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Range Judging Handbook And Contest Guide for Nebraska

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Acknowledgments

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Introduction

Rangeland can be described as land on which indigenous vegetation is primarily grasses, grass-like plants, forbs, or shrubs and is managed as a natural ecosystem. Historically, Nebraska was once covered with a vast array of rangeland, interrupted occasionally by woodlands along rivers and streams. Today, it is still the major land category, covering about 46 percent (nearly 23 million acres) of the state. Combined with seeded pastureland (2 million acres), these grasslands occupy about 50 percent of the state.

Rangelands are one of Nebraska's most important and valuable natural resources. They are usually best known as the major forage component supporting the livestock industry. In addition, rangelands provide varied habitats for many species of wildlife, protect the soil from wind and water erosion, and enhance our environment by filtering runoff to streams, increasing the intake of precipitation and aiding the recharge of groundwater.

Although youth are the primary participants in range judging, contests can be a challenging and effective learning tool for both youth and adults. An important objective is for participants to better understand rangeland ecosystems in order to make proper management decisions. Contests teach some basic principles of range ecology, including soil-plant and plant-animal interactions, and plant succession. Learning to judge range provides effective tools that are used to manage the range resource. Many individuals and organizations from across the state help organize and conduct range judging contests. The State Range Judging Committee includes members that are affiliated with the USDA-NRCS, Natural Resources Districts, Nebraska Extension, Board of Educational Lands and Funds, the Nebraska Section of the Society for Range Management, and the Nebraska Agricultural Educators Association.

This publication provides information about Nebraska's rangelands and serves as the guide for range judging contests. It is designed to help individuals and teams prepare for range judging contests and to learn more about rangeland and its management. Each of the nine sections that follow corresponds to a section on the range judging scorecard used in contests. Sample scorecards are provided in the back of this publication.

1
Range Plant Identification and Classification

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The starting point for most range management decisions is being able to identify range plants by name and knowing their growth habits, livestock forage value, and other characteristics. Also, this is the first knowledge required to compete in range judging.

Appendix Table 1 lists 175 of the most important range and pasture plants found in Nebraska. While this may seem like a large number of species, it is only about 10 percent of the total number of species that grow in Nebraska. These plants are considered important either because they are desirable for grazing and wildlife or because they are undesirable, such as weeds and noxious plants. Both kinds are listed in *Appendix Table 1*.

Important characteristics are defined and listed for each species. Scientific names are included to avoid confusion because there may be several common names for a single species. Each plant has only one correct scientific name, and that name is used throughout the world. For help in plant identification and to learn more about range plants, you should obtain copies of *Common Grasses of Nebraska* (EC170) and *Common Forbs and Shrubs of Nebraska* (EC118) from Nebraska Extension and other publications listed at the end of this handbook.

Plants can be classified or grouped in many ways. The following groupings and definitions will help in learning important characteristics.

Major Types of Range Plants

Grasses are plants with jointed stems. The stems are often hollow between the joints. Leaves are in two rows on the stem. Veins in the leaves are parallel. Examples: western wheatgrass, downy brome, sand bluestem, and blue grama.

Grass-like plants include the sedges and rushes. Some grass-like species are abundant in wet meadows while other species are found on uplands. These look like grasses but have solid (not hollow) stems. Stems of sedges are triangular, while stems of rushes are round. The stems have no nodes. However, the veins are parallel as in the true grasses. Examples: threadleaf sedge and Baltic rush.

Most ***forbs*** (wildflowers and weeds) have net-like veins in the leaves, and the leaves have various shapes. The growth aboveground dies back every winter. The word "forb" is better than "weed" because weeds usually are thought of as pests. Many range forbs are not pests. They are attractive wildflowers and provide excellent forage. Examples: purple prairieclover, dotted gayfeather, stiff sunflower, and prairie coneflower.

Shrubs have persistent woody stems that remain alive from one year to the next. New growth starts each spring from points aboveground along the stem. Many shrubs do not have trunks like trees have but branch out from near the base of the plant. The portion of shrubs that animals may consume is called **browse**. Examples: sand sagebrush, small soapweed, leadplant, and smooth sumac.

Life Span

Annual plants live only one season. They do not grow a second year from roots or crowns but must start from seeds each year. Summer annuals germinate in the spring with complete growth and seed production by summer or fall. Examples: annual sunflowers and sixweeks fescue. Winter annuals germinate in the fall and overwinter as seedlings before completing growth and seed production in the spring. Examples: downy brome and woolly plantain.

Biennial plants live two years and flower only during the second growing season. Examples: fourpoint eveningprimrose and sweet clover.

Perennial plants live from year to year and produce leaves and stems for more than two years from the same plant. Examples: sand bluestem, leadplant, leafy spurge, and threadleaf sedge.

Origin

Native plants are part of the original vegetation of North America. Examples: big bluestem, stiff sunflower, and leadplant.

Introduced plants are those that have been brought in from outside North America. Examples: smooth bromegrass, alfalfa, and crested wheatgrass.

Growth Season

Cool-season plants make their principal growth during the cool conditions in spring and fall. Inflorescences appear in late spring or early summer. Examples: prairie junegrass, needleandthread, Kentucky bluegrass, and western wheatgrass.

Warm-season plants generally make their principal growth during the late spring to mid-summer and develop seed in the late summer or early fall. Examples: prairie sandreed, sand bluestem, indiangrass, and blue grama.

Value and Importance for Livestock Forage and Wildlife Habitat and Food

Plants often are classified according to **palatability—** how attractive they are to grazing animals as forage. Highly palatable plants are more desired by livestock, and usually eaten before plants with low palatability. Preference varies with the type of grazing animal. For example, big bluestem is more highly preferred by cattle than by deer. Many plants have relatively high palatability while they are young and growing but it decreases as the plants mature. Palatability ratings given in *Appendix Table 1* are an average over the growing season for livestock.

Plants also have value as habitat or cover and food for wildlife. Generally, taller and thicker forage stands provide better wildlife cover. Food preference ratings for wildlife in *Appendix Table 1* are for upland game birds and water fowl.

Growth Form

The growth form of grasses fits into three categories. **Rhizomatous grasses** (parent plants) have spreading underground stems from which new plants may arise. **Stoloniferous grasses** have spreading aboveground stems that may root at the nodes and form new plants. Rhizomatous and stoloniferous grasses are classified as **sod-forming. Bunchgrasses** have neither rhizomes nor stolons. Forbs and shrubs with rhizomes are identified in *Appendix Table 1*.

Poisonous Plants

Many range plants are poisonous to livestock. A **poisonous plant** does not necessarily kill an animal; it may only reduce that animal's productivity. The level or danger of poisoning is highly variable and is related to the plant's growth stage, associated vegetation, type of animal, age of animal, condition of animal, and amount consumed. Range plants have been classified as highly poisonous, occasionally poisonous, and rarely poisonous (usually nitrate accumulators), *Appendix Table 1*.

2
Rangelands and Plant Community Change

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Rangeland is a specific kind of land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or woody plants suitable for grazing or browsing by large herbivores. When properly managed, rangeland can be used on a sustainable basis for livestock production while providing high-quality air and water, wood products, wildlife habitat, recreation, and native plants. Most rangeland is not suited to farming because of roughness and steepness of terrain, shallow and rocky soil, adverse climatic conditions (e.g., erratic rainfall patterns), and/or poor accessibility.

Range plants occur in a range landscape in communities in response to the environment's physical characteristics, which include climate, soil, and topography. Within particular climatic and topographical settings, development of soils and plant communities is highly interrelated. Soil characteristics influence the type and amount of vegetation; plants influence soil development by adding organic matter and reducing erosion. The composition and productivity of the plant community changes as the soil characteristics change. This predictable and orderly process of replacing one plant community with another over time is called plant **succession**.

Primary succession starts with soil parent material (e.g., solid rock) and low plant forms (e.g., lichens and mosses) that successively change over time to better developed soil and higher plant life forms. This process takes place over an extended period described as geologic time (millions of years).

The final stage in succession, **climax**, is achieved when the soil and plant community are somewhat in balance with the climate, topography, animals, and other factors. Major changes in the soil or plant community do not occur without significant shifts in the climate or topography.

Fire is a natural part of grassland environments. The presence or absence of fire will influence greatly the types of vegetation present in a climax plant community. Suppression of fire by European settlers in the 1800s is commonly cited as causing the proliferation of woody plant species such as eastern red cedar in Nebraska grasslands.

The **climax plant community** (reference plant community) often is referred to as the potential natural community and represents the group of plants best adapted to the physical characteristics of the site. This plant community makes the best use of the available soil nutrients, soil moisture, and energy from the sun under current conditions. Dominant plant species in the climax stage are generally sensitive to heavy grazing pressure and will decrease in prominence under such disturbance.

Disturbance of the climax plant community, such as improper grazing, results in degradation of a site. This is called **retrogression**. **Secondary succession** occurs following retrogression. Similar to primary succession, it involves successive changes as the plant community develops back towards climax. Secondary succession involves primarily vegetation changes and progresses much more rapidly because soil development is already present. Range managers routinely deal with secondary succession, but rarely with primary succession.

This view of successional change in plant communities ending with climax was largely developed by J.E. Weaver and F.E. Clements while studying the prairies of Nebraska and other states in the Great Plains. There are other conceptual models describing plant community change over time and space. Many of these other descriptions of plant community development suggest that community change is not as predictable and orderly as indicated in Weaver and Clements' climax model. The climax model serves as the basis for similarity index determination used in range judging contests as well as by most range managers in Nebraska.

3
Ecological Sites

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Rangelands in Nebraska offer many kinds of plants and plant communities with very different characteristics. These differences in vegetation are associated with differences in soils, topography, climate, hydrology, plant communities, drought, herbivory, and the presence or absence of fire. Vegetation changes with rainfall amounts and distribution. Soils on a steep slope produce a different plant community than soils on a deep upland site due to differences in soil types and soil moisture availability. Across a broad expanse of rangeland there are several subunits (ecological sites), each having specific physical characteristics that differentiate one from the other. Ecological sites are the basic vegetation units used in range management.

An **ecological site** is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. An ecological site is recognized and described on the basis of the characteristics that differentiate it from other sites in its ability to produce and support a characteristic plant community.

Ecological sites are landscapes divided into basic units for study, evaluation, and management. Unlike range site descriptions, the ecological site description contains much more information about a site, including information about soils, physical features, climatic features, hydrologic features, plant communities, plant community dynamics, annual production estimates, growth curves, animal communities, as well as interpretations for management.

Thus, an ecological site is the product of all the environmental factors responsible for its development, with its own set of key characteristics:

Soils: that have developed over time throughout the soil development process with varying parent materials and subsequent texture classifications.

Hydrology: water movement patterns such as infiltration and runoff that have developed over time as influenced by soil and plant communities.

Plant communities: the kind and amount of vegetation, the development of that vegetation, the soil, and hydrology are all interrelated. Each is influenced by the others and in turn influences the development of the others. All contribute to the attributes of the site over time. The plant community on an ecological site is characterized by an association of species that differs from that of other ecological sites in the kind and/or proportion of species, or in total production.

Herbivory: Most ecological sites evolved with a characteristic kind of herbivory, including kinds and numbers of grazing animals, seasons of use, and intensity of use. Herbivory directly influences the vegetation and soil, both of which influence the hydrology.

Fire regime: An ecological site evolved with a specific fire regime, especially in the Great Plains. Fire frequency and intensity contributed to the characteristic plant community of the site.

Identification of Ecological Sites

Ecological Site Identification

Ecological sites are subdivided by Major Land Resource Areas (MLRAs). The MLRAs are areas with similar soil and climate features. Some MLRAs cross state boundaries. There are 13 MLRAs in Nebraska. Some, but not all, ecological sites occur in all MLRAs. The MLRA concept expands the precipitation zone divisions found in the Range Site method to include other factors such as length

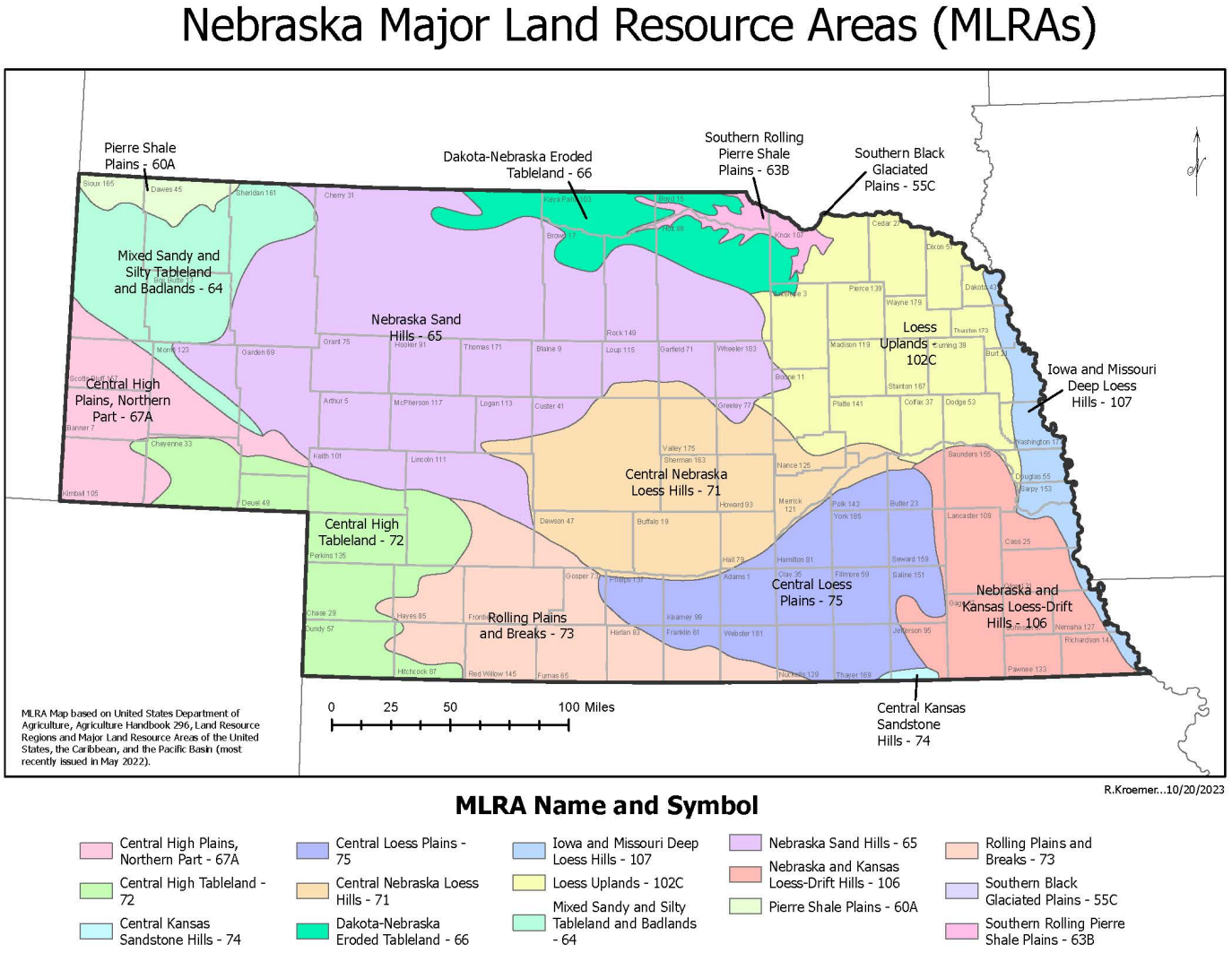

Figure 1. Nebraska's major land resource areas (MLRA).

of growing season, temperature, elevation, and latitude. See *Figure 1* for locations of the Nebraska MLRAs.

To completely identify and name an ecological site, it is necessary to add the major land resource area in which it is located (e.g., sands, MLRA 65). *Figures 2* and *3* illustrate the position of important ecological sites in relation to one another and to topographic features or landscape position. Twelve ecological sites are pictured in *Figures 4* through *14*. An understanding of the appearance, location, and relation of the ecological sites can be developed by studying these figures and the corresponding descriptions. Refer to *Appendix Tables 2* through *14* for information about principal plant species on each ecological site within individual MLRAs.

Some of the undesirable plant species associated with low similarity index are discussed in each ecological site description. Abbreviated descriptions of types of ecological sites can be found on the back of *Range Judging Scorecard C*.

Wetland Sites (*Figure 4*) occur on level bottomlands or in depressions. The land is somewhat marshy from subirrigation. The water table is within 3 feet (0.9 m) of the soil surface during most of the year and is generally above the surface during the early growing season. Soils range from sand to silty clay and in places are limy at the surface. The topsoil is dark and high in organic matter. This site is too wet for cultivated crops but too dry for common reed and cattails. Native forbs make up less than 5 percent of plant composition. Shrubs, except willows, are uncommon. Undesirable vegetation may include foxtail barley, dandelion, and Canada thistle.

Hay harvest often must be delayed until the water table drops and the soil becomes firm enough to support equipment. Interseeding of Garrison creeping foxtail, reed canarygrass, alsike, and red clover often is practiced to

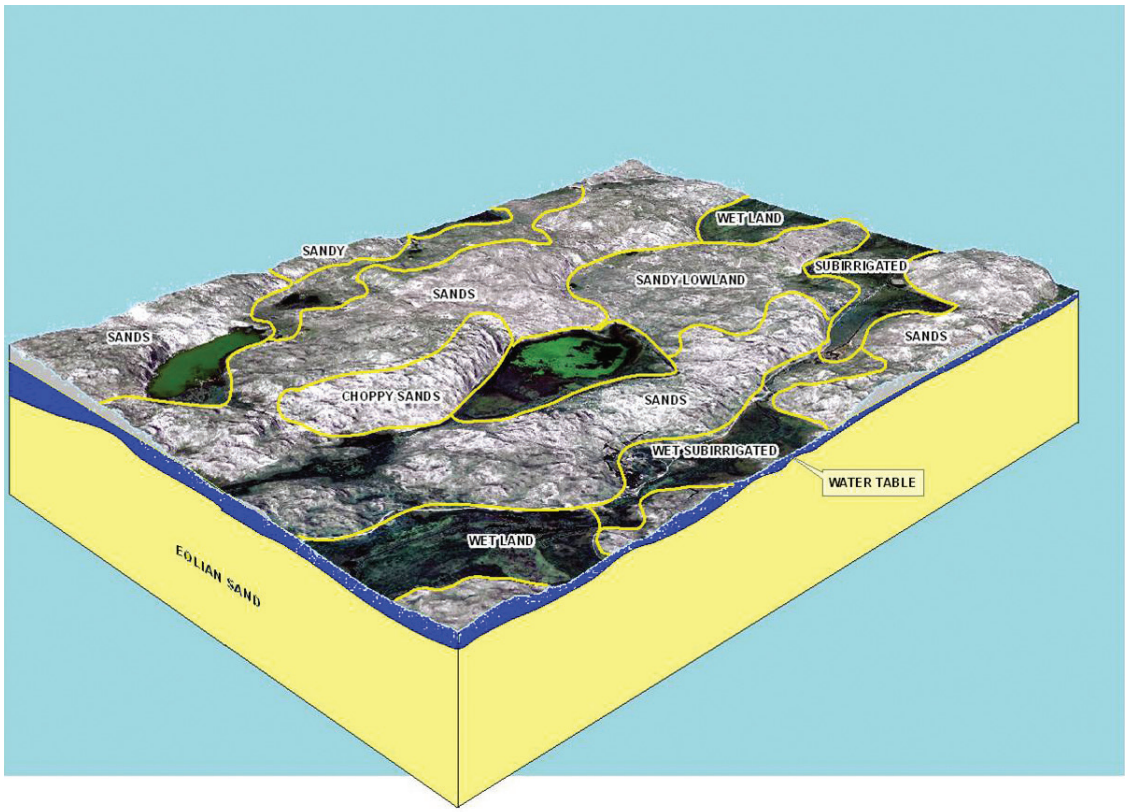

Figure 2. This diagram illustrates the position of several MLRA 65 ecological sites in relation to one another and to topographic features.

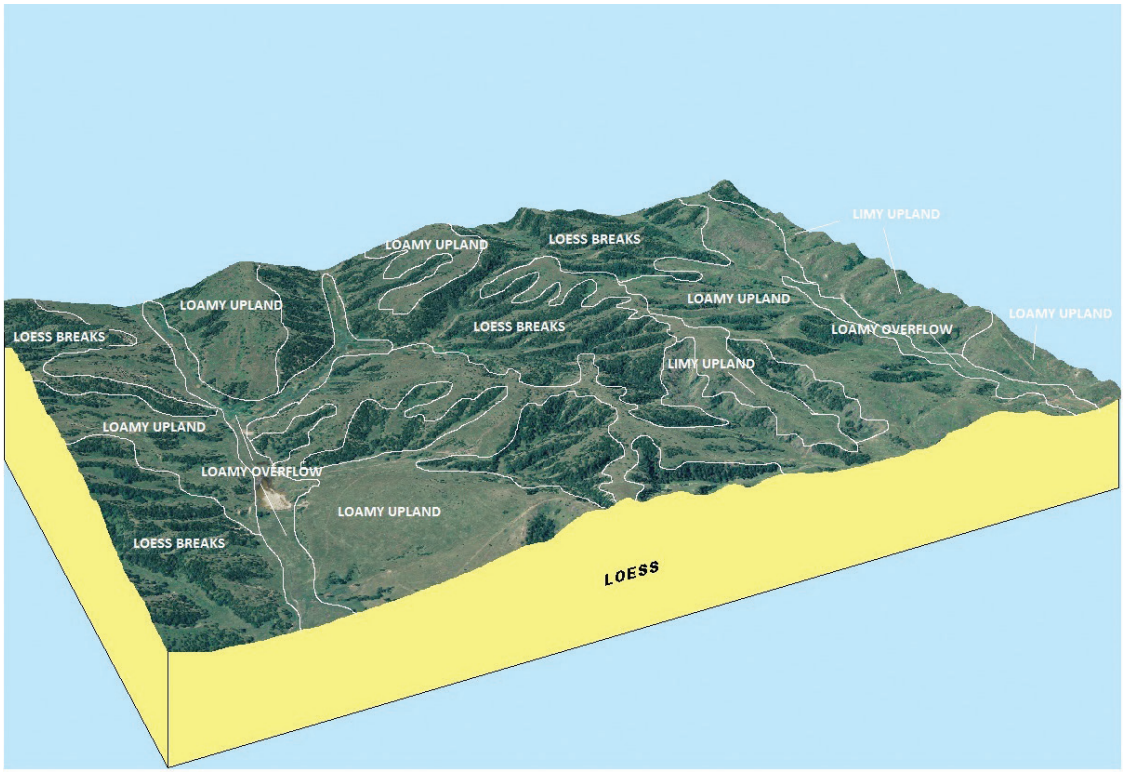

Figure 3. This diagram illustrates the position of ecological sites in relation to one another and to topographic features.

