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HOW TO RESEED PARKS AND OPENINGS IN THE
PONDEROSA PINE ZONE IN COLORADO

By

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F O R E W O R D

Range reseeding can increase by many times the amount of grass on one-half million acres of depleted parks and openings in the ponderosa pine zone in Colorado. Such an increase in grass will mean much to the range-livestock industry. It will aid in stabilizing the ranching operation and, if properly planned, will furnish feed at a time when native grasses are dormant and expensive supplemental feeding is necessary.

This publication is to help livestock men and range administrators do a better job of seeding these lands. The basic principles and guides which make for successful reseeding include the following:

1. Plan for the job
2. Select good areas where success is likely
3. Kill competing vegetation and prepare a good seedbed
4. Get the seed in the ground at the proper depth and rate
5. Use species which will yield the greatest returns
6. Seed at the proper season
7. Protect the young plants until they can withstand grazing
8. Manage the area to maintain the res seeded stand
9. Do not be discouraged. Allow at least 2 years for stand establishment. Many seedings which have been regarded as failures for 1 or 2 years have later produced good stands

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WHY RESEED

The 4 million acres of ponderosa pine (Pinus ponderosa) land in Colorado are producing only a fraction of the forage they should be growing. While most of this land can best be improved by management and natural seeding, there are approximately one-half million acres where the native forage plants are so scarce that it is uneconomical to wait for natural recovery of the range. Artificial reseeded on these areas is necessary to restore a good plant cover within a reasonable time. Many depleted ponderosa pine ranges and abandoned fields in the open parks in the ponderosa pine zone require 20 to 100 acres to support a cow for a month. Proper reseeded of some of the more productive parks and openings has increased the yield so that 1 acre will support a cow for a month (figs. 1 and 2).

In addition to the increased grazing capacity, reseeded stabilizes the soil and prevents siltation. Grass produces many deep, fine roots that hold the soil. The replacement of weeds with grass thus not only increases the amount of forage, but holds the soil in place and reduces the damage to reservoirs and irrigation systems below. Ponderosa pine lands, especially those with granitic soils, produce much of the sediment which fills reservoirs and clogs irrigation systems along Colorado's Front Range. Studies at the Manitou Experimental Forest, located 26 miles northwest of Colorado Springs, indicate that during heavy rainstorms (4 inches in an hour) runoff from depleted rangeland and abandoned farms may amount to 3,880 to 4,820 cubic feet per acre and will carry with it 690 to 2,218 pounds of soil per acre. We cannot afford to lose this soil, the forage, the timber, or the regulated flow of water it should produce. These

watershed, range, and timber values make the ponderosa pine lands important in Colorado's economy.

DESCRIPTION OF PONDEROSA PINE LANDS

The ponderosa pine type varies from a dense to an open stand of timber. Scattered throughout this zone are many open parks and valleys which normally support good stands of bunchgrass such as Arizona fescue (Festuca arizonica) and mountain muhly (Muhlenbergia montana) (fig. 3). Many of these areas have been farmed and abandoned, or have been badly overgrazed so that they now produce only low-value annual and perennial weeds and grasses (fig. 1).

Over most of the ponderosa pine area, the winters are dry and, although as much as 75 percent of the precipitation comes during the growing season, dry summers also occur. Winter moisture is more frequent in southwestern Colorado.

Subdividing the ponderosa pine zone by elevation and growing conditions into lower and upper zones makes possible more specific recommendations for species for reseeding the various areas. The lower zone ranges to about 6,500 feet elevation in the north and 7,000 to 7,500 feet in the south. Precipitation is from 14 to 19 inches. In these areas, the more drought-resistant grasses are best adapted for reseeding. Juniper (Juniperus spp.), pinyon pine (Pinus edulis), oak (Quercus spp.), and big sagebrush (Artemisia tridentata) are common subtypes in this lower zone.

