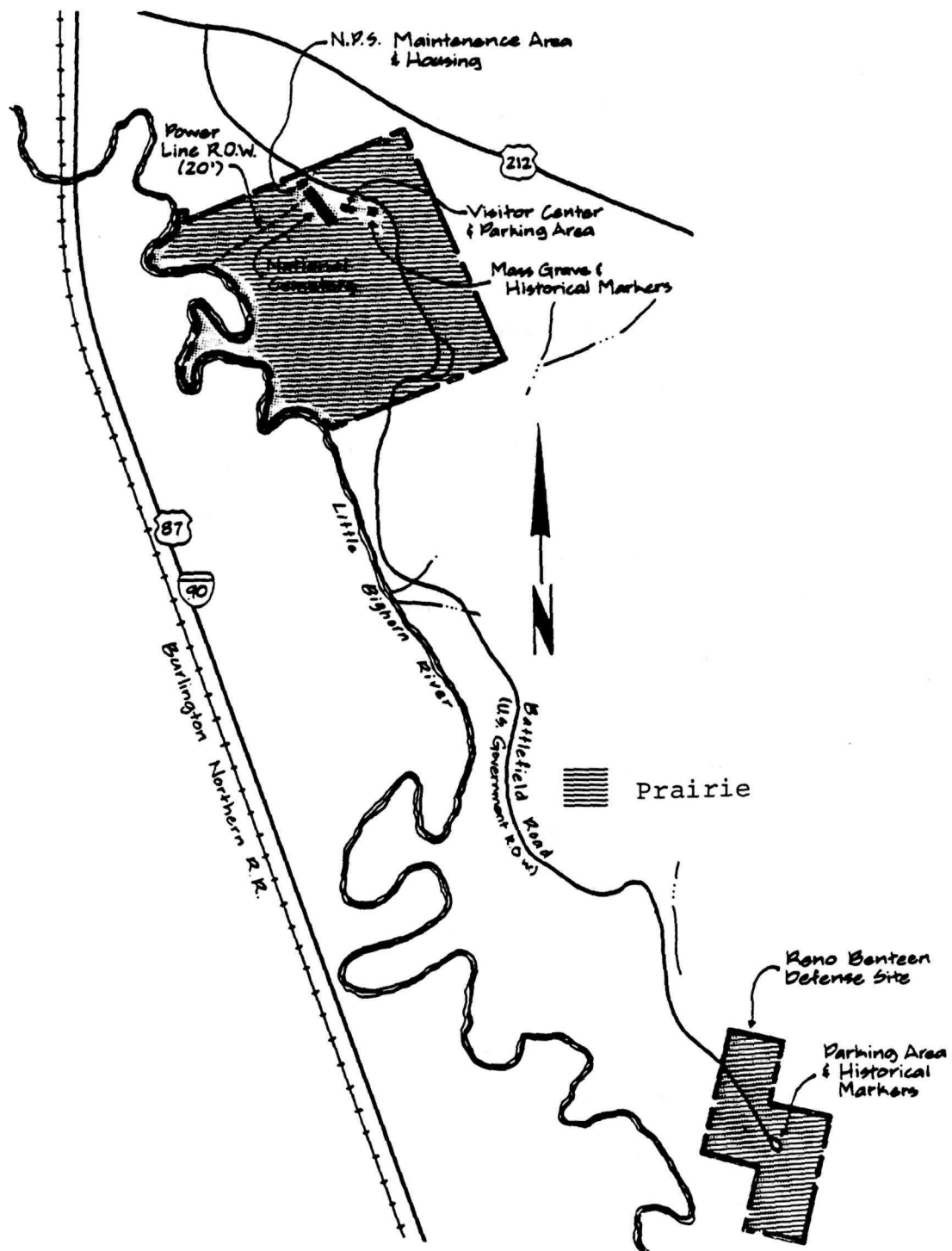


Figure 23. Prairie map, Custer Battlefield National Monument.

### Present Vegetation and Prairie Management History

The prairie, as a whole, is in good to excellent condition. It is in much better condition than the surrounding ranchland. Vegetation at the Custer Battlefield Unit was heavily grazed, primarily by horses, prior to fencing in 1891. The Reno-Benteen defense site was fenced in 1954. It also was heavily grazed, primarily by cattle, before that date. No grazing by domestic livestock has been allowed since those dates. Fires are controlled as soon as possible. A wild fire burned essentially all of the prairie in the summer of 1983.

Prescribed burning was tried as a control measure for Canada thistle (Cirsium arvense) with unsuccessful results. Use of herbicides (2,4-D) was initiated in 1971 for noxious weed control. Results indicate a 70% rate of effectiveness in the Battlefield area.

Bluebunch wheatgrass makes up over 30% of the vegetation. Other important grasses include western wheatgrass, blue grama, Idaho fescue (Festuca idahoensis), green needlegrass, prairie junegrass, Sandberg bluegrass, and needleandthread. Prairie sandreed (Calamovilfa longifolia) is prominent on sandy soils. An overstory of big sagebrush (Artemisia tridentata) occurs on much of the area. Fringed sagewort is present on the sandy sites. Hawthorne (Crataegus spp.), chokecherry (Prunus virginiana), small soapweed (Yucca

glauca), and greasewood (Sarcobatus vermiculatus) are other common shrubs. Cottonwoods (Populus spp.) occur along the Little Bighorn River.

Forbs are abundant throughout the grasslands. They include wild onion (Allium textile), sego lily (Calochortis gunnisonii), deathcamas (Zygadenus venenosus), Richardson tansymustard (Descurainia richardsonii), milkvetches (Astragalus spp.), prairie clovers (Petalostemum spp.), scurfpeas (Psoralea spp.), scarlet globemallow (Sphaerlcea coccinea), plains pricklypear (Opuntia polyacantha), scarlet gaura (Gaura coccinea), common milkweed (Asclepias syriaca), Hoods phlox (Phlox hoodii), Indian paintbrush (Castilleja sessiliflora), western yarrow (Achillea millefolium), rose pussytoes (Antennaria rosea), hairy goldaster (Chrysopsis villosa), annual sunflower (Helianthus annuus), dandelion (Taraxicum officinale), and common salsifly (Tragopogon dubius).

#### Land Use and Vegetation Within One Mile of the Park Boundary

Land outside of the boundaries is primarily used for livestock grazing. A small portion of the valley of the Little Bighorn is farmed.

Vegetation in the surrounding grazing lands is in poorer condition than that within the park boundaries. Heavy grazing has eliminated many of the taller and more highly

palatable species. Woody vegetation along the Little Bighorn River is similar inside and outside of the park boundaries.

### Prairie Research

Research at the Custer Battlefield National Monument has centered on the historical aspect of the park. A partial plant species list has been assembled.

Hewitt, George B. 1983. Forage yield at five sites in Montana. Progress report for 1982. Montana State University, Bozeman, Montana.

The primary thrust of this research is a soil moisture study. Yield data from this study show forage production of 1,317 pounds per acre (1,176 kilograms per hectare) from the grasses and 522 pounds per acre (466 kilograms per hectare) from the forbs.

### General References

National Park Service. 1973. Custer Battlefield National Monument/Montana. A brochure. 2 pages.

National Park Service. 1974. Draft environmental statement. Master plan. Custer Battlefield National Monument/Montana. 60 pages.

National Park Service. 1982. Statement for management. Custer Battlefield National Monument/Montana. 9 pages.

National Park Service. Undated. Resource management plan. Custer Battlefield National Monument/Montana. 17 pages.

DEVILS TOWER  
National Monument  
Wyoming

Devils Tower National Monument is located along the Belle Fourche River in northeast Wyoming. The tower is the core of an ancient volcano. Its name was affixed in 1875 by a scientific team escorted by Col. Richard I. Dodge. Around the tower, ponderosa pine (Pinus ponderosa) forest and a few small stands of aspen (Populus tremuloides) merge with the prairie. Devils Tower National Monument contains 1,346.9 acres (545.3 hectares) of federal land. Of the 1,142 acres (462 hectares) within the natural environment zone, approximately 400 acres (162 hectares) are classified as prairie (Figure 24).

Kuchler Vegetation Type: A mosaic of Wheatgrass-Needlegrass (Agropyron-Stipa) and Black Hills Pine Forest (Pinus) (Map Nos. 66 and 77)

Present Vegetation and Prairie Management History

Prairie at Devils Tower National Monument is surrounded by forests. Some prairie exists under a scattering of trees. Prairie vegetation has not been subjected to use by domestic

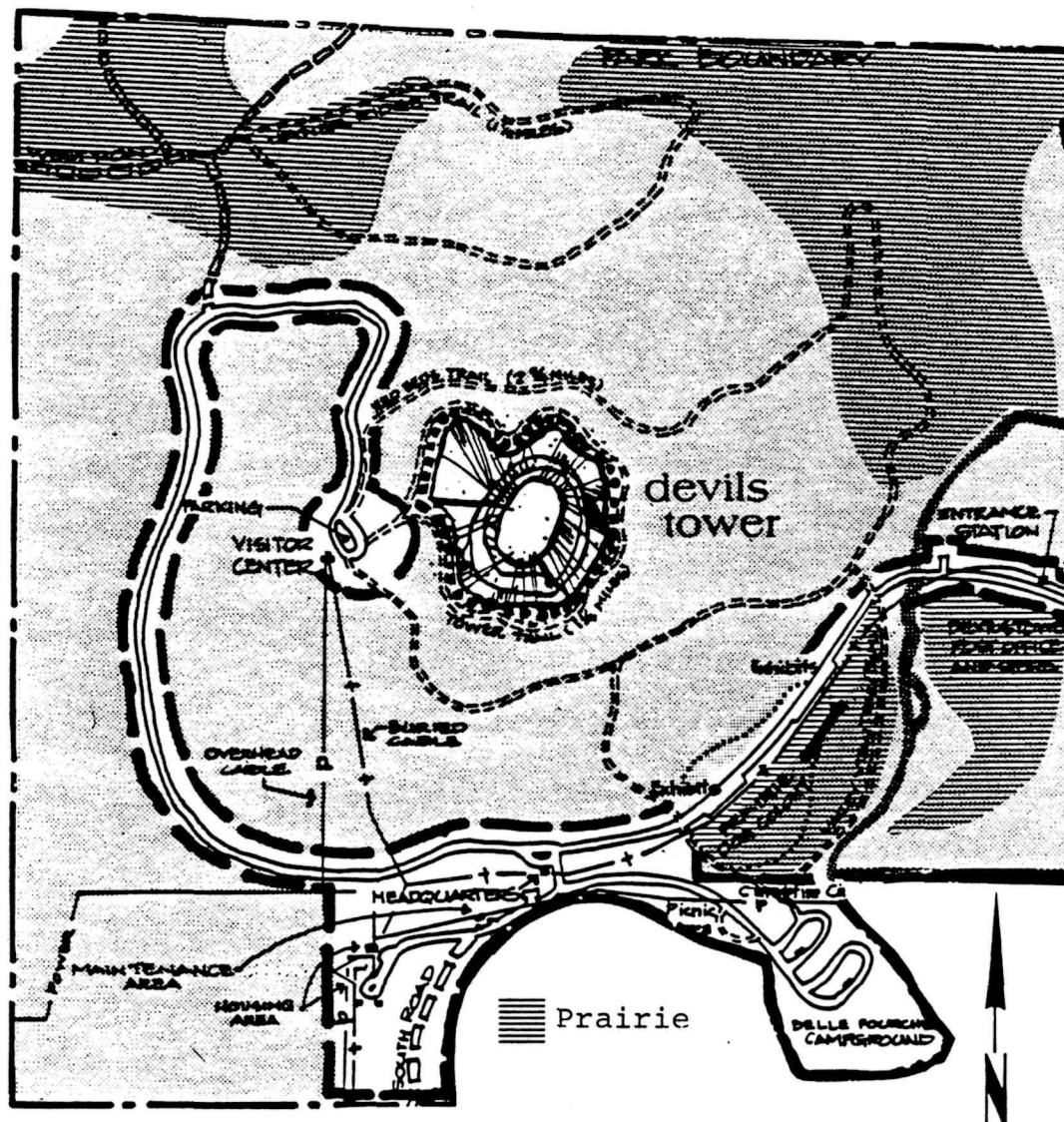


Figure 24. Prairie map, Devils Tower National Monument.

animals for many years. Wildlife have influenced prairie communities, especially within the prairie dog colony in the southeastern portion of the park.

Fire was suppressed on the monument for over 60 years. The results of fire suppression included a buildup of large quantities of litter, an increase in woody species, and a corresponding decrease in prairie species. Prescribed burning was initiated in the fall of 1974. A 28 acre (11 hectare) area directly north of the entrance station and a 30 acre (12 hectare) area between the headquarters and the prairie dog colony in the southern part of the park were burned. An additional 30 acre (12 hectare) area in the northwest portion of the park was burned in April 1982.

Visual observations indicated increased grass vigor and amounts of grass during the first growing season following the prescribed burn. Unfortunately, no quantitative measurements were made.

Leafy spurge (Euphorbia esula), an introduced forb, has become a problem weed in several areas within the park boundaries. The herbicide 2-4,D (2,4-dichlorophenoxyacetic acid) was used for control until 1973. Picloram (4-amino-3,5,6-trichloropicolinic acid), a more effective herbicide, has been used since that time. Biological control methods, such as the spurge hawkmoth, are currently being evaluated.

### Land Use and Vegetation Within One Mile of the Park Boundary

The area surrounding Devils Tower National Monument is all rangeland. These areas are grazed by domestic livestock. The Belle Fourche River borders the southern portion and flows through the southeastern portion of the park.

### Prairie Research

A dendrochronology and fire history study is currently being conducted by the Laboratory of Tree Ring Research at the University of Arizona. Dr. Clifford Ferris, University of Wyoming, is currently doing an insect survey. Improved bird lists are being assembled by Audubon Society members.

Marriott, Hollis. 1982. List of plant species. Devils Tower National Monument/Wyoming. Photocopy. 11 pages.

Hollis Marriott, a Master of Science candidate at the University of Wyoming, has indexed over 400 species of vascular plants.

### General References

National Park Service. 1975. Resource management plan. Devils Tower National Monument/Wyoming. 11 pages.

National Park Service. 1979. Interpretive prospectus. Devils Tower National Monument/Wyoming. 27 pages.

National Park Service. 1981. Statement for management. Devils Tower National Monument/Wyoming. 8 pages.

National Park Service. 1981. Wildflowers of Devils Tower. Devils Tower National Monument/Wyoming. 2 pages.



FORT LARAMIE  
National Historic Site  
Wyoming

Fort Laramie was the site of a private fur trading post from 1834-1849 and a military post from 1849-1890. It figured prominently in the covered wagon migrations to Oregon and California, in a series of Indian campaigns, and in many other pioneer events. The Fort Laramie National Historic Site was established on July 16, 1938.

Fort Laramie National Historic Site contains 856.36 acres (346.7 hectares). Federal land totals 562.8 acres (227.9 hectares) and nonfederal land totals 293.6 acres (118.9 hectares). There are approximately 604 acres (245 hectares) of natural and reestablished grassland (Figure 25). In addition, 220 acres (89 hectares) are currently being returned to grassland.

