

1960

EC60-131 The Nebraska Handbook of Range Management

Donald F. Burzlaff

Follow this and additional works at: <http://digitalcommons.unl.edu/extensionhist>

Burzlaff, Donald F., "EC60-131 The Nebraska Handbook of Range Management" (1960). *Historical Materials from University of Nebraska-Lincoln Extension*. 3490.

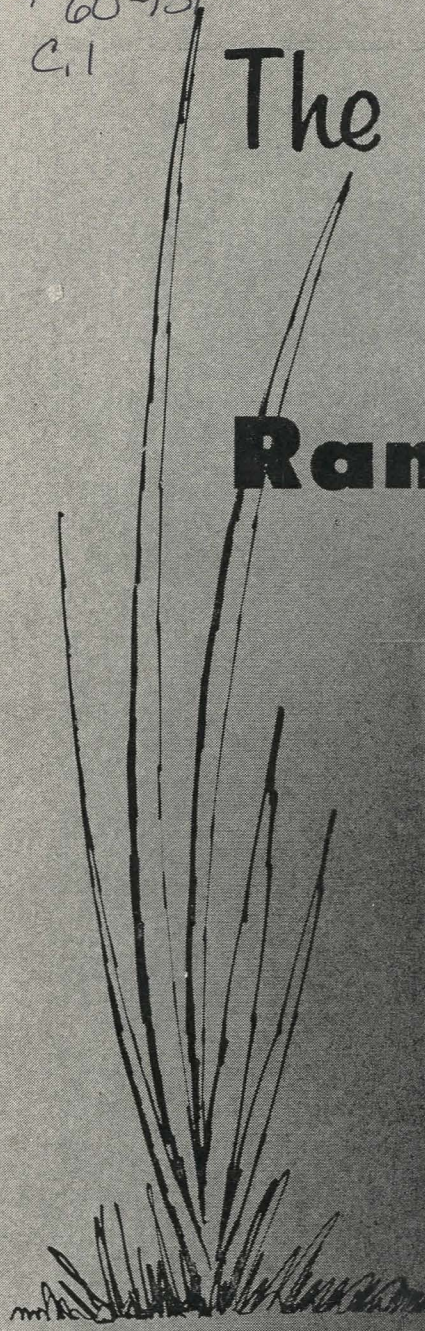
<http://digitalcommons.unl.edu/extensionhist/3490>

This Article is brought to you for free and open access by the Extension at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Historical Materials from University of Nebraska-Lincoln Extension by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

AGRI
S
85
E7
#60-131
C.1
EC 60-131

F 113
E.C. 60-131

The Nebraska Handbook of Range Management



RECEIVED
OCT 19 1972
C. Y. THOMPSON
LIBRARY

EXTENSION SERVICE
UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE
AND U. S. DEPARTMENT OF AGRICULTURE
COOPERATING
E. F. FROLIK, DEAN E. W. JANIKE, DIRECTOR

CONTENTS

Preface.....	2
Range—To Have and Use.....	3
What is Range Management?.....	4
Know Your Range.....	5
Plant Parts.....	7
Utilization of Grazing Lands	12
Range Condition Classes.....	13
Rounding-Up Your Range Plan.....	17
Range Improvement Practices.....	19
The 4-H Project.....	23
List of Plants.....	26
Glossary.....	27
Range Management Terms.....	27
Appendix.....	28

Issued January 1961—10M

PREFACE

The American Society of Range Management was created in 1947 to foster advancement in the science and art of grazing-land management. In 1954, Floyd Larsen, president of the society, appointed a committee to help national, state, and local youth organizations gain more knowledge of range management.

The committee developed a basic manual, "Range, Its Nature and Use," in 1957. Material used in the manual was presented in a logical sequence from basic principles to practical application.

Material that is presented in this circular is reproduced, to a large extent, from "Range, Its Nature and Use." The contents have been modified and adapted to meet the basic needs of the range industry in Nebraska.

The circular is intended for use by 4-H club members and leaders, who will find it a handy reference for both the introductory and advanced range management projects. It will serve, too, as a text for courses of study in range management that may be developed for Vocational Agriculture instruction.

The work of the Committee for Cooperation with Youth Organizations and the material provided by the American Society of Range Management are gratefully acknowledged.

Donald F. Burzlaff,
Extension Agronomist (Range Management)
University of Nebraska

NEBRASKA HANDBOOK OF RANGE MANAGEMENT

By Donald F. Burzlaff

RANGE—TO HAVE AND USE

What is Range?

Range is an extensive area of level, rolling, broken or mountainous land, usually not adapted to cultivation. It is covered with native grasses and other forage plants best suited for grazing of domestic and wild animals. Range may be privately or publicly owned, fenced or unfenced, and supporting a native or reseeded vegetation.

Does Range Concern Me?

Yes, each of us has a "steak" in the range, since it is the major grazing area of our meat supply (Fig. 1). It is also important in the production of wool and leather products, as a source of water, wildlife and many kinds of recreation. It is just as important for the non-user of rangelands to promote its conservation and maintenance for future use as it is for the person operating and living on the range.

Way Back When

Our range is one of our most valuable natural resources and has played a major role in the settlement and prosperity of western United States.

No story of the range is complete without a review of the livestock industry, which is a product of our range. The first cattle and sheep were brought into what is western United States by the Spanish explorer, Coronado, in 1540. With a favorable climate and an abundance of forage, cattle numbers increased rapidly. The range states of the west were well suited for cattle, sheep and horses.

More cattle moved west with the discovery of gold. The northern railroads offered outlets for cattle and large trail drives began about 1866. Cattle on the trail drives averaged 15 to 20 miles per day and gained weight from eating the abundant grasses along the trail. Some of the most famous trails were the Chisholm, Shawnee, Dodge City, Sedalia, Goodnight, California, and National. Cattle numbers increased steadily from 1864 to 1884, causing a heavy drain on our native forage supplies.

Nebraska contributed its share to the history of the range industry. The Dodge City trail ended at Ogallala. Cattle moved from this shipping point to markets in eastern United States.

During this period the Nebraska Sandhills were recognized as an important cattle-producing area. Livestock lost or abandoned along the trail were found fat and sleek the following spring. Trail herds held over for shipment at a later date gained well on the tall, nutritious grasses of the rolling hills. Settlement of the area by cattlemen was assured.

During the severe winter of 1885 and 1886, thousands of cattle died on the range. The next year the

Great Plains had a severe drought, again reducing cattle numbers. The drought, shortage of range forage, and falling prices reduced cattle numbers still more.

In the years following the decline of cattle numbers, the sheep-raising industry increased rapidly. The presence of the sheepman, with his large flocks and migrant habits, was resented by the cattlemen. Many range wars were fought between cattlemen and sheepmen. Eventually, the sheepman was recognized as a permanent part of the livestock industry of the west.

By the early 1900's our range forage supply on western and northern range was depleted seriously. There was also an increased demand for livestock products. These things caused cattle numbers to increase in eastern and southern states. Old cotton fields were reseeded to grass and legume pastures. Native pastures in the south were improved. Today southern range states are supporting large numbers of cattle and represent a challenge to the Western livestock producer.

The stock grower, then, was among the early frontiersmen of western America. Grazing was the primary use made of public lands for many years. With the increase in population after the turn of the century an increased demand for use of western lands arose. The settler ploughed many acres of grassland and planted field crops. The settler was encouraged by numerous government-sponsored land disposal measures.

The most important of these land-disposal measures were the Homestead acts. The first Homestead Act was passed in 1862. This law gave land in 160-acre tracts to settlers following a five years' residence upon the land. Most of the productive lands of the Middle West were in private ownership by 1870.



Figure 1. Each of us has a "steak" in the range. Photo courtesy of Rolling Stone Ranch.

The 160-acre provision in the Homestead Act was inadequate for settlement of the semi-arid regions of the West. The Enlarged Homestead Act was passed in 1909. This act increased the size of the homestead to 320 acres in nine western states. The residence requirement was lowered to three years by the Three-Year Homestead Act of 1912.

The Stock-Raising Homestead Act of 1916 was designed to settle far-western lands not suited to cultivation. Stockmen were given 640 acres of land under this act. This section was supposed to furnish forage enough to carry 50 head of cattle. This, too, proved to be too small and less than half of the homesteads were patented during the first 12 years of the act.

The use of many grazing lands has created competition between interests of various groups. The increase in population has created a greater demand for meat and other animal products. More people have more leisure time for recreation. They are demanding restricted use of the land for grazing and the consequent development of recreational facilities. Many of our grazing lands are the source of water for domestic, industrial, and agricultural uses. These things have brought about the need for a closer look at our range resources. The private stockman, as well as the public, has a real opportunity and a real need to plan for cooperative range use.

The depletion of our range resources has contributed to some of the serious soil and water erosion problems of our nation and state. Not only has improper land use resulted in the loss of valuable soil and water, but also there has been loss of life and property.

While these factors are serious, there is much about which to be optimistic. Many ranchers know the importance of careful range management and are practicing it. Many thousands of acres of private rangeland are being reseeded. Native meadows and irrigated pastures are being made to produce two to three times more hay. The various government agencies are working to restore much of the public rangeland to a good, healthy condition.

How Much Range do We Have?

There are nearly one billion acres of rangeland in the United States. Most of it is in the 17 western range states. The western range area contains more than 700 million acres.

Rangelands are important because of the tremendous land area devoted to grazing. Though far removed in most instances from the centers of population, the condition and productivity of the range influences every American citizen.

Nebraska Range Resource

In Nebraska there are approximately 24 million acres of land devoted to production of forage for grazing animals (Fig. 2). Every county in Nebraska has some rangeland. The sandhills represent the largest undivided expanse of grassland in the United

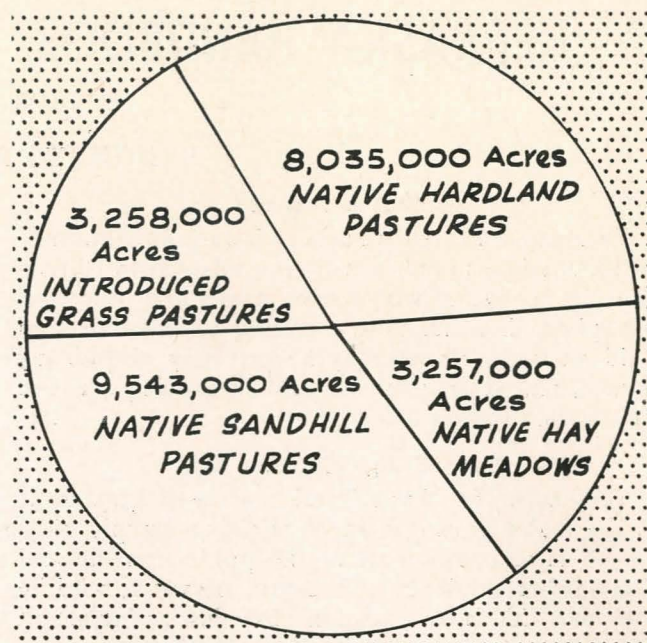


Figure 2. Nebraska's range resource.

States. Here are 12 million acres devoted to the production of forage for grazing livestock within a climatic zone that usually supports a more intensified type of agriculture. This phenomenon is the result of one factor—the soil.

There were 4½ million head of cattle in Nebraska in 1957.¹ These cattle obtained all or part of their forage from the state's grazing lands. Of this number 1,400,000 were beef cows two years of age or older.

WHAT IS RANGE MANAGEMENT?

Range management is the care and use of range-land to get the highest continuous yield of animal products without endangering the range, soil, and water resources and other important uses of the land. This is in keeping with conservation of the range. Animal products of the range are meat, wool, mohair and hides. Other important range products are water, wildlife and recreation.

Have you noticed when stockmen sell their products, they are paid for the pounds and not for the number of head sold? Pounds of products are the most meaningful measure of a range management plan (Fig. 3).

The goals of range management are:

1. Keep our range covered with good forage plants.
2. Maintain a range feed reserve.
3. Increase livestock and wildlife products.
4. Reduce and control the flow of water from rangelands.
5. Control soil erosion on the range watersheds.

¹Nebraska Agricultural Statistics—Beef Cattle, State Division of Agricultural Statistics, 1957.

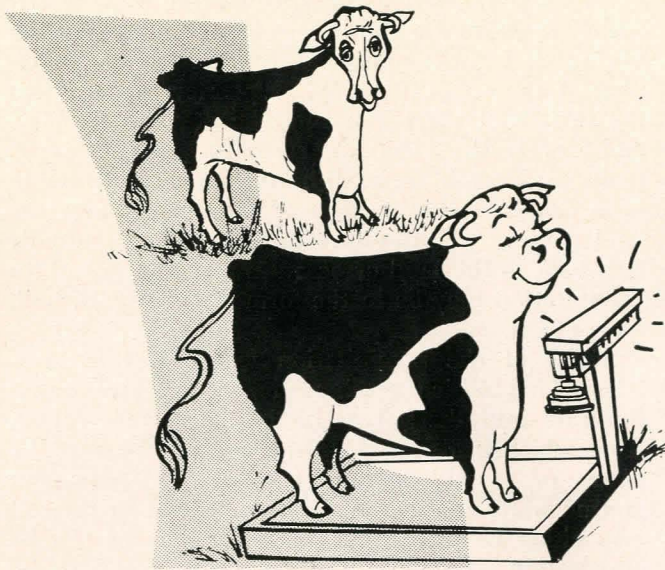


Figure 3. It's pounds that count.

What are Opportunities in Range Management?

The day has passed when a man could take a horse, rope, and a branding iron and start in the ranching business. Yet, in spite of the large amount of capital required to become a ranch owner-operator, such an objective can still be accomplished. The first step is to be prepared—increase your knowledge of the basic principles of range management. Experience in the application of these principles is of great value.

Range management is a profession for the young man who likes to spend much of his time out of doors. It offers satisfying opportunities for those who like to work with nature—who want to understand the response of plants and animals to changes in their environment.

Opportunities exist in plant and animal research at colleges and universities of the western states. The various state and federal agencies employ range managers to perform technical and educational services in range management. There is an expanding field in the profession of teaching range management.

KNOW YOUR RANGE

You can keep the range healthy and productive by knowing the plants and animals that live there and how to manage them. Plants and animals live together as a "community." When livestock or game animals graze changes take place in the plant community. To be a successful range manager you must recognize the changes in the plant community that result from grazing. You must be able to determine why the change took place and whether or not this change is desirable.

To understand and evaluate rangeland, you must have a practical knowledge of soils, plants, water, and climate. Each of these factors will be discussed in relation to Nebraska range.

The Soil

There are many kinds of soils. Each differs in depth, slope, texture, and structure. These are called the physical features of a soil.

Soil Depth

Soil depth is the thickness of the soil above the parent material (material from which soils are made). It takes millions of years to change bare rock into rich, fertile soil that will support plants and animals. As the soil is formed, it is deposited in layers. The upper layer is called the topsoil. The second layer is the subsoil. Below the subsoil is the layer from which soils are formed. It is called parent material.

It takes about 500 years to form one inch of soil from bedrock. It is important that we conserve the fertile topsoil of our ranges. Overgrazing results in bare soil surfaces. Wind and water erosion of valuable topsoil is a result of poor range management.

Soil Texture

Soil texture refers to size of the soil particles. There are four common soil textures: gravel, sand, silt, clay. Gravel is the particle of largest size. Clay is the name of the smallest soil particle.

Our soils usually are a mixture of the different sized soil particles. The name given the soil is based on the size particle that is most abundant. For example, a very fine sandy loam means that the texture was principally silt and clay with a considerable amount of very fine sand. A loamy fine sand would be a soil consisting of mostly fine sand with some silt and clay. Most of the fine-textured soils are more productive than the coarse-textured soils. This is because the fine-textured soils have a higher water-holding ability and a higher level of fertility.

