Progress In Range Management

By

W. R. CHAPLINE

Chief, Division of Range Research, U. S. Forest Service

Range management has developed, since the turn of the century, from a pioneering rule-of-thumb practice to a growing science based on tested research knowledge. Most federal range lands have been brought under administration. Private owners now have a greater appreciation of the benefits which can accrue to them, and the public generally, from efficient management of their ranges. Improved practices, developed by research, have already brought millions of dollars in savings and increased revenue to stockmen annually. Such progress would indicate that range conservation had already attained a high degree of success. However, the condition of western ranges was so bad fifty years ago, and there was such a lack of understanding of efficient range management, that major progress has been attained only within recent years.

Native forage-producing lands commonly called range, approximate 950 million acres, about half the total land area of the nation. About two-thirds are in private ownership and one-third public. Three-fourths of these ranges are in the West. Nearly two hundred million acres are grazed forest lands and coastal prairies of the South.

With abundant rainfall and a heavy cover of turf-forming grasses, southern ranges have not generally been seriously damaged, although the productivity of some has been lowered by promiscuous burning.

There is a vast difference between western ranges and the humid southern ranges, improved pastures of the East, and irrigated pastures. On western ranges where annual precipitation generally averages under 15 inches, low for plant growth at best, bunchgrasses which do not form a sod, succulent forbs or range weeds, and the foliage and tender twigs of shrubs largely furnish the forage. Whereas the heavy cover of turf-forming plants in humid pastures can withstand close grazing, bunchgrasses on arid and semi-arid ranges grow in a thinner stand and cannot withstand such grazing.

Lacking an understanding of the necessity for adjusting grazing to the growth requirements of range plants, stockmen have grazed more livestock than many ranges could support over the years. When there was no control or regulation on the unreserved

and upappropriated public domain and on unfenced state and private lands, stockmen used them in any manner that they desired. This engendered considerable competition for forage. Also, large areas, submarginal for farming, were plowed to produce wheat or other crops and later abandoned. As a result of such use, much of the western range was seriously deteriorated. Palatable plants were replaced by a thinner stand of less palatable ones. Low value shrubs increased greatly in density and many foreign annuals crowded in. Grazing capacity was greatly reduced. Even now grazing capacity is little more than 50 percent, on the average, of what it originally was.

Reduction of the protective plant cover which breaks the force of heavy rains and checks run-off has been accompanied by reduction in surface litter and humus and inevitable soil deterioration. Thus, the fertile productive topsoil over much of the range area has not been maintained but has been washed or blown away, increasing the difficulties of restoring range and watershed values. The magnitude of these losses becomes evident when it is realized that four-fifths of the important water-producing area of the West is made up of range land. Nearly 600 million acres of range is eroding, and of this eroding area three-fifths is contributing silt in disturbing quantities to major western streams, imparing their value for irrigation, power, and municipal water supplies. Devastating floods, spilling muck and debris over highly valuable croplands and ruining homes in their wake, are now common where once they seldom occurred.

A serious handicap in the effective management and rehabilitation is the large acreage of range lands, low or uncertain in forage productivity, badly deteriorated, and slow of recovery, being held in private ownership with difficulty because of high original cost, undue investments in improvements, and taxes. Many of these lands have been taken over by banks, insurance companies, or other non-residents during periods of drought and depression, blasting the hopes and ambitions of the families who struggled to make a living on them. Seldom is such land given the care that will prevent excessive use and deterioration. In addition, on a large area of range land having high public value for watershed protection, private owners cannot afford the cost of restoration and other measures necessary to assure adequate protection to public improvements, farms, and towns lying lower down on the drainage system.

The problems relating to the use and conservation of range land are many, complex, and varied. They apply to so vast an area and are so far reaching in their implications that no single measure can correct the situation. Each of the several programs

now in operation strikes at one or more aspects of these problems. Research aims to obtain the information needed by stockmen and farmers in managing their ranches and also to establish the factual basis on which public agencies can formulate plans for their policies and programs of action. The range extension program brings such information to farmers and stockmen and through demonstrations of improved methods and practices seeks to help the farmer to better his range conditions and management practices. The soil conservation program applies to both privately owned and public ranges. Either directly or under cooperative arrangements, the Department of Agriculture is furnishing advice, labor, and other assistance in bringing about management and soil conservation practices that will aid in bettering conditions, overcoming soil erosion, and giving better watershed protection. The range-conservation program under the Soil Conservation and Domestic Allotment Act relates directly to privately owned range lands and those state and county lands under direct control of private owners. The national-forest and grazing-district programs apply primarily to range lands in public ownership, but both aim to coordinate use of these public lands with the management and use of range lands held in private ownership. The farm credit activities facilitate financing that adds stability to ranch operations.