Kuchler Vegetation Type: Grama-Needlegrass-Wheatgrass  
(Bouteloua-Stipa-Agropyron) (Map  
No. 64)

The park is located near the Grama-Buffalo Grass (Bouteloua-Buchloe) type. Some of the uplands closely

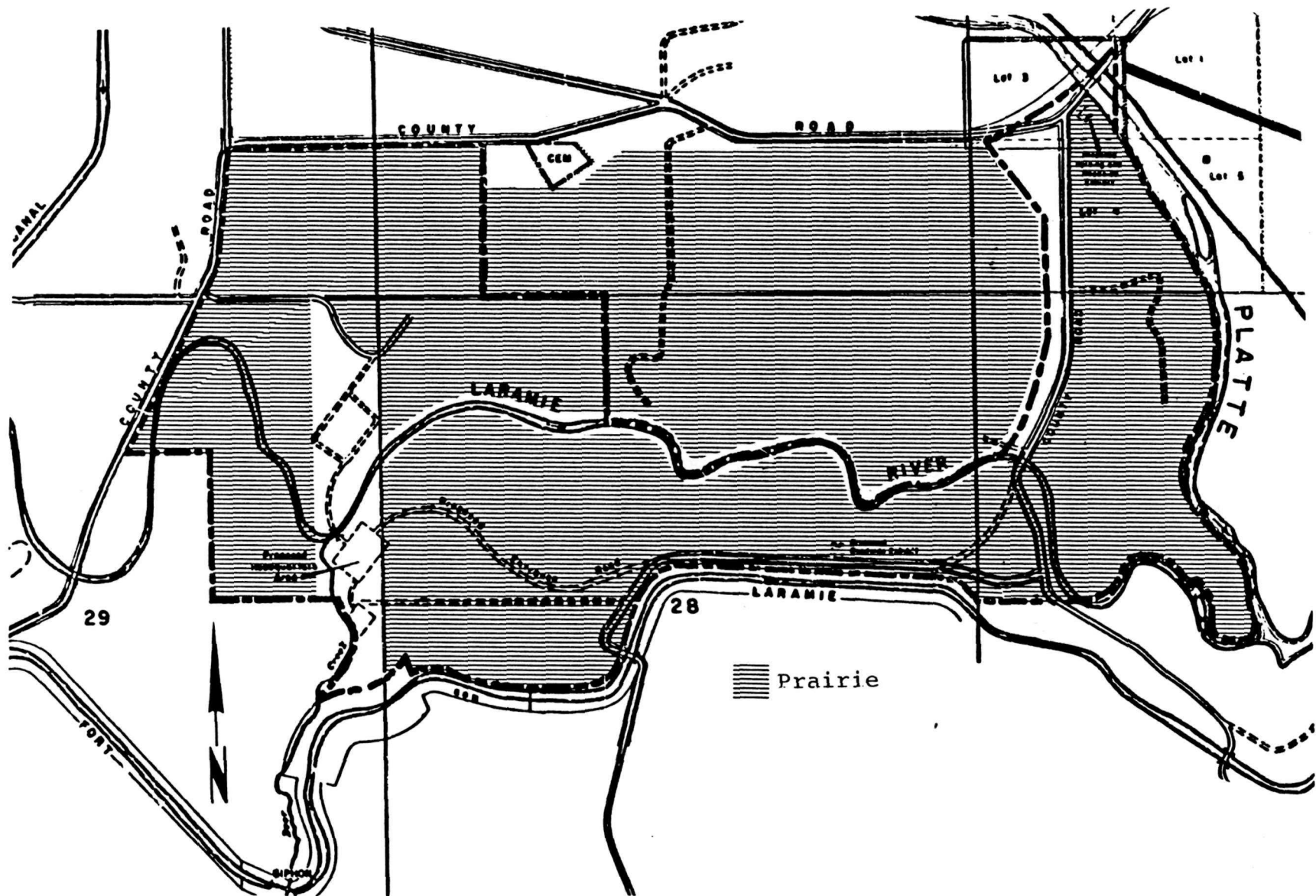


Figure 25. Prairie map, Fort Laramie National Historic Site.

resemble this fairly dense grassland of short grasses. Blue grama and buffalograss (Buchloe dactyloides) are the dominants in this vegetation type.

#### Present Vegetation and Prairie Management History

The area included within the boundaries of the Fort Laramie National Historic Site has been influenced by domestic grazing animals for nearly 150 years. Much of this grazing was excessive. By 1845, the grasslands had deteriorated to the point that animals had to be moved 3 miles (5 kilometers) from the fort to find sufficient forage. Reports show that the land in the immediate vicinity of the fort was devoid of vegetation by 1847. In the next few years, diarists describe the country around the fort as covered with prickly pear (Opuntia spp.)

Occasionally in the early 1850's, large herds of bison passed near the fort. As the grasslands continued to deteriorate, the bison ceased coming. The U. S. Army required horses and mules for transportation and cattle for food. These animals required pasture. In addition, the animals belonging to the thousands of immigrants passing through the fort added to the overgrazing problem. In an attempt to conserve some of the grasslands around the fort, an order was issued in 1852 limiting the number of animals owned by enlisted men.

Continued heavy grazing in the 1880's contributed to reduced competition from grasses, sedges, and other plants and allowed tree seedlings to become established. Cattle caused compaction of the soil, creating drier soil and exposing mineral soils. These factors combined to form an adequate seedbed for tree seedlings. Elimination of the natural prairie fires allowed the tree seedlings to grow. After acquiring the site in 1938, the National Park Service initiated a reseeding program to help prevent weed intrusion. Introduced species, such as smooth brome (Bromus inermis), were seeded. Natural succession has caused a gradual decline in these species as they are being replaced by the native plants. In general, these areas are in the mid-stages of plant succession. Grasses are probably thicker now than during the historic period. Although nearly all of the natural species are present, their relative abundance is not at historic levels and many introduced species still exist. The use of herbicides until the 1960's also had an effect on the vegetation of the area.

A revegetation program is currently being conducted on a portion of a recently acquired parcel of land. A total of 95 acres (38 hectares) was seeded over the period of 1981 to 1983. The proportions and seeding mixture was 45% western wheatgrass, 25% Indian ricegrass (Oryzopsis hymenoides), 20% green needlegrass, and 10% prairie sandreed (Calamovilfa

longifolia). This mixture was applied at the rate of 10 pounds per acre (11 kilograms per hectare).

The Environmental Subzone contains approximately 40 acres (16 hectares) that have never been tilled. The vegetation on this site has not been grazed for at least 40 years. During recent years, it has been grazed only lightly. The primary management practice on this land has been to simply leave it alone.

#### Land Use and Vegetation Within One Mile of the Park Boundary

The area north of the Fort Laramie National Historic Site is native prairie. It is grazed by cattle and horses. Grazing land is located on the south side of the site. This area was probably restored to grassland. Alfalfa is produced on farmland west of the boundary. Farmland, planted to corn, is located directly east of the boundary.

#### Prairie Research

Prairie research has not been conducted on the Fort Laramie National Historic Site. A list of major grasses and forbs was compiled in 1959. The list contains 36 grasses and over 100 grasslike plants, forbs, or shrubs. John C. Fremont collected some plants in the vicinity of the site in 1842.

Starting in 1868, some of the post surgeons collected plants in the area.

#### General References

National Park Service. 1971. Fort Laramie National Historic Site/Wyoming. A brochure. 2 pages.

National Park Service. 1972. Interpretive prospectus. Fort Laramie National Historic Site/Wyoming. 53 pages.

National Park Service. 1978. Draft environmental assessment. Fort Laramie National Historic Site/Wyoming. 39 pages.

National Park Service. 1982. Development concept plan. Fort Laramie National Historic Site/Wyoming. 41 pages.

National Park Service. 1982. Statement for management. Fort Laramie National Historic Site/Wyoming. 15 pages.

## FORT UNION TRADING POST

National Historic Site

North Dakota - Montana

Fort Union Trading Post was the most important site on the upper Missouri River associated with the fur trade in western America. It had a vital impact on exploration, transportation, economics, and the exploitation of the American Indian for the period of 1829 through 1865. Its setting near the confluence of the Yellowstone and Missouri rivers has been a focal point in American history from the time of Lewis and Clark's expedition of 1804-06. The establishment of Fort Union Trading Post National Historic Site was authorized on June 20, 1966, to commemorate the significant role played by Fort Union as a fur trading post on the upper Missouri River.

Fort Union contains 436.5 acres (176.7 hectares), 121 acres (50 hectares) of which is easement. Federal land totals 392.0 acres (158.7 hectares). Prairie and potential prairie occur in three areas, totalling 175 acres (71 hectares) (Figure 26). Areas near the fort site contain approximately 35 acres (14 hectares) of grasslands. Formerly cultivated land northwest, northeast, and southeast of the fort site is being allowed to return to grassland from alfalfa (Medicago sativa). This area contains 98 acres (40

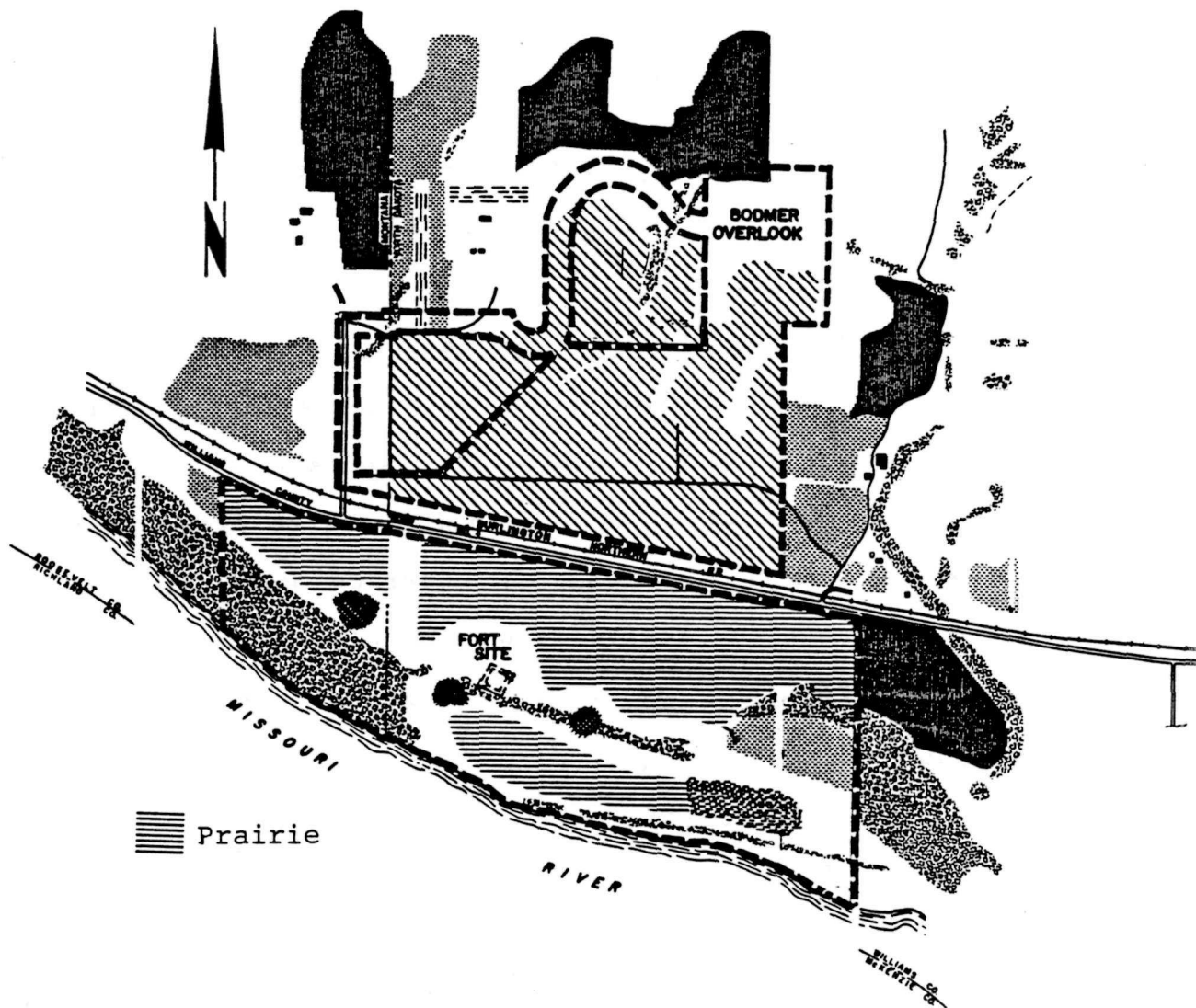


Figure 26. Prairie map, Fort Union Trading Post National Historic Site.



hectares). Natural grasslands are located in the 42 acre (17 hectare) Bodmer Overlook site in the northwest portion of the park.

Kuchler Vegetation Type: Wheatgrass-Needlegrass

(Agropyron-Stipa) (Map No. 66)

Present Vegetation and Prairie Management History

The area is divided into two distinctive vegetation zones by a terrace which separates the ancient flood plain on which the fort site is located from the active flood plain of the Missouri River. Along the terrace edge and in the western portion of the active flood plain are thick growths of cottonwood (Populus deltoides), green ash (Fraxinus pennsylvanica), chokecherry (Prunis virginiana), redosier dogwood (Cornus stolonifera), and willows (Salix spp.).

The upper terrace is not covered by water anytime during the year and contains the prairie and developing prairie. The 98 acre (40 hectare) area that was formerly in alfalfa is being allowed to undergo succession toward prairie. Numerous prairie species are returning to this area. Adjacent to and surrounding this vegetation type is a total of 35 acres (14 hectares) of mixed grass, forbs, and shrubs. Smooth broome (Bromus inermis) is abundant and will be a long-term problem. Historically, much of this area was heavily grazed.

Most of this area is now hayed to preserve the historic scene, but it is not mowed each year.

The area north of the railroad, with the exception of the Bodmer Overlook and access road corridor, is maintained as a scenic easement under agricultural use. Use is limited to small grain farming and pasture. The Bodmer Overlook is maintained as native grassland. Many of the climax grasses and forbs may be found in this area. The prairie is not grazed and is in good condition.

The following eight ecologically distinct vegetation types are known from the park (a discussion follows the prairie types only):

1. Hardwood draws

2. Upland Hills - this site was the least disturbed of all sites in the area. Although some evidence of livestock grazing was found, no recent abuse has occurred. This site contains an excellent mixture of midgrasses, short grasses, and forbs. It would be characteristic of the Wheatgrass-Needlegrass vegetation type.

3. Upland Prairies - this site occurs in the lower areas of the uplands. Much of this area has been farmed. Natural dominant and subdominant plant species would be similar to those on the Upland Hills.

4. Lowland Prairies - this site is an upper terrace of the Missouri River. Nearly all of these sites have been placed in cultivation.

5. Hardwood Bottoms

6. Willow Bottomland

7. Wet Bottomland

8. Barren Sandbars

Grass fires are periodically caused by passing trains along the railroad right-of-way. These fires are easily controlled. Natural fires are controlled only to the extent necessary to protect human life, historic resources, development facilities, or as necessary to confine the fire within the park boundaries.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Most of the area surrounding Fort Union Trading Post National Historic Site is classified as agricultural. Primary crops are wheat and alfalfa. Natural grasslands are also present and some of the area is developed as residential.

#### Prairie Research

Weist, Katherine M., James Lowe, Earl Willard, and Paul B. Wilson. 1980. Current and historic resources of the Fort Union Trading Post National Historic Site. University of Montana, Missoula. 128 pages.

A review of the literature was conducted to determine the natural vegetation of the area. Searches were made of the local area for relatively undisturbed sites along with relicts of natural vegetation. Few such sites were observed.

These researchers indicate that the current vegetation at Fort Union Trading Post National Historic Site is a mixture of natural plant communities and cultivated lands. Their report contains plant community descriptions, a list of

exotic species, and a list of scientific and common names of plant species referenced in the report.

#### General References

National Park Service. 1972. Fort Union Trading Post National Historic Site/North Dakota. A brochure. 2 pages.

National Park Service. 1985. Interim interpretative prospectus. Fort Union Trading Post National Historic Site/North Dakota. 16 pages.

National Park Service. 1978. General management plan. Fort Union National Historic Site/North Dakota and Montana. 50 pages.

National Park Service. 1982. Statement for management. Fort Union Trading Post National Historic Site/North Dakota and Montana. 8 pages.

## KNIFE RIVER INDIAN VILLAGES

## National Historic Site

## North Dakota

The Knife River Indian Villages comprise a cluster of 51 archeological sites located near the confluence of the Knife and Missouri Rivers, just north of Stanton, North Dakota. This site was occupied for centuries and possibly for several thousand years. Lewis and Clark visited the site often during their stay at nearby Fort Mandan in the winter of 1804-1805. Sakakawea lived there. The Knife River Indian Villages National Historic Site was established in 1974. Remains of earth lodges, cache pits, fortifications, and burials are present.

The Knife River Indian Villages National Historic Site contains 1,291.5 acres (522.9 hectares). Federal land totals 1,250.1 acres (506.1 hectares), and nonfederal land totals 41.7 acres (16.9 hectares). Approximately 400 acres (162 hectares) are classified as native prairies (Figure 27). An additional 350 acres (142 hectares) have been formerly cropped and are now undergoing natural succession toward prairie.

