

South Dakota Rangelands: More than a Sea of Grass

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Presettlement explorers described the region's landscape as a "sea of grass." Yet, this "sea" was quite varied, and included a wealth of less obvious forested communities. Both physiographic and climatic gradients across the state of South Dakota contributed to the development of variable vegetation types of South Dakota. The diverse flora truly identifies the state as a "Land of Infinite Variety." Variations in climate, soils, and topography help to accentuate this label. Large herbivores such as bison and periodic fires ignited by lightning and American Indians also contributed to the formation of the pre-settlement landscape.

Topography, Physiography, Climate

South Dakota is located in the geographical center of North America. It lies near the center of the large region of grassland vegetation that once occupied the central part of

the continent. Elevation increases from about 900 to 1,500 feet above sea level along the eastern border to 3,000 to 3,500 feet along the western border. The highest point in the United States east of the Rocky Mountains is Harney Peak in the Black Hills at 7,241 feet elevation.

The major portion of the state lies within the Great Plains physiographic province (Fig. 1), and a smaller portion in the Central Lowlands Province (Denson 1964). The Great Plains Province is a broad highland that slopes gradually eastward from the Rocky Mountains on the west to the Central Lowlands on the east. That portion of the Great Plains Province in the Western two-thirds of South Dakota has been termed the Missouri Plateau by some authors. The Central Lowlands Province extends from the drainage basin of the James River (approximately the 99th Meridian) eastward.

South Dakota's climate is highly variable, with long-term precipitation perhaps best exemplifying that variability. The capital city, Pierre, is near the center of the state on the