The upper zone has an annual precipitation varying from 17 to 21 inches. Dry summers are common in some areas and in some years, but for the most part this upper zone has better growing conditions and some of the many drought-resistant grasses are adapted here. Lodgepole pine (Pinus contorta), Douglas fir (Pseudotsuga taxifolia), and aspen (Populus tremuloides) are prevalent throughout the upper ponderosa pine zone.

The open parks and valleys throughout these two subdivisions are relatively easy to seed, and have produced good stands of reseeded grasses. The following recommendations apply to these open and level to moderately sloping areas. Reseeding of the steep sandstone or granitic slopes found throughout the ponderosa pine zone must await the development of better methods and machinery (fig. 4).

WHERE TO RESEED

Range reseeding properly done is a wise investment, while haphazard reseeding is often a waste of time and money. Before reseeding is undertaken, consider the need for and the expected value from reseeding on each area, and see if the increased forage or other benefits will make reseeding worth while. The following three questions should be answered satisfactorily before starting reseeding:

Can the range be improved cheaper through natural seeding? Often what appears to be nearly bare ground is just an area grazed so closely that the native grasses are not recognizable. Where the perennial forage



Figure 1. Typical abandoned farmland in the ponderosa pine zone northwest of Colorado Springs. It is covered with low-value shrubs and weeds, and requires 100 acres to carry a cow for a month



Figure 2. A similar area of abandoned farmland after re-seeding to crested wheatgrass. This reseeded stand is producing over 2,000 pounds of air-dry grass to the acre and it requires only 1 acre to carry a cow for a month

plants can increase through natural seeding, artificial reseeding is usually not necessary. To accomplish natural seeding, grazing must be light enough to allow seed production and seedling establishment.

Is the land good enough to insure successful stands? Reseed the better lands first is a good principle to follow. Greater increases will be obtained and information gained will help in judging the seeding possibilities and methods of seeding on the poorer lands. Look at the heavy stands of low-value grass, weeds, and brush as they often indicate fertile soil with good moisture which will produce good stands of seeded species. Steep slopes, rocky areas, and lands with scanty stands of native vegetation which indicate poor soil or moisture conditions should not normally be seeded until the better lands have been improved.

Can the seeded area be protected and properly managed? Seedlings need protection from grazing until they are well established. After establishment the areas need proper management. Reseeding is not a "cure-all" and reseeded grasses will be damaged by too early and too heavy grazing.

If the answer to the above questions is "yes" and it is decided that reseeding is worth a trial, then here are the steps to consider in the reseeding program: (1) cultural practices; (2) what to seed; (3) when to seed; and (4) how to graze reseeded areas. Suggestions on how to do each of these steps follow.

CULTURAL PRACTICES IN RESEEDING

To get good stands of reseeded grass on ponderosa pine lands, certain cultural practices are important. You must (1) remove competition; (2) prepare a good seedbed; and (3) use proper seeding methods. Seeding grass on rangelands is like seeding grass or any other crop on a farm. Good practices result in good stands; poor practices result in poor stands (fig. 5).

Methods of Removing Competition

It is impractical to grow two crops on the same land. The weeds and brush must be removed to get a crop of reseeded grass. The better the removal of weeds the better the stand of grass. As an example, several grasses were seeded by four methods at four locations northwest of Colorado Springs in 1946. Where a poor to fair seedbed was prepared by light disking, a fair stand of grass resulted; where there was no seedbed preparation, the reseeded grass failed. Later seedings on the same sites with good seedbed preparation gave excellent stands of grass.

