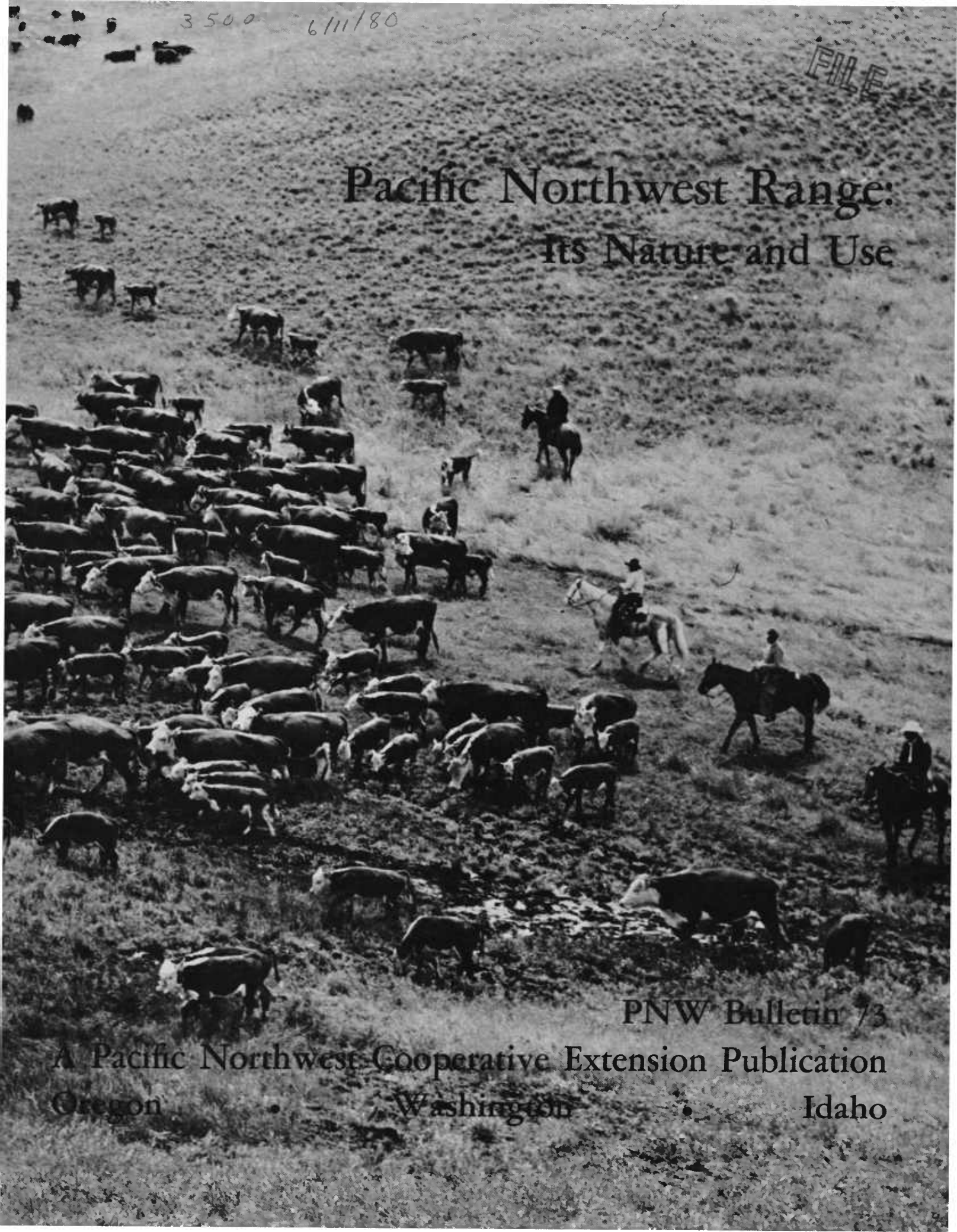

Pacific Northwest Range: Its Nature and Use

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The basic manual from which this booklet has been adapted was prepared by the Society for Range Management.

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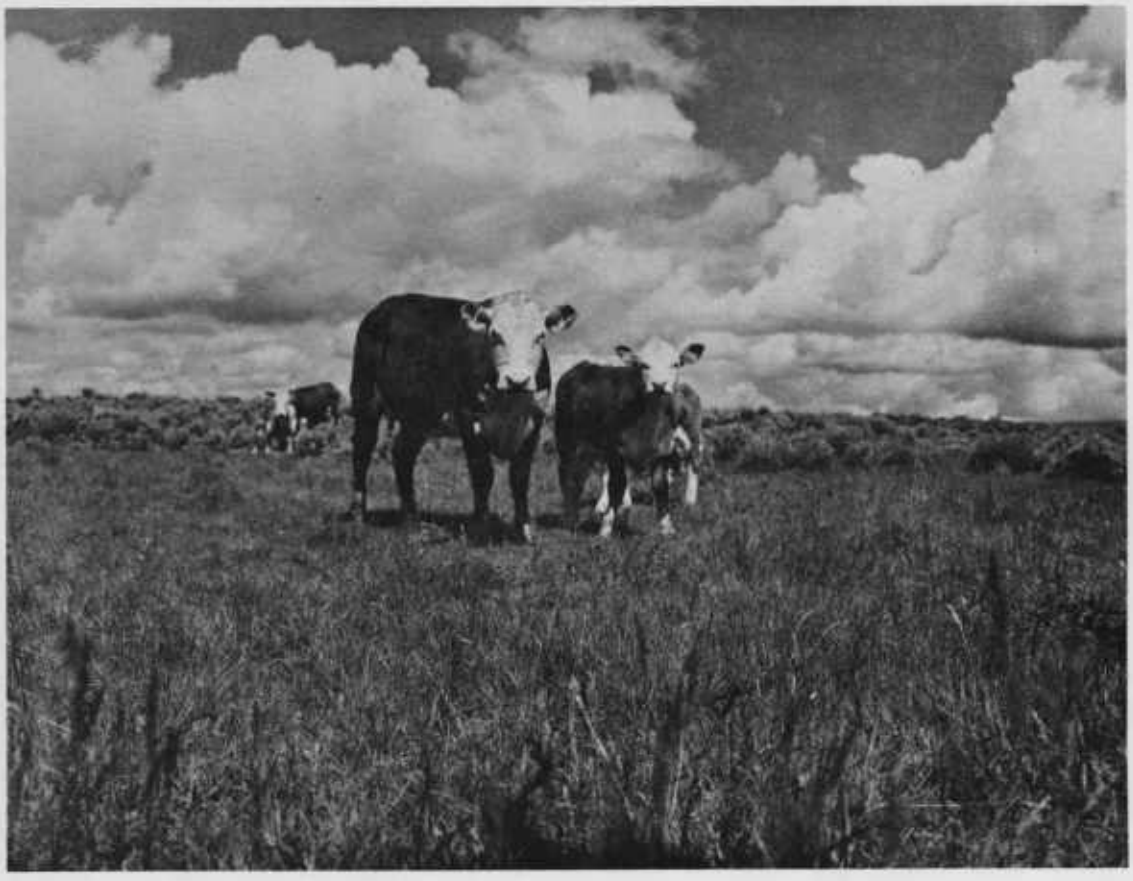
Pacific Northwest Range:
Its Nature and Use



Each of Us Has a "Steak" in the Range

Contents

Range . . . To Have and To Use

Story of the Range

What is range?

Range is an extensive area of level, rolling, broken or mountainous land, usually not adapted to cultivation, covered with native grasses and other forage plants; it is best suited for grazing of domestic and wild animals. Range may be privately or publicly owned, fenced or unfenced, and supporting native or seeded vegetation. However, it is sometimes difficult to say that some lands are or are not rangelands; for example, certain nonirrigated or dryland pasture may be called correctly either rangeland or cropland. There is little point in quibbling over what is range and what is nonirrigated or dryland pasture, since the same management principles apply in each case.

Does rangeland concern me?

Yes, each of us has a "steak" in the range, since the range is a major factor in the source of our meat supply. It is also highly important in wool production, as a source of water, wildlife, and many forms of recreation. The promotion of conservation and maintenance of rangelands for future use is just as important for the nonuser of rangelands as it is for the person operating and living on the range. Our range resource is one of our most valuable natural resources.

Way back when . . .

Rangeland has played a major role in the settlement and prosperity of the western United States. No story of the range is complete without a review of the livestock industry, which is a product of our range.

The first cattle, sheep, and horses were brought into what is now the United States by the Spaniard, Coronado, in 1540. A good climate and an abundance of forage favored cattle and sheep production, and numbers increased rapidly.

Horses escaped capitivity or were left behind by the conquistadors, and their numbers increased. The Indians learned how to use the horse from the Spaniards and Mexicans. Wild horses became common on our western ranges during the 1800's. In fact, in some areas horses were largely responsible for destruction of the original range vegetation.

Cattle drives, from areas where the cattle were raised to areas where they were needed for food or for breeding stock, became part of our western tradition. Cattle on the trail drives averaged 15 to 20 miles per day and gained weight from eating the abundant grasses along the trail. Some of the most famous trails were the Chisholm, Shawnee, Dodge City, Sedalia, Goodnight, California, and National.

The discovery of gold and extension of railroads into the West led to more livestock ranching. Originally, most of the big cattle drives were to the railroads. Eventually, transportation provided by the railroad put an end to these cattle drives.

Thousands of cattle died on the Great Plains range during the severe cold winter of 1885 and 1886. The next year, the Great Plains had a severe drought, cutting cattle numbers further. Falling prices reduced rancher income and cattle numbers still more.

Following the temporary decline of cattle numbers, the numbers of sheep increased rapidly. Depletion of range occurred as cattle numbers again increased. "Range wars" were fought between cattle and sheep producers.

Grazing was the primary use made of public lands for many years. As "America moved West," large portions of the western range were homesteaded, plowed, and planted to crops. The barbed wire fence did much to change the open range from free use to controlled use.

The range has decreased in area, as well as in forage production. Military reservations, cities, towns, airports, mining operations, recreational areas, and highways are continuing to cut into the range area.

As the number of people living in our country increases, so also does the use of our rangelands increase. People now have more leisure time for hunting, fishing, and other forms of recreation. The demand for meat and other animal products is increasing. The availability of water for irrigation, home use, industry, and power is becoming more critical each year. These things have brought about the need for a closer look at the entire range resource. Stock producers, federal and state agencies, and the public at large, have a real responsibility to *plan cooperatively for proper range use.*

The poor condition of some of our ranges has contributed to widespread floods, which have resulted in a

loss of life and property. Much valuable water and soil has been lost. Many important reservoirs and hydroelectric developments have been silted in unnecessarily and their useful life shortened.

While these factors are serious, there is much to be optimistic about. Many ranchers know how to take care of their range—and have been or are so doing. Government land-managing agencies have kept much of the public rangeland in good, healthy condition.