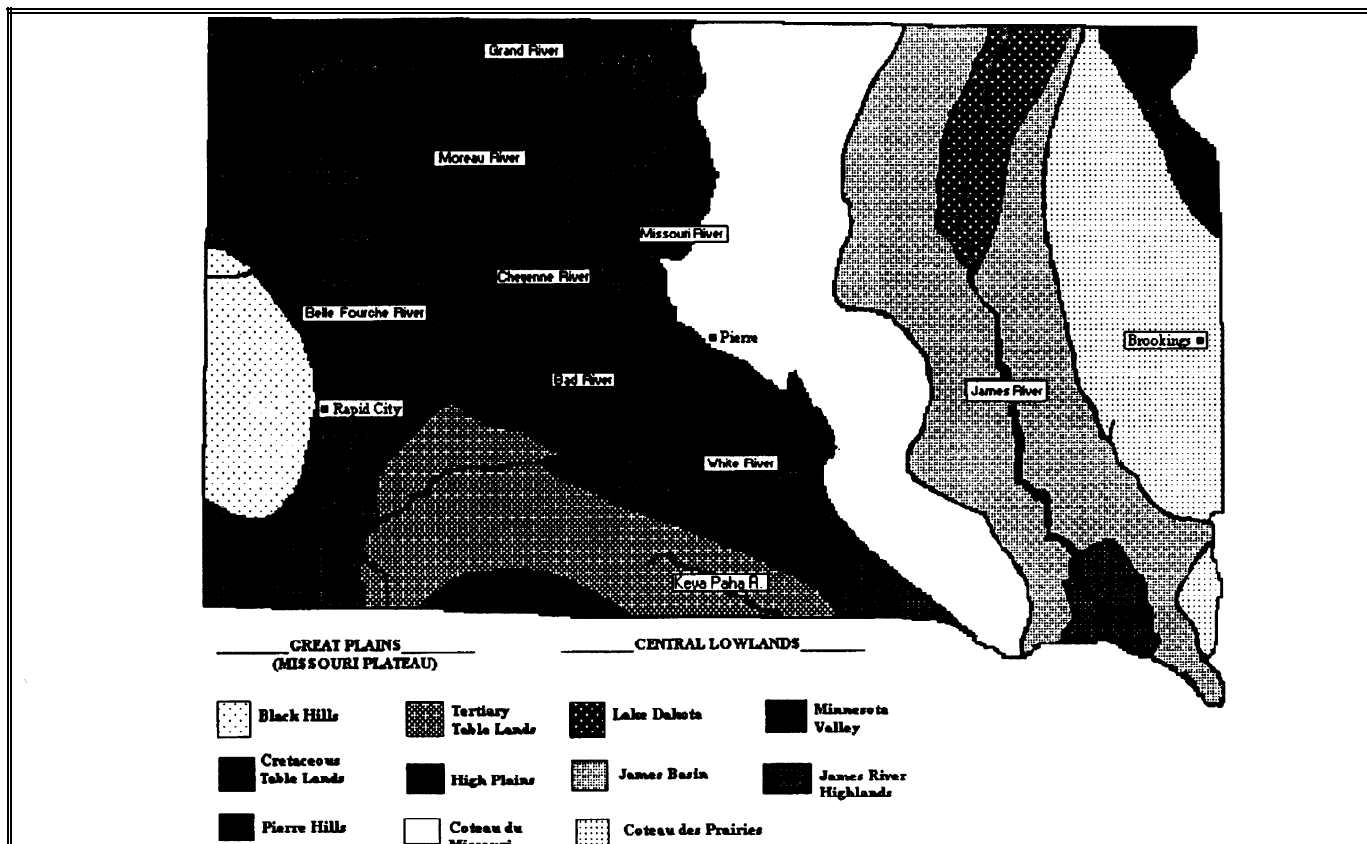


Fig. 1. Major physiographic divisions of South Dakota.

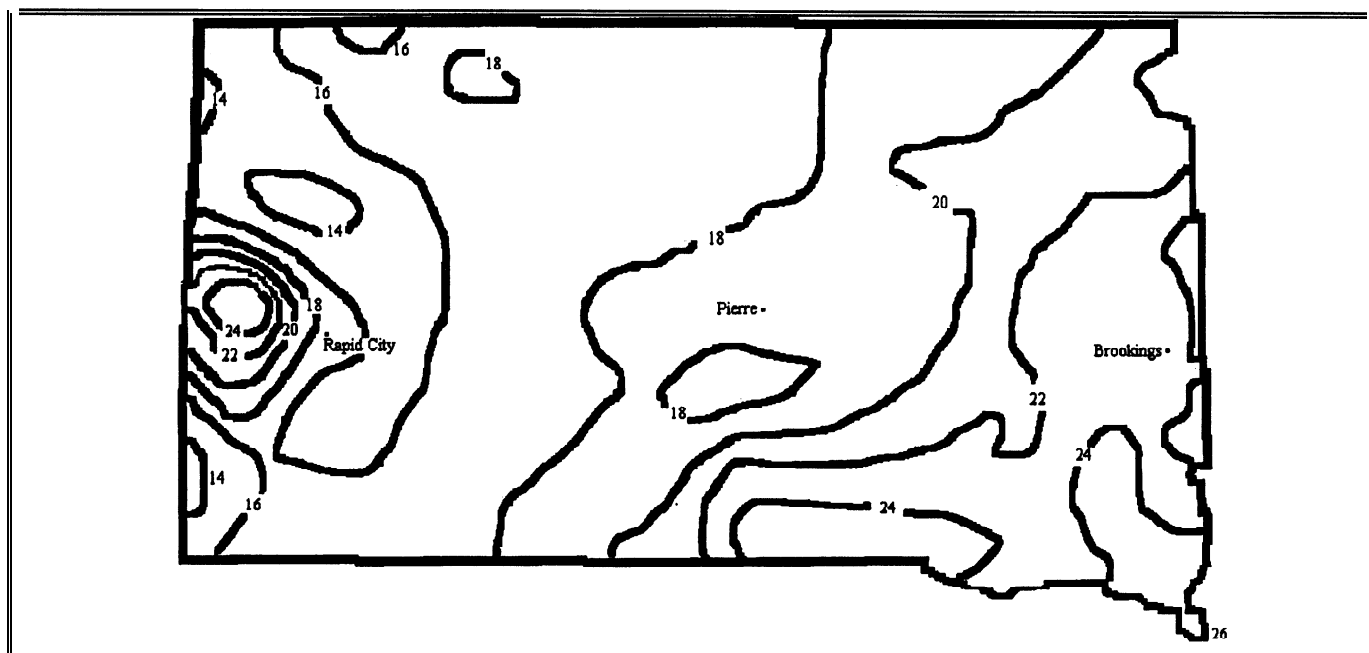


Fig. 2. South Dakota average annual precipitation (inches) 1961-90 (Bunkers, 1993).

east bank of the Missouri River. Pierre is also immediately west of the 100th Meridian, the arbitrary border between the subhumid and semiarid climatic zones. Schumacher (1974) carefully analyzed the 81-year (1892-1972 Pierre precipitation record. He noted that according to Thornthwaite's (1936) climatic classification scheme, five of the years were arid, 33 semiarid, 31 dry subhumid, 12 moist subhumid, and none were humid. Wet and dry years tended to be grouped. Dry years can be quite severe, especially when spring and early summer precipitation is deficient. Plant moisture stress occurs somewhere in the state nearly every year.

