Building On Our Heritage

Grasslands and Forages of Nebraska

Bruce Anderson

Centrally located within the United States and North America, Nebraska's variable climate, topography, soil, and water resources provide abundant opportunity for uniquely different natural ecosystems and agricultural production systems to develop and co-exist.

Rangelands occupy about 46% of Nebraska's 49.5 million acres, the single largest category of land area in the state (Table 1). Combined with seeded pastureland, these grasslands account for 50% of the total land area in the state. Including cropland harvested for hay or silage, more than 57% of Nebraska is devoted directly to grasslands and forage crops. In addition, more than 2 million acres of row crop corn and sorghum residues are grazed during winter. These resources help support the 6.65 million cattle and calves as well as the abundant wildlife in the state.

Table 1.Major land uses in Nebraska, 1992.

Land use	Acres
Rangeland	22,668,800
Pastureland	2,065,500
Total cropland	19,239,100
Other rural	2,911,800
Surface water	632,000
Urban, roads, etc.	1,990,100
TOTAL	49,507,300

Topography, Climate, Soils

Nebraska's continental climate is characterized by hot summers, severe winters, low to moderate rainfall and humidity, great yearly variations in temperature and rainfall, and major daily changes in weather. More variation in climate occurs from west to east across Nebraska than from eastern Nebraska to the Atlantic coast.

Topography. Nebraska often is thought of as being quite flat, but elevation changes are significant, varying from 840 feet above sea level near the southeast corner to a high point of 5,424 feet near the southwestern corner of the Panhandle. Less than 20% of Nebraska's land area is classified as "flat" plains or valleys. About three-fourths of Nebraska has moderate relief or is rugged with dissected plains, rolling hills, sand hills, bluffs, and escarpments. Properly managed range and pasture in these hilly regions is needed to stabilize soils and sustain livestock enterprises.

Climate. Average temperatures are relatively similar across Nebraska with average January temperatures ranging from 18 to 25° F while during July they range from 73 to 78° F. However, the length of the frost-free growing season varies from 120 days in the northwest to 180 days in the southeast, primarily due to differences in elevation.

The amount of rain, snow, and hail received annually declines rapidly from east to west, exceeding 36 inches in the southeast corner of Nebraska to fewer than 14 inches in the west central Panhandle. Thus, Nebraska experiences both sub-humid and semi-arid climatic zones. Approximately 75 to 80 percent of the annual precipitation falls during the growing season (April through September). Annual variation in precipitation is great, with short-term dry periods lasting less than one growing season being common. Droughts that affect more than one growing season occur about once every 20 years. In addition, annual evaporation demand is high, ranging from 40 inches in northeastern Nebraska to as high as 54 inches in the southwest.

Wind speeds average between 9 and 15 mph in all months at all locations. Periodic winds strong enough to damage trees occur often during summer thunderstorms. Strong winds, along with low soil moisture, can cause severe erosion of topsoil.

Soils. Nebraska has three main physiographic divisions: High Plains, Loess, and Sandhills. Soils in the High Plains and Loess sections originate from parent materials abundant in carbonate minerals that weather to form a clay subsoil rich in calcium, potassium, and magnesium. Nutrient cycling is substantial in the top soil of grasslands in these sections because leaching is limited due to low precipitation and the deep, fibrous root system of the native grass vegetation, which also adds organic matter. These soils have accumulated organic matter and nutrients, but abundant weatherable minerals still remain. Soils in the High Plains, primarily in the Nebraska Panhandle and the southwest corner of the state, usually are calcareous with soil pH often exceeding 8.0 because precipitation is inadequate to leach carbonates. The Loess section in eastern and southern Nebraska has mostly neutral to slightly acid topsoils with slightly calcareous subsoils. Only the far eastern region was glaciated.

The Sandhills section contains about 12 million acres in central and northern Nebraska. The area is characterized by a continuous succession of dunes and swales with some narrow, elongated, dry valleys, scattered shallow lakes, and infrequent streams. Soils are primarily fine and very fine sand which allow rapid infiltration of rainfall. Water holding capacity is adequate to support good cover of deep rooted plants. Since most precipitation infiltrates the soil, the Sandhills maintains a higher ground water table and a larger quantity of ground water than in other areas. In many areas of lower elevation, the ground water table is high enough to form lakes or marshes, and the water level may vary during the year so water is on the surface in early spring but recedes during summer. Sandhills soils have no dis-

cernible B horizon because they are relatively young with limited morphological development. The topsoil, or A horizon, is relatively thin with a neutral to slightly acid pH and low organic matter on uplands but is slightly thicker in valleys. It contains significant amounts of calcium, potassium, and magnesium but phosphorus is low for cropping. Because wind erosion potential is high, tillage and crop production are limited. As a result, the Sandhills has become one of the largest areas in the United States used almost exclusively for livestock grazing.

