

Vegetation of the Northern Great Plains

William T. Barker and Warren C. Whitman

The Northern Great Plains is a distinctive region of the Great Plains as a whole occupying an area about 950 miles long north-south, by about 500 miles wide east-west. It is considered to occupy that portion of the Plains lying between the foothills of the Rocky Mountains on the west and an imaginary line at the approximate 100th meridian on the east. The southern boundary is placed on the North Platte River through Wyoming and Nebraska. The northern boundary is at the contact between the grassland (Fescue prairie) and the Boreal Forest, through southeastern Alberta, the southern third of Saskatchewan, and extreme southwestern Manitoba (Coupland, 1961). As a physiographic feature the Northern Great Plains actually extends well to the north of this arbitrarily fixed boundary (see map).

About 50 percent of the Great Plains is considered to be in native range. The more easterly portions of the area are intermingled with dryland farming areas and are used in combined farming-ranching operations.

Most of the area is privately owned, supporting a sizable and valuable big game population made up of antelope, white-tailed deer, mule deer, and some elk. The great Central Flyway for migratory waterfowl passes through the heart of the area, and the numerous wetlands of the glaciated section are critical to the maintenance of this priceless wildlife asset.

The primary ranching operation of the Northern Great Plains is the production of beef cattle, although there are significant numbers of sheep produced on the western ranges. Most of the rangelands are considered to be year-long, but the grazing season is usually more limited and the feeding of hay and protein supplements during the winter months is a necessary practice throughout most of the area.

Physical Background

Three geological events have had great influence in determining the present physical characteristics of the Northern Great Plains. The first was the Cretaceous sea which spread over the Great Plains-Rocky Mountain region from the Arctic Ocean to the Gulf of Mexico some 100 million or so years ago (Hunt 1974).

The second major event was the great Rocky Mountain uplift toward the end of the Cretaceous period and the beginning of Tertiary period. This raised and tilted the underlying plains strata. Vast amounts of sediment were washed from the mountains onto plains area to the east. There was extensive erosion of the plains strata themselves.

The third event was the spread of the great ice sheets over most of the area. Through most of Pleistocene time, beginning some two million years ago and ending only about

10,000 years ago, the ice sheets advanced and retreated back and forth over a large portion of the Northern Great Plains area transporting vast quantities of rock and soil that they picked up, pulverized, and redeposited as glacial sediment (Bluemle 1977).

Much of the topography in the plains area north and east of the Missouri River is about as it was left by the glaciers (Fenneman 1931). A significant feature of the glacial advance has been the effect on the streams of the northern plains. Prior to glaciation the streams of the northern plains mainly drained northerly, north-easterly, or easterly. The ice front turned the Missouri River out of its northerly course in Montana and bent it sharply to the south in North Dakota. All the tributaries were blocked by ice and forced to become direct tributaries to the Missouri (Fenneman 1931).

These drainage changes resulted in rapid downcutting by the affected streams through the soft, nearly horizontal strata of the plains sediments, forming the unique badlands areas characteristic of many of the streams.

As the net result of these physiographic events, three recognizable regions have been defined for the Northern Great Plains. These are the Alberta Plain in Canada, the Missouri Plateau in southern Canada and in the United States, and south of this a portion of the High Plains (Hunt 1974).

The Northern Great Plains generally slopes from an altitude of 5,000 to 6,000 ft. at the base of the Rocky Mountains to about 1,500 to 2,000 ft. at its boundary with the Central Lowlands, some 500 miles to the east.

Characteristic of the Missouri Plateau area are the often flattopped erosion remnants that rise several hundred feet above the surrounding landscape. Commonly referred to as buttes, these features are usually capped by erosion-resistant layers of sandstone, limestone, gravel, or slag formed by fusion of material over naturally burning coal veins. Locally this material is called "scoria", and its distinctive reddish color greatly enhances the scenic attractiveness of the region.