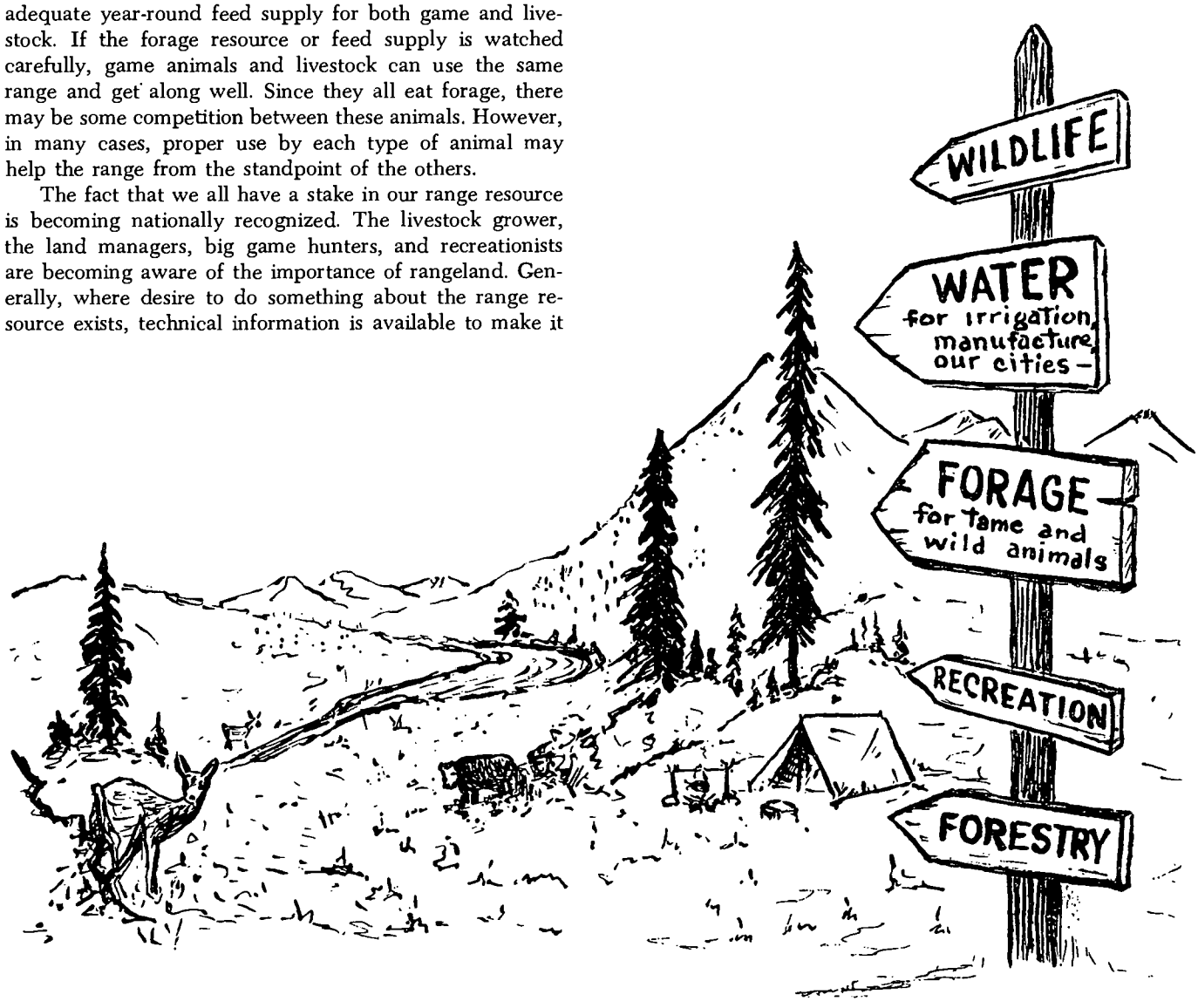
Many thousands of acres of rangeland, both public and private, are being seeded. Brush control programs are being used extensively. Native meadows and irrigated pastures yield many times more forage through the use of various improvement practices.

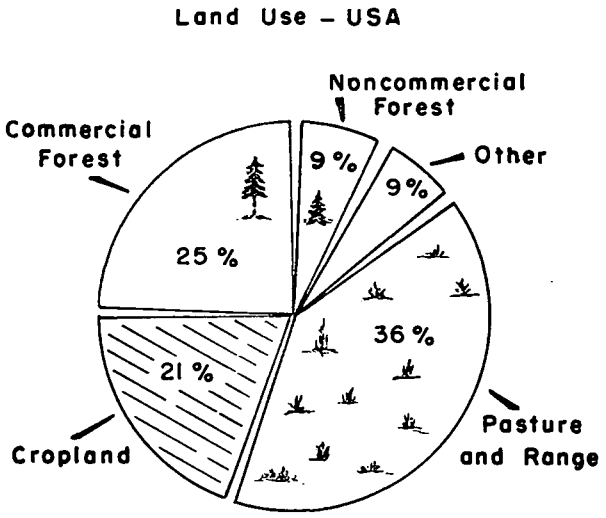
Most rangelands in the United States are grazed by big game animals, such as deer and elk, as well as by livestock. To make game management and hunts successful, it is necessary that our ranges be managed to provide an adequate year-round feed supply for both game and livestock. If the forage resource or feed supply is watched carefully, game animals and livestock can use the same range and get along well. Since they all eat forage, there may be some competition between these animals. However, in many cases, proper use by each type of animal may help the range from the standpoint of the others.

The fact that we all have a stake in our range resource is becoming nationally recognized. The livestock grower, the land managers, big game hunters, and recreationists are becoming aware of the importance of rangeland. Generally, where desire to do something about the range resource exists, technical information is available to make it possible. Slowly but surely, the value of our rangelands is being recognized by the general public. The multiple uses of much of our rangeland are bringing the value of the range into focus for many people who were previously almost unaware of its existence.

How much range do we have?

There are well over one billion acres of rangeland in the United States. Most of it is in the 17 "western range states." The western range area contains more than 700 million acres. Most of the commercial forest lands are also grazed by either domestic livestock or wild game. Large amounts of our croplands are utilized during some period of the year by grazing livestock. These sources make up the major portion of the grazing resource of the country.





Rangelands are important because of their tremendous size. Though the range is far removed in most instances from the centers of population, the condition and productivity of the range influences every American citizen. What is the nature and extent of our great range resource? What is required for continuous high production, and how may each of us take part in range improvement and maintenance?

Career Opportunities in Range Management

The day has passed when you could take a horse, a rope, and a branding iron, and start in the livestock ranching business. The successful range operator today must be skillful in applying science to the changing art of land management. Large amounts of capital are generally required to get started in the ranch business today. However, such an objective can be accomplished. The first step is to get prepared—increase your knowledge, training, and experience.

For those of you who are primarily interested in a profession which takes you outdoors much of the time, who like to work with natural subjects, and who have a genuine interest in the proper management of the great range resource, range management and its related fields offer many satisfying opportunities.

There are many opportunities in ranching, in plant and animal research, in recreational research, and in the various technical and educational services of state and federal agencies concerned with our range resource.

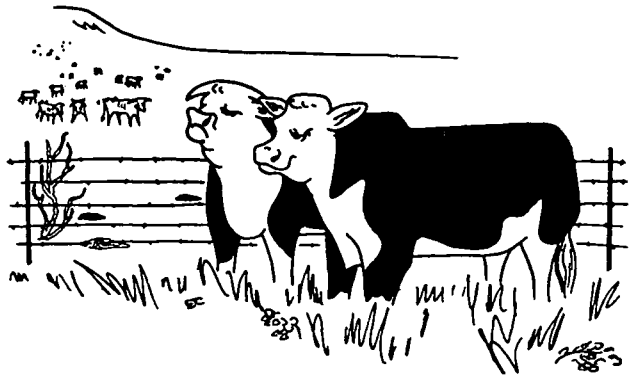
What Is Range Management?

Range management is caring for and using rangeland to provide the highest continuous yield of range products without endangering the range soil and water resources and other important uses of the land. This is in keeping with conservation of the range. Animal products of the range are meat, wool, mohair, and hides. Other important range products are water, wildlife, recreation, forest products, and minerals.

Have you noticed when ranchers sell their products, they are paid for the *pounds* and not the number of head sold? Pounds of products is the measure of a range management plan.

The goals of range management are:

1. Keep range covered with good forage plants.
2. Maintain proper use, with a dependable range feed reserve.
3. Increase livestock and wildlife products.



It's pounds that count, not numbers of animals

4. Increase the storage of water in the soil and "even" the flow of water in streams.
5. Maintain soil on the range watersheds so they will produce an abundance of water for future generations.

You can keep the range healthy and productive by knowing the plants and animals that live there and how to manage them properly. The plants and animals live together as a "community." Cattle, sheep, deer, antelope, rodents, birds, and other animals that feed upon range plants make up the animal community.

Long before the coming of the settlers, the range was used exclusively by buffalo, deer, antelope, and other wild animals. As our country was settled, much of the land was plowed and put into cropland. Cities were built. Domestic livestock was introduced. Fences were constructed. All the activities of civilization tended to push game animals into smaller areas. In some cases, game animals were concentrated on critical forage areas.

With so many livestock and game animals grazing on the range, a change had to take place in the plant and animal communities. Wildlife populations became low in some areas. Through careful and scientific management, both livestock and game numbers now have increased. Prior to scientific management, animal populations were controlled by natural biological factors. When feed was scarce, animals moved to new areas or died. In view of the great demands being put on our ranges now, management that recognizes both the animal requirements and the capabilities of the range resource is necessary. We can no longer afford just to let nature take its course.

Know Your Range

To be a successful range manager, you need to know a great deal about the range. The things that make up the range are soils, water, and plants. A practical knowledge of each is essential for knowing your range.

The Soil

The material from which soil is formed is called the parent material. Soil is formed by the action of climate and living things, as conditioned by the slope of the land.

There are many kinds of soil, differing in parent material, depth, color, texture, and structure. These soil characteristics are called physical features.

Physical features

Soil depth. The amount of soil above the parent material determines the soil depth. It takes millions of years for bare rock to be turned into rich, fertile soil that will support plants and animals. Soil is made up of layers, with the dark topsoil the most important to the range manager. It takes about 500 years to build 1 inch of soil from bedrock. When the topsoil is bare of plants, it will be eroded by water and wind. Washing and blowing wastes the fertile topsoil. Soil depth is an important factor in determining what kind of plants will grow on the soil.

Texture. The size of the various soil particles within each soil layer indicates the texture. Bedrock first breaks down into large rocks, then into smaller rocks and pebbles. As weathering continues, the pebbles are broken down into small particles until we have a fine textured soil. The kind of parent material, as well as time, influences the texture of the soil. Soil particles have the following names, based upon their size: gravel, sand, silt, and clay.

Our soils are a mixture of the different-sized soil particles. The name given the soil is based partly on the size of the particle that is most abundant in the soil. For example, very fine, sandy loam means that the soil is made up mostly of very fine sand particles, with some silt and clay particles. Approximate soil texture can be determined by "feeling" the soil.

Structure. The soil particles are grouped together like "grains" of a popcorn ball. The structure of soil is determined by how the particles are grouped. Soil with good structure readily takes in water and stores it for plant use. Good soil structure is associated with soil productivity.

Color. Color is also an important factor used in describing soils. Soil color is determined by the parent material from which the soil was formed, by climate, and by the amount of organic matter in the soil. Color is some-

times considered to be a reflection of soil productivity. For example, a dark black color generally indicates a highly productive site.

Slope of soil. The slopes of land are extremely variable, from slightly rolling to steep hills and mountains. Steepness of slope is an important factor influencing soil depth. Other factors, such as position on slope and rate of soil formation, also influence soil depth. Generally, the steeper the slope, the more rapidly erosion may occur, thus reducing soil depth.

Range site. A range site is a particular combination of soil and climate factors that produces a certain kind and amount of range vegetation. A given range site has characteristic use and management limitations. More information on this subject will be given later.

Plant matter. Range plants become a part of the range soils. Leaves dry and drop to the soil, protecting the surface. Roots die and furnish food for millions of little living plants and animals called soil organisms. These organisms are constantly working the soil materials into a form that range plants can use. Usually, the more organisms there are in the topsoil, the better the grasses on the range.

To keep the range soils productive for the future, it is necessary to return something to the soil. At the end of the grazing season, some vegetation should be left on the range to help reduce erosion and increase water intake.

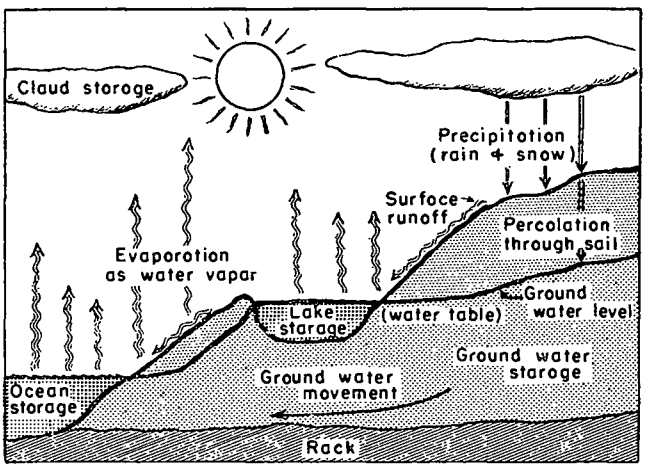
When grazing animals remove too much vegetation, expensive soil conservation practices such as terraces, pitting, furrows, dams, and seeding adapted grasses may be needed to hold the soils in place. It is better land management to graze properly than to rely on artificial practices to prevent soil erosion.

Water

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

Have you heard about the natural water cycle? It begins at the ocean, goes to the sky, to the land, and back to the ocean. Water evaporates from the surface of the ocean into the atmosphere as moisture. The moisture is lifted by air currents. Clouds form, causing precipitation to fall back to the earth as rain or snow.

We are most interested in receiving and holding rain and snow on the range. As precipitation falls, part of it is intercepted by the vegetation, part of it goes into the ground, and part runs off into streams and eventually back to the ocean. Water that runs off too fast may cause damage by carrying soil with it. Runoff may also rob range plants of needed moisture.



The natural water cycle begins at the ocean, goes to the sky, to the land, and back to the ocean. Water is present as a gas (water vapor), a liquid (raindrops, lakes, ocean), and a solid (snow, ice). Regardless of the form, it still is water.