Kuchler Vegetation Type: Wheatgrass-Needlegrass

(Agropyron-Stipa) (Map No. 66)

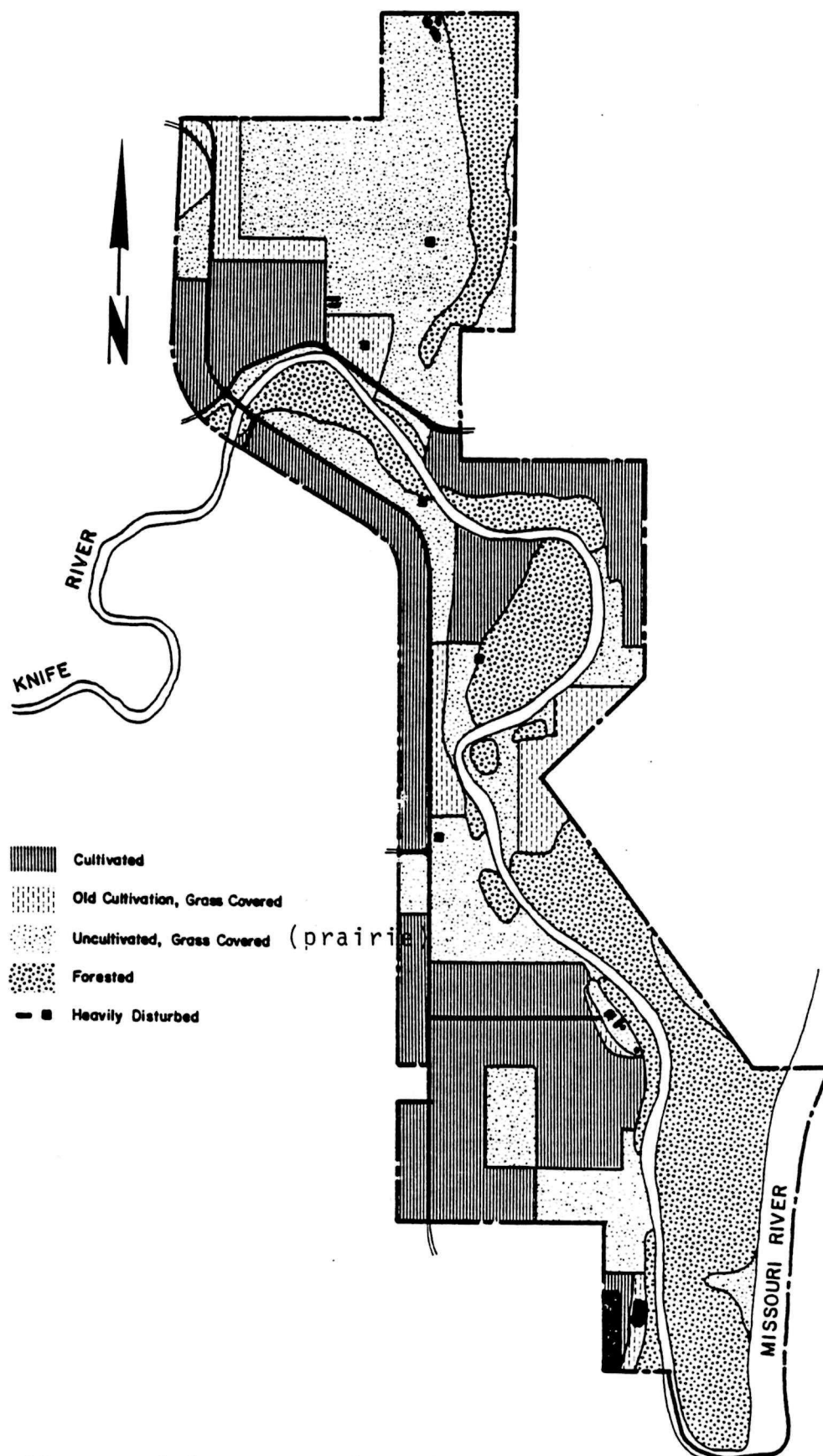


Figure 27. Prairie map, Knife River Indian Villages National Historic Site.

### Present Vegetation and Prairie Management History

Prairie areas of the Knife River Indian Villages National Historic Site have been grazed by both wildlife and domestic livestock during the historical period. Thousands of individuals lived in the area from AD 1000 to 1861. Their wood gathering, farming, and grazing practices are known to have grossly impacted the vegetation. Later, during the steamship era, the park area was a wood lot that provided fuel for the ships.

Grazing was discontinued upon establishment of the park. Formerly cultivated fields are currently undergoing succession toward a climax prairie community. These areas are in the early stages of succession and are dominated by weedy grasses and forbs. Native perennial plants are scattered. The native prairie areas vary from poor to excellent in condition.

### Land Use and Vegetation Within One Mile of the Park Boundary

The Knife River Indian Village National Historic Site is bordered on three sides by agricultural land. Most of this land is used to produce cultivated crops such as alfalfa (Medicago sativa) and wheat (Triticum aestivum). A few other crops are grown in the area. Some of the adjacent land is used for grazing animals. Generally, its condition is of lower quality than that of the native prairie areas within the park. The park is bounded on the south by the village of Stanton.

### Prairie Research

Ms. Bonnie Heidel of the North Dakota Land Heritage Program has identified areas of undisturbed native prairies within the park boundaries.

Clambey, Gary K. 1985. Vegetation baseline study for the Knife River Indian Villages National Historic Site. North Dakota State University, Fargo. 82 pages.

This study was completed during the summer of 1984. Objectives included: (1) a floristic inventory and establishment of a reference plant collection for use at the Site; (2) analysis of the contemporary vegetation; (3) clarification of earlier vegetation patterns; (4) consideration of current vegetation management issues and recommendation of future measures to be used. A total of 257 plant taxa were identified and voucher specimens for most of these have been deposited at the park headquarters. These include inhabitants of prairies, riparian forest, shrublands, river edge communities, and ruderal areas.

### General References

National Park Service. 1978. Master plan. Knife River Indian Villages National Historic Site/North Dakota. 31 pages.

National Park Service. 1980. Assessment of alternatives. Knife River Indian Villages National Historic Site/North Dakota. 68 pages.

National Park Service. 1981. Knife River Indian Villages National Historic Site/North Dakota. A brochure. 2 pages.



National Park Service. 1981. Statement for management.  
Knife River Indian Villages National Historic Site/North  
Dakota. 6 pages.

## THEODORE ROOSEVELT

## National Park

## North Dakota

The Badlands landscape of Theodore Roosevelt National Park presents a unique contrast to the gently rolling prairie of the Northern Great Plains. The Badlands, with its maze of canyons and coulees, interspersed with prairie uplands, was the hub of the northern open range cattle industry of the 1880's. Theodore Roosevelt was a part of this ranching industry, and the park area has been set aside as a memorial to him.

Theodore Roosevelt National Park was authorized on April 25, 1947. It contains 70,344.6 acres (28,479.6 hectares) in three units: North Unit, South Unit, and Elkhorn Unit. Federal land totals 69,975.9 acres (28,330.32 hectares). Prairies cover about 43,000 acres (17,409 hectares), or 60% of the park (Figure 28). Brush and woodlands each cover 10,000 acres (4,049 hectares), or 15% each. Approximately 7,000 acres (2,834 hectares), 10% are non-vegetated.

Kuchler Vegetation Type: Wheatgrass-Needlegrass

(Agropyron-Stipa) (Map No. 66)

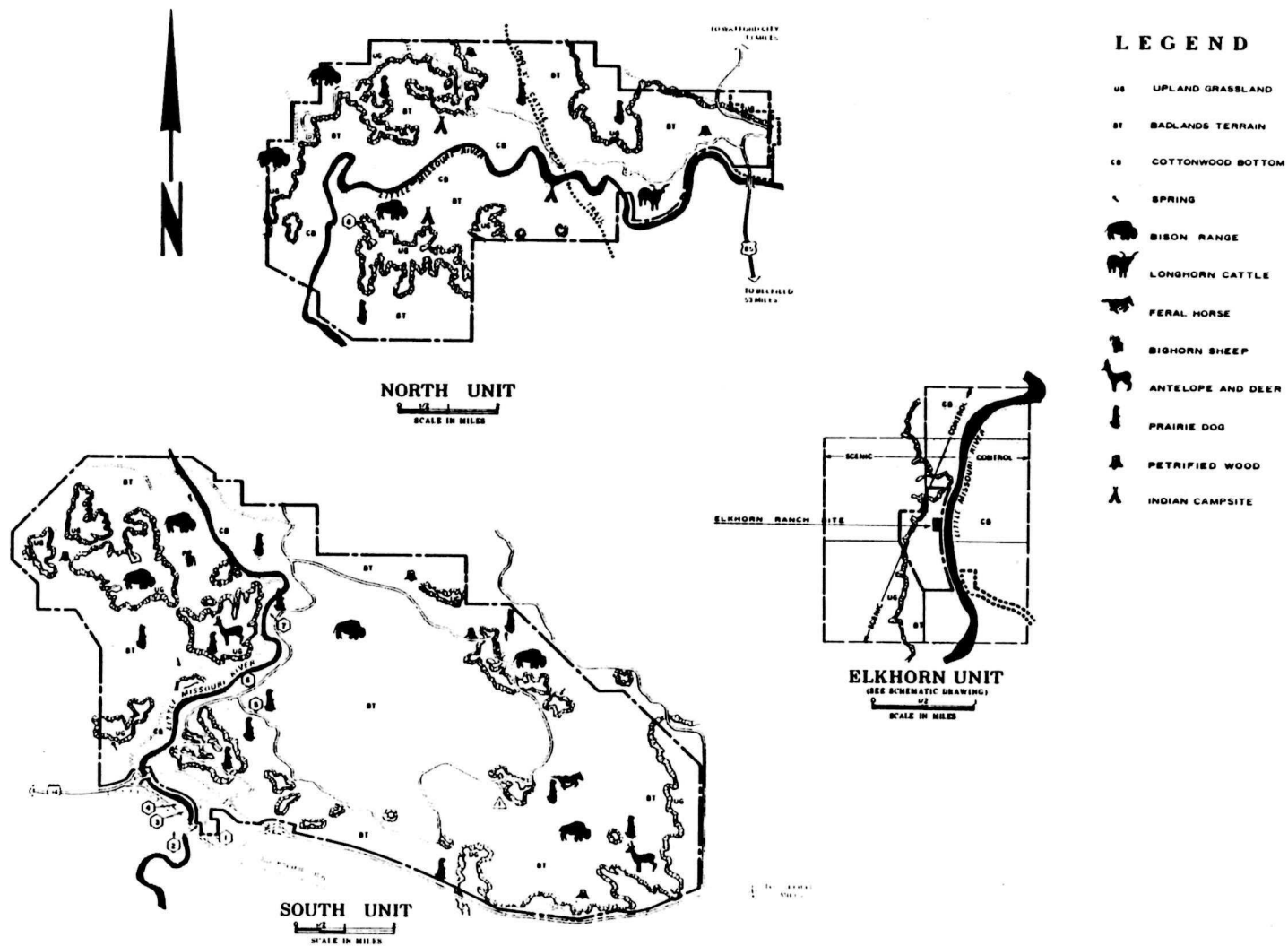


Figure 28. Land classification map, Theodore Roosevelt National Park.

### Present Vegetation and Prairie Management History

The grasslands were heavily overgrazed in the 1880's. Following the collapse of the range cattle industry in the 1890's, some of the uplands were cultivated and planted to grain crops. Cultivation continued until the drought of the 1930's made farming impractical. Since that time, the land has been allowed to revert to its natural state. It is unknown if any of the cultivated lands were seeded back to native grasses. Some exotics, such as smooth brome (Bromus inermis), were seeded. Old field patterns are still noticeable from the air in some cases, but the scars are gradually diminishing. Nearly all associated structures and fences were removed soon after the establishment of the park.

Numerous species of animals are found in the Theodore Roosevelt National Park. Bison and elk have been reintroduced into the park. They have a significant influence on the prairie vegetation. Wild horses exist in the South Unit, and longhorn steers are maintained in the North Unit. These animals also affect the vegetation, but they are associated with the historic scene and are a part of the living history of the park. The lands are generally being managed to perpetuate an undisturbed prairie ecosystem rather than to preserve the prairie in the disturbed condition that prevailed during the Roosevelt years.

The rough topography of the area and the wide variety of soils encourage several different plant communities. These vary from the prairies on the flat and rolling areas to north slope woodlands and desert shrubs on the south facing slopes. Dominant plants of the grasslands on plateaus are western wheatgrass, blue grama, little bluestem, and needleandthread. Some prairie species occur on the south facing slopes. The understory is often composed of grasses with overstory dominants of big sagebrush (Artemisia tridentata), silver sagebrush (Artemisia cana), small soapweed (Yucca glauca), greasewood (Sarcobatus vermiculatus), and plains pricklypear (Optuntia polyacantha). Over 800 species of vascular plants have been found in the park.

Researchers have classified vegetation at the Theodore Roosevelt National Park into 11 habitat types. Habitat types provide a means of describing grassland and woodland ecosystems and relating successional stages to potential climax. The six of these habitat types that may be considered to be prairie are:

1. Stipa comata - Carex filifolia
2. Agropyron smithii - Carex filifolia
3. Schizachyrium scoparium - Carex filifolia
4. Juniperus horizontalis - Schizachyrium scoparium
5. Artemisia tridentata - Agropyron smithii
6. Artemisia cana - Agropyron smithii

Several exotic plants have increased in the park despite continued efforts to control them. Smooth brome was seeded in some areas and has spread into some of the prairie areas. Leafy spurge (Euphorbia esula) and Canada thistle (Cirsium arvense) are special concerns.

#### Land Use Within One Mile of the Park Boundary

Much of the land surrounding Theodore Roosevelt National Park is owned by the Federal Government and is administered by the Forest Service as the Little Missouri National Grasslands. This land is leased for cattle grazing and oil and gas development. A relatively large amount of the adjacent lands are owned by the State of North Dakota. Private lands are mainly grazed, but numerous gas and oil wells have been developed. A small amount of the privately owned land is used for small grain and hay production.

#### Prairie Research

Whitman, Warren C. 1936. A preliminary study of some grassland types in western North Dakota in relation to soil characteristics. A Thesis. North Dakota Agricultural College. Fargo, North Dakota. 118 pages.

This research was conducted at 26 sites centering chiefly around Sentinel Butte. Seven of the major grassland vegetation types were identified and characterized. Quantitative measurements of the vegetation were made by

means of the frequency-abundance and point methods. The two main vegetation types that would be found on Theodore Roosevelt National Park are the Uplands Type and the Badlands Type. The Uplands Type occupies the nearly level to gently rolling upland plateaus and tablelands. The chief vegetation dominants are blue grama, needleandthread, and sedges. The total number of species represented in the community is fairly high and the forbs are numerous. The soil is generally a sandy loam with a well developed profile. The Badlands Type is found on the long slopes of only moderate relief. The chief vegetation dominants are blue grama, western wheatgrass, and sedges. The total number of species is low, and the forbs are few. The soil is a silty clay with a fairly well developed profile.

Ralston, Robert D. 1960. The structure and ecology of the north slope juniper stands of the Little Missouri Badlands. Master of Science Thesis. University of Utah, Salt Lake City, Utah. 85 pages.

This research determined the effects of fire on several shrubs. It is not directly related to prairie but it contains information about one of the vegetation types that come in contact with the prairie.

Hazlett, Donald L. 1971. An ecological study of Artemisia dominated vegetation in western North Dakota with special reference to the concept of allelopathy. Master of Arts Thesis. University of South Dakota, Vermillion, South Dakota. 42 pages.

This research was conducted entirely in the South Unit of Theodore Roosevelt National Park. The apparent randomness of silver sagebrush and big sagebrush individuals, combined with an age range of 10 to 14 years implied no significant intraspecific allelopathic inhibition for western North Dakota sagebrushes.

Sanford, Richard C. 1970. Skunk brush (Rhus trilobata Nutt.) in the North Dakota Badlands: Ecology, phytosociology, browse production, and utilization. Ph.D. Dissertation. North Dakota State University, Fargo, North Dakota. 165 pages.

Phytosociological data on skunkbrush sumac was collected at 20 sites, all within 20 miles (32 kilometers) of Medora. Growth and phytosociological parameters from shrub and herbaceous data were significantly different between sites and slope positions (bottom, middle, and top). Grasses comprised most of the herbaceous layer, becoming less important at the top. Shrubs and forbs increased toward the top. Growth, utilization, and plant age are also discussed.

Williams, Dean E. 1976. Growth, production, and browse utilization characteristics of serviceberry (Amelanchier alnifolia Nutt.) in the Badlands of southwestern North Dakota. Master of Science Thesis. North Dakota State University, Fargo, North Dakota. 110 pages.

Serviceberry was generally dominant in the shrub overstory, while the understory composition varied. Vegetative reproduction of serviceberry is accomplished



mainly through root sprouting. Twig growth and yield of serviceberry are discussed. Utilization during one winter was 11% and was 15% during another winter.

Hoffman, George R. 1978. An ecologic study of the habitat types of Theodore Roosevelt National Memorial Park, North Dakota. A Report. National Park Service.

This project was started in 1978 to delimit the habitat types, list the plants, and assess the animal components of the habitat types. This is a preliminary report. The information is expanded in later reports.

Hansen, P. L., R. B. Hopkins, and G. R. Hoffman. 1980. An ecological study of Theodore Roosevelt National Park: Habitat types and their animal components. A Report. Department of Biology, University of South Dakota, Vermillion, South Dakota. 182 pages.

Ten habitat types were delimited, samples, and described. Animal components were related to these habitat types. The report contains an excellent literature cited section.

Hansen, P. L. 1977. An ecological study of the vegetation of Theodore Roosevelt National Park, North Dakota. Master of Arts Thesis. University of South Dakota, Vermillion, South Dakota. 117 pages.

The study region is described by physiography, geology, soils, and climate. Eleven habitat types are described, and a key to these types is included.

Anonymous. 1981. South Unit Loop Road photo recovery study. A Report. National Park Service. 3 pages.

In August 1978 a landslide (slumping) destroyed a section of road in the South Unit of Theodore Roosevelt National Park. This damage forced the closing of the road until August 1980. The road was rerouted. The old railroad was removed and used as the foundation for the new roadway. The remains of the old roadway were then recontoured using heavy construction equipment. The old roadway was then abandoned to allow for natural recovery. Two sites were selected for photo documentation of plant succession. Starting April 1 of each year and continuing until October 1, photographs are made of each site on alternate months.