Figure 4. Zonation of vegetation showing *wetland* and *subirrigated* ecological sites near a marshy lake in Arthur County. From the center of photo toward the lower right are the following: (1) marshy lake (non-range) with cattails, bulrushes, and reed grasses; (2) narrow zone of wetland ecological site recently hayed; and (3) *subirrigated* ecological site with bales on the ground.

Figure 5. *Subirrigated* ecological site in the Sandhills showing regrowth of grasses and sedges after haying due to water within rooting depth of the plants. When annually hayed, introduced cool-season grasses tend to dominate subirrigated meadows, replacing native warm-season grasses.

increase hay quantity and quality where soil conditions permit early cutting. Wetland sites are not normally grazed during the growing season but can be used for grazing during the fall and winter.

Subirrigated Sites (*Figures 4* and *5*) occur on nearly level bottomlands, upland basins, foot slopes, and stream terraces. The water table is at a depth of 10 to 60 inches (25 to 152 cm) during the major part of the growing season. The soils vary from fine sand to silty clay loam in the surface layer and subsoil. In most places, soils are limy at the surface. The surface layer is high in organic matter. Undesirable plants such as foxtail barley, western ragweed, American licorice, dandelion, verbenas, thistles, and eastern red cedar may be troublesome on this site.

The subirrigated site is noted for its potential high-quality hay production. This site can be grazed in the summer every second or third year with satisfactory livestock gains and without damage to the plants or soil.

The ***Saline Subirrigated Site*** (*Figure 6*) occurs on nearly level bottomlands, upland basins, foot slopes, and stream terraces. The water table is at a depth of 10 to 60 inches (25 to 152 cm) during the major part of the growing season. Soils are strongly saline and/or alkaline near the surface, often appearing as a whitish-gray deposit. Soils vary widely in texture and depth and are often limy in places.

Ground cover varies from barren to a variety of forage plants, depending on the amount of salt in the soil. Where the salt content is low, many of the same species common to the subirrigated site will grow. Soils that are high in salt content support only salt- tolerant plants such as inland saltgrass, alkali sacaton, switchgrass, alkali cordgrass, western wheatgrass, sedges, and rushes. Undesirable vegetation includes foxtail barley, dandelion, and kochia. These lands are usually grazed rather than hayed. Arrowgrass, a poisonous plant common on this site, can kill livestock.

Clayey Sites (*Figure 7*) occur on nearly level to strongly sloping uplands. Soil texture ranges from silt loam to clay in the surface layer and silty clay in the subsoil. Soils are deep but water penetration and movement in the soil is restricted. When wet, soils are sticky but become very hard when dry. Clayey sites in Nebraska occur primarily along the White and Niobrara rivers in Sioux, Dawes, Sheridan, Keya Paha, and Boyd counties. Some are also present in eastern Nebraska. Annual brome and common pricklypear are often problems on depleted rangeland in western Nebraska.

Because of limited groundwater, a special emphasis is required on reservoirs and dugouts for stockwater. Soils on some clayey sites are high in selenium, which can be taken up by certain plants and may be highly toxic to livestock.

Sands Sites (*Figure 8*) occur mainly on gentle to rolling upland slopes, but also may be found on stream terraces and bottomlands. Soils are deep, excessively drained, and are subject to severe wind erosion when the protective vegetation cover is destroyed. Soil textures range from loamy sand to sand in the surface layer and from loamy sand to coarse sand in the subsoil. The upper part of the soil profile with dark color due to organic matter is usually less than 6 inches (15 cm) deep. The sands site is the most widespread ecological site in the Sandhills. Undesirable plants include sixweeks fescue, lemon scurfpea, green sageworts, woolly plantain, sandhill muhly, pricklypear, small soapweed, and eastern red cedar. Sand sagebrush occurs on large acreages of this site in the western Sandhills and in southwest Nebraska.

Sands sites are used primarily for grazing, although some haying is done on these sites where ranches do not have other hay sources. Forage production is moderately stable since moisture penetrates the soil rapidly and is available to plants for longer periods than on limy upland or silty sites. Improved grazing management and/or weed control measures may be required when western ragweed, sand sagebrush, green sageworts, small soapweed, roses, and leafy spurge become a problem. Chemical weed control alone rarely results in long-term improvements unless previous management practices that caused the problem are changed. Two poisonous plants—Riddell groundsel and lambert crazyweed—are fairly common.

Sandy Sites (*Figure 9*) occur on nearly level to moderately steep slopes. When found in a sandhills landscape, sandy sites occur on dry, flat valleys between choppy or rolling hills. The soils are well drained and have fine sandy loam to fine sand in the sur-face layer, with fine sandy loam to fine sand in the subsoil. The underlying soil material varies widely. More than 6 inches (15 cm) of the upper soil profile is often a darker color due to organic matter accumulation. This topsoil may be over 12 inches (30 cm) thick in eastern Nebraska. Undesirable plants include western ragweed, common ragweed, sixweeks fescue, annual bromes, woolly plantain, roses, and eastern red cedar.

Livestock tend to concentrate on this site because of nearly level topography. This frequently causes low similarity index. A considerable amount of formerly cultivated "go-back" land is found on sandy sites. Many of these sites have been developed for center pivot irrigation.

Choppy Sands Sites (*Figure 10*) occur on very steep, irregular slopes of greater than 20 percent. The soils are deep, loose, and excessively drained with a fine sand surface layer and subsoil. Wind erosion and blowouts are common where vegetation is denuded or absent. Narrow

Figure 6. *Saline subirrigated* ecological site near Broadwater showing whitish-gray deposit on the soil surface during the dormant season. The vegetation must be tolerant to the high soil salt content to grow on this site. The principal grasses in this photo are inland saltgrass and alkali sacaton, which are highly tolerant to set, saline/alkaline soil conditions. This is a poor site because of the soil condition and vegetation present.

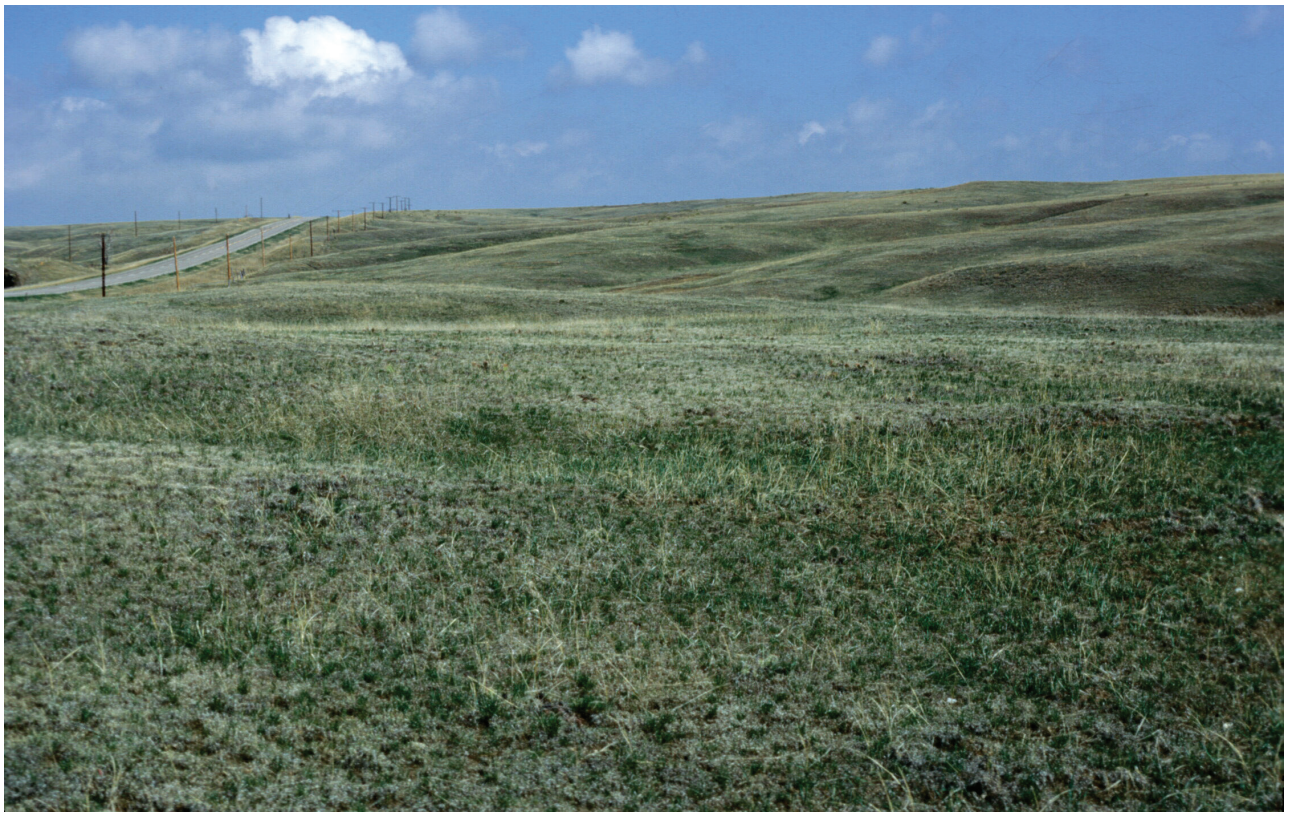

Figure 7. *Clayey* ecological site in Dawes County showing mixed vegetation of short grasses (buffalograss and blue grama) and mid-grasses (western wheatgrass and green needlegrass), which is typical for this site in western Nebraska. This vegetation is not typical of a *clayey* site in the eastern part of the state.

Figure 8. *Sands* ecological site in Rock County on rolling terrain. This is the most extensive ecological site in the Sandhills region.

Figure 9. *Sandy* ecological site in Cherry County showing gently sloping terrain and differences in vegetation cover due to grazing practices.

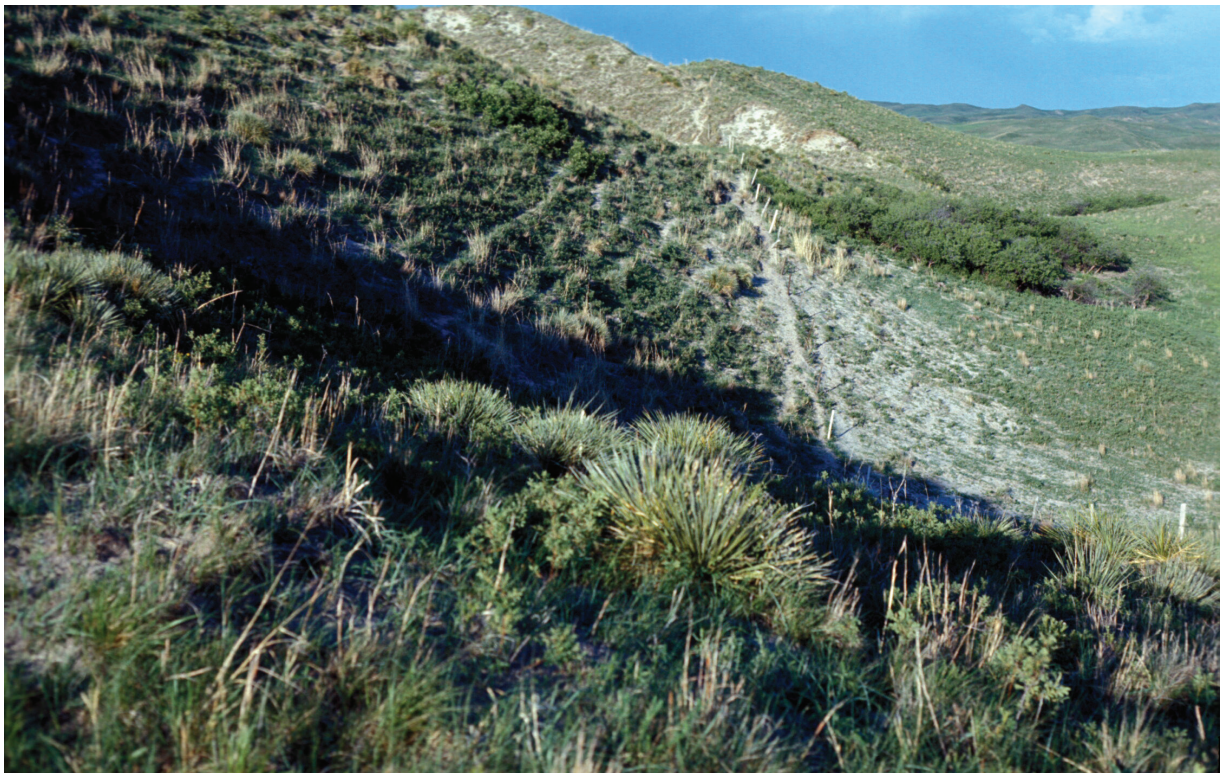

Figure 10. *Choppy sands* ecological site near Dismal River in Thomas County showing steep slopes and loose, sandy soils, resulting in irregular soil surface and damage from livestock trampling along fence line.

Figure 11. Loamy overflow ecological site in valley bottom south of North Platte, which receives additional water from surrounding hills. Upland areas in photo are primarily loamy range sites and limy upland.

ridges and broken surfaces (catsteps) are characteristic of this site. Ground cover and soil profile development is even less than on a sands site. Dark coloring from organic matter in the surface soil is at a minimum and seldom over 2 to 3 inches (5–8 cm) deep.

The vegetation on choppy sands sites is similar to that of the sands site. However, there is an increase of blowout grass, lemon scurfpea, hairy grama, and sandhill muhly on unstabilized areas. Shrubs, such as small soapweed and wild roses, are common. Grasses such as blue grama, sand dropseed, and needleandthread are less common than on sands sites.

It's difficult to prevent blowouts and maintain good livestock distribution because of the roughness of the terrain. Small soapweed may be a problem on this site but can be controlled by winter grazing. Eastern red cedar has become a major invading woody species on this site, especially in association with streams and other water courses.

Loamy Overflow Sites (*Figure 11*) occur on bottomlands that receive additional water from periodic overflow or runoff from higher elevations. The water table is more than 60 inches (152 cm) below the surface. Soil textures vary from silty clay loam to silt loam in the surface layer and from very fine sandy loam to clay subsoils. Undesirable plants include skunkbush sumac, snowberries, western ragweed, ironweed, annual bromes, and eastern red cedar.

Forage production for grazing or hay is normally greater for this site than associated ecological sites because of extra moisture received by overflow or run-in. Hay is commonly cut on overflow pockets. Livestock prefer grazing overflow sites because of the succulence of the forage and easy access. This frequently results in excessive use of these areas in relation to the surrounding vegetation.

Figure 12. *Loamy Upland* ecological site in Furnas County, which is in low similarity index as indicated by the predominance of short grasses, threeawn, and western ironweed. Cultivation is common for these soils on more level terrain.

Figure 13. *Shallow* ecological site in Sheridan County showing restricted rooting depth of plants due to underlying soil materials. The vegetation is at a high successional state for this site and precipitation zone and consists mostly of bluestem grasses.

Loamy Upland Sites (*Figure 12*) occur on nearly level to steep uplands and stream terraces. The soils are well drained but not to the extent of sands and sandy sites. Soil textures range from very fine sandy loam to silty clay loam in the surface layer and subsoil. This is the most common ecological site outside of the Sandhills region and includes the loess plains and hills south and east of the Sandhills, along the Republican River, and on the upland plains and gentle slopes of southwestern Nebraska and the Panhandle. Since the amount of moisture penetration into the soil is less and the water held unavailable to plants is more, deep-rooted grasses on a loamy upland site are somewhat more susceptible to drought, particularly when overgrazed, than on coarser textured soils.

Big and little bluestem are very important grasses in the 20- to 24-inch (50 to 61 cm) and higher precipitation zones but are less important in the Nebraska Panhandle and southwest Nebraska. Blue grama, buffalograss, and western wheatgrass tend to dominate on hilltops and areas receiving less than 20 inches (50 cm) of annual precipitation. Undesirable plants include annual bromes, prairie threeawn, perennial threeawn, common pricklypear, sixweeks fescue, woolly plantain, and eastern red cedar.

Most loamy upland sites suited to cultivation have been converted to crop production. Many smaller units in the southern and eastern parts of the state and larger units in the west are still in native grass cover. Unproductive and eroded croplands on this site have been planted back to a native grass mixture.

Shallow Sites (*Figure 13*) occur on nearly level to steep uplands. The soils are less than 20 inches (50 cm) deep over underlying material consisting of shale, mixed sand and gravel, limestone, siltstone, or caliche. They have a loamy fine sand to clay surface layer. The effective root zone of plants is restricted to 20 inches (50 cm) or less.

The vegetation varies on shallow sites depending upon soil depth, soil texture, and topographic features. Scattered eastern red cedar and ponderosa pine may be associated with this site along the Niobrara River and in the Pine Ridge area of Nebraska. Eastern red cedar can dominate the site if left uncontrolled.

This site is not adapted to cultivation. Steep terrain, difficult livestock access, and shortage of groundwater for stockwater are common characteristics of this site.

The ***Limy Upland Site*** *(Figure 14)* occurs on nearly level to steep uplands, footslopes, and stream terraces. The soils are deep or moderately deep and range from fine sandy loam to clay loam in the surface layer and subsoil. The soils have an abundance of lime in the surface layer.

The plant community on limy upland sites includes most of the same species found on silty and clayey sites; however, limy upland sites support more little bluestem and sideoats grama and less big bluestem and switchgrass. Eastern red cedar has become a major invading woody species on this site.

Loess Breaks Sites (*Figure 14*) occur on steep to very steep uplands that contain many catsteps and land slips. The soils are deep and have a silt loam surface layer. Subsoils are limy. Loess breaks sites are located on canyons or hillsides associated with the major drainage ways south and east of the Sandhills, but are not restricted to these areas. These sites are common in areas where farming predominates on the more level areas with the rougher terrain remaining in native grass.

The loess breaks site occurs in association with loamy upland, limy upland, and loamy overflow sites and has essentially the same vegetation as those sites. However, the steep, irregular land relief commonly creates a favorable microenvironment that supports more mid and tall grasses.

Since the loess breaks site is rough and often irregular in shape, good distribution of livestock grazing is difficult. Proper use of this site without overusing the associated sites is always a problem. Loess breaks sites are subject to severe water erosion. Care must be taken to prevent overgrazing. This site is also susceptible to heavy infestations of eastern red cedar if left uncontrolled.

Evaluating Ecological Sites in Nebraska

The **state and transition model** is used to describe plant community development and dynamics. Vegetation dynamics include pathways of succession and retrogression. The model provides a method to organize and communicate complex information about vegetation responses to disturbances and management. The first state described in the model is the historic plant community or naturalized plant community. From this state, transitions to other states can be recognized. Disturbance can include fire, lack of fire, drought, insects, and disease. A state is a recognizable, relatively resistant, and resilient complex. Each state interacts in equilibrium with its soil and vegetative components, which are connected through ecological processes to produce a sustained equilibrium. States are relatively stable and resistant to change. An example of a state and transition model is shown in *Figure 15.*

Plant Community Change

Plant community changes occur in response to different ecological influences or management strategies. The

Figure 14. *Loess Breaks* ecological site in Keith County on steep upland showing catsteps and land slips. *Limy upland* ecological sites are on the gently sloping, more stable areas with a denser vegetation cover.

changes in the plant community and the mechanisms for this change are described in State and Transition Models (STM). See *Figure 15* for an example STM.

Several states can occur on an ecological site. A state is stable and resistant to change and is made up of one or more plant communities or plant community phases. A plant community can change from one community phase to another easily when there are short-term changes in climatic conditions or when management activities change.

The most diverse and usually the most productive state for a specific ecological site is called the **reference state**. In most STMs, this state represents the conditions present before European settlement. The reference state consists of the plant community best adapted to the common environmental factors of the area and other communities that occur with the natural disturbances common to the site. When evaluating an ecological site, we compare the existing plant community to the reference plant community.

Historically, the sites were grazed and were subject to a variety of periodic disturbances such as short-term overgrazing, short-term drought, wildfire, flood, hail, or insect damage. Disturbances are a natural occurrence on all ecological sites and are necessary to maintain ecological structure and function.

When an ecological site experiences disturbances, the plant community shifts to another plant community within a state. The community will shift back to the original plant community when the disturbance is removed.

The shift from one plant community to another within a state follows a community pathway. These pathways are always reversible through succession, which is facilitated by grazing management and reversal of the disturbance.

If the plant community experiences severe or long-term disturbance, it becomes less resilient and will move to a less productive state or alternative state (Figure 16). Most ecological sites have several possible alternative states. The type of disturbance and/or the intensity of the disturbance will determine the resulting alternative state. This change to an alternative state is called a transition.