Water. Nebraska is a water-rich state. Underneath nearly 60% of its land surface are aquifers that have nearly 2 billion acre-feet of good-quality water, enough to cover the entire state with 40 feet of water. Most of this water is easily accessible. The largest quantities are beneath the Sandhills in the Ogallala aquifer and in the river basins that flow from this region.

Ground water helps support the 8.1 million acres of irrigated Nebraska farmland. Surface water from rivers and reservoirs also provides additional water in many areas. While a few localized areas have experienced reductions in amount of or depth to ground water, various water conservation practices along with natural water flow have maintained water levels well or even caused the water table to rise.

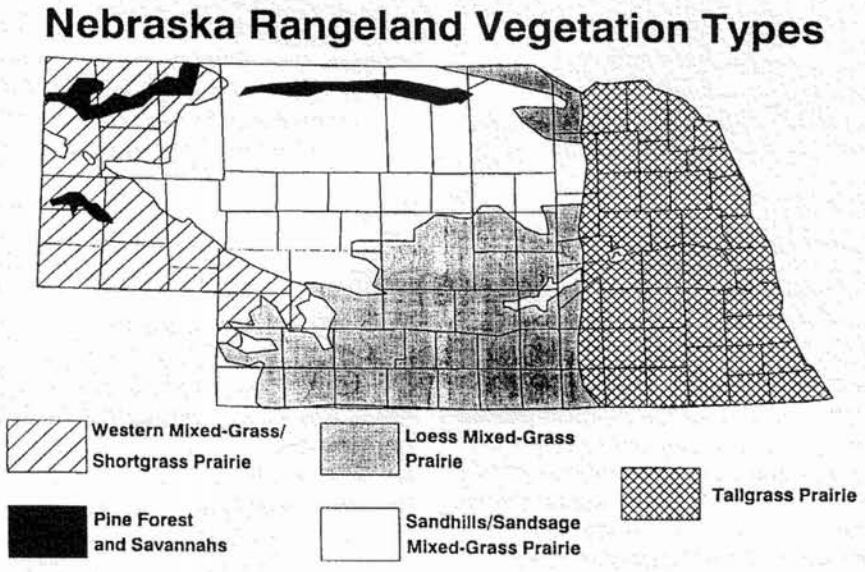
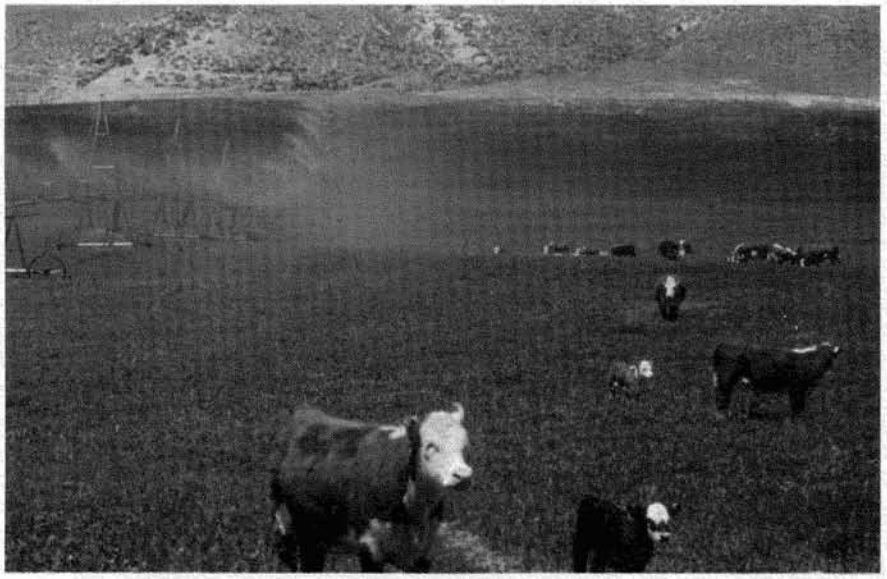


Fig. 1. ***Nebraska Rangeland Vegetation Types.***

Irrigation is most concentrated along the Platte River valley and in south central Nebraska. Most other river valleys, especially those originating in the Sandhills, also have substantial irrigation development.

