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Our Range Society

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WHEN the new range society was first considered, doubtless most of you thought "Why form another organization?" I'd be surprised if you didn't! Most range men already belong to so many professional societies that to participate actively in another would severely tax their personal energies and prove a financial burden.

Those active in efforts to form the society were well aware of the pitfalls and thus gave its creation serious thought. There were several objectives that most range men had in mind for a desirable society. These we have gleaned from your letters and from discussions with countless numbers of range men.

1. Recognition of range management and its application as a profession.

2. Liberal membership requirements to permit professional workers with highly varied basic training to become full members with an equal voice in society affairs.

3. The publication of a journal devoted to the subject of range and pasture which would provide a medium for exchange of new developments ideas, and for the discussion of policies.

4. Provision for meetings where range men can assemble yearly for exchange of ideas and development of unity in procedures for managing range lands.

Countless individuals in many different agencies or groups and with highly varied basic training are engaged in range and grassland work. On these workers fall the major responsibility of pointing the way toward the greatest productivity and fullest utilization of the forage resource consistent with maintenance of soil and forage. Moreover, these workers are responsible for the scientific validity of the work.

It seemed natural, therefore, that range men should organize to seek unity and agreement on objectives, procedures, and professional standards.

Nowhere within the framework of existent societies did there seem to be a place for range men. Objectives desired in a range organization could not be satisfied. All existing societies had been organized for other purposes and interests. To accommodate range men any one of them would have had to broaden its scope.

Plainly, something had to be done. Our profession had no status or unity. We needed a medium for exchange of ideas and unified expression of standards. We needed also a common meeting ground for the highly varied group in the field. But it was clear that we needed to push ourselves because no one was going to do it for us.

Out of these conditions the range society evolved. It first began in 1946 with a survey to find out what the majority of range men wanted. When it became evident that the majority desired a separate organization, a membership drive

was launched in July, 1947. By the time of our first annual meeting in Salt Lake City in January, 1948, 500 had joined the society. At present there are more than 650 members.

Preparations are being made for our second annual meeting at Denver. The Society's program is taking form rapidly as a result of the activities of the Council and seven committees. Interest in the Society is widespread throughout this country, Canada, and extending into South America.

Formation of our Society came at a particularly appropriate time. There is an acute awareness of the need to conserve renewable natural resources. Forage is one of these. In the battle for better management of resources we must align ourselves closely with other allied societies. There will be no conflict between our Society and others in the fields of conservation. Efforts of these organizations will complement each other.

Upon our stewardship, either as owners, research workers, teachers, or administrators, depends the improvement and maintenance of the range resource. Our Society through its own members and through cooperation with closely allied organizations shall strive to make these range and grassland resources serve mankind to the fullest degree now and in the future. In achieving this end, we can perform many valuable functions:

We can present the ideas of professional range men to the public, to government circles, and to other societies.

We can promote more complete and widespread education to insure the best management of our range resources.

We can sponsor application of the best knowledge available to the managment of publicly and privately owned range lands.

We can encourage additional research into the fundamental principles of range management.

We can provide an avenue for exchange of ideas and experiences among range and grassland workers.

To carry out these functions, as well as to increase unity and improve professional standards, will be the objectives of the American Society of Range Management.

The Range Journal

EDITORIAL BOARD

MEMBERS of the former publications committee felt that a journal carrying material whereby range men may keep abreast of their field is a vital part of the range management society. Therefore it was recommended at the annual meeting in Salt Lake City that the society sponsor this journal. The recommendation was approved. Those on the publications committee were R. S. Campbell, Robert A. Darrow, Harold F. Heady, L. A. Stoddart, and H. H. Biswell, Chairman.

The recommendation contained the following:

1. That the journal be a quarterly of 32 to 64 pages per issue at the beginning. Later its length might be increased.
2. That the sections of the journal consist of the following:
   - A. ARTICLES. The articles to be of a technical or semi-technical nature that are clear to any intelligent reader whether he be technically trained in range or not. Each article should be no longer than 15 printed pages with an upper limit of 20 percent of their length in tables and figures. At cost to the author, however, this length and space may be greater.
   - B. ABSTRACTS AND REVIEWS. This section to contain abstracts of articles and reviews of books pertaining to range.
   - C. NEWS AND NOTES. This section to feature names and activities of members.
   - D. LETTERS AND COMMENTS. This section to contain letters and comments that members of the society might wish to have published.
   - E. MEMBERS. This to be a list of members with addresses, to occur in the final number each year.

It should be mentioned that the Committee recommended a small journal to hold down the cost of publishing—about $11.50 per page.

In the first issue of the journal literature only is cited. We hope to have abstracts in the next issue. These will be of articles in technical and semi-technical journals and bulletins and circulars. Space will not permit including abstracts, or even listing, of the many fine articles that appear in livestock and similar journals, nor mimeographed and progress reports of one kind or another.

The editorial board wishes that each member of the Society will undertake to send in any news and notes that might be of interest to others.

At the Salt Lake City meeting it was decided to include advertisements also. These will be placed in the back portion of the journal and will be included as they become available.

The editorial board wants members of the Society to feel that the journal is theirs. Members of the board are willing to work hard to make the journal useful and worthwhile, but success will depend largely upon contributions from members. We need good suggestions and good articles. The first issue is only a beginning. Those that follow we hope will be better.

Milestones in Range Management

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RANGE management has just reached one of its most important milestones —the formation of a professional society. In fact, this organization with its own printed journal represents far more than an ordinary section marker or even a township corner post. It is better compared with the setting up of a base line which will orient and guide range managers for all time.

We have been a long time in organizing the society considering that our job is concerned with half of the United States —more than 700 million acres in the West and 200 million acres or more of forest and open range in the South. It is high time range men were banding together to attain nation-wide recognition as a professional group. May we grow strong and take our rightful place with other technical groups such as ecologists, foresters, agronomists, and animal husbandmen, and with organizations of ranchers and stockmen.

Although our organization is new, the profession of range management already has a long history. This is an appropriate time to review the milestones that have been reached. Some of these are: 1) attaining control of range lands, 2) early development of principles and improved practices, 3) coordinating grazing with other land services, 4) research to develop scientific knowledge, 5) extension to disseminate research results to stockmen, 6) action programs to get good management into practice, 7) working for stability of range use, and 8) developing educational facilities to train range managers.

These accomplishments were made by practical range managers, researchers, and educators working together. This brief article does not allow space to cite all names and references for a full account. For the latest general compendium of range management information see Stoddart and Smith's text (*3*), and for details on research see "The History of Western Range Research" (*5*). For the most complete information on the extent and condition of ranges as of 1935, see "The Western Range" (*4*).

Range Land Control

Control of land and livestock—the actual ability to regulate the time and place of grazing as well as numbers of animals—is the first step in range management. Control was well under way on privately owned and leased ranges in the Great Plains by the time of the cattle boom in the eighties. On public lands, mainly in the eleven far western States, control was an uphill fight all the way and was decades in being attained. Control of grazing is still a major problem on southern forest ranges.

Early exploratory studies by the U. S. Department of Agriculture provided the initial stimulus for attaining control on public range lands and making a start toward management throughout the West. Up to 1895, there had been botanical explorations, and agrostology and pasture studies but no outstanding work had been done on range management problems.

It is interesting to note that range managers have organized as a professional group exactly a half-century after the first exploratory range management investigations were made by such men as

F. V. Coville, H. L. Bentley, Thomas A. Williams, and Jared G. Smith. Several of these studies were published in 1898 as bulletins of the Divisions of Agronomy, Botany, or Forestry in the U. S. Department of Agriculture.

Aggressive administration and management of forest reserves was begun by the Forest Service when transferred to the U. S. Department of Agriculture in 1905. The objective was sustained, productive range on which to build a sound grazing enterprise and to provide economic family units. Even when this milestone was passed, the bulk of public lands still lacked effective control.

Indian range lands were next. They received some attention in the Southwest as early as 1910. By 1930, supervision of grazing activities was delegated to the forestry branch of the Indian Service, and a systematic program of range management was set up to meet the specialized needs of these lands, nearly 50 million acres in area.

Part of the unreserved public domain was brought under control by the Taylor Grazing Act of 1934, after decades of range exploitation. In 1936, the Act was amended to include the entire area. Thus, the Grazing Service was born and started on the long road to good management of some 134 million acres in 10 western States.

The last remaining "free range" is in the South, where it has long been the custom for the farmer-stockman to burn the range and to graze his animals on large blocks of cut-over forest land, much of it sparsely stocked with timber. These forest ranges, however, are in large part privately owned, and it appears only a matter of time until grazing is brought under fenced control in order to allow more effective production of timber as the primary crop.

Range Management Principles and Practices

Recognized basic principles of range management stem largely from the studies of James T. Jardine and Arthur W. Sampson on national forest ranges, beginning in 1907. Four of these principles are so well known that perhaps they are taken too much for granted: 1) proper kind of livestock, 2) proper number of livestock, 3) correct season of grazing, and 4) proper distribution of animals over the range. Jardine and Anderson's bulletin is a monument in describing these principles and their application (*2*). To these four principles must be added a fifth—that of multiple use to protect other land values such as watersheds, timber, wildlife, and recreation.