Soil Structure

Soil structure refers to the manner in which soil particles are grouped together. In most of our soils we find groups of different sized particles cemented together like grains of a popcorn ball. These "popcorn balls" of soil are called soil aggregates. The most productive range soils are well aggregated. When soils are well aggregated, air can move freely and rapidly through them. Such soils also take in water rapidly. Well-aggregated soils aid in the prevention of wind and water erosion.

Slope

Slope of land may vary from flat to slightly rolling. It may refer to steep hills or mountains. The degree or amount of the slope is expressed as a percentage figure. For example, a 20 percent slope is much steeper than a 6 percent slope. The steeper the slope, the more rapidly erosion is apt to take place. The direction of the slope will influence the kind of range plants that grow on the soil. Soils on south-facing slopes produce different kinds and amounts of forage than is produced on north-facing slopes. These differences in vegetation are a result of

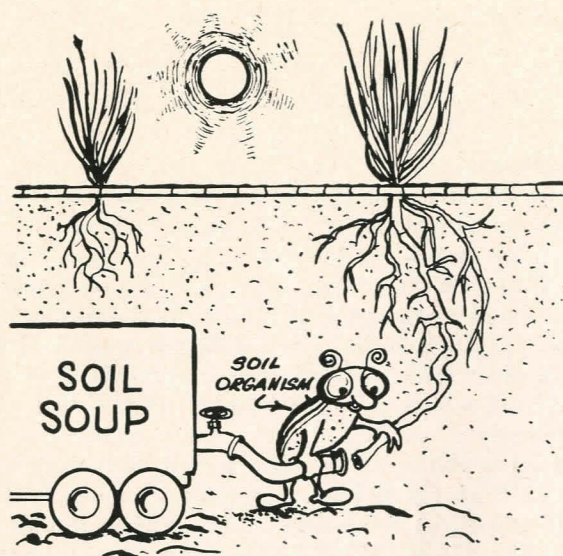


Figure 4. Living soil organisms make plant nutrients available.

the higher temperatures and unfavorable soil moisture conditions that occur on south slopes as compared to north slopes.

Organic Matter

Organic matter of soils is composed of the dead and decaying plant and animal material. Leaves and stems of range plants dry and drop to the ground. This dry plant material is called mulch. The mulch protects the soil against wind and water erosion. The plant materials break up, decay, and become a part of the soil. Roots of plants also die and contribute organic matter to the soil. Millions of little living plants and animals called soil organisms are found in the soil. These organisms are constantly breaking the organic matter into nutrients which can be used by the range plants (Fig. 4). Usually, the more organisms in the topsoil, the better will be forage production of our range.

To keep range soils productive for years to come, we must return something to the soil to help keep it fertile. At the end of the grazing season, some dry vegetation should be left on the range.

This remaining vegetation also helps reduce erosion and increases water penetration. When grazing animals remove too much of the vegetation, expensive soil conservation practices such as terraces, pitting, furrows, dams, and reseeding are needed to hold the soils in place.

Water for Plants

Water is the factor which most commonly limits production on rangelands. Water is needed by plants for growth. When range plants receive enough water, they produce plenty of forage for animals. When there is a shortage of water, all plant and animal life suffers.

Have you heard about the natural water cycle? Although cycles are continuous and actually have no beginning, we will consider the water cycle as beginning at the ocean (Fig. 5). Water evaporates from the surface of the ocean into the atmosphere. The moisture is lifted by air currents. As the warm, moist air rises it cools. The moisture condenses to form clouds. Air currents move the clouds over the land masses. The moisture in the clouds eventually falls back to the land or ocean as precipitation. This precipitation may be in the form of rain, snow, hail, fog, or sleet.

Some of the precipitation will evaporate as it falls. That which reaches the ground will either infiltrate into the soil or be lost as surface runoff. That which infiltrates into the soil will be used by plants or it will become part of the permanent ground water supply. Water that is held in the soil may either be used by plants or it may be lost by evaporation. Water is lost to the atmosphere by plants through a process called transpiration.

That water which is lost by surface runoff is of great importance to the range manager. This runoff could be used by range plants to produce forage. Instead, it not only is lost to the plant, but is carrying away valuable topsoil as well.

The wise range manager looks for ways to reduce surface runoff of water. He has found that one of the best methods of reducing this loss is to maintain a vigorous cover of range plants. The cover of vegetation protects the soil from the erosive force of the falling raindrop. The plants and litter slow down the movement of water over the surface. This permits more water to soak into the soil. A good cover of plants and litter also will reduce losses due to evaporation of moisture from the soil.

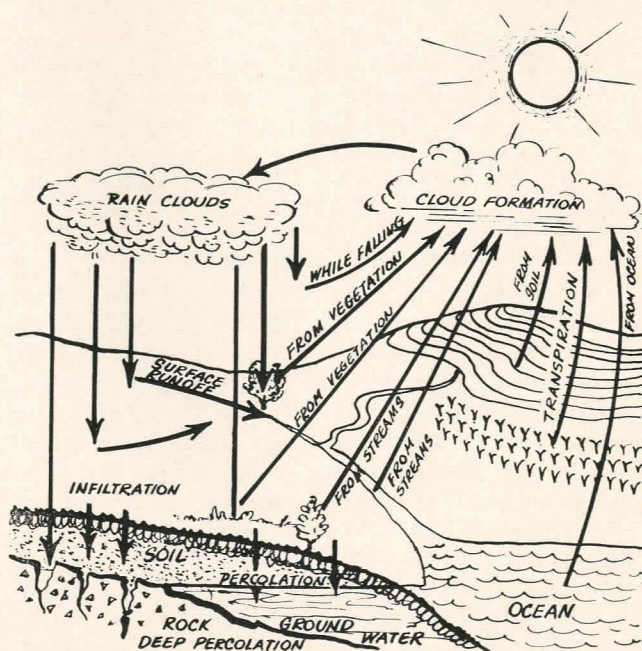


Figure 5. Water cycle (Page 42, 1955 Yearbook of Agriculture)

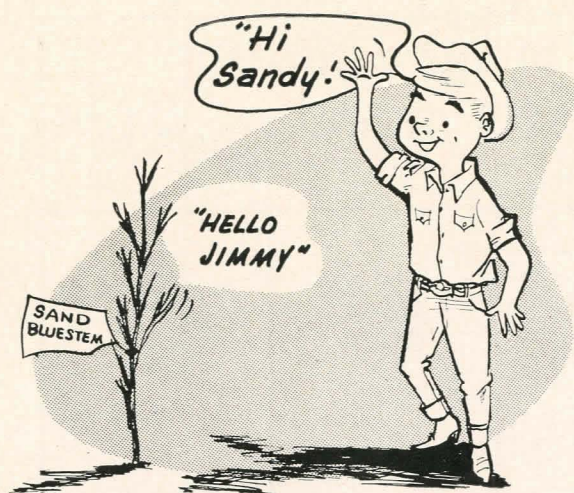


Figure 6. Know your plants—they are your friends.

Range Plants

It is important that the rancher become familiar with the plants growing on his ranges. He should not only know them by name, but recognize their importance as forage producing plants (Fig. 6).

Plants tell you what kind of range you have. Each plant helps to tell the story. The presence or absence of certain plants in the range tells how the range has been used and what should be done to improve or to maintain it.

There are hundreds of different plants on our Nebraska rangeland. You do not need to know all of them. You should be familiar with species that furnish the most forage for livestock on your ranges. As a general rule, there will be 15 to 30 species in any one range area that will be of outstanding importance. You need to know all details of managing them so they can be made to produce the most livestock and livestock products.

Range plants are so numerous and so different in their forms and growth habits that they should be grouped for convenience in management. There are four important kinds of plants: grasses, grass-like plants, forbs, and shrubs (Fig. 7).

Grasses

Plants with jointed stems. Stems are usually hollow. Leaves are in two rows on the stem. Veins in the leaves are parallel. These are the most important of range plants. Examples are switchgrass, western wheatgrass, big bluestem, and downy brome.

Grass-like Plants

These look like grasses but have solid stems which are often triangular. There are no joints or nodes on the stems of these plants. The veins of the leaves are parallel. Examples of grass-like plants include threadleaf sedge, needleleaf sedge, Nebraska sedge, and the baltic rush.

Forbs

Forbs are plants with annual stems (tops) and net-like veins in the leaves. Sometimes these plants

are called "weeds." In Nebraska we prefer to call them "forbs" because many of them provide valuable forage for livestock. Examples are the perennial sunflower, dotted gayfeather, silverleaf scurfpea, and fringed sage.

Shrubs

These are plants with woody stems which live over from one year to the next. Usually, the plants branch out from near the base of the plant. Examples include sand sagebrush, wild rose, leadplant amorpha, and yucca.

In addition to being classified on the basis of their life form or growth habits, plants are also grouped in other ways:

Annual plants live only one season. They do not grow a second year from roots or crowns.

Biennial plants live two years.

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

Native plants are those which have always grown or have originated within the United States.

Introduced plants are those which have been brought in from outside the United States.

Cool-season plants make their principal growth during the cool weather in the spring and late fall.

Warm-season plants generally make their principal growth during the frost-free period and develop seed in the late summer or early fall.

PLANT PARTS

Plants are like people—each is an individual. Some of these individuals may be similar in appearance; some will be very dissimilar. Even those that are similar in appearance have some characteristics by which we recognize them as individuals. Each plant species has some part or characteristic which makes it different from all other plants. As grass is the most important kind of range plant, we will first learn its parts and then compare it to other plants.

Grass plants have leaves, stems, roots, and flowers (seed heads). To tell one grass from another, you must know the names of the main parts and their differences on different grasses (Fig. 8).

Roots have no joints, no leaves, and no flowers. The growing part of the root is at the tip. Main functions of the root are to take water and minerals from soil to stems and to anchor plants.

The **stem** is made up of nodes (joints) and internodes (area of stem between the joints). The stem is usually hollow, but sometimes has pith in the center similar to corn. The main function of the stem is to transport water and minerals from the roots to the leaves and manufactured food from the leaves to the roots.

Rhizomes are actually creeping, underground stems with joints and leaf-like scales. You may have seen prairie sandreed or western wheatgrass rhizomes producing a new plant. Rhizomes store food that is







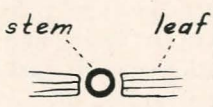

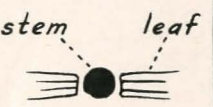


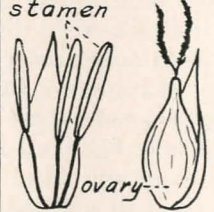








IMPORTANT RANGE PLANT GROUPS					
	GRASSES	GRASSLIKE		FORBS	SHRUBS
		Sedges	Rushes		
STEMS	 <p>Jointed Hollow or Pithy</p>	 <p>Solid Not Jointed</p>	 <p>Solid</p>	 <p>Solid</p>	 <p>growth rings Solid</p>
LEAVES	 <p>Parallel Veins</p>  <p>Leaves on 2 sides of stem</p>	 <p>Leaves on 3 sides of stem</p>	 <p>Leaves on 2 sides of stem; rounded</p>	 <p>"Veins" are netlike</p>	
FLOWERS	 <p>(floret)</p>	 <p>stamen ovary male female (may be combined)</p>		 <p>Usually showy</p>	
EXAMPLE	 <p>Western Wheatgrass</p>	 <p>Threadleaf Sedge</p>	 <p>Wire Rush</p>	 <p>Yarrow</p>	 <p>Big Sagebrush (twig)</p>

Figure 7. Important kinds of range plants.

PARTS of GRASS PLANTS

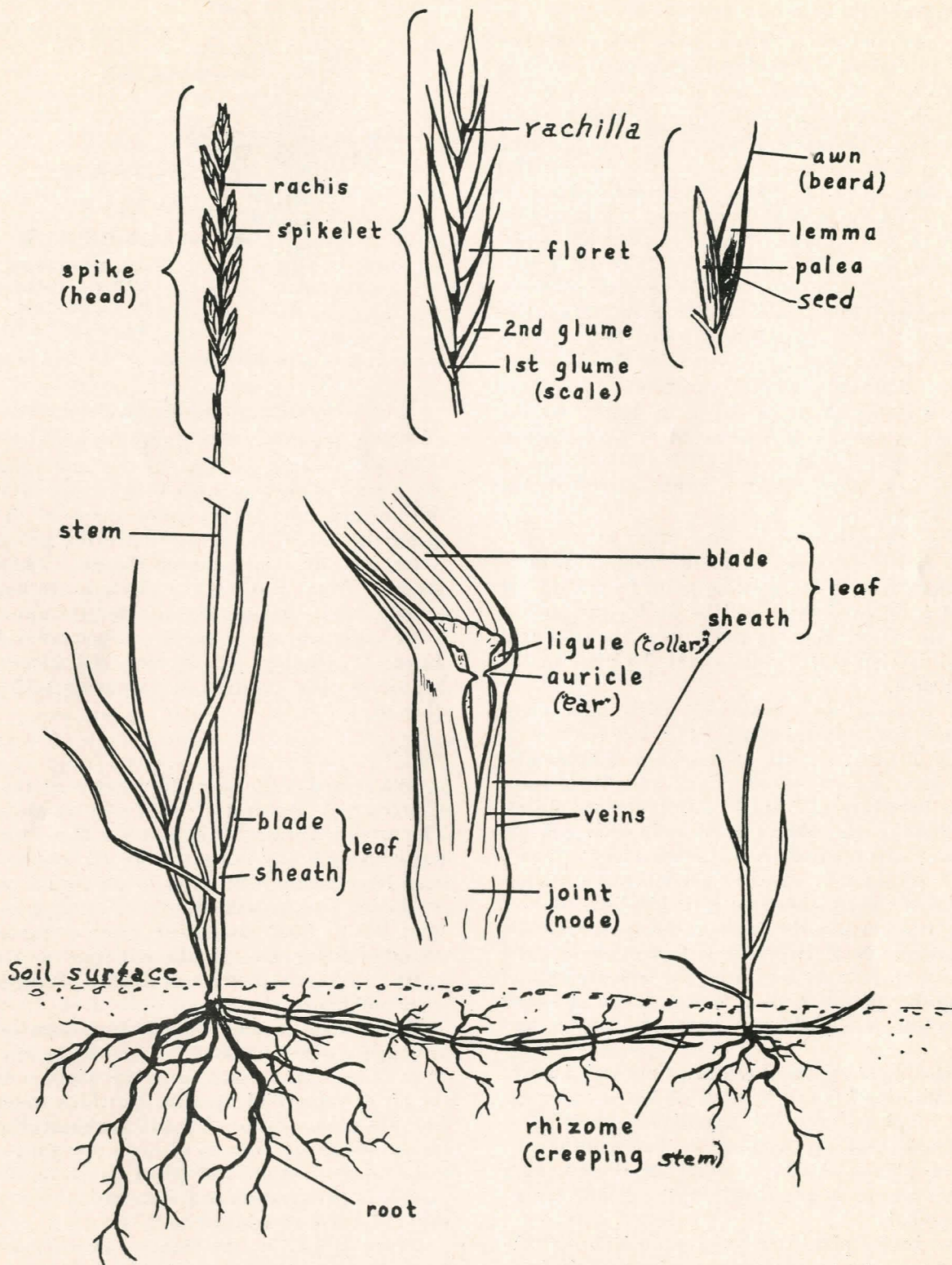


Figure 8. Parts of grass plants.

manufactured in the leaves and also reproduce new plants.

Stolons are above-ground stems. The runner of the strawberry plant is a stolon. The stolon reproduces new plants and stores food. Buffalograss is a common Nebraska grass that has stolons.

Above-ground parts of the grass plant may be divided into vegetative and flowering parts. Vegetative parts include the stems and leaves of the plant.