The key to maintenance of the range, with all its direct and indirect social and economic benefits, is the restoration and correct use of the range forage and the soil on which it grows. Thus, the premise upon which range programs are built is the development of basic principles and practices of better management. The initial impetus for progress in range conservation and management came when Mr. Gifford Pinchot was made Chief of the newly formed Forest Service upon transfer in 1905 of the "forest reserves" from the Department of the Interior to the Department of Agriculture. He was an ardent conservationist, strongly opposed to destructive exploitation but thoroughly imbued with the idea that conservative use was desirable and essential. Trees and grass became recognized as growing crops to be harvested. As a member of the Public Lands Commission appointed by the President in 1903, Mr. Pinchot had worked with Mr. A. F. Potter and Dr. Frederick V. Coville. It was natural for these three to team up in developing a sounder basis of grazing for the national forests as they came to be known upon transfer of authority. Mr. Potter was brought into the Forest Service to head up grazing administration. Dr. Coville, the leading authority at that time on range matters, was Chief of the Division of Botany in the Bureau of Plant

Industry. They planned for range studies which would facilitate efficient grazing administration on the National Forests.

In 1907 Dr. James T. Jardine, later Director of Research in the Department of Agriculture, and Dr. A. W. Sampson, later professor of range management at the University of California, were hired to initiate such range studies. Others were employed shortly thereafter and in 1910 the Office of Grazing Studies was formed in the Forest Service with Dr. Jardine in charge. The Great Basin Experiment Station, in the mountains of central Utah, was established in 1912 specifically for studies of range problems. In 1915 the Santa Rita and Jornada Range Reserves in southern Arizona and New Mexico were transferred from the Bureau of Plant Industry to the Forest Service along with authority for range research on other public and private lands, as well as the national forests. The McSweeney-McNary Forest Research Acts of 1928 set up an authorization which gave impetus to expansion of range research, both on forested and on untimbered ranges, public and private. Major expansion of western range research, however, has come since 1935. Also, in 1940 studies of grazing on forest ranges in the Southeast were initiated followed in 1944 by somewhat comparable studies in other parts of the South and finally in 1948 by studies of forest grazing in Missouri. The program of establishing experimental forests and ranges, supported by Congress in the last three years, has been a big factor in recent expansion. Range research is now underway at all six regional forest and range experiment stations in the West, and at the Central States, Southern, and Southeastern Stations.

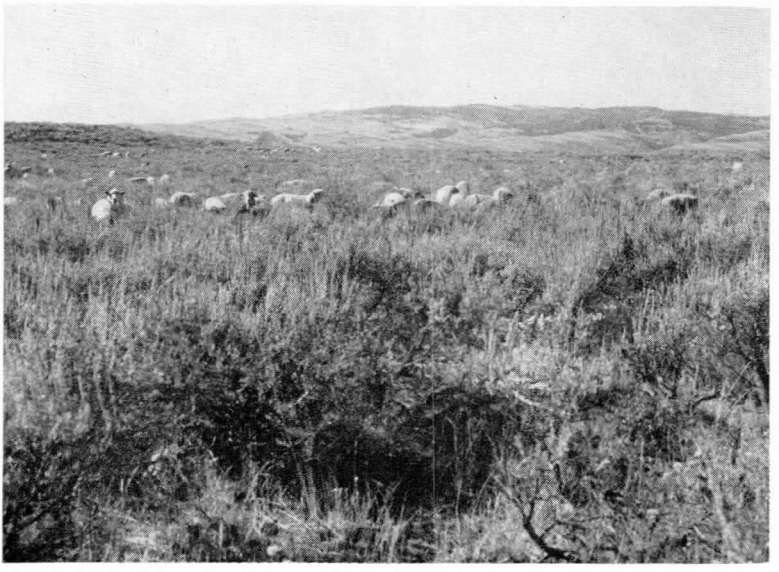
Much of the Forest Service Range Research is cooperative with other federal agencies, and with the State Agricultural Experiment Stations. It is a part of the broad coordinated program of research of the Department of Agriculture dealing with interrelations of soils, climate, vegetation, and animal life and of related economic problems. In its range research program the Forest Service studies grazing management, artificial reseeding, values and uses of range plants and watershed management of range lands. As a result of explorations in foreign countries, the Bureau of Plant Industry, Soils and Agricultural Engineering is introducing new plants and, through plant breeding and selection, is developing improved strains suitable for the range. The Soil Conservation Service is obtaining information on methods for collecting seed of native species and for mass production of seed and plants for revegetation in soil-erosion control. The Bureau of Animal Industry is conducting studies of range livestock husbandry. Farm and ranch management is studied by the Bureau of Agricultural Economics. Cooperation is also maintained with the