The development and improvement of specific practices to apply these basic principles on each range has led past many milestones, but new vistas are ever unfolding ahead. Let us call the roll of a few outstanding procedures and practices.

1. Range surveys and management plans, inventorying range forage and resources in order to fit improved practices to the individual range unit.
2. Deferred and rotation grazing, in which a different part of the range is deferred each year in rotation until the more important palatable forage plants have made vigorous growth and have reproduced.
3. Recognition of range readiness, so as to delay grazing on seasonal ranges until the important forage plants have made sufficient growth to withstand grazing.
4. Conservative grazing, which requires a degree of stocking sufficiently moderate year in and year out to improve depleted ranges and maintain forage plant cover, litter, and soil in satisfactory condition.
5. Standards of range utilization, condition, and trend. These are earmarks and criteria to guide the range manager in determining whether the forage is properly utilized, whether the range is in good or poor condition, and whether it is improving or going down grade.

6. Better distribution of animals on the range through development of fencing, watering places, and salt grounds.
7. Range seeding, to improve the forage stand and restore run-down ranges to full productivity.
8. Control of noxious plants, insects, and predatory animals.

Every range man has his own familiar examples of applied management that have paid off. For an excellent statement on applied range management see the 1948 Yearbook of Agriculture (*1*).

It is one thing to develop such management practices; it is another to get them applied and follow up the benefits. The research and action programs that have brought this about make up a large part of our story from this point on.

Range Research

The building up of strong range research organizations has been the means of furnishing scientific information on which improved practices are based. This attainment was a long, slow process and has been fully described elsewhere (*5*). A great deal of fine research was done by the Forest Service, the Bureau of Plant Industry, and the State Experiment Stations through 1927. But even in 1927 there were barely 40 full-time technical range research workers in the whole country, including men in range animal husbandry and range economics.

The turning point came in 1928 with the passage of the McSweeney-McNary Forest Research Act. Under the range research authorization of this Act, Forest Service range research doubled in the next 2 years and expanded periodically to meet needs as they arose. Fundamental range studies were pushed in ecology, physiology, forage utilization, condition, and artificial reseeding. Work was stimulated on range plants, animals, watersheds, soils, wildlife, and economics. Today there are probably 200 technical men engaged in the various phases of range research throughout the country. The impact of this organized research on range management is tremendous in furnishing needed facts for action programs.

Range Management Action Programs

From a humble beginning on a few progressive privately owned ranches at the turn of the century, range management has made remarkable strides through the cooperative efforts of stockmen and various public agencies. But the controversy still raging over grazing capacity, range watershed protection, and public land management is ample proof that the job is far from done.

Progress in range management was slow in States with large areas of public lands because of lack of control. With this hindrance now overcome the way is clear for real management. On the national forests, since they were placed under administration in 1905, the aim has been to provide a sustained forage supply and watershed cover on these 80 million acres of usable range lands. Tangible evidence of aids to best use of the national forest ranges is found in completion of range surveys and management plans for 80 percent of the allotments. These plans and the building of 17,000 miles of fence, 5,500 miles of stock driveways, and 11,000 water developments are accomplishments of no small value to the range users. Consequent benefits accrue to some 28,500 ranchers, grazing 1,300,000 cattle and horses and 3,400,000 sheep and goats on national forest ranges, not counting calves and lambs grazed free.

The 50 million acres of Indian lands make up another sizable area of public holdings where range surveys and management plans, water developments, and several thousand miles of fence have been completed.

Since its establishment in 1934, the Grazing Service has made progress in protecting and improving grazing dis-

tricts. Range surveys have been made on about half of the 134 million acres in the districts, and a range improvement program including more conservative grazing, water development, reseeding, and trail construction has been of real value to the 20,000 permittees with their 10 million head of livestock.

Conservation programs have given a real impetus to private range land management. The Soil Conservation Service has been especially effective with its on-the-ground farm and ranch plans within organized soil conservation districts. The report of the Chief for 1946 shows a total of nearly 41 million acres of range for which proper stocking was planned, with first-time application on 24 million acres in fiscal year 1946 alone. Range seeding was estimated to have yielded 1 million animal months of grazing. Other important practices included deferred and rotation grazing, water and fence development, and water spreading.

The inauguration of the range conservation program of the Agricultural Adjustment Administration in 1936 under the Domestic Allotment Act was a truly important step in the interest of good management on private range lands. The encouragement of better practices through incentive payments was an entirely new and effective approach. Almost 95 million acres of private ranges were under the "Grazing Land Management" practice, according to the 1947 annual report of the Chief of the Production and Marketing Administration. This acreage is all in the 11 western States and in North Dakota and Kansas. In addition, deferred grazing was applied on more than 3 million acres, and several thousand acres were seeded.

Many thousands of acres of private range land are under good management but not under any public action program.

Everyone concerned with the western range can point with pride to the fact that the livestock industry using this resource is much more stable now than it was 3 years after World War I. No doubt, conservative Government loan policies are in part responsible, but the widespread appreciation and application of conservative grazing and other good management practices have played an important role. Economic studies showing the financial advantages of good management have been especially convincing to the doubters. To avoid the periodic boom-and-bust cycles of the past, range men must see to it that the lessons learned are carried through the present period of financial inflation.

Other Land Services

Range managers have reached other milestones in recognizing the values of range lands for watershed protection and wildlife management. With the rapidly expanding dude ranch business, even recreation is coming in for its share. Range men are largely responsible for the improvement of conditions on overstocked big game ranges, such as those supporting deer herds on the Kaibab, Modoc, and Pisgah forests.

Likewise, range men from the beginning have been alive to serious watershed protection problems all the way from the high Wasatch Plateau in Utah to the Rio Puerco and Salt Rivers in the Southwest. Perhaps even more important has been the range manager's recognition of and willingness to help overcome the unspectacular but accelerated sheet erosion by water and wind. Half of the entire western range has suffered severe or extreme forage depletion, and it is but natural to build up forage, soil, and watershed values together.

Education and Extension

Until recently there was no formal training in range management. As late as 1935, range positions were being filled

mainly by men trained in related fields, such as agronomy, animal husbandry, ecology, and forestry. This call on related sciences is good for a broad background, but there is definite need to train men specifically for our difficult range management job. We may well be proud of the many schools in the West which are turning out trained range men.

Extension work in range management, while making some progress in the past 15 years, has lagged far behind the advances in education, research, and public action programs in other fields. While several States carry on some range extension through county agents and specialists in related lines, not a single State extension range manager is shown in the 1947 list of workers in Land-Grant Colleges and Experiment Stations. This does not mean, however, that there are no trained range men in the Extension Service. The few known range men in this work are listed as agronomists, animal husbandmen, or foresters. Our Society should have something to say and do about this!

The Road Ahead

Although we have passed many milestones, we still have far to go. The outstanding tasks facing range managers may be summarized as:

1. To improve management of ranges that are not yet under organized programs and thereby receive latest and best information on forage plants, range conditions and utilization, management practices, seeding, plant control, and the like. These lands may amount to as much as one-third of the total western range area. They are an especially fertile field for work by the Extension Service, the Soil Conservation Service and the Agricultural Conservation Program of the Production and Marketing Administration.

2. To build up damaged ranges by strengthening and maintaining management on public and private ranges already under organized programs. This means getting herds down to the grazing capacity of the range, building range improvements, controlling erosion, and handling big game and other wildlife. It especially means stepping up the range seeding programs on nearly 80 million acres too seriously depleted to be restored through natural means.

3. To put southern forest ranges under control, and start management.

4. To continue and expand research to adapt range management practices to changing biological, economic, and weather conditions. Particularly urgent is fundamental research in forage plant behavior, noxious plant control, and range seeding.

5. To encourage continued progress in related fields such as, forestry, animal husbandry, wildlife, and economics.

6. To initiate an aggressive range extension program.

7. To continue to develop sound educational facilities for training range men.

8. To promote the professional welfare of range men through the American Society of Range Management, and by cooperation with similar societies in related fields.

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Getting New Range Plants Into Practice

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PERHAPS the easiest way to get people to reseed range land is to claim that you have discovered, produced, or introduced a plant that is the perfect panacea. It should have universal adaptation, no limitations, and require little more than casual broadcasting. It should, of course, be grazed the first season and stringently thereafter with very little management. None of us has yet realized this dream. Getting new range plants into practice still requires painstaking testing and a long siege of transmitting our findings to land owners and operators by education and demonstration. It is just hard work, unless one schools himself to enjoy increments of progress and the occasional reward of finding something just a little better or someone a little more willing to adopt something new but yet not sensational.

The discussion here will be from the viewpoint of an agronomist, but it has been necessary to devise methods that facilitate the introduction of new material and methods for a wide variety of farm and ranch lands. My job has been to provide the soil conservationist with good plants and good methods for conservation seedings out on the job. He can not use "cut and try" methods if he is to be successful in getting conservation on the land and gain the confidence of the people in the Soil Conservation District to which he is assigned. He can implement effective soil and water conservation when a large number of ranch people adopt his recommendation. Materials and methods that work facilitate his job.

There is nothing glamorous or sensational about what we have learned from our work, but we have employed some principles that have proved practical and have facilitated the adoption and use of new plants and new methods. If there are things here that might facilitate range reseeding, they will promote soil and water conservation in the West.