At each node on the stem, there is a **bud** which may produce a branch or remain dormant. The **leaf** also arises from a bud at the node of the stem. The leaf is made up of two parts: the **sheath** which fits closely around the stem and the broad expanded portion known as the **blade**. These two parts are joined together at the **collar**. On the inside of the collar, next to the stem, is a small leaf-like projection known as the **ligule**. The ligule may be a membrane-like structure or it may be a tuft of hairs. Some grasses have two ear-like tips or projections on the outside of the collar. These tips are called **auricles**.

The growing point of the grass leaf is at the collar and at the base of the sheath. If a grass leaf is grazed before it is fully developed it will continue to grow. If it is fully developed when grazed it will not continue to grow.

The terminal bud or growing point of the grass plant is close to the surface of the ground. Seldom do livestock remove the growing point by grazing. If the bud is removed there will be no further elongation of the shoot. Buds at the base of the stem will begin to develop new shoots to take the place of the original stem.

The reproductive (flowering) parts of a plant are called the **inflorescence**. The inflorescence is made up of many smaller units known as **spikelets**. At the base of each spikelet there are two leaf-like bracts called **glumes**. A single grass flower is a **floret**. When there is more than one floret in each spikelet, each floret is supported on a short stem known as a **rachilla** (ray-kill-ah). Each of these florets at maturity produces a **seed**. The seed is enclosed by two leaf-like bracts known as the **lemma** and the **palea**. In many grasses, such as wheatgrass, the lemma and palea remain with the seed after the seeds ripen and fall. In other grasses, such as sand dropseed and sand lovegrass the seed falls free from the lemma and palea.

If the different parts of the plant are well known, an identification key can be used. A key is an organized list of plants arranged according to their structure. Plant keys are helpful in determining the names of plants. A key to some of the common Nebraska grasses is presented in the Appendix of this handbook.

If you have a plant that you cannot identify, take it to your county agent, your vocational agriculture instructor, or to your local Soil Conservation Service technician.

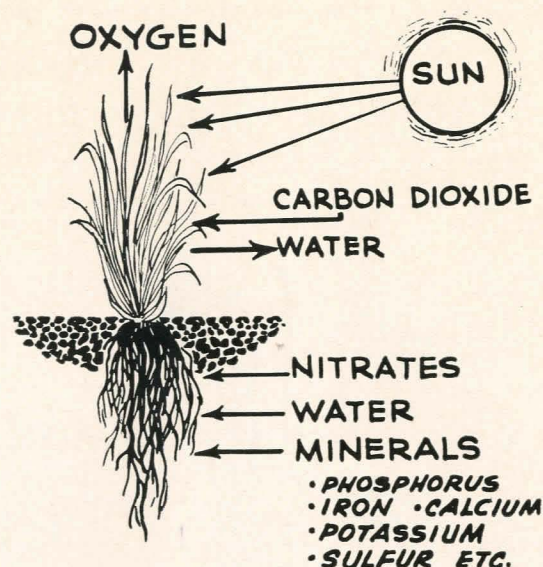


Figure 9. How grass obtains materials for food manufacture.

How Plants Live and Produce

Range plants are living organisms which require food, air, water, and light to live and produce. A green grass plant is nature's food factory. For power, this factory uses energy from the sun. The raw materials it uses in its manufacturing processes are water, air, and minerals from the soil. The finished product from this factory include carbohydrates (energy food) and protein (needed for growth). Its waste products are oxygen, carbon dioxide, and water. Let's follow, step by step, the materials used by the world's greatest food manufacturing plant (Fig. 9).

Water

Water makes up 70 to 90 percent of the weight of green grass and from 8 to 25 percent of dry grass. The young, tender leaves contain more water and nutrients than any other part of the plant. Grasses need large amounts of water to produce a pound of dry forage. In the semi-arid areas, range grasses need from 300 to 1,000 pounds of water to produce one pound of dry forage. Shrubs and trees need 1,700 to 2,400 pounds to produce a pound of twigs, bark, wood and leaves.

Most of the water is absorbed through the roots, although a small amount is taken in by the leaves. Most of the water taken in by the plant is lost into the air as vapor. The process by which water is lost from the plant as vapor is called **transpiration**. The process of transpiration in plants is thought to control temperatures within the plant much as does the process of perspiration and evaporation from the outside surfaces of the animal body.

Water is used by the plant as a carrier or solvent in the movement of nutrients into and throughout the plant. It also serves as a nutrient, because it is known to unite with other substances to form impor-

tant foods. The process by which water unites with carbon dioxide to form carbohydrates is called **photosynthesis**.

Air

Carbon dioxide taken from the air is the next most important element needed for plant growth. The plant breathes the carbon dioxide through **stomata** (small pores) on the under side of the green leaves. Inside the plant cells the carbon dioxide, together with other elements, is made into starches, sugars, fats, and protein. The grass plants take in carbon dioxide and give off oxygen.

Nitrogen is an essential element for plant growth. Air contains about 80 percent nitrogen. Most plants cannot use nitrogen as it exists in the air. Before they can use it the nitrogen must be changed to a form that can be taken up by the plant. Most plants take up nitrogen in the form of ammonia. Decaying plant and animal material in the soil is one source of ammonia for the growing plants. Another common source of nitrogen to the growing plant are so-called "nitrogen fixing" bacteria that live on the nodules of the roots of legume plants. These bacteria are able to convert nitrogen from the air into a form that can be used by the plant. This is one reason why it may be important to maintain legumes on our native rangelands.

Essential Mineral Elements

Many mineral elements have been found in plants. It is not known if all of them are necessary for plant growth. Eleven minerals are required for normal plant growth. These are calcium, phosphorus, iron, potassium, sulfur, magnesium, manganese, zinc, boron, copper and molybdenum.

Let's learn why each element is needed. **Calcium** stimulates the development of root hairs. It is also necessary for normal leaf development. It influences the movement of carbohydrates and proteins within the plant and is of importance in the storage of these substances during seed formation. **Phosphorus** is used by the plant during the process of photosynthesis. It is needed for cell division and for the utilization of starches and sugars.

Iron is needed by the plant for the development of chlorophyll (the material that gives the green color to plants). It is also necessary for the utilization of starches and sugars. **Potassium** plays an important role in the absorption of water by the plant; consequently, it can be considered to influence the uptake of other nutrients by the plant. It is utilized in the formation of proteins and is important in photosynthesis.

Sulfur affects chlorophyll development and is used in the formation of proteins. It is also concerned with the utilization of carbohydrates and sugars. **Magnesium** is a constituent of chlorophyll. It is essential for photosynthesis. It also controls the uptake of calcium to some extent. **Manganese** is necessary as it controls the activity of certain enzymes (a

substance that controls chemical reactions within the plant) in the process of respiration.

Zinc is necessary for chlorophyll formation and is important in the formation of substances that regulate the growth of plants. **Boron** is concerned with the uptake of calcium. It is also thought to be of necessity in the formation and utilization of proteins and carbohydrates. **Copper** is a constituent of chlorophyll. It is also important in the utilization of proteins and carbohydrates. **Molybdenum** (Moe-lib-denum) is associated with the utilization of nitrogen by the plant.

Remember, the tops or "shoots" of plants are like a small factory. This is where the food is manufactured for the plant and for the animals that graze the plant. It is important that after grazing some of the leaves are left to manufacture food for the plant to store for future use. If there are no food reserves, the plant will die and its place will be taken by some unproductive plant.

Plant Communities

Plants of various kinds tend to grow in separate groups or communities. You may have noticed the difference in the kinds of plants growing on the north side as compared to the south side of a choppy sandhill.

These different slopes represent different plant communities. The kind of plants in the community will be determined by the climate and soil type. Although the plant community never seems to change, it is never standing still. There are always changes taking place. These changes may be desirable or undesirable. The successful range manager must be able to recognize these changes. He must determine whether they are desirable or undesirable, and he must know if they are resulting from a normal fluctuation of the weather or if they are resulting from his management practices.

Range Sites

Rangeland with similar vegetation, soils, and climate is called a range site. The range site may be made up of one or more plant communities. Since each range site has different vegetation and soils, we must manage each site separately. If possible, fence lines should follow range site boundaries. This not only permits stocking rates for each site to be figured separately, but also allows development of suitable management practices.

There are thirteen important range sites in Nebraska. A description of the soils of each of these sites is presented below:

Wet Land. Water table within one foot. May be flooded during part of the season.

Subirrigated. Water table generally within one to three feet.

Overflow. Areas receiving overflow and run-in moisture.

Saline Lowland. Overflow or subirrigated land affected by salt accumulations.

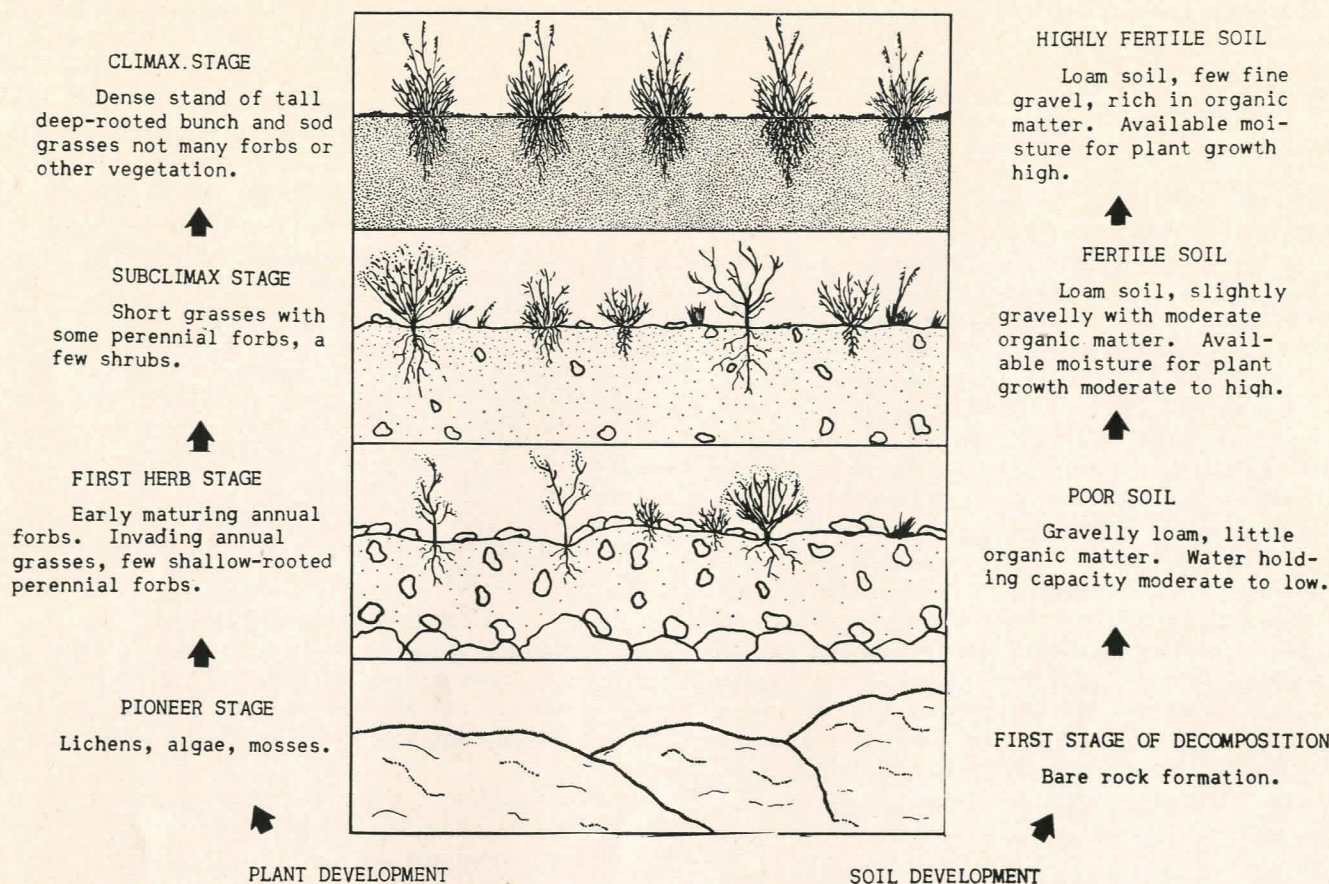


Figure 10. Vegetation and soils develop together.

Sands. Sands, loamy sands, and loamy fine sands on nearly level to gentle slopes.

Sandy. Loamy very fine sands and sandy loams.

Choppy Sandhills. Sands on abrupt, irregular slopes of 20 percent or more.

Silty. Very fine sandy loams, loams, silt loams, and silts.

Clayey. Sandy clay loams, silty clay loams, clay loams.

Dense Clay. Sandy clay, silty clay, and clay.

Shallow. All soils 10-20 inches deep over rock, shale or coarse gravel. Shallowly developed or immature soils.

Thin Loess. Shallowly developed or thin loess soils on slopes of 30 percent or more.

Very Shallow. All soils less than 10 inches deep over rock, shale, or coarse gravel.

UTILIZATION OF GRAZING LANDS

It takes thousands of years for "excellent" range to develop. When plants on the range are balanced with the soil and the climate, they are said to be in **climax** condition. The climax vegetation for any range site is a combination of plants that make the best possible use of the available soil nutrients, soil moisture, and the energy from the sun. Figure 10 shows how plants and soil develop together over a long period of time.

When rangelands are grazed by livestock, the balance of Nature is disturbed. Some plants are grazed more readily by livestock than others. If the shoots are kept closely grazed, the roots are damaged (See Figure 11). This makes the grazed plant less able to compete for moisture and nutrients with the ungrazed, unpalatable plants around it.

On rangeland that is being grazed, short plants and those that are unpalatable have an advantage over the tall growing ones. For example, let's consider a switchgrass plant and a hairy grama plant growing side by side. Now, if these were grazed to the same height, say 2 inches, 25 percent of the hairy grama top growth would be removed. However, grazing switchgrass to a height of 2 inches would remove 75 percent of its top growth. It is easy to see that the tall-growing grass would be at a disadvantage because its food-making machinery is reduced too much to provide a reserve of food. The tall plants become weak and may even die out. Their place will be taken by the shorter, less palatable grass.

The careful range manager plans to leave enough of the forage growth each year so that the grass can manufacture food for its own use. This food is stored in the roots for use by the plant during the dormant season and for growth next spring.

A properly used range should have not more than



Figure 11. Grass plants, taken as sod pieces 3" deep and 6" square, from three adjoining pastures. Same grass, same soil, but grazed differently. In six weeks the moderately grazed center plant produced six times as much tops and five times as much roots as the heavily grazed plant on the right. The lightly grazed plant on the left produced 16 times as much tops and 14 times as much roots as the heavily grazed plant on the right. Moderate grazing is usually the best.

50 percent of the current year's production of forage removed. The 50 percent left on the range is not wasted. It is left as a mulch and for maintenance of the plants.

In Nebraska, the degree of use of range forage is divided into eight categories. If the descriptions listed below are carefully observed and used, it will be possible to determine the degree of forage utilization on your rangelands.

Unused. No livestock use.

Slight. Practically undisturbed.

Light. Only best plants are grazed.

Moderate. Most of range being grazed. Little or no use of poor plants.

Full. All the range grazed. Little or no use of poor plants.

Close. All of the range shows use and major sections are closely grazed. Some use of low value plants.

Severe. Primary forage plants almost completely used. Low value plants carrying the grazing load.

Destructive. Much death loss of primary species. Only remnants of good plants survive.

RANGE CONDITION CLASSES

What Is Range Condition?

The term "range condition" refers to the species composition and forage production of a range site as compared to the climax vegetation and expected production of that site. The range manager uses the range condition survey as a tool. It helps him determine the "state of health" of a range. It tells him something of the past use of the range and how his management practices are working.

Range condition is divided into four classes: excellent, good, fair, and poor.