When an ecological site changes from one state to

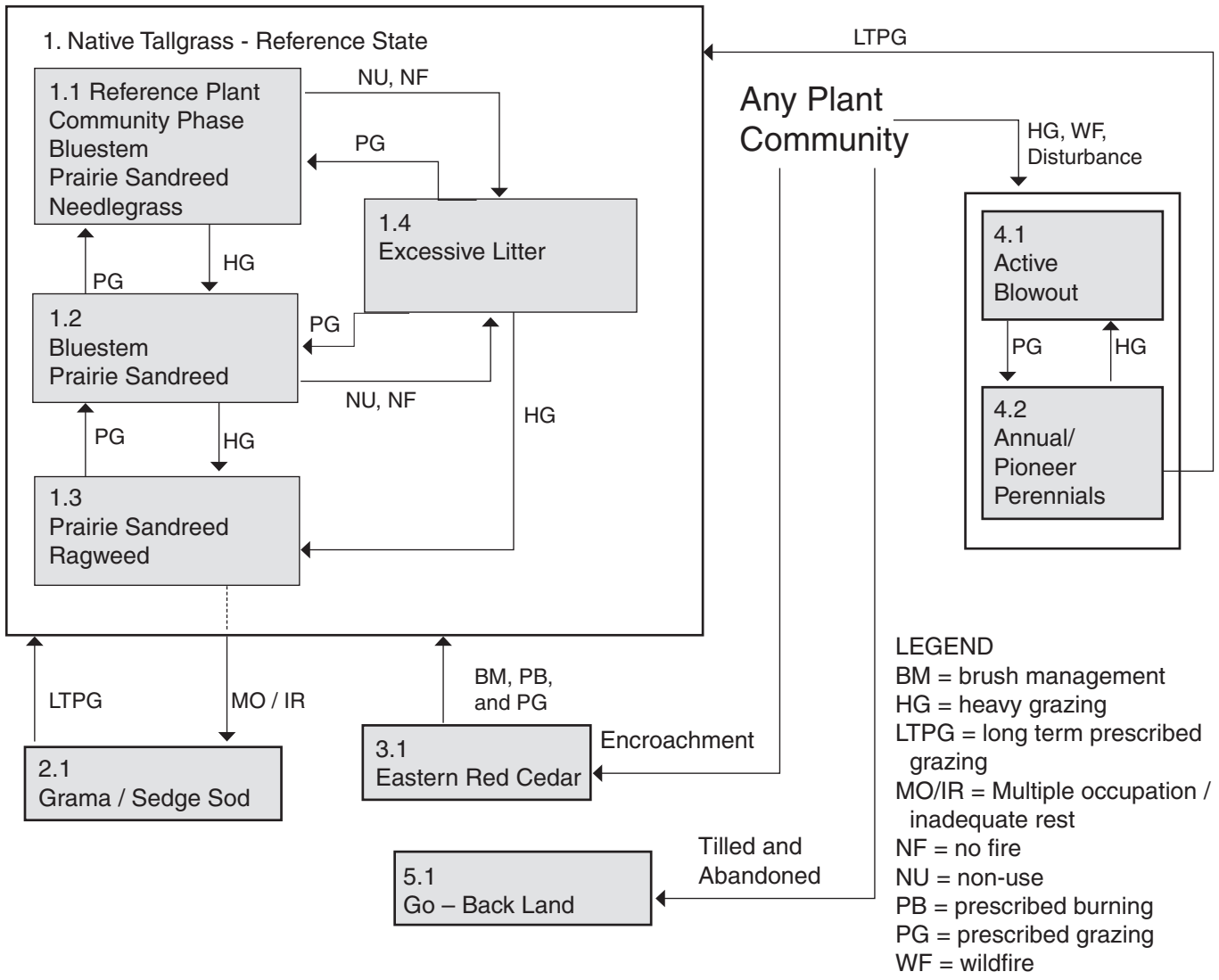

Figure 15. State and transition model for a sands site (17–22 inch precipitation zone) in MLRA 65, Nebraska Sandhills.

another, it crosses an ecological threshold. Once a threshold has been crossed, ecosystem structure and function have changed. Intensive and often costly management or restoration practices are required to return the site to the reference state. For example, once eastern red cedars have encroached onto a site at levels far exceeding that in the reference state, mechanical removal of the trees as well as prescribed fire will be necessary to return the site to the reference state.

Sometimes the changes to the ecological processes are so severe that the plant community can never return to the reference state. Examples of this severe change are a non-reversible drop in the water table for subirrigated or wetter sites, or soil erosion so severe that the plants making up the communities of the reference state are no longer able to grow on the site.

Determining Similarity Index

Similarity Index Determination: The Similarity Index (SI) is determined by comparing the existing plant community to a plant community in the State and Transition Model. Usually, the existing plant community is compared with the reference plant community. Sometimes the land manager has objectives that will be better met by a plant community phase that is different from the reference plant community. In those cases the SI is determined based on the land manager's desired plant community.

A list of the plants present on the site is made and the amount of each plant in the current plant community is determined. This amount is based on the projected weight of each species at the end of the growing season in an ungrazed condition compared with what would be present in the reference plant community. The amount of each

Figure 16. Contrasting vegetation separated by only a fence line is a common sight on rangeland. This represents a difference in use over many years. Vegetation on the left has been lightly to moderately grazed the previous years while the pasture on the right has been heavily grazed.

species is expressed as percent of the total end of season production.

The SI is determined by comparing the present species composition with the desired plant community. The Ecological Site Description (ESD) plant community table lists percent allowable for each species. The SI is expressed as a percentage from 0–100 percent.

For the purpose of range judging, the SI will be determined by comparing the existing plant community to the reference plant community.

The primary purpose of determining similarity index is to identify the current status of an area's plant community relative to the reference plant community. This information provides a basis for predicting the extent and direction of changes that can occur in the plant community in response to specific management. Determine the similarity index of areas within a particular ecological site by comparing the present plant community to the reference plant community. Use air-dry weight as the unit of measure to determine the composition and production of the present plant community.

Vegetation composition and production of the reference plant community for the site is listed in a similarity index guide specific to that site (*Appendix Tables 2–14*). Similarity index guides are available from the Natural Resources Conservation Service. The following three steps should be taken when determining similarity index:

1. Name the ecological site that is being considered (see ecological site descriptions).
2. Estimate total annual dry weight of each plant species within a representative area for that ecological site. (Expressed as a percentage of the total production in the current growing season.)
3. Determine the percentage of each species that can be counted toward the similarity index *(Appendix Tables 2–14)*. Use the proper major land resource area for the ecological site identified *(Figure 1)*.

A worksheet for determining similarity index is provided in *Appendix Table 18*.

4
Proper Use

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Herbage (aboveground, nonwoody plant growth) produced on rangelands can be grazed during any season of the year. Grazing is least likely to be detrimental after killing frost and before spring green-up. Selective grazing by animals during the dormant season does not change the competitive balance among plant species.

Heavily defoliating pastures each year during the growing season reduce forage production, site stability, and similarity index. All factors that defoliate or reduce plant growth must be considered for proper use when grazing rangeland. These factors may include fire, frost injury, hail, insects and rodents, drought, or grazing by livestock. Livestock should be removed or excluded from pastures that are heavily defoliated until enough plant growth has occurred in the following growing season(s) to assure site stability and an adequate supply of forage for livestock.

The amount of forage available for livestock increases as plants grow. The maximum amount of forage is generally available after most plants have headed (July-August). The number of animal unit days per acre (stocking rate) must be low at the beginning compared with the end of the growing season to obtain proper use throughout the summer grazing season.

Long-term grazing records can be used to select average stocking rates for the summer that minimize overgrazing potential. Degree of use should be monitored and recorded with grazing records to optimize management. Do this by cutting and tying a bundle of current-year **tillers** that represent the average composition of palatable species. Tie the bundle with thread, string, or a flexible grass leaf blade. Balance the bundle on your finger to determine average height at which 50 percent use would occur. Use the same procedure to monitor use of key management species. *Include only current-year growth in the bundle*.

Key management species are important for resource management or animal production objectives. For example, switchgrass or little bluestem can provide excellent visual cover for wildlife. Prairie sandreed can provide a dependable source of forage for livestock, even in dry years.

These key management species serve as indicators of grazing use and are watched more closely than the total vegetation to indicate whether the proper degree of use is being achieved. If improving similarity index is a primary goal, the degree of use of key management species should be monitored to decide when to move livestock. For example, sand bluestem and prairie sandreed could be designated as key management species for a sands range site and managed for 40 to 50 percent degree of use to maintain or improve the vigor of these two species. Managing for this degree of use for sand bluestem and prairie sandreed on a sands range site would result in a moderate degree of use for the entire pasture.

Figure 17 is a visual example of full use (50 percent use) for tall, mid, and shortgrass species. Full use is considered proper use when range has a high similarity index. A lower degree of use is desirable when range improvement is planned.

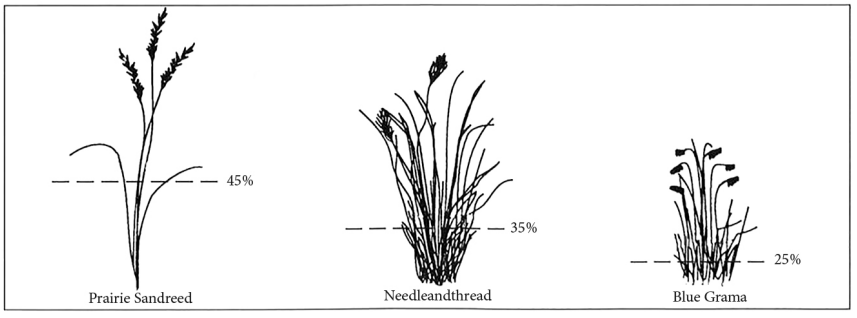

Figure 17. Proper levels of utilization are critical for efficient use of forage resources and maintaining healthy plants. The percent of total plant height remaining at 50 percent utilization of plant weight is less for shortgrass than tallgrass species.

5
Wildlife Habitat Management

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Habitat is the environment in which a plant or animal lives and grows. Wildlife species must be able to obtain food, water, and shelter from their habitats throughout the year to maintain viable populations. Grasslands can provide habitat for many species of wildlife, including mammals, birds, reptiles, and fish. This section will focus on upland and migratory game birds.

Most of the rangeland in Nebraska is privately owned. Historically, rangeland in Nebraska has been used primarily as forage for beef production. Management practices that maintain healthy rangeland and sustain relatively high levels of livestock production may be favorable for deer and some species of song birds. However, without high-quality cover, populations of upland game birds like prairie grouse (sharp-tailed grouse and prairie chickens) and pheasants will be limited on rangeland.

High-quality cover provides complete visual obstruction of birds and nesting sites at relatively close distances. Production of high-quality cover for game birds throughout a pasture or meadow will require complete exclusion of grazing or haying for one to two years. Residual herbage from the preceding year(s) generally must be combined with current year's growth to produce high-quality cover.

Nebraska rangelands are dominated by grasses. Consequently, grazing and haying decisions on ranches determine how much herbage is left for nesting, brooding, or loafing cover each year. It is not possible to maximize livestock production and upland game bird habitat at the same time. The value of wildlife to the landowner or other recreational uses may exceed the value of losses in grazing or haying needed to provide wildlife habitat. Rangelands can be used for many outdoor enterprises, including photography, bird watching, bicycling, hiking, relaxing, or hunting. A growing number of ranches and farms in Nebraska are adding outdoor enterprises to their operations.

Practices that are mutually beneficial for agriculture and wildlife are called **complementary** practices. Water development for livestock with drown-proof access for wildlife is complementary. Management practices that are beneficial for agriculture but detrimental for wildlife are called **antagonistic**. Drainage ditches increase the acreage and accessibility to hayland but often reduce populations of wildlife and plant species that occur only on undrained sites.

Location of riparian sites, topographic features such as ridges and draws, thickets of trees and/or shrubs, cropland, and existing high-quality cover all must be considered when developing habitat management plans. Riparian areas are next to open water or they occur on locations with high water tables such as subirrigated meadows. The activities of wildlife are rarely limited by land ownership. Capitalize on neighboring resources when possible. Location and distribution of habitat are important. An important aspect of wildlife management is **scale of landscape**, or total land area involved.

Developing high-quality cover in several areas that provide safe corridors of movement between feeding, loafing, and watering areas is often better than a single, large block of cover for quail and pheasants. In contrast, thousands of acres of grassland are needed to sustain populations of prairie grouse.

Understanding habitat requirements for reproduction and survival in the annual cycle of wildlife species is critical for successful management. High-quality nesting cover must be available in early spring. Timing and quality of cover are critical. *Figure 18* illustrates hatching periods for several species of upland game birds and waterfowl common to Nebraska rangelands. Areas of cover must be large enough to limit predator success—three to five acres and a width of at least 100 feet.

Nesting occurs from late March to late June. Young birds will stay with hens for 36 to 84 days. Blue-winged teal hens will brood chicks for about 38 days on average, while brooding in the other three species will last about 70 days.

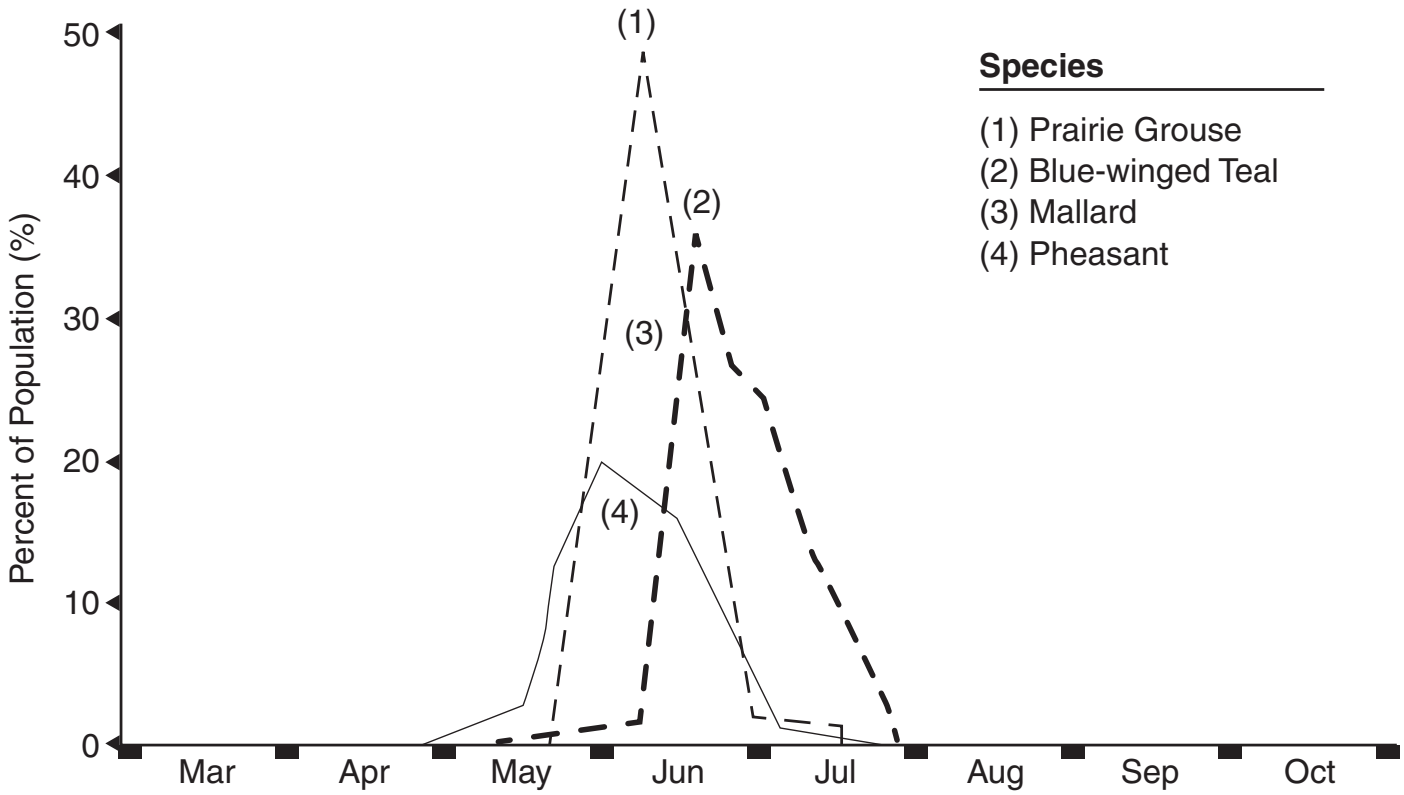


Figure 18. Typical distribution of hatching activities in populations of prairie grouse, blue-winged teal, mallards, and pheasants in Nebraska.

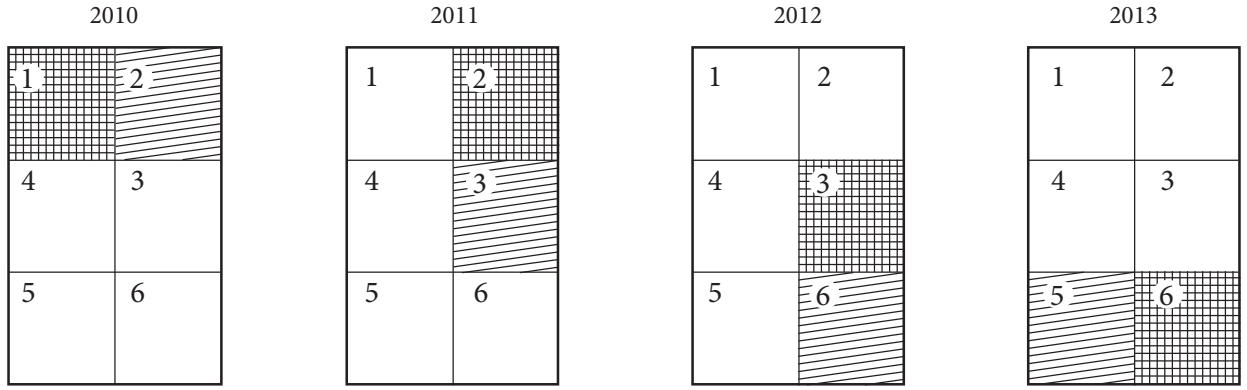
While wildlife populations fluctuate over the years, good habitat management maintains higher populations during low cycles and supports more rapid population growth when favorable conditions return. Upland and migratory game bird populations are reduced by cold, wet weather during the hatching period and hot, dry weather during the brooding period. Soil surface temperatures are lethal for young birds on many summer days in the absence of adequate cover. During drought, air temperatures are above average, and plant cover is dramatically reduced over large areas because of limited soil moisture. Hail storms also reduce local bird populations because of injury to birds and destruction of cover.

Carrying capacity of wildlife, or the number of individuals that survive to reproduce the following year, is controlled by the most limiting habitat factor within the home range. The carrying capacity of an area will not increase if the limiting factor is not resolved. Adding birds, providing food plots, or controlling predators will not increase the carrying capacity of grouse or pheasants if cover is the limiting factor.

The relative benefit of managing a parcel of land for wildlife habitat will depend on how well the landscape provides food, water, and cover during an entire year. Habitat requirements should be within average travel distances for the age of selected wildlife species. Resource areas for young birds should be relatively close. Chicks often feed selectively on insects at an early age. This concentrated source of protein tends to increase as forbs increase.

Pheasants are heavy bodied birds with relatively short flight distances, often of less than 1/4 mile. Mature grouse commonly travel two miles or more. Scattered weed patches, food plots, and cropping systems can benefit many bird species. Key food plant species must be in sufficient number within the plant community to provide an adequate supply of food. Row crops and alfalfa generally provide poor nesting sites because cover is limited in the spring and fields are cultivated or harvested during the spring and summer.

Perennial grasses on rangeland, roadsides, ditch banks, fence lines, shelter belts, farmsteads, and seeded farmland provide the greatest opportunity for nesting cover because residual herbage from preceding years can be accumulated. Areas planted for cover should be seeded with tall



Year	Pasture	Jun	Jul	Aug	Sep	Oct
2010	1	Rested - 2nd Year				
	2	Rested - 1st Year				
	3					
	4					
	5					
	6					
2011	1					
	2	Rested - 2nd Year				
	3	Rested - 1st Year				
	4					
	5					
	6					
2012	1					
	2					
	3	Rested - 2nd Year				
	4					
	5					
	6	Rested - 1st Year				
2013	1					
	2					
	3					
	4					
	5	Rested - 1st Year				
	6	Rested - 2nd Year				

Figure 19. An example of a summer-rest-rotation grazing system designed to use all of the herbage in two pastures to develop high-quality cover for wildlife. Herbage in the other pastures is used for a combination of livestock forage and wildlife habitat. Timing of grazing period should be based on plant growth stage in a given year.

bunchgrasses to increase cover. Adding small amounts of legumes will attract insects for young birds and provide a high protein plant diet for adult birds. High-quality cover must be available at all times of the year to sustain high populations of upland game birds. In contrast, cover requirements for ducks are seasonal because they generally leave in the fall and return in the spring.

Full growing-season deferment is the most beneficial practice for improving vigor of perennial grasses on rangeland. Leaving the **herbage** for cover during the winter and the following growing season for one or two years is beneficial to the vegetation and wildlife. Rest-rotation grazing provides 12 months of nonuse by livestock to one or more pastures each year. Stocking rates must be based on proper use in the pastures that are grazed in a given year. One consequence of excluding livestock from pastures is a reduction in the amount of forage available for livestock production. The total number of animal unit days of grazing must be reduced proportional to the amount and productivity of land rested. *Figure 19* is an example of a rest-rotation grazing system that could be used to maximize high-quality cover for wildlife.

6
Managing Rangeland Resources

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More than 90 percent of the rangeland in Nebraska is privately owned and used primarily for livestock production. While ranching is considered a way of life by many people, survival of these businesses requires good financial and natural resources stewardship. Income from livestock sales and other enterprises on the ranch is needed to pay for feed, equipment, fuel, labor, veterinarian, maintenance, and other production expenses. Money also is needed for family living expenses, personal needs, and annual land payments and taxes.

Consequently, limited funds are available for capital investments used to control distribution of grazing or to increase forage production and must be spent wisely. Using ranch income for these practices must improve the use or productivity of forage resources and provide enough additional net income to pay for the investment within five to 10 years.

Good stewardship of rangeland is critical for ranch survival. Managers must use grazing strategies designed to accomplish livestock production and resource management objectives. High levels of plant vigor are best achieved with moderate summer stocking rates in conjunction with periodic and timely nonuse during the growing season.

Part 1. Stocking Rate

Stocking rate is the number of **animal unit days** or **animal unit months** per acre (AUD/ac or AUM/ac). An animal unit day is a standardized mass of animal—1,000 lb of beef—that consumes about the same amount of forage dry matter each day—26 lb per day. An animal unit month is equal to 30 animal unit days or 780 lb of forage dry matter. Any class of cattle can be standardized by dividing the average animal weight for the grazing season by 1,000 lb. The average weight of the cow plus calf is divided by 1,000 lb to convert pairs to **animal units** (AUs). All livestock and big game animals can be converted to animal units when the daily dry matter intake of these animals is known.

Summer stocking rate has more effect on animal performance than any other aspect of grazing management. Average daily gains of cattle are near maximum when moderate stocking rates are used. Cattle remove about 25 percent of the average annual current-year forage production under moderate stocking rates. Higher than moderate summer stocking rates increases the risk of reduced animal performance and plant vigor. In contrast, repeated years of light stocking or exclusion of grazing on upland sites with high average precipitation (20–34 inches) and on riparian sites throughout the state can allow excessive amounts of litter to accumulate, which reduces forage production and diversity of plant species.

In general, stocking rates for a given management unit should be kept the same if the forage needed for livestock is within plus or minus 10 percent of available forage when both are expressed in the same units, AUD/AC or AUM/AC. Stocking rates should be reduced during and immediately after drought to avoid prolonged setbacks in plant vigor and similarity index.

Watershed Management—Stocking rate and date of grazing determine how much forage is left for wildlife cover, for prevention of soil erosion, and for organic matter to maximize infiltration of precipitation into the soil.