Fish and Wildlife Service and the Bureau of Land Management of the Department of the Interior respectively in studies of game and rodents on range lands and of pilot testing range reseeding research on Grazing District lands.

Grazing Management Research

The most important problem on western ranges is restoration of forage and soil values. A considerable part of range research, therefore, has been centered on this problem. Of almost equal importance is the problem of sustaining forage and livestock production on ranges in good condition. Fundamental ecological and physiological studies, backed by actual grazing tests, have revealed that each major range type and each productive condition of such a type, has its own unique management requirements. How to stop overgrazing, in order to prevent further deterioration and start restoration has been and still is paramount. Studies in several parts of the West have shown that with each advancing stage of deterioration of the range vegetation erosion increases and forage production and the possibilities for restoration of the plant cover lessen. Effects of the thinner vegetation are reflected in such features as more rapid runoff, more compact soil, less absorption of moisture by the soil, higher soil temperatures, greater evaporation and increased water requirements for the production of an equal quantity of forage. Finally, all of these increase the probability of more damage to the vegetation during prolonged dry spells.

Some plants withstand grazing better than others. Those which reproduce vegetatively ordinarily can stand heavier grazing than those which depend upon seed for reproduction. Most range plants, however, require seedling establishment once they are seriously depleted. Critical studies of carbohydrate production and storage by several range grasses in relation to growth show that accumulation of food in the crowns and roots of the plants takes place during the decline of the current leaf and stem growth after seed production; that plants draw heavily on stored food in winter and spring before growth of grasses can be observed; that start of above-ground growth depends on food stored the previous summer; and that yield of forage is in direct relation to food production during the current summer. These studies have shown how intensity and frequency of grazing influence the start of growth, food production, forage yield, and winter survival of plants; and how too frequent or too heavy grazing at any time literally starves the plants to death. Also, sufficient stubble in the form of basal portions of stems and partly ungrazed leaves must be left at the close of the grazing season to protect the crown



A dense stand of big sagebrush with a good understory of perennial native wheatgrass, difficult to graze. (Photo by J. F. Pechanec—U.S.F.S.)

Similar area from which the sagebrush has been burned, under prescribed procedure, making a greater quantity of the native wheatgrass available and more accessible. (Photo by J. F. Pechanec—U.S.F.S.)

of the plants from winter weather and check wind and water erosion.

There are other phases of utilization of the forage which must be considered. The degree of grazing relates in part to the density of the vegetation and the plant competition, and partly to danger of erosion. Utilization standards have been developed in relation to productive condition for a number of range types. The studies underlying these standards and the relationship of plant succession to range management clearly show that there are rather definite stages through which vegetation must develop in order to restore depleted range to a satisfactory condition. On seriously depleted ranges the trend is normally from low value annuals through certain perennial weed stages, finally to conditions in which perennial grasses predominate. The trend in soil is toward a more fertile, friable condition which absorbs precipitation more readily. Underlying the whole is the necessity for recognizing and understanding the various range conditions and whether the range is improving or declining in productivity as shown by density, utilization, plant vigor, soil factors, and other indicators.

It will be seen from this that practically every approach to management and improvement of the range is concerned with the knowledge of the range plants themselves, their identification, growth requirements, life history, other ecological relationships, their forage and other values and their ability to withstand grazing. While this must be determined with regard to each of the important plants within major types, the whole problem of plant competition, plant succession and the influence on those natural factors of grazing by livestock, game, rodents, or insects must also be given consideration.

Soil texture, structure, and fertility all play an important part in range forage production and in the rate of improvement. The plants on the range bind the soil against erosion, aid in the absorption of precipitation and in turn draw upon this soil moisture for their production. If bunchgrasses are as abundant as the normal soil moisture permits, their fibrous roots interlace between the tufts under the bare soil spaces. Their spreading root systems help to keep the soil mellow and porous and facilitate moisture penetration. Such non-eroded soil is much richer than eroded soil in nitrogen and phosphorus, the water-holding capacity is greater, and the water required by plants to produce forage is less. A great many more leaves, greater stem and leaf length and more forage are produced.

