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EC76-131 Nebraska Handbook of Range Management

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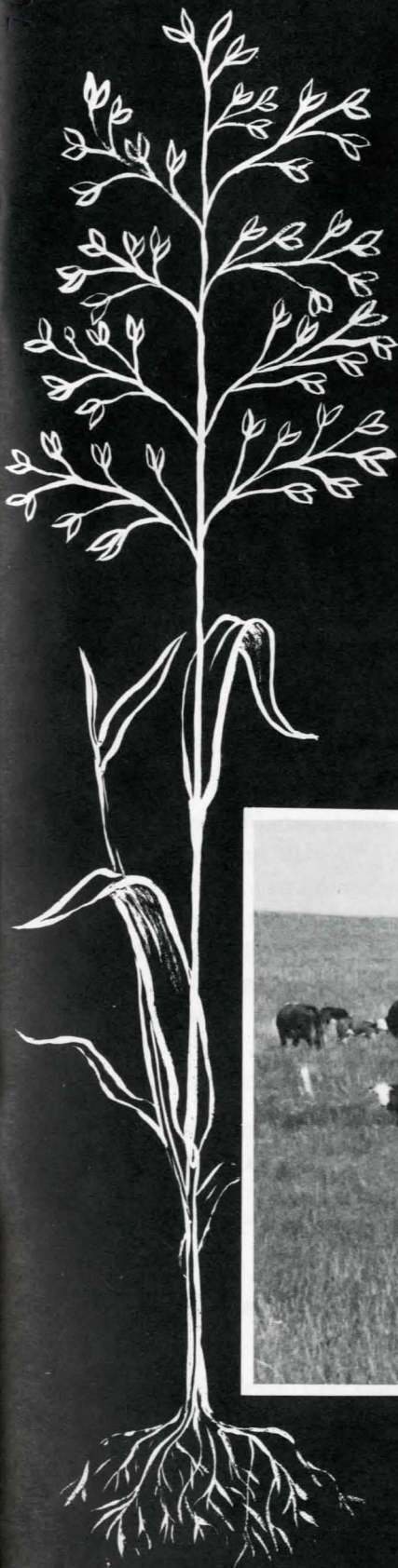
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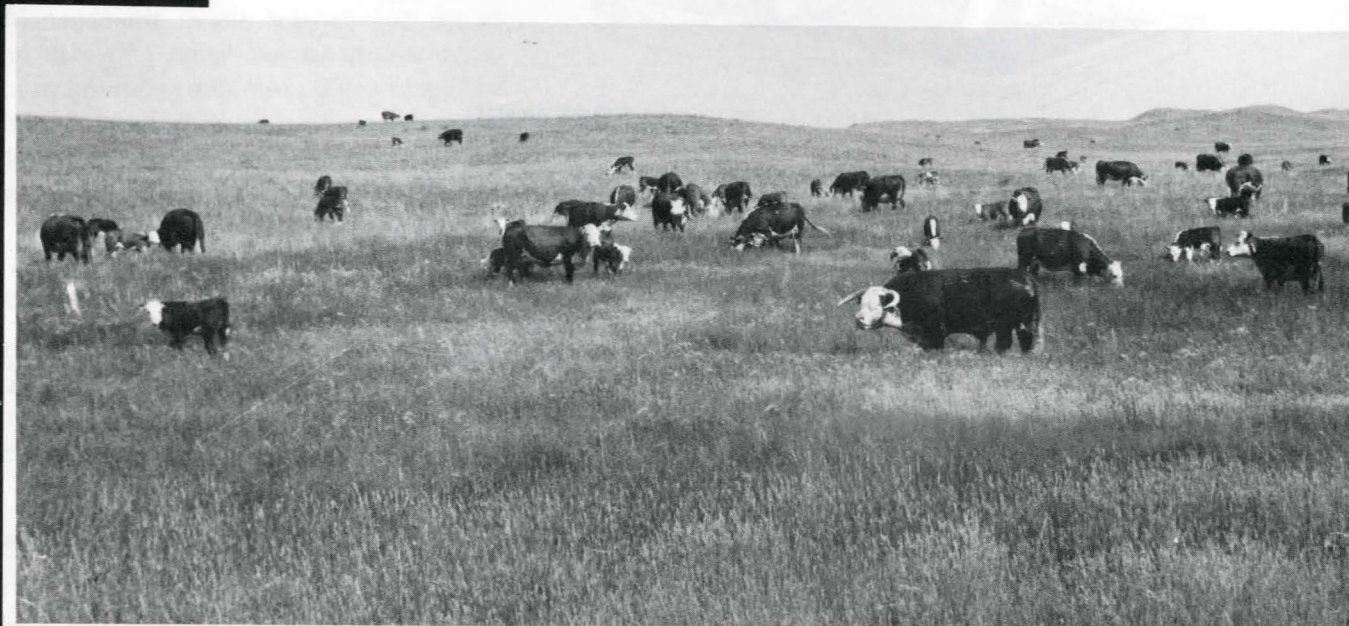
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Nebraska Handbook of Range Management



EXTENSION WORK IN "AGRICULTURE, HOME ECONOMICS AND SUBJECTS RELATING THERETO,"
THE COOPERATIVE EXTENSION SERVICE, INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES,
UNIVERSITY OF NEBRASKA-LINCOLN, COOPERATING WITH THE COUNTIES AND THE U.S. DEPARTMENT OF AGRICULTURE
LEO E. LUCAS, DIRECTOR

CONTENTS

Range—to Have and to Use	3
How the Range Livestock Industry Began	4
Nebraska—A Range State	5
Kinds of Range Plants	7
The Parts of a Plant	9
Range Plant Forage Values	11
Poisonous Plant Problems	15
How Rangeland Develops	15
How Grazing Affects Plants	21
Range Condition	23
Determining the Best Initial Stocking Rate	27
Adjusting the Stocking Rate	30
Grazing Management and Grazing Systems	32
Stockwater Developments and Range Fencing	35
Range Seeding	37
Miscellaneous Range Improvements	41
Complimentary Forage Crops	43

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FOREWORD

The Society for Range Management was created in 1947 to advance the science and art of managing grazing lands. Under the direction of its Committee for Cooperation with Youth Organizations, a basic manual, "Range, Its Nature and Use", was developed in 1957. Material taken from "Range, Its Nature and Use" and used in this manual is gratefully acknowledged. This manual was extensively modified to meet the basic needs of the range industry in Nebraska. It should find use not only as a youth manual but also as a reference for many range managers. Drs. J. F. Vallentine and D. F. Burzlaff prepared the first edition in 1968. We are particularly indebted to their work. We also acknowledge the technical inputs of Drs. J. T. Nichols and L. E. Moser.

Nebraska Handbook of Range Management

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CHAPTER 1

Range—to Have and to Use

Range is the primary resource of a ranching operation. Range generally refers to large blocks of level, rolling, broken, or mountainous land usually not suited to farming. These lands are covered with native grasses and other forage plants best used for grazing by livestock and wild game. Grass, the rancher's crop, is converted into a salable product through the grazing animal. Ranges may be privately or publicly owned, fenced into pastures or unfenced, and may support native or seeded vegetation.

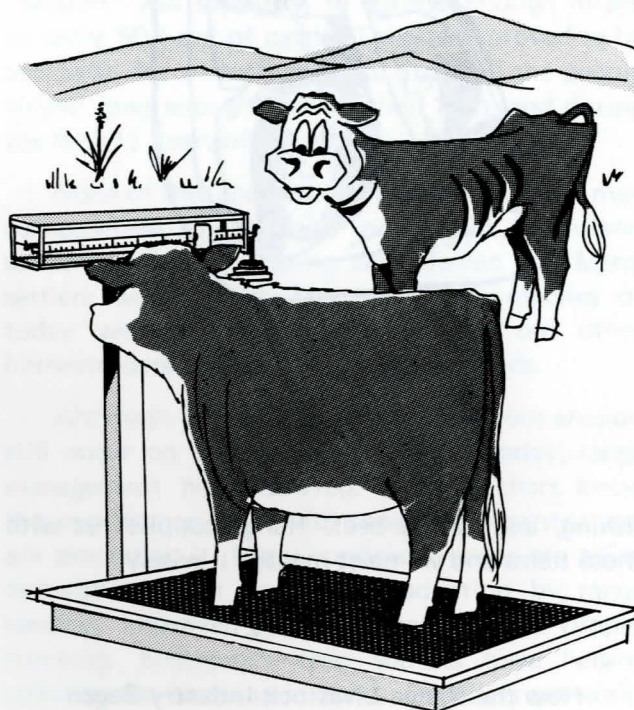
Range Management is the science and art of planning and directing range use to obtain maximum long-term animal production. Since range is a natural resource, it deserves sound management. Range production is based on sound management of a range forage crop for use by livestock. However, a range must be utilized so that soil does not erode, and so the range forage plants remain vigorous and productive.

Management of grazing animals is the first order of business for the range manager. Without the controlled removal of forage from the rangeland, all other processes in range management are useless.

Four key principles of rangeland management are:

1. Balance the number of animals with the forage supply.
2. Graze during the proper season or combination of seasons of the year.
3. Use every possible method to keep grazing animals properly distributed (spread out) over the range.

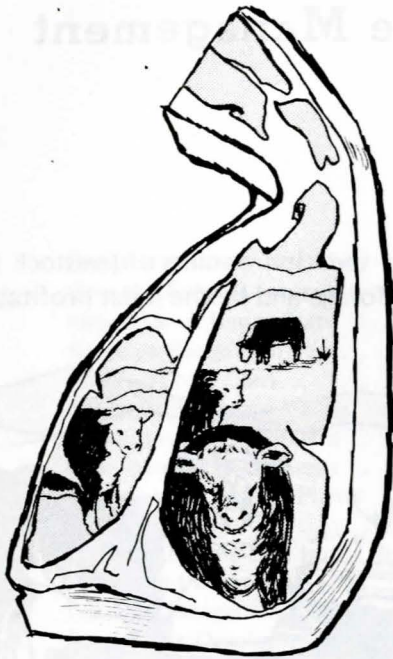
4. Graze the kind or class of livestock that can best use the forage and be the most profitable.



It's pounds that count.

Besides sale of livestock or their products, other uses may be made of the range at the same time. This is called **multiple use** and is particularly important on public lands. A range can be grazed by livestock to harvest forage and at the same time yield water, produce game animals, tree products, and provide recreation. However, these uses sometimes compete with one another. The stockman and other users of the range should work and plan together.

Everyone in Nebraska should be interested in range. The plants and soil are the foundation of Nebraska's economy. Grass must be of the right kind and kept productive for best use of this resource. Most people enjoy hunting, camping,



A "steak" in the range.

fishing, and eating beef. Range supplies us with those items and we must manage it wisely.

CHAPTER 2

How the Range Livestock Industry Began

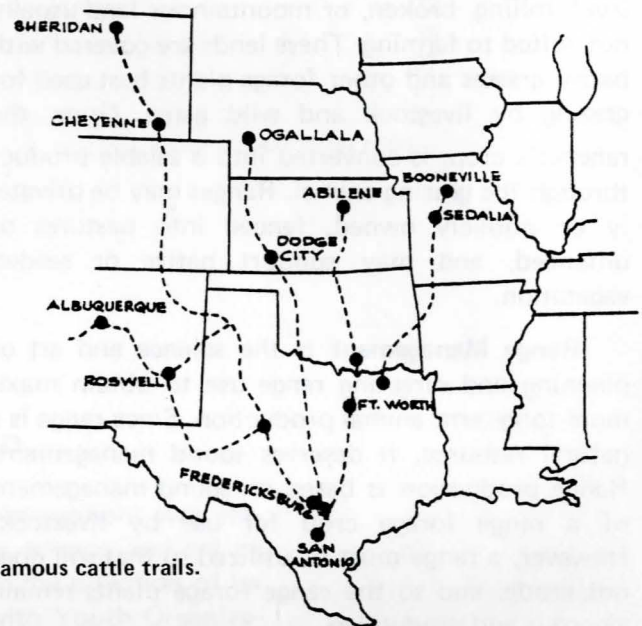
Before immigrants came to this country, rangeland was used only by buffalo, deer, elk, and antelope. These animals were used for food by the Indians and later by trappers and settlers. Today this same rangeland produces beef, lamb, and wool for America.

The story of range is not complete without a review of the range livestock industry. The first cattle were brought into the United States by the Spanish explorer Coronado in 1540. As missionaries and Spanish explorers moved north from Mexico into territory occupied by Indians, they took livestock with them. Grazing of livestock became important in Texas and California.

Cattlemen were often close behind the fur trappers in moving west. During the Civil War, cattle moving west from the eastern states and cattle coming north from Mexico met in Texas. Before long there was not enough range in Texas for these vast herds. New markets were needed.

Northern railroads offered outlets for cattle, and large trail drives began heading north from Texas to the railheads in about 1866. Cattle on trail drives averaged 15 to 20 miles per day and gained weight from eating the abundant forage along the trail. Some of the most famous trails were Chisholm, Shawnee, Ft. Griffin, Dodge City, Sedalia, and Goodnight.

Nebraska contributed its share to the history of the range industry. The Ft. Griffin and Dodge City Trail ended at Ogallala. Cattle moved from Ogallala by rail to markets in eastern United States. Many of the cattle were kept in Nebraska or trailed on to Montana and the Dakotas. Other cattle were brought to Nebraska from the East by settlers and by the "Forty Niners."



Famous cattle trails.

Stockmen coming to Nebraska first settled on "hardland" range along the Platte River. However, they soon learned that the Nebraska Sandhills could be an important cattle-producing area. Livestock that were lost or left in the Sandhills were often in good condition the following spring. Trail herds held over for shipment at a later date gained well on the tall grasses of the rolling Sandhills. Settlement of the area by cattlemen began, and Nebraska ranges were quickly filled with cattle.

Trouble was ahead for the cattlemen. During the severe winter of 1885-86, thousands of cattle died from exposure and starvation. The next year the Great Plains had a severe drought, again reducing cattle numbers. This was followed by one

of the severest winters yet recorded. High winds, snow, and bitter cold combined to nearly wipe out many cattle herds.

Other factors besides severe weather caused heavy cattle losses in the 1880's. For example, many ranges had been carelessly overstocked and ranches were poorly managed. No range was saved for winter grazing and no preparation was made to insure that cattle had forage and water during winter emergencies. Little use was made of fencing, salting, and new stock watering places to distribute livestock more evenly.

Only stockmen with a true regard for their cattle survived the 1880's. These were the pioneers of the present cattle industry in Nebraska. They saw the need for following better grazing practices, providing for their stock in the winter, and improving their business by starting permanent ranches.

Although hard times reduced cattle numbers in the 1880's, the sheep industry grew rapidly. The presence of the sheepman, with his large flocks and the habit of wandering from place to place, was resented by cattlemen. Many range wars were fought between cattlemen and sheepmen. Finally, sheepmen and cattlemen learned to live in peace, and sheep production was accepted as an important part of the livestock industry in the West.

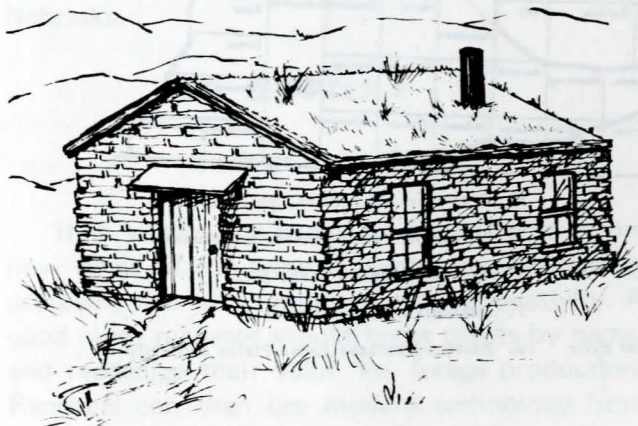
Settlers were encouraged by several government land settlement laws. The first Homestead Act was passed in 1862. This law gave land in 160-acre tracts to settlers after they had lived five years on the land. Most of the productive land in the Middle West was in private ownership by 1870.

It was soon learned that the 160 acres allowed by the Homestead Act was not enough to support a family in the West. The Enlarged Homestead Act was passed in 1909, which gave 320 acres to settlers. Also, the homesteader had to live on the land only three years to "prove up".

The Stock-Raising Homestead Act of 1916 was designed for settlement of far-western lands not suited to farming. Stockmen were given 640 acres of land under this act. This square mile, or "section" was supposed to furnish enough forage to carry 50 head of cattle. This, too, proved to be too small for a ranch and less than half the people stayed long enough to own their own land during the first 12 years of the act.

None of the land settlement acts allowed a man to homestead enough land for a ranch. Much land suitable only for grazing was plowed up. Many settlers went broke. Most Nebraska ranches of today were put together by buying out other homesteaders and by buying railroad lands.

Although improper grazing and serious erosion still occur on some Nebraska ranges today, range management has improved. Most ranchers know the importance of careful range management and are practicing it. Many rundown ranges are being restored to high levels of production by range seeding, improved grazing practices, and proper stocking. Emergency feed sources have helped stabilize the ranching industry. Ranchers are working together with University of Nebraska range specialists and the Soil Conservation Service to find new and better ways of producing livestock from range forage.



At home in the "soddy."

CHAPTER 3

Nebraska—A Range State

Nebraska ranks fourth only to Texas, Missouri, and Oklahoma in number of brood cows. In 1974 there were about 2.2 million beef cows two years of age or older in Nebraska. The total number of beef cattle in Nebraska on January 1, 1975, was 6.9 million. Most of these cattle get all or part of their forage from Nebraska grazing lands. Beef cow numbers have increased in all areas of Nebraska, but most rapidly in the crop growing areas of the

Table 1. Beef cow numbers, 1963 and 1974, in Nebraska by crop reporting districts.

