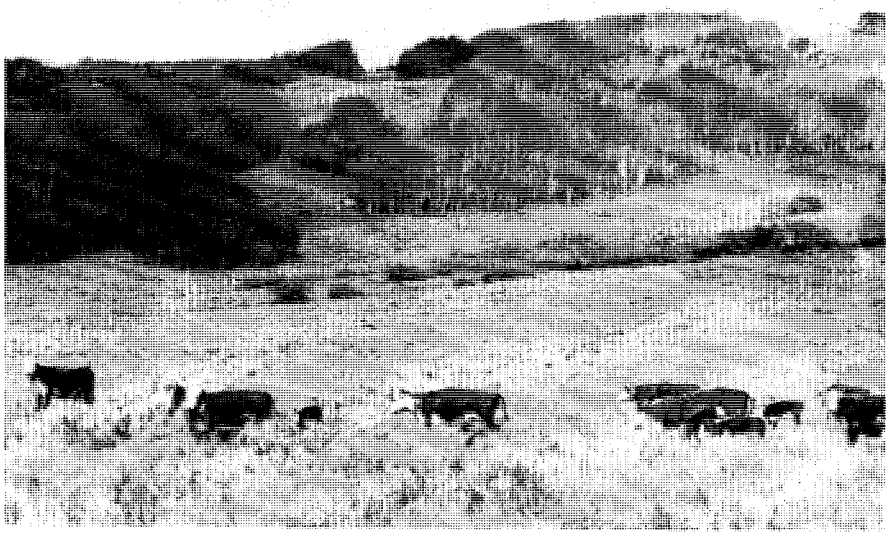
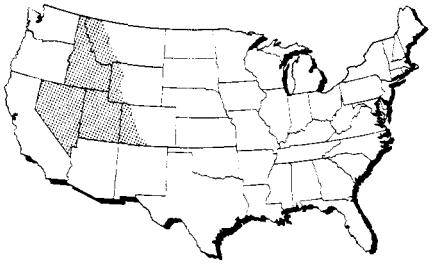


Aspen trees with sagebrush parks are typical of ranges in the intermountain region. In such high mountain ranges, Hereford cattle can graze unfenced



INTERMOUNTAIN

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With 33 to 40% of agricultural income in this area coming from range livestock, the importance of grazing land is high

RANGE LANDS of the intermountain country are characterized by mountains alternating with broad valleys (Figure 1). Diversity of elevation, climate, soil, and vegetation mark the area. Roughly the region includes the Rocky Mountains from Canada to central New Mexico and Arizona and extends westward to include the eastern slopes of the Sierra Nevada and Cascade mountains.

Range livestock account for from 33 to 40% of the agricultural income within the region. When one considers that this is for the most part produced from range forage harvested by animals from otherwise unusable land, the importance of grazing land can be appreciated. Much of the remaining feed consumed comes from by-products of various agricultural crops, thus turning otherwise useless or low-value products to use.

The intermountain area is one of the world's greatest range areas. The climate, the forage, and the people combine to make it permanently a center of feeder-livestock production and this will always be a top-ranking industry. At the same time, rough topography, complex flora, and delicately balanced ecological relationships make the area most challenging to the range manager. Good management offers infinite possibility. Poor management can ruin the important range resource.

Arid Climate

Low and erratic rainfall is characteristic of all but the higher elevations, which are by comparison humid. Further, the precipitation distribution pattern contributes to low forage production. Only 20 to 50% of the annual precipitation falls during the growing season (April 1 to Oct. 1) in the western and low-elevation areas. Except in the high mountains, there is seldom enough precipitation in summer to keep plants green, especially when the low precipitation is coupled with high temperature and low humidity which are normal in summer. Since winter temperatures are low, growth of short-rooted plants is confined to a brief spring period during which growing temperatures and moist soil overlap. Water falling as snow percolates deep into the soil, favoring perennial vegetation with deep rooting habits. Since fall frost follows closely the end of summer drought, fall growth of range plants is not common in northern latitudes and is almost nowhere reliable. The region is ideal habitat for spring annuals, which thrive in all save the high-mountain areas.

Total annual precipitation as low as five inches occurs in deserts of western Utah and Nevada. High mountains are estimated to receive 30 to 50 inches. The regional average is likely well under 15 inches.

