Desert Experimental Range: Establishment and Research Contribution

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The Desert Experimental Range in southwestern Utah is typical of winter grazing lands in the Great Basin and in parts of adjacent physiographic provinces. These arid lands are low-shrub desert that have been variously designated the shadescale association, the northern desert shrub formation, or the salt-desert shrub association. Climatically, the country is a cold desert: cold winters, warm summers.

The low-shrub desert has been used as winter range since the late 19th Century soon after domestic livestock arrived in the Intermountain West. Over most of the desert the availability of surface water is limited. Yet, in winter, the hills and valleys are hospitable to livestock because precipitation is "stored" above the ground for days or weeks in the form of snow, which serves as a water supply for the animals. [See cover photo.] Snowfalls are generally light, and only in an occasional winter is snow deep enough to inhibit animal movements and foraging.

As livestock range, the low-shrub desert differs in a number of respects from other American rangelands. Livestock carrying capacity per acre is low—10 to 20 sheep-days (.07 to .13 AUM) or 1½ to 3 cow-days (.05 to .10 AUM) annually on good condition range. Browse is a major component of the forage resource. Forage quality is exceptionally good for a winter range. A mixture of dormant shrubs and dry grass generally provides adequate nutrition for gestating livestock. Management of this range is unique in that it seeks to perpetuate woody as well as herbaceous species.

The Experimental Range

Establishment

President Herbert Hoover provided the basis for the Desert Experimental Range when he withdrew 87 square miles of land from the public domain in southwestern Utah as an "agricultural range experiment station," in February 1933. This presidential action followed expressions of concern for the condition of public rangelands, some of which had become almost devoid of vegetation. The Range, west of Milford, became a unit of the Intermountain Forest and Range Experiment Station, USDA Forest Service. Grazing studies began the winter of 1934-1935.

Description

About 75% of the Desert Experimental Range is alluvial slope or flat valley bottom bounded by some hills and mountainland. The steeper lands are overlain by a shallow soil mantle and broken by ledges of sedimentary or volcanic rock. Elevation ranges from 5,075 to 8,415 feet.

The soils are mostly gravelly loams, sandy loams, or loamy sands with a low clay content (Aridisols and Entisols). The soils have a pH of around 8.0; and although many call this "salt-desert shrub," salt content is very low at the surface and does not become limiting unless roots penetrate to a depth of 12 to 15 inches.

During the 48 years from 1934-1981, temperature extremes varied from +104° to -40° F. Typical July maximums are 92° F and typical January minimums are 12° F. The

Browse is a major forage component.

mean daily range in temperature is 32° F and the average frost-free period is about 125 days—mid-May into September.

Average annual precipitation is 6.2 inches at the Desert Experimental Range headquarters. Roughly half of the precipitation falls during the frost-free period when moisture is being actively used by the plants. The remaining half typically falls during October to April when temperatures are low and evapotranspiration is minimal, resulting in an accumulation of soil moisture.

The vegetation is a mosaic of low (ca 10 inches) shrub and shrub-grass types. The dominant shrub species are winterfat, bud sagebrush, black sagebrush, shadscale, and low rabbitbrush. Winterfat and the two sagebrush species are palatable and nutritious browse for sheep. Shadscale, also palatable and nutritious, is less desirable because its spiny growth habit permits only light use in winter. It replaces the sagebrushes and winterfat on many improperly grazed sites. Low rabbitbrush, which also increases under heavy grazing pressure, is typically unused by livestock.

Several perennial grass species are associated with the shrubs on most soils. The three most common are Indian ricegrass, galleta, and sand dropseed. While all three are good forage species, Indian ricegrass is the most desirable because it is more dependably palatable in winter.

Only one native ruminant, the pronghorn, inhabits the Desert Experimental Range. Jackrabbits and cottontail rabbits live in or near the dry washes, on rocky slopes, and in canyons where taller shrubs provide concealment. Rodents make up half of the approximately 30 mammal species present.

Special Designations

The Desert Experimental Range is designated as a Biosphere Reserve. Biosphere Reserves, part of the United Nation's Man and the Biosphere Program, form a worldwide network of specific ecosystems that are set aside for conservation, research, and education. In addition, the Range is part of a national network of Experimental Ecological Reserves sponsored by the Institute of Ecology for long-term ecological studies. The Desert Experimental Range also has a 1,846 acre Research Natural Area for protection of a low-shrub cold desert location.