Annual precipitation generally decreases from about 26 inches along the southeastern borders to about 13 inches at the extreme northwest and southwest corners of the state (Fig. 2). About 75 percent occurs during the growing season, April through September. The 18-inch precipitation isohyet partly conforms to the 100th Meridian and the eastern boundary of the Great Plains Province (Figs. 1 & 2).

South Dakota Natural Vegetation

A map of the pre-settlement or potential natural vegetation of South Dakota (Fig. 3) reveals that nearly all the land area of the state was once grassland (Baumberger 1977). Most grassland, i.e. rangeland, in the state is a mixed-grass community comprised of a mosaic of varied plant associations. Only a few scattered remnants of tallgrass prairie occur in the eastern third of the state. The mixed grass prairie grades into shortgrass and sagebrush-grassland in the extreme western portion of the state. Sandhills grasslands are found along the southern border and in a small isolated pocket of sandhill topography known as the Hecla

Sandhills in the northeast. Riparian woodlands line the rivers and streams of the state; other pockets of deciduous species are restricted to draws and other topographic locations where additional moisture permits their survival. Ponderosa pine occurs on outcrops at several locations in the western portion of the state, and is the dominant tree in the Black Hills. Despite substantial conversions of rangeland to cultivated land, rangeland still dominates most of the central and western South Dakota landscape.

Tallgrass Prairie

The Tallgrass Prairie (or true prairie) once occupied the eastern one-third of South Dakota, mostly on what is known as the Coteau des Prairies (Figs. 1 & 3). The general aspect, in a pre-settlement state, consisted of a dense cover of tallgrasses and an abundance of showy forbs. Soils are deep and formed mainly in glacial drift or loess. Elevations range from a low of about 900 feet above sea level in the extreme northeast corner of the state to about 1,500 feet in the southeast corner.

Dominant species of this portion of the Tallgrass Prairie are big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), porcupine grass (*Stipa spartea*), and tall dropseed (*Sporobolus asper*). Disturbance increases such species as western wheatgrass (*Agropyron smithii*), sideoats grama (*Bouteloua curtipendula*), blue grama (*B. gracilis*), hairy grama (*B. hirsuta*), and buffalograss (*Buchloe dactyloides*). Exotic plants, such as Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*), and noxious weeds, such as leafy spurge (*Euphorbia*) have invaded many remaining Tallgrass Prairie areas.

Today, the majority of this area is in cropland. What remains of the Tallgrass Prairie is mostly in low range condition with a high percentage of exotics and other invader species. In recent years, some Tallgrass Prairie areas have been restored and are being maintained with periodic fire to stimulate native species and control invaders.

Tallgrass Transition

The characteristic vegetation of this community is a dense cover of tall and midgrasses. It occupies the transition between the Mixed and Tallgrass Prairies in three major physiographic divisions (Figs. 1 & 3). Soils are mostly deep, having formed in glacial till or loamy glacial drift on uplands. At the western edge of the area and along the Missouri River, soils are formed in loess, silty glacial drift, or loess mantled glacial till on uplands.

Dominant species in pristine condition were western wheatgrass, big bluestem, little bluestem, porcupine grass, green needlegrass (*Stipa viridula*), and prairie junegrass (*Koeleria macrantha*). Forbs were abundant. The altered community develops a shorter aspect with increases in sideoats grama, blue grama, and needleandthread (*Stipa comata*), as well as a number of perennial and annual forbs. Kentucky bluegrass is a common invader species. A high percentage of this area has also been converted to cropland. Only steep and rocky soils remain as rangeland.