Soils vary in their ability to catch and hold moisture. Soil texture, structure, and organic matter are all important factors in soil moisture relationships. The amount of moisture a soil can hold and the length of time into the growing season the moisture can be held are important factors influencing which plants will grow on a given site.

Plants

As a range manager, you will need to know range plants by their names. Plants tell you what kind of range you have. Each plant helps to tell the story. The presence or absence of certain plants in the range tells how the range has been used and what should be done for improvement or maintenance.

Hundreds of different plants are found on a range. First, you need to know only the most important plants —the ones that furnish feed and shelter for livestock and wildlife. In addition, there are other plants (with little or no forage value) that help to indicate characteristics of the range site. As a general rule, there will be about 15 to 30 really important species on any one range area. You need to know the details of managing the plants in order to produce the most livestock and livestock products.

As plants grow, they shape as trees, shrubs, grasses, grasslike plants, forbs, and vines. Some have thorns, others sting when touched, and still others have no means of self-defense. Some plants grow in dry places, others live in wet places such as marshes.

Certain range plants, particularly grasses, are the most efficient plants for catching and holding moisture where it falls on the range. Vigorous, deep-rooted grasses are often the most effective for this purpose. They are also usually the best forage species.

Grasses have many fibrous roots; some are shallow, some are deep. Some of the roots die and are replaced each year when plants are vigorous. The dead root furnishes food for soil organisms. When a root dies, it leaves a small channel which water follows into the soil.

All range sites, however, are not best adapted to grass production. For example, we have ponderosa pine-grass sites where the tree-grass combination makes best use of the site. Also, there are shrub-grass sites and grass-forb sites, where different combinations of plants represent best use of a given site. It is a responsibility of the range manager to recognize the site differences and to apply fitting management methods.

Parts of plants

Plants are like people—they have "bodies and parts." Each plant has some parts that are different from all other plants. Because grasses are the most important group of range plants, we will learn the parts of grass and compare grass with other plants.

Plants usually have roots, crowns, stems, leaves, and seedheads. To tell one plant from another, you must know the names of the main parts and their differences.

Roots, unlike stems, have no joints, leaves, or flowers. The root's growing part is at the tip. The main functions of the roots are to take water and minerals from the soil to the stems, to store food over winter for spring growth, and to anchor the plant in the soil.

Rhizomes are actually creeping underground stems with joints and leaflike scales. You may have seen quackgrass or western wheatgrass rhizomes producing a new plant. Rhizomes store food and reproduce new plants.

Stolons are like rhizomes, except they grow above the ground. They do the same job as rhizomes (food storage and reproduction).

Above ground, a plant may be divided into vegetative and flowering parts. Vegetative plant parts include the stems and leaves. The grass *stem* is made up of *nodes* (joints) and *internodes* (between the joints); it is usually hollow but sometimes has *pith* in the center, similar to corn. The main functions of the stem are to transport water, minerals, and food between the roots and the leaves and to support the leaves.

At each node (joint) on the stem, there is a *bud* that may reproduce a branch or remain dormant. The *leaf* also arises from a node on the stem. It is made up of two parts: the *sheath,* which fits closely around the stem; and the broad, expanded portion known as the *blade.* These two parts are jointed together at the *collar,* which has two parts. On the inside of the collar, next to the stem, is a small leaflike projection known as the *ligule.* On the outside of the collar, on some grasses, are two ear-shaped tips that clasp the stem. These tips are called *auricles.*

The growing point of the grass leaf is at the base of the leaf and the sheath rather than at the tip. That explains why grass leaves can be grazed and still grow and produce forage for livestock. The growing point of herb stems is at the tip. When the tip is grazed or clipped off, the stem quits growing.

The "flower" or head of a grass plant is made up of many smaller units known as *spikelets.* At the base of each spikelet there are two leaflike bracts known as *glumes.* When there is more than one *floret* (single grass flower) in each spikelet, each floret is supported on a short stem known as a *rachilla.* Each of these florets at maturity produces a *seed.* The seed is enclosed by two more leaflike bracts known as the *lemma* and the *palea.* In many grasses, such as bluebunch wheatgrass, the lemma and palea remain with the seeds after they ripen and fall.

If you do not have an identification key and need to know the name and importance of a plant, take the plant to your county Extension (agricultural) agent or to some other range technician. If they cannot identify it for you, keep one specimen and send another one to your Extension range specialist or to the herbarium of your state university. When collecting for identification, you must collect the entire plant. It will also aid in identification if you press each specimen. (See Plant Collecting, page 12.) Number each plant. Numbers are used by herbarium workers in giving you the requested information.

Common range plants

Since plants have different life spans, they can be grouped according to how long they live and how they grow.

Annual plants live only one season. They must reproduce each year from seeds. They do not grow a second year from roots or crown.

Biennial plants live 2 years and reproduce by seeds the second year.

Perennial plants live over from year to year, producing leaves and stems for more than 2 years from the same crown. These plants reproduce by seeds, stems, bulbs, and underground rootstocks. There are both short-lived and long-lived perennials.

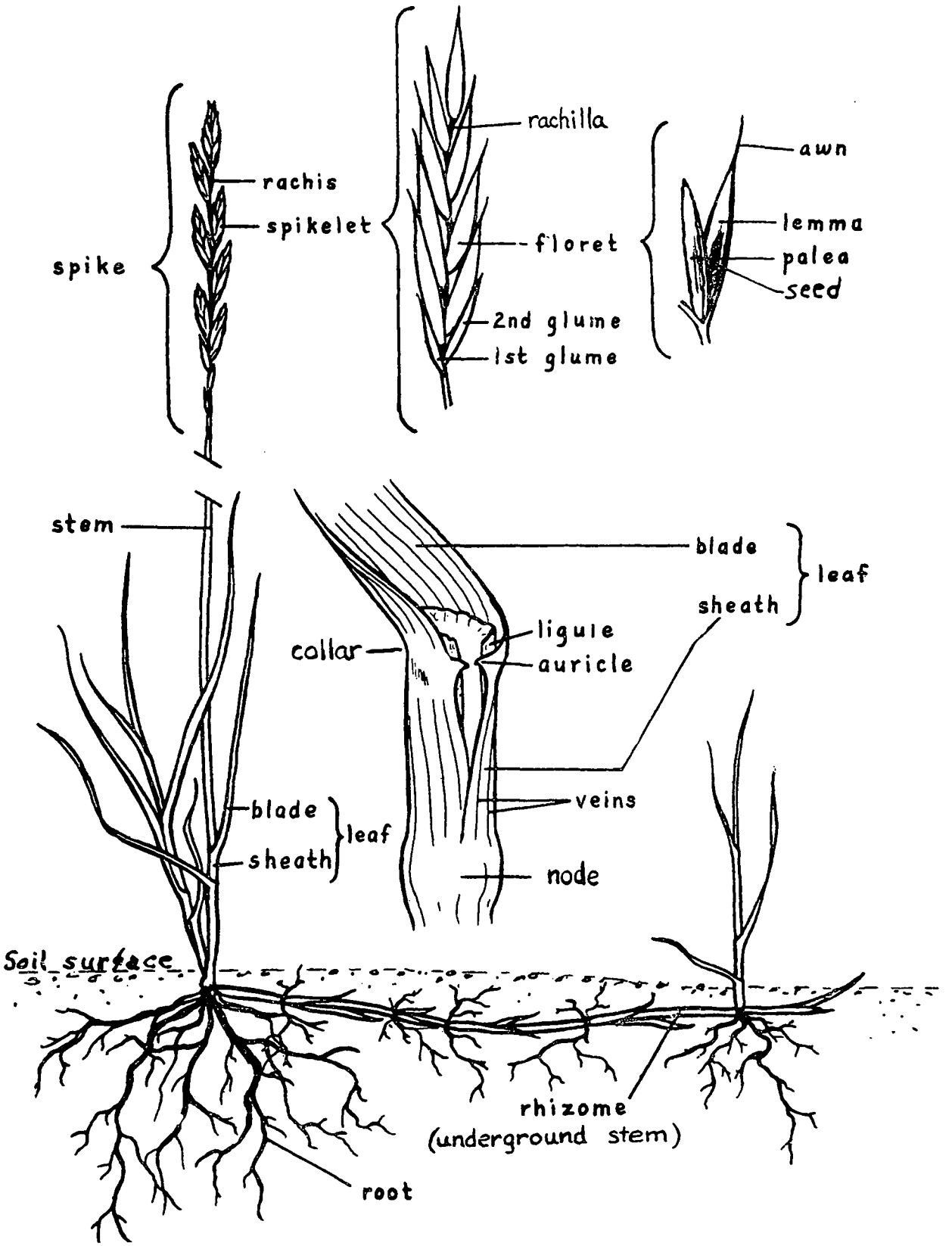
Not all plants are native to our locality, state, or country. Some have been brought in accidentally or purposefully from other areas or foreign countries.

Native plants are those species which had their beginnings in North America. Introduced plants are those which have been brought in from outside North America.

Plants grow in different seasons of the year. Cool-season plants make their principal growth during the cool weather in the spring or late fall. Warm-season plants generally make their principal growth during the frost-free period and develop seed in the summer or early fall. (They wait for warm weather.)

Plants are also grouped according to their growth form, that is, their shape or how they look as they grow. Be-

PARTS of GRASS PLANTS



cause range plants are so numerous and so different in their forms and growth habits, they should be grouped for convenience in range management. There are five main kinds of plants: grasses, grasslike plants, forbs, shrubs, and half-shrubs.

Following is a description of the kinds of common range plants:

Grasses. Plants with jointed stems; stems are generally hollow; leaves are in two rows on the stem; veins on the leaves are parallel. These are "true grasses" and are among the most important kinds of range plants. Examples are:

Bluebunch wheatgrass (perennial bunchgrass)
Quackgrass and western wheatgrass (perennial with creeping underground stems or rhizomes)
Cheatgrass brome (an annual grass)

Grasslike plants. These plants look like grass, but have solid (not hollow) stems which are often triangular and have no joints. Veins are parallel in the leaves. These are sedges and rushes. Examples are:

Elksedge (triangular in cross section)
Baltic rush (round in cross section)

Forbs. A forb is a non-grasslike plant with annual stems (tops). There are netlike veins in the leaves. Examples are weeds and range flowers. We use the term "forb" instead of "weed" because weeds are best thought of as undesirable plants. Many of this group of range plants are not pests, for they are valuable as forage, especially for sheep and wildlife. Examples are:

Yarrow (perennial creeping rhizomes)
Tapertip hawksbeard (perennial roots)
Bull thistle (biennial roots)
Tumbling mustard (an annual forb)

Shrubs. A shrub is a woody plant; its stems and buds live over the winter above the ground and branch from near the base. (A tree resembles the shrub in growth form, but the tree has a definite trunk with branches well above the ground.) Examples of shrubs are:

Big sagebrush
Rabbitbrush
Bitterbrush

Half-shrubs. A half-shrub is a perennial plant that dies back each winter, not to the ground line, but to a perennial woody base or a bare ground stem. Examples are:

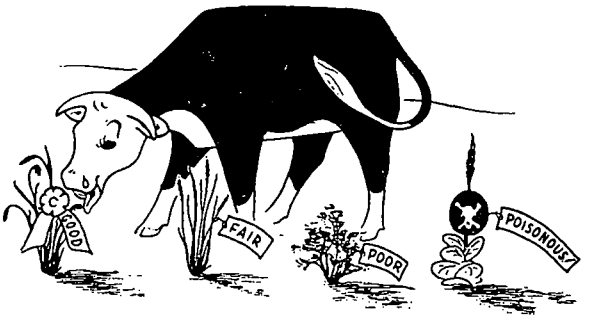
Matchweed
Winterfat

By knowing the groups of plants and plant parts, you can use an identification key. A key is an organized listing of plant characteristics according to structure (generally, flower parts). Plant keys are helpful in determining the correct names of plants.

See your county Extension agent or range technician for a key to range plants in your county or state.

You can use the chart on the next page to tell which range plants are grasses, grasslike plants, forbs, and shrubs.

Forage value. Forage value for each species can be determined on the basis of preference (how well it is liked by livestock), nutritive content, and dependability as a forage supply. This is a relative factor which may vary, depending upon the kind of livestock using the plants, the soil fertility, and the season. Forages may be classed as good, fair, and poor.



Livestock generally do not graze poisonous plants if desirable forage plants are available.

Cattle especially like to graze grass that is high enough so they can "wrap their tongues around it" and get a big bite. Early in the spring the taller grasses are soft and the livestock like them. Cattle can fill up quickly if they have taller growing grasses to graze. If they are forced to eat short grasses, they get less to eat and gain less. Cattle also eat some forbs and shrubs, especially in late summer.