Research Contribution

Range Management and Plant Ecology

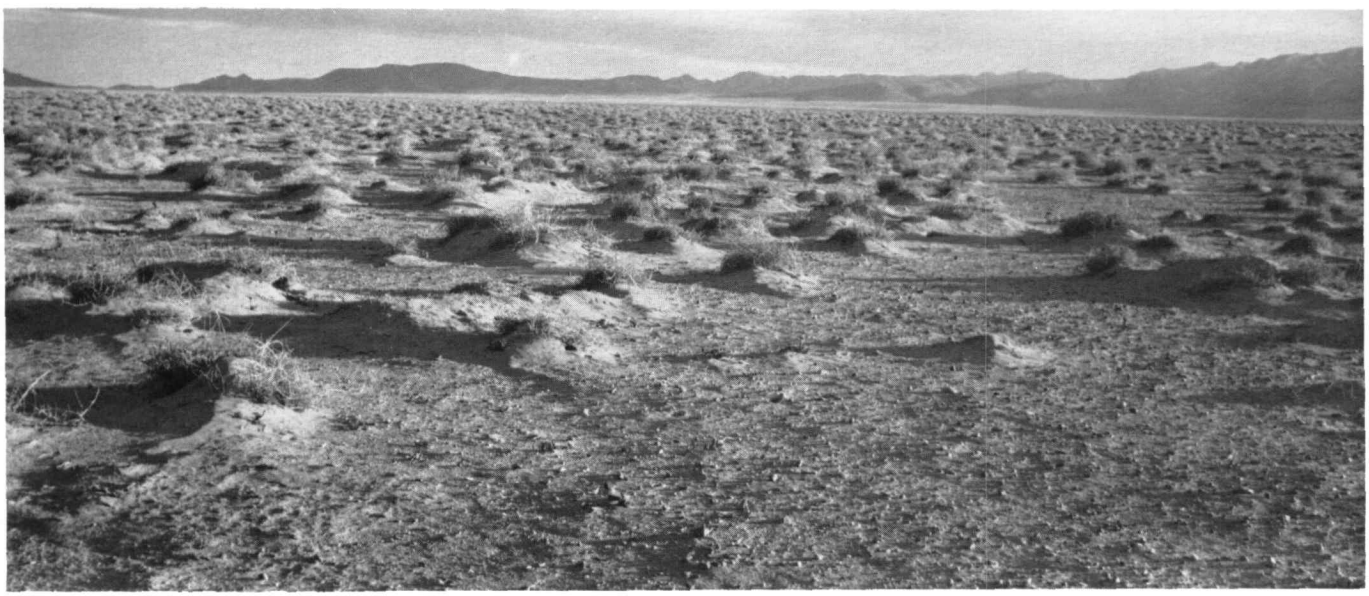
The poor condition of the desert ranges was a contributing factor in the decision to establish the Desert Experimental Range and begin a research program in the low-shrub desert. Early studies quickly determined that poor condition of the desert ranges in the 1930's was due to improper grazing practices rather than to the 1928-1935 drought. The conclusion was based on study of vegetation densities and age structures, soils, and grazing histories of two large contiguous valleys. No historical evidence suggested that the earlier and possibly more severe drought of 1897-1904 had altered community structure. In the words of G. Stewart, W.P. Cottam, and S.S. Hutchings, "Drought is not new to the desert valleys of western Utah, but the present disastrous forage impoverishment is of comparatively recent origin."

Scientists tried many experiments to restore depleted desert lands by artificially seeding both native and exotic plant species using different techniques. In a few cases, good stands were obtained, but even these stands declined and most plants died within 10 years. Thus, it appeared that these lands could not be improved by cultural practices using the plants and planting techniques currently available. Although attempts to improve the desert condition through seedings resulted in near universal failure, research showed that improvement of range condition by natural recovery was possible on many sites while under grazing use.