Mixed-grass Prairie

This community occurs in the Great Plains Province across two large physical divisions: the Pierre Hills west of the Missouri River and the Cretaceous Table Lands in the northwest portion of the state (Figs. 1 and 3). The former is underlain by the Pierre shale formation with soils formed

mainly in residuum from clayey or silty shales on uplands at elevations of 1,800 to about 2,000 feet. The Cretaceous Table Lands to the south contain soils that are a mixture of sandy and loamy materials formed from sandstone, siltstone, and shales on uplands to about 3,600 feet.

The natural vegetation of the northwestern section of this vast upland area consisted of a moderately dense cover of midgrasses dominated by western wheatgrass, needleandthread, little bluestem, prairie sandreed (*Calamovilfa longifolia*), green needlegrass, and stonyhills muhly (*Muhlenbergia cuspidata*). Dryland sedges (*Carex* spp.), blue grama, prairie threeawn (*Aristida purpurea*), and fringed sagewort (*Artemisia frigida*) increase with disturbance.

The remaining portion of this community is characterized by a moderately dense stand of mid- and shortgrasses. Dominants are western wheatgrass and green needlegrass with an understory of blue grama and threadleaf sedge (*Carex filifolia*). Perennial forbs are abundant. With disturbance, the midgrasses decrease in abundance and blue grama, buffalograss, and cacti (*Opuntia* spp.) increase. Common invaders in this community are Japanese brome (*Bromus japonicus*) and curlycup gumweed (*Grindelia squarrosa*).

Today, about 75 to 80 percent of the land area remains in rangeland. Favorable small grain prices have resulted in extensive land conversions over the past 20 years, even though somewhat severe soil and precipitation limitations exist.

Short/Mixed-grass Prairie

The Tertiary Table Lands in the southwestern portion of the state (Fig. 1) consist of a series of benches and buttes

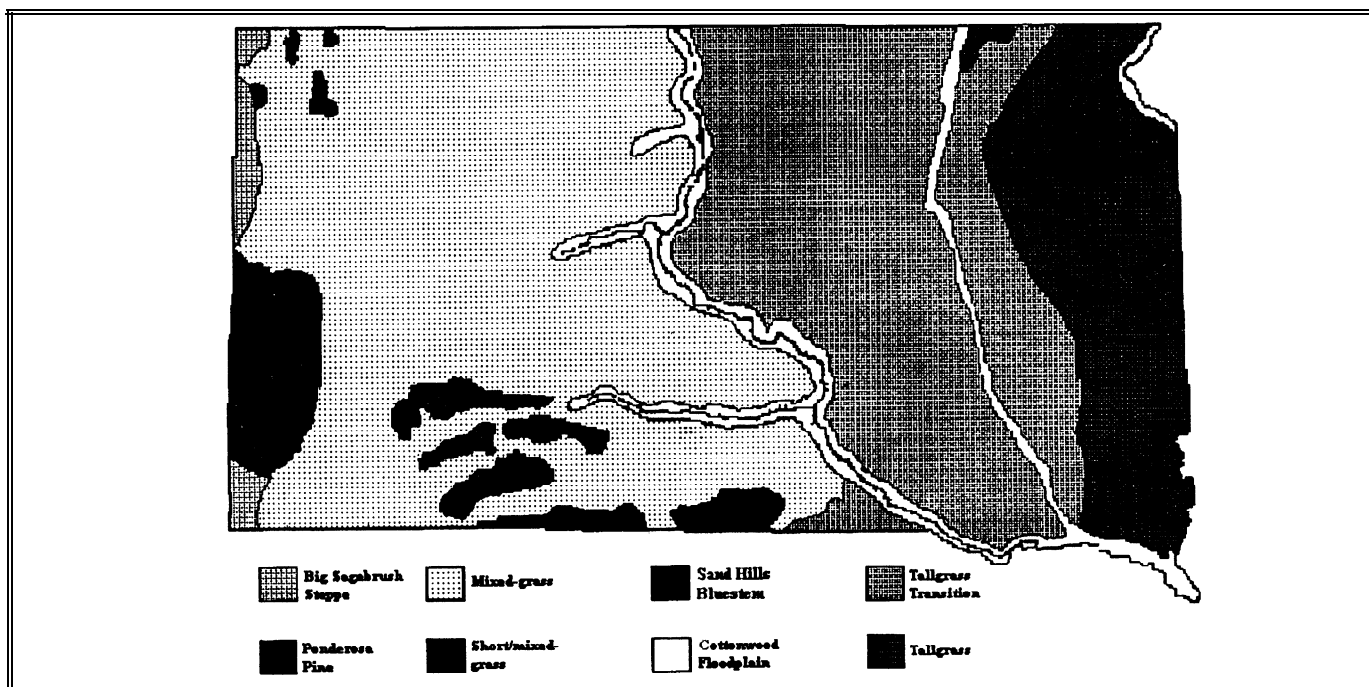


Fig. 3. South Dakota Natural Vegetation.