Experiences in testing plants may be portrayed by dividing the subject on the basis of answers to the questions why, what, how, and where. It is assumed that the areas we are discussing really merit reseeding. This qualification is made because experience indicates the wisdom of not trying to reseed range lands where some good method of grazing management will restore climax grasses and improve the condition class.

Why Do We Test?

Every test involves some kind of measurement. The very fact that we are testing implies that we are seeking something better than what we have. When grasses and legumes are tested, appraisal of their forage value is usually accepted as a primary consideration. More feed, better feed, feed at the right time, and consistent production are the objectives. These objectives are broader and more complicated than just yield and adaptation. They are complex because they require husbandry for both the crop and the stock. They are further complicated by the fact that the crop may modify the environment. So, we must test and measure all of these effects.

When forage crops are tested, it is implied that they will be planted and grown. Immediately this involves culture. The agronomist knows that success with grow-

ing the crop depends, in large measure, on good cultural techniques. He regards the study of cultural requirements as an important phase of testing. He has learned that improper cultural techniques have resulted in discarding a number of otherwise good plants. We often say that we use applied ecology in our tests but fail to include the item of culture that is an important factor in modifying the natural environment of the plant at some critical stage as, for example, during seedling development. Success with many plants depends on the skill with which this is done. Also, lack of attention to the minimum cultural requirements has been one of the reasons why so many large-scale seedings have failed.

Both the grazier and the agronomist are aware of the importance of good grazing management on sustained production by range and pasture crops. The tenets of good management are the same whether the forage is grown on farm land or on grazing land. A rather new concept is developing in the field of management that has a cumulative effect on production. I refer to designs for utilization that provide a liberal amount of organic residue. This has soil and water conservation value and also contributes to increased production. Therefore, in the quest for something better, the tests must be made with a particular kind of grazing management in mind along with its indirect effects.

The conservationist grows forages on cultivated land for the influence they have on soil structure. Improvement in structure that is brought about by the effect of grass roots on soil aggregates sets in motion a chain of events that result in increased infiltration rates, higher fertility levels, and greater resistance to erosion. Obviously, this leads to better and more consistent yields. It has prompted the study of root production as an objective of testing. Work in this field has resulted in giving a favored place to species and strains that otherwise might have been rejected. I am confident that the soils of range lands are subject to similar improvement and suggest that this be studied.

The objectives for testing grasses and legumes are similar for the agronomist and the grazier, but they differ in that the plants used on cropland must give optimum performance for a relatively shorter period than those planted on range land, and some adjustments must be made in testing range plants to compensate for this difference. The agronomist may fertilize or even irrigate the crop, and he can substitute a better variety each time the rotation cycle comes around. The grazier can hardly use these devices; so he must lay stress on finding material and systems of management that maintain yields for long periods. His reasons for testing are to bring plants, animals, and soil into adjustment to obtain sustained production at practical levels.

What Shall We Test?

The first inclination is to test everything; thus a huge assortment of material is gathered from every possible source and planted "to see what will happen." Further, each time a new employee comes to that location he repeats the process. Lists have been seen that include every possible species from the tall-grass prairie, the short-grass prairie, the Palouse bunchgrass prairie, and even from outside the grassland formation for a new nursery in a warm-temperate Mediterranean climate. I have been guilty of a certain degree of this indulgence myself. One hesitates to suggest that there are better ways, because it crosses the grain of human nature. However, the range ecologist has at his

disposal some devices of considerable objectivity. He knows what the species of the climax vegetation should be. He should know the existing successional stage on the site and the probability of site improvement. He should know the limiting factors to plant growth where he will test his material. By using this information, he should be able to approach the *what* by choosing species that are similar to those that compose the climatic climax or the existing association. In fact, he must compare the new materials to these standards.

There are several well-known sources for plant material. They divide themselves into two categories: (1) species from commercial channels, foreign plant introduction, and the native vegetation; and (2) strains, ecotypes, and hybrids that have been selected or produced by professional plantsmen.

During the decade and a half that marks the beginning of grassland agriculture in America, a vast amount of material of all kinds has been assembled and produced. The tendency has been to refine and subdivide the material to narrower and narrower limits of inherent genetic constitution. For this the agronomist may have to assume the responsibility since he is dealing primarily with short-ley seedings on cultivated cropland. The range man must remember that his is a different problem that may suffer from too much over-specialization of plant material. Objectively, then, he will profit from reasonable generalization, regardless of source of the material. A nice example of over-specialization has been reported by Colonel W. H. Leonard. Japanese scientists developed strains of rice during the prewar period that were high in production when heavily fertilized. After the war when fertilizer was available in smaller quantity, these highly specialized strains broke down badly with a disproportionately low yield. We have had similar experiences with strains of native wheatgrass.

There has always been a mystic appeal to anything imported from foreign lands. I would be the last to contend that foreign plant introductions have not been beneficial in America, but after many years I am persuaded that an equal amount of work on native forage plants would have produced remarkable results, especially for non-cultivated areas, albeit such work is more prosaic. Introductions should not be overlooked, but the beginning tests should revolve around plants that resemble the climax or a closely related seral vegetation.

We have made good use of materials from the native vegetation in our work. A surprising array of strains within species have been discovered but we found that they could be grouped into a few "strain types." This terminology is artificial, but we have used it because we were not in a position to determine if the material merited such distinctions as ecotypes or varieties. We did learn that a good native type outyielded commercial species and varieties and new introductions when planted on low capability land, especially during years when climate was decidedly limiting.

All sources of material should be examined when making lists for testing, but the final selection should include species similar to those in the climax association and over-specialized strains should be avoided. This will reduce costs and allow for more attention to studies of culture and management. Culture and management are dominant influences on plant growth on low capability lands, and it is our conviction that the more remote the species are in relation to those in the

climax, the more intensive the culture must be to get optimum performance.

How Shall We Test?

If one has fully developed the answer to *why* he is testing and has used good judgment in choosing *what* is likely to succeed, he can plan his methods for testing objectively. Methods may be general or precise like shooting at a target with a short-range shotgun or with a long-range rifle. Really, both general and precise methods are useful depending on the nature of the objective. However, they are frequently misapplied.

A beginning step for testing is usually the planting of the newly assembled material in a row nursery. Let us say that the commonly accepted broad objective is adaptation to climatic and edaphic conditions. It is almost patented that yield is the criterion for decisions, at least among agronomists. Where this is the case some erroneous conclusions can be reached. A few examples may serve to illustrate this point.

Some contend that a nursery for testing adaptation of range plants should not be cultivated. Accordingly, the material is planted and left to fight it out with the resident annual grasses and other volunteering vegetation right from the beginning. If any species should fail to yield well under such rugged competition, it is regarded as not being adapted. Nevertheless, some very useful grasses and legumes can easily be overlooked in this way. Some grasses that have good possibilities for range or pasture have weak seedlings, but after they are established they maintain their stands against competition. All they need is a little culture during the seedling stage. The kind of trial just cited therefore confuses two objectives—adaptation and minimum cultural requirements. It was found profitable to separate these objectives. Study of cultural requirements includes only material that is adapted to the soils and climate of the site. By this method it has been possible usually to find a satisfactory cultural procedure for good materials.

Many nurseries contain a heterogeneous mass of material, and, all too often, a single criterion such as total yield of dry matter at hay stage is used to sort it. Where this method is used, one ends up by finding that he has tried to compare dissimilar material with confusing results. It is not unlike trying to compare elephants, sheep, and chickens to determine the probable use for "animals." This is a crude example of incorrect method, but it is just as misleading to compare mountain brome (*Bromus marginatus*), intermediate wheatgrass (*Agropyron intermedium*), and Sandberg bluegrass (*Poa secunda*). To improve this situation we used the row nursery to divide the materials into "use groups" and compared only within groups. For example, vernal dominant bluegrasses were compared with each other but not with the summer-growing grasses. This suggests that for range reseeding the grasses that have promise for spring-fall use should not be compared with those that could provide summer grazing and so forth.

Each use group should contain a standard to which the others are compared. For example, commerical slender wheatgrass is the standard with which mountain brome, Canada wild-rye (*Elymus canadensis*), blue wild-rye (*Elymus glaucus*), bearded wheatgrass (*Agropyron subsecundum*), and Italian ryegrass (*Lolium multiflorum*) are compared. These grasses are a group wherein the members are more like one another than they are like other grasses when one considers their salient characteristics from the standpoint of their use and management in the field.

It would be disastrous to compare any of them with grasses in the groups exemplified, respectively, by Idaho fescue (*Festuca idahoensis*), orchard grass (*Dactylis glomerata*), purple needlegrass (*Stipa pulchra*), or western wheatgrass (*Agropyron smithii*). The group exemplified by slender wheatgrass (*Agropyron trachycaulum*) depends on reseeding for its longevity. High seed yields, rapid germination, and vigorous seedlings make this possible. If they are harvested before the seed matures they are relatively short-lived; and in a nursery where the method is to compare grasses on the basis of total production of dry matter at the hay stage, one would fail to discover the merits of these species.

Many other examples of objectivity in nursery and plot testing could be given. Those cited point out the need for using methods that have well-defined but simple objectives that are based on the use of the plants. This seems to be the best hope for finding something better than what we have in time to get a big and important job done.