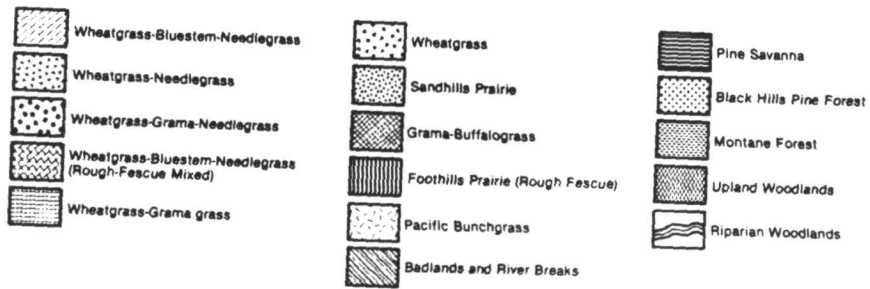
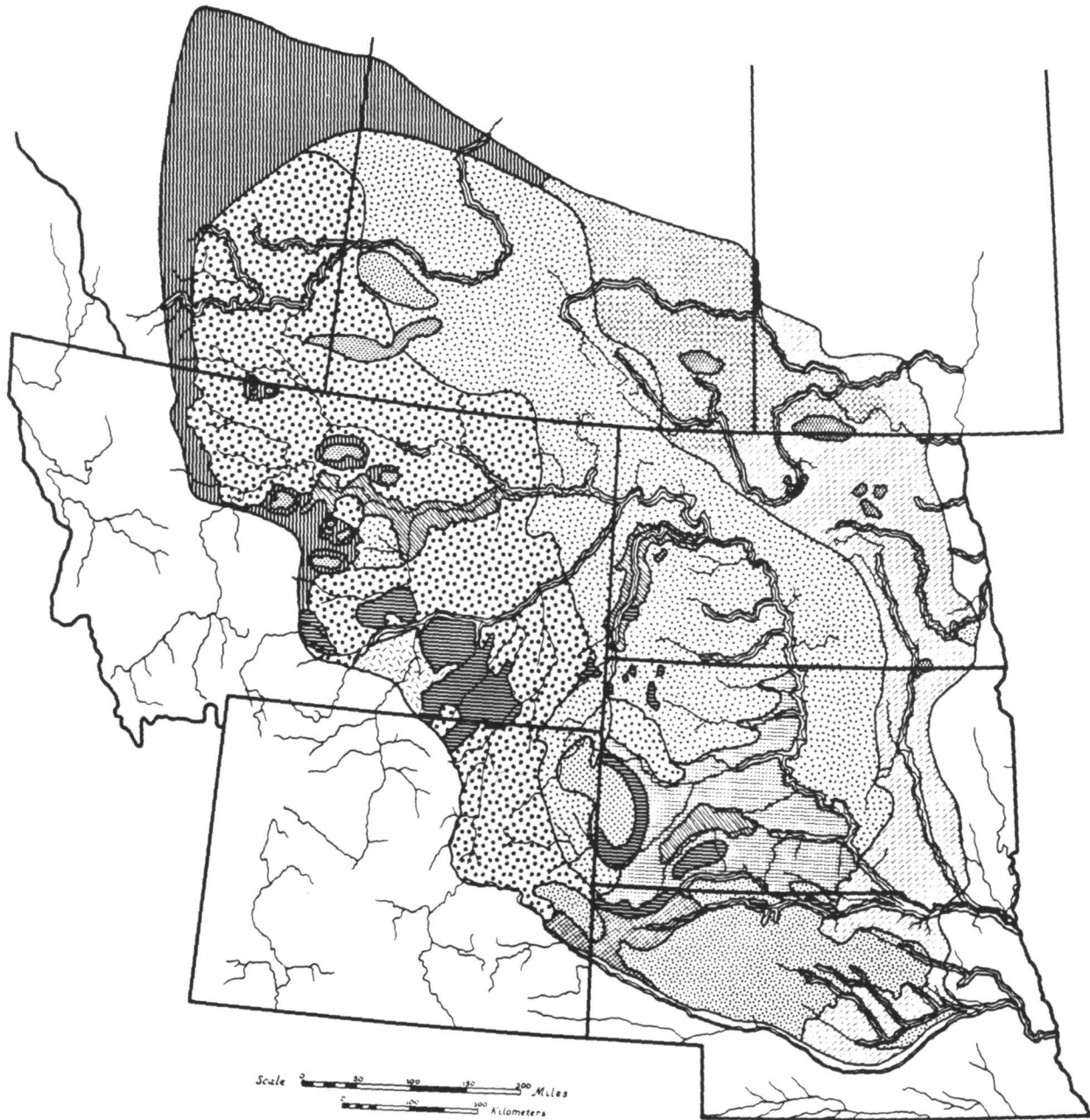
The most significant mountain formation in the Northern Great Plains section is the domed mountain uplift of the Black Hills in western South Dakota and northeastern Wyoming. Erosion following the uplift of the dome has exposed the Precambrian crystalline rocks of the dome and reduced the uptilted surrounding strata. The highest peaks now stand about 4,000 ft. above the plains to the east.