District	Cow numbers	
	1963	1974
---Thousands---		
Northwest	261	298
North	509	555
Northeast	127	259
Central	206	308
East	119	228
Southwest	189	248
South	96	152
Southeast	116	199
TOTAL	1,623	2,247

state, such as the northeast, central, south, and east (Table 1).

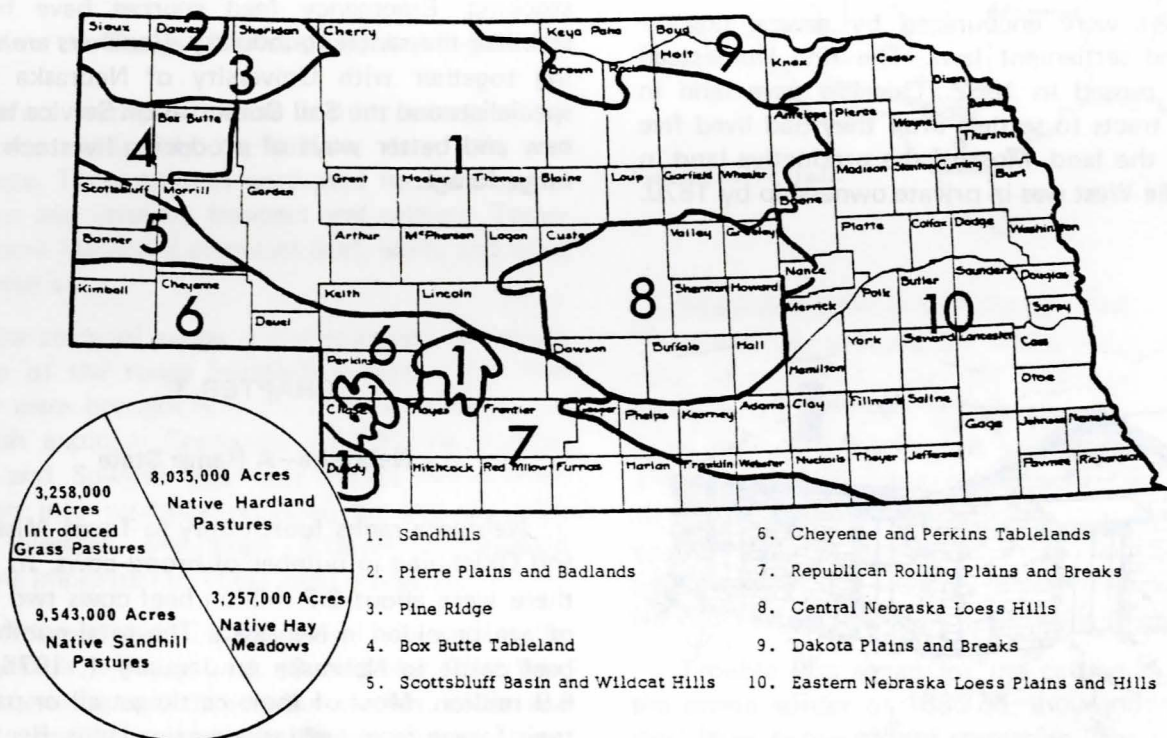
There are nearly one billion acres of rangeland in the United States. Most of this is in the 17 western states, including Nebraska. This western range area contains more than 700 million acres. Rangelands in the western U.S. are important because of the large amount of land area used for grazing.

In Nebraska there are about 24 million acres of grassland devoted to the production of forage for grazing animals. Thus, more than 50% of the land in farms and ranches in Nebraska is grassland. The larger blocks of rangeland lie in the northcentral and western parts of the state.

The Sandhills of northcentral Nebraska represent one of the largest undivided expanses of grassland in the United States. About half of all grassland in Nebraska is in the Sandhills. Because of the sandy soil, the Sandhills are better suited for grazing than for crop production, even though rainfall is high enough to produce field crops.

The Sandhills are known for their abundance of mid and tall grasses and for high quality beef cattle. Here are found many of the larger beef breeding herds in Nebraska. Cherry County, in the Nebraska Sandhills, has more grazing cattle and calves than any other county in the U.S. Cattle are marketed as calves, yearlings, or long yearlings, and occasionally even as two-year-old steers. Most go to feedlots for finishing.

Wild hay is cut from about 20% of the Sandhills ranges, particularly from the highly pro-



Nebraska's range resource and range areas.

ductive wet land and subirrigated meadows. Some Sandhills ranchers winter cattle by feeding hay and grazing regrowth on hay meadows. Other ranchers winter cattle on rangeland (uncut forage) with high protein supplements. These ranchers feed hay only in stormy weather. The use of alfalfa as a protein and energy supplement is increasing.

Range livestock is the main agricultural industry in the Pierre Plains, Badlands, Pine Ridge, and the Box Butte Tableland. Short grasses such as buffalograss and blue grama and a few taller wheatgrasses provide a major part of the range forage. Some flocks of sheep are maintained in these areas.

In other sections of the Nebraska Panhandle, range livestock are produced on roughlands and in river breaks. Only on the wheatlands in central Box Butte County and on the Cheyenne and Perkins Tablelands, and in irrigated sections along the Platte and White River Valleys, is cash grain production more important than range livestock production.

About half of the land is grassland along the breaks of the Republican River in southern Nebraska, in the Loess Hills along the forks of the Loup River in central Nebraska, and on the Dakota plains and breaks. Pastures in these areas have fewer acres than farther west and are mixed with cultivated lands. Cattle are commonly grazed on these pastures in the summer and wintered on hay, silage, or crop stubble. Poor grassland management is more common under these conditions than in areas of range-livestock production.

Rangeland is less important in the eastern Nebraska loess plains and hills. Small, scattered pastures are found in most counties. A few large areas of grasslands are present in northeastern Nebraska.

CHAPTER 4

Kinds of Range Plants

It is vitally important for ranchers to know how range plants grow in order to plan grazing programs that will improve range productivity. A good range manager should know plants by name, and recognize their value for forage production. Ranchers can then use modern technology from range science to increase ranch profits as well as improve and safeguard the range resource.



Know your plants.

Kinds and amounts of plants suggest the kind of range. The presence or absence of certain plants can indicate how the range has been used and what should be done to improve or maintain it.

There are several hundred different plants on Nebraska rangelands. Each is a different species, like western wheatgrass or blue grama. You need not know all of them. You should be familiar with plants that furnish the most forage for livestock as well as those that are pests, or even poisonous. As a general rule, there will be 25 to 30 species in any one range area that will be of outstanding importance. To have forage value, a range plant must be liked by grazing animals. Range plants are also vitally important for holding soil to prevent serious erosion.

Since there are so many different kinds of plants that grow on range, it helps to group them by their appearance and growth habits. The four main kinds of range plants are grasses, grasslike plants (sedges and rushes), forbs, and shrubs.

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

- Western wheatgrass
- Downy brome
- Sand bluestem
- Blue grama

Grasslike Plants. Grasslike plants are the sedges and rushes present in wet meadows but often found on uplands. These look like grasses but have solid (not hollow) stems and are triangular in the sedges. The stems have no nodes. However, the

veins are parallel as in the true grasses. Examples are:

Threadleaf sedge
Baltic rush

Forbs. Forbs (weeds and range flowers) are quite different from grasses. They are not grasslike but have net-like veins in the leaves and the leaves are often broad. They may be annuals or perennials, but the top growth dies back every winter. The word "forb" is better than "weed" because weeds are usually thought of as pests. Many of the range forbs are not pests because they can be used as forage. Examples are:

Purple prairieclover
Gayfeathers
Goldenrods
Prairie coneflower
Lemon Scurfpea
American Licorice

Shrubs. These are plants with woody stems with the topgrowth living over from one year to the next. New growth starts each spring from points above ground along the stem. Many shrubs do not have trunks but branch out from near the base of the plant. The portion of shrubs that animals may consume is called browse. Examples are:





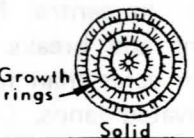


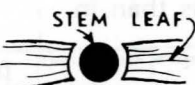


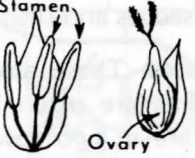








Sand sagebrush
Small soapweed
Leadplant
Smooth sumac

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

Life Span

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

IMPORTANT RANGE PLANT GROUPS

Grasses:	Grasslike		Forbs:	Shrubs:
	SEDGES	RUSHES		
				
				
LEAVES on 2 Sides	LEAVES on 3 Sides	LEAVES on 2 Sides	"VEINS" are NETLIKE	
				
(FLORET)	MALE FEMALE (may be combined)		Usually Showy	
				
Western Wheatgrass	Threadleaf Sedge	Wire Rush	Yarrow	Big Sagebrush (twig)

Examples are:

- Annual sunflowers
- Downy brome
- Sixweeks fescue

Biennial plants live two years. Examples are:

- Hoary evening primrose
- Musk thistle
- Sweetclover

Perennial plants live from year to year and produce leaves and stems for more than two years from the same crown. Examples are:

- Sand bluestem
- Leadplant
- Threadleaf sedge

Origin

Native plants are part of the original vegetation of North America. Examples are:

- Big bluestem
- Stiff sunflower
- Leadplant

Introduced plants are those which have been brought in from outside North America. Examples are:

- Smooth brome grass
- Alfalfa
- Crested wheatgrass

Growth Season

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

- Prairie junegrass
- Needleandthread
- Western wheatgrass

Warm-season plants generally make their principal growth during the frostfree period and develop seed in the late summer or early fall. Examples are:

- Prairie sandreed
- Sand bluestem
- Indiangrass

Adaptation

Adapted plants are those which can successfully become established, grow, and reproduce under certain environmental conditions (rainfall,

temperature, soil, etc.). Some plants can be adapted in one part of Nebraska and unadapted in another part of the state. Indiangrass is adapted to certain areas in central and eastern Nebraska which receive moderate amounts of rainfall. Indiangrass is unadapted to drier areas in western Nebraska.

Scientific and Common Names

Each plant has two names: its scientific and its common name. Some plants have several common names. The weedy grass commonly called downy brome in Nebraska is also called cheatgrass, June-grass, bronco grass, military grass, and wildoats. So it is desirable to choose one common name as the standard name so that everyone will know what plant is being talked about.

The scientific name always has two parts. The scientific name for downy brome is *Bromus tectorum*. *Bromus* tells what genus the plant belongs to, and *tectorum* identifies the particular species within the genus. Each plant can have only one scientific name which is the same throughout the world.

As you learn more about range management, you may want to learn the scientific names of range plants. The scientific name is harder to learn, but once learned, rangeland managers everywhere use the scientific name to identify each plant.

CHAPTER 5

The Parts of a Plant

Plants are like people because each is an individual. Some of these plants may be similar in appearance but some are different. Even those that are similar in appearance have some characteristics by which we can recognize them as individuals. Each plant species has some part or characteristic which makes it different from all others.

The Range Plant

Each range plant has vegetative parts (leaves, roots, and stems) and flowering or reproductive parts. The flowering parts of a grass plant are called the inflorescence.

Roots. Unlike stems, roots do not have joints or nodes. The root's growing point is at the tip. The main functions of the roots are to absorb water and nutrients from the soil, to store energy,

and to anchor the plants in the soil.

Stems. Stems hold leaves and inflorescences above the ground so they are able to absorb sunlight. Stems carry water and nutrients from the roots to the leaves and carry manufactured energy from the leaves to the roots.

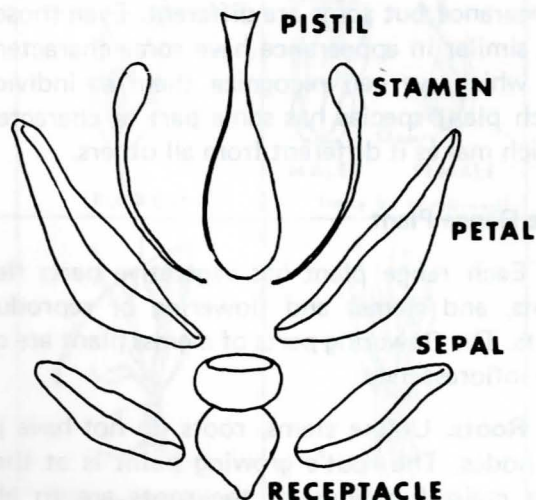
Rhizomes (rye-zoms). Rhizomes actually are creeping underground stems because they have nodes and leaf-like scales and should not be confused with roots. Western wheatgrass, sand bluestem and prairie sandreed all produce large rhizomes. **Stolons** are similar to rhizomes except that they grow above ground. Buffalograss is a common Nebraska grass that has stolons. Both stolons and rhizomes store energy and can reproduce new plants.

Flowers of forbs and shrubs. The flower of most forbs and shrubs include five basic parts: receptacle, petals, sepals, stamens and pistil (often more than one pistil).

The receptacle is the broadened support or base of the flower. The reproductive organs are the stamens (male) which produce the pollen, and the pistils (female) which bear the seeds.

The reproductive organs are generally enclosed by two kinds of leaf-like structures (the **petals** and the **sepals**). The petals make up the inner-most and upper-most series of leaf-like structures and are usually brightly colored. They are sometimes irregular in shape, as in alfalfa and larkspur.

The sepals form the lowermost series of leaf-like structures and are generally green and much less conspicuous than the petals. This series is generally quite regular.



Parts of forb and shrub flowers.

The Grass Plant

The range manager should know the parts of a grass plant. To learn these parts, look at the diagram on grass plant parts. Then learn to recognize these parts on living grass plants. Notice how these parts differ slightly among grasses.

The grass stem is made up of nodes (joints) and internodes (the area between the nodes), and is usually hollow except at the nodes.

The grass leaf is made up of two parts: the **sheath** which fits closely around the stem and the broad, expanded portion known as the **blade**. The region where the sheath and blade join is called the collar. Often on the inside of the collar, and sticking up above the sheath, is a thin lining called the **ligule**. The ligule may also appear as a ring of hairs or may be entirely absent. Two earlike tips which often protrude from the collar in some grasses, one on each side, are the **auricles**.

The grass head, or inflorescence, is composed of the axis or "backbone" called the rachis (ray-kiss) and specialized units called spikelets (consists of glumes and flower(s)). A normal spikelet is composed of two glumes, the **rachilla** (central axis for a spikelet), and one to several florets (reproductive subunit of spikelet).

Three types of grass seedheads are the **spike**, the **raceme**, and the **panicle**. In a spike, the spikelets attach directly to the seedstalk (rachis). In the raceme, each spikelet is placed on the end of a short, slender branch. Spikelets in a panicle are connected to the seedstalk by a branch which is branched two or more times.

The two glumes are the chaffy or leaf-like bracts at the base of the spikelet. The rachilla (ray-kill-ah) is the shortened axis of the spikelet upon which are borne the florets. The floret is the grass **flower**. Each grass flower has one pistil and three stamens.

Each fertile floret at maturity produces a seed. The seed is enclosed by two chaffy, leaf-like bracts known as the **lemma** and **palea** (pay-lee-ah). The bare seed without the lemma and palea is called the caryopsis. In many grasses such as the wheat-grasses, the lemma and palea remain with the seed after they ripen and fall. Others (like wheat and sand lovegrass) shell out and drop their caryopses without the chaffy lemma and palea.

Identifying Range Plants

The first step in identification is to group plants into grasses, grass-like plants, forbs, and shrubs. Determine a plant's name by comparing the plant you have collected with word descriptions, drawings, and photographs. Such things as flower color, shape of plant, and leaf peculiarities can be described.

If the different parts of a plant are well-known, an identification key can be used. A key is an organized list of plants arranged according to their structure. Identify your local plants if possible. Your county extension agent, Soil Conservation Service technician, vocational agriculture teacher, or 4-H Club leader can help you.

CHAPTER 6

Range Plant Forage Values

All range plants are not of equal value. A rancher must know not only the names of the plants on his range but also whether they are desirable or undesirable for grazing. Some range plants are valuable for grazing, some may be worthless or even highly poisonous, and others are valuable for soil stabilization. Examples of grasses almost worthless for grazing are threeawns, wind-millgrass, and stinkgrass. Examples of grasses good for soil stabilization on blowouts are blowoutgrass

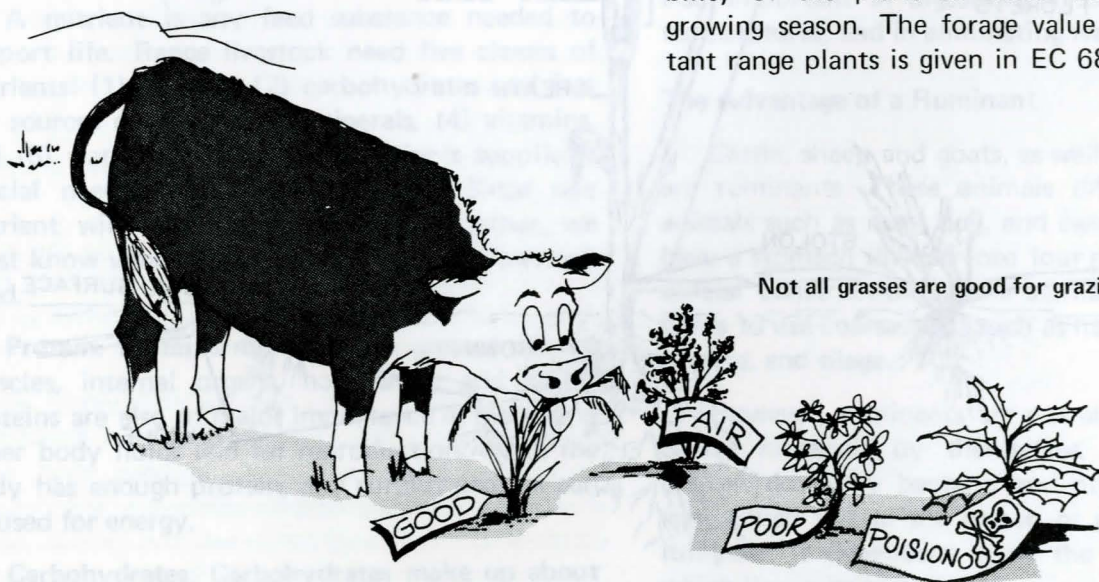
and sandhill muhly. All shrubs are not poor for grazing. Shrubs such as leadplant and sand cherry are desirable range plants.