Sheep and goats are browsers. They like fine grasses, forbs, and shrubs. Sheep like forbs and shrubs better than cattle do; this is even more true of goats. A knowledge of the kind of plants growing on your range will help you decide what kind of livestock to select.

Poisonous and injurious plants

Poisonous range plants may kill livestock and reduce the rancher's income. Diseases and other troubles of livestock are often caused by poisonous plants. Some range plants are poisonous only at certain stages of growth or seasons of the year, while at other times they provide good forage. A knowledge of these plants is essential to the rancher.

Here are some aids in preventing stock poisoning:

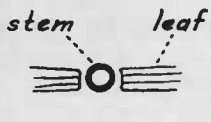
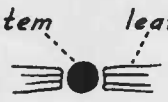
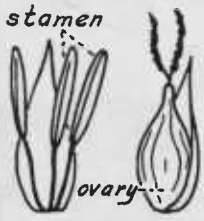
1. Know poisonous plants and their characteristics.

2. Do not overuse the range forage. Most poisonous plants are shunned by well-fed grazing animals. Overuse often kills good forage plants while encouraging growth of poisonous plants.

3. Graze livestock only in the proper season. Also, it is sometimes possible to prevent poisoning by grazing during that part of the season when poisonous plants are not available or are not preferred by livestock.

4. Be careful with *hungry* animals. They are more likely to graze poisonous plants during trailing, bedding, or after long truck hauls. Poison-free feed should be supplied before hungry animals are turned out on ranges with poisonous plants.

IMPORTANT RANGE PLANT GROUPS

	GRASSES	GRASSLIKE		FORBS	SHRUBS (Browse)
		Sedges	Rushes		
STEMS	 Jointed. Hollow or Pithy	 Solid. Not Jointed		 Solid	 growth rings. Woody. Solid
LEAVES	 Parallel Veins.  Leaves on 2 sides of stem	 Leaves on 3 sides of stem	 Leaves on 2 sides of stem; rounded	 "Veins" are usually netlike	
FLOWERS	 (floret)	 stamen. ovary. male female (may be combined)		 Often showy	
EXAMPLE	 Western Wheatgrass	 Threadleaf Sedge	 Wire Rush	 Western Yarrow	 Big Sagebrush (twig)

5. Provide ample salt and supplement any minerals known to be deficient in the native forage. Animals sometimes eat poisonous plants that they would not graze if they had the right kind of feed.

6. If possible, use a class of stock not poisoned by the plant present. Cattle can sometimes safely graze ranges containing plants harmful to sheep, and vice versa.

7. Use herbicides to kill the poisonous plants.

Many range plants are mechanically injurious to animals at various times of the year. Members of the cactus family cause injury to grazing animals when their spines stick into the animal's skin. This causes serious damage during screwworm seasons in the southern states. Needlegrass injures sheep when the seed is mature and begins to shed. Once the needlegrass seed gets into the wool, it may work through the skin. This damages the flesh for edible food and makes the hide useless for leather. At all other times, the nedlegrasses furnish good quality forage to grazing animals.

Grasses with sharp awns or beards may be injurious to livestock. They may furnish grazing early in the spring and again in the fall, but as a general rule, the forage value of heavy-awned grasses is limited.

Collecting Range Plants

As a beginning range manager, you will need to make a plant collection. For each plant you should list the name, location, associated plants, and grazing value. Your collection should represent the various plant species which you see as you ride over your range. The collection should extend over different seasons of a year, since plants grow and have flowers at various seasons. Plants should be collected when the flowers are the showiest or when grass is headed out. Careful pressing and drying help retain plant shape and preserve natural colors.

Steps in plant collection

Digging, pressing, and mounting are steps in the collecting of range plants. A brief discussion of each step, and the materials needed, follows.

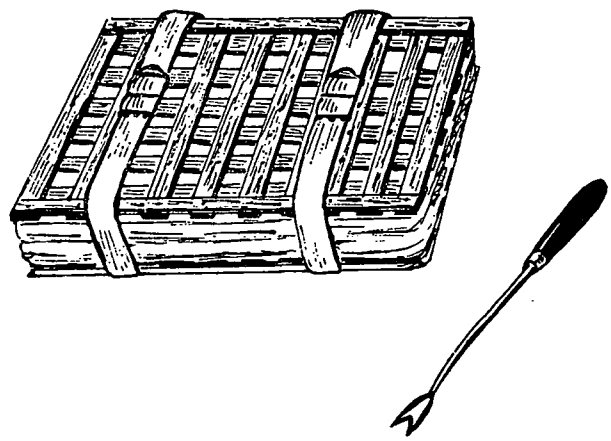
Digging plants. Be sure to get two plants of each kind. When collecting your plants, you will need a plant press. (A large magazine with rough, absorbent paper may be used as a substitute.) As you collect your plants, place them between the blotters of the press or the pages of the magazine. Or, you may want to collect plants in a plastic freezer bag and take them home to press and dry them. A dandelion digger, a small pick, or a shovel is useful for digging the plants; a sharp knife to cut and trim plants is also handy. In digging plants, be sure to get a fair sample of the root, especially of grasses, grasslike plants, and forbs, as some plants are identified by the roots. Collect twigs of shrubs and trees.

A complete specimen should show the roots, stems, leaves, and flower heads. Do not include too much plant material, as it will not dry well, and many specimens are apt to mold. Soil and dead plant material should be removed when the specimen is collected. If necessary, the plant should be folded neatly in an "N" or inverted "V" so it will fit inside the specimen sheets for pressing. Place plants in the press or magazine before they begin to wilt. When collecting plants for a range herbarium, it is a good idea to collect the same plant at different seasons of the year to show development changes in the plant. It is often necessary to be able to identify range plants in their vegetative non-flowering state.

Record the following data about each specimen at the time of collection:

1. Plant name and collector's number
2. Where collected
3. Plants growing around it
4. Slope
5. Date of collection
6. Name of collector

Pressing plants. Two pieces of plywood 12 x 18 inches (with 1-inch holes bored for ventilation), a dozen or so pieces of corrugated ventilating board and building felt of the same size, some old newspapers, and two heavy rubber bands or straps with buckles serve as a plant press. Cut the ventilating boards so the corrugations run the short (12-inch) way. The newspapers serve as specimen sheets (one plant to a folded sheet). The building felt should be changed or dried every day to preserve the natural color of the plant.



A plant press and digger.

Names of the plants can be put on the margin of each specimen sheet. Dryers and specimens sheets should be placed in the press in the following order: ventilating board, building felt, folded newspaper (containing specimen), ventilator, and so forth. Until the plants are dry,

keep them in the specimen sheets to retain their normal shape. When the specimens are dry, they may be retained in the specimen sheet until mounted on herbarium sheets.

Mounting plants. Each specimen can be mounted on standard herbarium cards, 11½ x 16½ inches or 8½ x 11 inches. Glue the plants to the sheets or cards with transparent, plastic glue. From 15 to 20 "dots" of this glue under roots, stems, and leaves will hold the plants in place. Weight the plants down while gluing them to the cards.

The mounting label or data sheet should be about 3 x 5 inches and glued to the lower right-hand corner of the sheet. It should contain the following information:

1. Common name and scientific name
2. Pertinent data—abundance, habitat, location, associated plants
3. Forage value
4. Collector's name
5. Date of collection

RANGE MANAGEMENT

Plant Label

Plant Name _____
GENUS SPECIES

Common Name _____

Location _____

Site _____

Date _____ 19___ My Name _____

Forage Value _____ Poisonous _____ Injurious _____

Grazing Response (Color Group) PLACE COLOR TAB HERE

A range plant label

Mounted specimens may be covered with cellophane for display purposes, but cellophane covers are not necessary. You may display your herbarium collection in a case or as a book of mounted specimens. Book backs made of plywood, masonite, or leather can make your collection attractive and interesting to your friends. Moth crystals should be kept with stored specimens to keep insects from eating the plants.

How Plants Live and Produce

Range plants are living organisms which require nutrients, minerals, air, water, and light in order to live and produce tops, roots, and seeds. If any one of these elements is cut off, the plant will die.

A green plant is nature's food-manufacturing machine. For power, it uses energy from the sun. Water, air, and minerals are the raw materials used in this manufacturing process. Some finished products are sugar (an energy food) and protein (needed for growth). Waste products are oxygen, carbon dioxide, and water.

Photosynthesis

Photosynthesis is the process by which plants take carbon dioxide and water, in the presence of sunlight, and combine them to make plant sugars. This process can take place in any part of a green plant, but it is carried out primarily in the leaves and stems. Thus, they are the main food-manufacturing parts of the plant.

Without sufficient green plant parts to serve as factories, the food manufacture of a plant will be reduced. As food manufacture is reduced, the plants will weaken and may die. A healthy, vigorous plant makes plenty of food for its present use and stores some in its roots for emergency use. Such emergencies are: (1) to make new growth following drought, and (2) to make new leaves in the spring or when the tops have been removed by clipping or grazing.

It is obvious, then, that if the food-manufacturing parts of a plant are kept grazed close to the ground surface, the plant will starve to death. *It takes grass to make grass.*

Water. Water makes up about 70 to 90 percent of the weight of green grass and from 8 to 25 percent of dry grass. Evaporation of water from the plant leaves helps the plant to "keep cool." Water also serves as a food and mineral carrier within the plant's body.

Water is absorbed into plants through the roots. The young, tender leaves contain more water and nutrients than any other part of the plant. Grasses, like other plants, need large amounts of water to produce a pound of dry forage. In the semiarid areas, range grasses need from 300 to 1,000 pounds of water to produce 1 pound of dry forage, while shrubs and trees need 1,700 to 2,400 pounds to produce a pound of twigs, bark, and leaves.

Air. Carbon dioxide taken from the air is another material required for manufacture of plant food that is needed for grass growth. The plant takes in the carbon dioxide through stomata (very small holes) on the underside of the leaves. Inside the plant cells, the carbon dioxide, together with other raw materials, is made into starches, sugars, fats, and protein. Green plants give off oxygen while they are in the process of making food. As long as we have a land covered with green grass and other green plants, how can we have a shortage of oxygen to breathe?

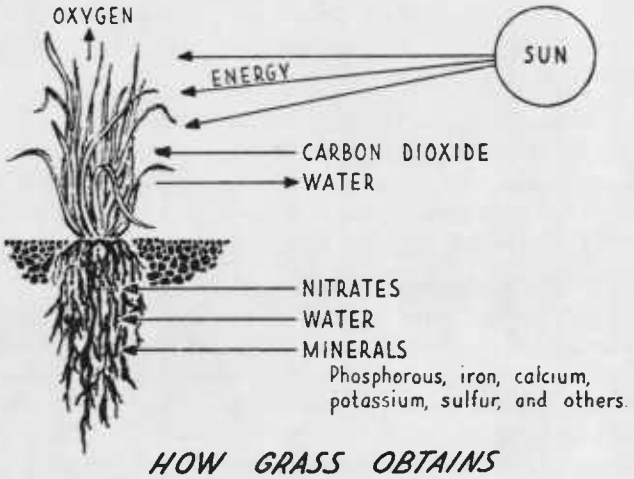
Minerals. Many mineral elements are found in plants. It is not known if all minerals found in plants are required for growth, but many of them are certainly essential. The three major elements required by plants are nitrogen, phosphorus, and potassium. Other minerals needed in varying amounts are calcium, iron, sulfur, magnesium, cobalt, manganese, zinc, boron, molybdenum, and chlorine.

Each mineral element has a definite place in the life of a grass plant. A plant uses nitrogen in the manufacture of protein, which is vital to plant growth and reproduction. Nitrogen is in a free state in the air, but as such, cannot be used by plants. Soil organisms take nitrogen from the air, combine it with other elements, and deposit it in the soil. Plants then get their nitrogen supply from the soil.

Calcium acts as a cement or glue to hold the cell walls of plants together. It forms a protection around each cell, allowing plant nutrients to enter but keeping out injurious particles.

Phosphorus is needed for rapid cell division, food making, seed development, and production of a strong, "healthy" plant. Phosphorus seems to be especially important in helping plants develop a strong root system.

Potassium is a mystery mineral. However, it is apparently needed to assist sunlight in forming other compounds necessary for plant life. Each of the other minerals also serves a purpose.



HOW GRASS OBTAINS MATERIALS FOR FOOD MANUFACTURE

Remember now, "it takes grass to make grass." It is the plant tops or "shoots" where the food is manufactured and the building materials for the roots and tops are made.

Plant communities

Plants that favor similar living conditions group into separate but related communities somewhat as people do. You have seen how the mixture of plants on a north slope differs from those on a south slope. They are two plant communities. The "individuals" in each community are always working together and competing with each other.