Temperatures are characteristic of the latitude, the growing season varying from about May 1 to Oct. 1 in the mountains and in more northern desert valleys, and from about March 1 to Nov. 1 in more southern desert lands.

Roughest Land in America

Topographically, this region embraces some of the steepest and roughest land in America, although some parts are level or gently rolling. The mountain areas, which include the most productive range lands of the region, are steep and rough. Much of the area has never reached ecological stability in either soil or vegetation. Natural erosion is rapid on the mountains and on some desert valleys. However, well developed soil profiles on many steep mountain lands attest the ability of vegetation to stabilize the soil.

Soils of this region are shallow and rocky. Exceptions are found in valley bottoms and localized areas of grasslands, and occasionally under timber stands in the mountains, but shallow lithosols and grey-desert soils are the rule. These generally are unclassified but are largely of limestone, shale, or sandstone origin. Salt-desert soils are undifferentiated, with little or no profile development, little organic matter, and high salt content, some being highly alkaline. Lime is commonly abundant. Sagebrush soils are deeper, better developed, higher in organic matter, and relatively free from soluble salts. Mountain soils are shallow and rocky. They are more productive than the desert soils, having high organic content in the surface layers, a neutral to slightly acidic reaction, and freedom from excess salts.

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Arthur D. Smith, associate professor of range management at Utah Agricultural College, is also connected with the Utah Fish and Game Department. He was research assistant with Utah Cooperative Wildlife Unit and is interested in big game management, in addition to range economics, watershed management, and range management. He received a B.S. from Utah State and an M.S. from the University of California. The author of two books and 15 other publications, Mr. Smith is a member of the American Society of Range Management, American Geophysical Union, and the Wildlife Society.

Apparently, neither desert nor mountain soils are deficient in available minerals essential to livestock, with the exception of phosphorus, which is commonly lacking in mature plants, especially grasses. Experiments have shown that supplementing both sheep and cattle pastures with phosphorus increases reproduction rate, wool yield, and body gains on desert winter-range. On summer range, data are less conclusive.

Shrubs Dominate Vegetation

Grasslands are rare in the intermountain area. Here shrubs normally dominate vast areas and, with increased control of fire, they are invading still more of the area. On the salt deserts, sagebrush deserts, juniper foothills, and mountains, woody shrubs are abundant and constitute an important part of the forage. These plants are generally palatable, nutritious throughout the year, resistant to grazing, and dependable during drought years. Animals having access to sufficient quantities of these shrubs can thrive year-long without supplements.

Strangely, almost all shrubs on the salt desert are of the goosefoot, or Chenopodiaceae, family. On the sagebrush desert and intermountain foothills, the family Compositae rules, with the big sagebrush, *Artemisia tridentata*, dominating. Higher foothills and mountain ranges support brush chiefly of the Rosaceae family. Shrubby species of oak dominate foothills to the south.

Grasses occurring at lower elevations include: wheatgrass, ricegrass, bluegrass, and squirreltail, with the invading annual cheatgrass occupying foothills, especially where fire has removed sagebrush. Southern and eastern hills abound in blue grama. Palouse grasslands of eastern Oregon and Washington are dominated by bluebunch wheat grass and Idaho fescue. Mountain ranges produce many other grasses, but they are commonly not in dense stands. Forbs are important only at intermediate to higher elevations where some species are valuable as forage, especially for sheep.

Mountain summer ranges are far more productive of forage than are the dry desert winter ranges (Figure 2). Open ponderosa pine foothills, intermediate-elevation aspen ranges, and high-elevation fir and spruce ranges are most productive. Generally, lodgepole pine and Douglas fir stands are too dense to be valuable as grazing land.

Grazing values vary widely. Mountain ranges in good condition may support 1 animal unit month (a.u.m.) on $1^2/_3$ acres. Good sagebrush range requires about 3 to 4 acres per a.u.m. These are probably near maximum production for these types. Salt-desert winter range usually requires 10 to 15 acres per a.u.m.

Only locally are poisonous plants serious and losses can be controlled adequately by avoiding the poison through good livestock management and correct stocking. On desert range, sheep occasionally suffer from big-head poisoning from the genus *Tetradymia*. Occasional concentrations of selenium, especially in Wyoming and eastern Utah, give trouble locally. On overgrazed spring foothill ranges, low larkspur, death camas, loco, and rubberweed (*Actinea richardsonii*) are dangerous. On higher-elevation ranges, animal losses may be serious from chokeberry, tall larkspur, lupine, and sneezeweed (*Helenium hoopesii*).