The maximum amount of protective plant cover occurs when pastures are rested for 12 months or more. Resting a pasture rules out receiving any income from livestock production. However, the long-term benefit in forage production or current-year benefit to hunting or other outdoor enterprises may justify the practice. If some forage must be used in every pasture, dormant season grazing will leave more litter than summer grazing at equal stocking rates.

Part 2. Grazing Distribution

If grazing is evenly distributed in pastures and the similarity index is acceptable, season-long continuous grazing is a reasonable practice. Periodically switching between summer and dormant-season grazing will help maintain plant vigor when rotational grazing is not possible with small, dispersed parcels of land. Infrequent use of a pasture for continuous summer grazing at light stocking rates is an excellent way to maximize growth of replacement heifers.

Poor distribution of grazing can reduce the similarity index even when stocking rates are moderate for the carrying capacity of the pasture. Overgrazing preferred areas progressively reduces productivity while other areas are underused. Several practices can improve grazing distribution by attracting animals to underused areas or by physically limiting access to overused areas. Primary factors that cause distribution problems are topography, distance to water, and contrasts in forage resources within a pasture.

Livestock Water

Stockwater problems may arise from inadequate yield or storage of water, poor water quality (alkaline or saline), improper location of watering places, or stockwater developments that waste water. There must be enough water to account not only for daily livestock consumption, but evaporation, seepage, and wildlife use. Spacing is also critical as water must be available within one mile on level terrain, and 1/4 to 1/2 mile on rough terrain. At least one watering place per section should be the goal for proper distribution of grazing livestock under most conditions in Nebraska.

Natural Surface Water

Streams and rivers, known as live water, and lakes can provide valuable sources of livestock water. However, failure to limit livestock access to these natural sources of water often causes serious grazing distribution problems, destruction of wildlife habitat, and reduction of water quality. These riparian sites can provide critical habitat for wildlife. If alternate water sources are not available, livestock should have limited access at water gaps where banks are least likely to be damaged by livestock. When pastures are managed in a rotation grazing system and other water sources are present, the need to fence out or limit livestock access to water depends upon the specific landscape or sensitivity of the site.

Dams and Dugouts

Dams and dugouts usually are only temporary sources of water, but are important in certain areas of Nebraska. Soil texture should be considered before such a structure is built. Heavy clay soils are ideal because of their resistance to seepage losses. Bentonite, a clay mineral, should be used as a sealing agent for the bottoms of reservoirs built on soils that permit seepage losses.

Wells and Pipelines

Wells and pipelines are desirable because they (1) can be placed in the most desirable locations; (2) furnish a dependable water supply in dry seasons and winter;

(3) generally provide high-quality water; (4) provide safe places for livestock to water in the winter ; and (5) deliver water to areas where other water sources are difficult to develop or use. As the cost of installing and maintaining wells increases, pipelines have become increasingly popular for delivering water to a number of different points from one or more wells. Some pipelines in Sioux County, Nebraska, are over 100 miles long and supply water to livestock on more than 50,000 acres. Consideration should be given as to the practicality of installing pipeline in steep terrain or rocky soils.

Fencing

Fencing is a direct method of regulating livestock grazing distribution. Traditionally, fences have been placed on property boundaries, section lines, and other convenient locations. Fences can separate grazing areas that require different grazing management practices to optimize grazing efficiency. Fence placement made without regard to its effect on livestock grazing management often results in poor grazing distribution.

Cross fence

Dividing pastures using cross fences is recommended where there are natural divisions between ecological sites or similarity index classes, resulting in better grazing distribution. Fencing out different ecological sites or similarity index classes will restrict livestock's ability to select the more desirable ecological site or similarity index class to graze. The size and number of pastures will vary based on the producer's goals and objectives.

Salt/Mineral Location

Livestock find salt very palatable, so strategic placement of salt can be used to draw livestock into underused parts of a pasture. It is *not* necessary to place salt beside water. With cattle, as much as eight hours may elapse between taking salt and watering. Salting locations should be at least 1/4 of a mile from water to be a useful tool for improving livestock distribution. Several supplement locations can be placed at least 100 feet apart in an underused area. Move salt to a new location when proper use of forage has occurred, when bunks are empty, or when blocks are consumed. Because of its low cost, salt placement is often the most economical method for improving grazing distribution.

Prescribed Burning or Mowing

Underused areas within a pasture may accumulate large amounts of old, unpalatable vegetation, which further reduces their attractiveness to livestock. If the standing dead material and litter is not removed, livestock will not use the site and it may inhibit their movement to adjacent areas.

Prescribed burning can be used to remove the accumulated residue and stimulate lush regrowth, which will entice livestock into the previously underused area. Prescribed burning is a particularly useful tool where surface conditions or terrain limit other practices such as mowing. Even though burning can be a very useful range management technique, it is not applicable in all range situations. Prescribed burning is primarily used where predictable precipitation is adequate to ensure growth following burning. On fragile sites such as choppy sands or other erosive sites, caution should be used when developing a prescribed burn plan.

Prescribed burning is an effective and economical method of controlling some species of woody invaders on rangeland. Eastern red cedar is becoming a serious threat to many rangeland ecological sites across Nebraska. Prescribed burning is effective on all sizes of cedar trees with the proper pre-burn preparations. This may involve mechanical cutting and stuffing of some trees to build ladder fuel for igniting larger trees or simply deferring grazing the preceding growing season to build a fine fuel load of grasses to control smaller trees of 6 feet or less. Extreme caution should be followed when implementing prescribed burning. A detailed prescribed burn plan must be developed, and all local and state open burning laws must be followed.

In cases where prescribed burning is not practical, consider other methods, such as mowing, for removing excessive levels of plant residue. Mature forages harvested from these areas can help control wind erosion in blowouts.

Reseed Specific Areas

Rangelands with a low similarity index may not respond to implementation of grazing systems or reduction of stocking rates. Improved management practices can restore vigor and accelerate the spread of desirable forage plants. However, a minimum of 10 to 15 percent of the desirable forage plants should be uniformly distributed before expecting satisfactory recovery by natural plant spread, using improved management practices. When insufficient desirable forage plants remain, the manager should consider reseeding.

Seeding also should be considered for renovation of previously cultivated lands or other disturbed areas. Above all, range seedings are generally successful and profitable only on more favorable sites. Planning for a seeding project is essential because perennial grasses—especially warm-season grasses—establish slowly and generally require two or more years before they are ready for grazing.

Properly prepared seedbeds are essential to provide for good seed- to-soil contact. An ideal seedbed is firm, well-packed, and free of large clods, with just enough loose surface soil for proper seed coverage. Residues from crops such as forage sorghum or sudangrass provide excellent seedbeds for seeding range species. Grassland drills specifically designed to seed native grasses are more effective than crop drills or broadcast seeding. Minimum or no-till reseeding practices can also be effective, especially on sites prone to erosion.

Blowouts

Excessive defoliation and/or drought on coarse-textured surface soils can lead to new blowouts or reactivation of old ones. Blowouts in the Nebraska Sandhills can be controlled. Control of large, steep-sided blowouts is expensive because they require fencing, leveling, or shaping sharp edges of the blowout, seeding of adapted grasses, mulching, and possibly fertilization. Smaller blowouts with gentler-sloping edges can be controlled using appropriate grazing strategies. Rotation grazing allows for planned nonuse periods when livestock are not in the blowout area and is always the first choice over mechanical control methods. Hay and manure also may be spread over the surface to provide organic matter and a protective cover. The hay can be worked into the sand by feeding or supple-

menting livestock in the area. If hay with mature seed is used, some grass will grow.

Control Brush or Weeds

Infestations of undesirable plants negatively affect the quantity and quality of range forage. Noxious weeds such as musk thistle and leafy spurge must be controlled according to Nebraska law. Other undesirable species such as eastern red cedar and sand sagebrush should be maintained at low densities in pastures, or forage production will be significantly affected. Control is recommended when the amount of woody or brushy species exceeds the amounts listed in the ecological site descriptions. Undesirable plants can be controlled with varying success with herbicides, mechanical methods (e.g., mowing, cutting, or shearing) and/or burning. Often, brush and tree control requires a combination of these control methods through an ongoing maintenance program. If an undesirable species is palatable to grazing animals, it may be possible to graze the plant during a critical time of its life cycle to prevent reproduction and spread. An example is intensive grazing of leafy spurge before seed maturity by goats or sheep to reduce reproduction and further spread.

Methods of Sustaining or Improving Forage Production

Sustained or improved forage production in a healthy plant community is related to use patterns. A rest or nonuse period during the growing season, following the grazing period, should be long enough to allow key management species to gain or regain vigor.

Nonuse for Part of the Growing Season may allow plants to gain vigor and grazing tolerance in one or more pastures in summer rotation systems. Nonuse periods, when livestock are excluded, differ in relative value during the summer grazing season. Little plant recovery will occur if soil moisture and air temperatures restrict plant growth. However, plant recovery when growing conditions are favorable and control of grazing distribution every year make rotation grazing a valuable range management strategy. When stocking rates are moderate, delaying grazing from spring green-up to heading every third or fourth year provides recovery time for most desirable plant species, when drought does not occur. Partial season nonuse is recommended following prescribed burning, mowing, chemical weed control, or severe insect damage.

Nonuse for One Full Growing Season

Excluding livestock from pastures from spring green-up until after killing frost provides the greatest opportunity for improving plant vigor and similarity index. If herbage is not needed for site stability or wildlife habitat, these pastures can be grazed at moderate to heavy stocking rates during the dormant season and still improve plant vigor and similarity index. Rooting depth and distribution, drought tolerance, and herbage production are highest when nonuse for one full growing season is planned for pastures every two to four years. Nonuse for one full growing season may be needed for one or more years to aid plant establishment after interseeding, untimely wildfire, or blowout control. Two or more years of nonuse during the growing season may be needed after full reseeding of native species, particularly where average precipitation is less than 19 inches. Nonuse for two or more years is recommended after a full reseeding in the immediate area around a newly built livestock dam or dugout.

Rotation Grazing

Moving a herd of livestock among a number of pastures allows range managers to selectively rotate growing-season nonuse or rest among pastures. Use of critical wildlife habitat also can be delayed until young animals have become mobile. Provide rotation grazing by using existing pastures and/or by dividing pastures into subunits with cross fences. At proper stocking rates, rotation grazing during the summer can allow rapid improvement in plant vigor and similarity index. Long-term histories of abuse in conjunction with drought can significantly reduce vegetation response to rotation grazing.

Livestock performance may be lower with rotation grazing compared with season-long continuous summer grazing. Animal performance depends on forage quality and quantity. Forage quality declines as plants mature. Livestock can re-graze preferred areas all summer under continuous grazing. Repeated grazing delays plant maturity and prolongs high-quality forage. Advanced maturity in pastures not grazed until the season's end in rotation strategies may reduce animal performance. Moderate stocking rates will minimize differences in performance among grazing strategies.

When summer grazing seasons are nearly four months long, using fewer than four pastures reduces the relative benefit of rotation grazing. Two- or three-pasture rotation

systems can be effective with five- to six-month summer grazing seasons. The optimum number of pastures for rotation grazing should be based on the economic and ecological efficiency of additional pastures and livestock water requirements. These additions will affect the grazing system in the following ways:

1. Total number of days each pasture is grazed.
2. Length of nonuse period for individual pastures.
3. Change in distribution of grazing as livestock concentration increases.

Rest-rotation is a type of rotational grazing consisting of four or more pastures where at least one pasture is ungrazed for a full year. This type of management is often used to maximize wildlife habitat, stockpile forage, or for drought recovery.

When a long-term history of poor grazing management causes a significant reduction in similarity index, change management practices to ensure economic feasibility of weed control or revegetation practices.

Planned nonuse is a part of all rotation grazing programs, but the length of nonuse may vary depending on management goals for livestock, wildlife, and other uses of the land.

Range Management Problem

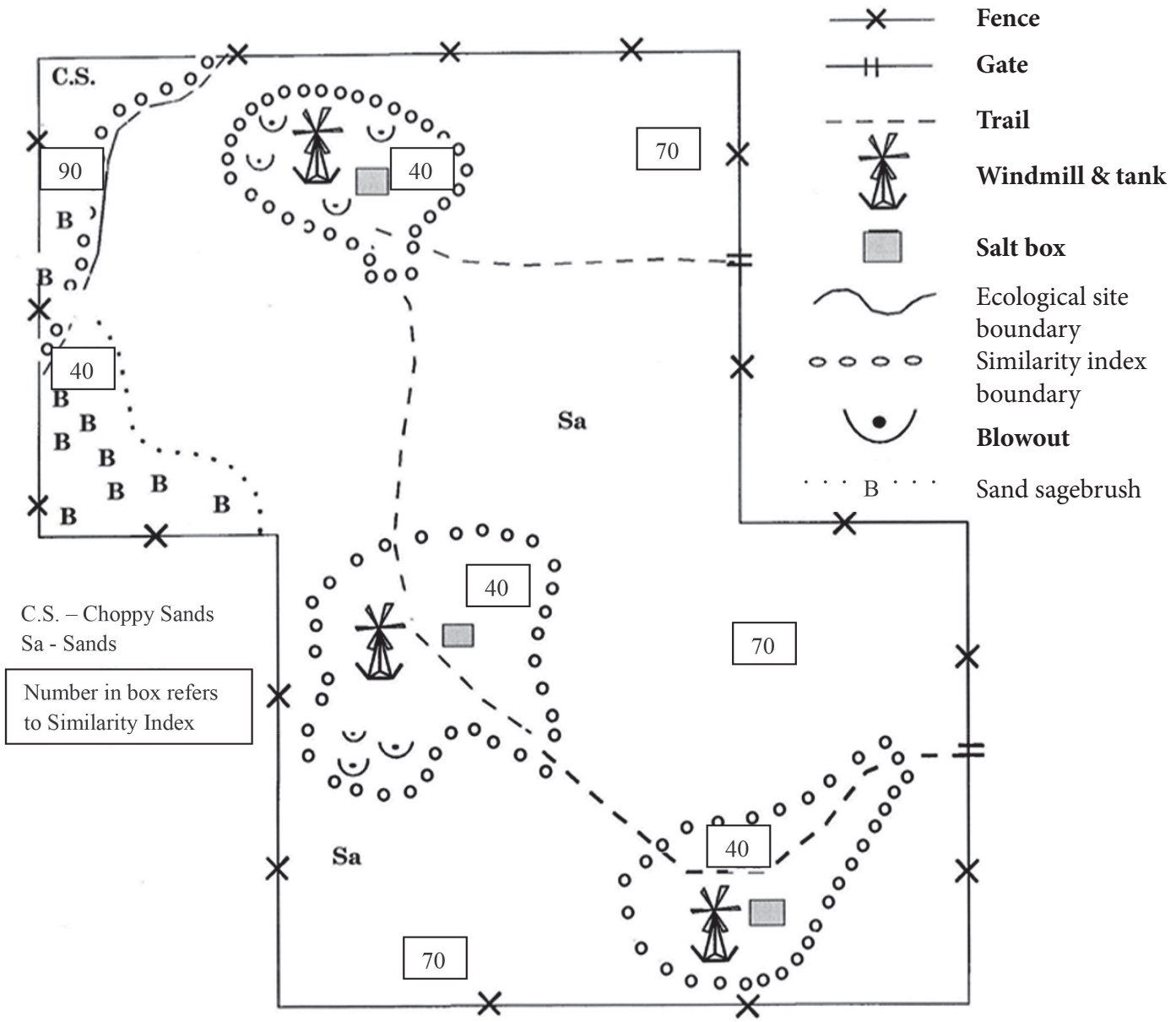
Example 1

Maps are used to provide information to contestants for their assessment in selecting reasonable methods of improving the value, use, and productivity of rangeland for specific objectives. The first example (*Figure 20*) illustrates several areas of concern that could be addressed and improved by various management practices. Management practices considered to be economically feasible and most practical are listed below the ranch map. The second example (*Figure 21*) is a unit of rangeland that does not need any changes, and will have only one correct solution for range improvements—initiate none of the above.

Example 2

See *Appendix Table 15* for the mathematical solutions for Examples 1 and 2. Note that all of these practices correspond to range improvement alternatives listed on the sample scorecard at the back of this handbook. Refer to *Appendix Table 19* for additional information on AU equivalents and suggested initial stocking rates.

It is important to note that there may be a more intensive management scheme or more costly range improvement practice to encourage overall range improvement. For the purpose of the Range Judging Contest, the contestant may assume an operation with typical financial and labor resources. A highly intensive management scheme *is not* desired by that operator.



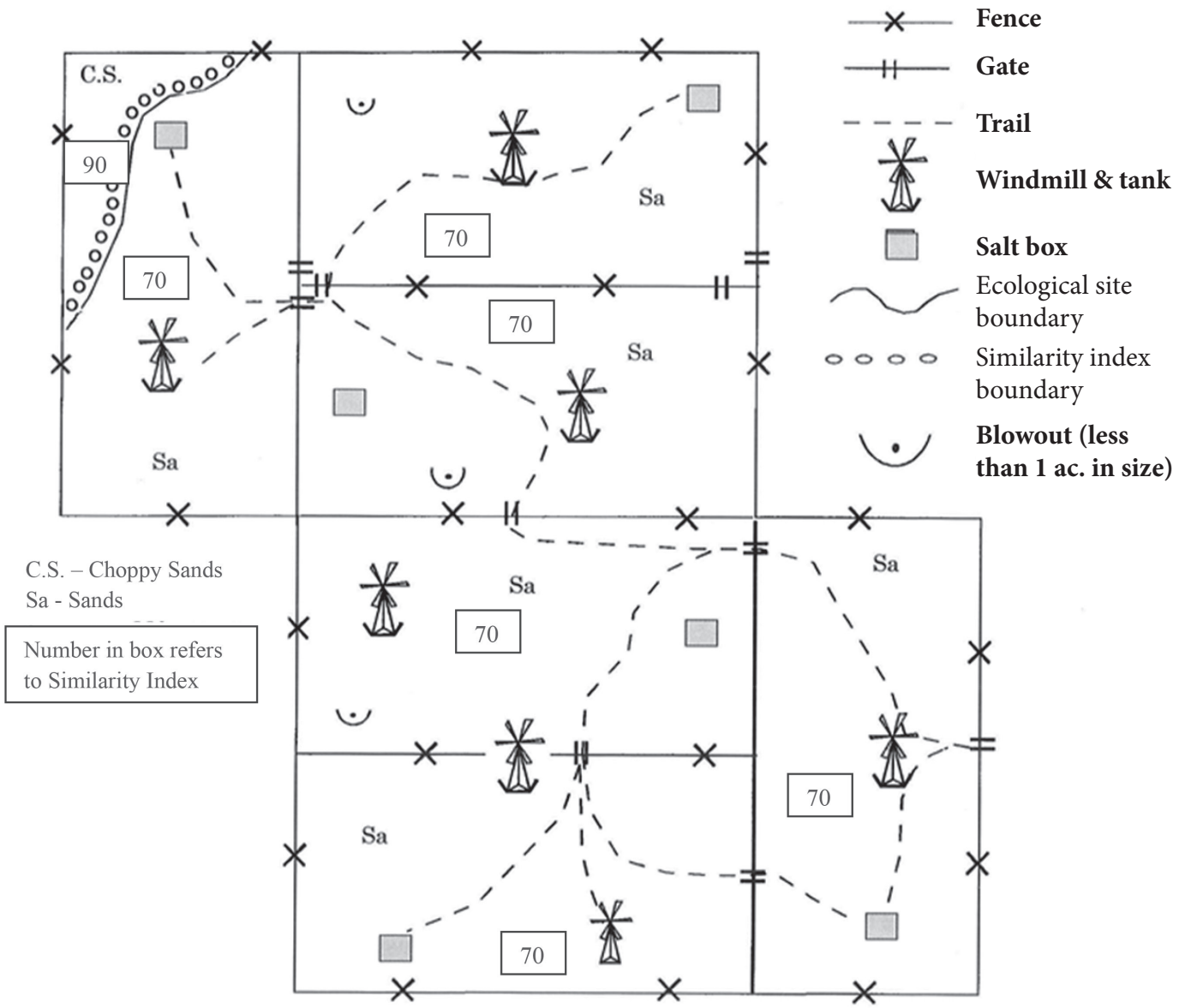
Grazing season – June 1 to November 1
150 Cow-Calf pairs – 1.5 AU/Pair
6 Bulls – 1.5 AU per bull (60 days)
1140 AUM of forage available – 1920 Acres

Owner would like to reserve 15% of forage for wildlife habitat each year.

Correct Solution:

Decrease stocking rate 1140 - (1140 X 15%) = 969 AUMs available for livestock
Install or relocate well or pipeline
Divide pasture (cross fence)
Change salting/mineral locations
Control brush or weeds
Initiate rotation grazing system
AU Note: If the owner had indicated he wanted to maximize wildlife habitat the most correct answer would have been "Initiate rest-rotation grazing system."

Figure 20. An example of a ranch plan with needed changes.



1584 AUM of forage available – 1920 Acres
Grazing season – June 1 to November 1
210 cow-calf pairs – 1.5 AU/Pair
1 herd, 6 pasture rotation, average 25 days in each pasture
6 bulls – 1.5 AU per bull (60 days)

Correct Solution:
Keep stocking rate the same.
Range improvements -
▶ none of the above.

Figure 21. An example of ranch plan with no needed changes.

7
Range Management Test Questions

To evaluate the knowledge gained from this publication and from participating in range judging contests, a simple written test is included as part of the range judging contest in addition to the ranch plan. Test questions should be developed by the contest committee from the material covered in this handbook. The questions can be given to all contestants. Ten questions are suggested, either true/false or multiple choice, which can be answered as a single letter or number in the spaces provided on the scorecard.

Sample questions are provided below with the correct answers in bold:

1. "Similarity Index" compares existing vegetation to the potential plant community. True or false? **TRUE**
2. Big bluestem is an example of a cool season grass. True or false? **FALSE**
3. Practices that are mutually beneficial for agriculture and wildlife are called complementary. True or false? **TRUE**
4. Choppy sands ecological sites are on steeper slopes than sandy ecological sites. True or false? **TRUE**
5. "Full use" is: A. overgrazing, B. proper use, C. undergrazing. **B**
6. Ecological sites differ in:
   A. yield B. kinds of plants C. proportion of kinds of plants
   D. all of these E. none of these. **D**
7. Wildlife must obtain _____ from the habitat throughout the year.
   A. Food B. Water
   C. Shelter D. All of the above. **D**
8. Pastures can always be grazed some time during the year without reducing the quality of cover for game birds. True or false? **FALSE**
9. Which grazing practice maximizes cover in pastures managed for game birds?
   A. Continuous grazing B. Winter grazing
   C. Rest-rotation D. Season-long summer grazing. **C**
10. The amount of forage produced on a given ecological site will be determined by the:
    A. Soils B. Topography
    C. Annual precipitation D. All of the above. **D**

8
Contest Guide for Range Judging

Individuals responsible for planning and conducting Area, State, and Old West Regional range judging contests should follow these guidelines.