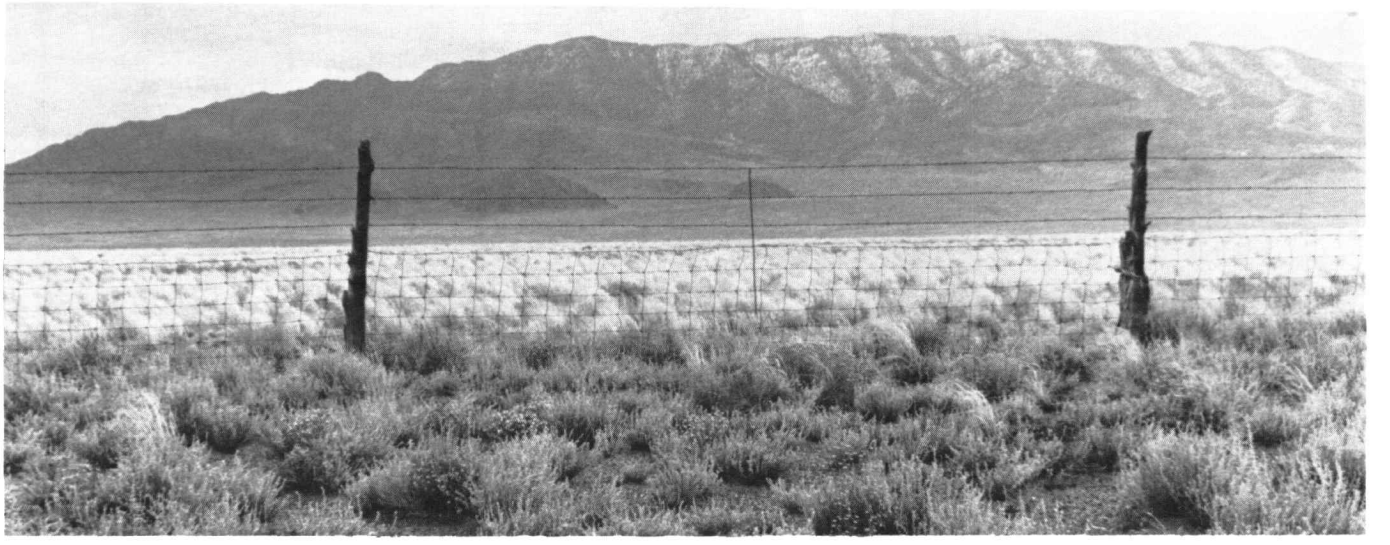
Studies at the Desert Experimental Range showed that:

- there is an intensity of grazing that at any time during winter is harmful to desirable plants and results in an increase of less useful species
- stocking at even a light rate is damaging if repeated year after year in late winter-early spring (March-April) on the same grazing unit
- range can improve in quantity and quality of forage production when grazed under a moderate annual stocking rate in early and middle winter
- alternate-year grazing, even at a heavier rate, results in improvement.

The exact path that natural recovery will take is difficult to predict on the low-shrub desert. Most plant communities



Very poor condition low-shrub desert range that resulted from uncontrolled grazing practices.



On this site protection resulted in a shrub-dominated stand, whereas heavy grazing beyond the fence resulted in a grass-dominated stand.

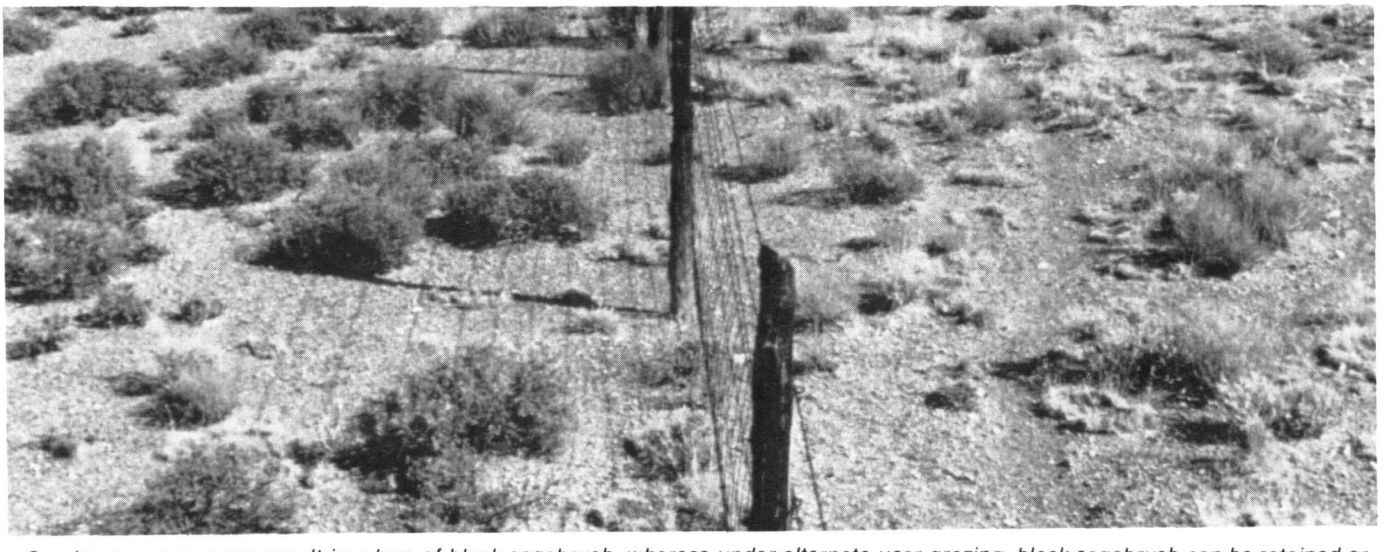
exist in a vegetation mosaic with other communities and are dominated by 1 or several species. Almost any combination of 2 or more species mentioned earlier will be found somewhere. Communities considered to be climax or near climax arrive at their condition of uniform composition from a number of different disturbed plant communities. The reverse also occurs wherein a single community type in a lower stage of succession can progress in different areas to different climax communities.