The grass community is a desirable community to have on a range. Grasses are good conservers of water and soil, and grasses are also good forage producers. The sagebrush-grass community is typical of ranges of the Pacific Northwest. This community usually consists of a mixture of bunchgrass (such as bluebunch wheatgrass, Idaho fescue, and Sandberg bluegrass) interspersed with sagebrush. Other plant communities of importance in the Northwest include trees. For example, ponderosa pine is often found with an understory of bitterbrush and bluebunch wheatgrass or Idaho fescue.

These are only a few examples of plant communities. It is natural to find many kinds of plant communities, since plants tend to sort themselves into groups according to their needs. Because this is true, many plants have "indicator value." That is, their presence indicates many things about the habitat in which they are growing.

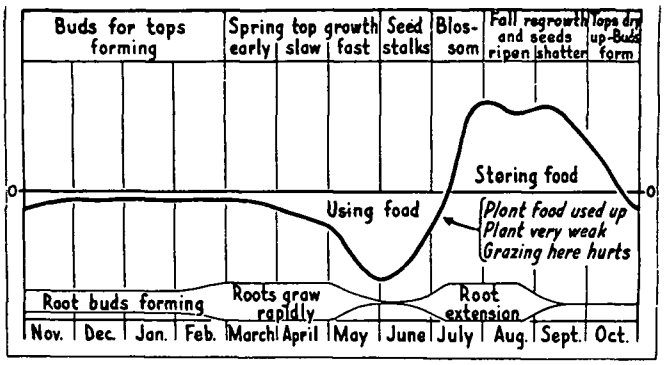
The majority of a top-condition range is covered with nutritious, preferred, and productive forage species. This range is the most "healthy," the most productive of animal products, and usually the best soil stabilizer.

The plant community is never stable, but is always changing for better or for worse. Range condition can be changed by management. In a typical sagebrush-grass community certain changes may take place as a result of continued early and heavy use. For example:

The taller, early growing but late maturing grasses such as bluebunch wheatgrass or Idaho fescue are grazed closely, preventing seed formation and storage of food in the roots. Many plants die as a result of continued, heavy use. The remaining plants are low in vigor and unable to compete successfully with less desirable plants (such as sagebrush and weedy grasses) which are being utilized to a lesser degree.

If a plant is grazed and then allowed to make top growth again, it will not be seriously hurt. But if the shoots are *kept grazed* close to the surface of the ground, the plant suffers. *Where the shoots are kept down, the roots are shortened.* This makes the range plant less able to compete for moisture and nutrients with thrifty, ungrazed, less preferred plants and undesirable plants. The better, hard-working range plants are thus replaced by plants that furnish little livestock or game feed.

If *all* plants are grazed to the same height, the short ones will have the advantage over the tall ones. Compare a tall (12-inch) 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 tops of each would be lost to the plant? Grazing short grass to the height of 2 inches would remove only about one-fourth of the tops. In the case of tall grass, the 2-inch grazing height would result in more than three-fourths of the top growth being removed. It is easy to see that the tall grass would be crowded out because its food-making "machinery" would be reduced too much to work well. They are usually replaced by less preferred or shorter plants. Poisonous and injurious plants may increase on rangeland where there is continuous heavy use.



The annual food and growth cycles of plants.

This diagram shows *three* things going on in a plant during the year. They are: (1) top growth (top line of diagram), (2) the rate at which the plant uses or stores food that it manufactures (curved heavy line), and (3) root growth. The rate of root growth is shown by the width of the strip just above the months of the year. Plants are most easily injured by grazing when their food storage is used up in the building of tops and roots.

How does "top" range happen? It takes many thousands of years for "top" range to develop. But finally, the plants on the range are balanced with the soil and climate. There is a mixture of plants which makes the best possible use of the available soil nutrients, soil moisture, and the energy from the sun. Top-condition range, or climax range, is the "healthiest" range.

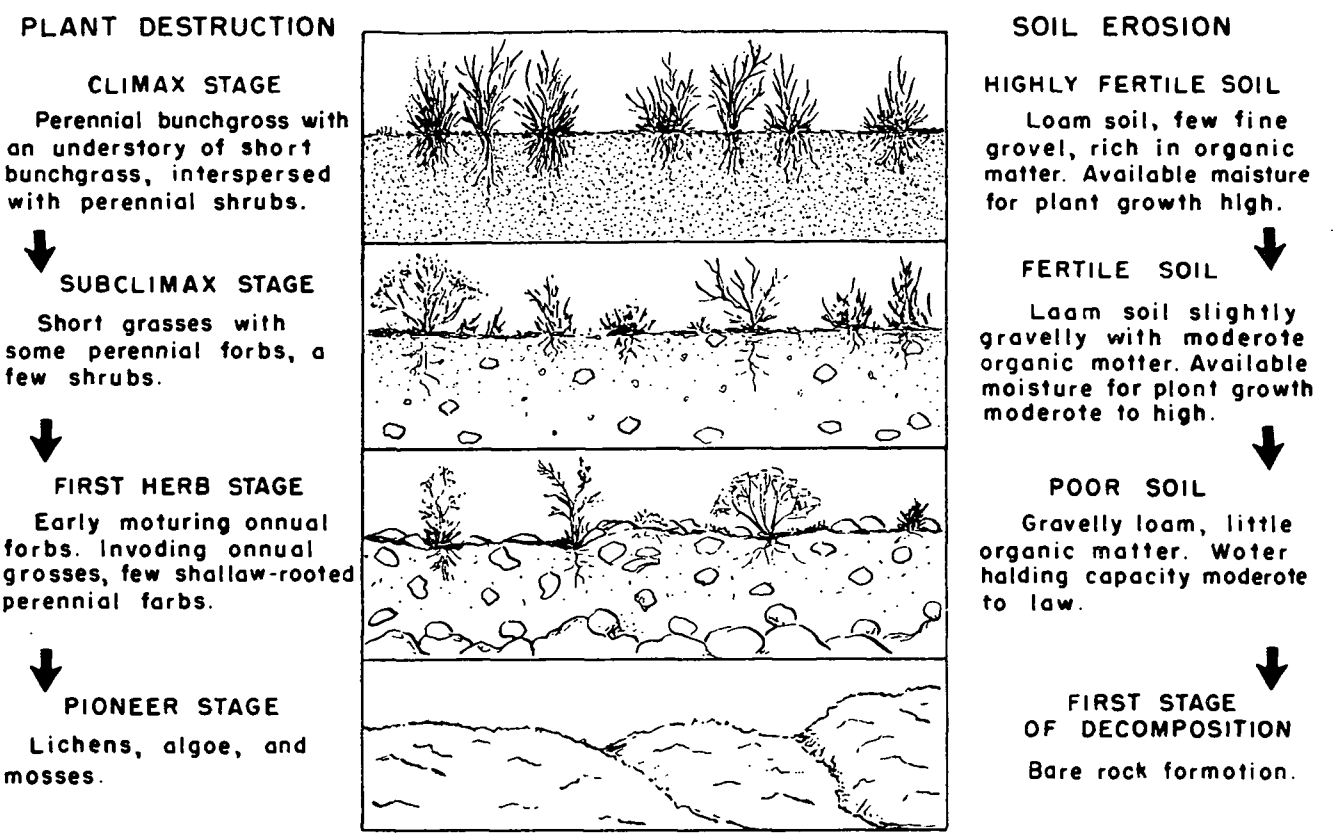
The objective in range management is to maintain the most efficient combination of good forage plants on the land, so that these growth factors—nutrients, moisture, and sunlight—may be converted into the largest possible amount of usable forage.

Reading the Story on The Range

If we apply the color and meaning of traffic signals to range plants, we are able to group plants in a way that makes reading the range easier. These groups will be: (1) the "green-group" plants; (2) the "yellow-group" plants; and (3) the "red-group" plants.

Plant groups

The green group. Plants in this group are the most desirable, the ones that livestock like best. When you see the green-group plants in abundance on the range, you know your grazing program is going well. The green-group plants consist of those which are plentiful in excellent condition on native range and are the first to decrease if range condition is forced down to "good," "fair," and finally to "poor" range. Range in the poorest condition has very few green-group plants on it.



The yellow group. These are also native plants, but they are less attractive to livestock. They escape grazing because they are short or because they are less tasty to livestock. Yellow-group plants are the ones to watch with "caution." They increase in number as grazing becomes heavy. They replace the green-group plants that have become smaller and weaker.

The range manager uses caution when the number of yellow-group plants increases on the range. It is safe if they are being replaced by green-group plants. That means the range is improving.

If heavy grazing continues, the yellow-group plants begin to weaken and die out. Their place is taken by the red-group plants.

The red group. These plants really do not need any explanation. They simply mean "Danger" to the range, so far as production is concerned. These plants are usually annuals or unpalatable species which have come in from other areas and occupy the range as invaders.

Red-group plants seldom, if ever, are as effective in controlling soil erosion and conserving water resources as the native plants which are more abundant when the range is in good or excellent condition. Soil and water losses cause nature's plant and soil development process to go in reverse. The range becomes less healthy and less productive.

Determining Range Condition

What Is Range Condition?

Range condition is range "health." We judge condition by the amount of natural plant cover that is on the range. The greater the proportion of forage furnished by green-group plants, the better the range condition. By knowing range condition classes, you will know how to manage your range better.

Classes of range condition

Range sites vary in condition, so we judge and classify the condition of each site separately. Standard condition classes are: excellent, good, fair, and poor.

What does it take to make up each range condition class?

Excellent. On excellent-condition range, the green- and yellow-group plants are producing within 25 percent as much as they could possibly produce on the site—within 25 percent of full capacity. Green-group plants make up the bulk of the forage. Red-group plants are either absent or are very minor components in the stand (plant community). Litter cover is usually good, plant residue is abundant, and the soil surface is loose and porous so that rain will soak in rapidly. There is no evidence of erosion.

Good. On good-condition range, the green- and yellow-group plants are producing from 51 to 75 percent as much as the site is capable of producing. Green-group plants still produce the bulk of the forage, but yellow-group plants may have increased slightly in importance. The ground is well covered, litter is adequate, the plants are vigorous, the soil condition is still good, and erosion is negligible. The green-group plants are still healthy and reproducing themselves. Red-group plants can be rated no higher than they were on the excellent-condition range.

Fair. On fair-condition range, the green- and yellow-group plants produce from 26 to 50 percent as much as the site is capable of producing. Green-group plants are contributing less to the total amount, and yellow-group plants may be producing the majority of the forage. The green-group plants are in a weakened condition. Unpalatable forbs and shrubs (red-group plants) may have begun to increase. Some invasion of red-group annual grasses and forbs may be evident. Plant residue is low, more bare ground shows, total production is decreased, some water may be running off the trampled or compacted soil surface, and erosion is evident.

Poor. On poor-condition range, green- and yellow-group plants are producing from 0 to 25 percent as much as they could be producing under excellent condition. Green-group plants have been killed out except within the protective cover of shrubs. The bulk of the grazable yellow-group plants has been killed, and the red-group plants are most abundant. In extreme cases, even the red-group plants have been destroyed and the soil is bare. In such cases, much water is lost through runoff, topsoil is often hard and compacted, and severe erosion may be evident.

Range sites

A range site is an area of land having a distinctive combination of soil, topography, climate, vegetation, and

management characteristics. Range sites are most easily recognizable on the basis of their vegetative and soil characteristics. On all but the most severely depleted ranges, sites are most easily recognized by the similar plant communities that cover them. Each range site is thought of as a separate part of the range for management purposes. Since each range site grows different combinations of plants, it is important that each site be judged separately when determining initial stocking rates, forage utilization, range condition, or range trend.

Management units

A management unit is a block of land used for one purpose. For example, it may be a spring range or a summer range used by a particular herd of cattle.

It is extremely important to understand the difference between a range site and a management unit. Range sites are like parts of a jigsaw puzzle in which mother nature put the landscape together. Management units represent the way in which we group these natural range sites for practical management. In instances where highly uniform soils and climatic conditions cover large areas, a management unit may be made up almost entirely of one range site. In most of the mountain and plateau land of the Pacific Northwest, however, a management unit will consist of logical groupings of many range sites, all of which have, insofar as practicable, similar management characteristics. In some cases, it may be necessary to group sites with different characteristics for purposes of logical land management.

Range condition score cards

With the help of a range condition score card, a range condition guide, and a little training, we can judge the condition of the range.

Score cards or record sheets may be obtained from your Extension agent, or the Soil Conservation Service, Forest Service, or Bureau of Land Management offices. Record sheets or score cards may vary in format, but are designed for the same purpose—to help determine the condition and productivity of the range.