Livestock usually prefer range plants when they are green, tender, and growing rapidly. This is the growth stage when they are the most nutritious. However, grasses such as blue grama and buffalograss cure well on the ground and are desirable for winter grazing. Annual plants are not desirable on range in Nebraska because they are usually less productive, less nutritious, and are not readily eaten by livestock when mature. In drought years, when forage is badly needed, they may not appear at all. All of these factors must be considered in determining the forage value of each range plant on the range.

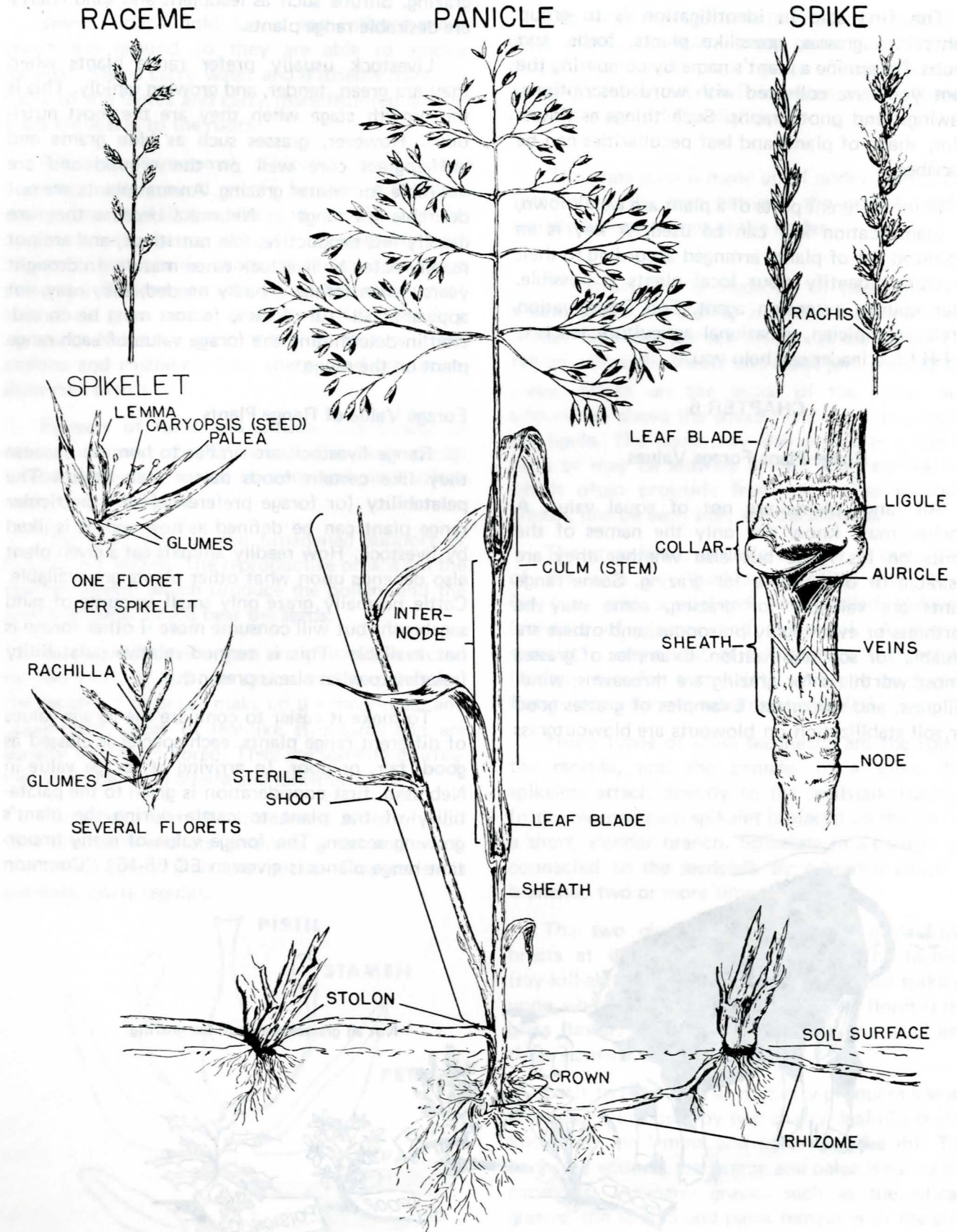
Forage Value of Range Plants

Range livestock are similar to humans because they like certain foods better than others. The **palatability** (or forage preference) of a particular range plant can be defined as how well it is liked by livestock. How readily animals eat a given plant also depends upon what other plants are available. Cattle normally graze only small amounts of sand sagebrush, but will consume more if other forage is not available. This is termed **relative palatability** (relative to what else is present).

To make it easier to compare the forage values of different range plants, each species is classed as **good**, **fair**, or **poor**. In arriving at forage value in Nebraska, first consideration is given to the palatability of the plant to cattle during the plant's growing season. The forage value of many important range plants is given in EC 68-161 "Common



THE GRASS PLANT





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

Range Plants in Nebraska." A copy can be obtained from your county Extension agent or vocational agriculture teacher.

Nutrient Value of Range Plants

Cattle and sheep will gain weight far more rapidly eating alfalfa than eating the same amount of straw, when fed nothing else. One of the reasons is because straw lacks certain nutrients that animals need. Many range plants, particularly in winter, will not supply enough essential nutrients regardless of how much the animals eat. However, these range plants may be used satisfactorily when supplemented by other protein and energy feeds.

A nutrient is any feed substance needed to support life. Range livestock need five classes of nutrients: (1) protein, (2) carbohydrates and fats for sources of energy, (3) minerals, (4) vitamins, and (5) water. Each of these nutrients supplies a special need in the animal's body. Since one nutrient will seldom substitute for another, we must know what it is in range forage that livestock need.

Protein. Proteins make up the greater part of muscles, internal organs, hair, wool, and horns. Proteins are also of major importance in blood and other body fluids and for reproduction. When the body has enough protein, any surplus protein can be used for energy.

Carbohydrates. Carbohydrates make up about 75% of the dry matter of range plants. Much of the energy and heat an animal needs comes from this

source. Sugars, starches, and cellulose are carbohydrates.

Fats. Fat is also a source of energy. It furnishes about 2.25 times as much energy per pound as carbohydrates. Although the fat content is generally low in most range forage, it may be quite high in supplemental feeds such as cottonseed meal or soybean oil meal.

Minerals. Minerals are important in all animal tissues. Calcium and phosphorus make up the major portion of bones and teeth and are needed in equal amounts. Salt provides needed sodium and chloride. Minerals needed in very small or trace amounts include iron, copper, iodine, cobalt, and others.

Vitamins. Although vitamins are needed in very small amounts, they must be present for animals to live and produce. Vitamin A is important in keeping body membranes healthy, in fighting off disease, and for reproduction and growth in livestock. Vitamin A appears in forage as carotene, which is converted in the animal's body to Vitamin A. Vitamin D is required in bone formation and in the proper use of calcium and phosphorus. Other vitamins are also needed by ruminants, but these are generally sufficient in the forage or can be manufactured by bacteria in the rumen.

Water. Water is an important substance because about 75% of animal bodies and growing plants are composed of water. Water carries nutrients from one part to another in plants and animals. Water is also important in digestion, in controlling body temperatures, and in eliminating waste products.

The Advantage of a Ruminant

Cattle, sheep and goats, as well as deer and elk, are ruminants. These animals differ from other animals such as man, dog, and swine because they have a stomach divided into four major parts. This special construction of the stomach allows ruminants to use coarse feeds such as hay, range grasses, browse, and silage.

However, ruminants are not able to digest the coarse materials by themselves. This forage is broken down by bacteria and other microorganisms which live in the **rumen** or paunch. Thus, a ruminant is dependent upon the microorganisms which live in its paunch.

Horses do not have a rumen, but do have a

large pouch or **caecum** (see-kum) in the intestines where millions of bacteria can do their work. Man has only a simple stomach with one compartment. An animal with a simple stomach has no special place for bacteria to live and help "digest" forage.

Nutrient Content of Forages Changes

The nutrient content of range forage depends largely upon the season. During rapid spring growth, range forage is high in nutrient content. Grazing animals generally need no supplemental feed at this time. As the forage plants begin to mature and dry, the content of many important nutrients declines and supplemental feeding of some nutrients is often needed. The amount of supplementation depends upon the season of the year and the livestock needs.

Throughout the year, protein, phosphorus, and carotene (vitamin A) content of range grasses follow similar patterns. All three are high in rapidly growing grass, but low in mature grass. As plants mature, they increase in fiber content. Heavy rainfall in the fall and winter may wash out many soluble carbohydrates.

Differences in nutrient content may also be found among plants. Cool-season grasses, such as wheatgrasses, grow early in the spring and sometimes again in the fall. They are higher at these times in protein, phosphorus, and carotene than warm-season grasses, such as the bluestems. The nutrient content of warm-season plants is highest during June, July, and August. Shrubs generally maintain higher levels of protein, carotene, and phosphorus than grasses during the winter.

Climate affects the nutrient content of range plants. Livestock will often perform better on range during years of low rainfall, providing ample forage is available, than during wet years. Soil fertility also affects the nutritive content of range and pasture forage. For example, when soils are low in phosphorus, phosphorus content of plants may also be low.

Supplementing the Diet

How does one know what to supplement range cattle and sheep with during the winter? Supplements should be based on the kind and amount of nutrients cattle obtain from range forage relative to their needs. Remember that to **supplement** means to supply nutrients missing or low in the range forage. These supplements are fed to correct a

deficiency in the range forage rather than to replace it.

Following is a guide to be used in supplementing range livestock:

1. Supplement deficiencies in the diet. It is seldom a good practice to supply nutrients for which a dietary need has not been proven or for which a deficiency would not be expected in range forage.

2. Feed supplements that are economical. Supplements may increase weaning weights and calving percentages, but not necessarily enough to be profitable.

3. Feed supplements so that each animal gets its share.

4. The method of feeding supplements must keep range animals moving and well distributed over the range.

Four nutrients which may be low in range forage on winter range are protein, phosphorus, vitamin A, and energy. Do not forget that water and common salt are nutrients also. Salt and fresh water should be supplied range livestock throughout the year.

Diets high in mature grass may include ample energy, but are usually low in protein, phosphorus, and carotene (vitamin A). If a moderate part of the diet consists of browse, less protein and phosphorus should be supplied through supplemental feeds. Diets containing larger amounts of browse have enough vitamin A but may be low in energy.

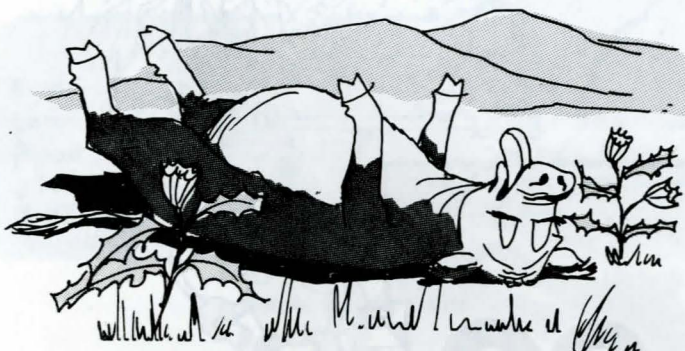
Cattle can store enough vitamin A in the liver to last three to six months on diets lacking this vitamin. However, this may not last until spring when grasses start to regrow.

Supplemental feeds high in phosphorus commonly fed to range cattle are bone meal, dicalcium phosphate, cottonseed meal, soybean meal, and alfalfa. Protein supplements commonly fed include cottonseed meal, soybean meal, and alfalfa. Supplemental feeds high in energy include oats, corn, sorghum, barley, and various milling by-products. All fresh, green, leafy forages are high in carotene.

CHAPTER 7

Poisonous Plant Problems

Some range livestock are lost each year in Nebraska from such plants as arrowgrass, locoweed, water hemlock, chokecherry, milkweeds, and groundsels. However, livestock losses in Nebraska from poisonous plants are much less than on ranges further west.



Prevent losses from poisonous plants by good range and livestock management.

Palatability is important in livestock poisoning. Many plants are poisonous only when eaten in large amounts. They may be good, nutritious forage when eaten in smaller amounts. Generally, animals do not graze large amounts of highly poisonous plants when they have an abundance of other forage. Thus, it is very important that we manage our ranges so that they are kept in good condition and contain large amounts of palatable, non-poisonous forage.

Ways to Prevent Losses from Poisonous Plants

1. Do not turn range stock out in the spring before good forage plants are well developed.
2. Graze moderately so that enough good range forage is always available.
3. Use salt and phosphorus supplements when needed to guard against depraved appetite.
4. Feed other forages when range forage is in short supply, as in drought or when trailing.
5. Graze the kind of stock not poisoned by the plant in question.
6. Graze during the season of the year when plants in question are least poisonous or are not eaten.

7. Eradicate or fence off local patches of poisonous plants.

8. Remove animals when poisoning first becomes evident. Put sick animals in corrals, if possible, and feed a laxative feed.

9. Avoid areas infected with poisonous plants when bunching, trailing, or bedding down in the case of sheep.

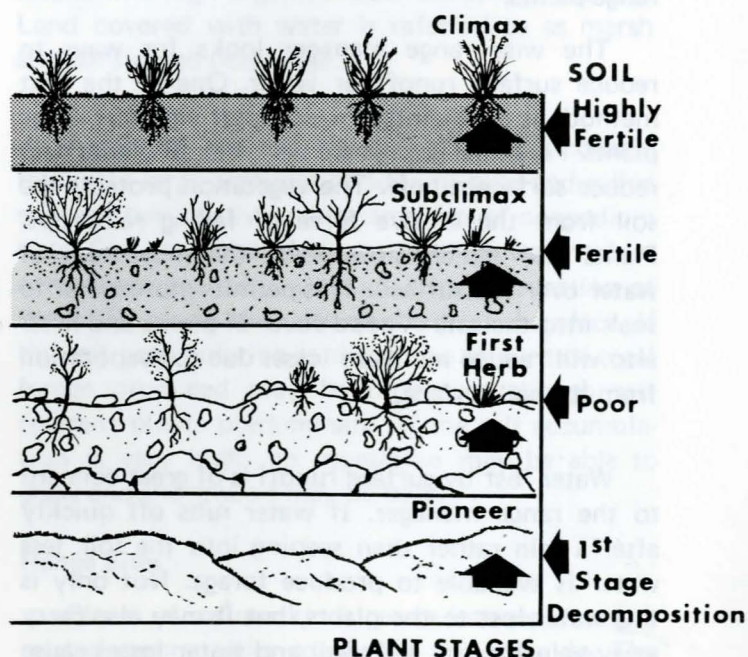
Obtain a copy of "Sixteen Plants Poisonous to Livestock in the Western States", U.S.D.A. Farmers Bulletin 2106, from your county Extension agent. It has pictures of most poisonous plants in Nebraska and gives further details on management to recognize and avoid poisonous plant losses.

CHAPTER 8

How Rangeland Develops

Soils and plants on rangeland have developed together over a long period of time. Range plants depend upon the proper development of soils, but they also affect this development.

Soil is made up of mineral matter, organic matter, air, and water. It results from the action of climate and vegetation upon rock material. Each stage of soil development from bare rock to a loamy soil is able to support a particular group of plants.



Lichens and mosses are able to grow on solid rock. They help the weather factors (wind, rain, freezing, and thawing, etc.) to gradually break down solid rock into smaller particles. They also add organic matter. This makes it possible for the establishment of annual forbs and grasses. As the soil continues to develop, a few perennial grasses and forbs are able to grow.

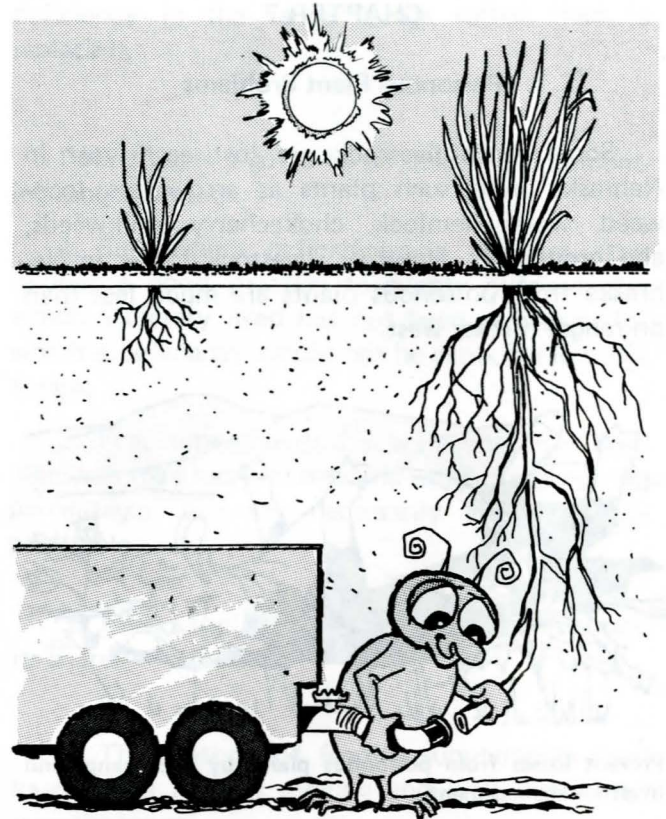
It takes many thousands of years for productive rangeland to develop. Finally, though, the plants on the range are in balance with the many organisms (including man), soils, and the climate. This is referred to as the **climax** stage. The climax has a mixture of plants which make good use of the available soil nutrients, soil moisture, and energy from the sun.