Excellent—range on which 100-75 percent of the forage yield is from climax vegetation. The ground is covered with a heavy mulch. Precipitation soaks in rapidly. Little or no erosion.

Good—range on which 75-50 percent of the forage yield is from climax range plants. A light mulch covers the ground. Important range plants are vigorous. Slight to moderate erosion.

Fair—range on which 50-25 percent of the forage yield is from climax range plants. Important range plants are in a weakened condition. Very little ground covered by mulch. Moderate to heavy erosion. Low production of forage.

Poor—range on which only 25-0 percent of the forage yield is from climax vegetation. Annual grasses and forbs are abundant. Undesirable forbs and shrubs are common. Soil is poorly protected. There is heavy erosion of soil due to wind and water. Soil fertility is lowered.

Range in excellent condition is the most productive land. Your management program should include those practices which will improve range condition.

Range Plants and Range Condition

The kinds and amounts of plants on the range can tell the story of grazing history better than any mechanical device. This is true because all plants are not affected in the same way by grazing. In Nebraska, we group the different kinds of range plants according to the way they respond to grazing by livestock. These groups are known as decreaseers, increaseers, and invaders.

The **decreaseers** are the most desirable plants. They are often called the "ice cream and cake" plants. They are the plants that the livestock like best. When you find an abundance of decreaseer plants on the range you know that your grazing program is going well.

Since livestock prefer to graze the decreaseer species, these are the plants that are weakened and lost by overgrazing. When they are grazed to the point they can no longer maintain a supply of root reserves, they die. Their place is taken by a less desirable plant.

The **increaseers** are those plants that are favored by light to moderate grazing. These plants are usually less palatable than the decreaseer species. In some

The following photographs are of a choppy sandhill range site in Nebraska. They show each range condition class.

EXCELLENT

Principal Plants

Prairie sandreed
Sand bluestem
Little bluestem
Sand lovegrass
Sandhill muhly
Hairy grama
Yucca

Heavy mulch
Little erosion



GOOD

Principal Plants

Prairie Sandreed
Little bluestem
Sand lovegrass
Hairy grama
Sand dropseed
Sandhill muhly
Yucca

Good plant cover
Plants vigorous

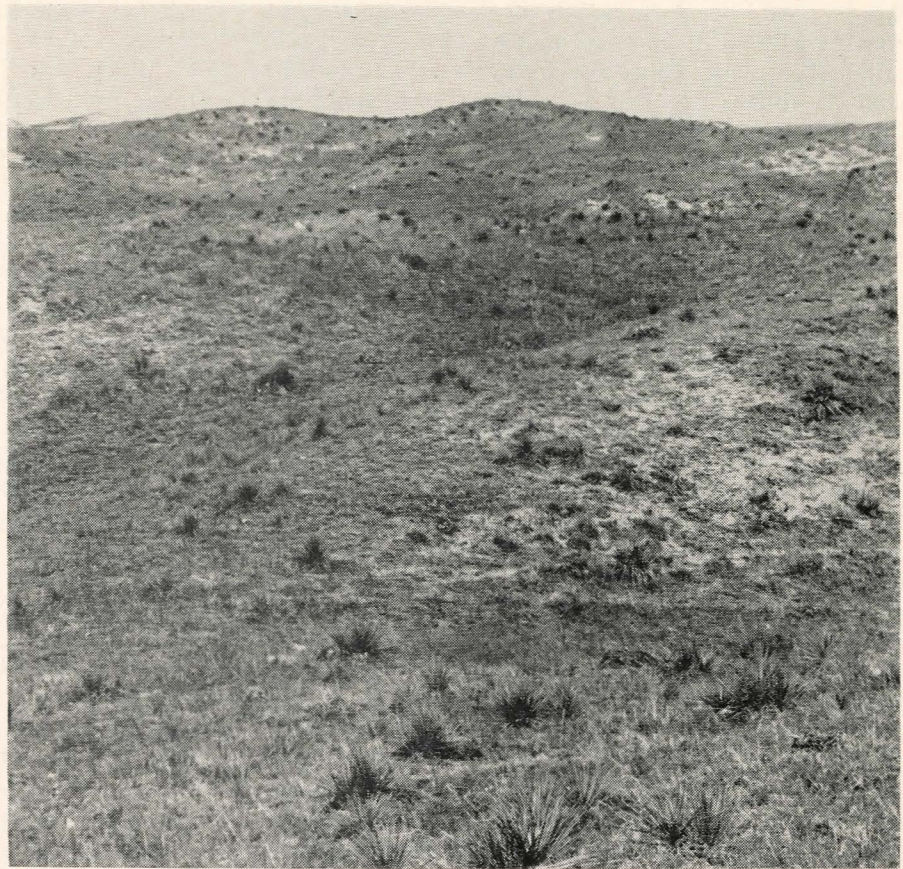
USDA — SCS Photos

FAIR

Principal Plants

Prairie Sandreed
Sand dropseed
Sandhill muhly
Little bluestem
Yucca
Sand lovegrass

Moderate ground cover
Low production
Erosion becomes a hazard



POOR

Principal Plants

Sandhill muhly
Hairy grama
Sand dropseed
Six weeks fescue
Green sagewort
Wooly Indian wheat
Blowout grass

Soil actively blowing.
Desirable plants are
destroyed or low in vigor.
Production very low.

cases, as in the short grasses, it is difficult for the grazing animal to remove enough of the forage to injure the plant. Since the increaser remains strong and vigorous under proper grazing it is ready to take the place of any decreaser that is not able to maintain itself. These are important plants for the range manager to watch. If the amount of forage produced by increaser species is getting larger each year, a change in management may be necessary.

The **invaders** are undesirable, unproductive range plants. They are usually plants that were not present in the climax vegetation. They include annual weeds and plants that may be injurious or poisonous to livestock.

Continuous heavy grazing causes even the **increaser** to be damaged. When this occurs the invaders take over. The usefulness of the range as a forage producing area is lost.

Determining the Range Condition Score

To determine the range condition score it is necessary to have a range condition guide and a range condition scorecard. Examples of the guide and scorecard are shown on pages 28, 29, and 30.

The first step in using the range condition scorecard is to list the different kinds of plants growing in an area. Arrange them in the proper group (increaser, decreaser, or invader). The list of plants in the back of the handbook will help you place them in the right group.

Now estimate the percent that each kind of plant contributes to the total forage production. These values should be placed in the second column—opposite the name of the plant.

To determine the percent to be counted toward condition score, you must use the range condition guide for the appropriate precipitation belt in your area. In the example, we used the guide for the 15 to 19 inch precipitation zone.

Within the decreaseers we use the total percentage recorded for each species. These amounts are written in the right-hand column.

In the increaser group we enter the percentage recorded for each species unless it is greater than the tolerated amounts listed in the guide. In the example, we recorded 35 percent for prairie sandreed. The guide shows that in this precipitation belt, prairie sandreed on a sandy site should not exceed 30 percent. Thus we can only count 30 percent toward the condition score, although more was present.

Under the invaders no value is allowed to count toward the range condition score.

When all values have been recorded in the right hand column the total is entered in the box labeled "Total Score." The range condition score in this instance was 80 or excellent.

Putting the Range Condition Score to Practical Use

The range condition score is a guide to the num-

ber of livestock that can be safely grazed on your range.

When you have the range condition score for a range unit, you are ready to figure the stocking rate. Suggested stocking rates are given in the tables on the lower part of the range condition guide.

Stocking rates should be varied, depending upon such conditions as drought, late spring season and insect damage. Stocking rate tables give the Animal Unit Months (AUM) of grazing per acre. That is, the length of time in months that one cow or her equivalent in other classes of livestock can graze on one acre of land.

Following are grazing "animal equivalents"

Class of Livestock	No. of Animal Units
1 1,000-lb. cow	1.00
1 yearling	.75
1 calf (3 to 6 months old)	.33
1 bull	1.25
1 horse	1.25
5 sheep	1.00

Figuring Animals Per Pasture

By the above procedure, you have obtained the animal unit months of grazing per acre. The next thing to determine is the number of usable acres. Do this by subtracting the timbered, rocky, and other unusable acres from the total acres in the site.

Formula: Total acres in the site,
minus wooded acres, rocky acres,
other unusable acres,
equals total usable acres.

Next, you need to find the animal unit month stocking rate for the site. Do this by multiplying the animal unit months of grazing per acre by the number of usable acres in the site. The total of all sites is the total for the pasture.

Formula: Animal unit months per acre,
times the number of usable acres in
the site,
equals stocking rate for the site in
animal unit months. Add stocking
rates for all sites in a pasture to get
total for entire pasture.

Your next step is to find out how many cattle the pasture will graze for the growing season. Do this by dividing the length of the grazing season, in months, into the total animal unit months stocking rate. This result equals the number of cattle that can be grazed on this pasture for the season.

Formula: Total animal unit months stocking
rate,
divided by number of months in
grazing season,
equals number of animal units to be
grazed for the season.

For example, a pasture with a 1,000 animal unit months stocking rate is to be used for five months grazing season. Five divided into 1,000 equals 200.

Therefore, 200 animal units can be grazed for five months in the pasture.

Mechanical Measurement of Range Forage Production

Another method used to estimate stocking rate is based upon direct measurement of the forage produced. This method might be a good demonstration project for a club tour or meeting.

Mark off a circle with a 20-inch piece of string with a large nail in each end. Clip the forage within this circle at ground level and weigh it. The forage weight will be in pounds. Multiply the weight by 5,000 as there are 5,000 of these areas in one acre. For example, if you had $\frac{1}{4}$ pound, you would have 1,250 pounds of forage per acre—($\frac{1}{4} \times 5,000 = 1,250$).

To find out how long a cow could graze one acre that had 1,250 pounds of forage, multiply by $\frac{1}{2}$, which would be 625 pounds. (Grazing one-half and leaving one-half is proper use of grass.) Let's say that the cow needs 30 pounds of grass a day, then divide 30 into 625, giving 21, the number of days to let one cow graze on one acre. Stocking on a year long basis, the cow would need 17.3 acres (365 days divided by 21 equals 17.3 acres).

After all is said and done, the most accurate method of determining the stocking rate is to stock the range according to your best estimate and see what effect this has on the vegetation of the key range areas. This method takes a long time. The estimate is usually based on one of the previously described methods. Then, after stocking at the estimated rate, the "decreaser" and "increaser" range plants are carefully watched to see how they react. Further adjustments are made from time to time until the greatest use is being made without permanent damage to the important plants. This is the "range condition" method.

You are ready, now, to begin fitting the main parts of the range management "picture" together! You have worked with the plants, the forage values and how plant relationships affect range production.

The next step is to picture or inventory the range with which you are to work. Make a range map. It should show all the essentials that are used in managing a range, such as range sites, fences, watering places, salt stations, drainage (streams, etc.), number of acres in each pasture, buildings and so on. (See example of map on page 18). After your map is finished, you will see a picture of your range and its problems.

ROUNDING-UP YOUR RANGE PLAN

Every good range operator knows the production resource with which he is working. Maps are used to "inventory" that resource. They are more accurate than memory. We don't always notice gradual changes.

Have you observed that folks who see children only once or twice a year notice that they have

grown, while those who are with them every day don't notice it, unless they check their height occasionally?

Range grazed by livestock may change so gradually that you may not notice the change. These changes may affect your income from range before you really know they have happened. The changes may mean financial profit or loss. They may also mean loss of valuable soil and water—which no one wants.

Your map, then, gives you a "picture" of your range. It should show each site and its range condition, vegetative types, fences, trails, salting places and natural features (streams, coulees, etc.).

Management practices are based upon what the map shows as to range condition and forage use in the different areas of each pasture. It also shows you the changes needed to get the best production from the range. For instance, a pasture which is in "Poor" condition in one end and in "Excellent" condition in another part, might indicate the need of cross-fencing; or, additional watering places nearer the good forage. Possibly a change in the salting places is needed to attract stock to areas of excellent forage. Maybe those five steers that died were all found near a poisonous plant infestation! It should be controlled or fenced out.

Improvements and changes can be shown on transparent mapping material laid over the detailed map of the range. These are called "overlays". Overlays can be used on aerial photos, too. Show the fences to be moved or new ones to be built on the overlay. The same can be done for new water developments and new salt grounds.

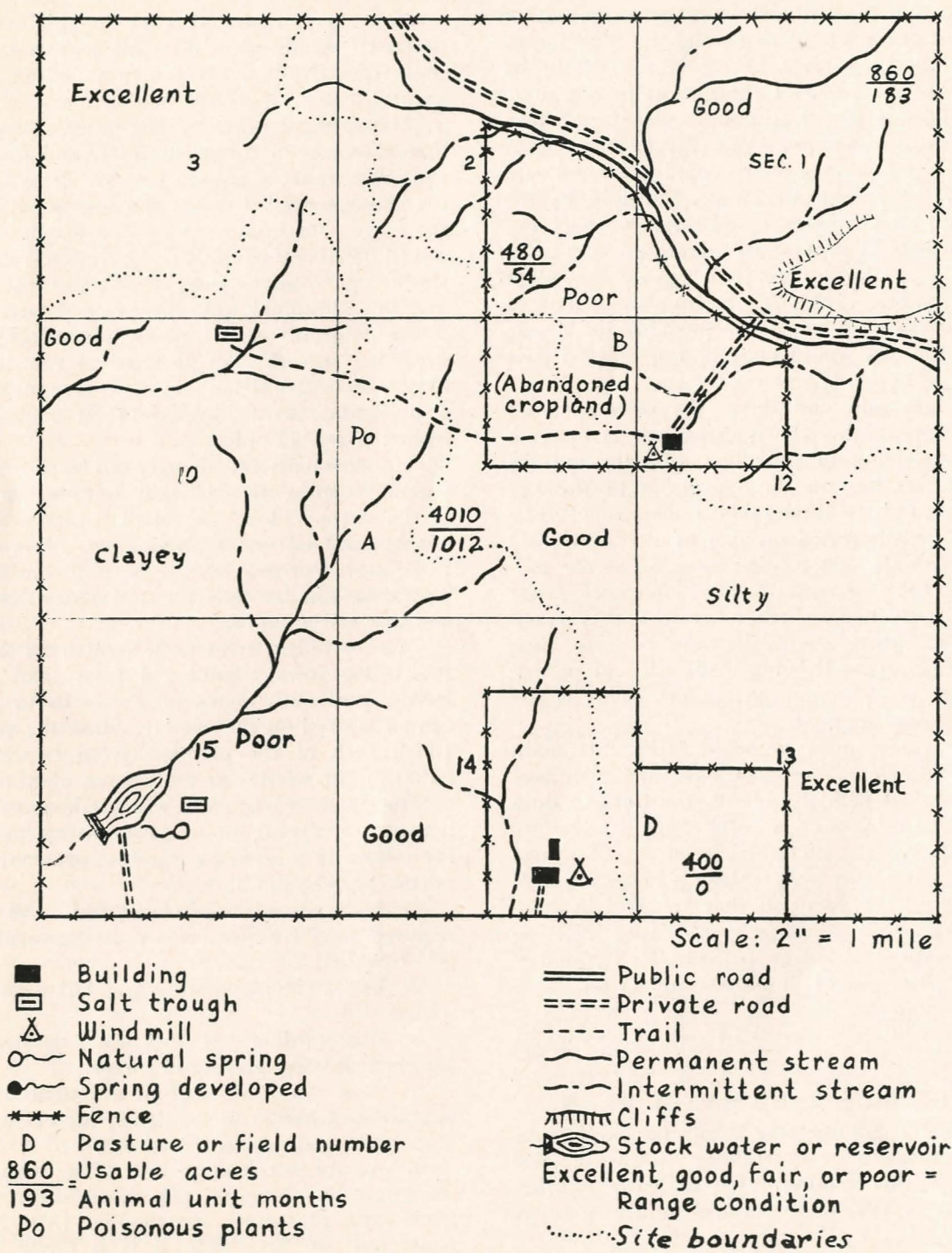
Mark problem areas to be treated on the overlay. Prairie-dog town, abandoned farm land to be reseeded, poisonous plants or shrubs to be controlled can be marked on the overlay. Show the year during which each of the practices is to be carried out, either on the overlay or the written plan, or both.