Several methods of removing competition are adapted to ponderosa pine ranges. In choosing a method, consider the vegetation, soil, slope, and other factors to determine which might be the best and cheapest method or combination of methods for each condition. The advantages and limitations of some of the most used methods are as follows:

Moldboard and disk plows are expensive to use but are among the best methods to kill weeds and low-value grasses. Plow only deep enough to kill the plants. This is usually about 4 inches. The loose seedbed must be

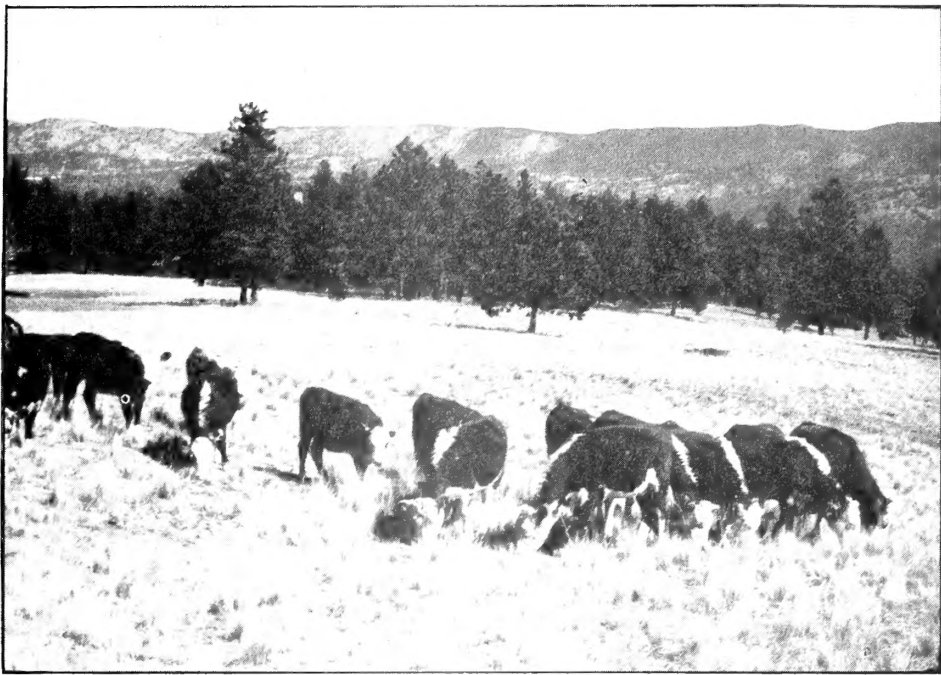


Figure 3. In this open park at the Manitou Experimental Forest, the native range is in good condition. On this area, 4 acres will support a cow for a month. No re-seeding is needed



Figure 4. A steep slope in the ponderosa pine near Deckers, Colorado. The soil is washing away with each heavy rain. Reseeding is needed here, but machinery and methods must be developed for getting a good protective cover on such areas

firmed either by rolling, dragging, or left to settle before seeding. On areas subject to erosion, plow as nearly on the contour as possible. As plowing is expensive, consider the expected cost and estimate whether or not the results will justify plowing.

Wheatland type plows, often called one-way plows or disk tillers, are widely used for sagebrush eradication and for plowing under weeds and brush on range areas. The Wheatland type plow is more cheaply operated than the moldboard plow. It was developed to cover large areas. By hitching two or more plows behind a large tractor, as much as 40 acres can be worked in a day. Plowing can be done during the summer before the seed crop of the undesirable plants is mature. The areas can then be drilled in the fall. Following are some useful hints in the operation of Wheatland type plows:

1. Keep the machine tight and in good repair. (Wheatland plows were not made for rangelands but can be used if care is taken.)
2. If the plow will not cut in hard and dry ground when set at the maximum angle (40° to 45°), wait until the soil is moist enough to do a good job.
3. For sagebrush eradication, set the plow at the maximum angle (40° to 45°).
4. Plow as shallow as possible and still get a good kill. This is usually 3 to 5 inches for weeds and low-value grasses, and 2 to 4 inches for sagebrush. Best results in killing sagebrush are obtained by plowing when the plants are dry and brittle.
5. Travel slowly; make left turns only; do not back up.
6. Avoid rocks and rough ground which cause breakage and lost time.
7. For sagebrush, use heavy plows with large disks (28 to 30 inches) to reduce breakage and clogging.
8. Avoid good grassy areas where plowing will kill the grass.
9. When plowing at a season suitable for seeding, attach a seeder box and plow and seed in one operation. Best results are obtained by seeding behind the plow.
10. Avoid too deep drilling on a loose, freshly plowed seedbed.