On the western edge of the Missouri Plateau near the Rocky Mountains a number of small mountain groups intrude into the plains. These mountains support over at least a portion of their extent some type of montane forest.

Climite

The climate of a region cannot be fully described by a single element such as precipitation or temperature (Packer

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Vegetation types of the Northern Great Plains.

1974), but the overwhelming importance of the amount and seasonal distribution of precipitation in the Northern Great Plains cannot be overemphasized. More important than average precipitation is the great degree of variability in precipitation (Van Dyne 1975). The variation in amount and timeliness of precipitation from year to year has been the factor most emphasized in the description of the climate of the area. It is well-established as the factor most affecting the production of seeded crops and native grazable vegetation.

The region discussed in this report is considered to have two major climatic patterns—a semi-arid western portion and a dry sub-humid eastern portion (Thornthwaite 1941).

For the region as a whole, the winter is a drought period with generally less than one-fifth of the total annual precipitation occurring as snowfall, much of which does not become available as soil moisture. Spring and early summer precipitation, on the other hand, is generally quite favorable with upwards of 60–80 percent of the total annual precipitation being received during the period April to September.

Weakly (1943) found from analysis of tree ring records from western Nebraska that in a 400-year period 154 years were drought years and 237 were wet years. The inevitability of dry years and drought seems well-established. The high temperatures, strong winds, and clouds of blowing dust that accompanied the great drought of the 30's will be long remembered in the northern plains.

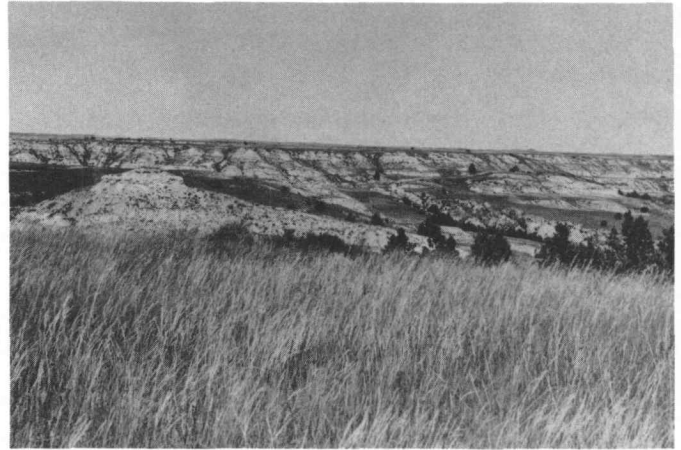
The frost-free period in the Northern Great Plains ranges from about 160 days at the southern end to about 120 days or less in Canada. Plant growth generally begins prior to the beginning of the normal frost-free period. At the extreme northern edge of the plains grassland and at higher elevations, the frost-free season may be less than 100 days and plant growth would not be expected to begin much before the first of May (Coupland 1961).

Snowfall can be expected over the region any time during the winter period (November–March). Total amounts of snow vary between 20 and 40 inches. Snow cover is more continuous toward the northern part of the area, where it commonly persists for three to four months. A large portion is usually heaped under blizzard conditions into drifts where topography and obstructions affect wind-flow, while open fields and ranges may be scoured nearly free of snow cover.

All portions of the area experience very high summer temperatures and very low winter temperatures. In the southern portion maximum temperatures of over 100°F are frequently reached during the summer months, with temperatures of 110°F or over not uncommon. Temperatures below –40° have been recorded a number of times for this area. Farther north summer temperatures over 110° have been reached but are not common, while temperatures below –60°F are on record.

Vegetation

Basically the grassland vegetation of the Northern Great Plains over most of its range is surprisingly similar. Three major genera of grasses are distributed throughout the region. These are *Agropyron*, *Stipa* and *Bouteloua*. Within these genera western wheatgrass and thickspike wheatgrass are the major wheatgrasses. Needle-and-thread, porcupine grass and needlegrass are the principal needlegrasses. Only blue grama grass is of major importance in the *Bouteloua*



Wheatgrass Needlegrass vegetation on ungrazed butte top. Rocky Mountain juniper scattered on slopes.

group, though side-oats grama becomes significant in some associations.