To keep range soils productive, nutrients have to be returned to the soil. At the end of the grazing season, some vegetation should be left on the range. This remaining vegetation is not wasted. Leaves and stems dry, drop to the ground and become mulch or litter.

Mulch protects the soil against erosion caused by wind and water. 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 small living plants and animals called **soil organisms** are present in the soil. These organisms are constantly breaking the organic matter into nutrients which can be used by the range plants.

The wise range manager looks for ways to reduce surface runoff or water. One of the best methods is to maintain a cover of vigorous range plants. Perennial grasses are best, but all plants help reduce surface runoff. The vegetation protects the soil from the erosive force of falling raindrops. Plants and mulch 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 moisture losses due to evaporation from the soil surface.

Water lost by surface runoff is of great concern to the range manager. If water runs off quickly after a rain rather than seeping into the soil, less water is available to produce forage. Not only is this water lost to the plants, but it may also carry away valuable top soil. Soil and water losses cause nature's plant and soil development to reverse.



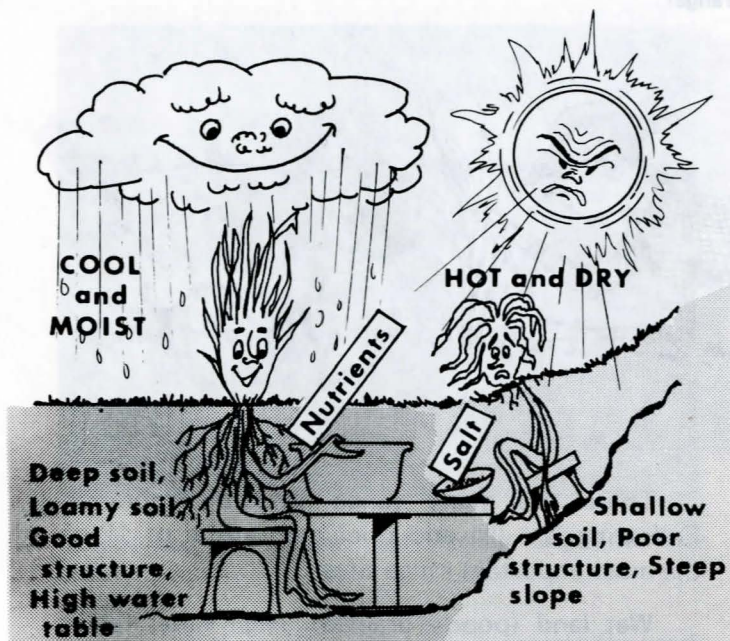
Living soil organisms make plant nutrients available.

Different areas of rangeland have different soil types and growing conditions for plants. On rock slides, soil development may be stopped at a very early stage. Adjacent soils on overflow bottomlands may be deep and fertile. Areas with deep, fertile soils are able to produce much more forage than areas where but little soil has developed.

Before a rancher can decide if his rangeland is producing its maximum amount of forage, he must first determine what it is capable of producing. Some of the factors which determine the kinds and amounts of plants a range can produce are:

Climate. Amount of precipitation greatly affects range site productivity. Even under ideal moisture conditions, extreme temperatures (high or low) will normally decrease forage production. Average annual rainfall on Nebraska rangelands varies from 26 inches at the eastern edge of the Sandhills to less than 13 inches along the Wyoming border.

Slope. Forage production on a steep slope is much less than on a gentle slope. Water runoff and drainage from a steep slope is usually high. This causes the soil to be drier. Soils on steep slopes are shallower and less developed than on gentle slopes, and erosion is often greater. Grazing steeper slopes



Nature sets the limits.

is more difficult and care must be taken that grazing does not cause steep slopes to erode.

The degree of slope is the number of feet the land rises or falls per 100 feet of horizontal distance. It is expressed as a percentage. For example, a 20% slope is much steeper than a 6% slope while a 0% slope is level.

The direction of slope also is important. For example, the kinds and amounts of plants on the north side of a hill differ from those on the south. Slopes that face south and west receive the moist sunshine. As a result, south-facing slopes are not only warmer and drier but also usually have shallower, less developed soil and are less productive. A steep slope makes a south exposure even more dry.

Soil Texture. Soil texture refers to the size of the soil particles. Soil texture is determined by the percentage of sand, silt, and clay particles in the soil mixture. Sand is the largest sized particle; clay the smallest. Soils are a mixture of different sized soil particles.

Loamy soils (soils of intermediate texture) are the most suited for forage production, take water easily, and have good moisture holding capacity. Moisture penetration in clay soils is slow and runoff may be high. Sands allow water to penetrate quickly but have a low water holding capacity and lower fertility.

The name given to a soil is based on the size of particles that are most abundant. For example, a very fine sandy loam means that the texture was mostly silt and clay with a considerable amount of very fine sand. A loamy fine sand would be a soil consisting mostly of fine sand with some silt and clay.

Soil Structure. Soil structure refers to the arrangement of the soil particles, whether they clump (aggregate) together or remain single. The most productive soils are those in which the soil particles clump together. This allows water, air, and roots to readily move through the soil and gives the soil good water and nutrient-holding capacities. Well aggregated soils are less susceptible to wind and water erosion.

Root Zone Depth. The depth to which roots can grow before reaching a layer they cannot penetrate affects how well a range produces. Restrictive layers may be rock, shale, or gravel. A large amount of top growth results from a large amount of roots. A deep soil allows maximum growth of roots.

High Water Table. Range sites with a high water table produce a different kind and amount of vegetation than do those with deep water tables. Water tables in many low places in the Nebraska Sandhills are a few inches to a few feet below ground level. A high water table increases forage production from 2 to 4 times, increases the proportion of tall grasses, sedges and rushes, and results in a high organic matter content of the soil. Land covered with water is referred to as marsh and considered non-range.

Alkalinity and Salinity. Alkaline soils contain relatively large amounts of sodium salts and saline soils contain relatively large amounts of nonsodium salts. Soil with poor drainage and high water tables often becomes salty. On such sites evaporation of the water leaves the salts on the ground surface. If the salt accumulation is slight, the amount of total forage produced may be high even though salt tolerant plants predominate. If the salt accumulation is very high, no vegetation may be able to grow and the ground may be bare.

Range Sites

Plants of various kinds group into separate but related communities somewhat as people do. The individuals in each community work together and



compete with each other. Some are good, productive plants and others produce very little. There are tall ones and short ones. There are those which are desirable and there are those that are not.

The plant community is continually changing. Even if changes are slow, they are always taking place. These changes may be good or bad. The successful range manager must be able to recognize these changes. He must determine whether they are good or bad, and he must know if they result from a normal change in the weather or from his management practices.

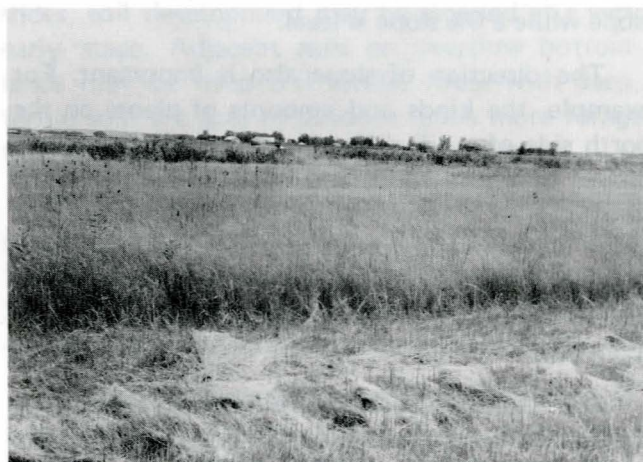
Rangeland with similar soils and climate throughout, which results in similar vegetation, is called a **range site**. Each range site produces distinct kinds and amounts of plants under natural or climax conditions. Different sites often require different management. The potential of each range site (climax vegetation) is the standard against which present condition of a range is judged.



Three range sites on the North Platte Experiment Station: thin silty site on the tops, thin loess on the sides, and overflow in the bottom.

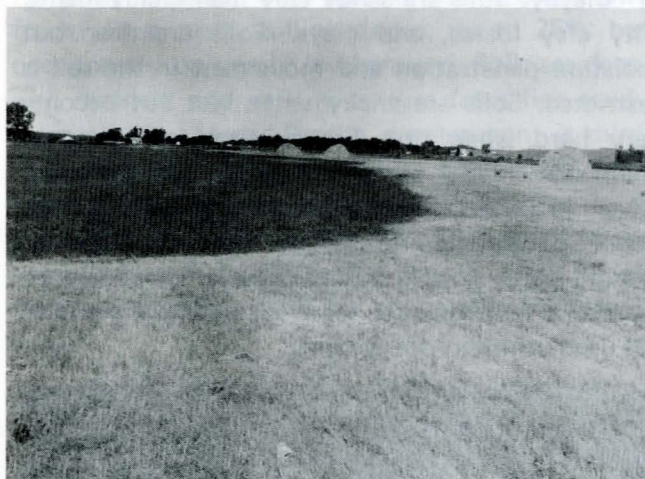
There are many range sites in Nebraska. Following is a list and brief description of 12 of the most important range sites:

Wet land (poorly drained). High water tables are common on these sites, which are generally next to streams or rivers. The water table is within 36 inches of the soil surface. These sites are generally flooded in spring. The water table fluctuates considerably from a normal high in March-May to a low in September-November. Soils vary from sands to silty clays. Forage production is about three times that from the average range sites. Hay production is the most common use.



Wetland range site near North Platte.

Subirrigated. This site is either next to a wetland site or to streams. It has a water table within 10 to 60 inches of the ground surface during most of the growing season. Water tables rarely rise above the ground surface, but remain within effective reach of deep rooted plants. Soils vary from fine sand to silty clay loam. The subirrigated site is noted for its high quality bluestem hay. Introduced plants have been seeded



Subirrigated (left center) and shallow range sites near Halsey.

on some of these sites. This site is commonly used for hay production, although sometimes it is grazed.

Saline subirrigated. As for the subirrigated site, the water table is within 10 to 60 inches of the ground surface. The soil has a high salt or alkali content, which often shows as a whitish-gray cover on the ground. The forage species on this site are often low in palatability. These lands are usually grazed rather than hayed.



Saline subirrigated range site along North Platte River near Minatare.

Overflow. This site regularly receives additional water from occasional stream overflow, run-in from adjacent slopes, or from snowdrift. However, the water table is more than 60 inches under the soil surface. This range site is found on flat bottom

ravines, foot slopes, terraces, and depressions throughout the state. Soils vary from fine sand to clays and are usually fertile and productive. Grass hay is commonly cut on overflow sites. Cattle generally prefer overflow sites because of the succulence of the forage plants and easy access to the areas.

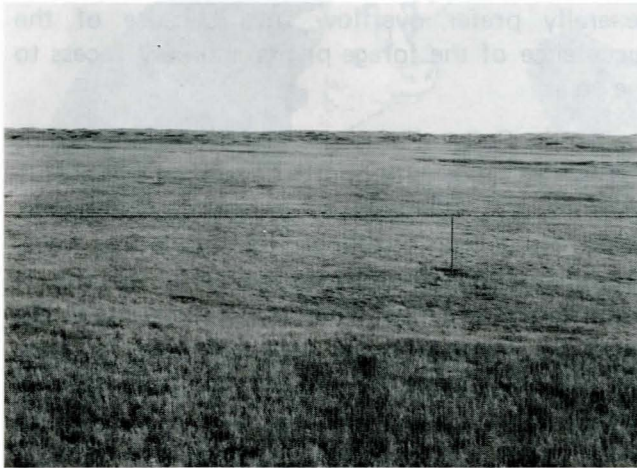
Sands. Soils of this site are deep, loose sands and loamy sands with poorly developed soil profile horizons and adequate to unrestricted drainage. Slopes are gentle to rolling. The undulating, wave-like hills of the Sandhills are typical of this site. It is the largest and most wide-spread range site in the Sandhills. These sites are used primarily for grazing, although some hay is cut on these sites on ranches having no meadows. Soil is subject to severe wind erosion when the vegetative cover is removed.



Sands range site near North Platte.

Sandy. Soils are principally loamy fine sands, but vary from fine sandy loams to loamy sands. There is often less than 1% slope and little change in relief. This site is typically a dry, flat valley between choppy or rolling sandhills. These valleys vary in size from five acres or less to a half section. Drainage is adequate and the water table is not within reach of plant roots. Sandy sites are normally grazed in winter. Although sometimes cut for hay, hay yields from native stands are seldom over a half ton per acre. Because of easy access, livestock tend to concentrate on sandy sites; thus, many such areas are in low condition. A considerable amount of formerly cultivated "go-back" land is found on sandy sites. Sandy sites are adapted to seeding intermediate or western wheatgrass with or

without alfalfa. These sites also are adapted for irrigation.



Sandy range site (center) near Stapleton.

Silty. Soils are very fine sandy loams, loams, silt loams, and silts on nearly level to gently rolling slopes. This is the most common range site outside of the Sandhills region and includes the loess plains and hills south and east of the Sandhills, along the Republican River, and on the upland plains and gentle slopes of southwestern Nebraska and the Panhandle. Since moisture penetration into the soil is lower and the wilting co-efficient higher, deep rooted grasses on a silty site are somewhat more susceptible to drought than on coarser soils. Most silty sites ideally suited to cultivation have been converted to crop production. However, many smaller units in the south and east and larger units in the west are still in native grass cover.



Silty range site in Keith County.

Clayey. Soils are sandy clay loams, clay loams, silty clay loams, and clays. Soils are deep but moisture penetration and movement in the soil is restricted. Soils are sticky when wet but become very hard when dry. Clayey sites are found in Nebraska chiefly along the White and Niobrara Rivers in Dawes, Sioux, Sheridan, Boyd, and Keya Paha Counties and in eastern Nebraska. Limited ground-water supplies place special emphasis on reservoirs and dugouts for stockwater. These sites are used primarily for grazing.



Clayey range site in northern Sioux County.

Choppy Sands. Soils of this site are deep, loose sands on steep, irregular slopes, over 20%, and are slightly acid. Drainage is unrestricted. Narrow ridges and broken surfaces (catsteps) are characteristic of the site. Ground water is deeper than on a sands site, and even less profile development is found. This site is highly susceptible to wind erosion, and blowouts in various stages of activity and stabilization are common. This site is found in the Sandhills region. Because of tall grasses and winter protection for livestock, choppy sands are best suited to winter use.



Choppy sands range site in Thomas County showing grasses stabilizing a blowout.

Limy Upland. This upland site is commonly found on smooth, rolling slopes, up to 25%, but occasionally on nearly level ground. Soils are deep, well drained, and vary in texture from fine sandy loam to clay loam. Profile development is minimum and both surface soil and subsoil are limy. Limy upland sites in cultivated fields show up as light colored knobs and slopes. Because of lower organic matter and increased runoff, limy upland sites are often less productive than silty and clayey sites.



Limy upland range site and barren (non-range) near Scottsbluff.

Shallow. Soils in which the effective root zone of plants is restricted to 20 inches or less are shallow sites. Impervious layers are found variously as bedrock, shale, gravel, or coarse sand. Outcroppings of these layers are common. Because of the limited amount of soil available to promote plant growth, carrying capacity of shallow sites is typically low.



Shallow range site in Sioux County.



Shallow range site in Morrill County.

Thin Loess. Soils are deep silt loams on steep to very steep, rough, broken slopes of over 25%. Catsteps or land slips are common. Soils are limy. Thin loess sites are typically the canyon sides along the rivers and streams south and east of the Sandhills but not limited to these areas.

CHAPTER 9

How Grazing Affects Plants

Effect on Individual Plants

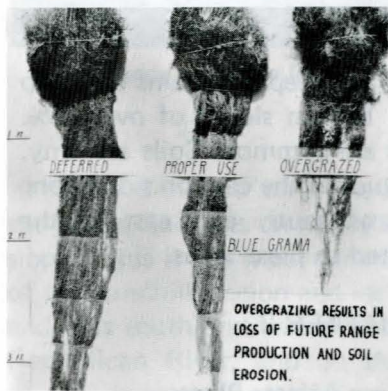
If range forage plants are to remain vigorous and productive, enough vegetation must be left throughout the year so that the grass can manufacture energy for its own use and build up storage materials in roots and crowns.

A common phrase is **take half and leave half** of the annual forage production from the good and fair forage plants. More may be taken if the plants are vigorous, if soil erosion will not result, or if grazing is limited to the winter. However, using half of the current year's production may be too much in times of severe drought. Season and duration of grazing use is just as important. More than half can be removed when a pasture is grazed for a relatively short time (such as 4 to 6 weeks) as opposed to continuous use through the summer grazing period.

Any amount of grazing affects a plant. However, range plants fortunately produce an extra amount of foliage which can be removed by grazing without permanent harm to the plant. Only when too much of the plant is removed does the

plant suffer. If forage plants are grazed and then allowed to make top growth again, they won't be seriously hurt. Only when shoots are kept grazed close to the ground do plants suffer.

Where the vegetation is closely grazed, the roots are shortened also. A deep root system helps range plants survive droughts. Since heavy grazing greatly reduces root development, such plants are more severely injured by drought. Continued heavy grazing can kill plants and also reduce the number of young plants available to replace normal death losses of the older plants. On the other hand research indicates that properly grazed plants are as productive as ungrazed plants.