Brushland plows combine the desirable features of the Australian stump-jump plow and the Wheatland plow. The Brushland plow gives a higher brush and weed kill than the Wheatland plows. Its outstanding feature is the paired disks mounted with a pitch on jump arms which are controlled by springs so that each pair of disks can rise over rocks and large brush independently of the other disks. Figure 6 shows a Brushland plow being used on a sagebrush area in the ponderosa pine zone of southwestern Colorado.

This plow is being developed and tested by the Forest Service Equipment Laboratory, and when in commercial production it will undoubtedly replace Wheatland type plows for reseeding rough rangeland. The Brushland plow costs more than the Wheatland plow, but is cheaper to operate and lasts much longer. Most of the hints enumerated above for operation of the Wheatland type plow can also be applied to the Brushland plow.



Figure 5. A 1-year-old stand of intermediate wheatgrass seeded on depleted rangeland in South Park. An excellent seedbed was prepared with a moldboard plow followed by packing and drilling



Figure 6. The Brushland plow killed practically all of the brush and prepared a good seedbed on this sagebrush area in the ponderosa pine zone in southwestern Colorado. The plow went over rocks, brush, and small trees without breaking or clogging. After plowing, the seedbed was allowed to settle until fall when it was drilled

Heavy offset disks are not as good as Wheatland type plows in heavy sagebrush, but in smaller brush and weeds they prepare a better seedbed than do Wheatland plows. For best work use disks which weigh over 3,000 pounds and have at least 26-inch disks. Notched disks seem to cut better than smooth disks on hard ground.

Some of the parks and valleys in the lower ponderosa pine zone in southwestern Colorado are covered with sagebrush. Such lands are good seeding possibilities, but the sagebrush must be removed before seeding. Because the removal of sagebrush is a special problem, the following useful tips should be considered in connection with the reseeding of sagebrush lands in the ponderosa pine zone.

1. Do not kill sagebrush where it is a needed browse for livestock or game.
2. Eradicate only in the summer or early fall. Late-fall operations when the sagebrush seed is ripe may plant another crop of sagebrush.
3. Burning is not recommended in the ponderosa pine zone.
4. Wheatland type plows are successful if care is used in operation and if they are not used on rough, rocky lands.
5. The Brushland plow is expensive but has less breakage, clogs less, and lasts longer than Wheatland type plows in sagebrush areas.
6. Heavy offset disks prepare a good seedbed in small brush.
7. Disk and moldboard plows are expensive to use and are limited to productive land.
8. Railing is cheap, but is not successful on flexible brush and will not cover broadcast seed.
9. Pipe harrows are good for covering seed on rough rocky lands and for eradicating small brittle sagebrush.
10. Spraying with 2,4-D offers promise, but more research is needed. (Trees make spraying dangerous on ponderosa pine lands. Furthermore, we know little regarding damage of 2,4-D to trees and other vegetation.)

Seedbed Preparation

Make every effort to obtain a good seedbed free of weedy competition. A well-prepared seedbed permits seeding at a uniform rate and depth. Keep in mind that a firm seedbed holds the moisture for seed germination better than a loose seedbed. A firm seedbed is a necessity for spring seeding since the ground will have little chance to settle before germination begins. With fall seeding, this is not so important because fall and winter storms will usually settle a loose seedbed before germination.

One of the best ways to firm a seedbed is to go over the area with a roller, preferably of the sheepfoot or toothed type. If this equipment is not available, weighted spiked-tooth harrows with the teeth flat or a heavy drag are satisfactory substitutes.