Allowing for the incursions of the bluestem grasses, big bluestem and little bluestem primarily in the easterly portion of the area, and for rough fescue types on the north and along the Rocky Mountain foothills, over 80 percent of the grassland vegetation of the area is readily accounted for by associations dominated by these species.

The map presented in this discussion distinguishes 16 major vegetation types in the Northern Great Plains. It must be recognized at once that this does not represent a full coverage of types by any means. "Badlands and River Breaks" is obviously not a vegetation type, but within these areas, and areas closely associated with these topographic breaks, at least 8 to 10 unique and distinctive vegetation types have been recognized by numerous investigators. "Montane Forest" as mapped, also involves several different vegetation associations, as does the designation "Riparian Woodlands". No attempt has been made to map wetlands, and specific alkaline-affected vegetation types, primarily because of scale difficulties, although some consideration is given to these in the text.

Primary sources of the type designations, distribution, and boundaries have been the reports prepared by the Old West Regional Range Commission Committees of the various states: North Dakota (Shaver 1977), South Dakota (Baumberger 1977), and Wyoming (Shrader 1977). For Montana the map prepared by Ross and Hunter (1976) has provided an excellent basis for delineating the types. For Nebraska vegetation reliance has been placed on the map prepared by Kaul (1975). The rangeland resource report of Hacker and Sparks (1977) has also been very useful. In a number of cases composition and distribution of types have been checked in Johnston (1987). Most mapped types have been checked back against the "potential natural vegetation" map of Kuchler (1964). In Canada type designations and distributions have been derived primarily from the papers of Clarke, Campbell, and Campbell (1942), Moss and Campbell (1947), Coupland and Brayshaw (1953), and Coupland (1950, 1961). In this presentation the word "type" has been applied to the recognizably similar assemblages of plant groupings occur-

ring in essentially similar landscape positions under generally similar climatic and edaphic conditions regardless of ecological position. Nomenclature of plants in general follows that of the Great Plains Flora Assoc. (1986).

Wheatgrass—Bluestem—Needlegrass Type

The Wheatgrass-Bluestem-Needlegrass type occupies the eastern portion of the plains area and extends from central Saskatchewan to the Platte River in Nebraska. It is essentially a transitional type lying between the Bluestem prairie to the east and the drier Wheatgrass-Needlegrass type to the west.

In North Dakota, South Dakota, and Nebraska, big bluestem progressively increases as a component on the loess hills of central Nebraska and becomes a major dominant (Hopkins 1951). On drier sites or where severely disturbed by grazing pressure, throughout the Wheatgrass-Bluestem-Needlegrass type components from the more xeric Wheatgrass-Needlegrass type may become dominant including western wheatgrass, needle-and-thread, and blue grama as well as other, more xerophytic species. Through the central part of the Wheatgrass-Bluestem-Needlegrass (N. Dakota, S. Dakota) Kentucky bluegrass has increased greatly in the cover, and in many places is a major component of the vegetation.

Scattered throughout the area from Nebraska into Canada are wetlands of various types. Many of these are salt-affected and support saline vegetation types. Dry saline-vegetation types are also frequent.

Considering the full expanse of the type as mapped, the principal grass species of the Wheatgrass-Bluestem-Needlegrass type are western wheatgrass, bearded wheatgrass, slender wheatgrass, big bluestem, little bluestem, porcupine grass, needlegrass, needle-and-thread, green needlegrass, sideoats grama, blue grama, Junegrass, prairie sandreed, and now, Kentucky bluegrass.

Wheatgrass-Needlegrass Type

The separation of the Wheatgrass-Needlegrass and the Wheatgrass-Grama-Needlegrass types has been continued in this treatment. This separation seems to be justified because of the continued dominance of the mid-grass component (wheatgrass and needlegrass) over the shortgrass component (blue grama and sedges) throughout much of the range of the type. In the Canadian portion of the area, Coupland (1950) considers needlegrasses and blue grama to be the major dominants, with the wheatgrasses relatively minor in importance. In general terms the Wheatgrass-Needlegrass type is somewhat less xeric than the Wheatgrass-Grama-Needlegrass type.

The Wheatgrass-Needlegrass type extends from mid-Saskatchewan to below mid-South Dakota, into eastern Montana and northeastern Wyoming. Considerable cropland has been broken out of the native sod through most of this area, especially in the glaciated portion east and north of the Missouri River. Except when closely grazed the principal aspect of the type is that of the mixed grass prairie with the mid-grasses, western wheatgrass and needle-and-thread, overtopping the principal shortgrass component of blue grama grass and sedges.