Grass plants 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.

Grasses are better able to tolerate grazing than most broadleaf plants. The terminal bud, or growing point, of the grass plant is close to the surface of the ground throughout most of the growing season. Even if the terminal bud of the grass plant is removed, buds at the base of the stem will begin to develop new shoots to take the place of the original stem.

The growing points of the grass leaf are also located to favor grazing. They are located 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 from the base of the blade or sheath. The ends of grass blades remain blunt after grazing even though the blade is still growing longer. If a grass leaf is grazed when fully developed it will not continue to grow.

Effect on Plant Communities

Plants group themselves in natural communities. Although plants live together in a community, they compete for moisture, sunlight, and minerals. Taller plants and those with the largest root

systems have the advantage until grazing becomes excessive.

All plants are not affected the same way when the range is grazed. Plants that animals like best are grazed first, while the less palatable plants often go ungrazed. If desirable plants are excessively grazed, they will be handicapped in competing for moisture and nutrients with the unpalatable, ungrazed plants around them. Some plants can withstand closer grazing than others.

Range plants in Nebraska are grouped by how they respond to heavy grazing by livestock. The three groups are decreasers, increasers, and invaders.

Decreasers are range plants that decrease in number under heavy grazing. They are palatable to livestock and are usually perennials.

Increasers are range plants which increase in number as the decreaser plants are weakened and die. They are usually less palatable than the decreasers. In some cases, as in the short grasses such as blue grama and buffalograss, the plants act as increasers because they withstand grazing better rather than being less palatable.

Invaders are the undesirable range plants which invade and take over a range after the decreasers and increasers are largely gone. They are plants not present in climax vegetation, or there in small amounts only (2.5% or less).

Most people think of the same thing when they see the different colors of traffic signals. Each has its own meaning. Green means go. Yellow means caution. Red means danger, stop!

These same colors and their meanings can be applied to range plants. We might call the decreaser plants the "green group plants", the increaser plants the "yellow group plants", and the invader plants the "red group plants".

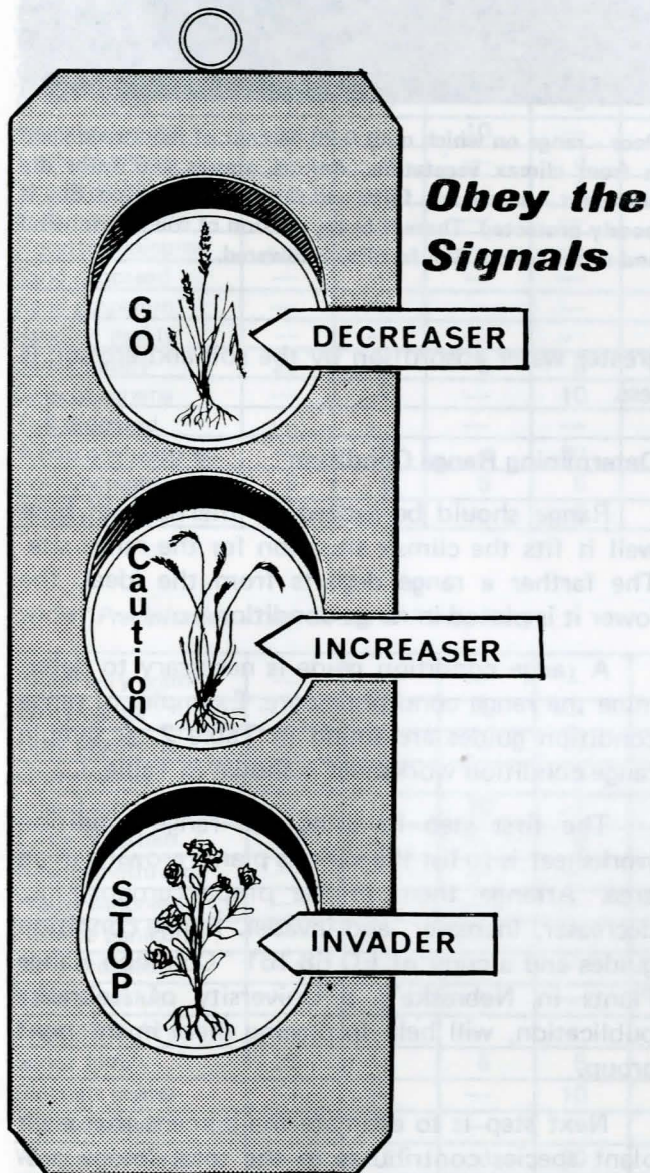
An ample supply of decreasers (green group) on the range indicates your grazing program is going well.

Increasers (yellow group) are the ones to watch with caution. If the amount of forage produced by increaser species is getting larger each year at the expense of the decreasers, a change in management may be necessary.

The invaders (red group) simply mean "DAN-

GER" on the range so far as production is concerned.

Eliminating the cause of range deterioration may restore the vegetation in a few years. The cause of deterioration in most cases is improper grazing management. Prolonged drought, extreme temperatures, insect attacks, or repeated burning also may have played a part. If no desirable plants remain, artificial seeding will be required. If the soil eroded along with the deterioration of the vegetation, permanent damage to the range will have resulted.



WATCH THE TRAFFIC !

CHAPTER 10

Range Condition

Range condition indicates how healthy a range is. It is a measure of the current species composition and production as compared to what the range is naturally capable of producing. In effect, it is nature's recorded history of a range. It suggests to the range manager the effects of past use of the range and how his management practices are performing. Experience in range judging helps the range manager to determine range condition.

Standard classes for range condition are excellent, good, fair, and poor (see pictures of different range conditions on a choppy sands range site).



Actual experience in judging range condition helps in deciding what range management practices are needed to make range most productive.



Excellent - range on which 76-100 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 51-75 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 26-50 percent of the forage yield is from climax range plants. Important range plants are in a weakened condition. Very little ground is covered by mulch. Moderate to heavy erosion. Low production of forage.

A range in excellent condition has maximum carrying capacity and produces a higher percentage of highly palatable forage species than lower condition range. It produces maximum pounds of beef or lamb per acre, higher calf or lamb crops, and has less livestock death losses. It also has



Poor - range on which only 0-25 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 action. Soil fertility is lowered.

greater water absorption by the soil and erosion is less.

Determining Range Condition

Range should be judged on the basis of how well it fits the climax situation for the range site. The farther a range departs from the ideal, the lower it is placed in range condition.

A range condition guide is necessary to determine the range condition score. Examples of range condition guides are found in Table 2. A sample range condition worksheet is shown in Table 3.

The first step in using the range condition worksheet is to list the various plants growing in an area. Arrange them in the proper groups, i.e., decreaser, increaser, and invader. Range condition guides and a copy of EC 68-161 "Common Range Plants in Nebraska", a University of Nebraska publication, will help in placing them in the right group.

Next step is to estimate the percent that each plant species contributes to the total forage production. Place these values in the second column, opposite the name of the plant. To find the percent to be counted toward condition score, use the range condition guide for the appropriate precipitation zone in your area. In the example of

Table 2. Guide for determining range condition

20-24" Precipitation Zone, North of Platte River

Maximum percentage in climax by range sites^{1/}

	Range Sites											
	Wet Land	Subirrigated	Saline Subirrigated	Overflow	Sands	Sandy	Silty	Clayey	Choppy Sands	Limy Upland	Shallow	Thin Loess
Blue/Hairy grama	---	---	---	---	5	10	15	10	5	15	25	15
Buffalograss	---	---	---	---	---	---	---	5	---	5	---	---
Gray sagewort	---	---	---	---	---	5	5	---	---	---	5	---
Green muhly	---	5	---	5	---	---	---	---	---	---	---	---
Inland saltgrass	---	---	10	---	---	---	---	---	---	---	---	---
Little bluestem	---	d	---	d	25	d	d	d	30	d	d	d
Needleandthread	---	---	---	5	10	20	15	d	---	15	d	d
Prairie sandreed	---	---	---	---	25	25	5	---	20	---	d	d
Rosette panicums	---	---	---	---	5	5	---	---	5	---	---	---
Sand dropseed	---	---	---	---	5	5	5	---	5	5	5	5
Sand paspalum	---	---	---	---	5	5	---	---	5	---	---	---
Sandhill muhly	---	---	---	---	5	---	---	---	5	---	---	---
Sedge family	25	15	5	5	5	5	5	5	5	10	5	10
Sideoats grama	---	---	---	10	---	d	15	d	---	d	d	d
Tall dropseed	---	---	---	---	---	---	5	5	---	---	---	---
Western wheatgrass	---	10	d	20	---	15	20	30	---	20	15	25
Forb increasers	5	5	5	5	5	5	5	5	5	5	5	5
Woody increasers	---	---	---	5	10	5	5	5	10	5	5	5

20-24" Precipitation Zone, South of Platte River

Blue/Hairy grama	---	---	---	---	5	10	15	20	5	15	20	20
Buffalograss	---	---	---	---	---	---	5	10	---	5	---	---
Gray sageworts	---	---	---	---	5	5	5	---	---	---	5	---
Green muhly	---	5	---	5	---	---	---	---	---	---	---	---
Inland saltgrass	---	---	10	---	---	---	---	---	---	---	---	---
Little bluestem	---	d	---	d	25	d	d	d	30	d	d	d
Needleandthread	---	---	---	---	10	d	d	---	---	10	d	d
Prairie sandreed	---	---	---	---	20	25	---	---	20	---	d	---
Rosette panicums	---	---	---	---	5	5	---	---	5	---	---	---
Sand dropseed	---	---	---	---	5	5	5	---	5	5	5	5
Sand paspalum	---	---	---	---	5	5	---	---	5	---	---	---
Sandhill muhly	---	---	---	---	5	---	---	---	5	---	---	---
Sedge family	25	15	5	5	5	5	5	5	5	5	5	5
Sideoats grama	---	---	---	10	---	d	15	d	---	25	d	d
Tall dropseed	---	---	---	---	---	5	5	5	---	5	---	---
Western wheatgrass	---	5	d	20	---	15	15	25	---	10	10	15
Forb increasers	5	5	5	5	5	5	5	5	5	5	5	5
Woody increasers	---	---	---	5	10	5	5	5	10	5	5	5

^{1/} Legend for Maximum Percentages of Increasers in Climax

(d) Means decreaser on site.

(-) Means less than 2½% or did not occur.

Table 3. Range condition worksheet.

Range site Sandy
 Name of pasture No 1
 Precipitation zone 20-24"
 County Logan

	<i>Estimated % of Each Species in Total Forage Yield</i>	<i>% To Be Counted Toward Condition Score for This Range Site</i>	<i>Write % Of Each Species Allowed Toward Condition Score</i>
Decreasers	15%	all	15
Sand Bluestem	trace	all	
Switchgrass	trace	all	
Little bluestem	trace 5%	all	5
Prairie junegrass	trace	all	
Sand lovegrass	5%	all	5
Increasesers			
Prairie Sandreed	35%	25	25
Needleandthread	30%	20	20
Sedge	5%	5	5
Gray Sagewort	5%	5	5
Invaders			
Downy Brome	5%	none	0000
Six-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 condition class space)
			Excellent 75-100
			Good 50-75
			Fair 25-50
			Poor 0-25

Table 3 we used the guide for the 20 to 24 inch precipitation zone (Table 2).

The total percentage recorded for each species of decreaseers should be written in the right hand column. Enter the percentage recorded for each species of increaseers unless it is greater than the tolerated amounts listed in the guide. In the example, we recorded 35% prairie sandreed. The guide shows that in this precipitation zone, prairie sandreed on a sandy site should not exceed 25%. Thus, we can only count 25% toward the condition score, although more was present. No percentage

of invaders is allowed to count toward the range condition score.

When all values have been recorded in the right hand column, enter the total in the box labeled "Total Score." The range condition score in the example was 80, or excellent.

Although plant composition is given primary emphasis in determining range condition, attention also should be given to total forage production, soil erosion, and ground cover. If there is not enough plant cover or if there is too much soil erosion, it may be necessary to lower the condition class

rating based initially on plant composition.

Trend in Range Condition

It is important that any definite change in range condition be recognized. This current change in range condition is called **trend**. It indicates whether the range is improving, deteriorating, or remaining about the same. Trend is more difficult to evaluate than range condition. Only an estimate of range trend can be made on a single visit to a range.

Relative vigor of decreaser, increaser, and invader plants and soil movement are possibly the best two points a rancher can use in evaluating range trend. On rangeland which is improving (upward trend), decreasers are vigorous, erosion is decreasing and gullies are healing. On a range going down in trend, decreasers will lack vigor and many will die and be replaced by less desirable plants. Gullies may be active and erosion will be evident.

The rancher can better manage his range if he knows its condition and its trend. Use of range condition and trend is a good tool to use in range management. It serves as the basis for stocking a range, for determining needed livestock management changes, and for pointing out needed range improvements.

CHAPTER 11

Determining the Best Initial Stocking Rate

When figuring stocking rates, one must learn two terms — **animal units** and **animal unit months**.

An **animal unit** is one mature cow, pregnant or dry, or its equivalent. An **animal unit month** (AUM) is the forage or feed necessary to carry an animal unit for one month.

You can compare the carrying capacity of your ranch with the forage and feed requirements of your range livestock by working with AUM's. Use the "animal equivalents" shown in Table 4.

Using Stocking Rate Tables

A good method to follow in setting up initial stocking rates is to use established stocking rate tables. Stocking rate tables give the AUM's of grazing per acre during an average year. This means the approximate length of time (in months) that

Table 4. Animal units of different classes of livestock

Class of livestock	No. of animal units
Cows	1.0
Cow and calf pairs*	1.3
Replacement heifers (over 24 months)	1.0
Two-year-old steers	.9
Yearling cattle (18-24 months)	.8
Yearling cattle (12-17 months)	.65
Weaner calves (under 12 months)	.5
Young bulls (over 24 months)	1.2
Bulls (mature)	1.3
Saddle horses (mature)	1.3
Sheep (mature)	.2
Lamb	.15

*Soil Conservation Service has a cow calf pair at 1.0 Animal Unit Equivalent.

one mature, dry cow or her equivalent can graze on **one acre of range each year**.

Table 5 is used in setting an initial stocking rate. Section A (of Table 5) gives suggested initial stocking rates for the various range sites and precipitation zones when in climax or 100% range condition. Note how grazing capacity increases from lower to higher precipitation zones and from shallow and thin loess to subirrigated and wetland range sites.

Since most range will be lower than 100% range condition, it will also be necessary to refer to Section B (of Table 5). This graph shows that stocking rates are related to range condition. As range condition goes down, so does grazing capacity and vice versa.

You must know three things in order to obtain an initial stocking rate from Table 5. These are (1) range site, (2) precipitation zone and (3) percent range condition. As an example, let's take a sands range site in the 20-24 inch precipitation zone that is in 75% range condition. From Section A it is found that this sands range site in 100% range condition would have a suggested initial stocking rate of .8 AUM per acre.

Next, refer to the graph in Section B. Place a straightedge perpendicular to the bottom scale and intersecting it at 75% range condition. Mark the point where the straightedge intersects the curved line. Then lay the ruler horizontally and passing through the point marked on the curved line. Note it intersects the left hand scale at 90%. The suggested initial stocking rate is then .72 AUM's

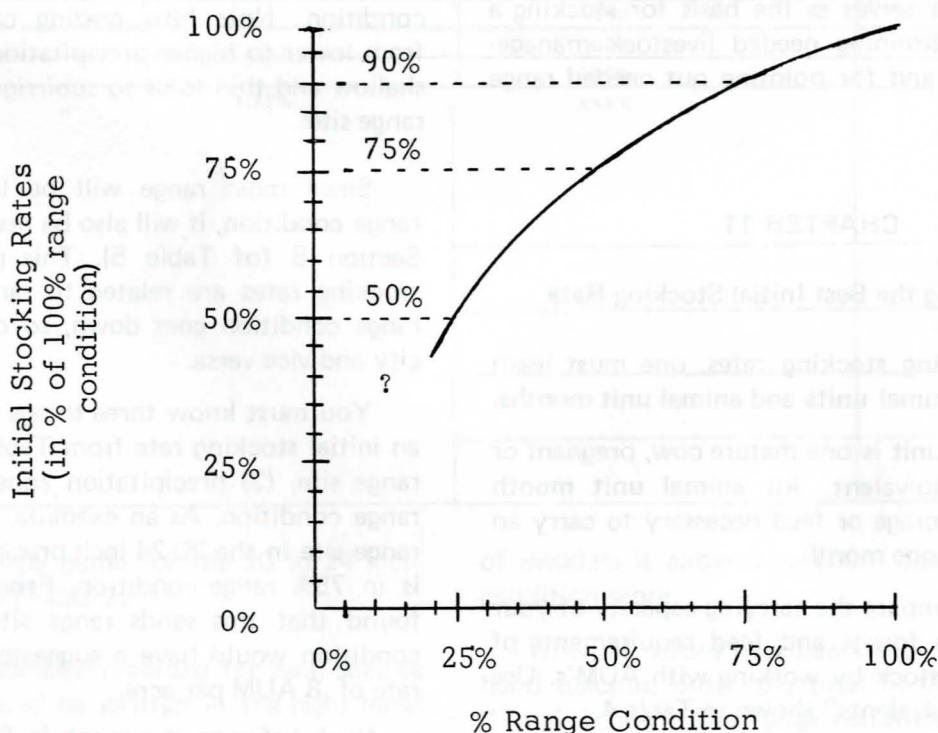
per acre (.8 x 90%) or .7 AUM's per acre when rounded off to the nearest 5/100th.