underlain by sandstones, siltstones, and shales. Elevations range from 3,000 to 3,600 feet. Soils are of loamy and clayey texture and located on nearly level to undulating lands and on steep slopes. Only a small portion of this predominantly rangeland area has been converted to cropland.

Natural vegetation (Fig. 3) includes all the midgrasses and shortgrasses previously mentioned. The vegetation has a wide variety of forms because of extreme variability in topography and soils leading to a "badlands" aspect. Sideoats grama and little bluestem are abundant on shallow soils of slopes. Shortgrasses, needleandthread, and dryland sedges increase when the natural plant cover is repeatedly overused. Rocky Mountain juniper (*Juniperus scopulorum*) occurs on shallow soils above stream channels and minor drainages, but has moved onto deeper soils due to the absence of natural fires. Ponderosa pine (*Pinus ponderosa*) is found on some buttes, but is uncommon east of the Badlands area.

Big Sagebrush Steppe

This community occurs almost exclusively along the extreme western border of South Dakota (Fig. 3). Soils are similar to those of adjacent communities and are clayey and silty in texture. Precipitation is the lowest of any area in the state.

Natural vegetation in the community consists of wheatgrasses, blue grama, prairie junegrass, and forbs with an overstory of big sagebrush (*Artemisia tridentata*) and/or silver sagebrush (*A. cana*). Protection from fire allows big sagebrush to increase; midgrasses decrease with heavy grazing. The majority of the area is in rangeland.

Ponderosa Pine

The largest expanse of ponderosa pine occurs in the Black Hills (Fig. 3). Soils are shallow, well-drained, and clayey to silty in texture. The natural vegetation consists of open to dense pine forest with a diverse understory of herbaceous and shrub species. Common understory species include white coralberry (*Symphoricarpos albus*), common juniper (*Juniperus communis*), and Oregon grape (*Berberis repens*) (Thilenius 1972). Stands of aspen (*Populus tremuloides*) and bur oak (*Quercus macrocarpa*) are common, and Black Hills spruce (*Picea glauca*) occurs on moist, north slopes and generally at higher elevations. Within the Black Hills forest are many large prairie areas.

A variation of the Ponderosa Pine community is confined to sandstone buttes in northwestern South Dakota, the Pine Ridge escarpment in the southwest, and the outer slope and hogback ridge surrounding the Black Hills (Fig. 3). The characteristic natural vegetation is an open stand of ponderosa pine with an understory of big and little bluestem, prairie dropseed (*Sporobolus heterolepis*), stonyhills muhly, blue grama, hairy grama, and sideoats grama. Forbs are numerous and leadplant (*Amorpha canescens*), a low shrub, is abundant. Severe disturbances cause tallgrasses to decrease with corresponding increases of warm-season shortgrasses, Kentucky bluegrass, fringed sagewort, and broom snakeweed (*Gutierrezia sarothrae*). Western wheatgrass also increases on some sites.

Ponderosa pine density and extent have increased dramatically in this century when compared with that documented by the Custer Expedition photographs of 1874 (Progulske 1974). Pine increases, especially in the foothills, are largely due to fire suppression over the past 75 to 100 years. Meadows and deciduous woodland habitats have retreated in response to expanding pine forests; spring and stream flows have also declined. Housing construction, recreational developments, road rebuilding, and mining are forces that threaten the pine forests in the Black Hills and other parts of South Dakota.

Sand Hills Bluestem

This community occupies the northern edge of the Nebraska Sand Hills at elevations from 3,000 to 3,600 feet with a minor outlier in the northeast (Fig. 3). Soils are mostly deep, undulating to rolling, and sandy textured.