On the next page, you will see how an "overlay" is used in planning for range improvement. It shows the following proposed range improvement practices, north (top) to south:

1. Four new pieces of fence built and one piece removed to give better pasture arrangement (pasture "C" is added).
2. Better calving pasture and fall pastures to be seeded.
3. Four possible new stock water developments to get more uniform grazing of forage.
4. Two stock salt stations moved and two new ones to attract stock to the lightly used range areas.
5. Poisonous plants fenced out.

If you are just starting your range map, you will save time by obtaining plat book sheets from the book store or county courthouse. Ordinary, heavy paper will do very well, if it is tough and light colored. It will need to have grid lines to represent quarter sections, sections and townships.

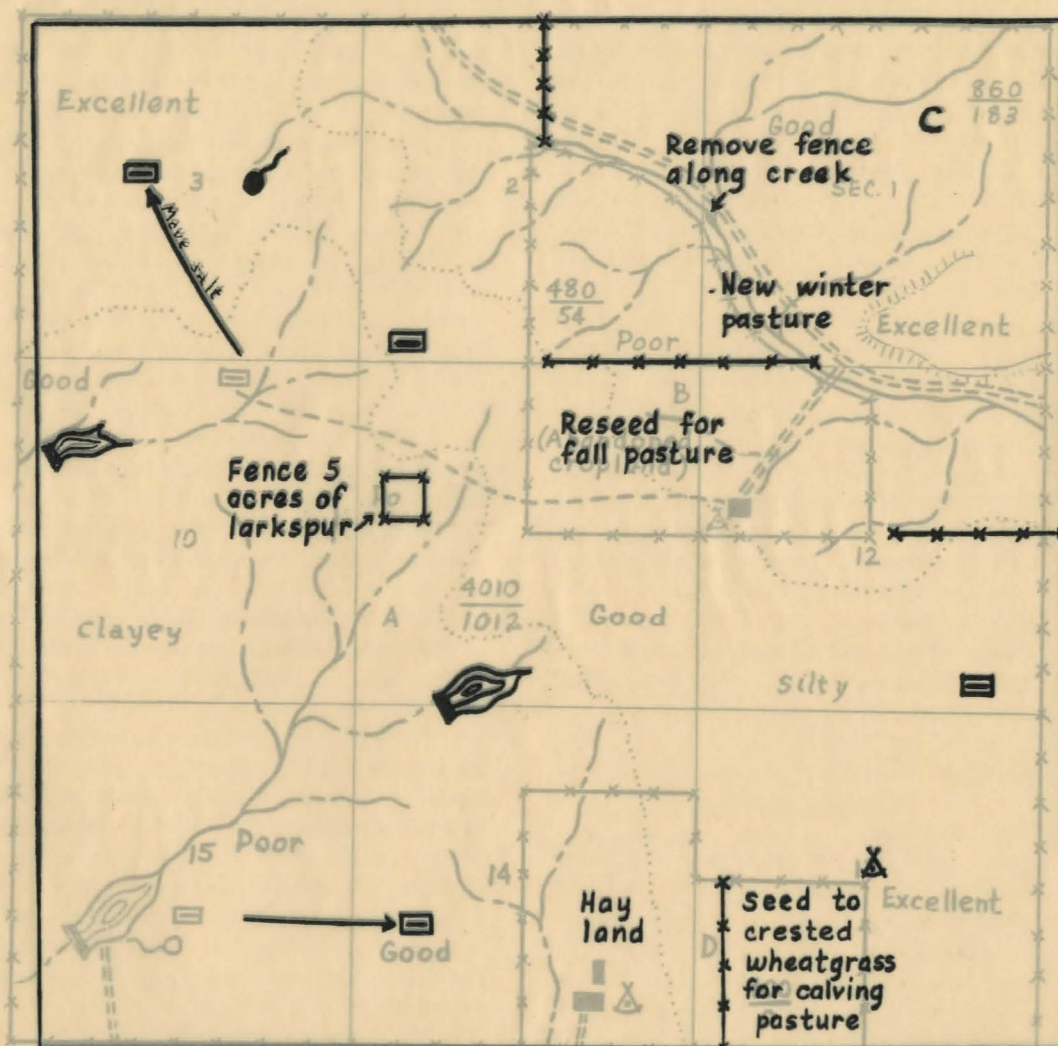
A SAMPLE RANGE MAP



A SAMPLE "OVERLAY" MAP

This shows how to "map" your plans for the following:

- Fencing
- Stock water development
- Trail building
- Salting places
- Range reseeding



Scale: 2" = 1 mile

- Building
- ▢ Salt trough
- ⚙ Windmill
- Natural spring
- Spring developed
- Fence
- D Pasture or field number
- 860 Usable acres
- 183 Animal unit months
- Po Poisonous plants

- == Public road
- === Private road
- Trail
- Permanent stream
- - - Intermittent stream
- ||||| Cliffs
- ⚙ Stock water or reservoir
- Excellent, good, fair, or poor = Range condition
- Site boundaries

Aerial photographs may help you locate important features on your maps. It will be practical to use tracing paper to transfer information to your maps from photos, *if* the aerial photos are on the *same scale* as your maps.

If you are fortunate enough to have aerial photos for use in your range project overlays can be used on the photos.

For further information on range mapping see your local county agent. He will tell you where you can get additional technical help.

RANGE IMPROVEMENT PRACTICES

Good range practices increase the amount of usable range forage, increase the pounds of beef produced, conserve soil and water, and increase the value of our range.

Stock Water Development

On most Nebraska ranges the water supply is not sufficient for the number of stock the range will carry. Even though there may be plenty of forage, livestock often have insufficient water to drink. They should not have to travel long distances for water. Cattle will graze an area close to water again and again, rather than move a long distance to better forage. The result is uneven utilization of range forage and poor gains on livestock. Additional watering places encourage better distribution of grazing animals.

The amount of water needed by livestock differs with the kind of range, the amount of salt consumed, the climate, the season, and the kind of stock. The average amount of water needed per day is ten gallons for cattle and one gallon for sheep.

Watering places require different spacings in rough, choppy hills than they do on gently rolling or level ranges. On steep, rough ranges cattle should not have to travel more than $\frac{1}{4}$ to $\frac{1}{2}$ mile for water. On more level ranges the distance from water to the farthest corner of the pasture should not be greater than one mile. Under Nebraska conditions, the range manager should plan for one waterplace per section for best distribution of grazing livestock.

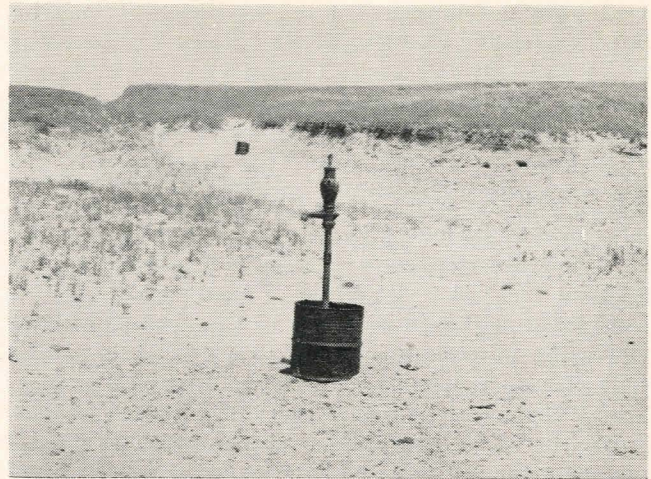
Wells and Windmills

The most common type of water development in Nebraska is the installation of wells and windmills. The windmill has many advantages as a source of livestock water. Some of them are:

1. They can be drilled near the forage supply.
2. They furnish a more dependable water supply in dry seasons and in winter.
3. They are a safer place for livestock to get water in winter.

Wells should be located in areas where there is an adequate amount of forage. When possible they should not be located on soils subject to erosion. Figure 16 illustrates one of the hazards of locating a windmill and tank on such a site.

Often windmills are located along fence lines.



U.N. Photo

Figure 16. A highly erodable soil and too many cattle led to the abandonment of this watering place.

This is a fine practice when the pasture size is small or when water development is needed in remote areas of two adjacent pastures (Fig. 17).

Springs and Seeps

These may be developed into a dependable supply of clean, wholesome water throughout the grazing season. Such development often creates a good water place from dangerous bogs and swamps.

To develop a watering place from a spring remove the soil from the area down to bedrock or to the source of water. Construct a concrete or masonry box around the source of water with an outlet pipe several inches above the bottom. The outlet pipe should lead to a tank or trough that is somewhat removed from the collection box. This prevents livestock trampling in the vicinity of the source of water.

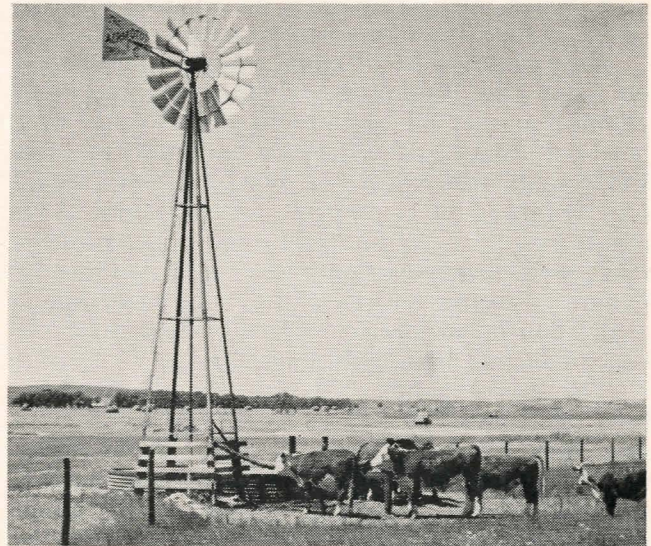


Photo Courtesy Rolling Stone Ranch

Figure 17. Location of the windmill and tank on a fence line permits this rancher to practice deferred grazing. He can also alternate the use of his range between hayland and grazing land.

In the development of bogs or seeps it may be necessary to lay a system of tile about the collection box. This will increase its efficiency.

The livestock watering tank should have an overflow which will deliver any excess water far enough away from the trough to prevent mud holes or ice sheets from forming around the tank.

Stockwater Dams or Reservoirs

These are important sources of water in certain areas of Nebraska. Before such a structure is built, consideration should be given to the kind of soil on which the water is to be held. Heavy clay or adobe soils are ideal because of their resistance to seepage losses. If dams are built on soils that permit seepage losses, the use of bentonite, a clay mineral, as a sealing agent for the bottom of the reservoir is suggested.

It is wise to check carefully the legal responsibilities involved in the construction of stockwater dams and reservoirs. In Nebraska, an application for a water right must be filed and approved on any structure that impounds water to a depth greater than 10 feet or to a volume greater than 15 acre feet.

Your local Soil Conservation Service technician can assist in selecting and designing the stockwater development needed on your ranch.

Fencing

There are five good reasons why you should have good fences on the range:

1. Fences help prevent straying or trespassing of livestock.
2. Fences help to distribute livestock and provide more uniform utilization of forage.
3. Fences make deferred grazing possible.
4. Fences make it possible to eliminate grazing or trampling on critical areas, such as blowouts and reseeded areas.
5. Fences make it possible to separate different classes of stock for better management.

Build cross-fences to follow natural land features or range site boundaries. Cross-fences should be planned so that all pastures have about the same potential stocking rates. When pastures are large and contain different range sites, livestock concentrate on the most convenient range site first. This results in over use of forage on some portions of the range and under use on other areas within the pasture. Fencing on range site boundaries allows application of management practices needed for the best production from each range site.

The size of pastures on Nebraska ranches have been determined, to a large extent, by the convenience of a certain size to the operation of the ranch. Convenience in operations certainly should be considered, but more important, perhaps, is the efficient use of forage produced on the range. It cannot be denied that the larger the pasture the more inefficient is the use of the forage by livestock. There are few circumstances that justify pastures to be larger than two sections.

A mile of 4-strand, barbed-wire fence requires 16, 80-rod spools of wire and 320 posts. This could be the most effective range improvement you could add to your ranch.

Salting Practices

Grazing animals need more salt than they can get from plants. Lack of salt causes animals to lose their appetite, lose weight, their eyes become dull and their coats rough. Supplemental feeding of salt to grazing livestock is a standard range practice.

Proper distribution of salt is one of the most inexpensive and convenient methods of obtaining uniform use of forage in a pasture. Livestock need salt. They will travel a long way to find it.

Salting places should be located away from water. These salting places can be moved to areas of the pasture where under-use is noticed. The salting place may be moved as often as is necessary to obtain even use of forage. The salt boxes should be located on areas that are not subject to severe erosion. On light soils, it may be necessary to move the salt box each time salt is put out.

Salt is usually placed in troughs to protect it from wind and dirt. Inexpensive salt boxes can be made from old oil barrels. The salt box shown in Figure 18 will provide an interesting project for the 4-H club or F.F.A. member. A portion of the barrel is cut out and folded back to make an awning over the opening. The hole in the barrel must be large enough for a bull with horns to get his head in and out.

Here are some suggestions for salting:

1. Allow 2 pounds per cow per month— $\frac{1}{2}$ pound per head per month for sheep.
2. Place salt about $\frac{1}{4}$ mile from water. Move the salt according to the use of forage.
3. Have one salt box for each 20-25 head of cattle.
4. If range forage is deficient in phosphorus, a mixture of monosodium phosphate or steamed bone

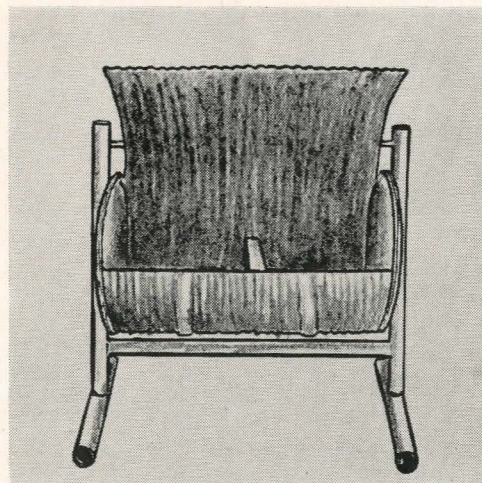


Figure 18. A salt box made from an old oil barrel.

meal and salt, on a 50-50 basis, is suggested. Bone-chewing, unthriftiness, dull hair, and poor calf crops are signs of phosphorus deficiency.

Range Reseeding

Many thousands of acres of rangeland in Nebraska are in need of reseeding. Those areas represent land that was at one time farmed and then abandoned. They include, also, rangeland that has been severely misused. The combination of drought and overgrazing has resulted in destruction of the vegetation and in a consequent low state of productivity on these sites.

Reseeding is an expensive range improvement practice. Consequently, it is recommended only on those sites where the native vegetation has been destroyed to the point that it will not respond to improved management practices.

Planning

Planning is necessary for a successful grass seeding. Plans for the seeding should include:

1. Selection of the grass or mixture of grasses that will fulfill the purpose for which the seeding is to be made.
2. Preparation of a suitable seedbed.
3. Following the best seeding practices known.
4. Careful management after the seeding is made.

Selection of the Grass or Grass Mixture

This will be dependent upon several factors. The first consideration involves the purpose for which the seeding is to be made. Select cool-season grasses to extend the period in which green grass is available for your livestock. Use native, warm-season mixtures on tracts of abandoned farm land that are to be reseeded and included in native pastures after establishment.