Numerous improved management practices, developed by research, are now widely applied on western range lands. These include (1) opening and closing dates which harmonize both

with readiness of the range for grazing and nutritional requirements of livestock; (2) a fairly good basis for determining approximate grazing capacities of range types; (3) deferred and rotation grazing which permits proper use of the forage on the range as a whole, but which delays grazing until after seed dissemination or forage maturity on a different portion of the range each year; (4) improved methods for grazing sheep and goats, such as open and quiet herding and bedding them down in a new place every night to avoid damage through trampling and localized overgrazing; (5) obtaining better distribution of cattle through well-placed watering facilities and better salting methods, thus bringing about more even and more effective use of the available range forage; (6) management which harmonizes grazing with forest regeneration; (7) eradication or control of many noxious plants and methods of management which minimize losses from poisonous plants; (8) economical procedures to reduce the stand of some of the low value shrubs so that grasses can make greater growth.

The end product of proper range management is of course, human welfare. Western agriculture is a great complex of interdependent crop farming and range grazing, with the latter furnishing well over half of the total feed requirements of western livestock. This whole enterprise, involving the welfare of thousands of local communities and even metropolitan centers, reflects adversity or prosperity on the range. All too frequently the strain of improper management has resulted in reduced livestock production, increased costs, over-investment, tax delinquency, bankruptcy, deserted homes and schools, and blighted hopes. These difficulties may be escaped and communities dependent on the range resource stabilized and maintained only where improved range management is applied.

Numerous examples can be cited of increased forage and livestock production obtained from improved management developed by this research. Such increases generally have come from more adequate and nutritious forage available for each animal, greater production per animal or per acre of range or both, increased calf and lamb crops, lower costs and greater profits. On the Jornada Experiment Range in southern New Mexico, for example, we are now producing almost twice as much beef per animal as 30 years ago. While part of this increase resulted from better breeding, primarily it is due to a greater amount of palatable range forage and more efficient utilization of it.

In studies at the Central Plains Experimental Range in Colorado in cooperation with the Soil Conservation Service, yearling Herefords gained, in the rather dry year of 1946, an average of

Proper stocking for a suitable season assures low cost forage for livestock production and aids restoration of deteriorated ranges. (Photo K. S. Swan—U.S.F.S.)

252 pounds on shortgrass range stocked at 40 head per section for a six month season, approximately grazing capacity. In contrast, on comparable range overstocked at 60 head per section, the average gain was only 174 pounds. The better developed animals on the properly grazed area sold for $1.25 more per hundred weight. Comparable profit in 1946 amounted to $1,807 per section for the range stocked at grazing capacity and $1,345 for the overgrazed, even though the latter produced slightly more beef. In years of more favorable rain fall and forage production, the spread is not so great. Overstocking has resulted in cumulative soil and forage deterioration during the seven years of the study.

In two bands of ewes winter grazed in the salt desert shrub type of western Utah, in alternate years on adjacent ranges grazed conservatively and heavily, the ewes on conservatively grazed range produced fully a pound more wool per head annually and were 12 to 20 pounds heavier at the close of winter. Death loss from under nourishment was practically eliminated on the properly grazed area, whereas three to five percent death loss was ex-

perienced year after year on the heavily stocked range. Lamb crops were 8 to 13 percent higher and financial returns $1.00 to $1.50 per ewe higher annually on conservatively stocked range. Moreover, the latter yielded 2½ to 3 times as much forage over a period of eight years as the heavily stocked range.

There are also possibilities for improving range management and cattle production in the South. The heavy cover of grasses occurring on southern forest and other ranges has seldom been recognized for its true value, partly because yearlong grazing without supplemental feeding has given such poor results in livestock production. The vast area of range lands provides an enormous quantity of forage. The switchcane or reed type is a relatively high capacity range type suitable for about eight months grazing. A longer season is possible if a fresh area is grazed in the fall and winter. Although most of the wire grass and broomsedge ranges of the southern piney woods are grazed yearlong at the present time, their value is greatest in the spring and early summer. It would be best to graze such ranges for that short spring and summer period, utilizing other pasture or forage during the balance of the year. Another alternative is to provide protein and other mineral supplements to range grazed livestock through the fall and winter periods in order to keep them in productive condition. The cooperative studies with the Bureau of Animal Industry and several state agricultural experiment stations of the chemical composition of forage plants at different growth stages and of supplemental protein, mineral and other feed requirements are pointing the way to better yearlong nutrition of southern range animals.

