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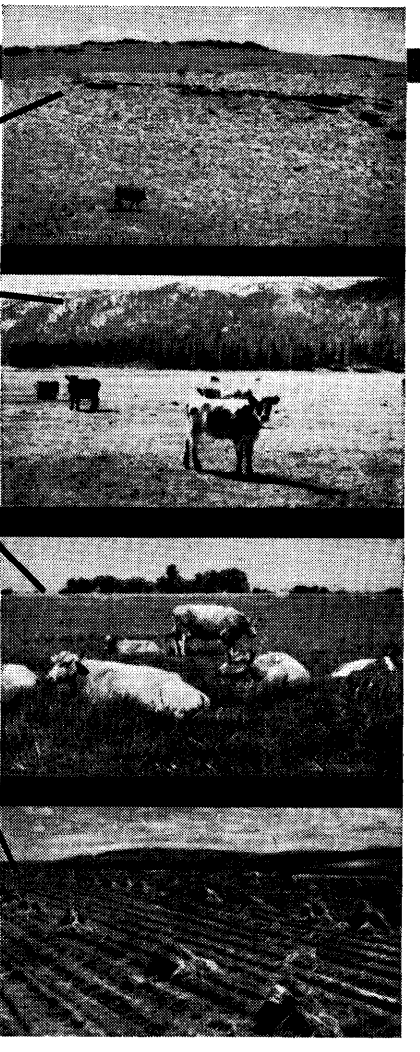

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THE AMERICAN SOCIETY OF RANGE MANAGEMENT

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To foster advancement in the science and art of grazing land management, to promote progress in the conservation and greatest substained 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.

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Editorial

Ecology and Range Management

EACH of us can be thankful that Mother Nature is a progressive old lady. She always keeps one rule in mind —improvement. And in her ability at first aid to the land lies our hope. On a denuded range, or even in a plowed field, she makes a new start each season. Our obligation is to aid nature's renewal processes to attain sustained yields of forage, timber, game animals, cultivated crops, and all the other products of the soil that contribute to our individual and collective welfare.

How can we aid this progressive lady? Most of the answer lies in learning and using the rules of biology for the benefit of mankind. If we ask, "Who, me?" the answer is, "Yes, you." Whether we are ranchers, technicians, or just plain citizens, we are individuals in the international sphere dependent on continued high production on the land as well as in the factory. In fact, our industrial production would cease if our biological management failed to work.

On the range, biotic relationships are not so simple that we can relax and say, "If it rains, the grass will grow, the livestock will prosper, and we can make more money." The range is complicated, and dynamic. Its vegetation, which is the crop the rancher sells, evolves in harmony with the forces and factors which make up the environment. If we disturb by just a little the balance of force against force in nature, a cycle of changes and responses begins that may span a lifetime. Herein lies the application of ecological knowledge to range management. If there were no such thing as change in response to a cause, man would waste his efforts in attempting to control the environment for the purpose of preserving the range resource. Let's be technical for a moment.

Action in nature is threefold: the organisms, the habitat, and the physical factors all act and react upon one another. The result is a struggle for existence among organisms. In this struggle, many processes are involved, including migration, invasion, retrogression, and competition.

DR. DAVID F. COSTELLO

Let's look at one of these—competition. When organisms compete they make demands for the same supplies: light, moisture, and nutrients. In plant competition, the species that makes the greatest demand is the one that succeeds. When a cow eats a grass plant she gives the adjoining thistle, which she leaves untouched, a competitive advantage. Multiply this a million times on a given area and you have the beginning of change in range condition. Start the range condition downward in trend on a million pastures and you have decrease in our livelihood, and our authority, in the world community. A lot depends on how we care for each little acre of ground.

And how can we care for that acre of ground? The answer is: by knowing its biological processes, and applying nature's rules for its maintenance. Each acre, each pasture, each ranch in our vast range is a problem in itself. And each unit of range, wherever it may be, is under the control of some person. In that person lies a primary responsibility. He knows, or should know, his own little parcel of land better than any other person, because he lives with it, and uses it year after year.

The individual owner or administrator usually needs help in knowing his land and the processes that operate upon it. This is a job for the technician or researcher, whose task it is to discover biological rules and relationships, and from his knowledge of these to suggest ways in which causes may be applied to produce desired effects.

Both the producer and the technician need help and understanding from the plain citizen, who is the ultimate consumer of products from the land. The plain citizen, in particular, must insist that proper use be made of the land on which we all depend. The attitudes and actions of all three largely determine how well we can compete in the struggle for existence among nations. Mutual assistance, understanding, and positive action are needed to control our environment and our destiny. It is a job for all of us.