A further consideration is to select grasses that are adapted to the soil and climate of your area. Crested wheatgrass, for instance, is best suited for the hardland soils of western Nebraska. Switchgrass and little bluestem may be included in mixtures for

most all of the range areas of Nebraska. Sand lovegrass is best used in mixtures on the coarse-textured soils of the State. Table 1 shows the region to which many of our common grasses are best suited in a reseeding program.

Seedbed Preparation

This is necessary for the successful establishment of grass seedlings. Many stands are unsatisfactory or even lost because of inadequate seedbed preparation.

Range seedings in Nebraska require a seedbed with a mulch cover. The cover will aid in keeping the soil moist, in lowering the soil temperature at the surface, and in preventing unnecessary erosion. The mulch cover is most often achieved by a close grown crop of sudan, sorghum, or millet. The cover crop should be seeded late enough so that there is no chance for the seed to mature. If it appears that seed will mature on the cover crop, the seedheads should be clipped before they ripen.

The grass seeding is made directly into the stubble the following winter or early spring. No tillage operations are necessary before seeding. Tillage operations destroy the cover and loosen the soil.

The seedbed must be firm. If tillage is practiced before seeding, several operations with rollers or treaders are necessary to obtain the desired firmness.

Seeding Practices

Use the best practices at your disposal to make the seeding. This includes the careful placement of seeds at a uniform depth and in close contact with the soil. Depth of seeding for most grasses in Nebraska should not exceed 1 inch. Some of the very small seeded grasses such as sand lovegrass are best planted at a depth of $\frac{1}{4}$ to $\frac{1}{2}$ inch.

Time of seeding is important. Cool-season grasses may be seeded either in late summer, early winter, or early spring. Late summer seedings are somewhat more hazardous than winter or spring seedings because of the undependable and unpredictable moisture situation that exists in Nebraska.

Table 1. Areas of adaptation of some of the grasses commonly used for range reseeding in Nebraska.

	Location								
	Eastern			Central			Western		
	Hardland	Sandy	Wet	Hardland	Sandy	Wet	Hardland	Sandy	Wet
Bromegrass	*	*	*			*			*
Tall Fescue	*	*	*			*			*
Orchardgrass	*	*	*			*			*
Intermediate wheatgrass	*	*		*	*		*	*	*
Tall wheatgrass	*		*	*		*	*		*
Crested Wheatgrass				*			*		
Russian wildrye							*		
Blue grama				*	*		*	*	
Sideoats grama	*	*		*	*		*	*	
Big bluestem	*	*	*	*	*	*			*
Little bluestem	*	*		*	*		*	*	
Indiangrass	*	*	*	*	*	*			*
Switchgrass	*	*	*	*	*	*		*	*
Sand lovegrass		*			*			*	
Western wheatgrass	*	*		*	*	*	*	*	*
Canada wildrye		*		*	*		*	*	
Green needlegrass				*			*	*	
Reed Canarygrass			*			*			*

Warm-season grasses may be safely seeded from early winter to mid-spring. Early spring seedings have been most successful if careful control of weed competition is practiced.

Management

Close attention must be paid to the management of the range after seeding. Seedlings should not be grazed until they are completely established. This may require from one to three years. The longer periods of time are needed for the warm-season, native grasses.

Competition from weeds is one of the common reasons for loss of stands. Broadleaf weeds in newly seeded grasses can be controlled with chemicals. Spraying new seedlings with $\frac{1}{2}$ pound of 2,4-D ester in the second week of June is recommended. There is no chemical to use for the control of grassy weeds in the new grass seeding. If foxtail or sandburs are a problem, the only solution is clipping.

When clipping for weed control, care should be used so that the new seedlings are not clipped too closely. Clipping should be done at heights of 4 to 5 inches.

Control of Undesirable Plants

Useless plants on the range cause lowered production of native grasses and pounds of beef. Some brush plants use about four times more water for growth processes than do forage grasses. Removal of undesirable plants from the range can increase forage production and stocking rates.

Some of the undesirable plants growing on our Nebraska ranges include: Perennial ragweed, sand sagebrush, green sagewort, ironweed, blue vervain, buckbrush, and sumac. Wild rose, prickly pear and yucca may be problems in local areas.

All of these plants can be controlled with applications of either 2,4-D, or 2,4,5-T. For specific recom-

mendations as to time of spraying and rates of chemicals contact your county agricultural agent. Ask him for Campaign Circular 171, Pasture Weed Control.

Although chemicals may be used to eliminate undesirable plants, you must remember that these plants have become a problem because of an error in management. Unless the cause of range deterioration is located and eliminated, control of the undesirable plants will not be profitable. In any weed control program, grazing should be deferred during the current growing season. This will give the grasses a chance to increase in vigor and ground cover.

Sand Blowout Control

There are many thousands of acres of unstabilized sand blowouts in Nebraska. Control of these lands would add much to the total forage and livestock production of the State.

Control of sand blowouts requires:

1. Fencing—to keep livestock from trampling and grazing new vegetation.
2. Leveling of hummocks and banks—to break upward swirling air currents which carry soil particles and cause an increasingly larger blowout.
3. Mulching—to prevent movement of soil particles. This is accomplished by spreading hay or straw over the area.
4. Seeding the blowout to adapted grasses and legumes. Drill the seed in the stubble residue of the annual crops.
5. Fertilization to hasten establishment of cover. The use of nitrogen, phosphorus, or manure will hasten the growth of grasses and legumes on these sterile, sand soils. The sooner the soil is stabilized, the sooner the blowout will be returned to usefulness.

Improving Production of Subirrigated Hay Meadows

The yield and quality of hay produced on many subirrigated grass meadows can be improved through the use of commercial fertilizers. The introduction of adapted legumes to the stand increases the efficiency of the fertilizers.

Improvement of meadow production includes:

1. Application of 40 to 80 pounds of available phosphorus per acre. This should be done in the fall or early spring.
2. If legumes are not present in the stand, interseed them in the early spring. The legumes may be seeded with a "grassland type" drill with a fertilizer attachment. A common interseeding practice is to broadcast the legume seed before grazing or feeding on an area. Some ranchers seed clovers by feeding mature clover-grass hay back on meadows where they wish to establish new stands.

The following table* will help you select the proper legume and seeding practice for your meadows.

*S.C.S. Conservation Guide Sheet No. 6



Photo Courtesy Rolling Stone Ranch

Figure 19. Winter feeding of high quality hay on snow-covered Nebraska ranges.

Table 2. Guide to Selection of Legumes and Seeding Practices.

Depth to Water- Table (March) (Inches)	Adapted Legume	Rate of Seeding	Time of Seeding
0 - 6	None		
6 - 18	Alsike	3 - 5#	Early Spring Late Fall
18 - 30	Red Clover	4 - 6#	Early Spring Late Fall
30 - 60	Alfalfa or Sweet Clover	4 - 6#	Early Spring Late Fall

THE 4-H PROJECT

The most satisfactory range management and conservation project will be carried on in conjunction with a livestock club. This is an excellent opportunity to impress upon the future ranchers of our state that the crop they are producing on their range lands is grass—not cattle. Livestock is the harvesting mechanism and process through which the grass crop is converted into a marketable product. Help the club member realize that on a well-managed ranch as much time and effort should be devoted to care and management of the grass as is spent in improving and caring for the livestock. Take care of the grass—even the highest quality cattle cannot make good gains on overgrazed or poorly managed range.

A well-balanced 4-H program should be based on identification and evaluation of important range plants. But these are not the only things to consider. You should give attention to improvement of deteriorated range land, controlled grazing systems, and meadow lands. Each of these phases of Range Management will be discussed in turn. Each 4-H member should be encouraged to follow a line of interest in selecting his range 4-H projects.

First Year Clubs

The first year of range club work should be limited to collecting, identifying, mounting, and displaying the most common range grasses.

Requirements

1. Be able to identify at least ten of the plants listed.
2. Build a plant press.
3. Collect and press the grasses he is able to identify.
4. Mount and maintain these specimens in a display book.
5. Attend the tour arranged by the county agent.
6. Keep a record of his activities in the club.
7. Seed a grass nursery if he so desires.

Second Year Clubs

Identification and collection of grasses will be emphasized again in the second year of the range project. In addition, an attempt should be made to evaluate the grasses for the second year member on the basis of forage value, palatability, and reaction to grazing. This is also a good year to bring improved management practices to their attention.

Requirements

1. Collect, press, mount, identify, and display six new or different plants than were used in first year.
2. Prepare a brief paragraph for five of the grasses collected the first year concerning their grazing value and importance on the rangeland. These should not be shorter than 50 words or more than 100 words for each grass.
3. Undertake some form of range improvement. This may be in the form of (1) control of sand blowout, (2) controlled grazing, (3) distribution of salt in relation to water, (4) reseeding an abandoned field, (5) fertilization of range or meadow land.
4. Seed a small grass nursery.
5. Keep an accurate record of his year's work and activity within the club.
6. Assist first year members with problems in collecting, mounting, and displaying their specimens.

Third Year Clubs

As the member enters his third year of clubwork he is becoming quite familiar with range management and conservation ideals. Already he has learned 16 or more of the major forage producing plants of the range land. He has worked with and observed proper management of the grass crop. In his third year he should expand his knowledge of plants and become better acquainted with their grazing value. Expose him to more of the principles that keep the range producing at its highest capacity.

Requirements

1. Collect, press, mount, and display ten new range plants.
2. Submit a brief paragraph on the grazing value and importance for each of ten additional grasses.
3. Continue with the range improvement project started in the second year or select a new project.
4. Become familiar with the methods used by the Soil Conservation Service in determining the condition of the range.
5. Complete the records on the grass nursery seeded the previous year.
6. Prepare a display or demonstration for the local county and state fairs.
7. Help first and second year members with problems encountered in their club work.

Advanced Range Management Project

The advanced range management project teaches the 4-H Club member some of the principles of good management of grazing lands. This project is divided into three units. It is suggested that one of these units be taken each year after completion of the first three years of basic range management. It is not required that the advanced units be taken in the A-B-C sequence.

Unit A—Requirements

In this project the club member is *required* to demonstrate the importance of proper forage utilization by the following:

1. Dig up 3 clumps of little bluestem in mid-February. Each clump should have a block of soil and roots about eight inches square. Transplant the clumps into separate containers, such as old 5-gallon paint buckets or frozen-cherry cans.

2. Label the containers I, II and III. Clip off all the old growth. Protect the clumps from freezing. Be sure they have plenty of light and water. Late in the spring they may be moved outdoors.

3. Clip the plants at different times. Leave plant I unclipped. Clip plant II three inches above the soil each time it gets five or six inches tall. Clip plant III four and a half inches above the soil each time it is seven or eight inches high.

4. Dry the clippings from each plant when it is cut. Place them in a separate box or bag until the end of the project. About August 15 cut off all three plants three inches above the soil. Dry the grass from each plant separately. Weigh all of the grass produced by each plant and record the weights in your record books.

5. Cut the bottom out of the can; remove the soil and roots in one piece. Soak the clump of soil in a washtub of water. When completely wet, carefully remove the root system from the soil. Spraying with a fine mist from a nozzle on the garden hose will be helpful in this step.

6. When the roots have been removed and washed, dry and press them in the plant press used in previous years. Remember to change papers daily until the roots are quite dry.

7. Mount the roots on a board and label each according to its treatment.

8. Write a short paragraph, about 50 words, on the reason for the difference in the size of the root systems. Tell why this is important to the rancher.

Unit B—Requirements

In Unit B the club member will observe different degrees of use of forage being grazed by livestock. He will also find that range plants are more closely grazed around windmills and other places where livestock tend to concentrate.

The careful range manager uses a guide to help him determine when his range is being grazed properly. The guide to degree of use is designed to serve as an aid in this project. Remember that good range management strives toward achieving full use of the forage. Full use means that at least one-half of the forage produced each year is left on the range.

The alert club member will notice that the more desirable "ice cream and cake" grasses are less abundant where the forage is constantly overgrazed.

Five project requirements:

1. Build three exclosures in a pasture to be grazed during the summer. (An exclosure is a pen built to keep cattle from grazing a small portion of range-land). The size of the exclosure should be approximately 16 x 16 feet.

Locate one of the exclosures about 100 yards from

a windmill and tank. A second should be placed as far as possible from the watering place. Build the third just halfway between the others.

The exclosures should be surrounded by a fence with at least (3) strands of barbed wire. A gate or stile is a safe, handy means of getting in and out of the exclosure.

2. In late June or early July make a list of the different plants growing in each exclosure. Be sure to number the exclosures in order to identify each with the proper list of plants.

Are different plants growing at different distances from the watering place?

3. While listing the plants inside the exclosure, determine the degree to which the range plants are being grazed by livestock. The guide to degree of use will be helpful. Is there any difference in use of areas close to the windmill as compared to those farther away?

Make this evaluation again in mid-August. Note whether or not the use patterns have changed.

4. Estimate the pounds of forage produced per acre in the following way:

Construct a wire frame 3 x 3 feet square. This will give a plot that is 9 square feet in area. In late August place the frame on the ground in the exclosure and clip off all the vegetation inside the frame. Leave a two-inch stubble. Collect all of the material clipped from the plot in a box or sack. Let the clippings dry for a few days. Be sure they dry in the sun to prevent molding. Weigh the clippings and record the weight of one plot from each exclosure.

Next multiply the weight (in pounds) by 4840. The result will be an estimate of the pounds of forage produced per acre.

5. The amount of forage the cattle have grazed from the range can be determined in a similar way. For this estimate clip a plot outside, but in the vicinity of the exclosure. Dry and weigh these clippings as in the previous determination. The differences in weight between clippings made outside the exclosure and those made inside the exclosure, multiplied by 4840, represent the amount of forage removed by cattle. This quantity can be expressed as a percentage of the total amount of forage produced. If the figure is near 50 percent, the range is being properly grazed.

Unit C—Requirements

In this project the 4-H club member is expected to become familiar with at least five of the important range sites in his home vicinity. Project requirements:

1. Visit and study the vegetation and soils of five range sites.

2. Make a collection of *three* of the most important plants on each of the range sites studied. (These plants are collected primarily for the member's information. They would make an attractive display for county fairs.)

3. Collect samples of soil at three different depths at each range site. Put a sample from each depth of sampling in a small vial or bottle. They will make an interesting display. Suggested depths of sampling are 0-6 inches, 6-12 inches, and 12-24 inches. Notice the differences in color at different depths for each site.

4. Determine the amount of the different sized particles in a sample from the top six inches of soil at each range site. This is done by filling a fruit jar about two-thirds full of water. Pour in soil until the jar is almost full. Replace the cover tightly and shake the jar and its contents vigorously. Place the jar on a table or bench and allow the soil to settle. Allow plenty of time because the small particles will be slow in settling.

After the particles have settled hold a card or heavy piece of paper against the side of the jar and draw a diagram showing the different layers. Label each layer clay, silt, sand.

The heaviest soil particles (sand) will be the bottom layer. The silts will be represented by the middle layer and the clays will be on top.

Compare the diagrams of soil from each range site. This information can be used in your display.

Preparing Grass Display Book

The beginning range manager will need to make a collection giving the name and placing a grazing value on each plant found in range area. His collection should represent the plant species which he sees as he rides over the range. The collection should extend over a period of a year as plants grow and have flowers at various seasons of the year. Plants should be collected when the flowers are the showiest or when grass is headed out. Pressing gives them a convenient shape and preserves natural colors of the plant.

Building a Plant Press

Before you attempt to collect any grasses for mounting in your display book, build yourself a plant press. A plant press is designed to be carried on the collecting trip and is the correct way to begin a good plant collection. Grasses properly collected, pressed, and dried will make neat, easy to mount specimens for your display.