Our testing work has been divided into the following steps: (1) An adaptation nursery in cultivated rows but not replicated. Here comparative notes are made at all the important growth stages. Species are tentatively placed into their use group and strain types are determined. (2) A replicated row nursery by use groups. Species within use groups or strain types within species may be compared by some pertinent measurement. The measure may be yield, response to treatment, or anything appropriate to the objective of further sorting the material for use. (3) Plot trials in solid-seeded pure stands with material from the replicated nursery. Plots are one step nearer the actual field conditions under which the plants will be used. Again, any measurement appropriate to the objective is applied, but usually within use groups. (4) Cultural trials in plots to determine the minimum requirements for management in keeping with specific uses. The objective may be establishment, competition in mixtures, response to fertilizers, response to clipping or grazing, et cetera, but seldom a combination of objectives. (5) Seed production trials under conditions similar to those that will be used on farms.

This system is a series of screens that gets finer and smaller with each step. The first contains the most material and the last contains the least. You will notice that use groups and single objectives dominate each step in the series. Cooperating research agencies extract materials anywhere along this line. Materials for plant breeding or disease resistance studies may come from the adaptation nursery or the replicated nursery. The products of plot trials may be used to test palatability or coefficients of digestibility. A promising combination of grasses and legumes from the mixture tests in the cultural trials may be used in a grazing study or in a study of erosion control. The objectives of each kind of trial are known to all agencies, and the results each one gets facilitate the supplemental work of others.

Another consideration in how to test is the design of the trial. Much has been written about design by agronomists and statisticians, but the truth is that little has been said about designs for perennials and even less has been said about designs suited to low capability lands. At the moment we have a tendency to make a fetish of this tool for investigation work. Elaborate designs are applied to adaptation nurseries on low capability land that were intended for use only where small differences among crop varieties are to be

evaluated on good farm land. I have seen adaptation nurseries on low capability land that contain materials from several entirely different use groups. Usually, only one criterion of evaluation was applied, and the data were analyzed as a single trial. I would be the last to discount the value of statistical analysis of data, but wisdom must be used or regrettable and costly mistakes in procedure will be made. To illustrate: a nursery that is replicated and randomized according to some common design contains Sandberg's bluegrass, crested wheatgrass, mountain brome, Indian ricegrass, pubescent wheatgrass, and sheep fescue. Yields are taken at the hay stage for each of five years. One could easily conclude that mountain brome is valueless because it produced a good crop for only three years, with no opportunity to reseed. The Indian ricegrass failed to germinate because the technician did not know how to grow it. Sheep fescue was low in yield, yet it probably had produced several tons of roots that improved the soil and a good dense top growth that protected the surface from erosion. One might conclude that pubescent wheatgrass has no claim to further consideration because it yielded less than crested wheatgrass; yet it was well adapted and had a different season of use than crested wheatgrass that would make it very useful on that range area.

A good agronomist once concluded that something was wrong with his data because there were no differences in yield among several grasses in a use group at the 5 percent level. These tests were made where soil and climate were limiting to growth. However, there were differences that were important only if yield was the same, but he did not discover them. These illustrations make the point that refinement in designs of testing may lead us astray unless we are wise in applying them and comparing like things within the capabilities of the site and within well-defined objectives.

We have learned that interactions are very important when working with perennials and design our trials to evaluate them. A few of these should be mentioned. Some of the most significant are those where "seasons" are one of the interacting factors because fluctuations in climate are notoriously great in the range area. Our study of this interaction has resulted in a hypothesis that those species or strains that fluctuate least in production from year to year are best adapted to a site. This view has provided an *a priori* means for finding material with wide genetic constitution. The influence of season on some unit of performance must be segregated from that resulting from age of the perennials. Such relationships have an important bearing on use and management of established stands. For instance, we have found a considerable variation among species of the dryland bunchgrass group with respect to the years required to reach full production after seeding, and the differences became greater as the conditions of the site became more limiting.

Treatment is a factor in interactions. This is a broad term but includes factors we can control. It seems unwise to compare grass that is planted on abandoned tillable land with native pasture on untilled land. Yet this has been done, and the conclusion was that the native grasses were inferior to the commercial species. This is much like comparing a breed of domesticated sheep with its wild progenitor. Clipping versus harvest at the hay stage has produced several differential plant responses even among strains within a species that would not have been apparent had only one treatment been given. When designing such an appraisal, care is required so that each species or strain is treated at comparable growth stages. If

this is not done the results may be misleading, as anyone conscious of season-of-use influences would surmise. A common illustration is the "calfeteria" method for testing relative palatability of a list of grass species from several use groups.

The compounding of mixture seedings results in interactions that can be important but are often overlooked. Here the use group concept is again helpful. In the area where the bunchgrass association is the climatic climax, interactions between bunch and sodgrasses are very noticeable, even among wheatgrasses, and analyses show that production per acre is determined by the bunchgrass. Another interaction, somewhat more complex, emerged from our mixture studies. It involved "place" and use group. An example is the mixture of crested wheatgrass and big bluegrass (*Poa ampla*), where the wheatgrass determined the yield at a semihumid location, but the bluegrass determined it at a semiarid station. These and other results have led us to believe that some theories about mixtures of perennials deserve careful examination. A common one is that the deliberate compounding of complex mixtures with species having widely different seasons of use will extend the probable grazing period. Our results show that this theorem is valid only when a skilled and well-trained operator manages the livestock. This does not happen very often in practice; so we believe that simple mixtures of species having similar seasons of use are to be desired. At least we know that production is as good or better than that from heterogeneous mixtures and that management is simplified. It does mean that adjacent but separate pastures are required to extend the grazing period.

Plant diseases sometimes influence the performance of a grass. Mountain bromegrass strains vary widely in vigor and in yield, but this rapid-developing grass depends on reseeding for its longevity. A strain susceptible to head smut, even if otherwise robust and vigorous, is destined to extinction, while a resistant one will be in production for a long time, although its annual increment of production is somewhat less.

Rodents are another biotic factor interacting with plant performance that must be reckoned with, especially in small plots. Any western range man knows what may happen to his trials with grass in the center of a sagebrush area if he forgets to control rodents.

Many other examples of interactions could be given, but I am sure that failure to recognize that they are especially important when working with perennials and failure to include them in the design of investigations has led to errors in interpretation of results. There are several that influence the performance of plants on the annual grass range, but they would support the theme that one must recognize interaction and exercise wisdom in design of trials.

Where Should We Test?

There are three things that have been valuable guides for deciding where to test grasses on agricultural lands. They should have counterparts on range lands. They can be illustrated by recounting how the system of outlying nurseries was devised and used in our work.

It is obvious that a single test under moderate conditions in large crop zones like the North Pacific coast or the Columbia Plateau would not serve the agriculture of these zones. Within them are smaller areas that differ significantly in the major factors that limit the growth of grasses and legumes. A system of outlying nurseries was devised into which were placed a limited number of type materials and type practices from the

large central nurseries. They supplemented the findings in the large nurseries. The idea is not new, but it was revised to suit the needs of perennial plants.

The tendency for the grass man is to institute too many supplemental trials. He may be borrowing the idea from the cerealist, forgetting that his material is perennial, does not have the advantage of frequent cultivation, should not have a narrow genetic constitution, and will not be planted on high capability land. For these reasons his outlying tests can serve a large area with respect to edaphic and climatic factors. We have abundant proof of the wisdom of this viewpoint. It is unavoidable that it combines "what to test" with "where to test." It has been profitable for us to take a good strain or composite with rather wide genetic constitution and then select the location of outlying tests on the basis of agricultural enterprises or soil groups rather than on the narrower basis of crop variety areas or soil types. The range ecologist has devices he can use to divide his area, but only to the extent required for perennials with wide constitution.

When an outlying nursery is established, attention should be given to correct land use. It is all too common for people to suggest that land best suited to the growth of timber or brush be converted to grassland for grazing. It is also common for people to believe it is easy to plant grass on open range totally unsuited to any cultivation. They usually come to this idea after the land has been denuded and eroded by either improper use or management. In a few instances reclamation has been achieved, but time after time we labor for years on such sites despite continuous failure. It may be a long time before the end justifies the expensive means that are required to establish and maintain good perennials on these places. Strict compliance with the tenets of correct land use will avoid the selection of these sites for the initial outlying tests.

When an area is selected for testing we have learned to consider the major land capability classes represented in it. This broad classification expresses the plant producing potentials of the land and the limitations with respect to its use. It is very common to find several capability classes on one farm or ranch. When one is working in a new area it has been wise to begin on the better land and work toward that having the greatest limitation. I recall a circumstance where an outlying nursery was established in an area representing more than a million acres of land. The major part of the area was used for grazing. The vegetation was all annual with a very short season of use. Overgrazing, run-off, and soil erosion were common. The area contained three typical land capability classes. A considerable portion of it had been used for grain production but was abandoned. This part was tillable. Many attempts had been made in the area to establish perennials but usually on the poorer land on which no preparation was possible. They were failures. By confining the trials to the tillable land with higher capability and by using appropriate but simple cultural techniques, it was possible to establish several good perennials, extend the season of use by several weeks, and get higher yields per acre. When the value of this work is fully recognized and adopted by ranchers, it will then be time to devote attention to the land having lower capability. I am sure that every potential grazing area where trials are contemplated has these differentials and that it will be profitable to treat the better ones first; in fact, I have seen this done to good advantage.