Measurable precipitation occurs about 56 days a year, but moisture that reaches depths effective for use by plants comes in less than a fifth of those days. Essentially all summer moisture in the surface 3 inches, a layer lacking feeder roots, is lost by rapid evaporation but nearly all moisture below about 6 inches is transpired. Between these two depths is a transition layer from which some moisture is transpired and some lost by direct evaporation. Moisture penetration into the soil profile appears to be closely related to the overwinter precipitation. Virtually all winters have at least 6 inches of moisture penetration while few winters have as much as 28 inches of soil moisture penetration. Somewhat more than a third of the average annual precipitation gets to the plants.

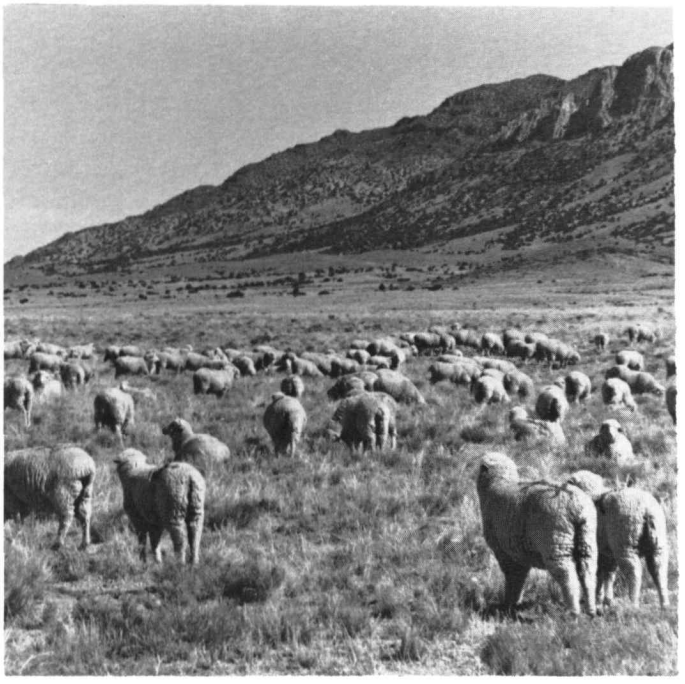
Plant production varies closely with differences in annual precipitation. The correlation has made it possible to predict with considerable accuracy the amount of forage available for winter grazing each year. Average annual yield of herbage (twig, leaf, flower, and fruit) in the 6-inch precipitation zone is about 220 pounds per acre. Below-ground production may be as much as 8 times greater.

Shrub longevity studies, an important part of the early research, show that some perennial forage species are long-lived and generally have a low mortality rate after the second year of establishment. For example, winterfat, an important livestock forage, appears to have maintained a consistent presence in part because of this longevity. In 1975 over half of the plants present were at least 40 years old. Shadscale, on the other hand, has had a higher mortality rate and has had to depend on a higher reestablishment rate to maintain its status in the community. Its abundance has declined. Bud sagebrush has shown the most sensitivity to grazing, but tends to replace shadscale when protected from grazing. Overall, there have been surprisingly few significant differences between the survival of plants in the ungrazed plots versus plots grazed during dormant periods.