The natural plant cover included little bluestem, big bluestem, sand bluestem (*Andropogon hallii*), prairie sandreed, needleandthread, sideoats grama, western wheatgrass, and a wide variety of forbs. Leadplant, wild rose (*Rosa* spp.), sand cherry (*Prunus pumila*), and yucca (*Yucca glauca*) are locally abundant. With retrogression, tallgrasses yield to shorter species and sand sage (*Artemisia filifolia*) and sageworts (*Artemisia* spp.) increase. Some rangelands have been converted to irrigated cropland where sufficient water is available from wells or other sources.

Deciduous Woodlands

Low precipitation limits the growth of deciduous woodlands to areas of increased moisture such as along rivers and in draws. Kuchler (1964) classified the potential natural vegetation along the Missouri and James Rivers in the eastern part of the state as a complex of cottonwood (*Populus deltoides*), peachleaf willow (*Salix amygdaloides*) and American elm (*Ulmus americana*). Cottonwood also lines smaller rivers and creeks throughout the State. Other common woodland types include bur oak stands and "woody draws" dominated by green ash (*Fraxinus pennsylvanica*) and chokecherry (*Prunus virginiana*). Poor tree reproduction is a common problem in wooded draws in the state (Severson and Boldt 1978). In addition, loss of tall shrubs and replacement of native sedges with Kentucky bluegrass threaten these woodlands.

The Black Hills: An Oasis In the Northern Plains

Along the western South Dakota border, the Black Hills comprise about 5,150 square miles, including the Bear Lodge Mountains in northeastern Wyoming (Orr, 1959). Several authors have singled-out the Hills area as the "gemstone of the Northern Plains." McIntosh (1949) stated that from a botanical standpoint the most important climatological difference between the Hills and surrounding country is that the Black Hills receive much more precipitation.

After leading a scientific party through the Black Hills in

the summer of 1875, Colonel R.I. Dodge (1876) concluded:

The Black Hills country is a true oasis in a wide and dreary desert. The approaches from every direction are through long stretches of inhospitable plains, treeless and broken. . . I pronounce the Black Hills, in many respects, the finest country I have ever seen. As a grazing country it cannot be surpassed; and small stock-farms of fine cattle and sheep cannot, I think, fail of success . . . Splendid grass, pure water, excellent shelter from storms-nothing is wanting to fill all the requirements of a first-class stock-farm . . . In a few years, when this wilderness shall have been made to "blossom as the rose" with cozy farms and comfortable residences, when rocky crags shall have been crowned with palatial hotels, the tourist will find an ample reward in climbing the rugged heights, or exploring the dark defiles of this wonderful land.

Most of Dodge's predictions have become realities in little more than a century. Today many fine ranches exist in the Black Hills, and logging and the summer tourist industry are vitally important to most Hills communities.

Settlement and, in particular, mining in the Black Hills led to unique present-day land management problems. Throughout the Hills, countless mining claims on which deeds were obtained created today's patchwork pattern of land ownership. This intermingling of private and public lands has complicated the tasks of natural resource managers.

Fire suppression following settlement of the Black Hills has prevented the natural, dynamic changes required by most plant communities. Interrupting these changes has led to stagnating ponderosa pine stands which are both hazardous and aesthetically unappealing. Along forest margins, fire suppression has permitted pines to extend their range into grassland at the expense of herbaceous vegetation.

In view of present and future land uses, there is an urgent need to examine fire as a possible management tool for reducing wildfire fuels and improving livestock and wild game ranges, timber productivity, and scenic vistas. The history of wildfire in the Black Hills should be reviewed in order to obtain a proper perspective of fire in various plant communities in the Hills area. In this manner the changes which have occurred with fire suppression may be delineated and, perhaps, underlying causes of change determined.

Today's Challenges

Settlement has drastically changed the character of South Dakota's rangelands. Today, more than 75 percent of the land is cultivated in many eastern South Dakota counties (Johnson and Nichols 1982). West of the Missouri River, less than 25 percent of the area is cultivated. Free-roaming bison have been replaced by confined herds of cattle, fires have been actively suppressed, and the spread of exotic species such as Kentucky bluegrass and noxious weeds such as leafy spurge threaten many native communities. The biggest challenge for range managers in South Dakota may lie in developing methods to restore that diverse "sea of grass" that early settlers saw.

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