Table 5. Suggested initial stocking rates (in AUM's per acre annually)^{1/}

A. 100% range condition (top excellent)^{2/}

	Precipitation zones in Nebraska				
	14-16"	17-19"	20-24"	25-29"	30-34"
	AUM/a.	AUM/a.	AUM/a.	AUM/a.	AUM/a.
Wet land	2.4	2.4	2.4	2.4	2.4
Subirrigated	1.6	1.6	1.6	1.6	1.6
Saline subirrigated and overflow	.8	.8	1.0	1.2	1.2
Sands, sandy, silty, clayey	.4	.6	.8	1.0	1.2
Choppy sands and limy upland	.4	.6	.7	.9	1.1
Shallow and thin loess	.3	.5	.6	.8	1.0

B. Relation of range condition and estimated initial stocking rates^{3/}



^{1/}All stocking rates based on summer grazing. Rates may be increased somewhat if grazing is limited to non-growing season.

^{2/}As modified from SCS Technicians Guide.

^{3/}Stocking rate relationships in graph are based on estimated full grazing capacity and do not include a planned degree of undergrazing. Stocking at rates computed from this table should allow range in good and fair condition to improve in condition if range improvement practices such as good distribution of grazing, deferred grazing, avoiding harmful overgrazing in drought years, and weed control are followed. Undergrazing at lower range condition is considered an impractical method of improving range condition.

Figuring Animals per Pasture

After determining the suggested initial stocking rates the next thing to determine is the number of usable acres in the pasture. Do this by subtracting heavily timbered, very steep, barren, or rocky areas from the total acreage. Acres not open to grazing also must be subtracted. Determine the number of usable acres for each range site and each range condition. Ignore different range condition classes or range sites less than 40 acres except on wetland and subirrigated sites. Refer to the example in Table 6 and accompanying map (on page 30).

To determine the number of animal unit months the pasture will provide, multiply the usable acres by animal unit months of grazing per acre. Do this for each range site and condition. Add AUM's for all sites and conditions to get the total for the entire pasture.

To determine animal units the pasture can support for the grazing season, divide the total number of AUM's by the number of months in the grazing season. In the example, a pasture with 653 AUM's of grazing capacity is to be used for a 5-month grazing season. Divide 653 by 5 which equals 131. A total of 131 animal units can be grazed for 5 months in the pasture.

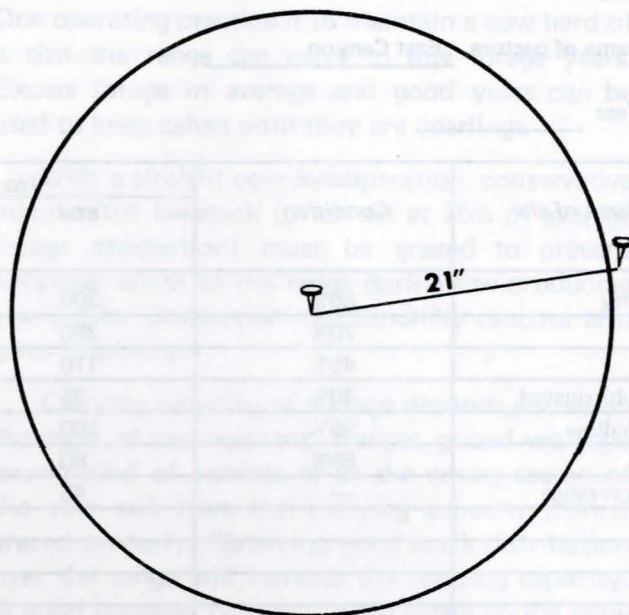
Mechanical Measurement of Range Forage Yield

A second method used to estimate an initial stocking rate is based upon a direct measurement of forage yield. This is determined at the end of the growing season, otherwise forage production will be underestimated. This method is seldom used since range condition is not considered.

When using this method mark off a circle with a 21-inch piece of string with a large nail in each end. All forage in the plot produced by decreaser and increaser plants should be clipped at ground level. Allow the forage to become air-dry and weigh in grams (453.6 grams equals one pound). **Multiply the number of grams by 10 to get pounds per acre.** For example, if you clip 60 grams of air-dry forage from the plot, there is 600 pounds of forage per acre (60×10 equals 600).

The average forage production of several plots on each site should be used. Since forage production on different sites varies, clip a new set of plots for each range site in the range unit.

Let's determine the initial stocking rate for a



How to determine yield of range forage

range site producing 600 pounds of forage per acre. First multiply the 600 pounds by $1/2$; this gives 300 pounds. Grazing half and leaving half is proper use of grass unless one is using a grazing system. If half the forage on summer range is proper use, grazing $2/3$ of the forage produced will be proper on winter range.

Since a mature cow eats about 25 pounds (air-dry) of forage each day, one AUM would be equivalent to about 750 pounds of forage. Our estimate of stocking rate for this range site would then be .4 AUM's per acre (300 divided by 750).

The estimate of stocking rate using this method may be very high or very low if forage production has recently been unusually high or low. Thus, for this method to be accurate, forage production may need to be determined over several years. Then use the average production in determining an initial stocking rate.

Local Experience

Local experience will help in setting an initial stocking rate. Check with a rancher who has a range similar to yours and has maintained his range in high condition over the years. If he has kept good stocking records over many years, his advice will be most helpful. However, remember that a hasty guess may be very misleading.

Table 6. Example of figuring animals per pasture.

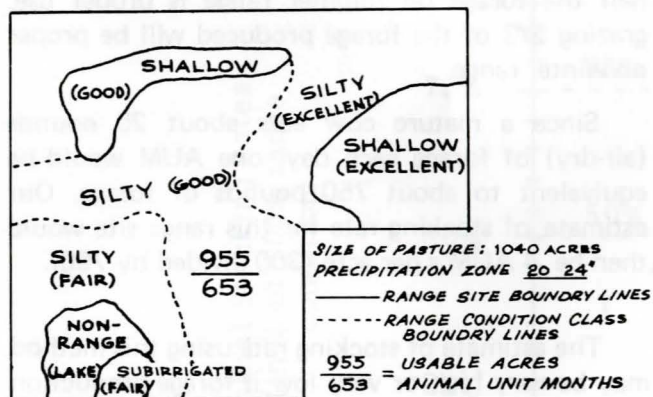
Name of pasture East Canyon

Year _____

Precipitation zone 20-24"

Name of site	Range Condition	No. of acres		Initial Stocking rate AUM's/acre	Number of AUM's
		Total	Usable		
silty	85%	300	290	.75	217
	70%	380	380	.7	266
	45%	110	110	.55	61
subirrigated	40%	25	25	1.05	26
shallow	95%	100	80	.6	48
	65%	80	70	.5	35
non-range	----	45	0	-----	0
Total	xxxxx	1040	955	xxxxx	653

$\frac{653 \text{ AUM's}}{5\text{-month grazing season}} = 131 \text{ animal units for the grazing season}$



Map of pasture showing range sites and range condition classes.

CHAPTER 12

Adjusting the Stocking Rate

Adjustments in stocking rates should be based on range condition and trend. After stocking is made at the initial rate, check the effect this has on key areas in succeeding years. Decreaser and increaser plants should be observed to see how they react. Further changes in stocking rates may be needed from time to time. Detailed grazing records for each pasture should be kept, giving AUM's of grazing and when grazed each year.

If range trend declines, livestock management changes or range improvements should be considered. A range will cause concern to the range manager if the trend is downward.

A range in fair condition with a distinct upward trend may cause no concern, but care should be given so that the condition improves at least to good condition in succeeding years. Either poor condition or downward trend should serve as a red flag of warning. However, once stocking rates have been adjusted to grazing capacity, good grazing practices rather than undergrazing should be used to improve range condition.

Range in poor condition should be improved through management or range improvements. This may require range rehabilitation, such as deferred grazing through two or more consecutive growing seasons, erosion control, weed control, or reseeding. Saving pastures in poor condition for winter grazing may increase their range condition. Even good condition range may benefit from fencing and further water development.

Carrying capacity varies from year to year and even from month to month on the same range. **No range has a single permanent, unvarying carrying capacity.**

Rainfall alone causes wide variations in forage production. It is not uncommon in the Great Plains for forage production on native range to be three times as great in a good year as in a drought year. Rainfall also varies from month to month. This causes actual carrying capacity of a range to vary rather than being fixed.

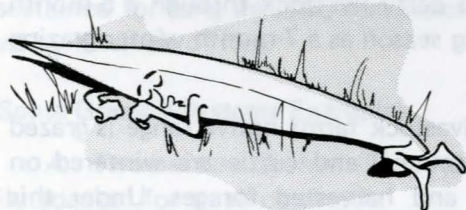
A flexible system of stocking is necessary to meet variations in forage production resulting from

drought, late spring seasons, and insect damage. One operating practice is to maintain a cow herd of a size the range can carry in low forage years. Excess forage in average and good years can be used to keep calves until they are yearlings.

With a straight cow-calf operation, conservative numbers of livestock (often set at 75% of average forage production) must be grazed to prevent excessive abuse to the range during low-producing years. Hay production on Sandhills ranches also gives flexibility.

Carrying capacity of a range depends also upon the type of management. Ranges grazed with the wrong kind of animals or at the wrong season of the year will have less carrying capacity than if grazed properly. Obtaining good stock distribution over the range will increase the carrying capacity. A good manager can graze more cattle on the same range than can a poor manager.

Degree of use check. A running check should be made by the rancher on his range as the grazing season progresses. The purpose is to determine how



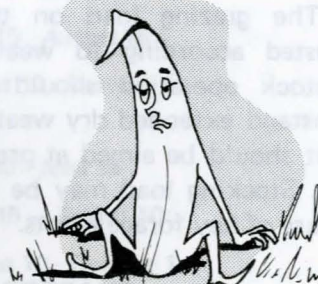
1. UNUSED

NO LIVESTOCK USE



2. SLIGHT

1-20% USE OF PRIMARY FORAGE PLANTS. PRACTICALLY UNDISTURBED.



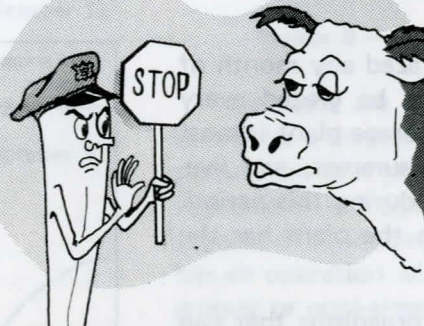
3. MODERATE

21-40% USE OF PRIMARY FORAGE PLANTS. MOST OF RANGE BEING GRAZED. LITTLE OR NO USE OF POOR PLANTS.



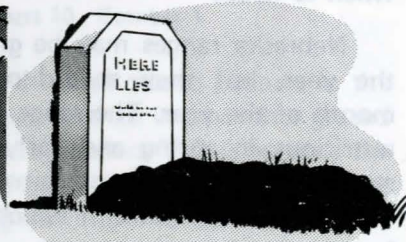
4. FULL

41-60% USE OF PRIMARY FORAGE PLANTS. ALL OF RANGE BEING GRAZED. LITTLE OR NO USE OF POOR PLANTS.



5. CLOSE

61-80% USE OF PRIMARY FORAGE PLANTS. ALL OF THE RANGE SHOWS USE AND MAJOR SECTIONS ARE CLOSELY GRAZED. SOME USE OF LOW VALUE PLANTS.



6. SEVERE

81-100% USE OF PRIMARY FORAGE PLANTS. LOW VALUE PLANTS CARRYING THE GRAZING LOAD.

closely the primary or **key** forage plants (decreasers and increasers) have been grazed during the current grazing season. The range manager will base his management on these key plants. These checks will give a better idea of how much more grazing can be done before the range reaches proper use. It will help in maintaining the long-time range condition at a high level.

If all plants are grazed to the same height, the short ones will have the advantage over the tall ones. Let's look at a tall (18 inch) grass and a short (3 inch) grass growing side by side. If both were grazed down to the same height, say 2 inches, what fraction of the top of each plant would be lost? In the case of short grass, grazing it to the height of 2 inches would remove about 25% of its total weight. In the case of tall grass, the 2-inch grazing height would result in more than 75% of the top being removed.

Grazing too close produces an increasingly less desirable plant cover which often is less dense, less productive, and shorter lived. Close grazing often forces animals to eat stemmy plant parts low in nutritive value. Healthy animals and maximum production cannot be expected from closely grazed ranges.

The grazing load on the range should be adjusted according to weather conditions. The livestock operation should be kept flexible to withstand extended dry weather. Grazing management should be aimed at proper use of the whole area. Stocking load may be adjusted by checking the use of key forage plants.

CHAPTER 13

Grazing Management and Grazing Systems

When to Graze

Nebraska ranges may be grazed any month of the year, but they should not be grazed every month of the year. The range forage plant is most nutritious in spring and early summer, and livestock will make greatest gains during this period. This is also the time in which the plant has the lowest stored energy reserves.

Plants are the only living organisms that can convert inorganic materials into organic materials (through the process of photosynthesis) that can be used as food by animals. Plants must not only manufacture all the feed eaten by cattle, but must

also produce food for themselves.

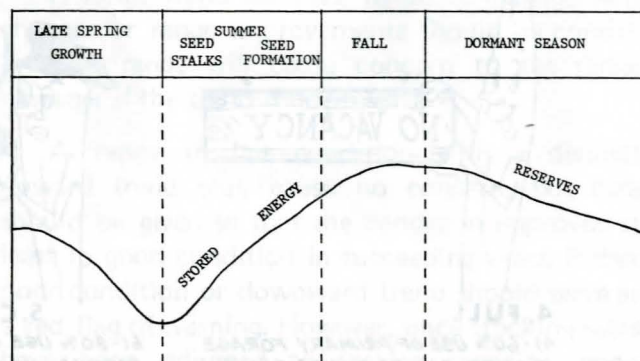
Plants live through the dormant season on their stored energy reserves. There must be enough energy stored to permit the plant to resume or start growth at the end of the dormant season in the spring. As the plant accumulates leaf area, rate of photosynthesis exceeds rate of energy use. This is the beginning point of energy storage.

Stored reserves are depleted if a plant is continuously grazed or grazed too short early in the spring and summer. Depletion occurs as the plant begins regrowth, and this causes weakened plants. Desirable range plants will die if over-grazing continues for several years. They will be replaced by less productive plants. Grazing animals prefer regrowth because it is more nutritious.

Most ranchers practice some type of grazing program, however, some Nebraska ranges are continuously grazed. A common grazing program involves rotating winter and summer use. Best production, however, is accomplished by following a carefully planned grazing program.

Research indicates that it requires about two-thirds as much range to run a cow during the summer six months as for the entire year. Ranchers commonly figure it takes as much range of a similar kind to carry livestock through a 5-month summer grazing season as a 7-month winter grazing season.

On some livestock farms native range is grazed only in the summer, and cattle are wintered on crop residues and harvested forages. Under this system of production, range should not be grazed until there is enough spring growth to carry the livestock.



The annual growth and energy storage cycle of warm grasses.

Planned Grazing Systems

To develop a grazing system it is necessary to divide the range into units. Generally, existing pastures can accommodate a grazing system on a ranch unit. Each pasture is systematically grazed for a certain period and then allowed to rest. This provides at least as much grazing as before and, at the same time, improves the vegetation and soil cover. Concentration of more livestock on a given area forces them to use plants and areas of the range that previously received little or no grazing. This provides use of both undesirable and desirable plants and tends to equalize the grazing stress for all plants throughout the pasture.

A good system allows range plants to recover from close grazing, regain vigor, and build up energy reserves. Therefore, greater forage production can be obtained from most range plants by grazing them, rather than by allowing them complete rest.

Under a properly designed grazing system, range will be stocked for close use of available forage in grazed units during the grazing season. This means 60 to 70% use. This is higher than the recommended 50% use normally suggested for continuous range use. Heavy use can be tolerated under a good grazing system because it is not sustained for long periods, but instead is interrupted by intervals of rest.

Some Grazing Systems Examples

A. Two-pasture System. This system is primarily adapted for small cowherds.

1. System Number 1

a. First year: Grazing Periods

Pasture A — (May 1-May 15); (May 15-July 15).

Pasture B — (May 1-May 15); (July 15-October 1).

b. Second year:

Pasture B — (May 1-May 15); (May 15-July 15).

Pasture A — (May 1-May 15); (July 15-October 1).

2. System Number 2

a. First year:

Pasture A — (May 1-July 15).

Pasture B — (July 15-October 1).

b. Second year:

Pasture B — (May 1-July 15).

Pasture A — (July 15-October 1).

The early use under these two systems suppresses cool-season grasses (like Kentucky bluegrass) and weedy grasses (like downy brome) when desired. The weedy grasses are most palatable at this time.

Early use of undesirable cool-season grasses allows more available moisture for desirable plants later in the growing season. If, in another situation, a rancher has primarily warm-season grasses, the beginning dates should be 15-25 days later in the season.

The dates listed for all grazing systems are only examples. Length of individual grazing periods may need to be adjusted according to pasture size and climatic conditions. All of these systems are flexible and it is better to adapt the grazing system to the current operation by changing time of use each year, than to revamp the ranching operation.

B. Three-pasture System. This sequence is best adapted to ranch units with three available pastures in the growing season. It is simple and easy to follow with a minimum of livestock movement.

1. System Number 1

a. First year: Grazing Periods

Pasture A — May 10 - June 15

Pasture B — June 15 - August 10

Pasture C — August 10 - October 1

b. Second year:

Pasture B — May 10 - June 15

Pasture C — June 15 - August 10

Pasture A — August 10 - October 1

c. Third year:

Pasture C — May 10 - June 15

Pasture A — June 15 - August 10

Pasture B — August 10 - October 1

Livestock are in the first grazed pasture in the spring for a shorter period than in any other grazed pasture for that growing season. This is because the vegetation is beginning its growth and is not capable of producing maximum forage. If a rancher has an operation with both cool- and warm-season grasses or cool-season pasture, the beginning dates could be 10 days earlier.