Man is the greatest of the biological factors. Through his increasing knowledge of ecology, he has within himself the power to act on his environment for his own greatest good. He will have to apply that knowledge, not through edict, arbitrary decision, or economic or political force, but within the limits of the natural law, if he is to succeed.—*David F. Costello*, Rocky Mountain Forest and Range Experiment Station, U. S. Forest Service, Fort Collins, Colorado.

Elk Problems in Montana

ROBERT F. COONEY

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THIS paper deals with elk problems in Montana and management practices which are being applied in working them out. Many of the aspects of this discussion appear to apply widely throughout the elk ranges of the west.

We are frank to admit that we have not solved all of our problems. We are working with them and have gained much by observing what neighboring states have done in similar situations. One of the highlights of this program has been the close cooperation with the landholders and public agencies responsible for the management of the land.

Past History

As a basis for this discussion, it would be interesting to glance for a moment into the past. The journals of Lewis and Clark describe an abundance of game 145 years ago that seems almost unbelievable to us. For the most part, these animals were found on the prairie and along the river bottoms. Vast numbers of elk ranged with the buffalo, deer, and other game.

With the coming of white settlement, this huge abundance was soon wiped out. In four years, between 1880 and 1884, the northern herd of buffalo, estimated to number a million animals, was almost completely annihilated by hide hunters. Elk fared little better. By the turn of the century, only small remnants were found well back in the more inaccessible mountain ranges.

With this alarming low, came the thought that perhaps game was not limitless and that it might be possible to lose entirely an important resource. With the realization came the establishment of Montana's first Fish and Game Commission and Department. The first State Game Warden was appointed in 1901.

For a time, elk were entirely protected. The first plant from Yellowstone Park was made in 1910. This marked the beginning of the trapping and transplanting program that in 25 years accounted for approximately 1,400 elk having been moved. By this program, 32 elk herds were established. Game preserves in several areas aided in bringing back the elk. We now have approximately 40,000 elk in the state.

The restoration of not only elk but other game animals has been accompanied by many problems. This has been due chiefly to the fact that other important uses of the land have developed through the years. These include ranching, farming, lumbering, and mining. Game must of necessity be fitted as harmoniously as possible into this present day complex pattern.

Conservation Committees

The development of conservation committees has been one of the most helpful means of working out difficult and sometimes controversial situations. The Gallatin Conservation Committee was the first to be formed. It came into being 15 years ago when a heated argument was in progress in that area between big game and livestock interests. It was a case of badly needed winter range for an important elk herd conflicting with well-

established livestock use. A dead-lock had been reached with neither side willing to compromise.

The Committee was formed by clear-thinking individuals who saw that a reasonable give and take on both sides would be necessary. It was composed of representatives of all groups interested in the area, including the cattlemen and woolgrowers, the Forest Service, the Park Service, guides and packers, sportsmen, and the Fish and Game Department. The group met and rode horseback out over the range in conflict. They then sat down and worked out a plan of use that has been operating effectively ever since.

One of the adjustments made at that time was the shifting of several sheep ranges into areas of higher elevation, where forage was inaccessible to elk during the critical winter months.

Twice each year, a field inspection is made on the range. The Committee's recommendations have been considered very carefully in working out other problems which have developed from time to time.

In more recent years, four additional conservation committees have been formed on problem areas. In each, the method of working out solutions has been the same.

Much basic information regarding big game numbers, distribution, sex ratios, annual increase and range condition, has been gained throughout the past several years. In obtaining this information, full advantage has been taken of the Pittman-Robertson program which has made additional funds available within the State for such work.

The Forest Service has cooperated closely in this program.

The Gallatin Canyon Range

One of the most interesting cooperative projects which is being worked out at the present time is a study of the grazing capacity in terms of elk of the Gallatin Canyon winter range. This area has supported for many years one of the state's most important herds of elk. The numbers have fluctuated through the years between two and three thousand head.

Concentrations of elk, particularly during severe winters have lead to undesirably heavy utilization of forage on exposed ridges and south slopes. In order that this condition could be remedied, it was felt necessary to determine as accurately as possible the carrying capacity of these winter ranges. For this purpose, a range technician has been assigned to the area to prepare a forage inventory using the standard range reconnaissance method. Fortunately, the area had been thoroughly covered by an aerial survey so that aerial photographs were available for typing in the field. The project is of particular interest as it marks the first time that this method has been used in Montana to determine range grazing capacity in terms of elk.

Palatability tables have been prepared for elk by observations made in this area and also on several other game ranges of similar type. Preference for various types of forage shown by elk was similar to that of cattle. As might be expected, however, elk used more weeds and browse than had been indicated for cattle on similar ranges. The cattle forage acre requirements are being converted to elk on a comparative body surface area basis.