We have used a fourth device for the *where* of testing that is related to getting things in common use by ranchers. It really supplements the central nursery and the system of outlying nurseries. We call it "field-scale trials." It is really a controlled demonstration planting on a limited number of typical farms in an enterprise area. In such a planting we use either a new species, variety, or strain or a new cultural or management practice that has been promising in the nursery trials. It is applied on an entire field adjacent to or near commonly used plants or methods and the two are compared. We usually supervise these plantings to make sure they are properly handled, because experience has taught us that just writing or talking about it, and then sending it out, doesn't usually get results. The people in that community are apprised of the comparison and can observe the differences, and we obtain comparative data while actually introducing the new things. This has shortened the time between investigation and application, and in these days that is important.

Summary

New range plants will get into practice if they provide more feed, better feed, and feed at the right time and if they give consistent production. There is no way to determine this except by testing them in comparison with what is on the range. It is especially important now that testing be facilitated and this can be done by a number of useful devices.

All tests should be objective with special emphasis on practical application. They should feature materials that resemble the climax grasses or a closely related association. The material should not be too specialized but should have broad adaptation.

A well-planned program for testing will have the larger number of plant accessions in simple comparative trials and fewer and fewer chosen accessions in a series of more complex tests that feature culture and management.

It will be helpful to sort the species into use groups and to test them within these groups. Strains within species can be classified into types and representative ones should be carried into advanced trials.

Designs for testing should be appropriate to the limitations of the site, to the objective of each trial, and to the plants in the test. Sight must not be lost of the fact that perennials are being tested and that several important interactions occur.

Tests that have featured an average location with respect to climatic and edaphic factors and a system of a few outlying supplemental tests have been more productive of results than a large number of small tests in areas that differ only slightly. The reasons are that long-lived perennials are under trial, that low capability lands impose limiting factors, and that culture and management are very important where animals, plants, and soil are integrated.

There is no substitute for judgment when conducting trials with range grasses. No system of methods succeeds well without it, but results are certain when the two are combined. If perchance there is also an urge to question dogma and to pioneer in unexplored areas of grassland agriculture, progress is assured. The real challenge comes when one is required to get good, sound findings into practical use on a large scale, but nothing is more urgent in these days when food is so badly needed and our range and soil resources are being de-

pleted faster than we seem able to replace them.

There is much to be gained from exchange of ideas and methods between agencies that work with range reseeding. An advantage from cooperative work is the greater rate at which we can accomplish this big and necessary but complex job. The final step in testing is getting a supply of good seed of authentic materials. Here the projection of probable needs by years in interagency meetings has been helpful. Those of us who work closely with the Crop Improvement Associations, Soil Conservation Districts, and other farm groups believe we can bring the better things into production within a reasonable time.

Succession in Sagebrush

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COMMON sagebrush (*Artemisia tridentata*) on the high grasslands of the Gravelly Range of the Beaverhead National Forest in southwestern Montana apparently will maintain itself indefinitely under natural conditions. This conclusion is the result of a 31-year-old study conducted by the Forest Service to determine the possibility of sagebrush giving way to grass under good management of rangeland.

The study area occupies a basin of deep loam soil at the head of Cherry Creek on the east side of the Gravelly Range. Before and during the period of early settlement of this section of the State, this entire range was grazed by herds of buffalo during the summer months. The last buffalo in the adjoining valley was killed in 1882. At this time the heads of the streams and the gently sloping grasslands had been reduced to areas of bare soil pocked with the wallows of the buffalo. On these areas they rolled, pawed, and threw dust for protection against insects. The wallows are still a feature of the landscape.

From 1882 until about 1914 little grazing use was made of the range and the bare soil was allowed to revegetate almost unhindered. During this period sagebrush gained a foothold and became established in favorable locations. Since 1914 the area has been grazed by sheep. In 1926 it was placed under systematic management, following a range survey.

Sagebrush plants in the stand had an average age of 61 years in 1945, by growth ring count. They became established, therefore, in 1885, and in 1915 when the study began, they were 31 years old. At that time they were 24 to 30 inches tall, and were thick and thrifty. A 30-foot square area supported 167 mature plants, having 659 basal branches extending from the plant bases. No other shrubs were present.

In 1932, 18 years after the study started, the plants had decreased in number to 114, with 224 basal branches, a loss of 32 and 66 per cent, respectively. No new plants were present. In 1936 only 93 old plants with 200 basal branches remained. However, the stand was beginning to show openings, and five seedlings were present in the open spots. The appearance of seedlings marked the turning point between sustained loss over a long period of years, and the beginning of replacement of the stand. At this time the reduction of old plants had reached 44 percent, and the loss of basal branches 70 percent.

In 1945, 88 old plants with 151 basal branches remained. In addition, the seedlings of 1936 had become well established plants. The old plant loss since 1915 amounted to 47 percent, and the basal branch loss 77 percent.

Total vegetation density and percentages composition of sagebrush, grasses and grasslike plants, and weeds present on the plots for each of the periods were as follows:

	1915	1932	1936	1945
Total vegetation density	.8	.7	.65	.5
Sagebrush (percent composition)	40	57	44	27
Grasses and grasslike plants (percent composition)	40	32	40	58
Weeds (percent composition)	20	11	12	15

Studies were made also of sagebrush invasion on a companion plot. In 1932 all the sagebrush on this plot was pulled, leaving it fully open to the sun. After five growing seasons, two new sagebrush plants were present on the plot, one 10 inches tall, the other 20 inches. In 1945, 14 years later, there were 33 plants present averaging 24 inches tall, and 243 other plants varying from established seedlings to 4 inches tall. The latter averaged 4 years old. Location of the seedlings, most of which were close to the older plants, indicated they came from seed of the older plants rather than from seed stored in the soil. The principal new stand was established in about 1941, and should reach the decadent condition of the older stand in about 50 years.

More general studies elsewhere on this range in 1945 showed a distinct trend toward increase of sagebrush in the grassland association. Many new seedlings and small plants now occupy areas formerly free of sagebrush except for a few scattered old plants. Once established such new plants increase the density of sagebrush cover and reduce the production of forage.

Discussion

It was apparent that the thick, thrifty stand of 1915 had to age sufficiently to break down into a more open stand before conditions were right for new plants to come in. As the age of the plants increased they became brittle and decay developed at the ground level. Basal branches succumbed first and later the plants would die. Because the plants were very thick in 1915, many plants died before the stand was open enough for the sunlight to reach the ground and permit seedlings to come in. This point was reached in 1936 when the number of plants had been reduced by 44 per cent, and the number of basal branches by 70 per cent. Seedlings began to appear then, and by 1945 these were firmly established. Fifty-two years elapsed, therefore, before new seedlings gained a foothold.

If the old plants had continued to die without replacement, the stand would eventually have passed out of existence, of course. However, with the stand opening up to the sun, new plants established themselves and maintenance began. At the present stage of this study the facts point toward continued replacement by new plants as the old ones die.

It may be concluded that the development of sagebrush in an established stand, under the conditions described, is inversely proportional to the thickness of cover present; therefore, the less the cover of sagebrush, the greater the amount of new growth which occurs. Also, that unless the habitat is disturbed unduly, sagebrush on sites favorable for growth probably will continue to reproduce itself indefinitely.

Correlation of the 61-year-old stand with periodic weather conditions indicates that its establishment in 1885 coincides with a period of favorable growing conditions for seedling establishment. Also, that the new stand in the companion plot established itself during a period of favorable moisture conditions. It may be concluded, therefore, that moisture conditions favorable for seedling establishment are necessary for the beginning of development of a thick stand of sagebrush, and also for its maintenance once the turning point of an established stand is reached.

At the elevation of this area, 8,300 feet, droughts are of little consequence, and are not as destructive to sagebrush as they have been demonstrated to be at lower elevations in this latitude.

Application of Results

In many of the high producing grassland areas where often only a few old sagebrush plants are found, numerous seedlings and small plants have become established, and more are coming in. If these are allowed to continue growth, it may be expected that the area of sagebrush will increase materially in the future. This will result in a decrease of forage, and also grazing capacity. Where high producing grasslands are involved, occupation by sagebrush will result in a major reduction in capacity.

Eradication of the parent plants and the new seedlings by grubbing, pulling, or by toxic sprays, represents a comparatively small task in many areas; whereas, if they are left until the problem becomes one of large areas occupied by dense sagebrush, the job becomes a major one which will involve appreciable amounts of time, labor, and money. Also the reduction of grazing capacity, and the management problems which are involved, will increase costs and reduce financial return to the dependent communities. Clearly action is needed immediately in order to forestall a large scale job in the future, and the inevitable reduction of numbers of livestock on those ranges where sagebrush dominance is now in its incipient stages.

The Mulch Layer of California Annual Ranges

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THE past few years of below average precipitation have emphasized the importance of a mulch layer on annual ranges in California. It has been apparent that where sufficient mulch was found germination was better, and early growth and total production of forage was greater than on ranges lacking enough mulch cover. It was observed also that where grazing animals had old forage in fall and early winter to eat along with the new, they scoured less and made better gains than where only new growth was available. A mulch layer also helps to maintain the percolating capacity of soils and prevent erosion.