C. Four-pasture System: The four pasture grazing system is common in the Sandhills. Each year pastures are moved up one step from the time

they are grazed the previous year. This system is most adaptable to ranching operations with several pastures.

<u>Dates</u>	<u>Year</u>			
	<i>first</i>	<i>second</i>	<i>third</i>	<i>fourth</i>
Grazing Periods				
May 15-June 10	A	B	C	D
June 10-July 15	B	C	D	A
July 15-Aug. 25	C	D	A	B
Aug. 25-Oct. 1	D	A	B	C

Livestock are in a grazing unit for a shorter time than in the previous described examples. The first grazing period is particularly short because of lack of adequate forage early in the grazing season.

Other Management Necessities of Grazing Systems

In any grazing system, the same pasture is not grazed or left ungrazed at the same time any two years in a row, except a system specifically designed to graze undesirable components (e.g., weedy grasses) in the spring. By not grazing the same pasture at the same time two years in a row, the plants are not consecutively close cropped by livestock at the same stage of development.

If additional winter feed is necessary, the early grazed pastures of the previous growing season could provide some forage. Livestock may be moved to the next pasture in the sequence when drought occurs or when existing pasture is smaller than the average. An adequate supply of water and salt must be provided in each pasture for the number of animals that will be grazing there at any one time.

Moving livestock can reduce livestock performance. Gates strategically located in fences between pastures where stock will drift through naturally will help. It also is desirable to move small bunches at a time rather than in a general roundup.

Livestock numbers and forage production must be in balance. Every pasture need not be included in the grazing system. Extra pastures may be needed for emergencies, sick animals, quarantine periods, bulls during non-breeding season, horses, etc. The working of livestock (spraying, branding, weaning, etc.) may be done at the time livestock are moved from one pasture to another.

Grazing systems are flexible and should be

designed for each individual situation. The systems presented here are only examples. Many changes and deviations of these exist in Nebraska, but the main principles and advantages of a grazing system remain the same.

Distribute Livestock

Grazing should be uniform over all parts of the range. Many ranges which appear to be overstocked in certain areas can be improved by more uniform grazing without a reduction in livestock numbers.

Even on properly stocked range there can be small areas where forage is wasted because of the great distance from water, difficulty of livestock access or other factors. Local areas will be grazed heavily close to water sources, main trails, and corrals. These "sacrifice areas" must be kept small.

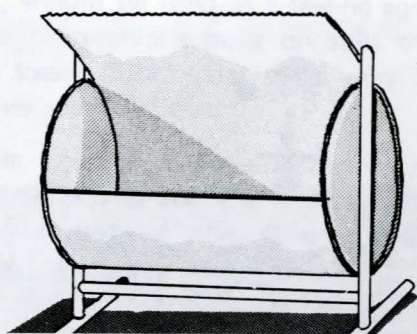
Cattle tend to concentrate on level ground, on meadows, around water sources, and around trees. A stockwater shortage almost always leads to improper livestock distribution. Lack of cross fences or improperly placed fences may also cause distribution problems. Distribution can be improved by:

1. Developing new stockwater facilities in undergrazed areas.
2. Cross fencing large pastures.
3. Fencing along range site lines and around seeded range.
4. Starting planned grazing systems.
5. Feeding winter supplements in underused areas.
6. Placing salt away from water.
7. Mowing old grass in underused areas.

Salting Practices

Livestock need salt all year. Feeding a salt supplement to grazing livestock is a standard range practice. Grazing animals need more salt than they can get from plants. Proper salt location is one of the cheapest and most convenient methods of getting uniform use of forage in a pasture.

Salting places should be located away from water. Salt locations can be moved to areas of the pasture where underuse is noticed and can be moved as often as necessary to get even use of forage. Salt boxes should not be located on areas

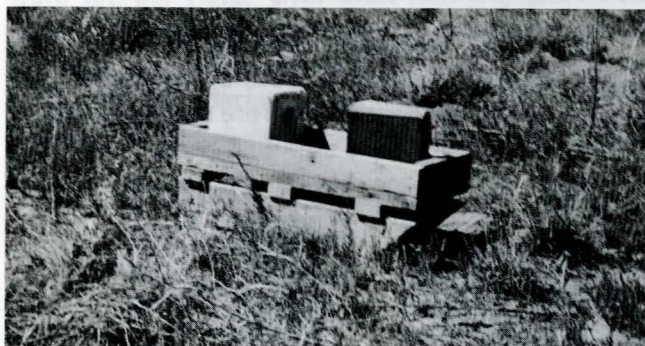


that are subject to severe erosion. On light soils, it may be necessary to move the salt box each time salt is put out.

Salt is usually placed in boxes to protect it from adverse weather. Inexpensive salt boxes can be made from old oil barrels. 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 animals with horns to get their heads in and out.

Suggestions for salting:

1. Allow 2 pounds per cow per month or 1/2 pound per head per month for sheep.
2. Place salt systematically over the range, but not less than 1/4 mile from water. Move the salt according to forage use.
3. Have one salt box or block for each 20-25 head of cattle.
4. If range forage is deficient in phosphorus, mix equal portions of calcium phosphate or steamed bone meal and salt.



A salt box on skids so it can be easily moved by the range rider to areas of ungrazed forage.

CHAPTER 14

Stockwater Developments and Range Fencing

Stockwater Development

On most Nebraska ranges there are not enough natural water sources for the number of animals the range will carry. Even though there may be plenty of forage, enough stockwater must be present before the range can be properly grazed. Livestock should not have to travel long distances to water. Cattle will graze an area close to water repeatedly rather than move a long distance to better forage.

Stockwater problems may arise from inadequate yield or storage of water, improper location and number of watering places or wasteful stockwater developments. A combination of permanent water sources such as lakes, streams, springs, and wells with temporary supplies such as reservoirs or dugouts may be most practical.

The amount of water needed by livestock differs with the kind of range, amount of salt consumed, climate, season, and kind of stock. The average amount of water needed per day is 10 gallons for cattle and 1 gallon for sheep.

Watering places require different spacings in rough or choppy hills than they do on gently rolling or level ranges. Cattle should not have to travel more than 1/4 to 1/2 mile for water on steep, rough ranges. On more level ranges the distance from water to the farthest corner of the pasture should not be greater than one mile.

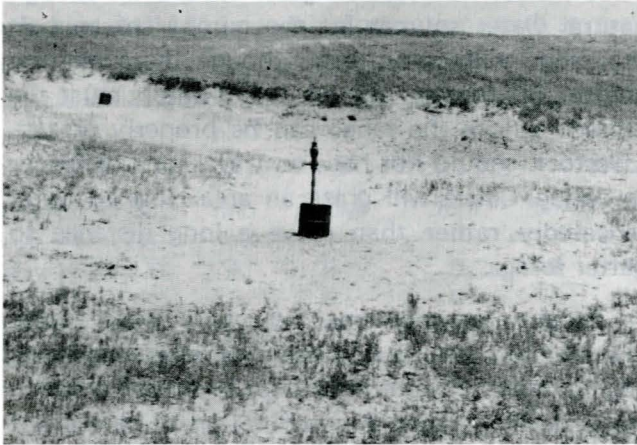
The range manager should plan for a minimum of one watering place per section for best distribution of grazing livestock under most conditions in Nebraska.

Wells and Windmills

The most common type of water development in Nebraska consists of wells and windmills. A well has many advantages as a source of livestock water. Some of them are:

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

Wells should not be on soils subject to erosion. Where erosion can be kept to a minimum, windmills may be put along fence lines. This is a good practice when the pasture size is small or when water development is needed in remote areas of



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

two adjacent pastures. Wells in the Sandhills should not be placed along fencelines because of potential serious erosion.

Springs and Seeps

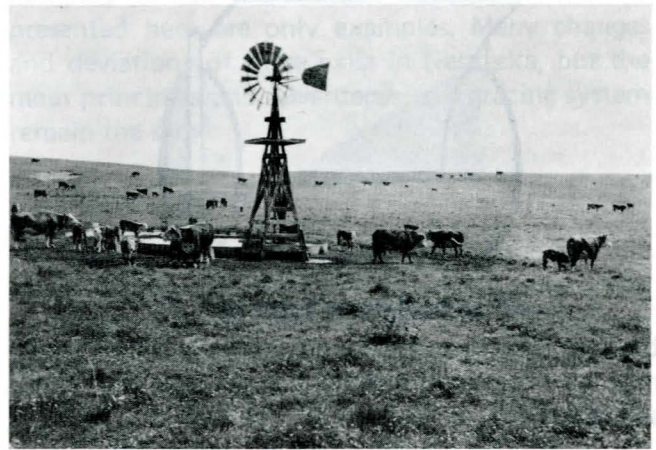
A dependable supply of clean, wholesome water throughout the grazing season may be developed from springs and seeps. Such development may create a good watering place from dangerous bogs and swamps.

To develop a watering place from a spring, soil should be removed down to bedrock or to the source of water. A concrete or masonry box should be built around the source of water, with an outlet pipe several inches above the bottom. The outlet pipe should lead to a tank or trough located a short distance from the collection box. This prevents livestock trampling in the vicinity of the water source.

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



A stockwater dugout constructed with dragline on native range.



Proper location of the windmill and tank together with correct stocking (no more than 50 animal units per watering place) and proper grazing reduces erosion hazards.

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

Pipelines

Water pipelines are being installed in some areas of Nebraska to supply large quantities of high quality water for both human and livestock consumption. A group of ranchers usually form a company and develop a relatively high producing well. Water is then pumped through buried polyvinyl-chloride (PVC) pipes. Some pipelines are over 100 miles in length and may supply water to livestock on more than 50,000 acres of rangeland.

Stockwater Dams or Reservoirs

Stockwater dams and reservoirs are important sources of water in certain areas of Nebraska. Soil texture should be identified before such a structure is built. Heavy clay soils are ideal because of their resistance to seepage losses. Bentonite, a clay

mineral, should be used as a sealing agent for the bottoms of reservoirs built on soils that permit seepage losses. Stockwater dams may be only a temporary source of water.

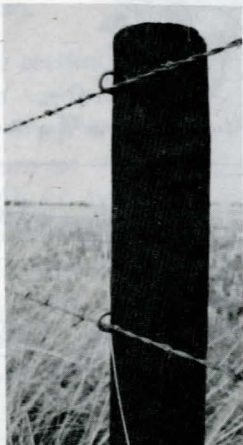
Other types of man-made stockwater developments include dugouts, catchment basins, and sand tanks. For further information on stockwater needs and developments, obtain a copy of E.C. 63-156, "Water for Range Livestock".

Range Fencing

There are five reasons for good range fences:

1. Fences help prevent straying or trespassing of livestock.
2. Fences help to distribute livestock and provide more uniform grazing of forage.
3. Fences make grazing systems possible and divide winter from summer range.
4. Fences can 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 and provide breeding pastures.

Cross-fences should be built to follow natural land features or range site boundaries as much as possible. The range manager should plan cross-fences so that all range units have about the same potential stocking areas. When range units are large and contain different range sites, livestock concentrate on the range sites most easily grazed. This results in over use of forage on some portions of the unit and underuse on other areas. Fencing on range site boundaries allows management practices needed for the best production from each range site.



The size of pastures on Nebraska ranches is 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 efficient use of forage produced on the range is more important. The larger the pasture, generally, the more inefficient the use of the forage by livestock.

A mile of 4-strand, barbed-wire fence requires 16, 80-rod spools of wire and 320 posts. This could be the most convenient and economic range improvement you could add to your ranch. Suspension fences are not as expensive as conventional fences, because they require fewer materials.

CHAPTER 15

Range Seeding

Thousands of acres of rangeland in Nebraska need reseeding. These areas represent land that was at one time farmed and then abandoned. They also include rangeland that has been severely misused. The combination of drought and overgrazing on some ranges has often resulted in destruction of the vegetation and/or a low state of productivity.

Reseeding is an expensive range improvement practice. It is recommended only on 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 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

A new suspension fence costs less to build, is easier to keep up, and is very effective.

to be made.

2. Preparation of a suitable seedbed.
3. Following the best seeding practices known.
4. Careful management after seeding.

Selecting the Grass or Grass Mixture

Selection of the correct grass or mixture of grasses depends upon several things. The first is the purpose of the seeding. Select cool-season grasses to provide grazing in late April and early May. They will also extend the period in which green grass is available to livestock in the fall. Warm-season grasses are used to provide high quality forage in midsummer. They should be seeded on abandoned farm land that is to be included in a native pasture after establishment.

Another consideration is to select grasses adapted to the soil and climate of the area. Crested wheatgrass, for instance, is best suited for the medium and heavy soils of western Nebraska.

Switchgrass and little bluestem may be included in mixtures for many range areas of Nebraska. Sand lovegrass is best used in mixtures on the coarse-textured soils of the state. Tables 7 and 8 show the region to which many grasses are best suited in a reseeding program.

Whenever possible, buy certified seed of improved and recommended varieties of grass. This assures an adapted seed that will have a better chance of seedling establishment and sustained production.

Seed should be bought and planted on a pure-live-seed (PLS) basis. The PLS content of grass seed is determined by multiplying the germination percentage times purity percentage. For information on the PLS method of determining seeding rates, the reader is urged to get a copy of EC 71-135 from his County Extension office. When making plans for a mixture, contact your local Soil Conservation Service office or county Extension agent and obtain the appropriate bulletins listed at the back of this bulletin.

AVOID THESE in range seeding

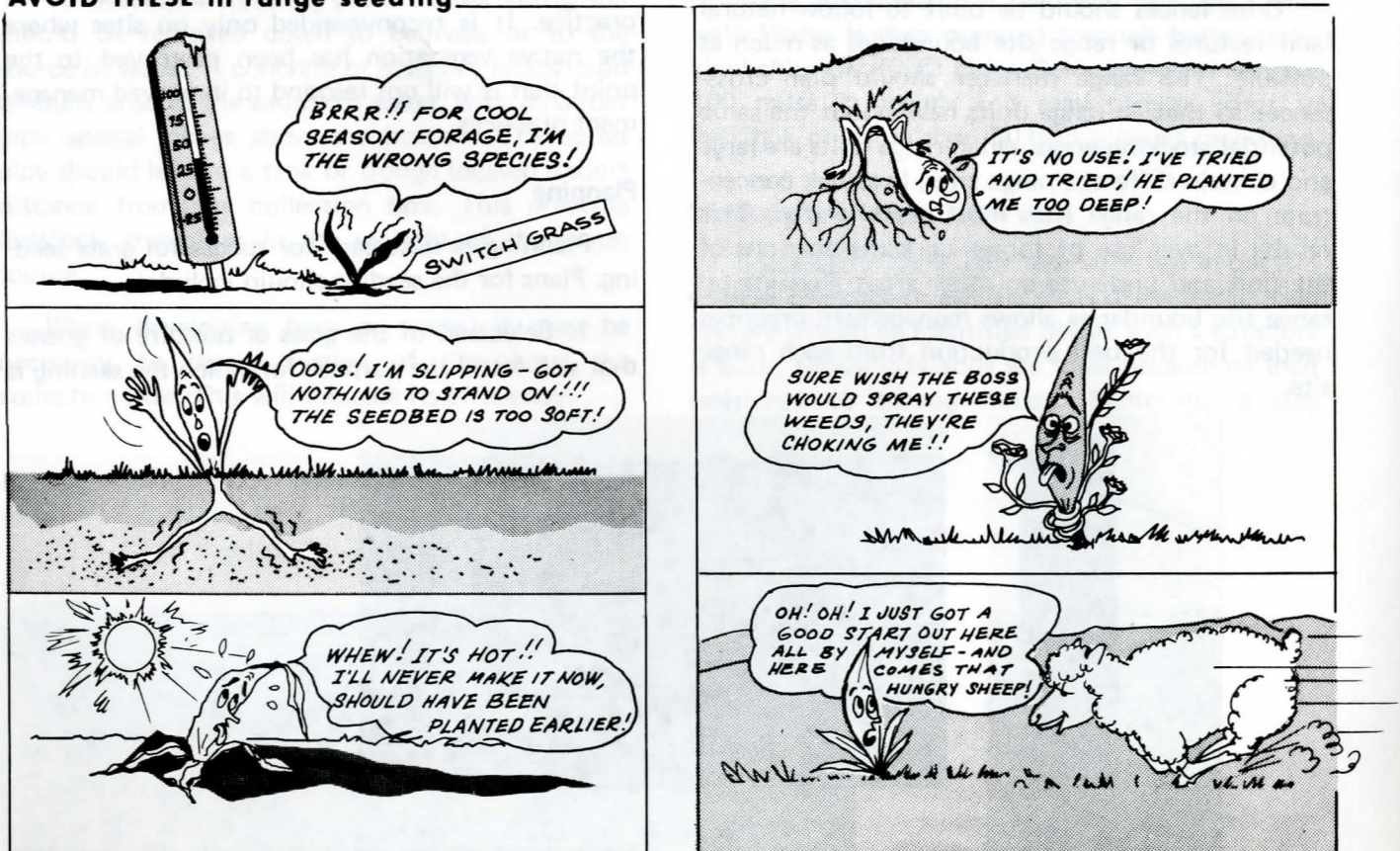


Table 7. Varieties of warm-season grasses for use in major land resource areas of Nebraska.^a

<i>Kind of grass and certified variety</i>	<i>Panhandle 60, 64, 67, 72^{b/}</i>	<i>Sandhills 65</i>	<i>North Central 63, 66</i>	<i>Southeast 72, 73</i>	<i>Central 71</i>	<i>South Central 73, 75</i>	<i>Northeast 102, 107N</i>	<i>Southeast 75, 106, 107S</i>
Big and Sand bluestems								
Garden Co.	S ^{b/}	S	S	S	S	...	...	...
Goldstrike	S	S	SB	SB	SB	S	SB	S
Champ	SBI	HSBI	HSBI	SBI	HSBI	...	HSB	...
Pawnee	...	...	...	I	HSBI	HSBI	HSBI	HSBI
Kaw	...	...	...	I	BI	HSBI	...	HSBI
Little bluestem								
Camper	...	SB	HSB	HSB	HSB	HSB	HSB	HSB
Blaze	...	...	...	SB	SB	HSB	HSB	HSB
Aldous	...	...	...	...	...	HSB	...	HSB
Indiangrass								
Holt	SBIW	HSBIW	HSBIW	SBIW	HSBIW	...	HSBIW	...
Nebraska 54	...	...	...	IW	SBIW	HSBIW	HSBIW	HSBIW
Oto	...	...	...	IW	SBIW	HSBIW	HSBIW	HSBIW
Sand lovegrass								
Nebraska 27	SBI	HSBI	SBI	SBI	HSBI	HSBI	HSBI	HSBI
Side-oats grama								
Butte	H BI	H BI	H BI	H BI	H BI	...	HS	...
Trailway	...	...	...	BI	H BI	HSBI	HSB	HSBI
Switchgrass								
Nebraska 28	SBIW	HSBIW	SBIW	SBIW	HSBIW	...	HSBIW	...
Pathfinder	...	HSBIW	...	SBIW	HSBIW	HSBIW	HSBIW	HSBIW

^{a/} Land resource areas are shown by number and identified by the accompanying map. Select varieties for use in each region and resource area as described in the footnote to the second table of varieties.