Where ponderosa pine lands have been farmed and are now in stubble, drill grass seed in the stubble without further seedbed preparation. Excellent stands of reseeded grass have resulted from this practice.

Seeding Methods

For successful seeding, distribute the correct amount of seed uniformly over the area at a depth which will be most favorable for germination and growth of young seedlings. Drilling is the best method of distributing seed evenly and covering it uniformly. Do not cover most grass seeds deeper than 1 inch as it reduces emergence. Cover the small to medium-sized seed of crested wheatgrass and most species used in range reseeding about 1/2 to 1 inch deep. Larger seeds may be covered up to 1 to 1-1/4 inches deep. Plant shallow on heavy clay soils to reduce losses from crusting, but plant deeper on sandy soils to avoid losses from rapid drying.

Where drilling is not feasible, broadcast the seed by machine or hand broadcasters and cover by shallow Wheatland plowing, disking, pipe harrow, spike-tooth harrow, etc. If seed distribution is poor and covering uneven, such as usually happens in broadcasting, increase the rate of seeding from 25 to 50 percent over the amount used for drilling. Under most conditions broadcast seeding without seedbed preparation has not been successful. However, broadcast seeding in stands of aspen or oak may produce good stands, if the seeding is done before leaf-fall. The falling leaves furnish the necessary covering for the seeds. On rough, freshly worked areas, soil sloughing is generally sufficient to cover broadcast seed.

WHAT TO SEED

Species

Crested wheatgrass^{1/} is the most widely used and generally adapted species throughout the lower ponderosa pine zone. Other grasses which might be used in this zone are Russian wild-rye; pubescent and intermediate wheatgrass; and smooth brome. Additional species which can be tried are shown in table 1.

For the upper ponderosa pine zone some of the best species are as follows: crested, intermediate, pubescent, and tall wheatgrass; Russian wild-rye; and smooth and meadow brome. Other species that might be tried are shown in table 2.

By learning the growth requirements and uses of the species and the growing conditions on the area to be seeded, much can be done toward selecting proper species. Keep in mind the purpose for which the seeding is done. Generally, crested wheatgrass is better spring and fall feed; intermediate wheatgrass and smooth brome are usually better for summer grazing; and Russian wild-rye and big bluegrass for early spring and late fall use. Plan your reseeding to fit your needs.

^{1/} For scientific names of species recommended for seeding, see tables 1 and 2.

Table 1. Species recommended for reseeding and species which are promising for reseeding in the lower ponderosa pine zone of Colorado

Common name	Scientific name	Pounds of seed per acre ^{1/}
<u>Recommended species</u>		
Crested wheatgrass	<i>Agropyron cristatum</i>	5
Intermediate wheatgrass	<i>Agropyron intermedium</i>	6
Pubescent wheatgrass	<i>Agropyron trichophorum</i>	7
Smooth brome	<i>Bromus inermis</i>	8
Russian wild-rye	<i>Elymus junceus</i>	6
<u>Promising species which may be tried</u>		
Amur wheatgrass	<i>Agropyron amurense</i>	7
Thickspike wheatgrass	<i>Agropyron dasystachyum</i>	6
Desert wheatgrass	<i>Agropyron desertorum</i>	6
Tall wheatgrass	<i>Agropyron elongatum</i>	8
Beardless wheatgrass	<i>Agropyron inerme</i>	7
Siberian wheatgrass	<i>Agropyron sibiricum</i>	6
Western wheatgrass	<i>Agropyron smithii</i>	12
Tall oatgrass	<i>Arrhenatherum elatius</i>	8
Meadow brome	<i>Bromus erectus</i>	8
Sheep fescue	<i>Festuca ovina</i>	5
Yellow sweetclover	<i>Melilotus officinalis</i>	6
Big bluegrass	<i>Poa ampla</i>	4

^{1/} Amounts are based on drilling good seed in a good seedbed. Increase seed 50 percent when broadcasting. Also increase when seed is of poor quality.