Rogers, Deborah. 1981. A bibliography of vegetation studies pertaining to North Dakota: Draft 1. North Dakota Natural Heritage Program, Bismark, North Dakota. 21 pages.

This bibliography lists 343 articles, books, theses, and other bibliographies which contain information relevant to the vegetation of North Dakota.

Snow, Ray. 1982. A flora of Theodore Roosevelt National Park, North Dakota. A working draft. National Park Service.

Species are arranged by family and species. It is noted if the species is (1) known to be in the park and in the herbarium, (2) known to be in the park and not in the herbarium, (3) species possibly occurs in the park, confirmation is needed, or (4) exotic.

Marlow, Clayton B., Lynn R. Irby, and Jack E. Norland. 1982. Optimum carrying capacity for bison in Theodore Roosevelt National Park. A Report. National Park Service. 2 pages.

This current research is designed to (1) delineate primary and secondary areas of bison use, (2) delineate net primary productivity and forage utilization for major range sites within primary and secondary use areas, (3) determine the general seasonal food habits of bison, (4) determine range trends under present population density of bison and the maximum carrying capacity of primary use areas, and (5) integrate range trend and carrying capacity estimated with management priorities for bison. Only preliminary data was available at the time of this report.

#### General References

National Park Service. 1973. Final environmental statement. Proposed wilderness. Theodore Roosevelt National Memorial Park/North Dakota. 57 pages.

National Park Service. 1973. Master plan. Theodore Roosevelt National Memorial Park/North Dakota. 39 pages.

National Park Service. 1980. Theodore Roosevelt National Park/North Dakota. A brochure. 4 pages.

National Park Service. 1982. Statement for management. Theodore Roosevelt National Park/North Dakota. 36 pages.

WIND CAVE  
National Park  
South Dakota

Wind Cave National Park is located on the southeastern flank of the Black Hills. The park preserves a distinctly different type of limestone cavern. It is a series of subterranean passages and rooms, some lined with colorful calcite crystal formations. Strong currents of air that blow alternately in and out of the cave suggested its name. The park also preserves a part of the original Black Hills prairie ecosystem.

Wind Cave National Park was established in 1903. It now contains 28,292.1 acres (11,454.3 hectares). Federal land totals 28,060.0 acres (11,360.3 hectares). Prairie occupies about 23,201 acres (9,393 hectares), or over 82% of the park (Figure 29). Pine forest occupies the remaining area.

Kuchler Vegetation Type: A mosaic of Wheatgrass-Needlegrass  
(Agropyron-Stipa) and Black Hills  
Pine Forest (Pinus) (Map Nos. 17 and  
66)

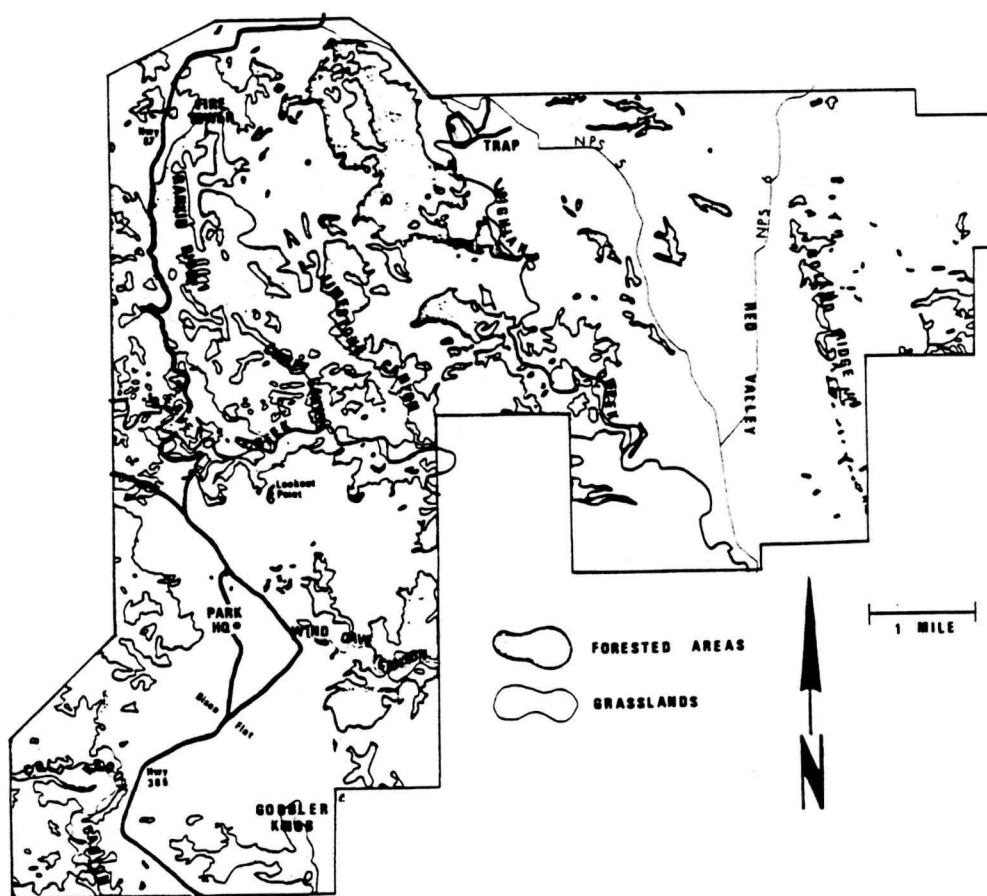


Figure 29. Vegetation map, Wind Cave National Park.

### Present Vegetation and Prairie Management History

Historically, grazing and fire were important influences on the prairie vegetation. A few areas were cultivated but cultivation was stopped many years ago. These disturbed areas are undergoing natural succession. The area has been more or less continuously grazed. Before the late 1800's, nomadic bison and other herbivores were important. In more recent times, resident herds of bison and elk have exerted the major grazing pressure on the vegetation. Other animals, such as prairie dogs and pronghorns, are also important.

At least 79 lightning fires and 33 fires caused by man were suppressed in and near the park from 1930 through 1974. Most were extinguished while small. The largest fire burned 5,466 acres (2,213 hectares) of forests and grasslands within the Park in September 1964. Experiments have been conducted with prescribed burning during the past ten years.

Prescribed burning has been used to reduce the number of woody plants and to control a variety of exotic range plants, such as Kentucky bluegrass (Poa pratensis) and Japanese brome (Bromus japonicus). Another problem weed has been Canada thistle (Cirsium arvense). Spot treatment with herbicides has been used as a control technique.

Prairie vegetation at Wind Cave National Park has been described by range site. A range site is a distinctive kind of land that differs from other kinds in its potential to

produce native plants. A range site is the produce of all environmental factors responsible for its development. Descriptions of the range sites, their vegetation, and acreages are as follows:

Overflow. This range site occurs along the intermittent streams that dissect the park and it occupies 1,329 acres (538 hectares). Soils in this range site regularly benefit from more than normal soil moisture and the climax plant cover is dominated by a stand of tall and midgrasses. The principal grasses are big bluestem (Andropogon gerardii), little bluestem, western wheatgrass, and green needlegrass. Forbs and a few shrubs are common. With continued overuse by grazing animals, the tall and midgrasses lose vigor and are replaced by bluegrasses and forbs.

Stoney Hills. This site occupies 2,729 acres (1,104 hectares) and is found on rolling hills. Climax cover is dominated by bluestems. Other important grasses are western wheatgrass, green needlegrass, and blue grama. Forbs such as sageworts, slimflower scurfpea (Psoralea tenuiflora), dotted gayfeather, and black samson are common. Leadplant and wild rose (Rosa arkansana) are abundant shrubs. With overuse, the palatable grasses are replaced by fringed sagewort and blue grama.

Silty. This site occurs in many of the open parks in the Black Hills and on nearly level to hilly uplands in the prairie. Wind Cave National Park contains 7,449 acres (3,014 hectares) of silty range site. Climax plant cover is dominated by a stand of midgrasses. Principal grasses are western wheatgrass, green needlegrass, needleandthread, blue grama, and Kentucky bluegrass. The most common forbs are fringed sagewort, slimflower and silverleaf scurfpea, and upright prairie coneflower (Ratibida columnifera). Shrubs are infrequent. With continued overuse by grazing animals, the midgrasses decrease and are replaced by blue grama and fringed sagewort.

Clayey. This site occurs on gently sloping to steep uplands on 895 acres (362 hectares), mostly in the northeastern portion of the park. Climax plant cover is dominated by a mixture of short and midgrasses with a number of prominent forbs. The principal grasses are western wheatgrass and green needlegrass with an understory of blue grama, buffalograss (Buchloe dactyloides), sedges, and bluegrasses. The principal forbs are fringed sagewort, silverleaf scurfpea, and upright prairie coneflower. Buffalograss will replace the taller species following overuse.

Shallow. This is the most abundant range site in the park, occupying 9,824 acres (3,976 hectares). It is situated on many of the steeper slopes and on the ridge tops throughout the park. Climax plant cover is dominated by little bluestem, which makes up 60% of the composition. Hairy grama (Bouteloua hirsuta), sideoats grama (Bouteloua curtipendula), and threadleaf sedge make up about 20% of the composition. Forbs and shrubs are common. With overuse, short grasses and forbs become dominant.

Thin Upland. This site occurs on the middle and lower slopes of steep uplands in the northeastern part of the Park. It only covers 566 acres (229 hectares). Climax plant cover is a mixture of short and midgrasses. Blue grama and threadleaf sedge account for 50% or more of the herbage. Next in importance are midgrasses. Forbs are present but are not abundant.

Condition of the prairie varies all the way from poor to excellent. In general, it is in good condition. Management of grazing and wild animals has made it necessary to sacrifice the condition of some of the prairie. For example, areas occupied by prairie dogs are in poor condition.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Lands surrounding Wind Cave National Park have vegetation similar to the prairie and forest within the park. Most of the land along the southern and eastern borders is privately owned, although one parcel is owned by the State of South Dakota. Custer State Park borders Wind Cave National Park on the north. United States Forest Service lands and private lands are located along the western boundary.

#### Prairie Research

Beginning in 1980 the National Park Service has produced a annual summary of research activities at Wind Cave National Park.



Albertson, F. W. 1953. A report of study of grassland areas of Badlands National Monument, South Dakota; Fort Robinson Military Reservation, Nebraska; North and South Units of Theodore Roosevelt National Memorial Park, North Dakota; and Wind Cave National Park, South Dakota. A Report. 61 pages.

Dr. Albertson surveyed the vegetation of Wind Cave National Park in 1953. He identified and described the vegetation as related to topography. He recorded similar species to those present today. He noted severe grazing near headquarters.

King, John A. 1955. Social behavior, social organization and population dynamics of a black-tailed prairie dog town in the Black Hills of South Dakota. Ph.D. Thesis. University of Michigan, Ann Arbor, Michigan.

This is a classic study on the social organization and ecology of black-tailed prairie dogs.

Soil Conservation Service. 1966. Conservation plan-soil and vegetation survey of Wind Cave National Park. A Report. Custer County Conservation District. United States Department of Agriculture.

This plan contains a history of the Wind Cave National Park. Range sites and woodland sites are identified. Important plant species, habitat use by animal species, and habitat condition trends for major animal species are presented for each site.

Lovaas, Allan L. 1973. A cooperative elk trapping program in Wind Cave National Park. The Wildlife Society Bulletin. 1:93-100.

A brief listing of prairie species and description of the climate of Wind Cave National Park is included in this article.

Lovaas, Allan L. 1973. Prairie dogs and black-footed ferrets in the National Parks, p. 139-148, In Black-footed ferret and prairie dog workshop. South Dakota State University, Brookings, South Dakota.

Movement of prairie dogs into prairie is briefly discussed in this article.

Lovaas, Allan L. 1976. Introduction of prescribed burning to Wind Cave National Park. The Wildlife Society Bulletin. 4:69-73.

The history of fire at Wind Cave National Park is outlined. A map showing the locations of suppressed fires in and near the park from 1930-1974 is included. The coordinated approach utilized by land management agencies to introduce fire into the Black Hill is outlined.

Gartner, F. Robert. 1977. Ecological changes on pine grassland burned in fall and spring. Final report. South Dakota State University, Research and Extension Center, Rapid City, South Dakota. 28 pages.

This report summarizes research conducted by Dr. Gartner. Fuel loads were reduced by burning without producing a negative effect on vegetation and soils. The burned areas, therefore, provided fuel breaks for fire control during the first summer after burning. Warm season grasses were reduced on meadows by fall burning. Composition and yields of warm season grasses on meadows burned in the spring and unburned

were not different. Percentage composition and yields of warm season grasses on slopes burned in the fall were less than on slopes burned in the spring. Yields of cool season grasses on meadows burned in fall were lower than those not burned or burned in the spring. Yields of cool season grasses on slopes burned in fall, spring, and not burned did not differ. Production of forbs and shrubs was greater on meadows burned in fall than those not burned or burned in the spring. Forb and shrub yields were greater on slopes burned in fall, and forbs increased on both fall and spring burned slopes compared with those not burned.

Schripsema, Janet Ruth. 1977. Ecological changes on pine-grassland burned in spring, late spring, and winter. M. S. Thesis. South Dakota State University, Brookings, South Dakota.

Prescribed burning at Wind Cave National Park was effective in reducing total fuels and creating natural firebreaks suitable for controlling wildfires. In grasslands, this may be effective until the mulch layer is replaced after four or five growing seasons. Burning reduced or eliminated dense pine thickets. Forage for wildlife was produced on these areas where there was little or no usable forage before burning. Burning retarded the spread of pine into grasslands. Season of burning is related directly to the management objective.

Varland, Kenneth L., Allan L. Lovaas, and Robert B. Dahlgren. 1978. Herd organization and movements of elk in Wind Cave National Park, South Dakota. Natural Resources Report Number 13. National Park Service, Washington, D.C. 28 pages.

This report includes a description of the prairie vegetation and of the park. Elk herds should be managed individually to prevent overuse of the range in any one area of the Park.

Worcester, Lynda Lou. 1979. Effects of prescribed burning at different fuel moisture levels on vegetation and soils of grasslands in Wind Cave National Park. M. S. Thesis. South Dakota State University, Brookings, South Dakota.

A little bluestem community and a mixed grass community were studied. Three fuel moisture levels were imposed on these communities; dry, medium, and wet with 30, 38, and 46% moisture, respectively. Comparison of preburn and postburn vegetative measurements indicated that fuel moisture levels examined did not have adverse effects on recovery, yield, or species composition.

Wydevan, Adrian P. 1979. Elk food habits and range interactions with other herbivores in Wind Cave National Park. M. S. Thesis. Iowa State University, Ames, Iowa.

This thesis contains a good description of the natural features of Wind Cave National Park. Yields of prairie species on different sites were determined. Cudweed sagewort was the major species eaten by elk in fall and winter. Threadleaf sedge was the major species consumed in the spring.

Big bluestem was the major species grazed in the summer. Management recommendations for wildlife and vegetation are presented.

Bock, Jane H. and Carl E. Bock. 1981. Some effects of fire in vegetation and wildlife in ponderosa pine forests of the southern Black Hills. Final report. Department of Environmental, Population, and Organismic Biology, University of Colorado, Boulder, Colorado.

Effects of prescription burns upon vegetation, birds, rodents, and bison were studied for three years in ponderosa pine forest and pine-grassland ecotone. Prescription fires were cool and largely restricted to understory vegetation and fuels. Densities of immature pines were reduced, and herbaceous ground cover was slightly increased. Grasses were generally unaffected. Birds, rodents, and bison showed strong positive responses to the prescription burns, but only through the first year of post fire succession.

Cappock, David Layne. 1981. Impacts of black-tailed prairie dogs on vegetation in Wind Cave National Park. M. S. Thesis. Colorado State University, Fort Collins, Colorado.

Studies were conducted in the mixed grass prairie of Wind Cave National Park to examine the effects of different durations of prairie dog impact on plant standing crops, composition, species diversity, and nitrogen concentration. Prairie dogs extensively modified the prairie. Long-term (12 years) impacts of prairie dogs dramatically altered plant community structure. Substantial reductions in the

litter layer suggests that prairie dogs could indirectly alter energy flow to decomposers. The only clear effect of prairie dogs on plant species diversity was noted for an Andropogon community where moderate (3-8 years) impacts of prairie dogs increased species diversity for total vegetation, grasses, and forbs.

Dalsted, K. J., S. Sather Blair, B. K. Worcester, and R. Klukas. 1981. Application of remote sensing to prairie dog management. *Journal of Range Management*. 34:218-223.

Remote sensing was used to determine the likely expansion potential and probable direction of growth of the 11 major prairie dog towns in the Wind Cave National Park. The prairie dog town inventory and expansion potential of each town has probable usefulness in the development of management plans.

Popp, Jewel Kay. 1981. Range ecology of bison on mixed grass prairie at Wind Cave National Park. M. S. Thesis. Iowa State University, Ames, Iowa.