Range judging in Nebraska was started in 1954 and has been conducted since that time as a joint effort of the following organizations and agencies: Nebraska Extension; Natural Resources Conservation Service (NRCS), USDA; Nebraska Association of Resources Districts; and Nebraska Section, Society for Range Management

Range judging contests:

1. Help participants and others recognize the importance of rangeland as a natural resource and learn how to care for it properly.
2. Encourage youth and adults to identify range plants and ecological sites, and learn range management practices.
3. Provide an opportunity for participants to become familiar with different types of rangeland in Nebraska.
4. Recognize achievements of youth and adults in range educational programs.
5. Provide an opportunity for communication among those in range conservation, particularly between youth and adults.

State Range Judging Committee

Members of the State Range Judging Committee will be the designated representatives of the sponsoring organizations and agencies listed. Committee responsibilities include:

1. Giving leadership to the range judging program in Nebraska;
2. Approving all rules and regulations for range judging contests;
3. Selecting the host counties for Area, State, and Old West Regional contests;
4. Confirming contest dates with local planning committees for Area, State, and Old West Regional;
5. Helping local contest committees plan and conduct range judging contests, particularly the state contest; and
6. At least one member of the State Range Judging Committee will be available to assist the local committee with set-up and conducting the Area Contests.

At the annual meeting, the chair and vice chair will be elected for the coming year. Suggestions for contest improvement should be submitted to the State Range Judging Contest Committee before the annual meeting, which is held the evening before the state contest. Additional meetings may be held as needed.

Organization and Function of Contest Committees

Range judging contests are effective ways to inform local people of the benefits of good range management and provide training for those who take part in a contest. County or invitational range judging contests may be organized in addition to the official Area, State and Old West Regional range judging contest(s).

A contest planning committee should include a Nebraska Extension staff member, an NRCS conservationist, an agricultural education instructor, and a representative of the Natural Resources District (NRD). Other technical experts, including Nebraska Game and Parks Commission staff, Pheasants Forever staff, science and biology teachers, and/or producers, also may be included on a planning committee. Extension range management specialists and NRCS range conservationists may be available for help in site selection and official judging.

The local planning committee should assume responsibility for organizing and conducting a contest. Any member of the committee can be elected to serve as chairperson at the initial planning meeting.

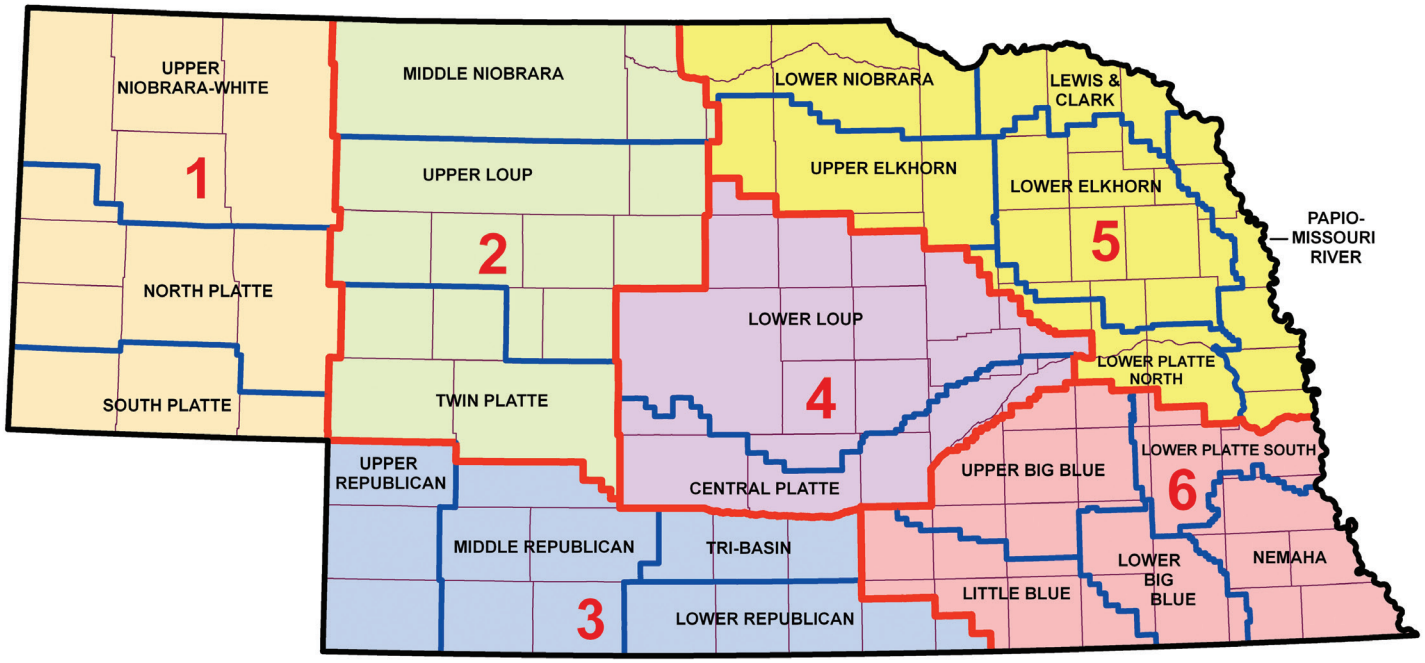


Figure 22. The six range judging areas in Nebraska and the Natural Resource Districts included in each.

Dates and counties for Area, State, and Old West Regional range judging contests are recommended by the Nebraska State Range Judging Committee. An invitation to hold a contest is extended to the local extension staff, NRD, and NRCS conservationist by the state range judging committee chair. Upon acceptance, these individuals are responsible for forming a contest planning committee with the minimum membership mentioned above. The committee will select the contest date and location.

Area and State contests are held every year. The scheduling process begins up to two years in advance in order to get contest dates on school calendars.

Nebraska is divided into six range judging contest areas (*Figure 22*). Most areas consist of at least three NRDs. An effort is made to see that an area contest is held in each NRD only once in a three-year period. Ideally, host counties are rotated within each NRD.

The State Range Judging Contest is rotated on a three-year basis, when possible, with sites located in western, central and eastern Nebraska, respectively.

The Old West Regional Range Judging Contest is held in Nebraska every fifth year in cooperation with other states in the Old West Trail Region. The order of rotation among the states is South Dakota (2016), Nebraska (2017), Wyoming (2018), Montana (2019), and North Dakota (2020).

To host a range judging contest, the following steps are suggested:

1. Finalize the decision to hold a contest with the contest planning committee.
2. Confirm the contest date as early as possible, no later than March 1. Area contests should not be held earlier than the second full week of September, and not later than the third week of September. This will allow time for the State contest at the end of September and the Old West Regional contest in early October.
3. Plan the details of the contest.
4. Publicize the event through schools, 4-H clubs, and mass media.
5. Conduct the contest as outlined in this handbook.
6. Evaluate procedures for the contest committees for the following year.

Contest Assignments and Responsibility

The contest planning committee should designate responsibilities and make assignments to carry out the many details of the event. It is essential that each person clearly understands his or her duties and that coordination exists among everyone involved. Responsibilities may be as-

signed to anyone within or outside the committee. However, priorities are suggested for the following assignments to specific agencies and organizations.

Publicity, Registration, Finance, and Refreshments—extension staff, agricultural education instructor, natural resources district personnel, and others.

1. Notify 4-H members (through extension staff), FFA members (through agricultural education instructors), NRCS field offices, and natural resources districts about details of the contest.
2. Contact media (radio, TV, newspapers) to publicize contest.
3. Coordinate with committee vice-chair to have adequate scorecards and ribbons for contestants.
4. Record the school, age division, and contestant number for each participant.
5. Distribute the scorecards.
6. Collect registration fee to cover contest expenses (printing, postage, scorecards, and awards) and forward to the Nebraska Section of the Society for Range Management secretary/treasurer. A minimum of $3/participant should be charged.
7. Provide refreshments and lunch for all contest volunteers.

Field Site Preparation—USDA-NRCS, extension staff, University of Nebraska range specialists, and/or other technical specialists.

1. Select the field site for the contest and obtain permission from the landowner or operator to hold contest. Choose a contest location with adequate access and parking to accommodate vans and buses.
2. Prepare the site for the contest:
    a. Identify and number plants for identification.
    b. Enclose ecological site boundaries with lath and cord or survey tape. Dig hole to indicate soil characteristics (depth, texture, water table).
    c. Prepare a ranch map, including improvement practices for Station 8.
    d. Prepare questions for Station 9.
3. Prepare official scorecards for the tabulation crew.
4. Explain contest rules and scorecards at the contest site and designate a field timer.
5. Provide copies of Guides for Determining Similarity Index.

Field Operations—NRCS personnel and other individuals appointed to specific tasks by contest committee.

1. Transportation—Determine best route to contest site, arrange for transportation if needed, supervise parking at contest site, and guard safety of contestants.
2. Group leaders—Guide contestants from station to station at contest site and discourage talking and copying among contestants. One group leader is required per group.
3. Runners—Collect scorecards at contest site and transport to scorers. Two or more runners are needed to transport scorecards to the tabulation room to expedite the scoring process.
4. Station judges—One judge should be at each station for contest supervision, to explain the ranch map problem, and to distribute questions. These should be the same people who prepared the field site location if possible.
5. Timer—Act as timer to coordinate movement of contestants from station to station. This individual should be located so the entire contest can be viewed and should be equipped with a sound system so he or she can be heard.
6. Contest official—Preside over field contest activities and review answers with participants following the contest.

Scoring and Tabulation—agricultural education instructors, extension staff, NRD employees, and volunteers.

1. Determine how many scorers and tabulators are needed and arrange for their help. The number of scorers will vary from eight to 20 depending on time available and number of contestants. Recommended ratio of scorers to contestants is one per 10–15 contestants.
2. Designate a *scoring official or judge* to rule on questionable answers.

3. Grade and score each contestant's scorecards and determine the winners in each division. Official scorecards are provided by field site preparation personnel.
4. Prepare a summary of individual and team placings.

Awards—Nebraska Section, Society for Range Management; Natural Resources District; other organizations for special awards.

1. Provide ribbon awards for Area, State and Old West Regional contests.
2. Arrange for special awards, e.g., plaques, books, etc.
3. Arrange for presentation of awards as recommended by Nebraska State Range Judging Committee.

Registration Fees and Expenses

The registration fee will be at least $3.00 per contestant. After the contest, the base $3.00 fee collected from all contestants will be sent to the secretary-treasurer of the Nebraska Section, Society for Range Management. The base fee covers the cost of scorecards and award ribbons supplied to each Area and State contest, as well as supporting travel scholarships for top teams going to the next level of competition. The local contest committee may charge additional fees per contestant on top of the base $3.00 fee. The sum of these extra fees collected can help cover costs such as lunch for contest helpers.

Preparing and Conducting a Range Judging Contest

Range judging contests are to be based on information found in this handbook.

Selecting the Contest Site

Select the contest site far enough before the contest for adequate preparation. The NRCS conservationist on the contest committee should take the lead in selecting the contest site. He or she will be familiar with ecological sites used in range judging, the similarity index, and degree of use.

Select a site close to an all-weather road and reasonably close to registration, scoring, and tabulation facilities. For the plant identification portion of the contest, select a site that has good plant diversity and has preferably not been grazed that growing season. The location of the contest ecological sites may include grazed range and should have two or three common ecological sites.

A range judging contest includes nine stations. Stations 1 to 4 are used for plant identification and evaluation. At stations 5 to 7, the ecological site will be identified, the similarity index determined, and degree of use estimated. At Station 8, the ranch map associated with Scorecard C will be presented. Contestants will review the ranch map and select whether or not possible improvement practices should be used. Questions will be asked at Station 9. When contestants are divided into eight groups, Station 9 will be completed by all groups during the 5th time period. When contestants are divided into four groups, Station 9 will be completed by all groups during the 9th time period. All stations must be close enough together to permit contestants to walk between locations within two or three minutes.

Plant Identification Site Preparation (Stations 1–4)

At each of the four plant identification stations, six range plants must be present and suitable for contestants to identify. Each plant should be marked by a numbered tag or stake. Typically, 24 plants are tagged. Clipping other plants from around the specimens to be identified may be necessary. A minimum distance of 10 feet between plants is suggested. One line of plants for identification will be needed for each 40 contestants. Plants in each line should be in the same sequence. All plants included for identification in range judging contests must be selected from the plant list in this publication.

It is desirable for the plants marked for identification to be growing naturally on the contest site. However, in some situations it may be necessary to transplant some individual plants to avoid scattering the contestants over too large an area.

Ecological Site Preparation (Stations 5–7)

Avoid selecting ecological sites in a transition zone. The site should be clearly defined to avoid confusion on the part of contestants. At each ecological site location, mark a 20-by-20-foot plot with lath and twine for determining ecological site, similarity index, and degree of use. Dig a hole on the plot boundary to indicate soil and site characteristics. Provide an acid bottle (0.1% HC1 solution) for contestants to check for soil lime, and supply a water bottle for determining soil texture. Degree of use should be simulated by clipping vegetation to attain a desired degree of utilization. A 3-by-6-foot plot in the corner of the ecological site area can be delineated—half clipped for estimating utilization and half unused *(Figure 23)*. Only ecological sites described in this handbook can be used for a contest.

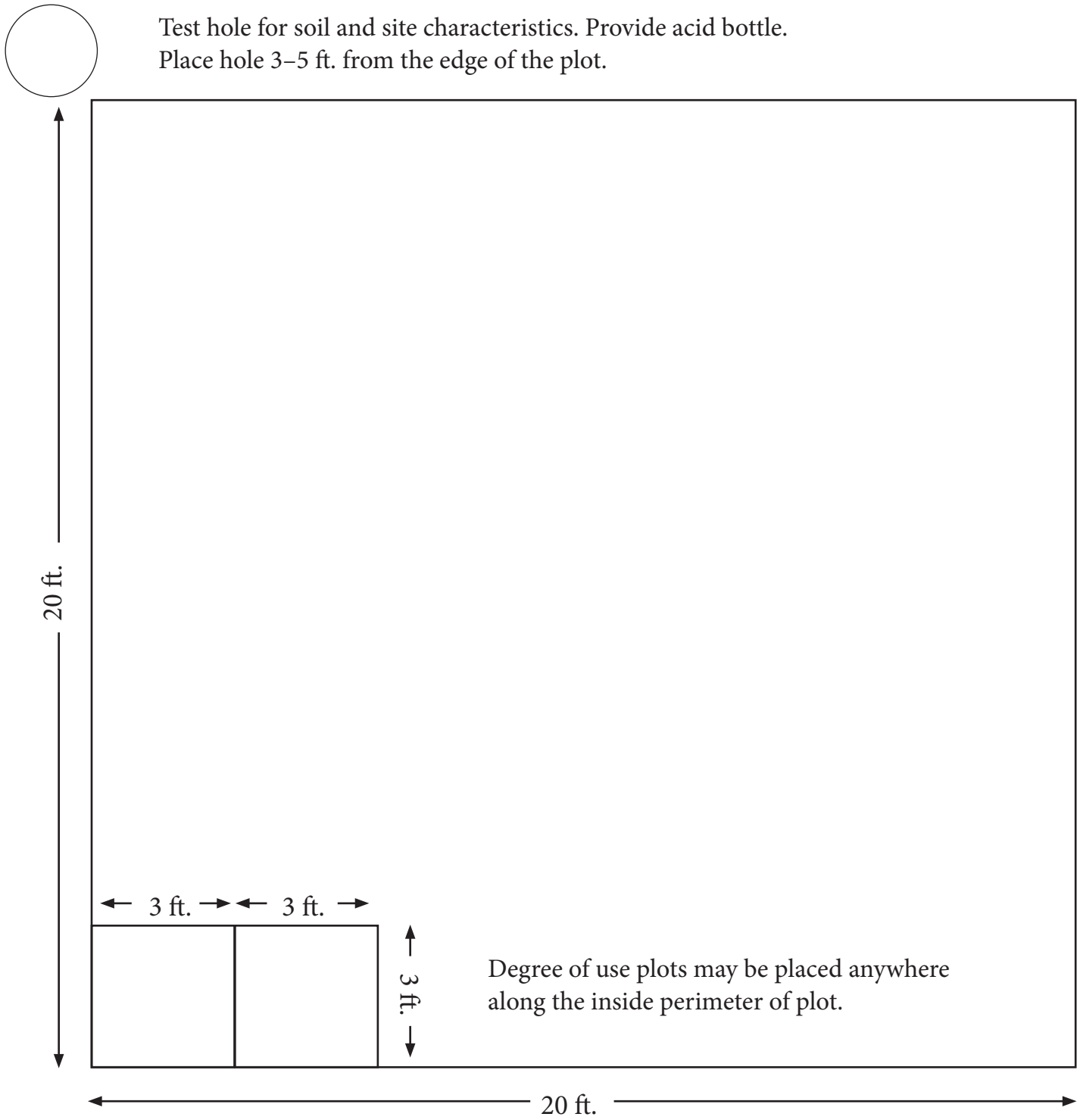


Figure 23. Sketch of ecological site, arrangement, and dimensions.

Ranch Plan and Questions (Stations 8 and 9)

Sketch a ranch map showing ranch features and conditions on paper or poster board so it can be viewed by contestants to determine what range improvement should be made. The problem should include natural situations found common to the range area where the contest is located, whenever possible. The correct answer for proper stocking rate (Part 1, Station 8) on Scorecard C will be based on degree of use, length of grazing season, stocking rate tables, wildlife habitat requirements, and other information given at the contest site.

Questions on range management (Station 9) for Scorecard C will be handed out on paper. All questions must be based on information contained in this handbook.

Conducting the Contest

Before the contest begins, explain the scorecards and rules to be followed. The general contest rules (*found in Appendix Table 20*) should be covered. Contest officials will provide contestants with practice judging sessions before State and Old West Regional Range Judging Contests.

Group leaders should be thoroughly familiar with the location of each contest station. Contest plans suitable for smaller contests that have four stations and four groups, and for large contests that have eight stations and eight groups, are shown in *Appendix Table 16.* Stations should be numbered and clearly marked.

Contestants will complete the plant identification and evaluation section using Scorecards A and B before proceeding to the latter part of the contest. After all contestants have turned in Scorecards A and B to their group leaders, provide each contestant with an appropriate similarity index guide to be used only in conjunction with Scorecard C. The contest committee will be responsible for providing the similarity index guides. On Scorecard C, the kind of ecological site, similarity index, and degree of use will be based on plots roped off for this purpose. Questions should be given at the final station as the last part of the contest. Examples of Scorecards A, B, and C are included on pages 66 to 69.

For very large contests, the participants should be broken into eight groups. Groups A-D would rotate through Stations 1–4 while Groups E-H rotate through Stations 5–8. All groups would be given the test questions to complete after the first four stations. After Groups A-D have completed the plant line and test questions, they would rotate through Stations 5–8. Groups E-H would rotate through Stations 1–4 after completing the ecological sites, ranch problem, and test questions. Groups E-H should turn in the guide and worksheet for determining similarity index prior to rotating to the plant line.

Ten minutes should be enough time to allow contestants to finish at each station. Each group must stay together and move to a new location when instructed to do so.

A full explanation of the correct answers on both scorecards should be made by the contest official following the contest and after the scorecards have been collected. Scorecards are not returned to contestants.

Contest Divisions, Rules and Regulations

There are three contest divisions recognized for competition in range judging: (1) Junior; (2) Senior; and (3) Adult. Whenever possible and feasible, each range judging contest should include these separate divisions.

Contestants or teams may compete in only one division. However, any number of teams or individuals may participate from any organization, but must compete within the designated contest divisions.

Contestants may compete in as many area contests as they wish, but they may compete for and receive awards in only one designated area contest. When competing in a second area contest, contestants should register in the Adult Division for scoring purposes. Schools are discouraged from splitting contestants or teams to send to different area contests.

Contestants *should not* make use of bulletins, notes, books, or drawings while judging. Talking, copying, or comparing scorecards during the contest is prohibited.

Student Division

The students are divided into two divisions: (1) Junior and (2) Senior. Teams or individuals in these two divisions will compete as separate groups. Teams must consist of no more than four members. Contestants must be placed in the appropriate division at the time of registration.

Instructors do not need to place students into four-person teams during the registration process. The scoring program will automatically sort students by the highest to lowest scores. The top four students will be on Team A, the next four highest scores will be on Team B, etc.

Instructors can still place freshman and sophomores in the senior division category. Instructors may wish to use this, if, for example, the FFA only has three senior individuals, a freshman could be added to complete the team.

For registration, instructors will only need to submit a list of students in the junior division (freshman and sophomores) and a list of students in the senior division (juniors and seniors).

To compete in the *Junior Division* either individually or as a team, a contestant must be a sophomore or below in class standing. *Senior Division* competitors must be high school juniors or seniors. If one or more team members are juniors or seniors (and others are sophomore or below), that team must compete in the Senior Division.

Adult Division

Contestants who have graduated from high school compete in the adult division as individuals. There is no limit on the number of times an individual may win the adult division at any contest.

Travel Scholarship

The highest scoring Nebraska teams at the State Range Judging Contest, regardless of age division, are eligible for a partial travel scholarship. The teams have a choice of using the scholarships toward the National Land and Range Judging Contest (Oklahoma) or the Old West Regional Range Judging Contest, but not both. If one of the high-scoring teams chooses not to travel to a regional range judging contest, eligibility for the travel scholarship slides down to the next highest scoring team. The scholarship must be used within 10 months of eligibility. Unused scholarships revert to the State Range Judging Committee to be awarded in subsequent years. Contact the current State Range Judging chair for more details.

Awards

The Nebraska Section, Society for Range Management will provide the ribbon awards for contest winners. The cost of ribbons will be covered by contest registration fees. Ribbons will be awarded as decided by the State Range Judging Committee.

Additional awards (plaques, books, etc.) may be presented by organizations such as the natural resources districts or other organizations that want to recognize winning teams and individuals. This is especially appropriate for the state contest where plaques are suggested for the purple ribbon winners. Only one plaque should be awarded per team.

Ribbon awards will follow a standard format for all area and state contests (*Appendix Table 17*).