In studying the mulch layer near Berkeley it was found that terminology applied to it varies among different workers (*1*, *4*, *6*, *7*, *8*, *10*, *11*, *12*). In an attempt to standardize terms and classification of the mulch layer on annual ranges in accordance with present usage, the writer proposes adoption of the terms—mulch, forage residue, and humic mulch. Applied in this way, mulch is a collective term which refers to the whole protective blanket of vegetation after the forage has dried. Forage residue includes all dried herbage of the past year's growth that might be used for grazing. Humic mulch is used only in referring to semi-decomposed materials which constitute but a thin layer on the surface of the soil.

Considerable work has already been done in determining the amount of forage residue which should be left on annual ranges to keep them in productive condition (*6*, *10*, *13*). This varies from about 400 to 1000 pounds per acre. However, few, if any, measurements of the humic mulch layer are available even though it has been used as an important factor in determining range condition (*6*, *7*, *10*, *12*). Since humic mulch on annual ranges is so thoroughly mixed with mineral soil, separation of it is difficult and time consuming. Accordingly, some method other than those used in other forage types (*4*, *9*) had to be devised for measuring the effect of intensity of grazing on the humic mulch layer of annual ranges.

Several workers have noted the increase in volume weight of soils brought about by grazing and cultural practices (*2*, *5*). In view of these results it seemed reasonable to assume that measures of volume weight of thin layers of surface soil might give usable measurements of the amount of humic mulch. If so, the effect of intensity of grazing on humic mulch could be determined indirectly by sampling the top layer of soil.

This was accomplished by using a 10-inch length of $1\frac{1}{2}$-inch water pipe sharpened on one end. After first clearing away green plants and residue, the sampling tube was sunk into the surface layer of soil to a depth of about 1 inch. Rotating the tube while sampling helped to avoid compaction and shear off the sample near the end of the cylinder. Volume of the sample collected was then determined by filling the hole with sand as described by Daubenmire (*3*). After drying in an oven for 24 hours at 105 degrees Centigrade, the samples were weighed and volume weights determined by the ratio of dry weight of soil and humic mulch in grams/volume in cubic

centimeters. Sampling was best accomplished when the soil moisture was about 20 per cent. If the moisture content was higher the samples were compacted; if much drier, the samples could not be retained in the tube. When the sample volume was between 30 and 40 cc., results with as few as 8 or 10 samples were fairly uniform. After dry weights were determined, the samples were placed in a muffle and ignited at red heat for $1\frac{1}{2}$ to 2 hours. Percentage loss by ignition was computed and this figure was used in correlating volume weights with approximate organic content of the top inch of soil and humic mulch.

Before extensive sampling was begun, Professor R. E. Storie of the Soils Department of the University of California prepared profiles from areas of Los Osos soil from which most of the samples were taken. These clearly show the effects of grazing in decreasing the amount of humic mulch (fig. 1). Close examination of these profiles revealed the humic mulch layer to be a heterogeneous mixture of partially decayed vegetation, including disintegrated parts of grasses and herbs, seeds, and mineral soil, interwoven by a fine mass of roots. Trampling by grazing animals and activity of earthworms were instrumental in mixing the humic mulch with mineral soil and making segregation of it impractical.

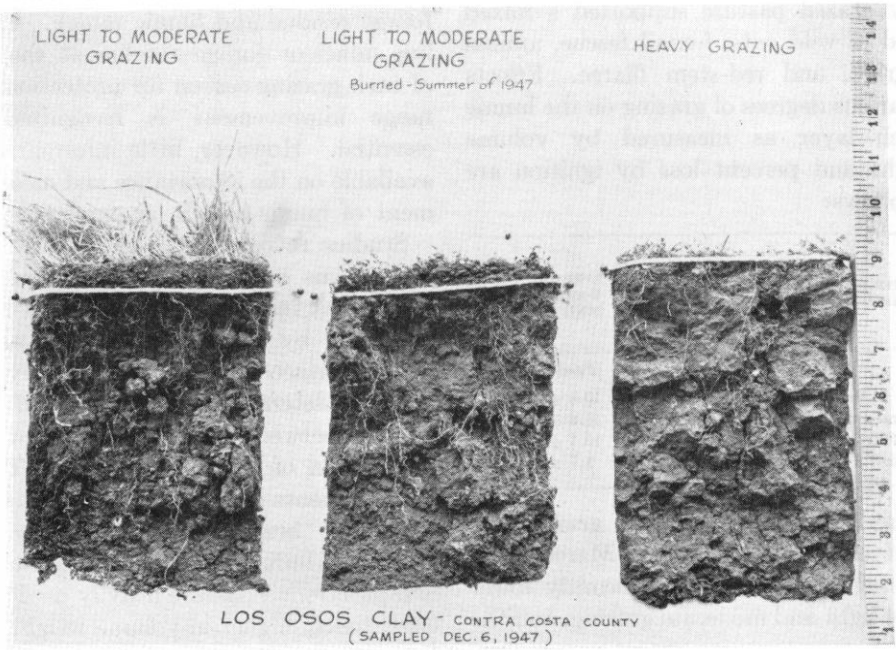

FIG. 1. EFFECT OF GRAZING AND FIRE ON MULCH LAYER OF ANNUAL RANGES
The string marks the approximate depth to which decaying plant materials are intermixed with the surface layer of soil. Fire removed the forage residue but had no apparent effect on the humic mulch.

Most of the sampling was done in an area protected for 14 years and in pastures used lightly, moderately, and heavily for the same length of time. Results obtained on the moderately and lightly grazed pastures were verified by samples taken in 5 other areas. Degree of forage utilization was determined according to

the method used by Hormay (7). Forage cover on the protected and lightly grazed areas consisted chiefly of wild oats (*Avena spp.*) and foxtail fescue (*Festuca megalura*). On the heavily used pasture, the cover was predominantly annual ryegrass (*Lolium multiforum*), Mediterranean barley (*Hordeum gussoneanum*), and red-stem filaree (*Erodium cicutarium*) with but small amounts of wild oats and foxtail fescue. The moderately grazed pasture supported a mixed stand of wild oats, foxtail fescue, annual ryegrass, and red-stem filaree. Effects of various degrees of grazing on the humic mulch layer as measured by volume weight and percent loss by ignition are as follows:

DATES OF SAMPLING	GRAZING USE	AVERAGE VOLUME WT.	AVERAGE LOSS BY IGNITION	NUMBER OF SAMPLES
		gms. per cc.	*Percent*	
March 1, May 10, and June 5, 1948 (combined)	None	.97 ±.03	10.8 ±.6	23
	Light	.95 ±.04	10.6 ±.5	24
	Moderate	.92 ±.04	10.3 ±.5	8
	Heavy	1.11 ±.06	8.7 ±.5	24

The results for moderate grazing are based on samples taken in March only. Volume weights were significantly lower under light and moderate grazing, and the approximate organic content was higher, than under heavy grazing. Differences were considered significant when the ratio of difference in means to standard error of difference was 2 or more. No significant difference existed among volume weights and organic content of samples from protected, lightly grazed, and moderately grazed areas. Volume weights were most variable under heavy grazing. This was attributed chiefly to compaction caused by trampling where only a small amount of humic mulch was found. A fairly good relationship exists between volume weights and percent loss by ignition. Generally speaking low volume weights are associated with high organic content and vice versa. Of course, direct comparison of samples can only be made in the same soil type. Between soil types differences in volume weight and percent loss by ignition could be due to inherent differences in the soils.

Conclusions and Summary

The mulch layer on annual ranges is comprised of two classes of materials, forage residue and humic mulch. Leaving sufficient forage residue at the end of each grazing season for protection and range improvement is recognized as essential. However, little information is available on the importance and measurement of humic mulch on annual ranges.

Studies reveal that humic mulch seldom forms a discrete layer on annual ranges. A method to measure this layer indirectly by obtaining volume weights of the surface layer of soil was devised. Limited determinations show good correlation between volume weight and loss by ignition of this surface layer. These measurements also bear out the fact that continued heavy grazing reduces the amount of humic mulch on annual ranges. Samples from a pasture heavily used were consistently higher in volume weight and lower in approximate organic content than adjoining protected, and lightly and moderately grazed areas.

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NEWS AND NOTES

W. T. White, Soil Conservation Service, Portland, Oregon, is in Italy for a period of six months to serve as a member of an agricultural mission sent by the Food and Agriculture Branch of the United Nations. The purpose of the mission is to increase Italy's crop and livestock production in an effort to lower food import requirements from the United States and other countries.

C. Wayne Cook of Utah State Agricultural College has taken sabbatical leave for a year to do advanced graduate study in animal nutrition at Texas A & M under Dr. Youngs. During Cook's absence Wallace R. Hanson, who taught range management at Branch Agricultural College at Cedar City, will teach range management at Utah State Agricultural College.

George H. Hart, who has been head of the Division of Animal Husbandry at the University of California since 1926 was made Dean of the Veterinary School July 1. Dr. Hart was honored last winter when his portrait was unveiled in the Saddle and Sirloin Club, Chicago, during the International Livestock Exposition.