A range condition guide describes the kinds of plants, the kind of soil, and other characteristics of a particular range site. Each kind of site has its individual condition guide, developed through research. The guide tells how to recognize various conditions on that type of site. A sample of the vegetation present is necessary to determine what percent of the different groups of plants are present, as described in the guide. Then the range site can be scored according to the condition classes described on page 16 (excellent, good, fair, poor). The first time you use the guide, it is best to receive assistance from an experienced person.

An example of a condition guide is on page 27, and an example of a record sheet is on page 28. The condition guide is for one specific range site. Other condition guides would have to be obtained for other range sites.

Stocking Rates

Stocking rate means the number of animal units that are grazed on a certain area of land for a certain period of time. The range condition score is a *guide* to the number of livestock that can be grazed safely on your range. When you get the score and the usable acreage for each range site in the management unit, you are ready to figure the stocking rate.

Rate tables

Stocking rate figures are expressed as animal unit months per acre. An animal unit is equal to one mature cow or five sheep. The forage required for one animal unit for 1 month is an animal unit month (AUM). Stocking rate tables prepared for each range site give the number of acres required to support one animal unit month for each range condition.

The following are commonly accepted grazing "animal unit equivalents":

1 cow (1,000 pounds)	= 1	A.U.
1 yearling	= 0.6	A.U.
1 bull	= 1.3	A.U.
1 horse	= 1.5	A.U.
5 ewes	= 1	A.U.
6 goats	= 1	A.U.
5 deer	= 1	A.U.
2 elk	= 1	A.U.
10 antelope	= 1	A.U.

As noted before, different kinds of animals prefer different kinds of forage plants. For this reason, one kind of animal may be much better suited to a particular range than another. Thus, the equivalents listed are not always the same; they change according to the kind of plants available, as well as with some other factors.

Certain range sites must be considered unusable or only partly usable because they are steep, rocky, densely forested, or too far from water. Unusable sites are ignored in the calculations, and those partially usable are estimated to the nearest 10 percent. The estimated total grazing capacity is the sum of the grazing capacities (AUM's) of the sites within the management unit. For example:

Estimated Total Grazing Capacity

Range site no.	Total acres	Acres per AUM (from condition guide)	Total AUM's	Percent est. usability	Total usable AUM's
1	37	11	3.4	90 (steep)	3.1
2	28	8	3.5	100	3.5
3	96	4	24.0	100	24.0
					30.6

Next, you may find out how many cattle can be grazed on the pasture for the grazing season. This is done by dividing the total animal unit month's stocking rate by the

length of the grazing season, in months. This result equals the number of cattle that can be grazed on the entire management unit for one season.

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

Example: AUM = 30.6
Grazing season = 3 months
30.6 ÷ 3 = 10.2 units grazed for the season

Determine the actual safe use of the range by checking the range condition and adjusting the number of animals accordingly. Stocking rates should be varied, depending upon safe use as affected by such conditions as droughts, late spring seasons, and insect damage.

Measurement of forage

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

This is a good place to differentiate between two range terms that are often confused—forage and herbage. Forage consists of the plants and plant parts that are actually eaten by grazing livestock. Herbage includes all of the current year's growth of plant material, whether used by livestock or not.

Mark off a circle, using a 20-inch piece of wire with a large nail in each end. Clip the herbage within this circle at ground level and weigh it. The herbage weight will be in pounds. Multiply the weight by 5,000, as there are 5,000 of these small plots in 1 acre. For example, if you had ¼ pound, you would have 1,250 pounds of herbage per acre —(¼ x 5,000 = 1,250). Clipped herbage should be air dried to assure the best estimate of actual herbage production.

To find out how long a cow could graze 1 acre that had 1,250 pounds of forage, multiply by ½, which would be 625 pounds. (Grazing half and leaving half is a guide to proper use of grass. It may be necessary to modify this guide, depending on kind of stock, kind of grass, season of use, and soil-moisture relationships.) Say that the mature cow needs 30 pounds of grass (dry weight) a day; 625 divided by 30 equals 21, the number of days a cow could graze on 1 acre. Stocking on a year-long basis, you would need 17.3 acres for the cow (365 days divided by 21 equals 17.3 acres).

Regardless of how you determine the proper stocking rate for the range, watch the range carefully to see how the grazing affects the desirable range plants ("green" and "yellow"). Make adjustments in grazing plans from time to time until the greatest use of the range is made without serious damage to the important plants.

Trend of Range

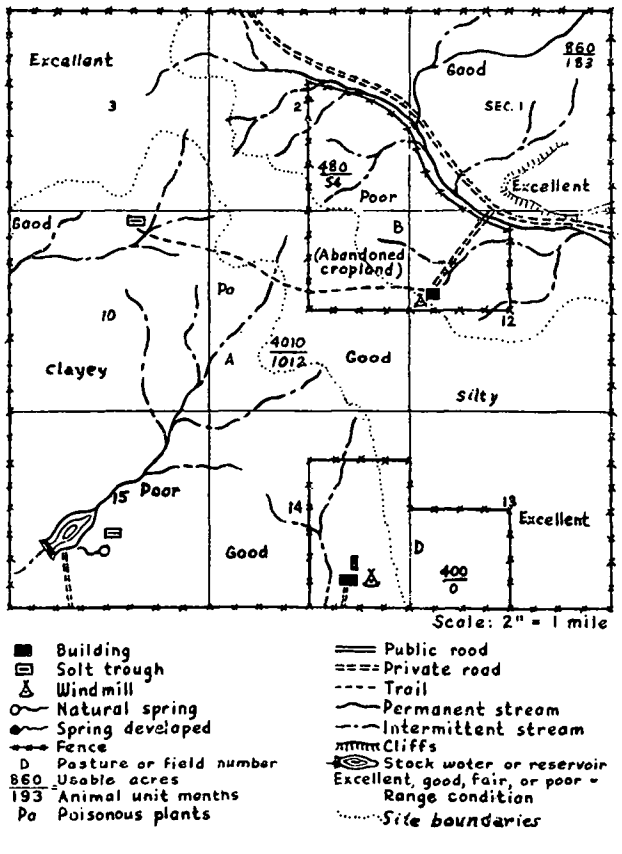
Trend means direction of change. The trend in range condition can remain about the same, go down, or go up. Trend changes quickly due to weather or grazing management. Range condition changes more slowly. Therefore, it is important to determine the trend in range condition each year. Then grazing management can be changed in time to prevent unwanted changes in range condition. It is best to set up *permanent transects* to measure the trend in range condition. Check these permanent samples every few years (approximately 5) to determine accurately whether the range condition is improving.

This might require the help of your Extension agent, vo-ag instructor, forest ranger, BLM range manager, or SCS technician. They will be happy to talk with you about this. Ask them how to set up "line transects" to measure how much of the green, yellow, or red plant species are present on the ranges you wish to score.

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

Range map

The next step is to draw a picture of the story you have read from the range. You can do this by making a range map. It should show all the essentials used in man-



aging a range—fences, watering places, drainage, (streams, and so forth), range sites, range condition, number of acres in each pasture, buildings, and so on. (See map on page 18.)

After your map is finished, you will see a picture of your range and its problems. Range improvement practices to help solve these problems are given in the next two sections of this range management manual.

The range management plan

If you live in a Soil Conservation District, technical help will be available to assist you in developing a range plan. The Soil Conservation Service will have aerial photographs of your ranch area. If requested, the SCS range technician will make an inventory of your range resource and help you develop a complete management plan. An inventory of soil and vegetation of the range area will be developed on aerial photographs. This information will then be transferred to a ranch-plan map. This ranch plan will include range improvements to be made, areas which could be seeded, brush that could be sprayed, and suggestions for water development and salt placement. It would also include suggestions for using various grazing management systems, such as deferred or deferred-rotation grazing, as required for proper management of your range resource.

Judging Range Utilization

What Is Range Utilization?

Utilization is the amount of the current year's growth that is removed by grazing livestock. Utilization is in no way similar to range condition. Close utilization may occur on a range in excellent condition or on a range in poor condition. Heavy utilization over a period of years causes regression and so lowers range condition. Utilization is difficult to determine with great accuracy.

Livestock do not utilize all species of range plants to the same degree. They eat more of the better tasting plants. Each grass, forb, and shrub can be grazed a certain amount without harmful effects to its productiveness. Proper use of a range area can be placed into three categories.

Categories

Heavy use. The range has a "clipped" or mowed appearance. Over half of the green and the yellow forage plants are grazed. This leads eventually to a decrease in forage production and range condition. Heavy use is directly harmful to plants and soil and indirectly to animals. Grasses are grazed short. As a result, the leaf "food factories" are inefficient, roots are decreased in size and length, and plants die during the dry summer season or a severe drought. Heavy use results in unprofitable returns and reduces the value of the land for sale. The land may be ruined for many years by speeded-up water and wind erosion and by trampling. Grasses that are grazed short require 3 to 5 weeks of top growth before root growth begins.

Light use. Only choice plants are grazed. Only a small amount of the less desirable forage plants are consumed, thereby wasting much valuable forage. Ungrazed plants and heavy litter build-up may result in serious fire hazard. Also, excessive amounts of unused plant material may contribute to poor utilization of forage by the grazing livestock because usually they will not eat last year's old stems and leaves.

Moderate use. The most economically important forage plants have been fully grazed on the most popular parts of the management unit. Factors to be considered when determining proper use are: (1) species of grasses being grazed; (2) season of year the grass is grazed; (3) amount of growth made in the present year; and (4) amount of soil moisture this year.

Utilization checks

For some grasses, the proper use is considered to be removal of about half of the growth made in the present year. While proper use must be considered in the light of the above-named factors, "taking half and leaving half" sometimes can be used as a "rule of thumb."

To determine the amount of stubble left when half the growth is removed, follow these steps:

1. Wrap an average-sized mature, ungrazed plant with string to hold it together when cut.

2. Cut off plant at crown (ground level).

3. Adjust the wrapped plant across a knife blade to make it balance. Measure with ruler from bottom of plant to point of balance. This gives height, indicating 50 percent use for that particular species of grass. Desirable approximate stubble heights for some native grasses are:

Grass	*Stubble left*
Bluebunch wheatgrass	4-8 inches
Idaho fescue	2-4 inches
Big bluegrass	3-5 inches

4. Repeat this for 10 average plants of the species to get an average 50 percent utilization height.

5. Select 100 plants randomly, measure their heights (whether grazed or not), and average the measurements. If the average grazed height is more than the standard shown above, the range is not fully used. If it is less, the range is overused.

A considerable amount of stubble and plant litter will remain on a properly utilized range. Plant material left on the range after being properly used is not wasted. It helps to improve range condition in these ways:

Increases intake and storage of water

Protects soil from wind and water erosion

Adds humus to the soil

Assures plants the necessary "food factory" for food storage

Increases plant vigor

Provides some protection for seedling establishment

Prevents evaporation of water from the soil

Helps hold snow in place

Watch the grazing load on the range; when the allowable forage has been utilized, remove the livestock. Grazing management should be aimed at proper use of the entire range area. Insofar as possible, the livestock operation should be flexible enough to withstand adverse weather conditions such as drought, as well as to take full advantage of extra forage produced during years when growing conditions are better than normal.

Some management alternatives that stabilize and add flexibility to the livestock operation are:

1. Develop a base herd that will be adequately supplied with forage during the average year.

   • In years of below-normal forage, strengthen your breeding herd by culling low producers. Be aware of the fact that years of below-average forage production are to be expected occasionally.

   • Do not worry about being unable to use all the forage produced in a good year. The range needs a break occasionally.

2. Carry over a reasonable feed reserve in the form of hay.

3. Seed adapted forage species, where possible, to provide early spring or "turn-out" pasture or to be used as needed in the ranching operation.

4. Develop water, fencing, and trail systems to make good animal distribution and flexible management possible.

5. Build up a cash reserve to help carry you over during periods of adversity.

6. Where appropriate, grow more feed by seeding, brush spraying, or fertilization. Check with local range technicians or your Extension agent for information and guidance.

Range Development Practices

Good range practices increase the amount of usable range forage, replace poorly producing plants with good ones, conserve soil and water, and increase the value of our rangelands.

Stock Watering Places

On many western ranges the water supply is not sufficient for the number of stock the range will carry. Even though there is plenty of forage, livestock should have all the clean, fresh water they can drink. They should not have to travel long distances for water. Livestock will graze an area close to water again and again, rather than move a long distance to better forage. The result is uneven use of range forage and reduced livestock gains.

Adequate watering places encourage distribution of grazing animals and improve livestock gains. If there is already plenty of water on the range and the feed is used evenly all over the range, new water developments may not be necessary.