Deterioration of Range

Depletion of range forage in the intermountain area has been extensive. Less palatable shrubs such as sagebrush and rabbit brush have increased and grasses have decreased, grass being virtually eliminated from much of the area. Sagebrush is the sole species of importance over vast areas. Grazing, cultivation, and fire have eliminated climax vegetation from much land that is occupied now by cheat grass and Russian thistle. These annuals furnish much forage but they are neither as nutritious nor as dependable as the perennial climax species.

Salt-desert lands are devoid of grasses in many areas and low-value shrubs have replaced high-value shrubs in many areas.

Because of more favorable conditions for plant growth and years of supervision of grazing on national forests, mountain ranges have suffered less from grazing damage. Some reduction in vegetal cover is apparent even on these areas, and on some, marked changes have occurred. Erosion is naturally rapid on most of this steep land, and increased erosion rate has undoubtedly accompanied vegetation depletion. Erosion on high mountains is especially critical because city dwellers, farmers, and factories depend upon them for water and because of the flood hazard to communities below.

Restoration of some of these areas may be achieved by improved grazing practices. Others may require total protection together with revegetation.

Improvement of Forage

Only locally is artificial revegetation practicable. Perhaps 5% of the area is topographically suited, has sufficiently good precipitation and soil, and is sufficiently devoid of good natural forage to make artificial seeding economically justified.

Crested wheat grass planted on abandoned farm lands in semidesert valleys adds materially to the forage resources of the intermountain ranges

Favorable publicity, government subsidy, and above-average precipitation have popularized range seeding in recent years. It has been successful on sagebrush areas and on most mountain ranges in this region. Except in emergency, only good sites supporting better than average soils should be seeded. Abandoned farm land is ideal (Figure 3).

Only grasses have proved practicable for seeding. Crested wheat grass has been by far the best adapted for lower-elevation ranges. Other species of promise are *Agropyron elongatum*, *A. intermedium*, and *A. trichophorum*. *A. elongatum* is especially good on saline bottomlands. On higher-elevation ranges, many species are adapted, including smooth brome, orchardgrass, bluegrass, slender wheatgrass, and timothy.

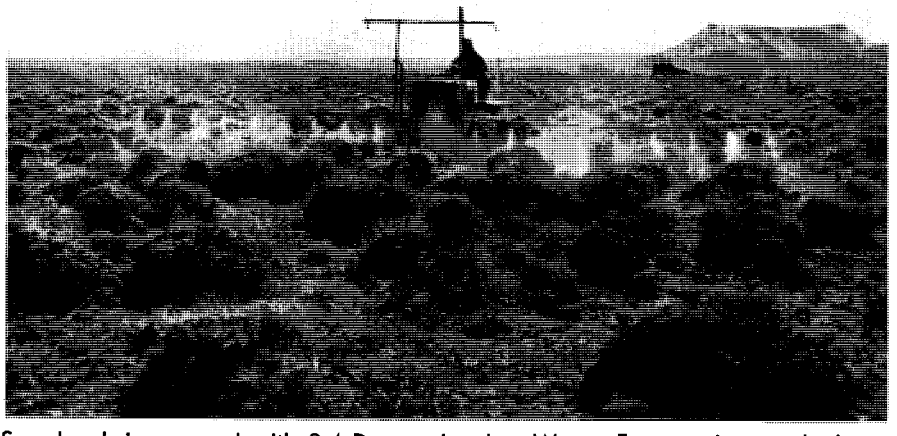
Properly grazed, artificially seeded ranges are capable of considerably greater forage production than deteriorated natural vegetation. In addition, they give better gains per animal and furnish forage earlier in the spring. If seeding can be done at low cost, it is profitable to the rancher. It should not, however, be considered a substitute for proper range management. Under

proper grazing, natural plants, if present, often can be made to produce forage more economically.

Great possibilities of increased livestock production lie in more intensive use of low-value adjacent croplands. The increasing demands for maximum water production from mountain areas may result in more conservative use for grazing in order to ensure watershed stability. However, opportunities exist for increasing forage yields from marshy, alkaline, or arid crop lands. Drainage and introduction of productive forage mixtures in place of the generally low-value sedges, rushes, and related native grasses offer considerable opportunity in wet bottomlands. Research has not yet shown that fertilizers are desirable or economic on low-precipitation areas but corrective fertilizer treatment may be justified on alkaline areas of ample moisture. Also, phosphate fertilizers have proved of immense value on irrigated pasture lands. Research at the Utah Agricultural Experiment Station has shown about 40% increase in total digestible nutrients accompanying application of manure and phosphate fertilizer to established pastures.