Mixed herds of bison preferred cool season sites and avoided warm season sites for all of their activities throughout the year. Cool season graminoids, such as bluegrasses, sedges, and western wheatgrass, usually dominated bison diets. The proportion of warm season grasses, such as grammas, buffalograss, and bluestems, increased during summer. Forbs and browse were a minor portion of bison diets.

General References

National Park Service. 1977. Visitor center interpretive plan. Wind Cave National Park/South Dakota. 22 pages.

National Park Service. 1978. Wind Cave National Park/South Dakota. A brochure. 2 pages

National Park Service. 1981. Statement for management. Wind Cave National Park/South Dakota. 11 pages.

National Park Service. Undated. Resource management plan. Wind Cave National Park/South Dakota.

## ALIBATES FLINT QUARRIES

## National Monument

## Texas

Alibates Flint Quarries National Monument was established on August 31, 1965. Its purpose is to preserve a concentration of unique flint quarries used as a source of raw materials for weapons and tools by High Plains prehistoric Indian cultures.

It consists of 1,332.6 acres (539.5 hectares) and is located on the Canadian River Breaks in Texas. A total of 1,062.6 acres is federally owned. All of the land, except for roads and other developed sites and creekbeds, may be classified as prairie (Figure 30).

Kuchler Vegetation Type: Shinnery (Quercus-Andropogon) (Map No. 71)

Present Vegetation and Prairie Management History

Grasses cover most of the canyon slopes throughout the area. Blue grama predominates but other grasses and forbs are common. Broad river terraces are largely grasslands with scattered honey mesquite, prickly pears (Opuntia spp.), one-seed juniper, sumacs (Rhus spp.), and daleas (Dalea spp.).



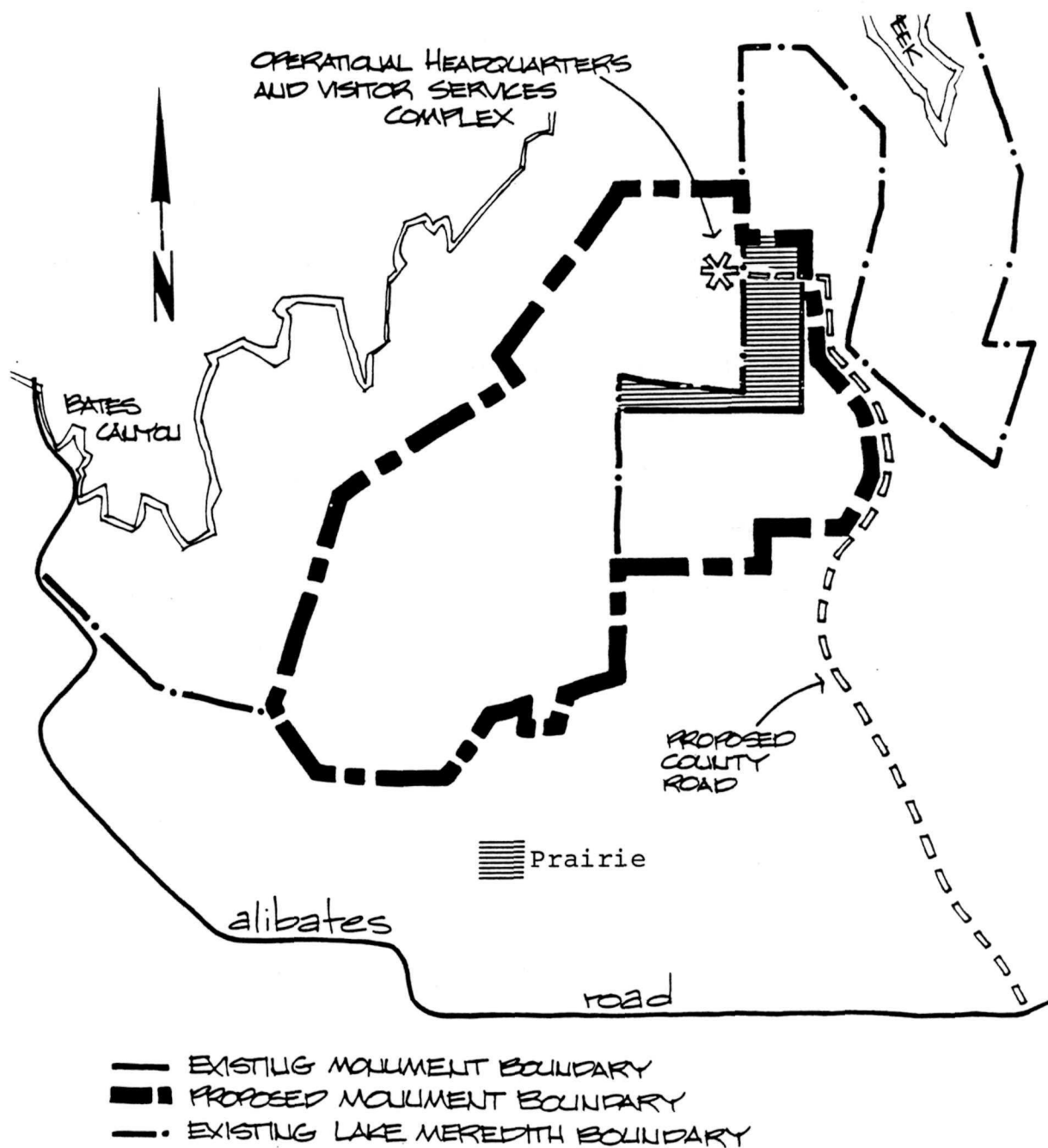


Figure 30. Prairie map, Alibates Flint Quarries National Monument.

The introduced, annual species Russian thistle (Salsola iberica) is common on disturbed sites.

Prairie within the boundaries of Alibates Flint Quarries National Monument was moderately to heavily grazed by domestic livestock, primarily cattle, for almost a century. In some cases the cattle's hooves have damaged the flint resources. Cattle no longer graze in the park.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Alibates Flint Quarries National Monument is surrounded on three sides by the Coldwater Cattle Company, which is a typical cattle ranching operation. The fourth side is bordered by the Lake Meredith National Recreation Area. Portions of Lake Meredith National Recreation Area are grazed by cattle under special use permits.

#### Prairie Research

No prairie research has been conducted on the Alibates Flint Quarries National Monument.

#### General References

National Park Service. 1975. Alibates Flint Quarries/Texas. A brochure. 2 pages.

National Park Service. 1976. Alibates Flint Quarries and Texas Panhandle Pueblo Culture National Monument/Texas. General development plan. 33 pages.

National Park Service. 1976. Alibates Flint Quarries and Texas Panhandle Pueblo Culture National Monument/Texas. Visitor use plan. 36 pages.

National Park Service. 1976. Alibates Flint Quarries and Texas Panhandle Pueblo Culture National Monument/Texas. Resources management plan. 51 pages.

National Park Service. 1978. Alibates Flint Quarries and Texas Panhandle Pueblo Culture National Monument/Texas. General management plan. 38 pages.

CAPULIN MOUNTAIN  
National Monument  
New Mexico

Capulin Mountain is the cone of a volcano that was active only 10,000 years ago. Its conical form rises 1,000 feet (305 meters) above its base. The mountain consists chiefly of loose cinders, ash, and other rock debris. These materials were spewed out by successive eruptions and fell back upon the vent, piling up to form the conical mound. The beauty of Capulin Mountain is enhanced by an abundance of vegetation. The mountain is covered with both grassland and forest.

Capulin Mountain National Monument was established on August 9, 1916. It contains 775.4 acres (313.92 hectares). All of the land is federally owned. Approximately 220 acres (89 hectares) are native prairie (Figure 31).

Kuchler Vegetation Type: A mosaic of Grama-Buffer Grass  
(Bouteloua-Buchloe) and  
Juniper-Pinyon Woodland  
(Juniperus-Pinus) (Map Nos. 23 and  
65)

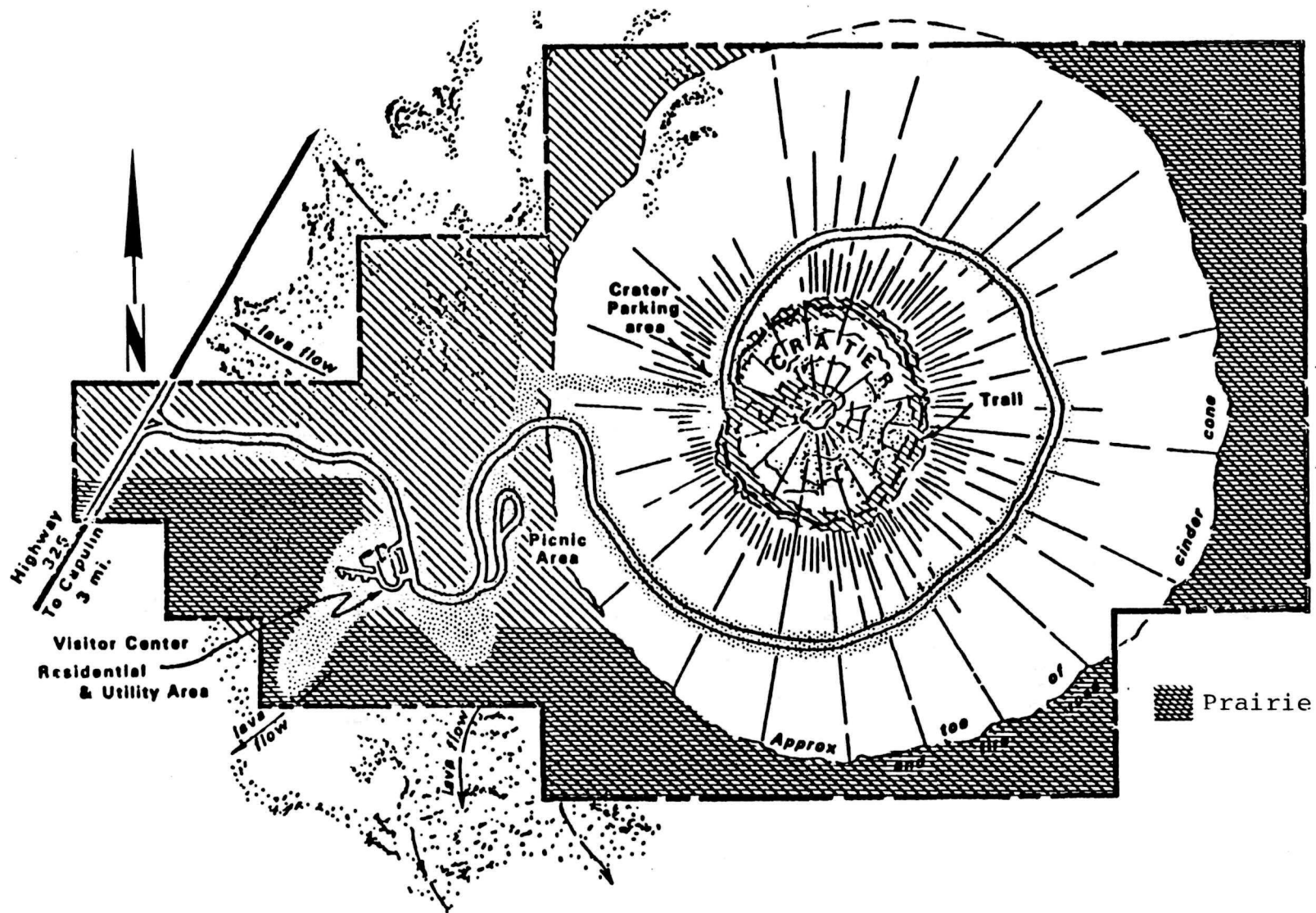


Figure 31. Prairie map, Capulin Mountain National Monument.

### Present Vegetation and Prairie Management History

The prairies of Capulin Mountain National Monument were grazed primarily by sheep from early settlement through 1936. The monument was fenced in 1937. Ninety acres (36 hectares) along the west and southwest boundaries were added to the monument and fenced in 1973. Prior to fencing, these areas were grazed by both sheep and cattle. Approximately 180 acres (73 hectares) were grazed by cattle from 1973 until 1978, under terms of a grazing permit. Fires are suppressed on the monument.

Research from 1974 through 1979 indicated that the most common grasses of the prairie at Capulin Mountain National Monument were mutton bluegrass (Poa fendleriana), western wheatgrass, squirreltail, little bluestem (Schizachyrium scoparium), big bluestem (Andropogon gerardii), ringgrass muhly, blue grama, and sideoats grama. Important forbs were Russian thistle (Salsola iberica), goosefoots (Chenopodium spp.), sunflowers (Helianthus spp.), and sages (Artemisia spp.). Shrubs included Spanish bayonet (Yucca angustifolia), oaks (Quercus spp.), fourwing saltbush (Atriplex canescens), true mountain-mahogany (Cercocarpus montanus), chokecherry (Prunus virginiana), and prickly pears (Opuntia spp.).

### Land Use and Vegetation Within One Mile of the Park Boundary

Land use is primarily for grazing. Prior to 1941, grazing was primarily by sheep. Since that time, grazing has been primarily by cattle.

### Prairie Research

Harfert, Robert C. and F. M. Brown. 1967. A study of the vegetation on volcanic cinder cones and their relationship to the caliche layers of Capulin Mountain. A Report. National Park Service.

This research investigated the vegetative differences between three volcanoes of similar age and dimensions. The study concluded that one factor causing Capulin Mountain to be densely covered with trees is the layering of caliche near to the surface of the slopes, aiding in moisture retention and availability.

Gennaro, A. L., James Patton, and Thomas Soapes. 1976. Report on biological studies at Capulin Mountain National Monument during the late spring, summer, and early fall of 1976. Natural History Museum, Eastern New Mexico University, Mexico University, Portales, New Mexico.

Gennaro, A. L. 1977. Report on biological studies at Capulin Mountain National Monument during the late spring, summer, and early fall of 1977. Natural History Museum, Eastern New Mexico University, Portales, New Mexico.

Gennaro, A. L. 1978. Report on biological studies at Capulin Mountain National Monument during the late spring, summer, and early fall of 1978. Natural History Museum, Eastern New Mexico University, Portales, New Mexico.

Gennaro, A. L., Mary Sublette, and Gary S. Pfaffenberger. 1979. Report on biological studies at Capulin Mountain National Monument during the late spring, summer, and early fall of 1979. Natural History Museum, Eastern New Mexico University, Portales, New Mexico.

A grassland monitoring program and other research was conducted from 1974 through 1979 by Dr. A. L. Gennaro and associates of the Natural History Museum of Eastern New Mexico University, Portales, New Mexico. The primary purposes of the program was to determine if grazing was detrimental to certain

certain areas of the monument. A grazing enclosure was constructed. Litter, cover, and vegetation inside and outside of the enclosure were compared over several years. The researchers concluded that grazing was reducing the amount of litter. They stated that a reduction in litter would cause decreased humus accumulation, soil aeration, nutrient retention of the humus fraction, recycling of nutrient materials, and seed germination. Cool season grasses were also being reduced by grazing. Based on these findings, grazing permits were not renewed in 1978.

A floral survey and insect survey were also conducted. The plant checklist includes 44 families and 172 species. Studies of animal utilization of browse species and a deer index were also conducted by Dr. Gennaro.

#### General References

National Park Service. 1974. Natural resources management plan. Capulin Mountain National Monument/New Mexico.

National Park Service. 1976. Interim Interpretive Plan. Capulin Mountain National Monument/New Mexico. 24 pages.

National Park Service. 1982. Capulin Mountain National Monument/New Mexico. A brochure. 2 pages.

National Park Service. 1983. Plant Checklist. Capulin Mountain National Monument/New Mexico. 6 pages.



CHICKASAW  
National Recreation Area  
Oklahoma

Chickasaw National Recreation Area is located in the transition zone between the prairie and forest in south-central Oklahoma. When first established in 1906, the area was named Platt National Park. The National Park Service assumed responsibility for administering certain additional lands and waters of the Arbuckle Reservoir in 1965. Platt National Park and Arbuckle Recreation Area were combined and renamed the Chickasaw National Recreation Area in 1976 to commemorate the Indian tribe upon whose lands the park was located.

Total acreage of the park is 9,500.1 (3,846.2 hectares). Federal land totals 9,112.3 acres (3,689.2 hectares), and nonfederal land totals 387.8 acres (157.0 hectares). Water covers about 2,409 acres (975.30 hectares). The Chickasaw National Recreation Area is composed of the Travertine District (formerly Platt National Park), Lake District (formerly Arbuckle Recreation Area), and Rock Creek Corridor (land acquired in 1976 to join the two areas). Prairie is estimated to occupy from 1,200 acres (486 hectares) to 1,500 acres (607 hectares) (Figure 32).