Another grass deserving special mention in this type is little bluestem. This grass is often abundant and conspicuous on the raw soils of small hilltops, sideslopes, and rough breaks throughout the range of the type.

Wheatgrass-Grama-Needlegrass Type

The Wheatgrass-Grama-Needlegrass type extends from southeast Alberta and southwest Saskatchewan to north-



Wheatgrass-Grama-Needlegrass type. Most of the basal area of the type is provided by blue grama grass but mid-grasses are prominent.

eastern Wyoming. There is increasing importance of blue grama grass in the cover in relation to increasing aridity of the climate as the Rocky Mountains are approached.

Considering the entire Wheatgrass-Grama-Needlegrass type there is no question but that blue grama grass has increased greatly in importance as the result of grazing. Buffalograss becomes increasingly important in the type, especially toward the southern section.

Probably the most significant alteration of the type is the widespread increase of big sagebrush. Over much of the type this species has become so important in the cover as to give the type the general appearance of a sagebrush-grass type. Big sagebrush extends into western North Dakota, South Dakota, and Nebraska, but dwarf sagebrush seems to be the major sagebrush species on the eastern and northern fringes of the type and the primary sagebrush species which extends eastward into the Wheatgrass-Needlegrass type.

Wheatgrass-Grama Type

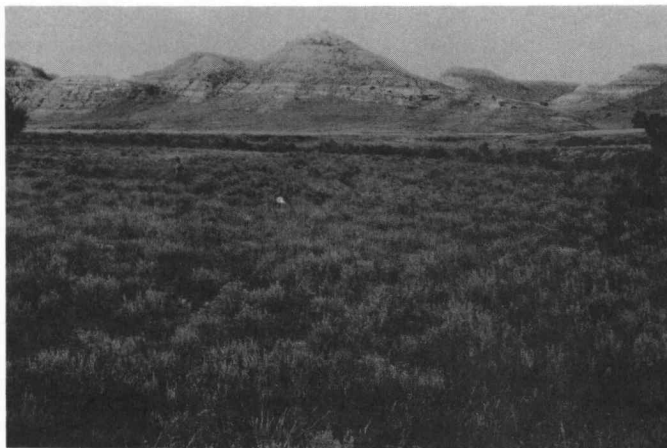
Baumberger (1977) has designated the vegetation found throughout the type and buffalograss becomes increasingly important with increase in grazing pressure.

Blue Grama—Buffalograss Type

On the tablelands of northwestern Nebraska and extending into Wyoming north of the North Platte River, the *Blue Grama-Buffalograss* type is developed (Kaul 1975). This appears to be an extension of the northern grama-buffalograss prairie of Kuchler (1974). While the midgrasses, western wheatgrass, needle-and-thread, and others are present to some extent, the aspect of the vegetation is definitely that of the shortgrass type.



White River Badlands showing well-grassed, nearly level areas contrasting with stark, eroded, barren clay slopes.



Abundant dwarf sagebrush on terrace above creek development of sagebrush-grass complex.

Sandhills Prairie Type

The vegetation of the great sandhills area of Nebraska has been mapped as Sandhills Prairie. This great grassland area extends a short distance into South Dakota and is commonly given an area of 17,000 to 18,000 square miles. The area supports a grassland cover that has shown surprisingly little degeneration since grazing of domestic livestock began in the region (Branson 1985). The vegetation is fundamentally that of a tall grass prairie with big bluestem, little bluestem, and bluestem, prairie sandreed, needle-and-thread, sand dropseed, Indian ricegrass, switchgrass as major species. Typical blowouts with characteristic vegetation are found in the area, particularly in the drier, western portion of the type. Here such additional species as blowout grass, sandhill muhly, and sand dropseed occur.

The sandhills area is dotted with many wetland areas supporting dense aquatic vegetation, and abundant wildlife populations. Other sandhill areas are scattered throughout the Northern Great Plains. Many of these areas are quite small and separate mapping of them was impossible.

Foothills Prairie

The fescue grassland, originally dominated by the tussock-forming rough fescue, and commonly associated with the dark soils fringing the boreal forests zone in Alberta and Saskatchewan, has here been designated as Foothills Prairie.