Grading and Scoring

Grading scorecards is made easier by preparing cutout overlays that have been made from the official scorecards prepared by field contest officials. Each official scorecard will indicate the total points possible based on a perfect score. Be sure the points allowed for each scorecard match any changes in the scorecards that may result from recent revisions or changes to the scoring system.

Scorers should work in groups of two. One grades and scores the sheet while the other checks it to see that no errors were made. Accuracy is essential. The number of scorers needed will depend upon the size of the contest. One scorer per 10–15 contestants is recommended.

Points lost should be totaled and recorded at the top of each scorecard on the appropriate line. The difference between the total maximum points and the points lost becomes the individual score. A spreadsheet template will be provided to the local committee by the state committee for score tabulation.

Breaking Ties

In the event of a tie score between individuals, the tie will be broken using Card C (the sites/ranch problem). If a tie still exists, the tie will be broken using Card A (the first plant card, plants 1–12). If a tie still exists, the tie will be broken using Card B (the second plant card (plants 13–24). In the event of a tie between teams, the tie will be broken by the cumulative team scores using the criteria listed above.

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2. Holechek, J.L., R.D. Pieper, and C.H. Herbel. 1998. Range Management: Principles and Practices. Prentice Hall, Upper Saddle River, New Jersey.
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Glossary

Animal Unit is a standard mass of animal. For beef, the standard animal unit is 1,000 pounds.

Animal Unit Day (AUD) is the amount of forage consumed by a standard animal unit each day. For beef, this is 26 pounds.

Animal Unit Month (AUM) is the amount of forage consumed by a standard animal unit in one month. For beef, this is 780 pounds.

Annual plants live only one season.

Antagonistic management practices *are not* mutually beneficial for agriculture and wildlife.

At-Risk Community Phase is the community within a state that is likely to move into a less productive state if additional disturbances occur.

Biennial plants live two years and flower only during the second growing season.

Browse is the portion of shrubs that animals may consume.

Bunchgrasses have neither rhizomes nor stolons.

Carrying capacity is the ability of a parcel of land to provide food, water, and shelter for one or more species of wildlife on a year-round basis. The number of individuals that survive to reproduce the following year is controlled by the most limiting habitat factor within the home range.

Climax is the final stage in succession when the soil and plant community are somewhat in balance with the climate, topography, animals, and other factors.

Climax plant community or **Reference plant community** is the group of plants best adapted to the physical characteristics of the site. This plant community makes the best use of the available soil nutrients, soil moisture, and energy from the sun under current conditions.

Community Pathway describes the causes of shifts from one community phase to another within a state. A community pathway is reversible, caused by succession, natural disturbances, short-term climate variation, and grazing management.

Community Phases are unique groupings of plants (plant communities) and associated soil properties that can occur within a state.

Complementary management practices are mutually beneficial for agriculture and wildlife.

Cool-season plants make their principal growth during the cool conditions in spring and fall. Inflorescences appear in late spring or early summer.

Degree of Use is the amount of annual forage production that has been used expressed as a percentage of total dry matter production for the year.

Disturbances are activities that can cause the plant community to change to a less productive, diverse plant community. Common disturbances include drought, floods, overgrazing, wildfire, lack of fire, unusually wet periods, severe hail, insects, and disease.

Ecological Site is a distinctive kind of land based on soil, landform, geology, and climate characteristics. An ecological site differs from other kinds of land in its ability to produce kinds and amounts of vegetation and in its ability to respond to management actions and disturbances.

Ecological Site Description is the documentation of the characteristics of an ecological site. It includes the data used to define the distinctive properties of the site, the biotic and abiotic characteristics of the site, and describes how changes in disturbances and management can impact the site.

Encroachment is the term used to describe the increase of woody species that are native to the site in small amounts. If unchecked, encroachment can convert grassland to forestland.

Forbs (wildflowers and weeds) have net-like veins in the leaves, and the leaves have various shapes. The growth aboveground dies back every winter.

Forage is herbage and browse that is available and may provide food for grazing animals.

Grasses are plants with jointed stems. The stems are often hollow between the joints. Leaves are in two rows on the stem. Veins in the leaves are parallel.

Grass-like plants look like grasses but have solid (not hollow) stems. Stems of sedges are triangular, while stems of rushes are round. The stems have no nodes. The veins are parallel as in the true grasses.

Habitat is the environment in which a plant or animal lives and grows. It is a combination of scale of landscape, food, water, and shelter.

Heavy Grazing is long-term grazing at higher than recommended stocking rates. Long-term heavy grazing can cause the plant community to cross a threshold to an alternative state.

Herbage is the annual aboveground, non-woody plant growth produced by range plants.

Introduced plants are those that have been brought in from outside North America.

Major Land Resource Areas are large scale planning areas with common physiography, geology, climate, water, soils, biological resources, and land use.

Nonuse is a term to describe the management of an area that is left ungrazed by livestock for several years, causing a buildup of litter that can reduce the health of grasses present.

Palatability refers to relative preference by livestock and/or wildlife for grazing. Palatability will decrease with maturity of plant and with grazing animal.

Perennial plants live from year to year and produce leaves and stems for more than two years from the same plant.

Prescribed burning is the thoughtful and skillful application of fire to a specific site under selected weather conditions and at specific times in the plant's growth cycle to accomplish specific land management objectives

Poisonous plants may kill animals or reduce animal productivity. The level of danger of poisoning is related to plant growth stage.

Primary succession is the initial development of soil parent material and low plant forms over time to better developed soil and higher plant life forms. This process takes place over geologic time (millions of years) and ends at the climax stage.

Reference Community Phase is the community within the reference state that is used to classify an ecological site and contains the full range of plant species historically present on the site. This community phase is formed through the interaction of environmental conditions, natural disturbances, and characteristics of the species that make up the community.

Reference State is the group of plant community phases that describes the ecological potential of the site and the natural or historical range of variability in the site.

Resilience is the ability of a site to return to the original community phase after a disturbance.

Retrogression occurs when disturbance, such as improper grazing, of the climax plant community results in degradation of a range site.

Rhizomatous plants have spreading underground stems from which new plants may arise from the parent plants. Rhizomatous grasses are classified as sod-forming.

Scale of landscape, an important aspect of wildlife management, is the total land area involved in habitat management. The needed scale of landscape varies depending on the wildlife species being managed.

Secondary succession follows retrogression and, similar to primary succession, involves successive changes as the plant community develops back toward climax. Secondary succession involves primarily vegetation changes and progresses much more rapidly because soil development is already present.

Similarity Index is a numerical value that compares the composition of the existing plant community to that of a community defined in the Ecological Site Description. This is usually the reference plant community but may be a different plant community based on the landowner's objectives.

Sod-forming plants have rhizomes and/or stolons that allow the plant to spread vegetatively, forming a dense stand and a thick mat of roots in the topsoil. Soil particles are tied together tightly, preventing wind and water erosion.

Shrubs have persistent woody stems that remain alive from one year to the next. New growth starts each spring from points aboveground along the stem. Many shrubs branch out from near the base of the plant.

State is a group of plant community phases and the soil properties present on a site that interact with the environment within a natural range of variability.

State and Transition Model is a method to organize and describe the relationships between vegetation, soil, animals, hydrology, disturbances, and management on an ecological site.

Stocking Rate is the relationship between the number of animals and grazing management unit utilized over a specified period of time (e.g., animal unit days per acre, animal unit months per acre).

Stoloniferous plants have spreading aboveground stems that may root at the nodes and form new plants. Stoloniferous grasses are classified as sod-forming.

Succession is the predictable and orderly process of replacement of one plant community by another over time.

Targeted grazing is accomplished by managing the timing and intensity of grazing to accomplish objectives.

Thresholds are conditions that modify the ecosystem structure so severely that the ecological processes do not function and the system moves to an alternative state.

Transition is a description of the biotic and abiotic variables or events that contributes to the loss of resilience and results in shifts between states. Transitions can be triggered by disturbances and/or management actions. They can occur quickly as a result of catastrophic events or gradually over a long period of time.

Tillers are reproductive and vegetative stems of grass plants aboveground.

Warm-season plants generally make their principal growth during the late spring to mid-summer and develop seed in the late summer or early fall.

Appendix

Table 1. List of important range plants in Nebraska

Common name	*Scientific Name*	*Life Span*[1]	*Origin*[2]	*Season of Growth*[3]	*Value and Importance for*			*Growth Form*[7]	*Poisonous*[8]
					Livestock Forage[4]	*Wildlife Habitat*[5]	*Wildlife Food*[6]		
GRASSES									
1. Alkali sacaton	*Sporobolus airoides*	P	N	W	M	M	L	B	—
2. Annual bluegrass	*Poa annua*	A	I	C	L	L	L	B	—
3. Big bluestem	*Andropogon gerardii*	P	N	W	H	H	M	R	—
4. Blowoutgrass	*Redfieldia flexuosa*	P	N	W	L	L	L	R	—
5. Blue grama	*Bouteloua gracilis*	P	N	W	M	L	L	B	—
6. Bluejoint reedgrass	*Calamagrostis canadensis*	P	N	C	M	M	L	R	—
7. Buffalograss	*Buchloe dactyloides*	P	N	W	M	L	L	S	—
8. Canada wildrye	*Elymus canadensis*	P	N	C	M	M	M	B	—
9. Downy brome	*Bromus tectorum*	A	I	C	L	L	M	B	—
10. Eastern gamagrass	*Tripsacum dactyloides*	P	N	W	H	H	H	S	—
11. Fall panicum	*Panicum dichotomiflorum*	A	N	W	L	L	M	B	—
12. Foxtail barley	*Hordeum jubatum*	P	N	C	L	L	L	B	—
13. Foxtails	*Setaria* spp.	A	I	W	L	M	M	B	—
14. Goosegrass	*Eleusine indica*	A	I	W	L	L	L	B	—
15. Green needlegrass	*Nassella viridula*	P	N	C	H	M	M	B	—
16. Hairy crabgrass	*Digitaria sanguinalis*	A	I	W	L	L	M	S	—
17. Hairy grama	*Bouteloua hirsuta*	P	N	W	M	L	L	B	—
18. Indian ricegrass	*Stipa hymenoides*	P	N	C	M	M	M	B	—
19. Indiangrass	*Sorghastrum nutans*	P	N	W	H	H	M	R	—
20. Inland saltgrass	*Distichlis spicata*	P	N	W	L	L	L	R	—
21. Japanese brome	*Bromus japonicus*	A	I	C	L	L	M	B	—
22. Kentucky bluegrass	*Poa pratensis*	P	I	C	H	L	L	R	—
23. Little barley	*Hordeum pusillum*	A	N	C	L	L	L	B	—
24. Little bluestem	*Schizachyrium scoparium*	P	N	W	H	H	M	B	—
25. Marsh muhly	*Muhlenbergia racemosa*	P	N	W	L	M	L	R	—
26. Needleandthread	*Hesperostipa comata*	P	N	C	M	M	L	B	—
27. Northern reedgrass	*Calamagrostis stricta*	P	N	C	M	M	L	R	—
28. Perennial threeawns	*Aristida* spp.	P	N	W	L	L	L	B	—
29. Plains bluegrass	*Poa arida*	P	N	C	M	L	L	B	—
30. Plains muhly	*Muhlenbergia cuspidata*	P	N	W	M	L	L	B	—
31. Porcupinegrass	*Hesperostipa spartea*	P	N	C	M	M	L	B	—
32. Poverty dropseed	*Sporobolus vaginiflorus*	A	N	W	L	L	L	B	—
33. Prairie cordgrass	*Spartina pectinata*	P	N	W	H	H	L	R	—
34. Prairie dropseed	*Sporobolus heterolepis*	P	N	W	M	M	M	B	—
35. Prairie junegrass	*Koeleria macrantha*	P	N	C	H	M	M	B	—
36. Prairie sandreed	*Calamovilfa longifolia*	P	N	W	H	H	M	R	—
37. Prairie threeawn	*Aristida oligantha*	A	N	W	L	L	L	B	—
38. Purple lovegrass	*Eragrostis spectabilis*	P	N	W	L	M	L	B	—
39. Purpletop	*Tridens flavus*	P	N	W	M	M	M	B	—
40. Reed canarygrass	*Phalaris arundinacea*	P	N	C	H	H	M	R	—

Table 1. (*continued*)

Common name	*Scientific Name*	*Life Span*[1]	*Origin*[2]	*Season of Growth*[3]	*Value and Importance for*			*Growth Form*[7]	*Poisonous*[8]
					Livestock Forage[4]	*Wildlife Habitat*[5]	*Wildlife Food*[6]		
41. Sand bluestem	*Andropogon hallii*	P	N	W	H	H	M	R	—
42. Sand dropseed	*Sporobolus cryptandrus*	P	N	W	M	L	M	B	—
43. Sand lovegrass	*Eragrostis trichodes*	P	N	W	H	M	M	B	—
44. Sand paspalum	*Paspalum setaceum*	P	N	W	L	L	L	B	—
45. Sandberg bluegrass	*Poa secunda*	P	N	C	M	L	L	B	—
46. Sandhill muhly	*Muhlenbergia pungens*	P	N	W	L	L	L	R	—
47. Sandbur	*Cenchrus longispinus*	A	N	W	L	L	L	B	—
48. Scribner rosette grass	*Dichanthelium oligosanthes*	P	N	C	M	L	M	B	—
49. Sideoats grama	*Bouteloua curtipendula*	P	N	W	M	M	M	R	—
50. Sixweeks fescue	*Vulpia octoflora*	A	N	C	L	L	L	B	—
51. Slender wheatgrass	*Elymus trachycaulus*	P	N	C	H	M	M	B	—
52. Squirreltail	*Elymus elymoides*	P	N	C	L	L	L	B	—
53. Stinkgrass	*Eragrostis cilianensis*	A	I	W	L	L	L	B	—
54. Switchgrass	*Panicum virgatum*	P	N	W	H	H	M	R	—
55. Tall dropseed	*Sporobolus compositus*	P	N	W	M	M	L	B	—
56. Tumblegrass	*Schedonnardus paniculatus*	P	N	W	L	L	L	B	—
57. Western wheatgrass	*Pascopyrum smithii*	P	N	C	M	M	M	R	—
58. Wilcox rosette grass	*Dichanthelium wilcoxianum*	P	N	C	M	L	M	B	—
59. Windmillgrass	*Chloris verticillata*	P	N	W	L	L	L	B	—
60. Witchgrass	*Panicum capillare*	A	N	W	L	L	M	B	—
FORBS									
1. American deervetch	*Lotus purshianus*	A	N	—	M	L	H	—	—
2. Annual buckwheat	*Eriogonum annuum*	A	N	—	L	L	L	—	—
3. Annual sunflowers	*Helianthus* spp.	A	N	—	M	H	H	—	R
4. Black medic	*Medicago lupulina*	A	I	—	M	L	M	—	R
5. Breadroot scurfpea	*Pediomelum esculentum*	P	N	—	M	M	M	—	—
6. Bush morninglory	*Ipomoea leptophylla*	P	N	—	M	M	H	—	—
7. Canada thistle	*Cirsium arvense*	P	I	—	L	L	L	R	R
8. Chicory	*Cichorium intybus*	P	I	—	M	L	M	—	R
9. Clammy groundcherry	*Physalis heterophylla*	P	N	—	L	L	M	R	R
10. Common groundcherry	*Physalis longifolia*	P	N	—	L	L	M	R	R
11. Common mullein	*Verbascum thapsus*	B	I	—	L	L	L	—	—
12. Common ragweed	*Ambrosia artemisiifolia*	A	N	—	L	L	M	—	R
13. Common yarrow	*Achillea millefolium*	P	N	—	L	L	M	R	R
14. Crazyweeds	*Oxytropis* spp.	P	N	—	L	L	L	—	H
15. Cudweed sagewort	*Artemisia ludoviciana*	P	N	—	L	L	M	R	—
16. Curlycup gumweed	*Grindelia squarrosa*	B	N	—	L	L	M	—	R
17. Cutleaf ironplant	*Xanthisma spinulosum*	P	N	—	L	L	L	—	R
18. Daisy fleabane	*Erigeron strigosus*	A	N	—	L	L	L	—	—

Table 1. (*continued*)

Common name	*Scientific Name*	*Life Span*[1]	*Origin*[2]	*Season of Growth*[3]	*Value and Importance for*			*Growth Form*[7]	*Poisonous*[8]
					Livestock Forage[4]	*Wildlife Habitat*[5]	*Wildlife Food*[6]		
19. Dandelion	*Taraxacum officinale*	P	I	—	M	L	H	—	—
20. Death camas	*Zigadenus venenosus*	P	N	—	L	L	L	—	H
21. False boneset	*Brickellia eupatorioides*	P	N	—	L	L	L	R	—
22. Fourpoint eveningprimrose	*Oenothera rhombipetala*	B	N	—	L	L	M	—	—
23. Gayfeathers	*Liatris* spp.	P	N	—	M	M	M	—	—
24. Goldenrods	*Solidago* spp.	P	N	—	L	H	M	R or S	R
25. Green sageworts, tarragon	*Artemisia* spp.	P or B	N	—	L	M	L	—	R
26. Gromwells, puccoons	*Lithospermum* spp.	P	N	—	L	L	M	—	—
27. Hairy goldaster	*Chrysopsis villosa*	P	N	—	L	L	M	R	—
28. Heath aster	*Aster ericoides*	P	N	—	L	M	L	R or S	R
29. Hemp dogbane	*Apocynum cannabinum*	P	N	—	L	L	L	R	—
30. Horseweed	*Conyza canadensis*	A	N	—	L	L	L	—	R
31. Illinois bundleflower	*Desmanthus illinoensis*	P	N	—	M	H	H	—	—
32. Knapweeds	*Centaurea* spp.	P or B	I	—	L	L	L	V	—
33. Kochia	*Kochia scoparia*	A	I	—	M	H	H	—	R
34. Lambsquarters	*Chenopodium album*	A	N	—	M	M	M	—	—
35. Leafy spurge	*Euphorbia esula*	P	I	—	L	L	L	R	O
36. Lemon scurfpea	*Psoralidium lanceolatum*	P	N	—	L	L	L	R	—
37. Locoweeds or milkvetches	*Astragalus* spp.	P	N	—	L	L	L-M	V	H
38. Lupines	*Lupinus* spp.	A or P	N	—	L	L	L	—	H
39. Milkweeds	*Asclepias* spp.	P	N	—	L	M	L	R	O
40. Musk thistle	*Carduus nutans*	B	I	—	L	L	L	—	—
41. Penstemons	*Penstemon* spp.	P	N	—	M	L	M	—	R
42. Pepperweed	*Lepidium densiflorum*	A	I	—	L	L	M	—	—
43. Prairie coneflower	*Ratibida columnifera*	P	N	—	M	L	M	—	—
44. Prairie groundsel	*Senecio plattensis*	P	N	—	L	L	L	—	R
45. Pricklypoppy	*Argemone polyanthemos*	A	N	—	L	L	L	—	R
46. Purple coneflower	*Echinacea angustifolia*	P	N	—	H	L	H	—	—
47. Purple poppymallow	*Callirhoe involucrata*	P	N	—	L	L	L	—	—
48. Purple prairieclover	*Dalea purpurea*	P	N	—	H	L	M	—	—
49. Pussytoes	*Antennaria neglecta*	P	N	—	L	L	L	V	—
50. Riddell groundsel	*Senecio riddellii*	P	N	—	L	L	L	—	H
51. Rocky Mountain beeplant	*Cleome serrulata*	A	N	—	L	M	H	—	R
52. Roundhead lespedeza	*Lespedeza capitata*	P	N	—	M	M	H	—	—
53. Rush skeletonplant	*Lygodesmia juncea*	P	N	—	L	L	M	—	R
54. Russian thistle	*Salsola tragus*	A	I	—	M	M	L	—	R
55. Scarlet gaura	*Gaura coccinea*	P	N	—	L	L	L	R	—
56. Scarlet globemallow	*Sphaeralcea coccinea*	P	N	—	L	L	M	—	—
57. Serrateleaf eveningprimrose	*Calylophus serrulatus*	P	N	—	M	L	M	—	—

Table 1. (*continued*)

Common name	*Scientific Name*	*Life Span*[1]	*Origin*[2]	*Season of Growth*[3]	*Value and Importance for*			*Growth Form*[7]	*Poisonous*[8]
					Livestock Forage[4]	*Wildlife Habitat*[5]	*Wildlife Food*[6]		
58. Showy peavine	*Lathyrus polymorphus*	P	N	—	M	L	H	R	R
59. Silky prairieclover	*Dalea villosa*	P	N	—	M	M	H	—	—
60. Silverleaf scurfpea	*Pediomelum argophyllum*	P	N	—	L	L	L	R	R
61. Slender greenthread	*Thelesperma megapotamicum*	P	N	—	M	L	M	R	—
62. Slimflowered scurfpea	*Psoralidium tenuiflorum*	P	N	—	L	L	M	—	—
63. Smoothseed wildbean	*Strophostyles leiosperma*	A	N	—	M	L	M	—	—
64. Snow-on-the-mountain	*Euphorbia marginata*	A	N	—	L	L	L	—	R
65. Spiderworts	*Tradescantia* spp.	P	N	—	M	L	M	—	—
66. Stickleaves	*Mentzelia* spp.	P or B	N	—	L	L	L	—	—
67. Stiff sunflower	*Helianthus pauciflorus*	P	N	—	H	M	H	—	—
68. Sweetclovers	*Melilotus* spp.	B	I	—	M	L	M	—	R
69. Texas croton	*Croton texensis*	A	N	—	L	L	H	—	R
70. Thistles (native)	*Cirsium* spp.	P or B	N	—	L	M	M	V	R
71. Verbenas	*Verbena* spp.	A or P	N	—	L	M	M	—	—
72. Western ironweed	*Vernonia baldwinii*	P	N	—	L	H	M	R	—
73. Western ragweed	*Ambrosia psilostachya*	P	N	—	L	M	H	R	—
74. Western salsify	*Tragopogon dubius*	B	I	—	L	M	L	—	—
75. White prairieclover	*Dalea candida*	P	N	—	H	L	M	—	—
76. Wild bergamot	*Monarda fistulosa*	P	N	—	L	L	M	R	—
77. Wild four-o'clock	*Mirabilis nyctaginea*	P	N	—	L	L	M	—	—
78. Wild licorice	*Glycyrrhiza lepidota*	P	N	—	L	M	M	R	—
79. Woolly plantain	*Plantago patagonica*	A	N	—	M	L	M	—	—
80. Woollywhite hymenopappus	*Hymenopappus tenuifolius*	B	N	—	L	L	L	—	—
SHRUBS									
1. Broom snakeweed	*Gutierrezia sarothrae*	P	N	—	L	M	M	—	O
2. Chokecherry	*Prunus virginiana*	P	N	—	L	H	H	R	O
3. Fringed sagewort	*Artemisia frigida*	P	N	—	L	M	M	—	—
4. Leadplant	*Amorpha canescens*	P	N	—	H	H	H	R	—
5. New Jersey Tea	*Ceanothus herbaceus*	P	N	—	M	M	M	—	—
6. Poison ivy	*Toxicodendron radicans* var. *rydbergii*	P	N	—	L	L	M	R	H
7. Roses	*Rosa* spp.	P	N	—	L	M	H	—	—
8. Sand sagebrush	*Artemisia filifolia*	P	N	—	L	H	M	—	—
9. Skunkbrush sumac	*Rhus aromatica*	P	N	—	M	H	H	—	—
10. Smooth sumac	*Rhus glabra*	P	N	—	L	H	M	R	—
11. Snowberries, buckbrush	*Symphoricarpos spp.*	P	N	—	L	H	H	R	R
12. Western sandcherry	*Prunus pumila var. besseyi*	P	N	—	M	H	H	—	—
13. Wild plum	*Prunus americana*	P	N	—	L	H	H	R	O
14. Yucca	*Yucca glauca*	P	N	—	M	H	M	—	—