At the Manitou Experimental Forest 122 forage species have been tested. For a report of the first 3 years, see Research Note No. 5 by the Rocky Mountain Forest and Range Experiment Station. Other agencies and individuals have tested many species in the ponderosa pine zone. Testing is still going on and as other species appear promising or can be recommended, they will be listed in future publications.

Rate of Seeding

Plenty of seed helps get full stands quickly and keeps down the invasion of weeds and brush. Although sufficient seed is a necessity, too much seed increases seeding costs. The following factors determine the correct amount of seed to sow: (1) Type of seedbed and efficiency of planting method; (2) purity and germination of seed; (3) size of seed.

Average seeding rates based upon drilling good seed on a good seedbed are shown in tables 1 and 2. Where seed is broadcast or the seedbed is poor, increase the rate of seeding up to 50 percent.

Table 2. Species recommended for reseeding and species which are promising for reseeding in the upper ponderosa pine zone of Colorado

Common name	Scientific name	Pounds of seed per acre ^{1/}
<u>Recommended species</u>		
Crested wheatgrass	Agropyron cristatum ^{2/}	5
Tall wheatgrass	Agropyron elongatum	8
Intermediate wheatgrass	Agropyron intermedium	6
Pubescent wheatgrass	Agropyron trichophorum	7
Meadow brome	Bromus erectus	8
Smooth brome	Bromus inermis	8
Russian wild-rye	Elymus junceus	6
<u>Promising species which may be tried</u>		
Amur wheatgrass	Agropyron amurense	7
Beardless wheatgrass	Agropyron inerme	7
Slender wheatgrass	Agropyron trachycaulum	7
Tall oatgrass	Arrhenatherum elatius	8
Orchardgrass	Dactylis glomerata	5
Meadow fescue	Festuca elatior	5
Red fescue	Festuca rubra	5
Alfalfa	Medicago sativa	6
Yellow sweetclover	Melilotus officinalis	6
Big bluegrass	Poa ampla	4

^{1/} Amounts are based on drilling good seed in a good seedbed.

Increase seed 50 percent when broadcasting. Also increase when seed is of poor quality.

^{2/} Use only on the drier sites.

Row Spacing

Forage production is about the same from 6- to 24-inch row spacings of crested wheatgrass. Plants from the closer spacings are smaller, but they keep down weeds and brush better and give the soil more protection than do plants at the wider spacings. Row spacings of from 24 to 48 inches yield the most seed.

Good Seed

It takes good seed to grow a good crop. In buying seed be sure to (1) determine the purity and germination, and (2) examine it for chaff, straw, light seed, and awns to make sure it will feed through a drill. Seed houses usually show the germination and purity on the tag. Sometimes there is no record, or the seed is bought locally, or is old so that a question arises as to germination and purity. In such cases take a small amount of seed from each sack, mix it to get a representative sample, and send about one-fourth pound of seed to the State Seed Laboratory at Fort Collins. Indicate whether standard or farmer germination and purity tests

are desired. The State Laboratory will make the standard germination test for \$0.50 to \$1.00. Purity tests indicate percent purity and noxious weed seed content and cost \$1.00 to \$2.50. The farmers' test costs about half as much as the standard, and gives approximate germination, purity, and noxious weed seed content.

Mixtures

Mixtures usually provide more forage, a better variety of forage, and a longer grazing season than do single species. Species in mixtures have varied growth habits and although not every species will grow in every location, at least one or more will be adapted to the varying soil and moisture conditions found on rangelands. Adapted legumes in a mixture increase herbage production. If you use a mixture, select species as nearly equal in palatability as possible. When making a seeding to provide grazing at a specific season, a single species or a rotation of single species in separate pastures will give feed when needed and be easier to manage in grazing.