The high water tables in many valleys of the Sandhills and near many rivers, especially the Platte River valley, provide significant amounts of moisture to plant roots. Many of these areas are described as "subirrigated" and support much greater plant growth than similarly located non-irrigated sites.



Use of irrigated land for pasture varies due to grain prices, pasture rental rates, livestock prices, and land productivity potential for grain and pasture. Photo by Lowell Moser.

Natural Grasslands

Nebraska's natural grasslands are composed primarily of four principal prairie types: Western Mixed-Grass/Shortgrass Prairie, Mixed Prairie, Tallgrass Prairie, and Sandhills Prairie (Figure 1). In addition, there are smaller vegetation regions that contain Rocky Mountain and Eastern Deciduous Forests, Floodplain Prairie and Forest, Sandsage Prairie, Dakota Prairie, and Kansas Mixed Prairie. More than 68% of the rangeland in these areas was rated in good to excellent condition in 1992 with an upwards trend according to the 1992 Rangeland National Resource Inventory. In addition, less than 21% of Nebraska's rangelands needed conservation practices; no other western or Great Plains state needed conservation on less than 60% of their acres.

Tallgrass Prairie

The Tallgrass Prairie, sometimes divided into True Prairie and Tallgrass Prairie, originally dominated Nebraska east of the 98th meridian. Because of its higher level of precipitation, more developed soils, and moderate relief, much of the Tallgrass Prairie has been

*Native tall or mixed-grass prairie, cultivated pastures and haylands, and grain crops compete for land area where the Tallgrass Prairie and Mixed Prairie once dominated the land*scape. Photo by Bruce Anderson.

converted to cropland. Only in far southeastern Nebraska can large areas still be found untilled.

Dominant species include big bluestem, indiangrass, switchgrass, little bluestem, sideoats grama, prairie dropseed, and porcupinegrass. Numerous forbs, such as scurfpeas, prairieclovers, and sunflowers as well as shrubs like leadplant also are common.

Because most remaining native pastures are small, they often are overgrazed. As a result, many introduced grasses have invaded these prairies, especially Kentucky bluegrass and smooth brome, as well as several noxious weeds such as musk thistle and leafy spurge.

Mixed Prairie

The Mixed Prairie generally extends between the 98th and 101st meridians, excluding the Sandhills Prairie. While much of the Mixed Prairie has been converted to cropland, especially where the terrain is relatively flat and irrigation water available, nearly one-half of the native prairie remains as rangeland.

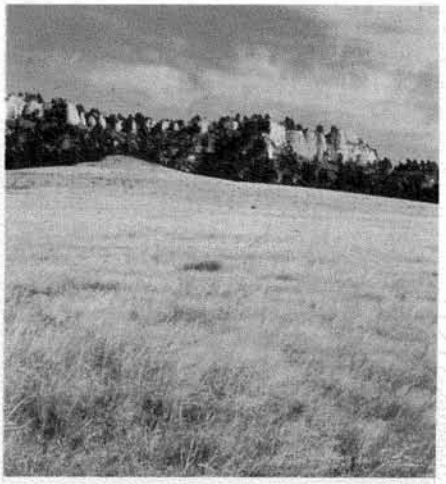
Diversity of plant species often is great in the Mixed Prairie. Besides having all the same dominant grasses, forbs, and shrubs as the Tallgrass Prairie, blue grama, western wheatgrass, and green needlegrass are common. This plant diversity enables the Mixed Prairie to form a plant community that can survive drought and excessive grazing pressure for several years while continuing to provide forage for livestock and cover for wildlife.

Western Mixed-Grass/Shortgrass Prairie

The Western Mixed-Grass/Shortgrass Prairie occupies most of the Nebraska Panhandle that is not a part of the Sandhills. Most of the prairie remains as rangeland, with crops grown in valleys, level tablelands, and under irrigation.

Short grasses dominate the Western Mixed-Grass/Shortgrass Prairie, with significant contributions from several mid-grasses. Prairie sandreed, needleandthread, threadleaf sedge, buffalograss, western wheatgrass, and blue grama are the dominant grasses.

The western mixed-grass/shortgrass prairie often combines pine forests and scenic terrain with the grasslands. Photo by Jim Stubbendieck.



High water tables in the Sandhills subirrigate meadows for abundant hay and grazing. Photo by Jim Stubbendieck.

Sandhills Prairie

The most unique natural grassland in Nebraska, if not all of North America, is the Sandhills. It is the largest area of stabilized sand dunes in the Western Hemisphere and represents one of the largest continuous expanses of grassland in the U.S. Over 90% of the land area in the region remains as grassland. Nebraska's largest wildlife refuges and National Forests also are located in the Sandhills. Nearly all the trees in the National Forests were started in nurseries and transplanted for forestation.