The amount of water needed by stock differs with the kind of range, plant species, the stage of plant maturity, the amount of salt consumed, the weather, the season, and the kind of stock. Cattle use 6 to 10 gallons of water per day; sheep or goats use 1 to 2 gallons.

Cattle like to drink daily during the summer. They normally will drink every 2 days in the winter. Sheep can go without water for 3 or 4 days when on succulent forage, or longer during wet, cool weather. On winter range, sheep eat snow and may get along without watering places. However, they will do better if watered daily, even on winter ranges.

Watering places require different spacings in mountainous country than in a plains region. In the steep mountain country, cattle should not have to travel more than ½ mile for water and sheep not more than 1½ miles. In level country, cattle can travel 1½ miles and sheep 3 miles. Shorter travel is better, especially in hot weather. Since forage use drops sharply as the distance from water increases, it is best to develop water wherever practicable.

Generally, development of needed additional stock water is a worthwhile and profitable project. Where possible, develop springs and seeps which will furnish a dependable supply of clean water throughout the grazing season. Try to make safe watering places out of dangerous bog holes. Stock water should be clean and fresh to aid in parasite control and to insure adequate water intake by the stock.

To develop a good watering place from a spring, clean the soil away from the spring down to the bedrock, if practical. Around the source of water, construct a box with an outlet pipe several inches above the bottom. This box could be built of concrete, wood, rock, old culvert, or other available materials. A close-fitting, heavy lid is essential to keep out dirt, rodents, snakes, frogs, and other small animals.

The spring should be fenced for protection from livestock and big game. Run the outlet pipe to a trough or tank. The tank should have an overflow which will deliver the extra water far enough away from the trough to prevent mudholes or ice sheets from forming near the tank. Unused tanks and troughs should be drained in the winter.

Wells with windmills or motor-driven pumps are often used where natural springs or good reservoir sites are not available. Well drilling should be contracted to experienced persons with good equipment for the work.

Ranchers often have an initial investment of from 5 to 10 dollars per animal unit for water development.

Advantages of wells for stock water:

- Can sometimes be drilled near the forage supply
- Furnish a more dependable water supply in dry seasons and in winter
- Provide a safe place for livestock to get water

The depth of livestock water troughs should be about 16 inches for cattle and 8 to 10 inches for sheep. The windmill and tank should be placed on a well-drained area as near a dependable forage supply as possible.

Tanks and reservoirs may provide the cheapest supply of water. It is important to develop enough water storage to supply the livestock during the entire grazing period. Talk with conservation technicians and Extension agents regarding possible locations and designs for your reservoirs. Build where there is good drainage. The soil type is important. Reservoirs built on sandy soil are of little value; they often cannot be made to hold water. Treating

reservoir bottoms with bentonite clay or other commercial sealers, salt, or plastic liners may help to seal leaks.

Check carefully regarding the legal specifications for dams in your state. The design of the spillway is especially important. A good rule is to make the spillway low enough to allow the water to flow through when it comes within 3 or 4 feet of the top of the dam. Have the spillway wide enough and level enough to allow the water to pass through in a thin, solid sheet that will not erode the soil.

Hauling the water may also prove to be a desirable practice. It may be too expensive in many cases, but frequently this practice can be used to help obtain better livestock distribution on the range. Stock can be watered in under-utilized areas. When proper utilization is obtained, the tanks can be moved.

Fencing

There are five good reasons for having good fences on the range:

1. Fences help prevent trespass by stray stock.

2. Fences help distribute livestock and prevent drifting. Livestock tend to graze too much in some spots and too little in others.

3. Fences make deferred and rotation-deferred grazing possible.

4. Fences make possible exclusion of problem grazing areas, such as poisonous plants and newly seeded areas.

5. Fences make it possible to separate different classes of stock for better management.

Barbed wire became popular about 1880. It is still the most common fencing material. Four-wire fences with wooden posts are used widely for cattle and horses, while woven wire is usually required for sheep and goats. Electric fences, consisting of one single barbed wire strung on widely separated posts, make good temporary fences, although they are not considered effective for sheep and goats.

Space the posts as needed to make a fence sturdy. It takes considerable time and effort to build and maintain good fences.

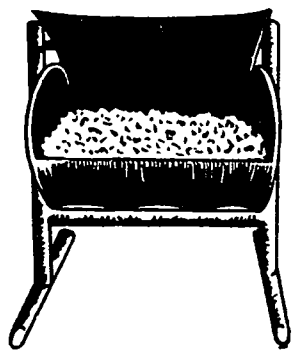
Build division-fences to follow natural land features on the "lay" of the land. Plan cross or drift fences to make maximum use of and control seasonal use of the available forage resource. When pastures are large and contain different range sites, livestock normally concentrate on the most desirable sites first. When the forage on these sites is depleted, livestock move to the next most desirable sites. A valley site is capable of producing several times more forage than shallow upland or ridgeland. Study the movement of livestock in a pasture for about a year before you actually build the cross or drift fences. Do not build fences that will cause the stock to walk farther to feed and water. Stock like to move "on the level" and in all directions from water. When possible, let them do it.

Salting Places

Grazing animals need more salt than they can get from plants. Lack of salt causes animals to lose their appetite and lose weight; their eyes become dull, and their coats rough. The animals do not grow as they should.

Salt distribution offers an excellent means of getting even use of range forage in a management unit. Salt attracts livestock and they will often travel a long way to get it. When you move salt to provide better livestock distribution, drift a small bunch of livestock into the new location to make sure they find it.

Loose salt is most commonly used for salting sheep and is often used in salting cattle on the range. It should be placed in troughs to protect it from wind and rain. Hollowed-out logs can be used in the mountainous areas. On the plains, salt containers can be made from oil barrels. Cut part of the side of the barrel out and fold it back to make an awning over the opening. The hole in the barrel must be large enough so a bull with horns can easily get his head in and out.



An oil barrel may be used for a salt box.

Salt blocks are commonly used to provide salt for range cattle. They are compact and easy to transport. Unused portions of the blocks are easily picked up. In addition, if mineral deficiencies exist in the area, mineralized salt can be used to correct the deficiencies. There is less waste from blocks than from loose salt.

As a general rule, salt should be placed where grazing has been lightest. Move the salt as often as necessary to get proper livestock distribution. Salt should be located away from water on knolls, benches, openings in timber, and gentle slopes on underused sites. But do not hide it.

Salting Suggestions

- Allow 2 pounds per cow per month; ½ pound per head per month for sheep and goats.
- Place salt about ½ to 1 mile from water in an area where forage is plentiful. Move the salt with the livestock.
- Provide one salt ground for each 40 to 50 head of cattle.
- If your range soils are short of phosphorus, the range forage will be low in phosphorus. Phosphorus may also be low in dry or cured forages. Bone chewing, unthriftiness, dull hair, and poor calf crops are signs of phosphorus deficiency. Phosphorus deficiencies usually can be corrected by using proper mixtures of salt and minerals. Check with your Extension agent on this.

Seeding Rangeland

If the best forage plants on a range are destroyed, it takes a long time for recovery, even if grazing animals are completely removed. If, as a range manager, you are not satisfied to wait for recovery, you can hasten the process by artificially seeding the range. Seeding is expensive and success is unpredictable because ranges almost always provide poorer opportunities for cultivation and plant growth than agricultural sites do. In fact, only about 3 to 5 percent of the range area can be seeded at all. This emphasizes the wisdom of taking care of the natural cover through use of good management practices. You may be able to increase production manyfold on depleted rangelands by seeding a better plant cover. Millions of acres in North America are in need of seeding. This is range that was mismanaged for long years or plowed and farmed unsuccessfully.

Ranchers seed pastures for several other reasons—for better seasonal pasture, such as early spring pasture, or just to lengthen the time their stock can graze on green pasture. They may also seed pastures to furnish grazing while native range is "rested" for improvement.

Select the areas best adapted to seeding first. Seeding these areas will cost less, the chances for success are greatest, and the returns are the highest. Successful establishment and production are limited on many ranges by shallow, rocky, sandy, or salty soils; by steep topography, by presence of trees or shrubs, by insufficient precipitation, by short growing seasons, or by combinations of these factors. Selection of a site is very important in regard to success or failure of seeding plans.

Seedbed preparation

Seedbed preparation is the next "hurdle" to overcome. New seedlings are weak plants. They cannot stand competition of large, established plants. Therefore, all undesirable, moisture-using plants must be removed from the site to be seeded. Chances for successfully establishing seeded grasses are much better on clean ground that is free of other plants. On arid sites, conserving moisture by fallowing is a very good way to help insure success.

Shallow tillage should be done just before seeding, to kill weeds. A clean grain stubble is an excellent seedbed even without tillage, provided there is enough moisture. Seedbeds should be very firm. Loose soil allows seedlings to dry out and die.

A drill with depth regulators is the best tool for seeding. If small grass seeds are planted too deep, they die before they reach the surface. Seeds planted too shallow will dry out. Moisture is necessary to germinate the seeds. Therefore, plant at depths where seeds will have moisture, yet can emerge. Plant the *smallest seeds ¼ inch deep,* the larger seeds no more than 1 inch. Plant slightly deeper in sandy soil and shallower in heavy clay or silt soils. Special drills have been developed for seeding to rough, rocky rangeland. These drills make it possible to seed areas formerly regarded as unseedable.

Broadcasting seed from ground or air is generally *not* a good practice. It is not recommended unless competing plants have been killed and provision has been made for covering the seed. Broadcasting seed in ashes immediately following a hot burn has occasionally proved successful, but it is much riskier than drilling. Also, drilling can be done without additional seedbed preparation on many recently burned areas.

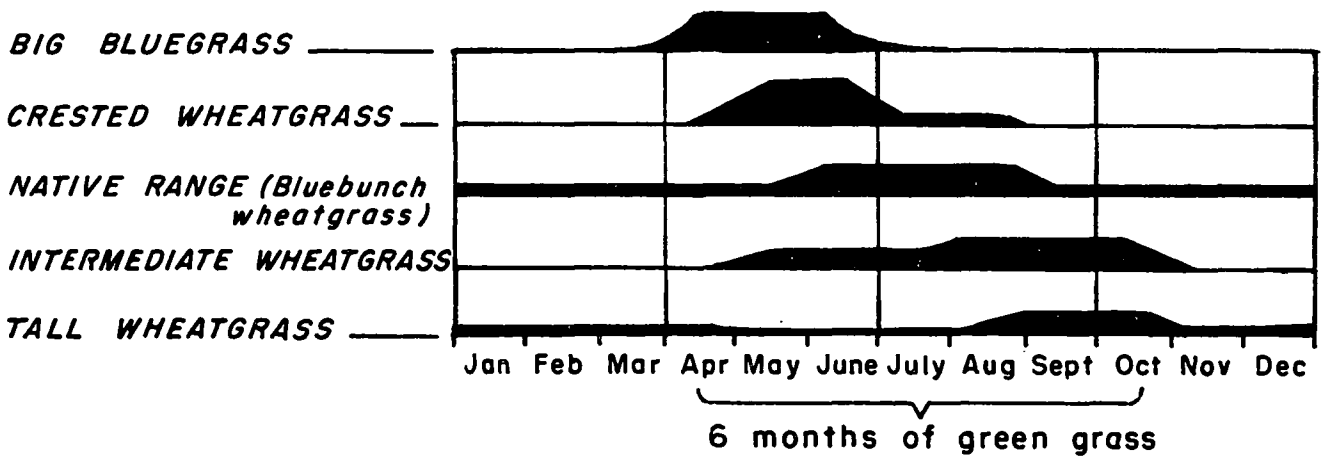
Time of seeding

The time of seeding is important. Fall seeding is generally more feasible than spring seeding. Moisture is the most important factor while the seedlings are getting established. In the Pacific Northwest there is generally sufficient winter and spring moisture to germinate fall-seeded grasses.

What to seed

Plants vary greatly in their adaptability. Use species that have been proved productive in your area. Plant small plots of several species to test their ability to grow and yield under local conditions. This will make a good demonstration project. Some grasses do better on heavy, clay soil; others do better on sandy soil; and in the mountains, another grass is best suited. Ask your Extension agent or Soil Conservation Service range technician to help you get seeds of useful species.

A legume, such as a grazing-type alfalfa, may also be desirable in the seeding. However, legumes are not well adapted to all range sites. Ask your Extension agent for suggested species and varieties of legumes.



Managing seeded range

While the new seedlings are getting established, it is best not to graze them. They may be trampled or pulled up by the roots if grazed too soon, especially if the soil is wet. It takes at least one, and usually two, growing seasons for the seedlings to become firmly rooted. If weeds seem to be getting ahead of the young grass during the first year, they can be clipped. The fallen weeds make good mulch, which helps hold the moisture near the surface of the soil.

Areas to be seeded must be fenced or otherwise protected so they can be managed as separate units.