It is expected that this project will be completed early this spring so that the information will be available as a basis for setting next year's hunting regulations.

Along with the forage inventory and the elk grazing capacity figure, necessary information is being gained regarding the present condition of important forage

plants on the heavily used sites. Reseeding and browse plantings are being carried out on an experimental basis in an effort to find ways of speeding up range restoration. The results of this project are being looked on with much interest as information gained from it may well be useable on other problem game ranges.

Elk Distribution

Distribution has been found to be one of the most important factors in elk management. Salt has become a commonly used tool here in the West in attempting to draw elk up off winter ranges as early as possible in the spring. This allows the maximum amount of growth on these critical ranges. The airplane has been found to be efficient in the placement of game salt in the more remote and inaccessible areas. In the past, it was difficult to distribute salt on these higher ranges sufficiently early in the spring due to the presence of snow and logged-in trails.

Salt as a management tool in moving elk has been particularly successful on several areas where heavily used natural licks were present on the winter range. In the past, elk tended to remain in the vicinity of these natural licks well into the summer. The effect was serious heavy utilization of forage for some distance around the licks. A very marked lessening in the use of these concentration areas has been noticed following adequate salting at higher elevations. The scars caused by former use about these licks are healing rapidly.

Winter Range Acquisition

The acquisition of vitally needed winter elk range has been found to be an additional important management tool. The Sun River area lying on the eastern slope of the Continental Divide has demonstrated how a very difficult game problem was solved by the purchase of range.

For many winters the Fish and Game Department had carried on an intensive program of herding in an effort to hold approximately 3,000 head of elk back in the mountains off the private lands along the foothills. Although as high as 10 men had been used during the severe periods during those winters, the program was not successful. Elk were getting out on private lands during storm periods. Also, actual pushing of elk back into the mountains was causing a zone of heavy concentration. The result was the overuse of available forage. The only remedy seemed to be a drastic cut in the herd. Then, three years ago, the elk got a break.

Approximately 12,000 acres of land lying adjacent to the Forest boundary became available, and was purchased by the Fish and Game Department. In addition, state land was leased and also the Bureau of Land Management made available for wildlife use approximately 4,000 acres in the same tract. This unit made up an important part of the foothill range that the elk had been vainly striving to reach during past winters. A minimum of herding was therefore necessary in moving the elk onto this tract of winter range. It has been extremely interesting to watch the use that they have made of this area. It extends from the foothills several miles out into the prairie to the east. The herd of approximately 3,000 elk that have wintered there during the past years has shown a surprisingly even pattern of use.

There has been little difficulty in holding the elk on this range during the winter months. A relief from heavy winter concentrations back in the forest has already been noticed. There has been no serious use of private lands in the area

since the purchased unit has been made available to the elk.

Several other critical winter range areas have been acquired and are being developed. The result in each case has been very encouraging.

Hunting Seasons

Special and extended hunting seasons have been found to be very effective in reducing damage on private property. These special seasons allow the Fish and Game Department to issue a given number of licenses to take elk from areas where the limited numbers do not warrant a general open season. Other degrees of hunting pressure have been obtained by the use of seasons restricted to either branch-horn or antlered bulls. It has been found that this type of hunting is particularly effective where an area is opened up to the hunting of elk for the first time. Extended seasons well into the winter have been used in numerous cases to hold elk off private land. They have also been used to obtain sufficient kill where elk remained in game preserves or closed areas until moved out by the snows of mid-winter. An example of this type of season is found along the northern edge of Yellowstone Park.

Fencing

The use of haystacks by elk that have moved down onto private pastures presents serious problems in local areas. Fencing of these haystacks has not been practical unless they were in rather isolated locations. With the fencing of one or more haystacks, elk tend to move on to others in the same vicinity. Where this work has been conducted, the movable type panels have been found to be most practical.

Electric fences have been used in a few cases to check elk. The most successful type was a variation of an electric deer fence developed in the State of New York. It is constructed on the outrigger principle; the electric fence itself being located $3\frac{1}{2}$ to 4 feet out from an already existing fence. This presents a rather formidable barrier and has proven successful in checking the movement of elk onto private pastures where only a short fence of this kind was necessary. The cost of construction and the necessary maintenance would surely make this type of elk control impractical on a large scale.

Herding

Herding as a method of keeping elk away from haystacks and private pastures has not been found particularly helpful. In most cases, where elk have become established, they would return to the stacks soon after the herder had left the area.