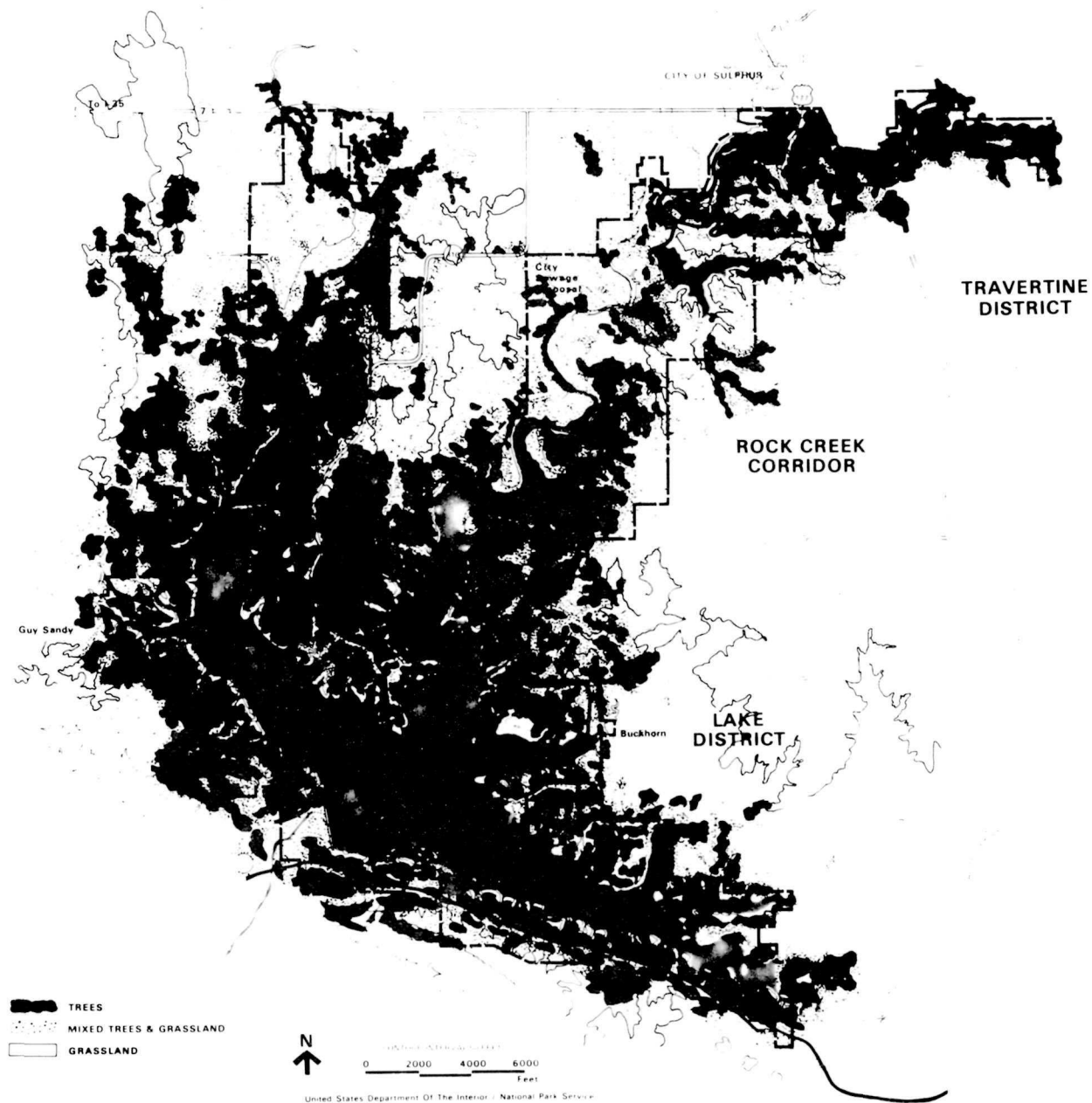


Figure 32. Vegetation map, Chickasaw National Recreation Area.

Kuchler Vegetation Type: A mosaic of Bluestem Prairie  
 (Andropogon-Panicum-Sorghastrum)  
 and Cross Timbers  
 (Quercus-Andropogon) (Map Nos. 74  
 and 84)

Present Vegetation and Prairie Management History

Four distinct forest types have been identified. The short-lobed oak (Quercus breviloba) type is characterized by absence of understory in shaded areas and open areas are characterized by communities of buckbrushes (Symphoricarpos spp.) and other species requiring small amounts of moisture for growth. In the post oak/winged elm (Quercus stellata/Ulmus alata) type, Texas ash (Fraxinus texensis) and catbrier (Smilax bona-nox) often occur in association. The Texas oak/chinkapin oak (Quercus texana/Quercus muehlenbergii) type often has an understory dominated by American elm (Ulmus americana), roughleaf dogwood (Cornus drummondii), winged elm (Ulmus alata), and bittersweet (Celastrus scandens). The American elm/southern hackberry (Ulmus americana/Celtis laevigata) type has a bitternut hickory and black walnut (Juglans nigra) as secondary species.

Three types of grassland are present in the Chickasaw National Recreation Area. The little bluestem type occupies

mesic, upland sites with well drained soils. Dominant plants are little bluestem and tall dropseed (Sporobolus asper). Forbs are mostly perennials typical of the tallgrass prairie. Vegetation of this type is in a late stage of succession approaching a bluestem prairie. The hairy grama (Bouteloua hirsuta) type occupies xeric uplands with thin, dry soils. Principal dominants are hairy grama and red threeawn (Aristida purpurea). Forbs are mostly annuals and short lived perennials. This type is probably indicative of severe overgrazing in the past. The third is the reverchon muhly (Muhlenbergia reverchoni) type. Reverchon muhly is the only dominant. It occupies poorly drained, thin soils that are saturated in the spring and very dry in the late summer.

Prairie vegetation was subjected to severe overgrazing before acquisition by the National Park Service. Some grazing has continued. A bison pasture of 90 acres (36 hectares) is located in the Travertine District. A portion of the area was formerly cultivated. These areas are now undergoing succession.

Grazing still occurs on Chickasaw National Recreation Area. From 9 to 12 bison graze the bison pasture in the Travertine District. Approximately 300 cattle graze about 1,000 acres (405 hectares) along Rock Creek. None of the area is cultivated, but haying is done on 103 acres (42 hectares) in the Lake District along Guy Sandy Creek.

This vegetative composition of the area continues to change. The trend is toward an increase in eastern redcedar (Juniperus virginiana) and a corresponding decrease in the native grasses and forbs. This vegetational shift may be the result of the policy to extinguish all fires, even though fire was a natural component of the ecosystem.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Some grazing occurs around the park, but it is not major. Farming is minimal, but there are a number of small family gardens. Production of hay is the main agricultural enterprises. Many areas immediately outside of the park boundaries have similar vegetation to that found within the park.

#### Prairie Research

Anonymous. Undated. The vegetation type survey of Platt National Park, 1937-1939. Mimeo. National Park Service. 28 pages.

This work was done by the Branch of Forestry, Civilian Conservation Corps of the W.P.A. Project during the period of 1937 through 1939. A vegetation survey was conducted and a vegetation type map was prepared for the 849 acres (344 hectares) Platt National Park. Lists of species and species acreage summaries are included.

Dale, Edward E., Jr. 1956. A preliminary survey of the flora of the Arbuckle Mountains, Oklahoma. The Texas Journal of Science. VIII:41-75.

This article assembles the published and unpublished literature on the flora of the Arbuckle Mountains and compiles a checklist of the vascular plants of the region. Geology, climate, and ecology are also discussed. The checklist includes 867 species.

Dale, Edward E., Jr. 1959. The grasslands of Platt National Park. The Southwestern Naturalist. 4:45-60.

An ecological analysis was made in 1956 of the grasslands of Platt National Park. These grasslands had been protected from disturbance for about 26 years. It was concluded that the three natural grassland types of the area were in a subsere condition. The little bluestem type most closely approached the original climax. The hairy grama type was comprised of xeric, preclimax vegetation on the least disturbed areas. The reverchon muhly type was a subsere community with a single dominant which was tolerant of alternate wet and dry soil moisture conditions. A list of 124 vascular plants that occurred in the grasslands is included.

Dale, Edward E., Jr. 1965. Final report on vegetation and microenvironments of Platt National Park. Mimeo. National Park Service. 57 pages.

In this final report, Dr. Dale summarized all of the vegetation data that had been collected in the Platt National

Park and includes some new information. A number of tables showing the relative frequency, relative density, relative basal area, and importance percentage are included for several vegetation types. New data on soils and microclimate are included.

Merrill, George M. 1935. Unpublished.

George Merrill collected over 600 species and varieties of native vascular plants. These specimens were placed in an herbarium at the Platt National Park in 1935.

#### General References

National Park Service. 1979. General management plan. Chickasaw National Recreation Area/Oklahoma. 93 pages.

National Park Service. 1979. Resources management plan. Chickasaw National Recreation Area/Oklahoma. 46 pages.

National Park Service. 1982. Chickasaw National Recreation Area/Oklahoma. A brochure. 4 pages.

FORT UNION  
National Monument  
New Mexico

Fort Union was established in 1851 to help defend the New Mexico Territory. Included in the monument are the remains of three forts covering the period of 1851 to 1891. Remains of the Santa Fe Trails are adjacent to the third fort that was constructed between 1863 and 1866. Fort Union was abandoned in February 1891.

Fort Union National Monument was established in 1956. It is composed of two parcels of land totalling 720.60 acres (291.7 hectares). Parcel One contains 637 acres (258 hectares) of grassland. Parcel Two contains 83.6 acres (34 hectares) that is mainly grassland with a fringe of rocks, pinyon pine (Pinus edulis), juniper (Juniperus sp.), and scrub oak (Quercus sp.) at its western edge. Nearly all of the land, except that near and comprising the building site, is native prairie (Figure 33).

Kuchler Vegetation Type: Grama-Buffalo Grass

(Bouteloua-Buchloe) (Map No. 65)



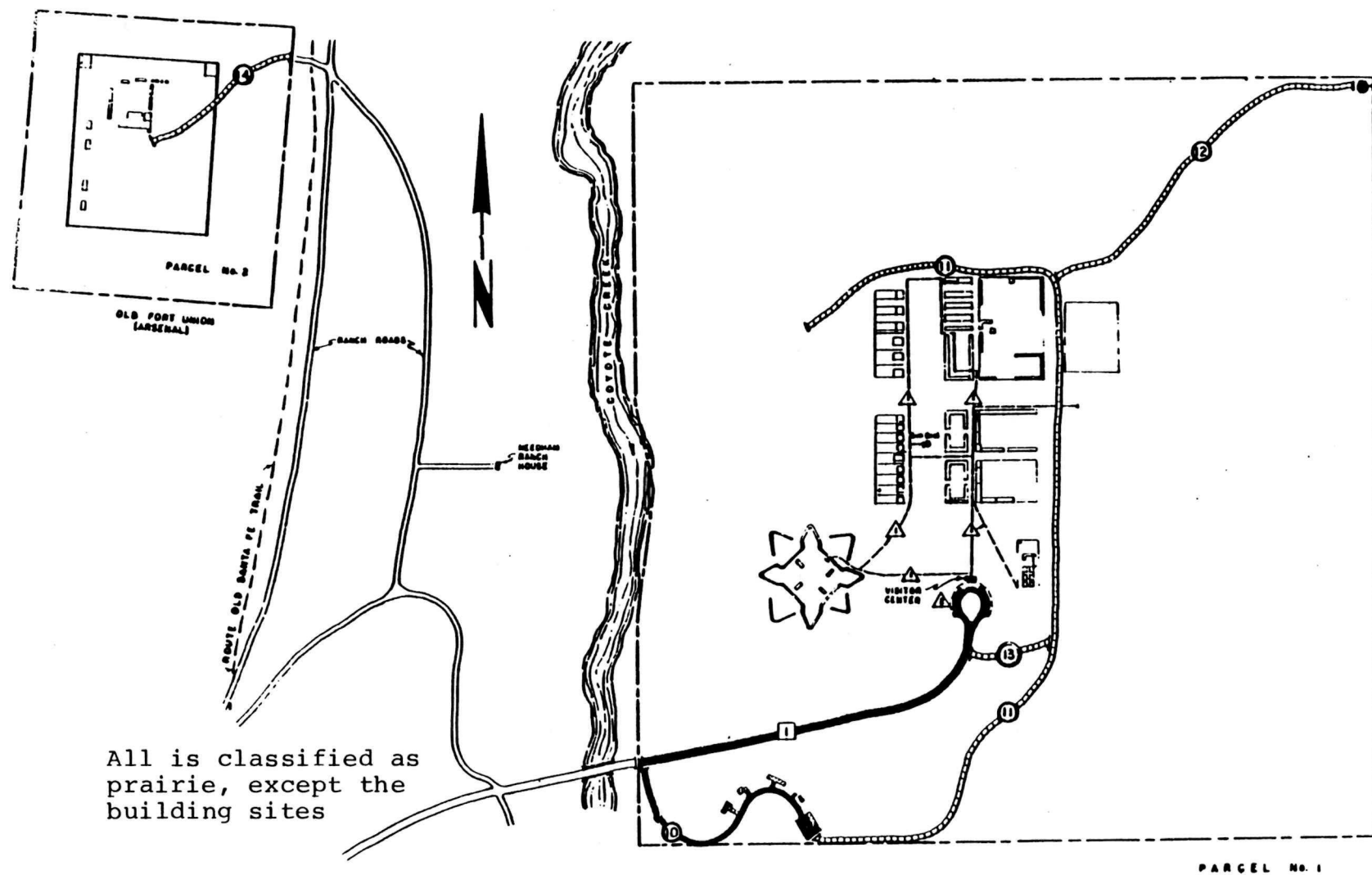


Figure 33. Prairie map, Fort Union National Monument.

### Present Vegetation and Prairie Management History

The area that is now Fort Union National Monument was probably heavily grazed during the 40-year period of activity. The area was also grazed from the time of abandonment in 1891 until establishment of the national monument in 1956. The area was fenced in 1956 and no grazing of domestic animals or other use of the vegetation has been made since that time. Fires are controlled and the prairie vegetation is generally in excellent condition.

The most important grasses at Fort Union in 1884 were listed as (current nomenclature follows in parenthesis):

Gramma	<u>Bouteloua oligostachya</u> ( <u>Bouteloua gracilis</u> )
Switch Grass	<u>Panicum virgatum</u>
Red-Top	<u>Sporobolus airoides</u>
Blue-Stem	<u>Agropyrum glaucum</u> ( <u>Agropyron smithii</u> )
Antelope Grass	<u>Muhlenbergia gracillium</u> ( <u>Muhlenbergia torreyi</u> )
Wild-rye	<u>Elymus canadensis</u>
Buffalo Grass	<u>Buchloe</u> sp. ( <u>Buchloe dactyloides</u> )

Current vegetation is probably similar to that of 1884. Blue grama is the dominant ground cover, and there is a scattering of other grasses. Blue penstemon (Penstemon glaber), Indian paintbrush (Castilleja sp.), slimflower scurfpea, verbena (Verbena sp.), primrose (Oenothera sp.),

locoweed (Astragalus sp.), and a variety of coneflowers (Ratibida spp.) are common. Only a few shrubs, such as skunkbrush sumac (Rhus trilobata) and fourwing saltbrush (Atriplex canescens), are present. Bermudagrass (Cynodon dactylon) was sprigged into the parade ground.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Both parcels of land are completely surrounded by the Fort Union Ranch. Cattle grazing is the only current land use. Vegetation surrounding the monument is similar to the vegetation within the monument, although vegetation within the monument is in better condition.

#### Prairie Research

A historic vegetation study is now in progress, but no preliminary data are available.

#### General References

National Park Service. 1964. Master plan. Fort Union National Monument/New Mexico. 15 pages.

National Park Service. 1977. Fort Union National Monument/New Mexico. A brochure. 4 pages.

LAKE MEREDITH  
Recreation Area  
Texas

Over the centuries, the Canadian River cut a broad, meandering canyon through the hard caprock of the arid plains of North Texas. The river and the breaks of these high plains, or Llano Estacado, served as linear landmarks throughout the settlement of the area. In 1965, as a part of the Canadian River Project, a dam was placed across the river, and Lake Meredith was created. The National Park Service administers the recreational use of the lake area. It was originally known as Sanford Recreational Area. The name was changed to Lake Meredith National Recreation Area in October 1972.

Total area within the boundaries is 44,994.3 acres (18,216.3 hectares). Nearly 70% of the land, 20,000 acres (8,097 hectares) may be classified as prairie (Figure 34).