Kenneth W. Parker, who has been Chief of the Division of Range Research at the Southwestern Forest Experiment Station, has been assigned to a special study of range conditions and trends throughout the six Western Forest Regions. The major purpose of the study will be to uncover, adapt or develop a method or methods for the determination and measurement of trends in condition of western national forest ranges. Parker will spend a large share of his time in the field gathering first hand information on this subject. For the time being his headquarters will remain at the Southwestern Forest Experiment Station, Tucson, Arizona.

C. Kenneth Pearse of the Forest Service was transferred recently from his position as Assistant Chief of the Range Division in Washington, D. C., to Chief of the Division of Range Research at the Southwestern Forest Experiment Station, Tucson, Arizona.

A. Starker Leopold of the Museum of Vertebrate Zoology, University of California, Berkeley, was in Mexico from about July 15 to September 15 under auspices of the Pan-American Union completing a study on game animals. This was carried on in cooperation with the Mexican Government.

Paul C. Lemon, who has worked in range research at Tifton, Georgia, with the Southeastern Forest Experiment Station, for the past six years, left his position there and is now teaching Botany in the Biology Department, New York State College, Albany, New York.

Robert A. Darrow has left his position in the Botany and Range Management Department of the University of Arizona and has joined the Forestry and Range Department at Texas A & M His duties began there at the first of August.

The next meeting of the American Society of Range Management will be held in Denver, Colorado, on January 24, 25, 26. Headquarters will be at the Shirley-Savoy Hotel. Plan early and come to the meeting.

Several members of the Range Society attended the Inter-American Conference on Conservation of Renewable Natural

Resources in Denver between September 7 and 20. One part of the agenda dealt with range and forest problems, including their relationships with other resources, the multiple-use concept, the effects of burning on plant successions, industrial demands, and related matters.

R. R. Humphrey, formerly with the Soil Conservation Service at Wenatchee, Washington, has accepted a position as Associate Professor of Botany and Range Ecology at the University of Arizona.

John C. Dibbern is now with the Southwestern Forest and Range Experiment Station in watershed influences. He was formerly in the Botany and Range Ecology Department at the University of Arizona.

The letter below indicates an event unique in the annals of range management for the entire west. For this reason it is quoted. The Lakeview Rotary Club deserves hearty congratulations for sponsoring this program.

"TO EASTERN OREGON COUNTY AGENTS:

Gentlemen:

A large scale sagebrush removal and fire fighting demonstration will occur on August 19th at the Elder Ranch at Valley Falls in Lake County. This will be the first public event of its kind ever held in the United States. The demonstration will show:

I. Sagebrush removal: a. Fire; b. Rail; c. Wheatland plow; d. Offset disc; e. Stump jump plow; f. Dixie harrow, g; 2,4-D.

II. Fire: a. How to use it; b. How to stop it; c. Best fire fighting equipment; d. Construction of fire line.

III. Reseeding: a. Equipment; b. Problems; c. Methods.

This whole thing is unique in several ways. First, it is the kick-off meeting for a long-time, rather ambititious range improvement project of the Lakeview Rotary Club. This sort of thing is completely different from any ordinary service c ub community program. They hope to make it a big event with a special day designated at the P. I. for "The Grass Man of the Year," national publicity, a worth-while annual prize, and a bigger five-year prize. Local livestock organizations are cooperating. Conceivably, it may be the largest range event in the west.

Second, the Forest Service Bureau of Land Management, and SCS are all cooperating. Public agenicies manage lots of Oregon sagebrush land and results here will apply to millions of their acres. The Forest Service folks have the know-how on this deal more than anyone else, but so far all of their demonstrations have been on their own land.

Third, no public demonstration of this sort has ever been given before.

Fourth, the things shown on August 19th in Lake County will apply for years to about a third of the total land area in Oregon and to land in *every* eastern Oregon county.

Therefore, the importance of this deal justifies local publicity in every county. In my opinion, the county agents should be there; and they should attempt to interest land owners with sagebrush or cheatgrass ranges. By all means, your livestock association should be represented.

You will get additional information about this, but please protect the date and begin to get other folks interested.

Very truly yours,

E. R. JACKMAN

Extension Specialist in Farm Crops"

Elbert H. Reid who has been engaged in range research at the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, has been

transferred to Washington, D. C., to become an assistant to W. R. Chapline, Chief, Division of Range Research, U. S. Forest Service.

C. H. Wasser, acting head of the grazing and range management department at Colorado A & M, is on sabbatical leave from October 1, 1948 to July 1, 1949. During this time he will do graduate work in plant ecology at the University of Minnesota. Mr. Lowell K. Halls has been appointed instructor in the college and assistant range conservationist in the Agricultural Experiment Station, effective September 15, 1948.

BOOK REVIEW

"Grass", Yearbook of Agriculture for 1948

THE yearbook for 1948 is a tribute to workers in the various fields of grassland management. For the first time the problems and accomplishments of range and pasture managers are brought together and presented in a well-blanced form by the U. S. Dept. of Agriculture. Articles are arranged under three main sections: Grass in the Nation's Life, Grass in the Ten Regions, and Grass in Charts and Tables. The first section deals with the place of grass in a permanent agriculture, its value in soil and water conservation, and the importance of grass on range and pasture lands. The second part describes the range and pasture resources and problems of various regions of the United States and its Territories. This section contains up-to-date information on characteristics, adaptation, and use of the more important native and introduced forage grasses and legumes. The last section of the yearbook supplies useful information on scientific and common names, seed statistics, and regions of adaptation of various grasses and legumes.

This publication should become a valuable reference book for all workers interested in grassland agriculture. Except for the drawings, the yearbook is not particularly well illustrated. In fact, more drawings of forage plants and fewer colored pictures would have enhanced its value to range men. Listing plants alphabetically by both scientific and common names should be welcomed by most field workers. Articles describing grasslands in different sections of the United States are necessarily general but should add to one's understanding of range conditions over the whole of the country. It seems as though more could have been said about the nutrition of grasses. Information on their value at certain seasons would be helpful in planning and putting into practice a profitable management and reseeding program. Although the arrangement of material is quite artificial, it serves to emphasize the importance of grass in the changing pattern of land use. The yearbook of agriculture for 1948 is a must for every range man's library. It may be obtained free of charge by writing to your congressman or from the Supt. of Documents, Washington, D. C. at $2.00 per copy—*D. W. Hedrick*, 231 Giannini Hall, Univ. of Calif., Berkeley, Calif.

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Compiled by: ROBERT A. DARROW, Texas A & M, College Station, Texas.

Index to Volume I

Constitution and By-Laws of American Society of Range Management

CONSTITUTION

ARTICLE I. NAME

Section 1. The name of the Society shall be the American Society of Range Management.

ARTICLE II. OBJECTIVES

Section 1. The objectives of the Society shall be to foster advancement in the science and art of grazing land management, to promote progress in the conservation and greatest sustained use of forage and soil resources, to stimulate discussion and understanding of scientific and practical range and pasture problems, to provide a medium for the exchange of ideas and facts among Society members and with allied technologists, and to encourage professional improvement of its members.

ARTICLE III. MEMBERSHIP

Section 1. Persons shall be eligible for membership who are interested in or engaged in practicing range or pasture management or animal husbandry; administering grazing lands; or teaching, or conducting research, or engaged in extension activities in range or pasture management or related subjects.

ARTICLE IV. OFFICERS

Section 1. The officers of the Society shall be a President, a Vice-President, a Secretary, a Treasurer.

Section 2. The Society shall have a governing body which shall be known as the Council and shall consist of the elected officers, the immediate past President and six elective members, each of whom shall be a member of the Society in good standing.

Section 3. The term of office of the President, Vice-President, and Treasurer shall be one year. The immediate past President shall serve as a member of the Council for one year. The terms of the six elected Council members shall be for one, two, and three years respectively for two each for the first term after this constitution is adopted. Thereafter, the two Council members elected each year will serve a three-year term. Terms of office shall begin at the close of the regular annual meeting after their election.

Section 4. The President and other officers, shall not be eligible to re-election to the same office until at least one year has elapsed after the end of their respective terms. The Secretary may be reappointed to a second successive term. Council members may be re-elected if they have not served a full term of three years.

Section 5. Vacancies in any unexpired term of office shall be filled from among the Society members by a majority vote of the Council.

ARTICLE V. NOMINATION AND ELECTION OF OFFICERS

Section 1. All officers of the Society, other than the Secretary, shall be elected by letter ballot which shall be sent to all members by the Secretary.

Section 2. The Secretary shall be appointed by the President, subject to confirmation by the Council.

Section 3. A nominating committee

and an elections committee shall be appointed by the President not later than May 1 of each year. It shall be the duty of the nominating committee: (1) to receive nominating petitions from the membership at large as provided in Section 3, (2) to prepare a list of candidates who are qualified for the elective offices, including the elective memberships in the Council; this list of candidates shall include all nominations duly presented to the Committee by petition as herein provided; this list shall include at least two candidates for each elective office, including each Council member position, but may include others than those received by petition; such list of candidates shall be furnished to the Secretary not later than September 1.

Section 4. Nominations by petition shall be subject to the following conditions: (1) each petition shall name but one candidate for each office; (2) all candidates nominated by petition must be eligible to hold elective office; (3) the petition shall bear the signatures of at least 10 voting members of the Society who at the time of signing such petition are eligible to vote by having paid their current dues; (4) petitions must be in the hands of the nominating committee by August 1.