A general upward trend in perennial plant cover together



Grazing every year can result in a loss of black sagebrush, whereas under alternate-year grazing, black sagebrush can be retained or increased.



Improved management techniques have doubled net profit per ewe.

with certain variations in species response suggest that climatic or other ecological trends have had important effects in addition to those caused by grazing pressure.

The economics of good management practices were studied 1935-1943. Improved management included moderate stocking rate, grazing in individual allotment units for prescribed periods, sheep bedded at a different location each night, herding carefully controlled to permit quiet grazing and to eliminate unnecessary trailing, and hauling water to the herd every 1 to 2 days when snow was not available. When all income and operating costs were included, the net income per ewe was twice as high under improved management as under management that included heavy grazing, grazing over the entire allotment several times during the winter, trailing long distances to bedgrounds or to water, and providing water at only second or third-day intervals.

Development of Vegetation Sampling Techniques

Vegetation measurement technology did not offer the choices 50 years ago that it does now, and techniques then available had been developed in kinds of vegetation different from the open cover of the desert. A major modification of borrowed methods was change of plot size to bring plots into harmony with the wide spacing of individual desert plants. Plant cover on the permanent plots at the Desert Range has been inventoried from the beginning by the point-observation-plot method. This method was later adapted elsewhere for estimating the weight of herbage produced. A method of mapping chart quadrats was also developed at the Desert Range. As new field sampling methods appeared in the literature, a number of them were compared and tested on desert vegetation.

An important early Desert Range ecological contribution was a plea to ecologists to use data analysis that provides investigators with mathematical methods of obtaining from their data much that is not obvious to the eye—the statistical method. Scientists explained that the correlation coefficient (*r* value) had become important in analyzing agronomic problems, and it could be used to describe competitive relationships among native plant species. Relations detected by that first analysis of data from the experimental range have since been demonstrated empirically in the grazing studies.

Wildlife Investigations

Pronghorn is the only native ruminant occupying the low-shrub deserts. Studies over approximately 20 years have helped to define the importance of drinking water for the pronghorn and to document the often high predator losses of fawns. Other studies have addressed the question of alternate-prey populations and their relation to pronghorn fawn predation. Pronghorn forage preferences were determined, and some behavioral characteristics have been studied.

Recent studies show that even moderate sheep use of dormant vegetation in winter leaves grazing units relatively unfavorable for pronghorn until spring regrowth occurs—at least on ranges where key pronghorn forage plants are in short supply. However, the rapidly expanding pronghorn populations on the Desert Experimental Range suggests that management systems, that provide rested areas to which pronghorn can move, will not be particularly limiting to pronghorn populations.

The Future

We consider the Desert Experimental Range to be one of the "classic" range research areas. Although other range research areas have been in place for a longer period, the basic sheep winter season-and-intensity study, which has continued for nearly 50 years at the Desert Experimental Range, is probably the longest, continuous, specific grazing study in existence anywhere. These studies and other supportive investigations have provided a great deal of information on grazing management procedures for low-shrub desert sheep winter range which can benefit both sheep production and plant communities on tens of millions of acres.

A change in the research program is now being considered for the Desert Range. At the time of the Range's establishment, winter grazing by sheep was the primary use of the low-shrub desert. Over the years there has been a continuing trend of conversion of sheep grazing allotments to cattle. Thus, it appears that current livestock information needs are more cow-oriented than sheep-oriented, or from the standpoint of the desert and its wise use, perhaps a need is to determine if the trend is ecologically or economically justifiable. The need for continued long-term research is also a pressing consideration. We have already learned that plant community changes are ongoing and can be a function of factors and events not under man's control. If the people of future generations will have a need to understand the processes of change, the Desert Range now has a half-century head start in records needed for that understanding. Another factor in future planning is the cost to maintain an isolated research facility. Consideration must be given to efficient use of limited research funds to obtain the best information return.

We are currently working to bring many of the plot measurements up to date and to provide interpretations of plant response for the entire period of measurement. Funding levels along with the advice and information needs of others will help determine the future at the Desert Experimental Range.

(NOTE: Literature references may be obtained from the authors).