Pacific Bunchgrass Type

Only a small area in south-central Montana has been mapped as representing the Pacific Bunchgrass type. The type has been so designated because bluebunch wheatgrass is usually the major dominant, as in the bunchgrass vegetation west of the Rocky Mountains. Idaho fescue is present in some situations, especially at higher altitudes, but in many cases is poorly represented in the cover or may be entirely absent.

Badlands and River Breaks

The vegetation of the badlands and steep river breaks throughout most of the Northern Great Plains is so distinctive and unique that it deserves separate classification. It has already been mentioned that the major badlands areas in the region are between the Cheyenne and White rivers in South Dakota (mainly along the White River) and along the Little Missouri River in North Dakota. Extensive areas of badlands also occur in southeastern and south central Montana along the tributary drainages of the Yellowstone and Missouri River. Both the Yellowstone and the Missouri rivers have numerous sharply eroded breaks, steep bluffs, and essentially badlands areas, throughout much of their courses through the upper plains (see map).

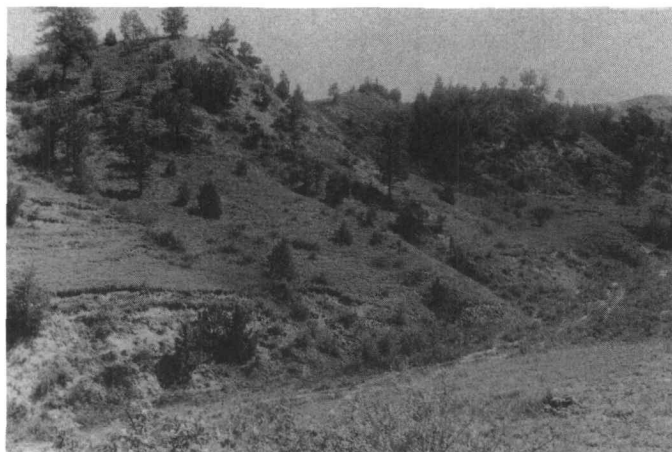
Characteristics of these steep, eroded broken areas are abrupt changes in the nature of the exposed soil and geological materials, in topography, slope, exposure, degree of erosion, and sodium accumulations. At the same time there are intermixed gentle slopes, rounded knolls, and nearly level plateau-like remnants which show considerable soil development. Corresponding to the abrupt changes in edaphic and micro-environmental factors are abrupt changes in vegetation patterns. In general, north- and east-facing slopes have more mesic conditions, while south- and west-facing slopes may be extremely xeric.

Pine Savanna

The woody vegetation type characterized by scattered stands of ponderosa pine frequently associated with Rocky Mountain juniper, which occurs extensively on the rough uplands through central and eastern Montana into north-western Wyoming, western South Dakota, and to a very limited extent in western North Dakota, has been here designated as the Pine Savanna type.

Black Hills Pine Forest

The Black Hills Pine Forest is by far the largest single forest unit in the Northern Great Plains and has been described in detail by McIntosh (1931). Over most of its range in the higher hills ponderosa pine grows in open park-like stands. On the foothills the pines become more scattered, taking on the savanna-like appearance previously described. In some cases second-growth trees form dense, nearly closed stands. In the deep cool canyons of the interior ranges white spruce is found. Associated with the spruce is paper birch.



Pine Savanna type with scattered ponderosa pine and Rocky Mountain juniper.

The grasses of the mixed prairie extend into the foothills, the pine savanna and the larger park-like areas of the major forest region. Included are western wheatgrass, bluebunch wheatgrass, needle-and-thread, green needlegrass, prairie junegrass, blue grama, hairy grama, and buffalograss. Needleleaf and threadleaf sedges are common. In some places tall grass prairie remnants are found with big and little bluestem, Indian grass, side-oats grama, and prairie sandreed as major species. Forbs of both grassland types are those common to the types.

Montane Forest

Forests found on the upper levels of the Rocky Mountain outliers in western Montana and on the Cypress Hills in Saskatchewan have been placed in this category. These forests are not of the same composition in all cases. Most frequently the vegetation at all but the highest elevations is forest-grass complexes, with Douglas fir and ponderosa pine being the principal tree species.

Upland Woodlands

Scattered across the northern plains are various types of tree growth which have been categorized here as Upland Woodlands. Most commonly these are associations dominated by (1) aspen; (2) bur oak; (3) green ash; or (4) junipers. Normally these types are associated with favorable habitats, and do not make up any sizable portion of the total vegetation. However, to the north into Canada and at higher elevations westward, the aspen becomes increasingly abundant. To the south and west the junipers become more important.