Section 5. As soon after receipt of the final ballot from the nominating committee as possible, and not later than October 1, the Secretary shall send to all members a typed or printed ballot containing a list of all candidates made by the nominating committee or duly nominated by petition. An envelope shall be provided in which the ballot shall be enclosed, the envelope sealed and signed by the member voting and returned in a second envelope to the Secretary.

Section 6. All ballots received on or before November 30 shall be turned over, unopened, to the elections committee for counting. The candidate receiving the greatest number of votes for each office shall be declared elected to that respective office. In the first election of Council members the two candidates receiving the highest number of votes shall be declared elected to a three-year term; the two candidates receiving the next highest number of votes to a two-year term; and the two receiving the next highest number of votes to a one-year term. In succeeding elections the two candidates receiving the two highest number of votes for the Council shall be declared elected members of the Council. A tie vote for any office shall be resolved by the Council. Should a candidate receive votes sufficient to elect him to each of two or more offices he shall be declared elected only to the office of the higher or highest rank to which nominated and for the purpose of such determination it shall be deemed that the offices from highest to lowest rank are in the following order: President, Vice President, Council member, and Treasurer.

ARTICLE VI. MANAGEMENT OF THE SOCIETY

Section 1. The Society shall be governed by the Council.

Section 2. The Council shall meet immediately after the close of the annual meeting of the Society, at such other times as the Council may select, and at the call of the President. Six Council members shall constitute a quorum of the Council.

ARTICLE VII. MEETINGS

Section 1. An annual meeting of the Society for the presentation and discussion of professional papers and for professional intercourse shall be held annually at such time and place as the Council may determine. Notice of such meetings, including the tentative program, shall be announced to the membership

by the Secretary at least sixty days in advance of the meeting.

Section 2. Business meetings and other meetings may be called at intervals by the Council. Upon written request of not less than fifty members, which request will state the purpose of the meeting, the Council shall call a special meeting of the Society. The call for such a meeting shall be issued not less than thirty days in advance and shall state the purpose thereof, and no other business shall be transacted at such meeting.

Section 3. The By-Laws shall provide rules for the order of business at meetings, but at each annual meeting the members by a majority vote may, without notice, modify or change these rules as to that meeting.

Section 4. The members in attendance at a regularly called meeting shall have the authority to transact the business of the Society.

ARTICLE VIII. LOCAL SECTIONS

Section 1. Local Sections, composed of Society members, may be established in any locality, and such organization shall become effective as soon as the proposed constitution and by-laws of any Local Section shall have been submitted to and approved by the Council.

Section 2. Local Sections, in their speech, writing, and action, shall conform to the principles, policies, and objectives of the Society, as set forth in its Constitution and/or By-Laws.

Section 3. The functions of Local Sections shall be the encouragement of members to prepare and discuss papers, to confer and to suggest as to matters of Society policy, to study local range and pasture conservation and management problems, to cooperate with other local sections and other local organizations in matters of common interest, and to bring about closer personal acquaintance and a spirit of cooperation on matters relating to the objectives of the Society.

Section 4. The Council may annually assign, from the funds of the Society, to each Local Section, a sum varying in proportion to its needs not to exceed one dollar for each member belonging to that Section.

ARTICLE IX. PUBLICATIONS

Section 1. The publications and papers of the Society shall be issued in such a manner as the Council may direct.

ARTICLE X. AMENDMENTS

Section 1. Prosposed amendments to the constitution shall be submitted to all members. The constitution may be amended by a two-thirds affirmative vote of the members voting.

Section 2. Amendments may be proposed at any business meeting of the Society, providing they are submitted in writing, and bear the written endorsement of at least twenty-five members. Such proposed amendments shall not be voted upon at that meeting but shall be open to discussion and modification and to a vote as to whether, in its original or modified form, it shall be mailed to Society members for action.

Section 3. A ballot shall be sent with the proposed amendment and the voting shall be by methods outlined for voting for officers, closing at noon of the twentieth day preceding the next announced business meeting of the Society. The presiding officer at the meeting of the Society following the close of the ballot shall announce the result, and if the amendment is adopted, it shall there upon take effect.

BY-LAWS

ARTICLE I. MEMBERSHIP

Section 1. Applications for membership may be made at any time and applicants will be considered elected to membership

upon payment of current dues. The Council has the right to approve or reject applications.

Section 2. Annual dues of members shall be payable in advance to the Treasurer of the Society on January 1 of the current year.

Section 3. Members whose dues are in arrears on the first day of August will be declared delinquent. Members whose dues shall have remained unpaid for twelve months shall be dropped from the roll of membership.

Section 4. A former member dropped for non-payment of dues will be eligible for reinstatement (1) upon payment of dues in arrears at the time he was dropped, or (2) by approval of the Council and payment of the current year's dues.

ARTICLE II. MANAGEMENT OF THE SOCIETY

Section 1. The Council shall manage the affairs of the Society in conformance with the provisions of its constitution. It shall direct the investment and care of funds of the Society; act upon applications for the establishment of Local Sections; take measures to advance the interests of the Society; disseminate technical knowledge by publications, meetings, and other media; and generally direct its business.

Section 2. The President shall have general supervision of the affairs of the Society. He shall appoint necessary committees, preside at meetings of the Society and of the Council and shall deliver an address at the annual meeting.

Section 3. Standing Committees shall be accountable to the Council, under the general supervision of the President.

Section 4. The Vice-President shall, in the absence of the President, preside at meetings and discharge his duties in the absence of the President.

Section 5. The Secretary, as the executive officer of the Society shall be accountable to the Council under the general supervision of the President. The Secretary will be expected to attend all meetings of the Society and of the Council. He shall outline and duly record the business and proceedings therefore; maintain a suitable membership file; conduct the correspondence of the Society and keep full records of same; to make a report which shall be presented at the annual meeting of the Society, and perform all other duties which may from time to time be assigned to him by the Council.

Section 6. The Treasurer shall collect all dues and receive and deposit all monies in the name of the Society and shall pay all bills when certified by the Secretary. He shall make a financial report which shall be presented at the annual meeting of the Society. The final fiscal report of the Treasurer shall be published. He shall be bonded in a suitable amount as decided by the Council and at the Society's expense. His account shall be audited by the Council or their designated representative before presentation of his annual report.

Section 7. Within thirty days after assuming office, the Secretary and Treasurer will jointly prepare a budget for the current business year for submission to and approval by the Council.

Section 8. The business of the Society shall be conducted on a calendar year basis.

ARTICLE III. MEETINGS

Section 1. Annual meetings of the Society shall be held at dates and places determined by the Council. Regular business meetings of the Society shall be held in connection with the annual meeting.

Section 2. The order of the business at meetings of the Society unless otherwise provided shall be as follows:

Report of the President

Report of the Secretary
Report of the Treasurer
Announcements by the Secretary
Committee Reports
New Business
Presentation of Papers

Section 3. A program committee for the next annual meeting shall be appointed by the President immediately following the annual meeting to be responsible for the formulation of the program for the approval of the Council. Any member desiring to present a paper at a meeting shall so notify the committee chairman.

ARTICLE IV. LOCAL SECTIONS

Section 1. An application for the establishment of a Local Section must be signed by at least fifteen members.

Section 2. A Local Section shall be recognized upon approval of its constitution and by-laws by the Council.

Section 3. Each Local Section shall elect a president, and a Secretary, and may elect such other officers and provide for such committees as it finds advisable.

Section 4. All members of the Society who reside within a Local Section area and who have paid their national dues shall be deemed to belong to the Local Section. Upon the formation of a Local Section, the Secretary of the Society shall keep the Secretary of the Local Section informed of the names of members in good standing in that area. Any member of the Society may attend the meetings of any Local Section, but may vote only in the Local Section to which he belongs.

Section 5. Each Local Section may hold such meetings and engage in such activities as it desires, and is encouraged to suggest needed action on the part of the Society. The Secretary of each Local Section shall report the proceedings of that section to the Secretary of the Society.

Section 6. National dues should be paid directly to the national Treasurer. If a Local Section receives any annual dues for the national organization, it shall transmit the entire amount to the national Treasurer without any deduction therefrom for local expenses.

Section 7. The Council will examine and resolve any conflicts that may arise between Local Sections.

ARTICLE V. PUBLICATIONS

Section 1. All publications of the Society shall be under the direction of the Council.

Section 2. The publications of the Society shall consist of a quarterly or other journal when such an enterprise is deemed feasible by the Council and such other publications as the Council may direct.

Section 3. The Society shall not be responsible for statements or opinions advanced in papers or discussions at meetings of the Society, or printed in its publications.

ARTICLE VI. AMENDMENTS

Section 1. Amendments to the By-Laws may be proposed at any annual meeting of the Society and may be adopted by a two-thirds affirmative vote of the members present, or may be referred to the entire membership for majority vote by letter ballot.

Section 2. Voting shall be by written ballot.

Section 3. Tellers shall be appointed by the presiding officer.

Section 4. The tellers shall not receive any ballot after the stated time for the closure of the voting.

Section 5. Tellers shall consider a ballot as valid provided the member is in good standing as certified by the Secretary, the intent of the voter is clear, and provided also he has conformed to the regulations for voting.

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