^{b/} See footnotes, Table 8, and map on page 40.

Seedbed Preparation

Seedbed preparation is necessary for successful establishment of grass seedlings. Many seedings are unsatisfactory or even lost because of poor seedbed preparation.

Range seedings in Nebraska are most successful when the seedbed has a mulch cover. The cover will help keep the soil moist, lower the surface temperature of the soil, and prevent unnecessary erosion. Mulch cover is most often provided by a crop of sudan, sorghum, or millet. The cover crop should be seeded late enough so that there is no chance for seed to mature. If it appears that seed will mature on the cover crop, seedheads should be removed by mowing before they ripen. The grass seeding is made directly into the stubble the following fall, winter, or early spring. No tillage is

necessary before seeding. Tillage destroys the cover and loosens the soils.

The seedbed must be firm. If the soil is tilled before seeding, several operations with rollers or treaders are necessary to obtain the desired firmness. Nurse crops should not be planted along with range grasses because they compete for moisture.

Seeding Practices

The best seeding practices require use of a grass drill with depth bands. This assures 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, should be planted at a depth of 1/4 to 1/2 inch. Contact the local Soil Conservation

Table 8. Varieties of cool-season grasses for use in major land resource areas of Nebraska^{a/}

Kind of grass and certified variety	Panhandle 60, 64, 67, 72	Sandhills 65	North Central 63, 66	Southwest 72, 73	Central 71	South Central 73, 75	Eastern 102, 106 107
Smooth Brome grass							
Lincoln	I	BI	BI	BI	HSBI	HSBI	HSBI
Lyon	I	BI	BI	BI	HSBI	HSBI	HSBI
Lancaster	...	...	...	...	HSBI	HSBI	HSBI
Orchardgrass							
Sterling, Napier	I	I	I	I	I	BI	HSBI
Reed Canarygrass							
Ireed	IW	IW	IW	IW	IW	IW	HBIW
Crested Wheatgrass							
Nordan	HB	HB	HB	...	...	...	...
Ruff	HB	HB	HB	HB	HB	...	...
Russian Wildrye							
Vinall	HBI	HBI	HB	HBI	...	...	...
Intermediate Wheat- grass Slate	HSBI	HBI	HSBI	HSBI	HSBI	HSBI	HSBI
Tall Wheatgrass							
Platte	BIWA	BIWA	BIWA	BIWA	BIWA	BIWA	BIWA
Western Wheatgrass							
Flintlock	HBWA	HBWA	HBWA	HBWA	HBWA	HBWA	...

^{a/} Land resource areas are shown by number and identified by the accompanying map and description. Select varieties for use in each region and resource area as suggested by the following:

H = Hardlands: the finer-textured upland or terrace soils in an area.

S = Sandy soils: the coarser-textured soils of an area.

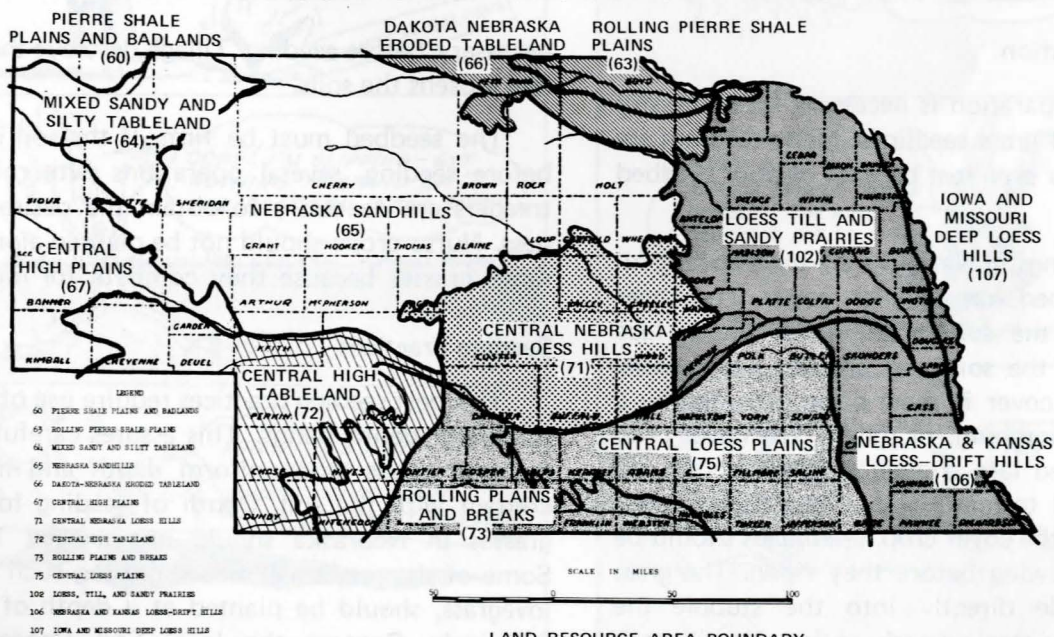
B = Bottomlands: lowlands, with relatively favorable moisture conditions, that do not remain excessively wet for long periods.

I = Irrigated lands.

W = Wet lands: poorly drained soils which have a high water table or are subject to frequent flooding.

A = Alkali or salty soils.

MAJOR LAND RESOURCE AREAS FOR NEBRASKA



Service office or Natural Resource District office for suggestions concerning grassland drills. Many grass seed companies lease grassland drills to their customers.

A range interseeder is used where tillage for seedbed preparation would cause severe erosion hazards. This machine seeds grass in the bottom of a shallow lister furrow without disturbing the vegetation between furrows. The range interseeder is best adapted for reseeding abandoned farm land on sands or sandy range sites.

Time of seeding is important. Cool-season grasses should be planted in late summer for fall establishment, if soil moisture conditions are favorable. They may also be planted in early spring. In central and western Nebraska, wheatgrasses may be planted during the late fall and winter (December-March) for early spring germination.

Since warm-season grasses are not frost resistant in the seedling stage, they should be planted in midspring from early April to early May. Slow germinating warm-season grasses such as bluestems, switchgrass and Indiangrass should be planted at the earlier date.

Management

Close attention must be paid to the management of range after seeding. Seedlings should not be grazed until they are established. Establishment may require from one to three years and more time is often needed for 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 1/2 pound of 2,4-D ester in the second week of June is recommended. Currently there is no recommended chemical to use for control of grassy weeds in new grass seeding. If foxtail barley, bristlegasses, or sandburs are a problem, the only solution is mowing. Care should be used when mowing so that the new seedlings are not cut too close to the soil surface. Mowing should be done at heights of 4 to 5 inches.

CHAPTER 16

Miscellaneous Range Improvements

Weed Control

Useless plants on the range cause lowered

production of native plants and fewer pounds of beef. Some weedy plants use about four times more water than do forage plants. Removal of undesirable plants from range can increase both forage production and stocking rates.

Undesirable plants growing on Nebraska ranges include: western ragweed, sand sagebrush, musk thistle, Canada thistle, green sagewort, ironweed, blue verbena, buckbrush, and skunkbrush sumac. Wild rose, prickly pear, and yucca may be problems in local areas.

Most of these plants can be controlled with 2,4-D, 2,4,5-T, or silvex. Grassy weeds such as downy brome can be controlled by applying atrazine in the fall. For specific recommendations as to time of spraying and rates of chemicals contact your county Extension agent to obtain a copy of "Herbicide Use in Nebraska" which is a guide that is revised each year by the Nebraska Cooperative Extension Service.

Although chemicals may be used to eliminate undesirable plants, the range manager must remember that these plants have usually become a problem because of poor grass management. Control of the undesirable plants will not be effective unless the cause of range deterioration is located and eliminated. In many weed control programs, 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 blowouts in the Nebraska Sandhills. Drought conditions and over-utilization have reactivated many old blowouts. To heal these areas, sand movement must be stopped and a cover of grass must be established. Control of sand blowouts requires:

1. Fencing to keep livestock from trampling and grazing new vegetation on the blowout areas.
2. Leveling or shaping sharp edges of the blowout into a gradual slope. Sharp embankments give the wind its swirling action.
3. Mulching to stop damage from blowing sand while grasses are becoming established. Old hay may be spread over the surface. A disk or tiller will help work the hay into the sand. Feeding hay to cattle on the area will help trample hay into the sand.

Table 9. Guide to selection of legumes and seeding practices for meadows.

<i>Depth to water table (March)</i>	<i>Adapted legume</i>	<i>Rate of seeding</i>	<i>Time of seeding</i>
<i>Inches</i>		<i>lb/A</i>	
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 Sweetclover	4 - 6	Early spring Late fall

4. Seeding the blowout to adapted grasses such as sand lovegrass and switchgrass.

5. Fertilizing infertile, sandy soils will hasten the growth of these grasses.

If mature hay, stacked after the seed has ripened, is used for mulching, some grass will grow from the shattered seed. In many cases this is the only seed applied to blowouts. Temporary crops such as rye, sudangrass, millet, and hairy vetch seeded the year before perennial grasses are seeded will help form a good seedbed.

To prevent new blowouts, avoid concentration of livestock around windmills and in fence corners and other critical points on the range.

Improving Production of Subirrigated Meadows

Yield and quality of hay produced on many subirrigated meadows can be improved with commercial fertilizers. Introduction of adapted legumes to the stand will increase the fertilizer efficiency. Use of fertilizer for improving meadow production includes:

1. A reliable soil test.

2. When legumes are present in subirrigated meadows, production can be increased in western Nebraska (and western Sandhills) by applying 60 pounds of nitrogen and 60 pounds of phosphate (P_2O_5) per acre per year. In eastern and central Sandhills the nitrogen recommendation is 100-140 pounds of nitrogen and 80-100 pounds of phosphate per acre per year.

3. If legumes are not present, nitrogen fertilizer will increase grass production. Where legumes are absent from the stand, 60 pounds of nitrogen is recommended for western Nebraska and 100-140

pounds of nitrogen per acre is recommended for central and eastern Nebraska.

4. If legumes are not present, they can be interseeded in winter or early spring. Legumes may be seeded with any seeder or drill equipped to handle small seed. This is often done with attachments to fertilizer spreaders at the time of phosphorus application. Some ranchers seed clovers by feeding mature clover-grass hay on meadows where they wish to establish new stands.

Table 9 will help in selection of the proper legume and seeding practice for meadows.

Grazing cattle on subirrigated, but not wetland, meadows is a sound practice under proper management. It is recommended that a subirrigated meadow be grazed one year and cut for hay two consecutive years. Gains of cows and calves grazing meadows have proven equal to those from grazing upland sandhill ranges during the summer.

Fertilization

Pastures seeded to cool-season grasses such as smooth brome, intermediate wheatgrass, crested wheatgrass, or Russian wildrye may require nitrogen fertilization for top production. Suggested nitrogen rates vary from 80 to 100 pounds of nitrogen per acre in eastern Nebraska to 30 to 60 pounds per acre in western Nebraska.

Fertilization of upland, native range in central and western Nebraska with either nitrogen or phosphorus fertilizer is not now recommended except in special situations. An application of 40 to 80 pounds of nitrogen per acre may be economical in central and eastern Nebraska. Further research is being conducted to determine the

implications of fertilizers on the grassland community.

Range Pitting and Furrowing

Range pitting makes shallow depressions to trap runoff water on soils that do not take water readily. This results in an increased amount of moisture available for plant growth and a smaller amount of surface runoff. Contour furrows and terraces also help reduce surface flow after rains and get more moisture into the ground. Pitting or furrowing is most useful:

1. Where the soil is hard and it is difficult for water to penetrate.
2. Where much of the rainfall normally runs off.
3. Where the terrain is rolling to moderately steep.
4. Where less than 20 inches of precipitation is received annually.
5. Where desirable forage plants are present to take advantage of the additional moisture.

Rodent and Insect Control

Rodents, particularly pocket gophers, prairie dogs, and jackrabbits may become a serious problem on rangeland. Rodents may become so numerous that they may eliminate forage stands. A mechanical burrow-builder for placing poison bait in meadows and hay fields infested with pocket gophers has been effective. The use of the burrow-builder is not practical on most upland ranges. Range seeding in areas with heavy populations of jackrabbits or pocket gophers may require some type of control before it can be successful. Poisoning has been used.

Insects such as grasshoppers and black wheat-grass bugs also may become serious problems on rangeland and in other forage crops. Several insecticides are approved for use in controlling these pests. County Extension agents can give advice on the most practical control measures for your area.

CHAPTER 17

Complementary Forage Crops

Complementary forage crops are forage resources (such as irrigated pasture, sudangrass,

dryland cool-season pastures, and crop residues) that complement the range resources of a ranch for a more effective livestock feeding program. Most Nebraska ranches outside the Sandhills depend on complementary forage crops during some period of the year.

Most common complementary forage crops are crop residues. Ranchers turn their beef cow herds, following fall weaning, into harvested corn or milo fields. Because nutritional needs of the beef cow are relatively low following weaning, beef cows in good condition will normally obtain their minimum requirements of crude protein and energy from corn or milo residues until inclement weather prevails. Supplementation is necessary during periods of snow cover and when persisting cold temperatures with wind occur.

Another common complementary forage crop is sudangrass used for late summer grazing or as winter feed. When used for fall or winter feed, the common practice is to windrow the sudangrass in August or September and allow the livestock to graze the swaths of forage one at a time with the aid of an electric fence. Sudangrass can be baled, collected dry, or used as a silage to feed beef cows or yearlings in winter and spring. Sudangrass is also used for summer grazing during August and September when pasture production is limited.

Irrigated pasture has attracted recent attention because of dependability of large amounts of high quality forage. Grazing time is potentially from May 1 to November 1. Advantages of an irrigated pasture over dryland range for beef cows include:

1. Forage quality meets the beef cow's requirements to a greater degree in early spring and fall.
2. More dependable forage quantity adds stability to the ranching operation.
3. Cows will generally have shorter time intervals from calving to first heat.
4. A higher percent of beef cows will cycle by start of breeding season.
5. Cows will generally have higher conception rates.
6. Calves will normally perform better.

Hay and/or silage is always an important forage resource on ranches where the practice is appropriate. The use of any complementary forage crop demands an intensive management plan from seed-

ing through harvestings. Such factors as soil site, seeding, fertilization, cultural practices, livestock utilization, etc., must be planned as a group when incorporating a complementary forage crop into a range-livestock operation. Some ranchers do not have the farming experience needed to produce these crops. Thus, a well prepared plan is essential.

For further information on complementary forage crops obtain the appropriate bulletins listed on the next page.

Sources of Additional Information on Range Forage and Beef Cattle

Bulletins can be obtained from your local county Extension agent or by writing Publications, Agricultural Communications, University of Nebraska, Lincoln, Nebraska 68583.

EC67-170 Nebraska Range and Pasture Grasses

EC68-161 Common Range Plants in Nebraska

G74-138 Seeding Warm-Season Grasses

EC71-135 Pure Live Seed. a Basis for Calculating Seed Requirements for Planting Grasses and Legumes

SB-517 The Production of Upland Hay in the Sandhills of Nebraska

G75-218 Planned Grazing Systems for Nebraska

EC63-156 Water for Range Livestock

EC72-195 Producing Alfalfa in Nebraska

G74-151 Seeding and Using Alfalfa

G74-139 Seeding Cool-Season Grasses

EC72-189 Forage, Balance Sheets for Nebraska, a Guide for Planning and Analyzing a Year-Round Forage Program

G73-2 Fertilizer Recommendations for Alfalfa

SB521 Fertilization of Subirrigated Meadows in Western Nebraska

G73-3 Fertilizing Irrigated Pastures

EC72-194 Fertilizer for Bromegrass Production

G74-173 Formulating Beef Cow Rations

G74-145 Average Composition of Common Feeds (Dry Basis)

G74-146 Average Composition of Common Feeds II (As Fed Basis)

G74-176 Cow-Calf Nutrition for Eastern Nebraska

G74-152 Supplementing Crop Residues

EC72-195 Alfalfa Analyst

Textbooks on Range Management

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