Common associates in such situations are ponderosa pine and shrubs such as big sagebrush, bitterbrush buckbrush, fragrant sumac, and rabbitbrush. Western wheatgrass, bluebunch wheatgrass, thickspike wheatgrass, blue grama, Kentucky bluegrass, and other grasses from the surrounding grassland are common. Dense stands on north and east-facing slopes in western North Dakota have a characteristic grass, little ricegrass, as a part of the understory.

Riparian Woodlands

By far the most important riparian woodland type in the northern Great Plains is the Cottonwood Type which occurs



Green ash wooded draw in western North Dakota. The type develops mainly in favorable runoff sites and is vital as wildlife habitat.

on the floodplains of the larger rivers and streams, in subirrigated valleys, and as small groves or as scattered individual trees along minor drainages. The cottonwood is the dominant tree, with green ash, boxelder, American elm, hackberry, peach-leaved willow, and occasionally bur oak as associates. The junipers, Rocky mountain juniper and to the south eastern red cedar, may become common in the type. The sandbar willow sometimes forms dense thickets along the streambank side of the woodland.

Two other riparian woodland types come into the borders of the Northern Great Plains from the East. These are the Elm-Ash type and the Elm-Ash-Basswood or Plains Hardwood type (Clambey 1986). The Elm-Ash-Basswood type occurs mostly outside the Northern Great Plains area, with one notable exception. In northern Nebraska the type extends far up the Niobrara River to meet and mingle with ponderosa pine (Kaul 1975). Small extensions of the type also occur along the Elkhorn and Loup Rivers in the same general region.

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The CMR: An Enigma for Range Managers

Kim Enkerud and John R. Lacey

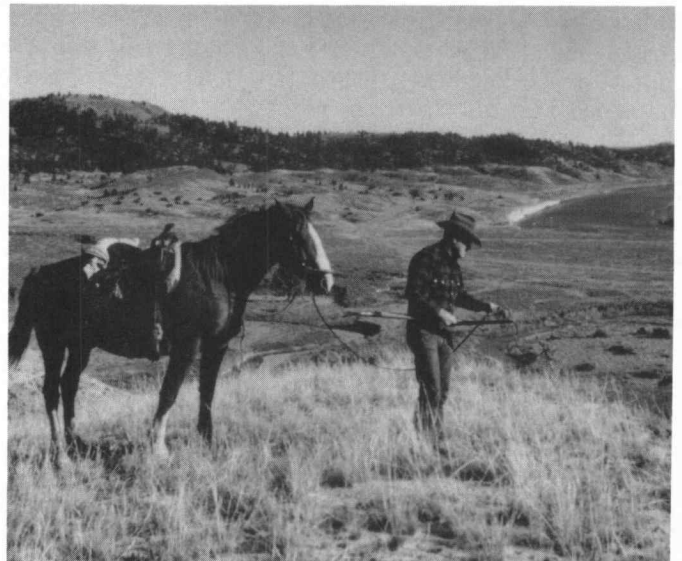
The Charles M. Russell National Wildlife Refuge (CMR)—intriguing, beautiful, formidable, and controversial (Figure 1). Its management is a lesson for the range management profession.

Biological decisions affecting management on the CMR have been, and continue to be, made in the political arena. Unfortunately, the process of educating and informing politicians and their staffs of the goals and objectives of range management was never completed. An Environmental Impact Statement (EIS) has been written on the management of the CMR. Comments in it are laced with emotion, prejudice, bias, and the "I-am-right" attitude:

1. "Your response to my letter ... says that the economic impact will be insignificant to the region. I can assure you that this is not correct because I have not seen any prairie dogs paying property taxes to educate our school children, spending money for machinery..."

2. "The range which is 92 percent good and excellent condition needs no reduction in livestock or wildlife ungulates. The 33 percent overall reduction in livestock grazing is unwarranted. The utilization cuts used by CMR to compute stocking rates and proposed livestock reductions are unreasonable and not based on practical or scientifically sound data."

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Range condition on the CMR is an answer to a stockman's dream.

3. "While the FWS economic analysis indicates no impact to the regional economy if livestock reductions are implemented, it does recognize that a few individual livestock operators would be substantially impacted. While this is unfortunate and regrettable, it does not seem significant enough to warrant further delay in the