Table 1. (*continued*)

Common name	*Scientific Name*	*Life Span*[1]	*Origin*[2]	*Season of Growth*[3]	*Value and Importance for*			*Growth Form*[7]	*Poisonous*[8]
					Livestock Forage[4]	*Wildlife Habitat*[5]	*Wildlife Food*[6]		
CACTI									
1. Ball cactus	*Coryphantha vivipara*	P	N	—	L	L	M	—	—
2. Bigroot pricklypear	*Opuntia humifusa*	P	N	—	L	L	M	—	—
3. Brittle cactus	*Opuntia fragilis*	P	N	—	L	L	M	—	—
4. Plains pricklypear	*Opuntia polyacantha*	P	N	—	L	L	M	—	—
SEEDED PASTURE AND HAY PLANTS[9]									
1. Alfalfa	*Medicago sativa*	P	I	—	H	H	H	—	—
2. Alsike clover	*Trifolium hybridum*	B-P	I	—	H	M	H	—	—
3. Birdsfoot trefoil	*Lotus corniculatus*	P	I	—	H	M	H	—	—
4. Creeping foxtail	*Alopecurus arundinaceus*	P	I	C	H	M	L	R	—
5. Crested wheatgrass	*Agropyron cristatum*	P	I	C	H	M	M	B	—
6. Cicer milkvetch	*Astragalus cicer*	P	I	—	H	H	H	R	—
7. Intermediate wheatgrass	*Thinopyrum intermedium*	P	I	C	H	M	M	R	—
8. Orchardgrass	*Dactylis glomerata*	P	I	C	H	M	M	B	—
9. Red Clover	*Trifolium pratense*	B-P	I	—	H	M	H	—	—
10. Redtop bent	*Agrostis stolonifera*	P	I	C	M	M	L	R	—
11. Russian wildrye	*Psathyrostachys juncea*	P	I	C	H	M	M	B	—
12. Smooth brome	*Bromus inermis*	P	I	C	H	M	M	R	—
13. Tall fescue	*Schedonorus arundinaceus*	P	I	C	H	M	L	B	O
14. Tall wheatgrass	*Elymus ponticus*	P	I	C	M	H	M	B	—
15. Timothy	*Phleum pratense*	P	I	C	H	M	M	B	—
GRASS-LIKE PLANTS (SEDGES AND RUSHES)									
1. Horsetails	*Equisetum* spp.	P	N	C	L	L	L	R	R
2. Sedges	*Carex* spp., *Cyperus* spp.	P	N	C	M	M	M	V	—
3. Threadleaf sedge	*Carex filifolia*	P	N	C	M	L	L	B	—
4. Needleleaf sedge	*Carex eleocharis*	P	N	C	M	L	L	R	—
5. Rushes	*Juncus* spp.	P	N	C	L	H	L	V	—

1 Life Span: P = perennial, B = biennial, A = annual.
2 Origin: N = native to North America, I = introduced.
3 Season of Growth: W = warm-season, C = cool-season.
4 Livestock Forage: Considers growth form, production, abundance, regrowth potential, and palatability; H = high, M = medium, L = low.
5 Wildlife Habitat: A general rating for that species with regards to providing cover and shelter for major wildlife groups, including big game, small mammals, upland gamebirds, and songbirds; H = high, M = medium, L = low.
6 Wildlife Food: A general rating for that species with regards to providing food for major wildlife groups, including big game, small mammals, upland gamebirds, and songbirds; H = high, M = medium, L = low.
7 Growth Form: B = bunch, R = rhizomatous, S = stoloniferous, V = variable (some species are rhizomatous, others are not).
8 Poisonous: Level or danger of poisoning is highly variable with growth stage, type of animal, age of animal, condition of animal, and associated forage plants. H = highly poisonous, O = occasionally poisonous, R = rarely poisonous (usually nitrate accumulators), and — = not poisonous.
9 This group of plants are all introduced species that may be found growing in association with native plants. They are important because they can contribute to the productivity of the site for haying and grazing.

Table 2. Guide for determining similarity index (MLRA 60A)

Maximum Percent in reference plant community by Ecological Sites

MLRA 60A	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:										
Alkali sacaton					40				5	
Big bluestem	10	10	5	40				10	35	
Blue grama	10	20	10	5	5	10	15	15		
Bluejoint reedgrass										25
Buffalograss	5	5	5	5				5		
Canada wildrye				5					5	
Foxtail barley				*	5				5	5
Green needlegrass	40	5	15	10				5		
Hairy grama		5				5		10		
Indian ricegrass						*	*			
Inland saltgrass				*	20				5	
Little bluestem	5	35	5	*	5	20	15	20		
Marsh muhly									5	
Needleandthread	5	15	20	5		10	20	15		
Northern reedgrass										10
Plains bluegrass					10					
Plains muhly		5						5		
Porcupinegrass	5	5								
Prairie cordgrass									20	55
Prairie junegrass	5	5	5	*		5	*	5		
Prairie sandreed		5		5		30	35	10		
Reed Canarygrass										5
Sand bluestem						40	15			
Sand dropseed				5	10	5	5			
Sand lovegrass						*	5			
Sandberg bluegrass	5	5	*	*			*			
Scribner rosette grass							*			
Sideoats grama	20	20	10	5				10		
Slender wheatgrass				10	10				10	5
Switchgrass				20	15	5	5		15	5
Thickspike wheatgrass	50									
Western wheatgrass	50	15	30	30	20	10	5	15	10	5
Other Perennial Native Grasses[1]	5	5	15	15	15	5	5	10	25	30
GRASS-LIKES:										
Threadleaf sedge							10			
Sedge Family (other)	5	10	10	5	10	5	5	10	10	35
FORBS:										
Native Perennial Forbs	10	15	10	15	5	10	10	10	10	10
SHRUBS:										
Native Shrubs	10	10	10	10		10	5	10	10	5

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 3. Guide for determining similarity index (MLRA 63B)

Maximum Percent in reference plant community by Ecological Sites

MLRA 63B	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Shallow
GRASSES:					
Big bluestem	15	35	25	45	30
Blue grama	10	5	5		5
Buffalograss	10	10			5
Canada Wildrye		5		5	
Green needlegrass	25	10	25	20	25
Hairy grama					5
Indiangrass		5	15	10	5
Little bluestem	10	25	15	15	25
Marsh muhly				5	
Needleandthread	5	10	20		25
Plains muhly	5		10		5
Porcupinegrass	10	10	20	10	25
Prairie junegrass	5	5	5	5	5
Prairie sandreed		5			10
Sand dropseed	5	5			
Scribner rosette grass	5	*	5	*	*
Sideoats grama	10	15	15	10	15
Slender wheatgrass	5		10	5	5
Switchgrass		10	15	15	5
Tall dropseed	5	5	5		
Western wheatgrass	45	10	25	15	10
Other Perennial Native Grasses[1]	15	25	15	10	10
GRASS-LIKES:					
Threadleaf sedge					5
Sedge Family (other)	5	5	5	10	
FORBS:					
Native Perennial Forbs	10	10	10	10	10
SHRUBS:					
Native Shrubs	5	5	10	5	5

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 4. Guide for determining similarity index (MLRA 64)

Maximum Percent in reference plant community by Ecological Sites

MLRA 64	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Loess Breaks	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:											
Alkali sacaton						40				5	
Big bluestem	10	10	5	45	10			30	10	25	
Blue grama	10	20	15	5		5	10	15	15		
Bluejoint reedgrass											25
Buffalograss	5	5	5	5					5		
Canada wildrye				5	15					5	
Foxtail barley						5				5	5
Green needlegrass	40	5	10	5	10			5	5		
Hairy grama		5			5		5	5	10		
Indiangrass										15	
Inland saltgrass						20					
Little bluestem	10	30	5	5	5	5	15	30	15	15	
Marsh muhly				5	20					5	
Needleandthread	15	15	25	10			10	25	15		
Northern reedgrass											15
Plains muhly			*		10				5		
Porcupinegrass	15	5			10				5		
Prairie cordgrass				*						15	55
Prairie junegrass	5	5		*	5			*	5		
Prairie sandreed					5		40	30	10		
Sand bluestem							25	35			
Sand dropseed				5		10	10	5			
Sand lovegrass							*	5			
Sandberg bluegrass		5		5							
Sandhill muhly							5				
Scribner rosette grass							*	5			
Sideoats grama	15	20	10	*	10			5	20		
Slender wheatgrass				5		10				10	5
Switchgrass				15		15	5	10		15	
Western wheatgrass	50	15	30	35	5	20		10	15	10	
Other perennial native grasses[1]	25	5	10	10	30	15	5	5	5	10	10
GRASS-LIKES:											
Sedge Family	5	10	10	10	5	10	10	5	15	10	35
FORBS:											
Native Perennial Forbs	15	15	15	10	10	5	10	10	10	10	20
SHRUBS:											
Native Shrubs	10	10	10	5	20		5	10	5	5	10

*This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 5. Guide for determining similarity index (MLRA 65)

Maximum Percent in reference plant community by Ecological Sites

MLRA 65	Choppy Sands	Loamy Upland	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:								
Alkali sacaton			40					
Big bluestem		25			10		50	
Blowoutgrass	5							
Blue grama	5	20	5	10	10	15		
Bluejoint reedgrass								25
Buffalograss		5						
Foxtail barley			5				*	
Green needlegrass		10						
Hairy grama	5			5		10		
Indian ricegrass	*			*	5			
Indiangrass	5	10		5	10		30	
Inland saltgrass			20					
Little bluestem	25	25	5	25	20	10	25	
Marsh muhly							5	
Needleandthread	10	15		10	10	15	10	
Northern reedgrass								25
Perennial threeawn		5						
Plains bluegrass			10				*	10
Plains muhly		5						
Porcupinegrass	5	5		*		5	5	
Prairie cordgrass								45
Prairie junegrass	5	5		5	5	5	15	
Prairie sandreed	25			30	25	20		
Purple lovegrass					5			
Sand bluestem	35			40	35	30		
Sand dropseed	5	5	10	5	5	10		
Sand lovegrass	15			10	5			
Sand paspalum					5			
Sandhill muhly	5			5				
Scribner rosette grass	5			5	5			
Sideoats grama		15			5	5	5	
Slender wheatgrass			10					10
Switchgrass	15	10	15	15	10		15	
Western wheatgrass		20	20		5		10	
Other Perennial Native Grasses[1]	10	10	20	5	15	10	5	25
GRASS-LIKES:								
Threadleaf sedge		10						
Sedge Family (other)	5	10	15	5	5	5	10	35
FORBS:								
Native Perennial Forbs	10	10	5	10	10	5	10	10
SHRUBS:								
Native Shrubs	10	10		5	10	15	5	5

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 6. Guide for determining similarity index (MLRA 66)

Maximum Percent in reference plant community by Ecological Sites

MLRA 66	Choppy Sands	Limy Upland	Loamy Upland	Loamy Overflow	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:										
Alkali sacaton					40					
Big bluestem		30	20	40			30	10	40	
Blowoutgrass	10									
Blue grama	5	10	10		5	10	10	20		
Bluejoint reedgrass										20
Buffalograss	5		5					5		
Canada wildrye				*				5	5	
Foxtail barley					5				5	5
Green needlegrass		5	30	15				10		
Hairy grama	5	5				10	5	10		
Indian ricegrass							5			
Indiangrass	10	10	10	5		15	15	5	20	
Inland saltgrass					20					
Little bluestem	25	30	15	18	5	25	25	25	20	
Marsh muhly				5					5	5
Needleandthread	10	10	20			15	20	20	5	
Northern reedgrass										20
Plains bluegrass					10				5	10
Plains muhly		5	5					10		
Porcupinegrass	10	5	10	5		10	5	15	5	
Prairie cordgrass									10	70
Prairie junegrass	5	5	5	*		5	5	5		
Prairie sandreed	25	5				35	30	20		
Purple lovegrass		5					5	5	5	
Sandberg bluegrass		5								
Sand bluestem	40			*		40	35	25		
Sand dropseed	5		*		10	5	5	10		
Sand lovegrass	20					15	5			
Sand paspalum	5					5	5			
Sandhill muhly	10									
Scribner rosette grass	5	5	*	*		5	5	*		
Sideoats grama		15	10	10			5	25	10	
Slender wheatgrass				5	10				5	10
Switchgrass	25	5	10	10	15	20	20	5	15	
Tall dropseed			*	5				5		
Western wheatgrass		10	25	20	20		5	10	5	
Other perennial native grasses[1]	10	10	10	10	15	5	5	5	10	15
GRASS-LIKES:										
Threadleaf sedge		10	10					10		
Sedge Family (other)	5	5	5	10	15	5	10	5	20	30
FORBS:										
Native Perennial Forbs	5	10	10	10	5	10	10	10	10	10
SHRUBS:										
Native Shrubs	5	1	10	5		10	5	15	5	5

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 7. Guide for determining similarity index (MLRA 67A)

Maximum Percent in reference plant community by Ecological Sites

MLRA 67A	Choppy Sands	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Loess Breaks	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:												
Alkali sacaton							45				5	
Big bluestem					15	15				5	25	
Blowoutgrass	5							5				
Blue grama	5	10	25	15	10	10		10	15	20		
Bluejoint reedgrass												25
Buffalograss		5	5	5	5	5				10		
Foxtail barley							5				5	5
Green needlegrass		25	5	10	15					5		
Hairy grama	5					10		5		5		
Indian ricegrass	5			5				10	10	5		
Indiangrass					5						15	
Inland saltgrass							15					
Little bluestem	15	5	15	10	10	25	5	20	20	20	20	
Needleandthread	15		20	30	15	10		30	40	25		
Northern reedgrass												15
Plains bluegrass							15					
Plains muhly			5			10				5		
Prairie cordgrass											15	55
Prairie junegrass	5	5	5	5	5	5		5	5	5		
Prairie sandreed	45		5		5	10		40	30	10		
Reed canarygrass												5
Sand bluestem	30							40	15	5		
Sand dropseed	5		5			5		5	5	5		
Sand lovegrass	10							5				
Sand paspalum	5											
Sandberg bluegrass		5	5	5	5		15			5		
Sandhill muhly	5							5				
Sideoats grama			15	5	5	20			5	10		
Slender wheatgrass					5		10				10	5
Switchgrass	10				5		5	10			10	
Tall dropseed												
Western wheatgrass		50	10	25	40	10	15		10	25	10	
Other perennial native grasses[1]	10	5	5	15	15	10	35	5	20	25	25	10
GRASS-LIKES:												
Threadleaf sedge		5	15	5	5	10			10	15		
Sedge Family (other)	5		5			5	10	5	5	5	10	35
FORBS:												
Native Perennial Forbs	10	15	15	15	10	10	10	10	15	15	10	10
SHRUBS:												
Native Shrubs	15	10	10	10	10	10	5	10	15	5	10	10

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 8. Guide for determining similarity index (MLRA 71)

Maximum Percent in reference plant community by Ecological Sites

MLRA 71	Choppy Sands	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Loess Breaks	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:											
Big bluestem	10	20	30	25	50	20			20	40	
Blue Grama	5	10	10	10	5	5	5	10	5		
Bluejoint reedgrass											20
Buffalograss	5	5	5	5	5						
Canada wildrye			*	*	*	*					
Foxtail barley					5					5	5
Green needlegrass		10	5	5					20		
Hairy Grama	5		5			*	5	5			
Indiangrass	10	5	10	10	15	5	10	5		20	
Little bluestem	25	25	35	25	30	35	25	25	15	25	
Marsh muhly										5	5
Needleandthread	10	10	10	10	5		10	15	10	5	
Northern Reedgrass											20
Perennial threeawn								5	5		
Porcupinegrass	10	5	5	5	5		10	5		5	
Prairie cordgrass										10	40
Prairie junegrass	5	5	5	5	*	*	5	5			
Prairie sandreed	25					5	30	25			
Purple lovegrass										5	
Reed canarygrass										5	5
Sand bluestem	40						35	35			
Sand dropseed	5	5	5	5			5	5			
Sand lovegrass	20						10	10			
Sand paspalum	5							5			
Sandhill muhly	10						5				
Scribner rosette grass	5	5	5	5	5	*	5	5	5		
Sideoats grama		10	15	15	10	20		5	20	10	
Slender wheatgrass	25									5	10
Switchgrass		5	5	10	10	5	20	15		15	
Tall dropseed			5	5	5	5					
Western wheatgrass		30	10	15	10	*	5	5	5	5	
Other perennial native grasses[1]	10	10	5		5	20	5	10	5	10	
GRASS-LIKES:											
Sedge Family (Other)			5	5	*	*	5	5	5	10	15
Threadleaf Sedge						5			15		
FORBS:											
Native Perennial Forbs	10	10	10	10	10	10	10	10	10	10	5
SHRUBS:											
Native Shrubs	5	5	5	5	5	5	5	5	5	5	

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 9. Guide for determining similarity index (MLRA 72)

Maximum Percent in reference plant community by Ecological Sites

MLRA 72	Choppy Sands	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Loess Breaks	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated
GRASSES:											
Alkali sacaton		5					35				
Big bluestem			15	*	30	15				15	30
Blowoutgrass	5										
Blue Grama	10	30	20	25	10	10	5	10	20	10	
Buffalograss		5	5	10	5	5	5		*	5	
Canada wildrye					5		5				10
Green needlegrass		20	10	15	10	10				5	
Hairy Grama	10		5			5		5	*	5	
Indian ricegrass	*	*						*	*	*	
Indiangrass	10				5			15	5	5	15
Inland saltgrass							15				
Little bluestem	10		30	*	15	30	5	15	10	20	20
Marsh muhly											5
Needleandthread	10		10	15	15	5		10	10	5	5
Plains muhly			5			5			*	5	
Prairie cordgrass							5				15
Prairie junegrass	5	*	5		5	*		*	*	*	
Prairie sandreed	25					5		15	30	5	
Sand bluestem	30							30	20		10
Sand dropseed	5	*		*	5	*		5	5	5	
Sand lovegrass	5							5			
Sand paspalum	5							*			
Sandberg Bluegrass							5				
Sandhill muhly	5							*			
Scribner rosette grass	*				5			*			5
Sideoats grama		5	25	*	15	20			5	20	10
Slender wheatgrass							10				5
Switchgrass	10		5	*	5		15	15	10	10	15
Tall dropseed		*				*		*			
Western wheatgrass		40	20	30	40	15	25	*	5	10	10
Other perennial native grasses[1]	10	10	5	5	10	10	25	5	5	5	15
GRASS-LIKES:											
Threadleaf sedge			5			5				5	
Sedge Family (Other)	*	5	5		5	5	10	5	5	5	15
FORBS:											
Native Perennial Forbs	10	15	15	15	10	10	5	15	15	15	15
SHRUBS:											
Native Shrubs	10	15	15	15	5	15		15	15	10	5

* This plant occurs at 1-2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 10. Guide for determining similarity index (MLRA 73)

Maximum Percent in reference plant community by Ecological Sites

MLRA 73	Choppy Sands	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Loess Breaks	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:												
Alkali sacaton							35					
Big bluestem		25	30	30	35	20				35	40	
Blowoutgrass	10											
Blue grama	10	15	15	15	10	10	5	5	20	15		
Bluejoint reedgrass												20
Buffalograss	5	5	5	5	5	5	5		5	5		
Canada wildrye		5	5	*							5	
Foxtail barley							5				5	5
Green needlegrass					5							
Hairy grama	5		5			10		*	*	5		
Indian ricegrass									*			
Indiangrass	10	5	10	10	10	5		15	5	5	20	
Inland saltgrass							15					
Little bluestem	25	20	35	25	25	35	5	15	15	45	25	
Marsh muhly											5	5
Needleand thread	10		10	10	10	10		10	15	15	5	
Northern reedgrass												20
Plains bluegrass		*					10				5	10
Plains muhly			5	5		10			*	5		
Porcupinegrass	10					5						
Prairie cordgrass											15	45
Prairie junegrass	5		5	5	5	5			*	5	5	
Prairie sandreed	30					5		15	35	15		
Purple lovegrass									*	*		
Reed canarygrass											5	5
Sand bluestem	40							30	20			
Sand dropseed	5	*	5		5	5	5	5	5	5		
Sand lovegrass	20							5				
Sand paspalum	5							*		5		
Sandhill muhly	10											
Scribner rosette grass	5			5	5	5				5	5	
Sideoats grama		20	20	20	10	20		5	15	15	10	
Slender wheatgrass							10				5	10
Switchgrass	25	10	5	10	15	5	15	15	10	5	15	
Tall dropseed		*	5					*		*		
Western wheatgrass		10	10	20	40	10	15	*	5	5	5	
Other perennial native grasses[1]	10	10	10	5	10	10	10	5	5	5	15	
GRASS-LIKES:												
Sedge Family (other)	15	*	5	5	5	5	15	5	5		20	15
Threadleaf sedge			10	5	10	10			5	5		
FORBS:												
Native Perennial Forbs	5	15	10	10	10	10	5	10	15	15	15	5
SHRUBS:												
Native Shrubs	5	5	5	5	5	10		5	5	5	5	

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 11. Guide for determining similarity index (MLRA 75)

Maximum Percent in reference plant community by Ecological Sites

MLRA 75	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:										
Alkali sacaton					25					
Big bluestem	40	35	35	40				25		
Blue grama	5	10	10	5	10	10	10	5		
Bluejoint reedgrass										20
Buffalograss			5	5				*		
Foxtail barley					5					
Green needlegrass		5							5	5
Hairy grama	5	5				5	5			
Indiangrass	10	10	15	15		10	10	5	20	
Inland saltgrass					10					
Little bluestem	30	40	25	30		25	25	30	25	
Marsh muhly									5	5
Needleandthread	*	10	*	5		10	15	10	5	
Northern reedgrass									5	20
Perennial threeawn							5			
Plains bluegrass					10				5	10
Plains muhly	5	5	5					*		
Porcupinegrass	*	10	*	5		15	10	5	5	
Prairie cordgrass									10	40
Prairie junegrass	*	5	*	*		5	5	*	5	
Prairie sandreed		5				30	25			
Purple lovegrass						5	5		5	
Reed canarygrass									5	5
Sand bluestem						35	35			
Sand dropseed						5	5			
Sand lovegrass						15	10			
Sand paspalum						5	5			
Sandberg bluegrass		5								
Sandhill muhly						5				
Scribner rosette grass	*	5	5	5		5	5	5	5	
Sideoats grama	*	15	10	10			5	15	10	
Slender wheatgrass		10							5	15
Switchgrass	10		10	10	15	20	15	5	15	
Tall dropseed	10		*	5				*		
Western wheatgrass	*	10	10	10	25		5	5	5	
Other perennial native grasses[1]	5	10	5	5	10	10	10	5	10	10
GRASS-LIKES:										
Sedge Family (other)		5	*	*	15	5	5	*	10	15
Threadleaf sedge		10								
FORBS:										
Native Perennial Forbs	10	10	10	10	5	10	10	10	10	5
SHRUBS:										
Native Shrubs	5	10	5	5		5	5	10	5	

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not on this list.