The annual precipitation (17 to 23 inches) and root-zone soil water holding capacity (< 3 inches) in the Sandhills normally would support only mid-grasses. However, tall grasses dominate the region because of very efficient soil moisture characteristics. More than 75% of the annual precipitation falls during the growing season and little runs off because the fine sandy soils have a high infiltration rate. Most of this precipitation becomes readily available to the deep and extensive root systems of properly managed tall grasses because of the low water binding capacity of the sand particles.

Two primary plant communities occur in the Sandhills. On sandy uplands, sand bluestem, prairie sandreed, little bluestem, switchgrass, sand lovegrass, blue grama, and needleandthread are the dominant grasses with important contributions

Alfalfa hay is an important cash crop and richly provides nutrients for Nebraska livestock. Photo by Bill Kehr.

Crop residues, especially corn stalks, provide inexpensive winter grazing for about one-half of Nebraska's beef cows. Photo by Bruce Anderson.

from numerous forbs, including prairieclovers and scurfpeas. These rangelands are used primarily for grazing. Bottomlands, often called wet or subirrigated meadows, frequently are dominated by prairie cordgrass, big bluestem, switchgrass, indiangrass, little bluestem, and numerous sedges, bulrushes, and rushes. However, many bottomlands that have been harvested frequently for hay or grazed have developed plant communities dominated by introduced and native cool-season grasses such as smooth brome, Kentucky bluegrass, redtop, timothy, and foxtail barley.

Cultivated Forages

Nebraska's climate, water, soils, and topography permit excellent crop, forage, and livestock production. Although precipitation levels alone would limit greatly the yields and areas in which many crops could be grown, Nebraska's 8 million acres of irrigated cropland produce reliably high yields. Typically, Nebraska ranks between 6th and 8th among states in cash receipts from crops, 3rd or 4th from livestock, and 4th in total farm marketings.

Cattle are an important part of Nebraska's agricultural economy. Nebraska ranks 3rd nationally with over 4 million head of beef fed and marketed annually and its 2 million beef cows rank 4th among states. Although there are only about 70,000 dairy cows in the state, sizable growth is underway due to an abundance of desirable natural resources, feed resources, and infrastructure support.

Hay and silage crops are major commodities in Nebraska (Table 2). At least 1,000 acres of alfalfa plus another 1,000 acres of other hay is grown in every one of Nebraska's 93 counties. Although only a small portion of the corn and sorghum is harvested as silage, more than 25% of the acres of crop residues are grazed during winter, especially by beef cows. These forages complement the abundant grazing available from Nebraska's grasslands, providing year-round forage use. Since more crop residues are available in areas that contain fewer acres of perennial grasslands, distribution of beef cows is remarkably uniform across the state.

Table 2. Major forage crops in Nebraska, average of 1995-1997.

Crop	Acres	Production	Rank among states
Corn grain (bushels)	8,242,000	1,064,400,000	3
Corn silage (tons)	183,000	2,625,000	9
Sorghum grain (bushels)	750,000	72,063,000	3
Sorghum silage (tons)	60,000	680,000	2
Alfalfa (tons)	1,350,000	4,755,000	5
Other hay (tons)	1,817,000	2,298,000	9

Literature Cited

Bose, Dan R. 1977. Rangeland resources of Nebraska. Soc. for Range Manage. Denver, Colo.

Nebraska Agricultural Statistics. 1996-1997. Nebr. Agr.. Stat. Serv. Lincoln, Neb

Rangeland National Resources Inventory Report. 1992. USDA-SCS.

Weaver, J.E. 1965. Native vegetation of Nebraska. University of Nebraska Press. Lincoln, Neb.

The author is Professor of Agronomy and Extension Forage Specialist, Dept. of Agronomy, Univ. of Nebraska, Lincoln, Neb 68583-0910. Published with the approval of the Director of the University of Nebraska-Lincoln Institute of Agriculture and Natural Resources, Agriculture Research Division as Journal Series No. 12465.

Thanks to J. Stubbendieck, range ecologist, University of Nebraska-Lincoln, and P.E. Reece, extension range and forage specialist, Scottsbluff, Neb, for comments and guidance in developing this manuscript.

Editor's Note: This paper is one of a series describing some of the resources and features of Nebraska which may be of interest to attendees at the SRM/AFGC annual meeting in Omaha in 1999.