Water spreading during periods of high runoff in the spring, and in some areas during summer storms, can be expected to produce phenomenal increases in forage yields on arid foothills and benchlands now yielding but little forage.

Possibilities of range improvement by means of herbicides are not yet clear. While undesirable shrubby plants may be killed or markedly reduced, many desirable plants may also be affected. High costs and uncertain results make general recommendations impossible until further information is secured. Encouraging results have been obtained by applying 2,4-D to sagebrush and mule-ear dock (*Wyethia*) in rapid growth but not all research has shown sagebrush spraying to be either successful or economical (Figure 4).



Sagebrush is sprayed with 2,4-D near Lander, Wyo. Encouraging results have been obtained, but 2,4-D has not always been shown successful or economical

Livestock Operations

Cattle are most important in the intermountain region, although sheep, to which the area is best adapted, occur in great numbers.

Throughout the region there are great variations in the size of individual operations. Size is determined largely by the presence of extensive public lands in the vicinity of the ranch. About 60% of the region is publicly owned and is grazed on a permit basis whereby numbers are rigidly controlled. These ranges generally are unfenced but sheep are usually herded on individually allotted tracts of range. Cattle are largely left to roam at will, although on mountain ranges drift fences are utilized, together with the services of a range rider, to aid in maintaining proper and even use of range units. The use of fences to control cattle will increase on these ranges, for many areas cannot be protected from concentrations of stock without them. It is doubtful if it will ever be economically feasible to fence low-producing desert ranges.

Typically, summer grazing comes from national forests on high mountains (6000 to 13,000 feet). Winter grazing is obtained from Bureau of Land Management grazing districts. These are generally lower-elevation deserts (3000 to 4500 feet), however some arid plateaus of 6500 to 7500 feet are dry enough to avoid excessive winter snows. This relationship between summer grazing on the high mountain ranges and winter grazing on the deserts does not require that the two types of range be contiguous. In many instances the seasonal ranges are separated widely and the long distances are negotiated by trailing or trucking. Especially is this true of sheep. One-way distances between winter and summer grazing units may exceed 250 miles, although distances of less than 100 miles are more common.

Much of the area lacks land which is suitable to graze between the time that winter ranges can be used and the time that grazing is permitted on the high mountain areas. Many winter ranges can be grazed only when storms provide water in the form of rain or snow. Since many of the mountain faces are bold escarpments which rise abruptly from the valley floors, there is a shortage of spring-fall range not subject to early autumn snows and upon which the vegetation develops early in the spring. Many valleys which originally furnished spring-fall grazing are now farmed which further constricts the land available for spring and fall grazing.

Absence of range in the spring in many localities has made well-balanced livestock grazing difficult and has led to expensive feeding or to overuse of existing spring ranges. The mountain summer ranges often are properly used only during a short season, sometimes not to exceed four months. With the disappearance of water from the winter range and the need to cease grazing so that new forage may be produced before the soil becomes dry, grazing animals must be removed from the deserts. This has resulted in excessive use of the limited spring grazing areas. Consequently, the productivity of these sites has declined, further aggravating an already acute situation.

Livestock water is a problem in some parts of the area. Mountain ranges often are adequately watered by streams and springs. Spring development is practical and common, although it has by no means been adequate. Desert ranges are watered by wells pumped by wind or gasoline, by artificial reservoirs fed by flash storms from otherwise dry gullies, or by snow. Hauling water by trucks has made more effective the few water sources available. Greatly increased water development is essential to proper management of these lands.

Predominantly, grazing animals are marketed as grass-fat animals directly from the ranges. Sheep marketing begins in June in the northern part of the region where lambs are dropped on farms during winter. Most range-born lambs reach the market as grass-fat animals late in the summer. The remainder are sold as feeders from September to November and go to the feeding centers from which they are marketed during the winter and spring months.

Cattle marketings generally show a less pronounced seasonal peak than in the case of sheep. This is the result of more extensive feeding of cattle within the region, both by the producer and by professional feeders. However, many of the cattle are marketed to feeders in the Midwest.