Kuchler Vegetation Type: Shinnery

(Quercus-Andropogon) (Map No. 71)

Present Vegetation and Prairie Management History

The prairie areas of Lake Meredith Recreation Area were grazed by domestic livestock for about a century before the

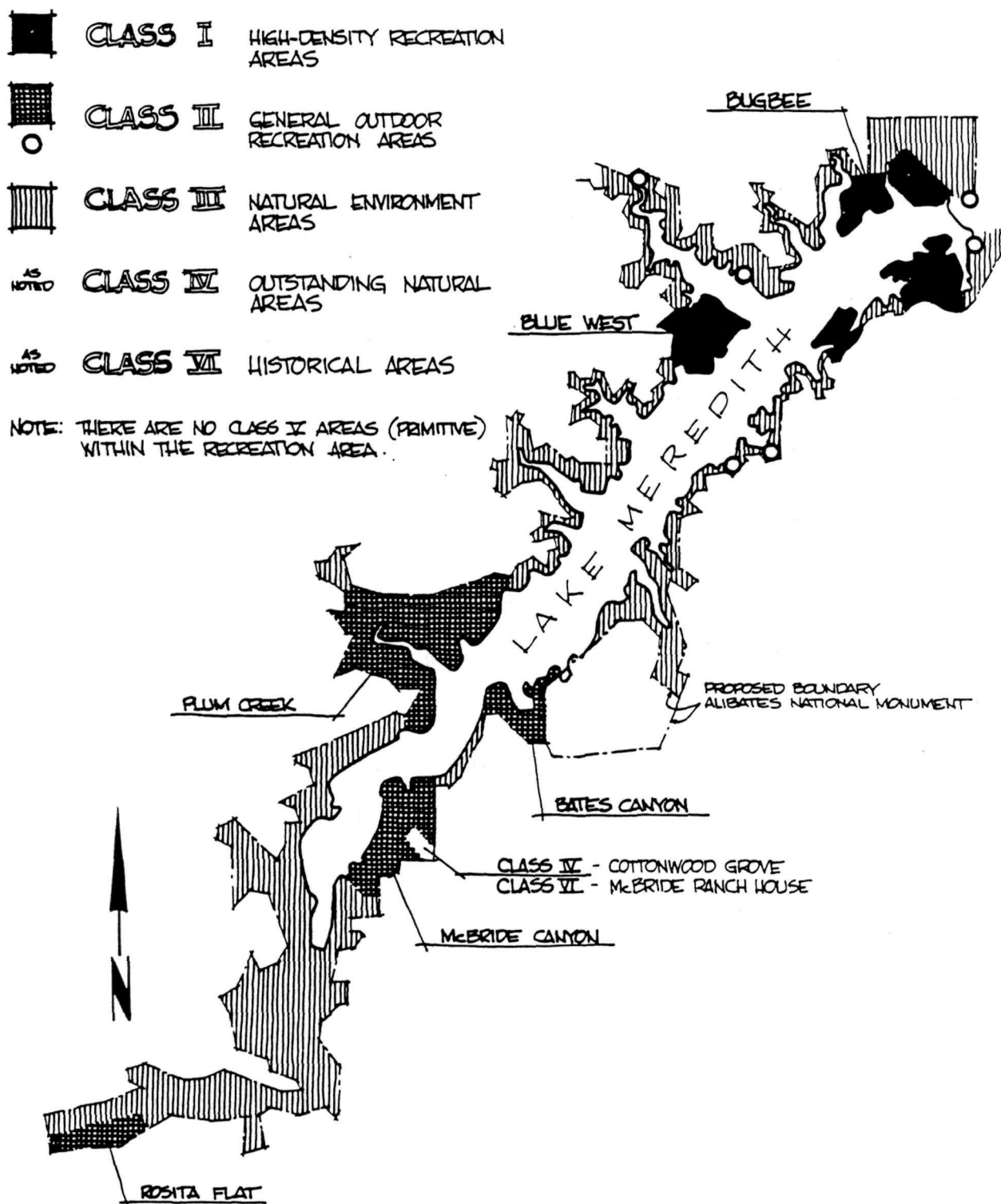


Figure 34. Land classification, Lake Meredith National Recreation Area.

dam was constructed. About 10,364 acres (4,196 hectares) of the area is still grazed by cattle under six special use permits. This moderate to heavy grazing has impacted the prairie vegetation. About 2,750 acres (1,113 hectares) of the area has been removed from grazing during the past ten years and are currently undergoing succession toward climax vegetation.

The vegetation can be grouped into five major plant associations. The steep slope, gravelly slope, mesatop, and sandhill associations would be classified as prairie. The fifth association, bottomland, would not be prairie.

The steep slope association is located along steeply sloping areas along the Canadian River and in side canyons. These are grass-dominated stands with a mixture of shrubs and forbs. Grasses include sideoats grama (Bouteloua curtipendula) and little bluestem. This association is relatively undisturbed.

The gravelly slope association is located on ridges, knolls, and undulating areas of uplands. Stands in the eastern part of the area are composed of a mixture of grama grasses and a few small shrubs. Stands in the western part have larger shrubs such as one-seed juniper. Some of these areas have been disturbed by trail bikes and other vehicles.

The mesatop association is located on level to gently sloping uplands. Buffalograss and blue grama dominate. Some

of these sites show the effect of grazing by domestic animals.

The sandhill association is a mixture of shrubs, grasses, and forbs. Sand sagebrush is the dominant. Vegetation in this association has deteriorated due to excessive grazing by domestic livestock.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Lake Meredith Recreation Area is surrounded on three sides by rangeland. These areas are grazed by cattle in typical ranching operations. A small portion of the park shares a common border with the Alibates Flint Quarries National Monument. Few differences exist between the vegetation within and outside of the park boundaries. Vegetation in areas protected from grazing is generally in better condition than in those being grazed.

#### Prairie Research

Wright, Robert A., and Keith Meador. 1979. The vegetation of the Lake Meredith Recreation Area, Texas. A Report. 72 pages.

Data were collected on the quantitative representation of the species in various stands of vegetation. From these data, the stands were grouped into five major plant associations: bottomland, steep slope, gravelly slope, mesatop, and sandhill. Their species list includes 333 forbs

and woody plants and 73 grasses. Each species is listed by scientific name, common name, life span, and origin.

Killebrew, Flavius C. Undated. A survey and population analysis of mammals by habitat at Lake Meredith Recreation Area and Alibates National Monument. A report. 106 pages.

Ten habitat types for small mammals at Lake Meredith Recreation were described. Habitat types were characterized by recording soil type, location, and vegetation. Three types were specific to the prairie areas. This report includes vegetation composition for 25 grids and an excellent set of photographs representing the habitat types.

Higgins, Larry. undated. A checklist of the plants of Blue West, Lake Meredith. A Report. 7 pages.

This checklist includes 145 forbs and woody plants and 31 grasses of the Blue West region. They are listed by scientific name.

#### General References

National Park Service. 1973. Master plan. Lake Meredith Recreation Area/Texas. 59 pages.

National Park Service. 1973. Proposed comprehensive design plan, Blue West. Lake Meredith Recreation Area/Texas. 105 pages.

National Park Service. 1974. Natural resources management plan. Lake Meredith Recreation Area/Texas. 57 pages.

National Park Service. 1975. Lake Meredith/Texas. A brochure. 4 pages.

National Park Service. 1976. Statement for management. Lake Meredith Recreation Area/Texas. 37 pages.



LYNDON B. JOHNSON  
National Historical Park  
Texas

Establishment of the Lyndon B. Johnson National Historical Park was approved on December 2, 1969. It includes two units, totaling 1,477.8 acres (598.3 hectares). The Johnson City Unit centers on the President's boyhood home and Johnson family Settlement and contains approximately 75 acres (30 hectares). About 56 acres (23 hectares) are classified as prairie (Figure 35). The LBJ Ranch forms the nucleus of the second unit. Approximately 145 acres (60 hectares) of the total 217 acres (88 hectares) are devoted to forage production. This is an improved range area with irrigation capacity that is used for forage production and grazing. It cannot be classified as prairie.

Kuchler Vegetation Type: Juniper-Oak Savanna  
(Juniperus-Quercus-Andropogon)  
(Map No. 86)

Present Vegetation and Prairie Management History

Soon after 1850, a few pioneers settled in the area. The country was primarily open range covered with tall

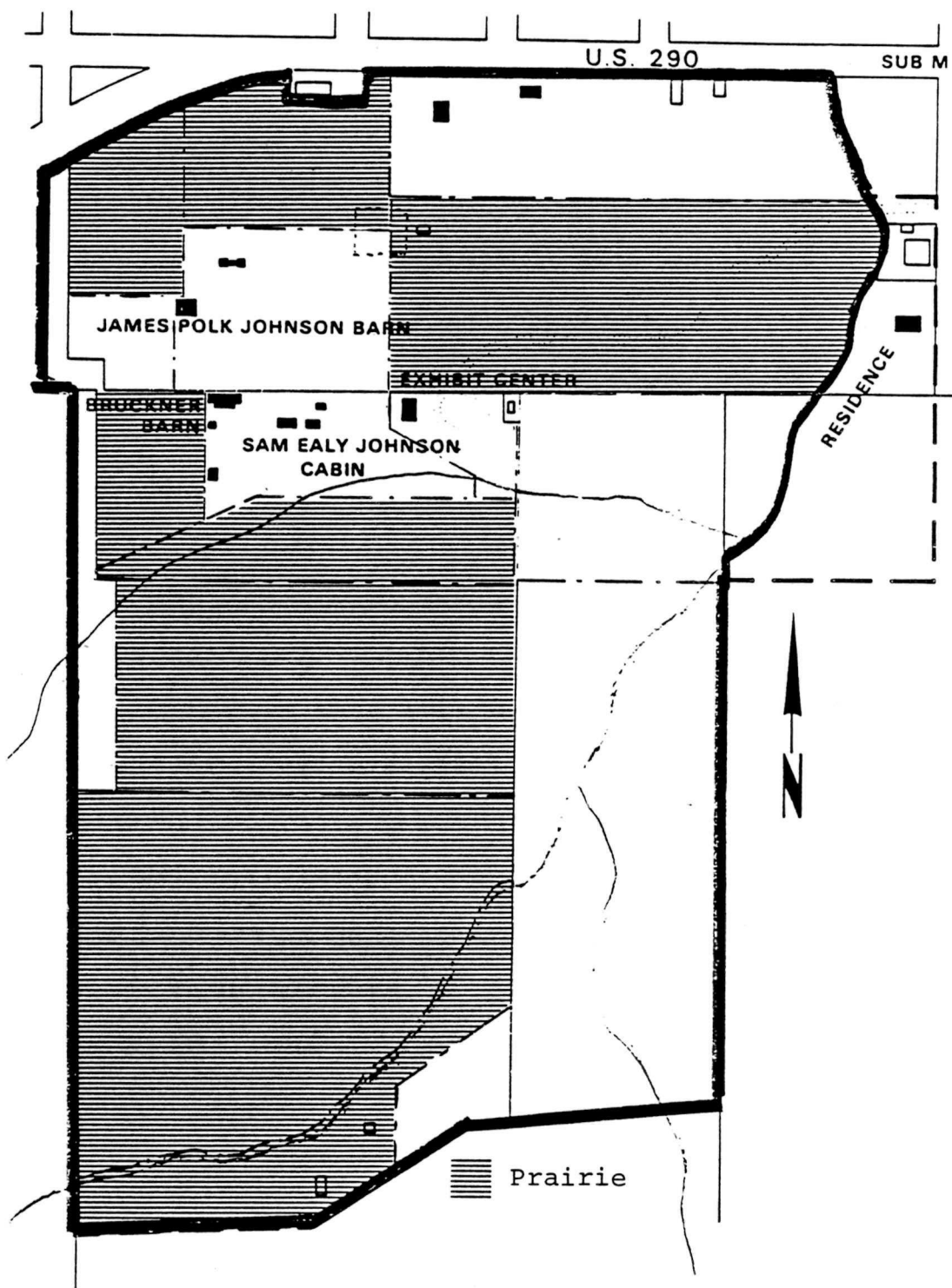


Figure 35. Prairie map, Lyndon B. Johnson National Historical Park.

grasses such as little bluestem, big bluestem, sideoats grama, indiagrass, and tall dropseed. Ashe juniper, or cedar (Juniperus ashei), was confined to a few cedar breaks. The first fences were built during the 1850's. When fences were built, livestock were concentrated in the enclosures. No effort was made to balance numbers of livestock with available forage, which resulted in overstocking. This resulted in a decrease in the tall prairie grasses and an increase in woody plants and other weeds. Soil erosion followed. Vegetation at the Lyndon B. Johnson National Historical Park has been historically subjected to heavy grazing. This is evidenced by the condition of the rangeland. Over 60% was classified in March 1981, as being in poor condition (25% of climax or less), and the remaining area was only in fair condition (25 to 50% of climax). The U.S. Soil Conservation Service recommended that a portion of the area be reseeded to native species. These areas continue to be grazed but at a moderate level. Present vegetation is made up of a few desirable species and many weedy species. It includes indiagrass, cane bluestem (Bothriochloa barbinodis), Canada wildrye (Elymus canadensis), tall dropseed, buffalograss, Texas wintergrass (Stipa leucotricha), red threeawn, johnsongrass (Sorghum halepense), gayfeathers (Liatris spp.), engelmann daisy (Engelmannia pinnatifida), catbriar (Smilax bona-nox), honey mesquite (Prosopis glandulosa), flameleaf sumac (Rhus

copallina), bur clover (Medicago hispida), Texas filaree (Erodium texanum), upright prairieconeflower (Ratibida colmunifera), greenthreads (Thelesperma spp.), rosering gaillardia (Gaillardia pulchella), Texas bluebonnet (Lupinus texensis), and bundleflowers (Desmanthus spp.).

In 1974, National Park Service personnel recognized that many of the native grasses had disappeared. They chiseled, disked, and planted native grass seeds on a small area in the northwest portion of the Johnson Settlement.

#### Land Use and Vegetation Within One Mile of the Park Boundary

Residential and commercial properties exist north and east of the Johnson City Unit of the Lyndon B. Johnson National Historical Park. Rangeland, which is devoted to livestock grazing, is found to the south and west.

#### Prairie Research

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Personnel from the Soil Conservation Service evaluated the range condition in 1981. They determined that over 60% of the area was in poor condition with the remaining area in fair condition. In addition, they formulated a conservation plan which called for an outlined procedures for range seeding, weed control, fertilizer application, deferred

grazing, proper grazing use, planned grazing systems, and recreational area improvement. This plan includes maps and a species composition list.

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PEA RIDGE  
National Military Park  
Arkansas

Pea Ridge was the site of an important Civil War Battle in March 1862. Although it took place in Arkansas, it is considered to be the battle that saved Missouri for the Union. It was authorized as Pea Ridge National Military Park on July 20, 1956. The State of Arkansas purchased the land and the transfer of deed to the Federal Government took place on March 7, 1960.

Pea Ridge National Military Park contains 4,300.4 acres (1,741.0 hectares). Federal land totals 4,278.8 acres (1,732.3 hectares). Three acres (1.2 hectares) of prairie have been reestablished (Figure 36). Historical records show that a limited amount of prairie was present at the time of the battle.

Kuchler Vegetation Type: Oak-Hickory Forest  
(Quercus-Carya) (Map No. 100)

The small areas of original prairie were Bluestem Prairie (Andropogon-Panicum-Sorghastrum), but they probably contained

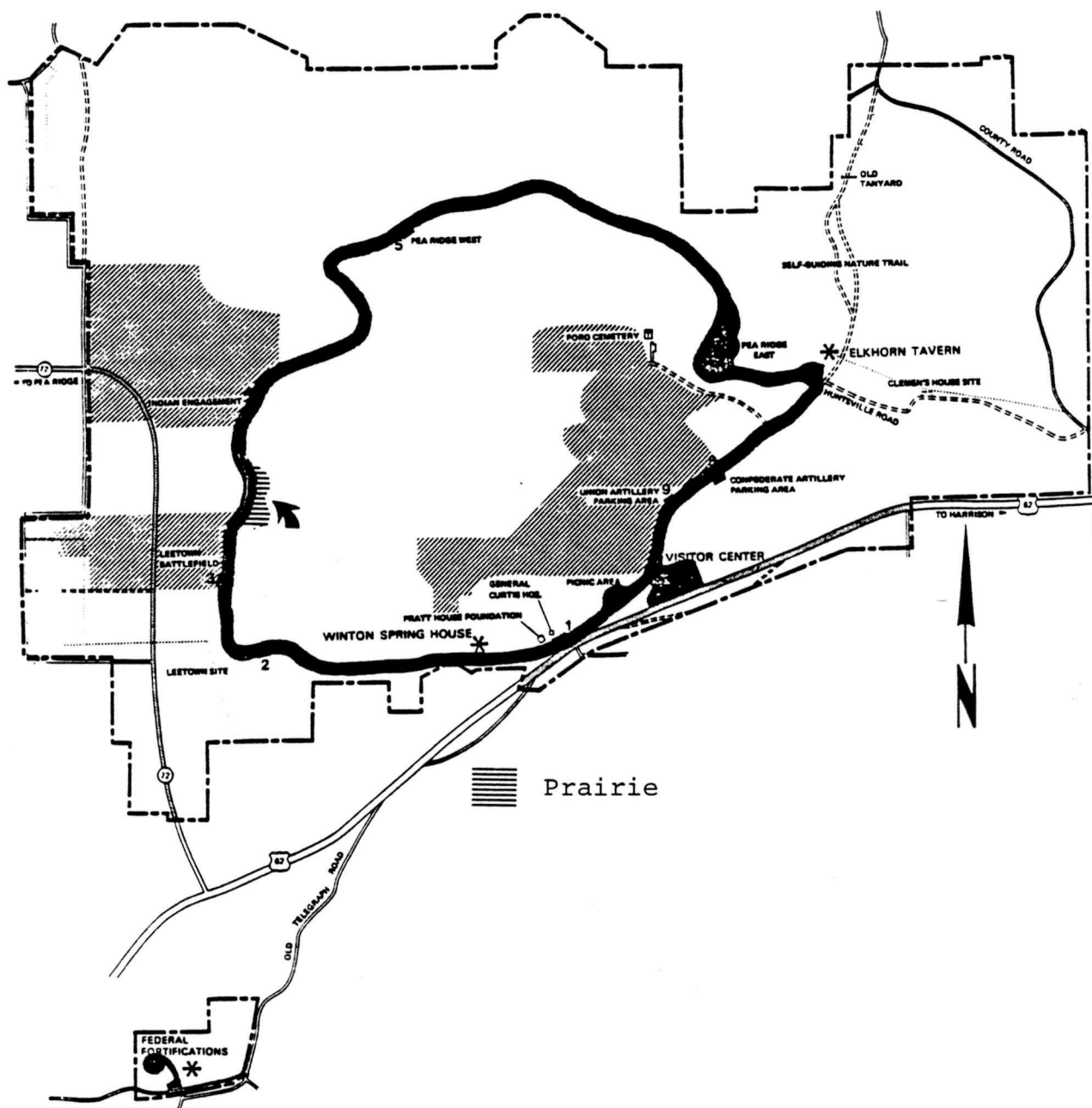


Figure 36. Prairie map, Pea Ridge National Military Park.

many species from the Bluestem-Sacahuista Prairie (Andropogon-Spartina), which is located to the south of the park.