The grazing calendar shows how different pastures might be seeded to provide more than 6 months of green grass.

Control of Undesirable Plants

Brush plants

Useless shrubs or brush on the range lower the production of native grasses and thus reduce livestock production. The brush plants use moisture, nutrients, and space that should be used by desirable forage plants. Removing undesirable brush plants can increase both forage and livestock production. Not all brush species are bad; for example, shrubs are very important on the winter range and bitterbrush furnishes valuable forage for both big game animals and livestock when snow is on the ground. Generally, it is a good idea to keep shrubs on your winter range if they grow there naturally.

There are several methods of controlling brush, commonly using herbicides, mechanical implements, and fire. The herbicides are usually liquid materials that are sprayed on the brush leaves by aircraft or machines on the ground. A common herbicide is 2,4-D. Soil sterilants may be used to kill small weed patches on high-value land. Recommendations for chemical control of undesirable plants change frequently, as new information and herbicides become available. For latest recommendations, check with your Extension agent. Follow instructions carefully.

Mechanical methods of controlling brush include rotary mowing, bulldozing, railing, chaining, beating, and plowing. They vary widely in their effectiveness, depending upon species, topography, season used, soil moisture, and associated plants.

Fire is another method for brush control, but this can be very dangerous, even when carefully planned. Never try to burn brush without a permit from the local fire warden, who will require you to have a complete plan. It covers: (1) construction of fire lines; (2) suitable crews available to control the fire; (3) equipment such as bulldozers, graders, and tank trucks standing by; (4) proper weather reports, including predicted wind velocities; (5) seed ready for planting; and (6) bond provided to cover damages. Many people are discouraged by all of these restrictions and use some other method of control.

Any area that has been treated by brush control measures should be deferred from grazing the first growing season, or longer, so native grasses can get a good start in the space left by the brush. Large amounts of brush on a piece of rangeland may well indicate poor management in the past. After brush is controlled, wise management practices will be necessary to prevent it from reinvading the rangeland.

Poisonous plants

Many poisonous range plants can be controlled by use of herbicides. Proper timing and soil moisture conditions are necessary for good control. Protection of desirable forage plants is important. Check with your extension agent for recommendations on chemical control of poisonous plants.

Make sure that good plants replace the killed ones. Seed desirable forage plants or defer grazing as necessary. Some poisonous species start growing earlier in the spring

than good range plants. In this case, deferred grazing is a good practice.

Just as with range seeding, your work in controlling range plants should be followed through with good grazing management. The range should be rested and, if necessary, even seeded to help nature replace the undesirable plants with more productive plants.

Grazing Systems

Grazing systems are designed to increase livestock production and improve the forage cover. Many different kinds have been tried in the past. Most systems are planned for cattle ranges. The simplest one and the one most often compared with others is the "season long" or "single pasture" plan. Here, the livestock are kept in one pasture for the grazing season.

Rotation grazing means grazing one unit or pasture, then another, and so on, until back to the first. This system applies best to irrigated pastures.

Deferred grazing generally means waiting until the most important forage plants have made seed before grazing an area. This is a good way to improve heavily grazed rangelands that are in poor condition. "Rest" during a seed-producing period is the best medicine for a "sick" range.

Delayed turnout, associated with deferred grazing, is a beneficial management practice for native range. Early spring growth is made at the expense of food reserves stored in the roots or stem bases. If plants are not allowed to grow long enough to replace depleted food reserves, the plants will be weakened. Repeated early use can kill the desirable perennials.

Deferred-rotation systems delay use of one unit until after seed has formed, while other units are grazed. The following year, the deferment is rotated to another unit. Thus, each unit is given an occasional rest from grazing during the critical seed-production season. Expensive cross-fencing and more handling of the livestock are required.

Whatever the grazing system, it should fit the range resource available. Ranchers can get help on plans for a good grazing system from their Extension agent or an SCS range technician.

Rounding Up Your Range

Good range operators know the production resource with which they are working. Maps are used to make a permanent record of the condition of the resource. They are more accurate than memory.

Range grazed by livestock may change so gradually that you do not notice the change. These changes may affect your income from the range before you really know what has happened. The changes may mean financial profit or loss. They also may mean loss of valuable soil and water.

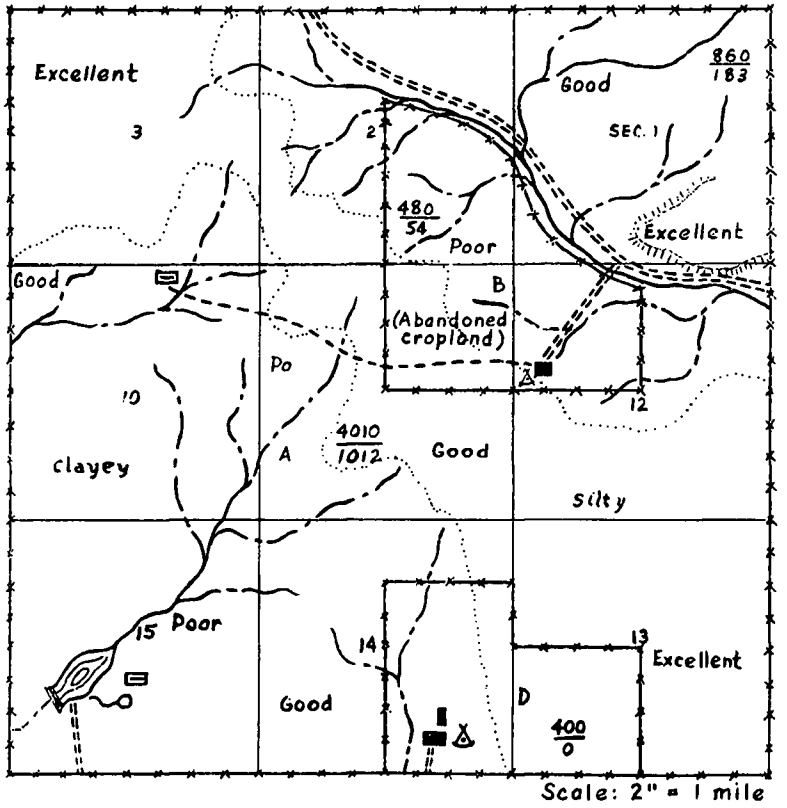
Management practices are based on the map's indication of range condition and forage use in the different areas of each pasture. The map also shows you changes needed for best production from the range. For instance, a pasture in "poor" condition in one part and in "excellent" condition in another part might indicate the need of (1) cross-fencing; (2) additional watering places nearer the good forage; (3) a change in the salting places to attract stock to areas of excellent forage; or (4) control of poisonous or injurious plant areas.

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

Problem areas should be marked on the overlay. Ground squirrel towns, abandoned farm land to be seeded, poisonous plants or shrubs to be controlled can be indicated. Show the year during which each practice is to be carried out, either on the overlay or in the written plan, or both.

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

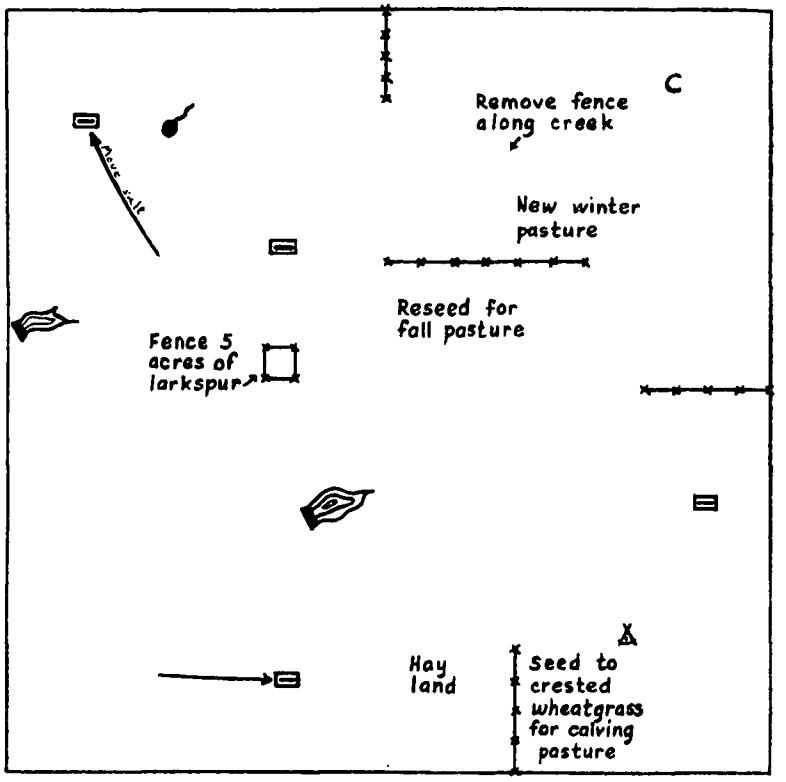
1. Four new pieces of fence built and one piece removed to give better pasture arrangement (pasture "C" is added).



■ Building
▭ Salt trough
Windmill
Natural spring
Spring developed
Fence
D Pasture or field number
860 Usable acres
193 Animal unit months
Po Poisonous plants

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

A SAMPLE RANGE MAP



This shows how to "map" your plans for the following:
Fencing
Stock water development
Trail building
Salting places
Range reseeding

AN "OVERLAY"

2. Better calving pasture and fall pastures to be seeded.

3. Four possible new stock water developments to get more uniform grazing of forage.

4. Two stock salt stations moved and two new ones set up to attract stock to the lightly used range areas.

5. Poisonous plants fenced out or controlled.

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

Aerial photographs may help you to locate important features on your maps. You can use tracing paper to transfer information to your maps from photos, *if* the aerial photos are on the *same scale* as your maps. If you are fortunate enough to have aerial photos for use in your range project, overlays can be used on the photos.

For further information on range management, see your Extension agent, who can assist or tell you where you can get additional technical help.

TECHNICIANS' GUIDE TO RANGE CONDITION CLASSES

Green-Group Plants	Yellow-Group Plants	Red-Group Plants
DECREASERS: Plants that disappear when range is abused. Percentage figures indicate approximate amount found in climax for the site *but count all found on site as climax.*	INCREASERS: Plants that increase when range is abused. Percentage figures indicate approximate amount found in climax for the site, *so count no more than amount shown toward climax.*	INVADERS: Plants that invade when range is abused. These did not occur in climax, *so none of these are counted toward climax.*
60% Bluebunch wheatgrass	15% Sandberg bluegrass	Cheatgrass
5 Idaho fescue	5 Shortawn needlegrass	Squirreltail
T Giant wild rye	2 Prairie junegrass	Six-weeks fescue
		Rattlesnake brome
		Soft brome
	10% max. in aggregate	
	1 Biscuitroot	Kitchenweed
	2 Yarow	Salsify
	2 Phlox	Gumweed
	1 Buckwheat	Tarweed
	2 Milkvetch	
	1 Silver lupine	
	1 Hawksbeard	
	1 Arrowleaf balsamroot	
	1 Carrot	
5% Bitterbrush	T Rose	Gray rabbitbrush
		Big sagebrush
		Matchweed
		Juniper

John Day Land Resource Area—Oregon
Open Grassland Climax Type
May 1960

MODERATE SOUTH EXPOSURE
Site 42

U. S. Department of Agriculture

Soil Conservation Service

RANGE CONDITION RECORD SHEET

Plants	Percent present	Percent in climax
Grasses and grasslike plants		
Bluebunch wheatgrass	15	60
Idaho fescue	0	5
Sandberg bluegrass	30	15
Cheatgrass	35	0
Forbs		
Yarrow	5	2
Phlox	5	2
Balsam	5	1
Carrot	5	1

Shrubs and trees _____ %

Total usable plants _____ % 100

Series type _____

Slope _____ % Exposure _____

Location _____

Technician _____

Date _____ Site. No. _____

Trend Indicators

	Rating		
	High	Med.	Low
Vigor of key forage plants			

	Albun.	Some	None
Seedlings and young key forage plants			
Seedlings and young key increasers and invaders			

Gullies: Many _____ Some _____ None _____

Rills: Many _____ Some _____ None _____

Final trend rating: Improving _____

Stable _____ Going down _____

Estimated Forage Yield

Lbs. per acre—avg. dry weight: _____

Acres per Animal Unit Month: _____

Estimate potential improvement _____

Condition Indicators

Condition class based on vegetation:

Excellent _____ Good _____ Fair _____ Poor _____

Active erosion: wind water sheet rill gully

None _____ Slight _____ Mod. _____ Severe _____

Stand for site: Full ___ ¾ ___ ½ ___ ¼ ___ 1/10 ___

Range type: _____

Site name: _____

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