Table 12. Guide for determining similarity index (MLRA 102c)

Maximum Percent in reference plant community by Ecological Sites

MLRA 102C	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Loess Breaks	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:											
Alkali sacaton						25					
Big bluestem	35	30	30	35	20				30	40	
Blue grama	10	10	10		5	10	10	10	5		
Bluejoint reedgrass											20
Buffalograss	5	5	5								
Canada wildrye		5	5	5	5					5	
Foxtail barley						5				5	5
Green needlegrass	10		5						20		
Hairy grama	5	5			5		5	5	5		
Indiangrass	10	10	10	10	10		10	10	10	20	
Inland saltgrass						10					
Little bluestem	30	35	30	20	35		25	25	35	20	
Marsh muhly											5
Needleandthread	10	5	10		5		15	15	10	*	
Northern reedgrass											20
Perennial threeawn								5	5		
Plains bluegrass						10					10
Plains muhly	5	5			10						
Porcupinegrass	10	10	15		5		10	5		5	
Prairie cordgrass										10	40
Prairie dropseed	5										
Prairie junegrass	5	5	5	5	5		5	5	5	*	
Prairie sandreed					5		30	25			
Purple lovegrass	5		5				5	5	5		
Reed canarygrass										5	5
Sand bluestem							35	35			
Sand dropseed						5	5	5			
Sand lovegrass							15	10			
Sand paspalum							5	5			
Sandhill muhly							5				
Scribner rosette grass	5	5	5	5	5		5	5	5	*	
Sideoats grama	10	40	15	10	20			5	20	10	
Slender wheatgrass						10			10		15
Switchgrass	10	10	10	15	5	15	20	15		15	
Tall dropseed	10	5	5	5	5						
Western wheatgrass	30	5	10	20		25		5	5	5	
Other perennial native grasses[1]	10	10	15	5	5	10	10	10	10	15	10
GRASSLIKES:											
Threadleaf sedge									15		
Sedge Family (other)	5	10	10	10	10	15	5	5	5	10	15
FORBS:											
Native Perennial Forbs	10	10	10	10	10	5	10	10	10	10	5
SHRUBS:											
Native Shrubs	10	5	10	5	10		5	5	10	5	

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not listed.

Table 13. Guide for determining similarity index (MLRA 106)

Maximum Percent in reference plant community by Ecological Sites

MLRA 106	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Saline Subirrigated	Sandy	Shallow	Subirrigated	Wetland
GRASSES:									
Big bluestem	40	35	40	35			30	45	
Blowoutgrass									
Blue grama	5	5	5	5	10	5	5		
Bluejoint reedgrass									20
Buffalograss	*		*				5		
Canada wildrye	5		5	5			5		
Foxtail barley					5			5	5
Green needlegrass							*		
Hairy grama	*	5	5				5		
Indian ricegrass									
Indiangrass	15	10	15	25		10	10	20	
Inland saltgrass					10				
Little bluestem	30	40	30	20		25	35	20	
Marsh muhly								5	5
Needleandthread	*						5		
Northern reedgrass									20
Plains bluegrass					10			5	10
Plains muhly			5						
Porcupinegrass	10	10	10	*		10	5	5	
Prairie cordgrass				5				10	25
Prairie junegrass	*	5	5	*		5	5	5	
Prairie sandreed						15			
Purple lovegrass	5		5			5	5	5	
Reed canarygrass								5	5
Sand bluestem						20			
Sand dropseed						5			
Sand lovegrass						10			
Sand paspalum						5			
Scribner rosette grass	*	5	3			5	5	5	
Sideoats grama	5	10	10	5			25	10	
Slender wheatgrass					10			5	15
Switchgrass	10	10	10	10	15	10	10	10	
Tall dropseed	5	5	5	5			5		
Western wheatgrass	*	5	5	15	25		5	5	
Other perennial native grasses[1]	5	10	20	10	10	10	15	10	10
GRASSLIKES:									
Sedge Family	5	5	10	5		10	5	10	
FORBS:									
Native Perennial Forbs	10	10	10	10	10	10	10	10	10
SHRUBS:									
Native Shrubs	5	5	10	5		5	10	5	5

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Perennial native grasses listed above with no entry may be included as well as other perennial native grasses not listed.

Table 14. Guide for determining similarity index (MLRA 107B)

Maximum Percent in reference plant community by Ecological Sites

MLRA 107B	Clayey	Limy Upland	Loamy Upland	Loamy Overflow	Loess Breaks	Saline Subirrigated	Sands	Sandy	Shallow	Subirrigated	Wetland
GRASSES:											
Big bluestem	35	35	35	50	25				30	45	
Blue grama	5	5	5			10	5	5	5		
Bluejoint reedgrass											20
Foxtail barley						5				5	5
Hairy grama	5	5			5				5		
Indiangrass	10	10	10	10	10		10	10	10	20	
Inland saltgrass						10					
Little bluestem	30	40	30	20	30		20	25	35	20	
Marsh muhly										5	5
Northern reedgrass											20
Plains bluegrass										5	10
Porcupinegrass	10	10	15		5		15	10		5	
Prairie cordgrass										10	25
Prairie dropseed	5		5								
Prairie junegrass	5	5	5	5	5		5	5	5	5	
Prairie sandreed							20	15			
Purple lovegrass	5		5				5	5	5	5	
Reed canarygrass										5	5
Sand bluestem							30	20			
Sand dropseed							5	5			
Sand lovegrass							10	10			
Sand paspalum							5	5			
Scribner rosette grass	5	5	5	5	5		5	5		5	
Sideoats grama	5	10	10	5	10				10	10	
Slender wheatgrass						10				5	15
Switchgrass	10	10	10	15	5	15	15	10		10	
Tall dropseed	10	5	5	5	5						
Western wheatgrass		5	5	15	5	25			5	5	
Other Perennial Native Grasses[1]	10	10	10	10	10	10	10	10	10	10	10
GRASSLIKES:											
Sedge Family (other)	5	5	10	10	5	15	5	5	5	10	15
FORBS:											
Native Perennial Forbs	10	10	10	10	10	5	10	10	10	10	5
SHRUBS:											
Native Shrubs	10	5	5	5	5		5	5	10	5	

* This plant occurs at 1–2% of the plant community in the reference plant community. Include this plant with "Other Perennial Native Grasses" at no more than 2%.

[1] Native Perennial grasses listed above with no entry may be included as well as other native perennial grasses not on this list.

Table 15. Stocking rate calculations for the ranch problems in Examples 1 and 2 (Figures 20 and 21)

Example 1		
LIVESTOCK FORAGE REQUIREMENT CALCULATION:		
150 Cow-Calf pair × 1.5 AU/pair	225 AU	
6 bulls × 1.5 AU/bull	9 AU	
225 AU × 5 Months	1125 AUM	
9 AU × 2 Months	18 AUM	
Total	1143 AUMs required for livestock	

FORAGE AVAILABLE CALCULATION:

RANGE SITE	**ACRES**	**AUM/AC**
CS	120	.5
Sa	1200	.7
	600	.4
CS	120 ac × .5 AUM/ac	60 AUMs
Sa	1200 ac × .7 AUM/ac	840 AUMs
	600 ac .4 AUM/ac	240 AUMs
Total	1920 ac	1140 AUMs available for live-stock and wildlife

15% of forage for wildlife

1140 AUMs–(.15 × 1140 AUMs) = 969 AUMs available for livestock

Difference: 1140–969 = 171 AUMs (greater than 10%)

DECREASE STOCKING RATE

Example 2		
LIVESTOCK FORAGE REQUIREMENT CALCULATION:		
210 pair × 1.5 AU/pair	315 AU	
6 bulls × 1.5 AU/bull	9 AU	
315 AU × 5 Months	1575 AUM	
9 AU × 2 Months	18 AUM	
Total	1593 AUMs required for livestock	

FORAGE AVAILABLE CALCULATION:

RANGE SITE	**ACRES**	**AUM/AC**
CS	120	.5
Sa	1800	.7
CS	120 ac × .5 AUM/ac	60 AUMs
Sa	1800 ac × .7 AUM/ac	1260 AUMs
Total	1920 ac	1320 AUMs

Rotation Grazing will allow 20% more forage to be used with proper stocking, so:

1320 × 1.2 = 1584 AUMs available for livestock.

Difference between needed and available AUMs: 1593–1584 = 9 AUMs

Since the difference is less than 10%, KEEP STOCKING RATE THE SAME.

Table 16. Two suggested judging contest rotation schedules.

Letters refer to groups of contestants

Suggestion 1 (Accommodates 4 groups of contestants)								
Time Period	**Station 1:** *Plants 1–6*	**Station 2:** *Plants 7–12*	**Station 3:** *Plants 13–18*	**Station 4:** *Plants 18–24*	**Station 5:** *Ecological Site* / *Sim. Index* / *Use*	**Station 6:** *Ecological Site* / *Sim. Index* / *Use*	**Station 7:** *Ecological Site* / *Sim. Index* / *Use*	**Station 8:** *Ranch Problem*
1st	A & E	B & F	C & G	D & H				
2nd	B & F	A & E	D & H	C & G				
3rd	C & G	D & H	A & E	B & F				
4th	D & H	C & G	B & F	A & E				
5th	All groups stay in place for Station 9–Test Questions							
6th					A & E	B & F	C & G	D & H
7th					B & F	A & E	D & H	C & G
8th					C & G	D & H	A & E	B & F
9th					D & H	C & G	B & F	A & E

Suggestion 2 (Accommodates 8 groups of contestants)								
Time Period	**Station 1:** *Plants 1–6*	**Station 2:** *Plants 7–12*	**Station 3:** *Plants 13–18*	**Station 4:** *Plants 18–24*	**Station 5:** *Ecological Site* / *Sim. Index* / *Use*	**Station 6:** *Ecological Site* / *Sim. Index* / *Use*	**Station 7:** *Ecological Site* / *Sim. Index* / *Use*	**Station 8:** *Ranch Problem*
1st	A	B	C	D	E	F	G	H
2nd	B	A	D	C	F	E	H	G
3rd	C	D	A	B	G	H	E	F
4th	D	C	B	A	H	G	F	E
5th	All groups stay in place for Station 9–Test Questions							
6th	E	F	G	H	A	B	C	D
7th	F	E	H	G	B	A	D	C
8th	G	H	E	F	C	D	A	B
9th	H	G	F	E	D	C	B	A

* Stations 8 and 9 can be combined or Station 9 can be run as a separate station with the entire group of contestants staying at their current location and given the test questions at one time following the fourth time period, allowing about 10 minutes for test completion. Test sheets must be distributed to all stations to hand out at the appropriate time if the test is given to all contestants after the fourth time period.

Stations 1–4 (Plants): Range Judging Scorecards will be turned in after Time Periods 2 and 4.

Stations 5–9 (Range Sites and Problems): All five time periods are located on one scorecard, turn in scorecard upon completion. Groups will be provided an appropriate range condition guide; this must be handed in before rotation to Stations 1–4.

Table 17. Ribbon distribution for Area, State, and Old West Regional Contests

	Purple	*Blue*	*Red*	*White*	*Green*	*Area*	*State*	*Old West Regional*
INDIVIDUAL								
Junior Youth	1	1	1	1	Awarded to 25% of the youth contestants*			
Senior Youth	1	1	1	1				
Adult		1	1	1				
Grand Champion Youth						1	1	1
Grand Champion Adult						1	1	1
TEAM (4 INDIVIDUAL/TEAM)								
Junior Youth	4	4	4	4				
Senior Youth	4	4	4	4				
GRAND CHAMPION TEAM						**4**	**4**	**4**
Total	12	12	12	12		6	6	6

*Calculated as follows: Total number of youth contestants × 25% minus (-) the individuals receiving purple, blue, red, and white ribbons (any fraction rounded to the next highest number).

Table 18. Worksheet for Determining Similarity Index

MLRA _____ *Ecological Site*_____ **LIST OF PLANTS PRESENT**	*Percent of each species (dry weight) in total forage yield*	*Percent allowed toward Similarity Index score (from MLRA plant tables)*	*Percent applied to Similarity Index*
		TOTAL:	

Table 19. Animal Unit Equivalent

Animal unit equivalent (AUE) is a number relating the forage dry matter intake of a particular kind or class of animal relative to one animal unit (AU). One approach is to use the standard of 1 AU = 1,000 lb of animal weight. The AUE for a 1,200 lb dry cow, for example, would be 1.2. For a 1,200 lb cow with a 200 lb calf (1,400 lb total), the AUE would be 1.4. For this cow-calf pair estimate, it is noted that the forage intake by the calf is not likely to be in the same proportion by weight to the cow, but the cow forage intake is typically higher because of lactation. The following table provides approximate AUEs for different kinds and classes of animals. When animal weights are known, the preferred method for calculating AUE is taking the average weight divided by 1,000.

Kind/Class of Animal	AUE
CATTLE	
Cow (1,200 lb) and calf (300 lb)	1.50
Replacement heifers (24–36 months)	1.00
Yearling cattle (18–24 months)	0.80
Yearling cattle (12–17 months)	0.70
Weaned calves (under 12 months)	0.50
Bulls (24–60 months)	1.50
HORSES	
Yearlings	0.75
Two-year-old horses	1.00
Mature light horses	1.25
SHEEP	
Sheep (mature)	0.20
Lamb (weaned to yearling)	0.12
Lamb (yearling)	0.15
Ram	0.25
GOATS	
Goat (mature)	0.15
Kid (yearling)	0.10
WILDLIFE	
Deer (white-tailed, mature)	0.15
Deer (mule, mature)	0.20
Antelope (mature)	0.20
Bison (cow, mature)	0.90
Bison (bull, mature)	1.50
Bison (herd average)	1.20
Elk	0.60

Table 20: General Contest Rules and Instructions (to be read to contestants prior to contest)

- You are a guest on this land so be respectful of the landowner.
- Make certain that you have three scorecards and make certain that your name, contestant number, and school are written on all three scorecards.
- No talking during the contest is allowed. This means no talking from the time you get off the bus at the contest site until the contest is completed and all scorecards have been turned in. If you do not observe this rule, your scorecards will be pulled by the station judge or your group leader.
- Transfer all answers from handouts to the scorecards. Only the scorecards will be scored. Other materials will be handed in but not scored.
- Even though you are a member of a team, you are expected to do your own work. Do not compare answers with other contestants.
- No clipboards are allowed on the contest site.
- No calculators are allowed on the contest site.
- No cell phones are allowed on the contest site.
- No keeper scorecards, notes pages, or other methods of recording answers for later use are allowed. Instructors may be allowed to keep a copy of all contest materials handed out at the site.
- Use only pencil or black or blue pens.
- Do not write anything on any part of the scorecards except your answers. The presence of notes or other handwritten information on the scorecards will result in disqualification of the contestant.
- Notes or math calculations may be written on the ecological site guide, similarity index worksheet, ranch problem handout, and/or question handouts.
- The time allowed at each station is 10 minutes.
- Do not touch the flagged plants. You may touch or pick unmarked plants in the area to help in plant identification.
- There are multiple examples of each plant flagged; please spread out among the plants. You may look at all of the flagged plants to assist with identification.
- Each station will have a station judge; if you have questions about which plant is flagged or other questions about the station, please ask the station judge.
- Your group leader will lead you from station to station. Stay with your leader and do not move from station to station until directed to by your group leader.

RANGE JUDGING CARD A - PLANT IDENTIFICATION #1-12

Contestant Name/Number _____ Total Maximum Points 132

Team (or School)_____ Points Lost _____

Place the appropriate plant name & the appropriate letter for plant characteristics in the space below for each plant.
Plant Names are worth 5 points each, Plant Characteristics (columns B – G) are worth 1 point each. Score _____
Illegible answers will be scored as incorrect for that response. ·Only one response per column is allowed.

	A	B	C	D	E	F	G
	Plant Name (Write in name)	Life Form G = Grass F = Forb GL = Grass-like S = Shrub Ca = Cactus	Life Span A = Annual B = Biennial P = Perennial	Origin I = Introduced N = Native	Season of Growth (Grass or Grass-like Only) C = Cool-season W = Warm-season	Livestock Forage Value H = High M = Medium L = Low	Growth Form (Grasses Only) B = Bunch S = Stolon R = Rhizomatous
EX	Bluejoint Reedgrass	G	P	N	C	M	R
	Station 1						
1							
2							
3							
4							
5							
6							
	Station 2						
7							
8							
9							
10							
11							
12							

RANGE JUDGING CARD B - PLANT IDENTIFICATION #13-24

Contestant Name/Number _____ Total Maximum Points 132

Team (or School)_____ Points Lost _____

Place the appropriate plant name & the appropriate letter for plant characteristics in the space below for each plant.
Plant Names are worth 5 points each, Plant Characteristics (columns B – G) are worth 1 point each. Score _____
Illegible answers will be scored as incorrect for that response. ·Only one response per column is allowed.

	A	B	C	D	E	F	G
	Plant Name (Write in name)	Life Form G = Grass F = Forb GL = Grass-like S = Shrub Ca = Cactus	Life Span A = Annual B = Biennial P = Perennial	Origin I = Introduced N = Native	Season of Growth (Grass or Grass-like Only) C = Cool-season W = Warm-season	Livestock Forage Value H = High M = Medium L = Low	Growth Form (Grasses Only) B = Bunch S = Stolon R = Rhizomatous
EX	Bluejoint Reedgrass	G	P	N	C	M	R
	Station 3						
13							
14							
15							
16							
17							
18							
	Station 4						
19							
20							
21							
22							
23							
24							

RANGE JUDGING CARD C – ECOLOGICAL SITES, RANCH MAP AND WRITTEN QUESTIONS

Total Maximum Points 310

Contestant Name/Number _____

Points Lost_____

Team (or School) _____

Score_____

Station 5-7 – Ecological Sites

	Ecological Site Name* (20 pts. ea.)	Similarity Index* (20 pts. ea.) Full Credit ± 10%	Degree of Use** (10 pts. ea.) Full Credit ± 10%
Station 5		%	%
Station 6		%	%
Station 7		%	%

* *See the back of card for Ecological Site and Similarity Index Information.*

** *Degree of Use –An estimate of the amount of forage removed expressed as a percentage (air dry weight) of the clipped plot compared to the unclipped plot.*

Station 8 – Ranch Map

Part 1.	Stocking Rate for Livestock			
Total possible pts. 50	Forage Resources (10 pts. ea.)		Select One (20 pts.)	
	Available AUM's	AUM's	Decrease Stocking Rate	
	Needed AUM's	AUM's	No Change	
	Difference in AUM's	AUM's	Increase Stocking Rate	

Part 2. To improve value or use for livestock production and/or wildlife habitat, mark YES or NO for each practice (5 pts. ea.). Total possible pts. 60	YES	NO
A. Change Salt/Mineral Locations----------		
B. Prescribed Burning----------		
C. Limit Livestock Access to Water----------		
D. Build Livestock Dam Or Dugout----------		
E. Install Or Relocate Well or Pipeline ----------		
F. Control Brush or Weeds----------		
G. Reseed Depleted Rangeland or Farmland-----		
H. Divide Pasture (cross fence)----------		
I. Initiate Rotational Grazing System----------		
J. Initiate Rest-rotation Grazing System---------		
K. Change Season of Grazing----------		
L. Non-Use After Wildfire, Severe Drought, Severe Hail or Grasshopper Infestations----------		

Station 9 – Written Questions

(5 pts. ea.)
Total Possible Pts. 50

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Range Judging Card C (reverse side)
Ecological Site Descriptions

1. WET LAND — Poorly drained. Water table within 36 inches of the soil surface.
2. SUBIRRIGATED — Water table within 10-60 inches of the surface during major part of growing season
3. SALINE SUBIRRIGATED — Subirrigated lands affected by salt/alkali accumulation (near surface).
4. LOAMY OVERFLOW — Receive additional water from stream overflow or run-in.
5. SANDS — Loamy sands, sands or coarse sands on gently sloping to rolling hills and uplands or on stream terraces or bottomlands. Dark layer at surface is < 6" thick.
6. SANDY — Fine sandy loam or fine sands on nearly level to moderately steep slopes or on flat valleys between choppy or rolling sandhills. Dark layer at surface is > 6" thick.
7. LOAMY UPLAND — Loams, silt loams, and silts on nearly level to steep slopes.
8. CLAYEY — Clay loams, silty clay loams, and clays.
9. CHOPPY SANDS — Sands on steep, irregular slopes; cat-steps are characteristic.
10. LIMY UPLAND — Sandy loams, silt loams, loams and silty clay loams. Calcareous (limy) in the surface soil.
11. SHALLOW — All soils 0-20 inches deep over rock, shale, or coarse gravel.
12. LOESS BREAKS — Silt loam on very steep, rough broken slopes.

Stocking Rate should be adjusted as needed any time the difference between required AUM's and available AUM's is greater than 10%. This consideration should be made after any adjustments for wildlife habitat needs as described in each individual Ranch Problem.

Extension is a Division of the Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln cooperating with the Counties and the United States Department of Agriculture.