A mixture of grasses and legumes is a very desirable practice in almost all cases. At the present time yellow sweetclover (Melilotus officinalis) can be recommended for seeding on dry sites in mixture with grasses. On better sites alfalfa (Medicago sativa) may be used if adapted to the location. The greatest benefit from planting of legumes under such conditions is an increase of soil fertility through the addition of soil nitrogen.

WHEN TO SEED

A good rule is to seed just prior to a period when there will be enough moisture for seed germination and seedling growth during 1 to 2 months of growing weather. This varies with the two zones.

In the lower ponderosa pine zone, very early-spring and medium- and late-fall seedings are generally best. Plant in March or early April for spring seeding. There is usually enough rain in March and April to establish the plants well enough to withstand the summer drought. Seedings made after March decrease the chances of success. Early-fall seeding (late August or early September) is hazardous because seeds might germinate from a flash rain and then dry up. Seeding from late September to November should be reasonably successful because seedlings can come up either from good fall moisture or from moisture the next spring.

The upper ponderosa pine zone has somewhat the same precipitation pattern as the lower lands, but the total precipitation is higher and more dependable. Here seedings can be made with considerable assurance in early spring (April or May) on well-prepared seedbeds. Because it is often too muddy to travel and seed these higher areas in early spring, the best time for seeding is usually September and early October before fall storms hinder seeding operations. In southwestern Colorado, seeding in early August may be better than late fall because the plants begin growth that fall and are better able to compete with weeds the next spring.

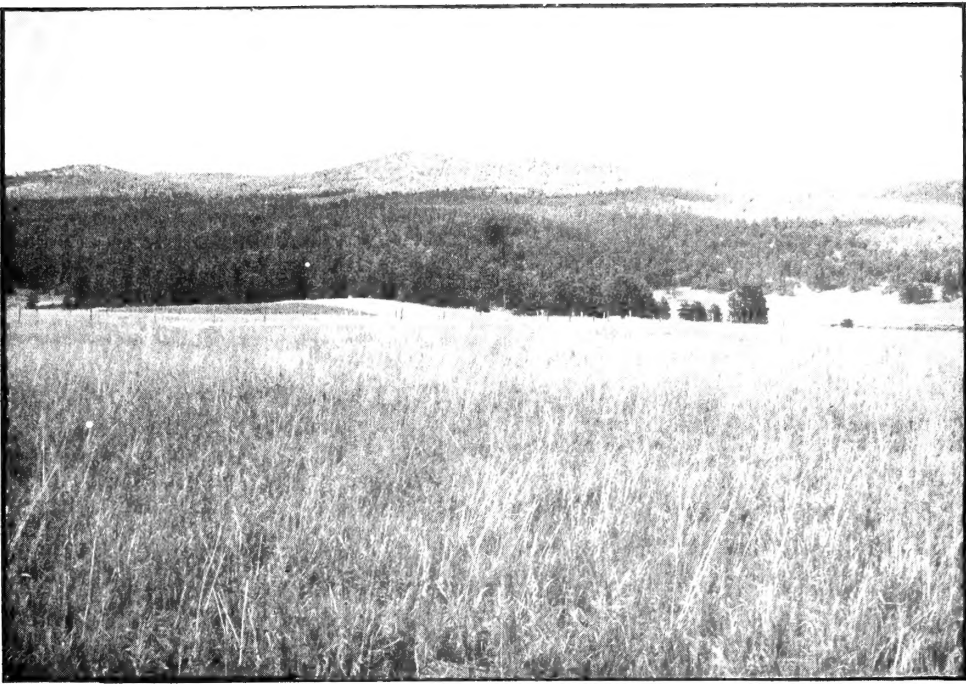


Figure 7. An excellent 2-year-old stand of smooth brome seeded on abandoned farmland at the Manitou Experimental Forest. This stand is being used to determine the best methods of grazing for reseeded grasses