A plant press as illustrated in Figure 20 is easy to

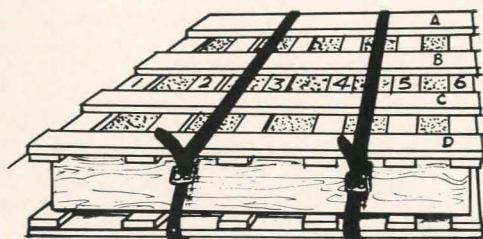


Figure 20. A simple plant press.

construct. Pieces labeled A, B, C, and D in the illustration are $\frac{3}{4}$ " x $1\frac{1}{2}$ " x 20" in dimension. It requires 8 such pieces to complete the plant press. The numbered pieces can be made of ordinary lath cut into 16" lengths. Twelve of these pieces are required to finish the press.

When these pieces have been properly nailed together, slip a dozen old newspapers (folded in half) and some pieces of corrugated cardboard that have been cut to size, between them. Two canvas, web, or leather belts are now needed to hold the frames and papers together.

Collecting Range Plants

Now let's consider digging, pressing, mounting and labeling range plants and the materials needed for each step.

Digging Plants: Be sure to collect two specimens of each kind of plant.

When collecting your plants, you will find a dandelion digger, a small pick, or spade useful; also a sharp knife to cut and trim the plants. In digging plants, be sure to get a fair sample of the root, especially of grasses, grasslike plants and forbs, as some plants are identified by the underground parts. Collect twigs with leaves of shrubs and trees.

Select only mature plants—those with flowers or heads formed—for collecting. Remove as much dirt as possible from the roots after digging out the plant. Loose dirt and sand will detract from the specimen after it is mounted. Place a piece of cardboard between the folded newspapers as each plant is collected. Place the collected plant between two or three thicknesses of newspaper. Arrange the stems, leaves, roots, and inflorescence exactly as you want them to appear on the display sheet. Replace the top portion of the plant press, tighten the belts, and you are ready to look for another specimen. When you have completed the collecting for the day, tighten the straps of the plant press as much as possible. Be sure to change the newspapers between the plants every two days until the plants are completely dry. This will prevent the growth of mold on the plants.

Mounting the Plant: When the plant is thoroughly dried it may be mounted on the pages of your display book. The sheets for mounting purposes should be at least 12" x 16" in size and not larger than 16" x 24".

Arrange the plant on the sheet in an attractive manner. A cloth tape is more satisfactory than scotch tape for fastening plants to the paper. Leave room in the lower right hand corner of the sheet for a small label like Figure 21.

Range Judging in Nebraska

Range judging is a competitive approach to education of the rancher in improved methods of managing our Nebraska grazing lands. The days are gone when the ranch unit could be expanded most easily

Common Name:	Big Bluestem
Scientific Name:	Andropogon gerardi
Where collected:	Thomas County
Date:	August 15, 1960
Collected by:	John Doe

Figure 21. A satisfactory plant specimen label.

by buying more land. To increase production now it is necessary for the rancher to look for production practices that increase the net return per acre on his unit.

The score the rancher makes in the contest is not as important as the lesson in range management he gets as he selects answers for his score card and listens to the explanation of the official scorers after the contest.

The contest stresses identification of range plants. Not only is it important for the rancher to recognize the plants growing on his ranges, but he must know how each contributes to the forage for his livestock. It is well-known that livestock exhibit preference for certain grasses. It is not so commonly realized that grasses react differently to grazing by livestock.

Those grasses most readily eaten by livestock have difficulty in maintaining themselves in the stand. Repeated grazing weakens them to the point of death. This group is known as the "Decreasers." Their place in the stand is taken by a group of vigorous plants not so readily eaten by livestock. They are vigorous range plants and an important source of feed on the range. This group is called the "Increasers." Continued heavy utilization will eventually result in even the disappearance of the hardy "Increasers." They are replaced by annuals and undesirable perennial plants known as "Invaders."

In the contest, 20 plants must be identified and evaluated. The rancher must know how much forage livestock can remove and still maintain the desirable grasses in the pasture. The range judge must also determine the proper range condition class of the contest site. The range condition survey is to the rancher what the thermometer is to the physician. A low condition class means a high temperature. The range is "sick." Some changes in management are needed if it is to survive as a productive unit.

Once the diagnosis has been made a prescription is in order. The range judge must select treatments necessary for the pasture being judged. These treatments must be selected to give correct utilization of forage, uniform distribution of grazing animals, and long time range improvement.

Among the things he must consider are increased or reduced stocking rates, cross-fencing, water development, relocation of salting places, mowing, reseeding, and deferred grazing programs.

LIST OF PLANTS

DECREASERS

Big bluestem	P ; W
Blowout grass	P ; W
Canada wildrye	P ; C
Dotted gayfeather	P ; *
Green needlegrass	P ; C
Half-shrub sundrop	P ; *
Indiangrass	P ; *
Indian ricegrass	P ; C
Leadplant amorphia	P ; *
Little bluestem	
(15 to 19 inch precipitation belt)	P ; W
Perennial sunflower	P ; *
Plains muhly	P ; W
Porcupine grass	P ; C
Prairie cordgrass	P ; W
Prairie junegrass	P ; C
Prairie sandreed	
(thin loess and shallow sites)	P ; W
Sand bluestem	P ; W
Sandcherry	P ; *
Sand lovegrass	P ; W
Scarlet guara	P ; *
Sideoats grama	P ; W
Switchgrass	P ; W
Western wheatgrass (on sand	
and clay sites in low rainfall)	P ; C

INCREASERS

American licorice	P ; *
Blue gramagrass	P ; W
Buffalograss	P ; W
Cudweed sagewort	P ; *
False boneset	P ; *
Fringed sagewort	P ; *
Hairy goldaster	P ; *
Hairy gramagrass	P ; *
Lemon scurfpea	P ; *
Little bluestem	
(over 20 inch precipitation)	P ; W
Needleandthread	P ; C
Needleleaf sedge	P ; C
Prairie coneflower	P ; C
Prairie sandreed (except on	
thin loess and shallow sites)	P ; W
Purple lovegrass	P ; W
Purple prairieclover	P ; *
Red threeawn	P ; W
Sand dropseed	P ; W
Sandhill muhly	P ; W
Sand paspalum	P ; W
Sand sagebrush	P ; *
Schribner's panicum	P ; C
Silky prairie clover	P ; *
Silverleaf scurfpea	P ; *
Slimflowered scurfpea	P ; *
Sun sedge	P ; C
Threadleaf sedge	
(often called blackroot)	P ; C

Western wheatgrass (except on sand and clay in low precipitation)	P ; C
White prairieclover	P ; *
Wildrose	P ; *
Yucca	P ; C

INVADERS

Annual eriogonum	A ; *
Broom snakeweed	P ; *
Cheatgrass brome	A ; C
Curlycup gumweed	P ; *
Daisy fleabane	A ; *
Green sagewort	P ; *
Hairy brome	A ; C
Japanese brome	A ; C
Kochia	A ; *
Lambsquarter	A ; *
Little wild barley	A ; C
Prairie threeawn	A ; W
Pricklypear	P ; *
Rocky mountain beeplant	A ; *
Russian thistle	A ; *
Shepherd's purse	A ; *
Sixweeks fescue	A ; C
Stinkgrass	A ; W
Texas croton	A ; *
Western ragweed	P ; *
Wooly indianwheat	A ; *
Woolywhite	A ; *

*Season of growth is not listed for broadleaf range plants.

In the above list the plants have been grouped according to their response to grazing in areas where they are of most importance. Two growth characteristics are given for each plant. The letters following the name of the plant indicate these characters. P = perennial, A = annual, W = warm-season, C = cool-season.

For example: Big bluestem P ; W means that big bluestem is a perennial, warm-season grass.

GLOSSARY

Following is a list of terms and definitions commonly used by people who work in the field of plant and range management identification. This list is not complete but should assist you in training the 4-H Club member to identify grasses. Many of the terms are illustrated in the manual.

Annual—a plant that goes through a complete life cycle in one year, an annual plant lives only one year.

Anther—the terminal portion of the stamen which contains the pollen.

Articulate—jointed; disarticulate—breaking apart at the joints.

Auricles—ear-like appendages present at the base of the leaf blade on certain grasses.

Awn—a long, slender, bristle-like appendage; a beard.

Biennial—a plant requiring two years to complete its life cycle.

Blade—the flat, extending, parallel veined portion of the grass leaf.

Caryopsis—a fruit in which the ovary wall and seed coat are inseparable, the fruit of a grass is a caryopsis.

Collar—the section of the grass leaf located at the junction of the blade and the sheath.

Cotyledon—the first seed leaf of a plant.

Culm—the stem of a grass.

Dicotyledon—having two seed leaves.

Dioecious—male and female flowers are borne separately and on different plants as in buffalograss.

Floret—a small flower, usually refers to the flower of a grass.

Glabrous—smooth, without hairs.

Glaucous—possessing a white powdery substance on the leaves and stems.

Glume—the two outermost bracts or leaves of the grass spikelet.

Lemma—the lower of the two bracts enclosing the grass floret.

Ligule—a membranaceous or hairy growth on the inside of the collar of a grass.

Monocotyledon—having one cotyledon or seed leaf, characteristic of the grass family.

Monocious—male and female flowers separate—but both present on the same plant.

Palea—the uppermost or innermost of the two bracts enclosing the grass floret.

Panicle—a type of inflorescence in which the rachis is much-branched, the spikelets are attached to these branches (rays) by short pedicels.

Pedice—the stem which attaches a flower or spikelet to the rachis.

Pistil—the female portion of a flower, consisting of the stigma style and ovary.

Prostrate—lying flat on the ground.

Pubescent—covered with fine hair.

Raceme—an inflorescence on which the spikelets or flowers are attached to the rachis by an unbranched pedicel.

Rachis—the central axis of the inflorescence.

Rhizome—an underground stem which gives rise to a new plant.

Sheath—the tubular portion of the grass leaf which folds around or envelopes the stem.

Spike—a type of inflorescence in which the spikelet or flower is attached directly to the rachis; without the aid of a pedicel.

Spikelet—a unit of the grass inflorescence consisting of two glumes and one to many florets.

Stamen—the male portion of the flower, composed of the filament and anther.

Stolon—an above ground stem that roots at the nodes and gives rise to new plants, the runners of buffalo grass are stolons.

RANGE MANAGEMENT TERMS

Short grass—Grasses normally growing less than 12 inches in height.

Mid-grass—Grasses normally growing from 1-3 feet in height.

Tall grass—Grasses normally growing over 4 feet in height.

Bunch grass—Grasses that grow in definite upright bunches. Reproduce by seed. They do not form a dense sod.

Sod grass—Grasses that form a mat or turf. Reproduce by seed, rhizomes, and stolons.

Litter—Plant material or residue left on the ground to improve soil condition and fertility.

Plant vigor—A measure of the health of the plant.

Ground cover—The percent of the ground covered by growing vegetation.

Range site—An area of rangeland in which the soil, climate and topography produce distinct kinds and amounts of vegetation.

Range condition—A comparison of the vegetation now growing on the site with the highest stage of plant growth the site can support. This describes the state of health of your range.

Decreasers—Include plants that are reduced in the composition as a result of utilization.

Increasers—Plants that increase in percentage of composition as a result of over utilization and death of the decreaser group. Under continued heavy grazing the increaser plants will actually react as decreasers.

Invaders—Plants that are present in small quantity or not present at all under ideal range condition. They tend to increase or come in with continued over-utilization of ranges.

RANGE CONDITION GUIDE

(15-19" Precipitation Belt)

Key species and their response to grazing as judged from climax or original type.

Maximum Percent Dry Weight in Climax or Original Type by Sites*													
INCREASERS	Wetland	Subirrigated	Overflow	Saline Lowlands	Sands	Choppy Sands	Sandy	Silty	Clayey	Dense Clay	Shallow	Thin Loess	Very Shallow
Prairie Sandreed	---	---	30	---	35	30	30	---	---	---	d	d	d
Needle and thread	---	---	10	---	20	10	30	20	d	d	d	d	d
Western wheatgrass	---	10	40	d	---	---	25	d	d	d	d	d	d
Sand dropseed	---	---	---	---	10	10	10	5	---	---	10	5	d
Indian ricegrass	---	---	---	---	5	10	15	---	---	---	---	---	d
Blue and hairy grama	---	---	5	---	10	5	15	20	20	25	25	20	35
Buffalograss	---	---	---	---	---	---	---	---	5	5	5	5	15
Sandhill muhly	---	---	---	---	5	5	---	---	---	---	---	---	---
Sedge family	25	15	5	5	5	---	15	10	---	---	15	---	d
Sandberg bluegrass	---	---	---	---	---	---	---	---	5	5	5	---	10
Perennial threeawns	---	---	---	---	---	---	---	---	---	---	---	---	5
Inland saltgrass	---	---	---	25	---	---	---	---	---	---	---	---	---
Grey sageworts	---	---	5	---	5	---	5	5	---	---	5	---	---
Woody increasers	---	---	5	---	5	5	5	---	---	---	---	---	15
Other forb increasers	---	5	---	---	---	5	---	5	---	---	---	---	5

*The symbol "—" means the species produces less than 2½% of the dry weight, or was not a part of, the climax vegetation of the site.

The symbol "d" means the species is a decreaser on the site.

DECREASERS		INVADERS (Less than 2½% in climax)	
Prairie cordgrass	Big bluestem	All annuals	All exotics
Sand bluestem	Indiangrass	Tumblegrass	Foxtail barley
Switchgrass	Canada wildrye	Western ragweed	Dandelion
Green needlegrass	Little bluestem	Ironweed	Curlycup gumweed
Sideoats grama	Slender wheatgrass	Thistles	Broom snakeweed
Sand lovegrass	Prairie junegrass	Green sagewort	Buckthorn plantain
Plains muhly	Alkali sacaton	Cactus	
Forbs decreasers			

*As modified from SCS Technicians Guide

Range Condition and Recommended Stocking Rates Based on Precipitation Belt, Site, and Range Condition in Percent.

For Wet Land use 3 times value for Precipitation Belt; for subirrigated use 2 times value for Precipitation Belt; for Overflow use value of next higher Precipitation Belt; for Saline Lowland use value ½ to 1 belt higher; for Sand, Sandy, Silty and Clayey use values for Precipitation Belt; for Choppy Sand use value ½ belt lower; for Dense Clay and Shallow use value ½ to 1 belt lower; for Thin Loess use values 1 to 1½ belts lower; for Very Shallow use values 1½ to 2 belts lower.

Average Annual Precipitation (Inches)	100	Range Condition Percentage		
		75	50	25
		(Animal Unit Months Per Acre)		
35-39	1.4	1.05	.7	.35
30-34	1.2	.9	.6	.3
25-29	1.0	.75	.5	.25
20-24	.8	.6	.4	.2
15-19	.6	.45	.3	.15
10-14	.4	.3	.2	.1
5-9	.2	.15	.1	.05
Condition Class	(Excellent)	(Good)	(Fair)	(Poor)

RANGE CONDITION GUIDE

(20-24" Precipitation Belt)

Key species and their response to grazing as judged from climax or original type.