Range Reseeding Research

About 80 million acres of western range lands are so badly depleted that reasonably rapid natural revegetation appears improbable. On this area reseeding is the only hope for speedy recovery. Present range reseeding knowledge is a product of research conducted largely during the last decade and a half, although earlier work laid part of the foundation.

Early studies developed procedures suitable for reseeding mountain meadows which had especially favorable soil and moisture conditions. Costs were relatively high, but the resulting increase in forage production usually justified the cost. Limited studies in other types gave some leads for successful seeding.

The need for regrassing abandoned cultivated fields and depleted range lands in the Northern Great Plains led to intensive studies in that region beginning in the early thirties. The critical shortage of forage and the serious erosion on foothill ranges

grazed in spring and fall emphasized the necessity for more intensive fundamental studies which would develop procedures adapted to arid and semi-arid ranges. Accordingly, such studies were undertaken in the mid-thirties in the valleys and foothills of the Intermountain Region. Similar intensive studies were extended to other parts of the West and to the South in 1945.

Ranges have been analyzed to learn how differences in soil, climate, and other factors affect possibilities for reseeding. Studies were then concentrated on sites which showed the most promise for success.

Intensive studies have been made to determine adaptability of species, varieties, and strains of forage plants for the various range situations. Native plants, those introduced from foreign lands which grow naturally under more or less similar ecological conditions, and improved strains of both native and introduced species have been tested.

Critical study has also been made of seeding methods especially adapted to range conditions, including how much seed to plant of each adapted species, depth of planting required to attain satisfactory establishment, best season for planting, what machines to use in planting and to reduce competing vegetation and other comparable features. These investigations have developed efficient and economical procedures for the establishment of adapted species under different site classifications. When conducted on relatively large areas they have provided a basis for determining costs. Several large-scale reseedings, too, have served as experimental grazing areas where the true forage value of the various plants and the best management practices are being determined.

As a result of these studies, we know how badly depleted areas in a number of range types which would require 30 to 50 years to recover naturally, can be seeded economically and made productive in from one to three years. Already over five million acres of private and public western range lands and abandoned cultivated fields have been seeded successfully at reasonable cost. Seedings have increased forage production five to ten times, some fifteen to twenty. Close application of the specifications which have been evolved by research has given success nine times out of ten.

In the piney woods section of the South, another important objective of range reseeding research is to establish plants which will extend the season of palatable and nutritious range forage and thereby reduce the feeding of costly supplements, now essential for sustained livestock production.

Although range research has made considerable progress in developing answers to grazing management and reseeding problems, especially in the last ten or twelve years, there are still many problems unanswered or only partly answered. Much information, now available in only rough form, must be refined. Because of the great variation of vegetation, soils, and climatic characteristics—from the desert lands supporting sparse vegetation to the highly productive mountain meadows—there is need for a great deal more information on practices that will give optimum production on all major range types. The wide variation, too, in productive condition on deteriorated ranges presents many unanswered problems relating to range restoration through management and reseeding. Studies, too, should be extended to many important range types and areas not previously investigated. These offer opportunities for greater range livestock production than can be fully realized only with the advance in knowledge which can best be accomplished through research.

FACTS ABOUT THE AUTHOR

William Ridgley Chapline, who is the present Chief of the Division of Range Research for the U. S. Forest Service, was born and raised in Nebraska. Upon graduation from Lincoln High School in 1909, Mr. Chapline began his studies at the University of Nebraska. In 1913 he received his B.S. in Forestry with a minor in ecology and agriculture.

Mr. Chapline's work after graduation consisted of various jobs in range research for the Forest Service. In 1920, after having handled research work on range land conservation, management, and restoration, he was named Chief of what is now known as the Division of Range Research.

As head of this division in the Forest Service, his service for the country was great. It is impossible to list, in the space available, all the important assignments and achievements that Mr. Chapline has accomplished in his 35 years in range work. During this time he was co-author of the book "Soil Erosion a National Menace," a member of a President's advisory sub committee, technical advisor for the writing of a senate document and supervisor, and many times the author, of over 300 articles, guides and booklets on range and allied fields.

Mr. Chapline is recognized as an international authority on range management and improvement. His work has carried him to all the states of the union, to Great Britain and eight countries of Europe as well as Canada and Mexico.

It is with much pride that we present Mr. Chapline's article on "Progress in Range Management."