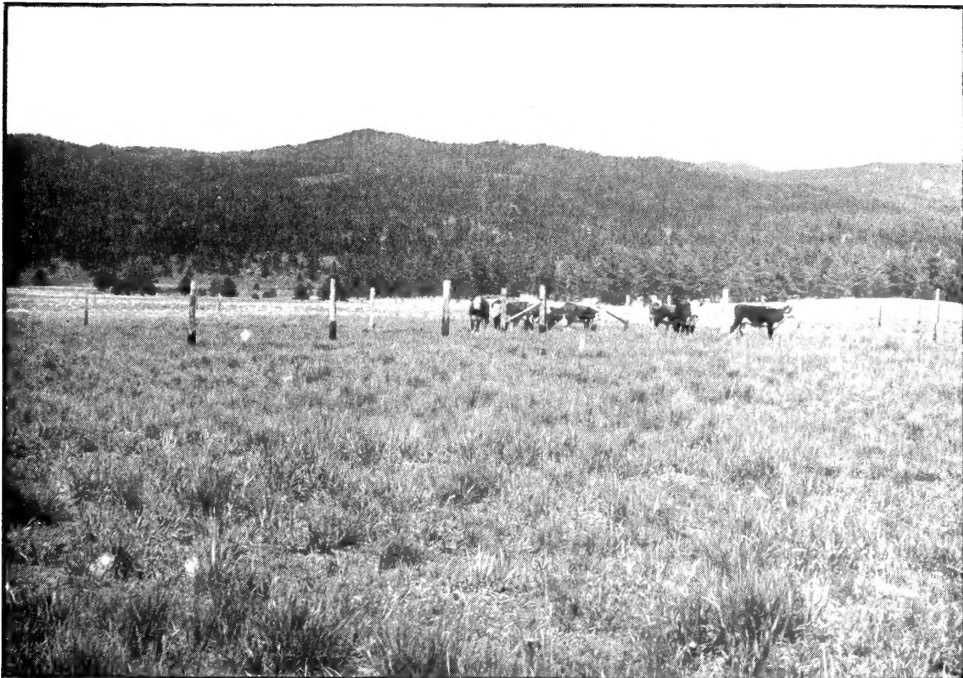


Figure 8. A 4-year-old stand of mixed smooth brome and crested wheatgrass at the Manitou Experimental Forest. It has been grazed at 1 cow-month per acre for 2 years; produces 2,500 pounds of air-dry herbage per acre and, in 1949, produced 115 pounds of gain per acre on yearling Hereford heifers

HOW TO GRAZE RESEEDED AREAS

Do not begin grazing newly seeded areas until the stand is well enough established to prevent plants being pulled up or trampled by grazing animals. Grazing can usually commence during the summer or fall of the second or third growing season. Early or heavy grazing may either destroy a stand or reduce plants in vigor so that they are slower to reach a full stand. After the plants are well established, graze the reseeded area to leave enough of the plant to maintain plant vigor and protect the soil (fig. 7).

At the Manitou Experimental Forest the rule has been to graze reseeded species during the third growing season. By then the plants are vigorous and it takes about an acre of reseeded grass to support a cow for a month (fig. 8).

The possibility of harvesting a seed crop the second growing season should not be overlooked as a source of additional income. All of the large-scale plantings at the Manitou Experimental Forest could have been handled in this manner. In 1949 approximately 1,000 pounds of cleaned intermediate wheatgrass seed was harvested from 18 acres planted in the spring of 1948.

Don't be discouraged if your reseeding doesn't look good the first growing season. Poor appearance may be due to two causes--heavy weed cover and small grass seedlings. The first year's growth of grass seedlings is usually very short. The plants appear widely spaced and do not show up in the dense weed cover that usually develops. The stand looks anything but good. Many visitors at the Manitou Experimental Forest are greatly disappointed in new grass seedlings. During the second growing season the plants develop good top and root growth and begin to crowd out the weeds. By the third growing season they are usually ready for grazing.

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