Maximum Percent Dry Weight in Climax or Original Type by Sites*

INCREASERS	Wetland	Subirrigated	Overflow	Saline Lowland	Sands	Choppy Sands	Sandy	Silty	Clayey	Dense Clay	Shallow	Thin Loess	Very Shallow
Little bluestem	---	---	20	---	25	30	d	d	d	d	d	d	d
Prairie sandreed	---	---	15	---	30	20	25	---	---	---	d	d	d
Western wheatgrass	---	5	20	d	---	---	15	25	30	d	30	25	d
Needle and thread	---	---	5	---	10	---	20	15	d	d	d	d	d
Sideoats grama	---	---	---	---	---	---	d	15	d	d	d	d	d
Blue and hairy grama	---	---	---	---	5	---	10	15	15	20	20	15	30
Sand Dropseed	---	---	---	---	5	5	5	---	---	---	5	5	d
Tall dropseed	---	---	5	---	---	---	5	5	---	---	---	---	---
Sedge family	25	15	5	5	5	5	5	5	---	---	5	d	d
Rosette panicums	---	---	---	---	5	---	5	---	---	---	---	---	---
Sandhill muhly	---	---	---	---	5	5	---	---	---	---	---	---	---
Buffalograss	---	---	---	---	---	---	---	---	---	5	5	---	10
Inland saltgrass	---	---	---	25	---	---	---	---	---	---	---	---	---
Perennial threeawns	---	---	---	---	---	---	---	---	---	---	---	---	5
Grey sageworts	---	---	---	---	5	---	5	5	---	---	5	---	---
Other forb increasers	---	5	---	---	---	5	---	5	5	5	---	---	5
Woody increasers	---	---	10	---	5	10	5	---	---	---	---	5	15

*The symbol "—" means the species produces less than 2½% of the dry weight, or was not a part of, the climax vegetation of this site. The symbol 'd' means the species is a decreaser on that site.

DECREASERS

Prairie cordgrass	Reed canarygrass
Reed grasses	Big bluestem
Sand bluestem	Indiangrass
Switchgrass	Green needlegrass
Porcupinegrass	Sand lovegrass
Canada wildrye	Prairie junegrass
Alkali sacaton	Plains muhly
Green muhly	Forb decreaseers
Leadplant amorphia	

INVADERS (Less than 2½% in climax)

All annuals	All exotics
Tumblegrass	Foxtail barley
Perennial threeawn	Short muhly spp.
Western ragweed	Dandelion
Ironweed	Curlycup gunweed
Verbena	Thistles
Broom snakeweed	Green sagewort
Leafy spurge	

*As modified from SCS Technicians Guide

Range Condition and Recommended Stocking Rates Based on Precipitation Belt, Site, and Range Condition in Percent.

For Wet Land use 3 times value for Precipitation Belt; for subirrigated use 2 times value for Precipitation Belt; for Overflow use value of next higher Precipitation Belt; for Saline Lowland use value ½ to 1 belt higher; for Sand, Sandy, Silty and Clayey use values for Precipitation Belt; for Choppy Sand use value ½ belt lower; for Dense Clay and Shallow use value ½ to 1 belt lower; for Thin Loess use values 1 to 1½ belts lower; for Very Shallow use values 1½ to 2 belts lower.

Average Annual Precipitation	100	Range Condition Percentage		
		75	50	25
(Inches)		(Animal Unit Months Per Acre)		
35-39	1.4	1.05	.7	.35
30-34	1.2	.9	.6	.3
25-29	1.0	.75	.5	.25
20-24	.8	.6	.4	.2
15-19	.6	.45	.3	.15
10-14	.4	.3	.2	.1
5-9	.2	.15	.1	.05
Condition Class	(Excellent)	(Good)	(Fair)	(Poor)

RANGE CONDITION SCORE CARD
Rainfall Belt 15 to 19 Inches Per Year

Pasture No. 1 Range Site <i>Sandy</i>	Estimated % Of Each Species in Total Forage Yield	% To Be Counted Toward Condition Score for This Range Site	Write % Of Each Species Allowed Toward Condition Score
DECREASEASERS			
Sand Bluestem	5%	ALL	5
Switchgrass	Trace	ALL	} 5
Little bluestem	Trace	ALL	
Prairie junegrass	Trace	ALL	
		ALL	
		ALL	
INCREASEASERS			
Prairie Sandreed	35%		30
Needle and Thread	30%		30
Sedge	5%		5
Green Sagewort	5%		5
INVADERS			
Downy Brome	5%	NONE	0000
Sixs Weeks Fescue	5%	NONE	0000
Prickly Pear Cactus	5%	NONE	0000
		NONE	0000
		NONE	0000
		NONE	0000
		NONE	0000
TOTAL ALL SPECIES → 100%		XXXX	TOTAL SCORE 80 (Copy Total Score in Correct RANGE CON- DITION CLASS Space)
Suggested Stocking Rates → in Animal Unit Months per acre for each kind of range. (From Range Condition Guide)		.6	EXCELLENT 75-100
			GOOD 50-75
			FAIR 25-50
			POOR 0-25

Formula: Acres in pasture less unusable acres, equals *usable* acres. Usable acres, times Animal Unit Months (AUM) per acre (from Suggested Stocking Rate Table) equals AUM in pasture for grazing season. Months in grazing season, divided into AUM equals Animal Units (AU) carrying capacity of the pasture for season. To figure how long (months) a pasture will carry a "herd" of animals, divide the AUM for the pasture by the AU in the herd.

1 mature cow (with or without calf) or five sheep, equals one AU

1 yearling equals .75 AU.

1 horse or 1 mature bull equals 1.25 AU.

NEBRASKA RANGE JUDGING

Contestant Number _____

Sheet II

Sheet II Score _____

Scorecard

Indicate answers by placing an X in front of the correct word or statement.*

Part II—Kind of Range Site (Check one)

<input type="checkbox"/>	Wet land	<input type="checkbox"/>	Clayey
<input type="checkbox"/>	Subirrigated	<input type="checkbox"/>	Dense clay
<input type="checkbox"/>	Overflow	<input type="checkbox"/>	Choppy Sandhills
<input type="checkbox"/>	Saline lowland	<input type="checkbox"/>	Shallow
<input type="checkbox"/>	Sands	<input type="checkbox"/>	Thin loess
<input type="checkbox"/>	Sandy	<input type="checkbox"/>	Very shallow
<input type="checkbox"/>	Silty	<input type="checkbox"/>	

Part III—Degree of Use (Check one)

<input type="checkbox"/>	Unused	<input type="checkbox"/>	Full
<input type="checkbox"/>	Slight	<input type="checkbox"/>	Close
<input type="checkbox"/>	Light	<input type="checkbox"/>	Severe
<input type="checkbox"/>	Moderate	<input type="checkbox"/>	Destructive

Part IV—Range Condition (Check one)

<input type="checkbox"/>	Excellent
<input type="checkbox"/>	Good
<input type="checkbox"/>	Fair
<input type="checkbox"/>	Poor

Part V—Possible Treatments

A. For Full Use	
<input type="checkbox"/>	Reduce amount of grazing
<input type="checkbox"/>	Increase amount of grazing
<input type="checkbox"/>	Keep stocking rate the same
B. For More Uniform Use	
<input type="checkbox"/>	Install another well
<input type="checkbox"/>	Relocate well
<input type="checkbox"/>	Construct livestock dam
<input type="checkbox"/>	Develop spring
<input type="checkbox"/>	Relocate fence
<input type="checkbox"/>	Divide pasture
<input type="checkbox"/>	Relocate salting places
<input type="checkbox"/>	Mow certain areas
C. For Range Improvement	
<input type="checkbox"/>	Deferred during grazing season
<input type="checkbox"/>	Deferred first part of grazing season
<input type="checkbox"/>	Deferred last part of grazing season
<input type="checkbox"/>	Deferred two or more consecutive growing seasons
<input type="checkbox"/>	Reseed specific areas
<input type="checkbox"/>	Reseed entire pasture
<input type="checkbox"/>	Mow annual weeds
<input type="checkbox"/>	Spray perennial weeds and brush
<input type="checkbox"/>	Mechanical treatment
<input type="checkbox"/>	Other

* See back side for help in selecting answers on Parts II, III and IV.

Read each of these carefully. They will help you to select the correct answers for Parts II, III and IV of the Contest. When you find the situation corresponding to the contest site, mark it on the front of this score card.

Part II—Selection of Range Site

Wet Land (Poorly drained)—Water table within one foot. May be flooded during part of the season.

Subirrigated—Water table generally within one to three feet.

Overflow—Areas receiving overflow and run in moisture.

Saline Lowland—Overflow or subirrigated land affected by salt accumulations.

Sands—Sands, loamy sands and loamy fine sands on nearly level to gentle slopes.

Sandy—Sandy loams and loamy fine sands.

Silty—Very fine sandy loams, silt loams and silts.

Clayey—Sandy clay loams, silty clay loams, and clay loams.

Dense clay—Sandy clay, silty clay, and clay.

Choppy sandhills—Sands on steep slopes.

Shallow—All soils 10-20 inches deep over rock, shale, or coarse gravel.

Thin loess—Silty on steep slopes, generally over 20%.

Very shallow—All soils less than 10 inches deep, over rock, shale, or coarse gravel.

Part III—Degree of Use

Unused—No livestock use.

Slight—Practically undisturbed.

Light—Only best plants grazed.

Moderate—Most of range being grazed. Little or no use of poor plants.

Full—All the range grazed. Little or no use of poor plants.

Close—All of the range shows use and major sections are closely grazed. Some use of low value plants.

Severe—Primary forage plants almost completely used. Low value plants carrying the grazing load.

Destructive—Much death loss of primary species. Only remnants of good plants survive.

Part IV—Range Condition

Excellent—75—100% of the vegetation is of climax or original type.

Good —50— 75% of the vegetation is of climax or original type.

Fair —25— 50% of the vegetation is of climax or original type.

Poor — 0— 25% of the vegetation is of climax or original type.

NEBRASKA RANGE JUDGING

Contestant Number _____

Sheet I

Sheet I Score _____

Scorecard

Part I

Write name of plant

Check one in each division

	NAME OF PLANT	Perennial	Annual	Cool	Warm	Increaser	Decreaser	Invader
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

KEY TO GRASSES AND GRASSLIKE PLANTS OF NEBRASKA

- A. Triangular stem; from a vertical view, the leaves spread out like a three-bladed propeller.
 - i. Dryland plant; yellow-green slender leaves, V-shaped, four to six inches tall..... *Threadleaf Sedge.*
 - ii. Plant of moist areas, leaves silvery blue, over one-fourth inch wide..... *Nebraska Sedge.*
- B. Stems round; leaves not three ranked.
 - i. Leaves similar to the round, single dark-green stem; flowers appear from a slit along the upper stem; stems and leaves arise from woody underground stem..... *Baltic Rush.*
 - ii. Leaves arranged on opposite sides of a round stem which is hollow except at the nodes..... *Grass Family.*
- I. Spikelets have one perfect terminal floret and a sterile floret below it; glumes fall with the ripe seed.
 - 1a. Spikelets in pairs, one perfect and without pedicel; the other sterile and on pedicel; inflorescence has a feathery appearance.
 - 2a. Inflorescence feathery, jointed, with small seeds
 - 3a. Inflorescence shaped like a turkey foot.
 - 4a. Rhizomes short or lacking, hairs of inflorescence usually purplish, plant typically on bottom land sites..... *Big Bluestem.*
 - 4b. Long rhizomes, hairs of inflorescence usually yellow; plants typically on sandy sites..... *Sand Bluestem.*
 - 3b. Inflorescence jointed but not divided from a single point, slender; distinctly bunchgrass..... *Little Bluestem*
 - 2b. Inflorescence resembling a feathery millet head..... *Indiangrass.*
 - 1b. Spikelets not in pairs.
 - 5a. Inflorescence a panicle; seeds small, hard, shiny and slick; rhizomes present..... *Switchgrass.*
 - 5b. Spikelets with short stalks arranged in two rows on one side of the branched stalk, having the appearance of beads attached along a broom straw; does not have rhizomes..... *Sand Paspalum.*
- II. Spikelets have one to many florets; if sterile floret is present it is usually above fertile florets; glumes generally do not fall with the ripe seed but remain on the stalk.
 - 6a. Spikelets attached to rachis without a pedicel
 - 7a. Inflorescence is a single, terminal spike; spikelets alternate on opposite sides of the rachis.
 - 8a. One spikelet at each node of the rachis.
 - 9a. Plants have rhizomes and form a sod; blue-green in color; abundant on clay soils..... *Western Wheatgrass.*
 - 9b. Plants without rhizomes; forms bunches..... *Slender Wheatgrass.*
 - 8b. Two or more spikelets at each node of the rachis.
 - 10a. Two 2-flowered spikelets at each node of the rachis; rachis breaks into individual joints when mature..... *Squirrel Tail.*
 - 11a. Three spikelets at a node, the two outer ones reduced to awns; spikelets have one floret..... *Foxtail Barley.*
 - 11b. Three or four spikelets at a node, outer ones not reduced to awns; spikelets have two or more florets..... *Canada Wildrye.*
 - 7b. Inflorescence is composed of two or more one-sided spikes; spikelets arranged along the stalk like teeth of comb; spikelets are in two rows on one side of the stalk.
 - 12a. Plants with stolons; male and female flowers on separate plants..... *Buffalograss.*
 - 12b. Plants without stolons; flowers perfect.
 - 13a. Plants turf-like or spreading in habits.
 - 14a. Low growing turf-like plants spreading only by tillering (producing new stalks from the base of the plant) .
 - 15a. Rachis usually curved, giving the spike resemblance to curl of a dog's tail; spikelets to the tip of the rachis..... *Blue Grama.*
 - 15b. Rachis straight or curved but always extending beyond spikelets; hair on margins of leaves..... *Hairy Grama.*
 - 14b. Taller turf-forming plants spreading by short rhizomes; spikelets somewhat pendulous from a vertical stalk..... *Sideoats Grama.*
 - 13b. Plants distinctly bunchlike in habit; inflorescence branched and made up of long slender spikes..... *Texas Crabgrass.*
 - 6b. Spikelets attached to rachis by a pedicel.
 - 16a. Spikelets with one floret. Inflorescence is open or spike-like panicle.
 - 17a. Fruit is hard, sharp-pointed; lemma awned.
 - 18a. Awn three-branched..... *Three-awn.*
 - 18b. Awn not branched.
 - 19a. Awn persistent and twisted upon maturity.
 - 20a. Awn three or seven inches long; fruit sharp pointed; panicle narrow, included at the base..... *Needle and Thread.*
 - 20b. Awn about one inch long; panicle narrow but exserted; throat of sheath villous..... *Green Needlegrass.*

- 19b. Awn neither persistent nor twisted, less than one-fourth inch long; fruit not sharp pointed; panicle branches in pairs; panicle wide spreading *Indian Ricegrass*
- 17b. Fruit thin, not sharp pointed.
- 21a. Lemmas awned; plants typically form a ring; rhizomes present *Sandhill Muhly*.
- 21b. Lemmas not awned; plants do not form a ring.
- 22a. Floret with tuft of hairs from the base; rhizomes present *Prairie Sandreed*.
- 22b. Floret without tuft of hairs at the base; rhizomes absent.
- 23a. Large clumpy bunchgrass in alkaline meadow-land areas; not conspicuously hairy at the top of the sheath *Alkali Sacaton*.
- 23b. Medium sized bunchgrass common to sandy soils and old fields; conspicuous white hairs at the summit of the sheath *Sand Dropseed*.
- 16b. Spikelets with two or more florets; inflorescence wither a narrow or open panicle.
- 16b. Spikelets with two or more florets; inflorescence with either a narrow or open panicle.
- 24a. Glumes as long as the lower-most floret; panicle compressed, nearly cylindrical in shape *Prairie Junegrass*.
- 24b. Glumes do not reach the tip of the lower-most floret; panicle open.
- 25a. Male and female flowers on separate plants; rhizomes present *Saltgrass*.
- 25b. Flowers perfect.
- 26a. Annual plants
- 27a. Lemma awned from a split apex; sheaths hairy; awns $\frac{1}{2}$ inch long *Downy Brome*.
- 27b. Lemma awned from the tip; sheaths smooth; awns $\frac{1}{4}$ inch or less in length *Sixweeks Fescue*.
- 26b. Perennial grasses of the sand dunes.
- 28a. Rhizomes present; leaves elongated, lax, narrow; sheaths not hairy at the summit *Blowout Grass*.
- 28b. Rhizomes absent; leaves and culms erect; sheaths conspicuously hairy at the summit *Sand Lovegrass*.