#### Present Vegetation and Vegetation Management History

Most of the area within the boundaries of the Pea Ridge National Military Park is second growth oak-hickory forest. Approximately 600 acres (243 hectares) of meadow fescue (Festuca elatior) hay are maintained through agricultural use under special use permits to local farmers. These lands were in agricultural use at the time of the battle. A little more than 25 acres (10 hectares) are classified as developed area and are kept mowed.

Prairie reestablishment began in 1975. Areas 1 acre (0.4 hectare) in size were planted to prairie grasses and forbs in 1975, 1976, and 1978. Various planting and management techniques, including burning and mowing, were used. Many of the prairie species are now well established. A more detailed discussion of the condition of the prairie may be found under the section entitled "Prairie Research."

#### Land Use and Vegetation Within One Mile of the Park Boundary

All lands adjacent to the Pea Ridge National Military Park are privately owned. Agriculture is the principal use. Small farms are common, with beef and dairy cattle as the



major products and poultry and swine production being secondary. Some of the steeper and more hilly land is used for timeber production.

### Prairie Research

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Edwin C. Bearss produced a report that provided documentation for the features of his Historical Base Map of Pea Ridge National Military Park (Map. No. 3003-A). The map shows the battlefield landscape as it appeared in 1862. It is marked off in grid sections. In the report, Mr. Bearss documents the features shown within each grid section by referencing primary sources and providing quotations from these sources.

Wright, Cris A., Gordon E. Bradford and David E. Classen. 1970. Vegetation of Pea Ridge National Military Park, Benton County, Arkansas. Final Report. National Park Service.

This report describes the vegetation of the park.

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Dale, Edward E., Jr. and Thomas C. Smith. 1978. Reestablishment of prairie at Pea Ridge National Military Park, Benton County, Arkansas. Final Report. 39 pages.

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Research on reestablishment of prairie was conducted by Dr. Edward E. Dale, Jr. and Thomas Smith of the Department of Botany and Bacteriology of the University of Arkansas, Fayetteville, Arkansas. Dr. Dale's work was conducted during the period of 1975 to 1981. Prairie plots, each approximately 1 acre (0.4 hectare), in size, were established in 1975, 1976, and 1978.

The area seeded in 1975 was divided into 16 subplots. Species seeded included sideoats grama (Bouteloua curtipendula), indiangrass, switchgrass, big bluestem, and little bluestem (Schizachyrium scoparium). Sods of several prairie grasses and forbs were transplanted into the area in midsummer. A small test area was also seeded to these prairie grasses. These plots were subjected to various combinations of raking, trampling, and mulching. Establishment at the end of the first growing season was estimated to be 5%. Raking was the only treatment which

increased establishment. Transplanting of grasses and forbs was successful.

A second area was seeded in 1976. The same species were planted, but the seeding rates were increased to three times the 1975 rate for little bluestem and twice the rate for all other species. Fertilizer was applied to the subplots, and the area was hand-weeded. All species successfully established, and fertilizer improved the growth of the grasses.

Similar methods were used to seed the same five grasses in 1978. Fertilizer was applied to these seedings to improve rate of growth. By September, 1978, ground cover for the seeded species was nearly 20%.

Representative plots of prairie established in 1975, 1976, and 1978 were selected for additional research in 1980. Treatments were burning, mowing, and control. Burning was done in early April, 1980, and mowing was done in April, June, and September. Mulch was left on the ground on one half of each mowed plot and removed from the other half shortly after mowing. No plot was mowed more than once. Seeds of several forbs were broadcast in October, 1981, in the tracts of prairie established in 1975 and 1978. Burning caused a decrease in the cover of grasses. Mowing in April was the only treatment that did not consistently reduce cover. Plots from which the mulch was removed showed

consistently greater declines in percentages of prairie grasses than on plots where the mulch was left on the ground.

In summary, results of this study suggest that generally vegetation of restored prairies on which the standing debris and mulch have not been removed for four or five years will show a poorer growth than those areas that have been mowed or burned. It is questionable whether burning was entirely beneficial on all plots. Removal of mulch by burning apparently favored a large increase in weeds. Mowing in June was definitely harmful to prairie grasses. Mowing in April gave the best results. Mulch removal was not beneficial for growth.

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PECOS  
National Monument  
New Mexico

Pecos was a cultural crossroad and frontier outpost for centuries. Indians, Spaniards, and Anglos passed through this mountain gateway between the Great Plains and the Rio Grande Valley seeking trade, treasure, and conquest. Construction of housing complexes began over six centuries ago. By the time of Coronado's visit in 1541, Pecos was a thriving town. Warfare and disease reduced the numbers of inhabitants until the Pecos Pueblo was abandoned in 1838. The establishment of Pecos National Monument was authorized on June 29, 1965.

It is situated in the Upper Sonoran vegetative zone. Forests of pinyon pine (Pinus edulis) and one-seed juniper (Juniperus monosperma) open to areas of grasslands. Approximately 40 acres (16 hectares) of the 364.8 acres (147.7 hectares) within Pecos National Monument is prairie (Figure 37). All of the land is federally owned.

Kuchler Vegetation Type: Grama-Galleta Steppe

(Bouteloua-Hilaria) (Map No. 53)

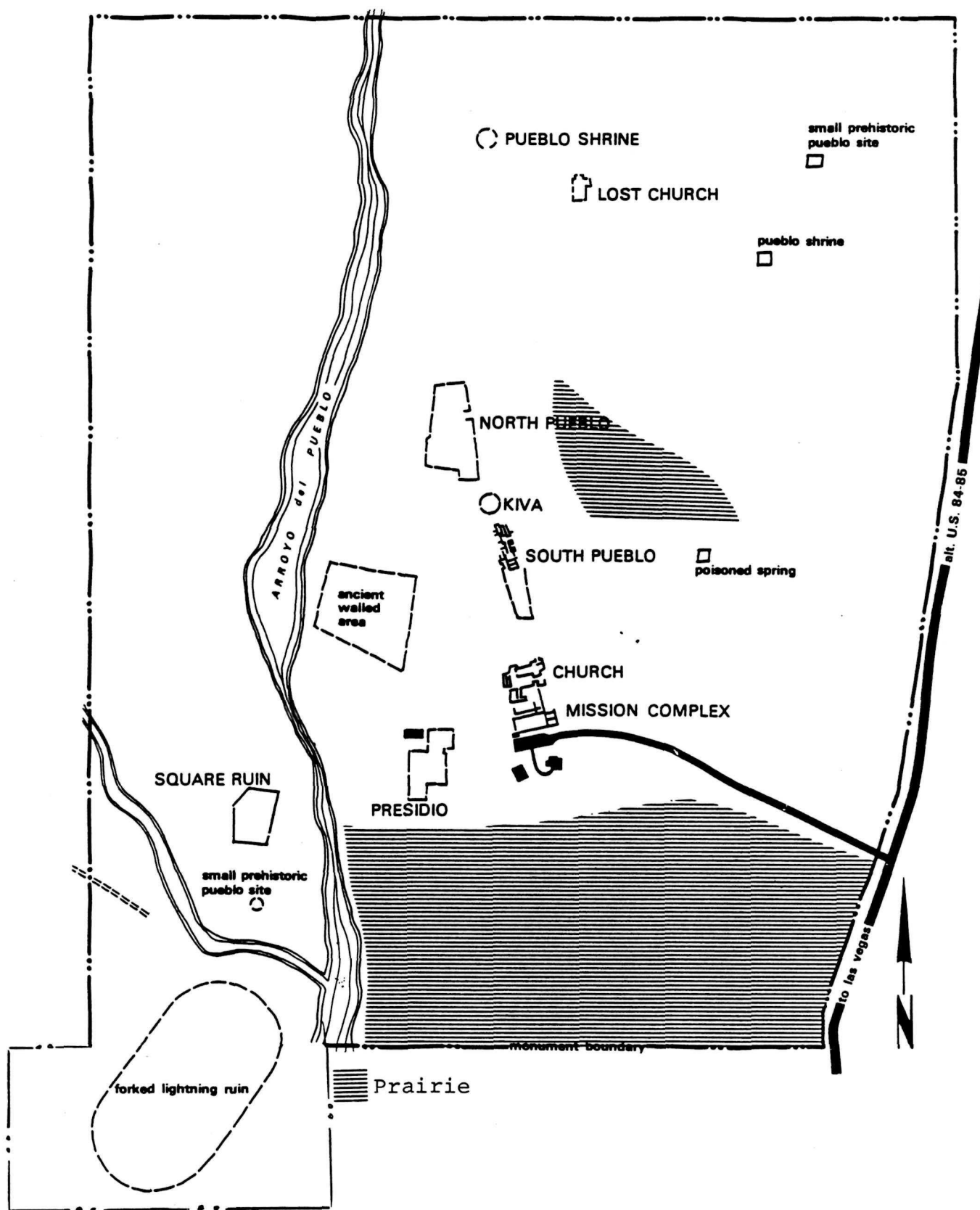


Figure 37. Prairie map, Pecos National Monument.

### Present Vegetation and Prairie Management History

The natural vegetation of the Pecos National Monument has been modified by man for centuries. Collection of wood has impacted the forests, and grazing has had the greatest influence on the prairie. Grazing ceased on all but the most recently acquired 20 acres (8 hectares) of the monument in June 1967 when the boundary fence was completed. The 64 acre (26 hectare) core of the monument had been closed to grazing in the 1940's however no exact date is known. Grazing ceased on the latest acquisition in 1978.

In 1978, small ravines throughout the monument were filled with pinyon pine and one-seed juniper brush in an attempt to halt erosion. The meadow (20 acres or 8 hectares) east of the main ruins complex was successfully seeded to Russian wildrye (Elymus junceus) in June 1969. From 1968 until 1981, kochia (Kochia scoparia) was sprayed with herbicides in an attempt to eradicate this exotic species. Since 1981, hand pulling and other methods have been used as control measures. Burning was also used as a control measure.

There are no estimates of the condition of the grasslands. A large species diversity may be found in the area, which will continue to serve as a source of seed for grasslands undergoing succession.

### Land Use and Vegetation Within One Mile of the Park Boundary

Lands surrounding the Pecos National Monument are primarily covered with forests with small grassland openings. These areas are currently grazed by domestic animals. Chaining has been frequently used on the pinyon-juniper woodland in an effort to create improved pastureland.

### Prairie Research

No formal research relating to prairie has been conducted on Pecos National Monument. Pauline M. Patraw assembled a list of plants, excluding grasses, in the late 1960's. She assembled a 13 page manuscript (unpublished) which is filed at the Pecos National Monument.

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## SUMMARY TABLES

TABLE 1

Total acres, acres of prairie, and origin (native, restored, go-back) of prairie within each park and region.

Park	Total Acres	Prairie Acres	Native Prairie	Restored Prairie	Go-Back Land
<u>Midwest Region</u>					
AGFO	3,055	2,755	X		
CHRO	84	65	X		
EFMO	1,475	70	X		X
FOLS	718	341	X	X	
FOSC	17	4		X	
GWCA	210	55	X	X	
HEHO	187	76		X	
HOME	195	95	X	X	
ICAG	32,500	15	X		
INDU	12,535	989	X		
PIPE	282	260	X		X
SCBL	2,988	2,161	X	X	X
SACN	71,366	50	X		
WICR	1,750	146		X	
Total	127,360	7,082			
<u>Rocky Mountain Region</u>					
BADL	243,302	171,000	X	X	X
BEOL	800	638	X		X
BICA	120,158	1,560	X		
CUST	765	740	X		
DETO	1,347	400	X		
FOLA	856	824	X	X	
FOUS	436	175	X		X
KNRI	1,291	750	X		X
THRO	70,345	43,000	X		X
WICA	28,292	23,000	X		X
Total	467,592	242,087			
<u>Southwest Region</u>					
ALFL	1,333	1,300	X		
CAMO	775	220	X		
CHIC	9,500	1,350	X		X
FOUN	721	715	X		
LAMR	44,994	20,000	X		
LYJO	1,478	217			X
PERI	4,300	3		X	
PECO	365	40	X		X
Total	63,465	23,845			
Grand Total	658,419	273,014			

TABLE 2

Kuchler Vegetation Types by park and region.

Park	Number	Kuchler Vegetation Type
<u>Midwest Region</u>		
AGFO	64	Grama-Needlegrass-Wheatgrass
CHRO	65	Grama-Bufferlo Grass
EFMO*	74	Bluestem Prairie
FOLS*	69	Bluestem-Grama Prairie
FOSC*	74	Bluestem Prairie
GWCA*	74	Bluestem Prairie
HEHO	74	Bluestem Prairie
HOME	74	Bluestem Prairie
ICAG*	74	Bluestem Prairie
INDU*	74	Bluestem Prairie
PIPE	74	Bluestem Prairie
SCBL*	64, 65, 66, & 70	Grama-Needlegrass-Wheatgrass, Grama-Bufferlo Grass, Wheatgrass-Needlegrass, & Sandsage-Bluestem
SACN*	74	Bluestem Prairie
WICR*	74	Bluestem Prairie
<u>Rocky Mountain Region</u>		
BADL	68	Wheatgrass-Grama-Bufferlo Grass
BEOL	65	Grama-Bufferlo Grass
BICA*	40, 55, 63, & 64	Saltbush-Greasewood, Sagebrush Steppe, Foothills Prairie, & Grama-Needlegrass-Wheatgrass
CUST	64	Grama-Needlegrass-Wheatgrass
DETO*	66	Wheatgrass-Needlegrass
FOLA	64	Grama-Needlegrass-Wheatgrass
FOUS	66	Wheatgrass-Needlegrass
KNRI	66	Wheatgrass-Needlegrass
THRO	66	Wheatgrass-Needlegrass
WICA*	66	Wheatgrass-Needlegrass

Table 2. Continued

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<u>Southwest</u>	<u>Region</u>	
ALFL	71	Shinnery
CAMO*	65	Gramma-Buffalo Grass
CHIC	74 &	Bluestem Prairie &
	84	Cross Timbers
FOUN*	65	Gramma-Buffalo Grass
LAMR	71	Shinnery
LYJO	86	Juniper-Oak Savanna
PERI*	--	
PECO	53	Gramma-Galleta Steppe

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\*Only grassland types are listed, park includes other types.



TABLE 4

Prairie management history within each park.

Park	Burning	Grazing	Haying/ Mowing	Weed Control	Seeding	Misc.
<u>Midwest Region</u>						
AGFO		X				
CHRO		X				
EFMO		X		X		
FOLS	X		X	X	X	X <sup>1</sup>
FOSC			X		X	
GWCA	X				X	
HEHO	X		X	X	X	
HOME	X		X	X	X	
ICAG						
INDU	X					
PIPE	X		X	X		
SCBL	X	X			X	
SACN						
WICR			X		X	
<u>Rocky Mountain Region</u>						
BADL		X				X <sup>1</sup>
BEOL		X			X	
BICA		X				
CUST	X	X		X		
DETO	X					
FOLA		X	X	X	X	
FOUS	X		X			
KNRI				X		
THRO		X				
WICA	X	X				
<u>Southwest Region</u>						
ALFL		X				
CAMO		X				
CHIC		X	X		X	
FOUN						
LAMR		X				
LYJO		X				
PERI	X		X		X	
PECO	X	X		X		

<sup>1</sup> Prairie dog control

### SECTION THREE

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