Feeding

The feeding of elk as a general practice is not considered desirable under Montana conditions. However, during emergency periods, and in limited cases, it is felt that it may serve a useful purpose. Although our experiences with this work are quite limited, it was noticed that carefully selected feeding stations were essential and that better results were obtained by placing hay at these locations every other day. It was noticed that by skipping every other day elk did not lose the urge to rustle, and were often found considerable distance from the feeding stations during the alternate days. Undoubtedly, the amount of hay to be placed out would vary with the conditions. Four pounds per day per animal was found adequate as a maintenance ration for elk in areas where a moderate amount of browse was available.

Competition with Other Game

The conflict or competition that appears to exist between elk and other big game animals on critical winter ranges is an important consideration. Indications have been noticed that competition appeared to exist between elk and white-tailed deer on browse type ranges, particularly in areas where heavy concentrations of both species existed. This relationship is being considered carefully in any plans for the development of elk on ranges now carrying important numbers of white-tailed deer.

A further relationship that needs study is that of the possible competition between elk and mountain sheep on jointly used critical winter ranges. This condition was observed during a detailed study which was made on the Sun River area prior to the acquisition of the elk range. At the time of the study, both mountain sheep and elk were concentrated upon the reef type emergency ranges during severe portions of the winter. It is planned to re-check these ranges now that competition from the elk has been almost entirely eliminated due to their present migration out to the winter range in the foothills.

There will undoubtedly always be elk problems. It has been encouraging, however, to find that solutions are becoming less difficult. A highlight in this regard has been the increasing use of basic range management information by game administrators.

We are all heading toward the same goal—the best possible use of the range resource. This may be by livestock, game, or a combination of the two. Here, then, is an excellent common ground upon which we all can meet to discuss and work out our problems.

HORSES AND MEN

The Australian Pastoral Review and Graziers' Record, January 1951, philosophizes about horses and men: The average horse has far more sense and intelligence than the average man and he would tell the latter so if he could, but horses have their own ways of revealing what they know.—Reg'd C. M. Reynolds.

Three Grasses' Struggle for Supremacy on the Island of Molokai

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IN leafing through history books, we read of races of people replacing other races and in turn being replaced by a still more vigorous group. The history of plants is often similar to the history of people. The story of grasses may not be so grim as the story of the rise and fall of peoples, but it can be a fascinating study. The native plant can be displaced by a vigorous foreigner, that in turn can be forced from a dominant place by a more aggressive plant. Life it seems for people, animals, or plants is seldom static.

Here is the story of three grasses that grow on the arid lands of the Island of Molokai, Territory of Hawaii. One of the grasses, pili grass (*Heteropogon contortus*), has lived here so long that if it is not actually indigenous, it is considered a native. A second grass, fuzzytop (*Andropogon barbinodis*), came in a little after the turn of this century. The third grass, African foxtail (*Pennisetum ciliare*) was introduced about fifteen years ago. The third grass is a true malihini (a rank newcomer). It came directly from South Africa.

This study of grasses was made on the arid section of the Island of Molokai. The island is located at 21 degrees N. latitude. The long axis lies almost due east and west. The island is about 36 miles long and 7 miles wide. The highest point on Molokai is a little under 5000 feet. The struggle of the grasses described here is confined, however, to the arid lands under 1000 feet elevation on the west end of the island, and to the limited low lying fringe lands along the southeast coastline.

Geologically, Molokai island is of volcanic origin. Parts of the island have in the past risen from the sea. Some low areas along the coast have developed from soil washed from higher slopes. Red, medium textured soils dominate. Some of the rangelands have rocks on the surface. Much of the area is severely eroded and gullied. An extreme degree of erosion is indicated by the fact that in places rocks protectively cap pedestals of soil.

The temperature on arid Molokai is warm yearlong, averaging about 74 degrees F. It never freezes. Winds blow through most days. Yearly rainfall averages a little under 20 inches, though the average means little in this section. A large part of the total yearly rainfall might, and has, occurred in a single week.

Pili Grass

Pili grass, as it grows in the Hawaiian Islands, is a weak-rooted perennial that greens up briefly after rainstorms. In India pili grass is called "spear grass," in the southwestern part of the United States, "tanglehead." Both names describe the appearance of the seed heads at different stages of maturity. Pili grass is also indigenous in other parts of the sub-tropics and to some extent in the tropics.

It is a perennial grass growing from one to three feet high in a compact, upright bunch. The leaves are a bright green after

[1] At present with the U. S. Army.

each rain and slowly turn brown in drying weather. The seed heads as they emerge from the sheath resemble a single tier of overlapping shingles that produce long, crooked awns, which become tangled when dry. Spear grass and tanglehead aptly describe the seed head first in the green and later in the dry stage. Pili has a shallow, limited root structure so that cattle will often pull up the plant when grazing. The shallow roots are unable to seek the deeper moisture in the soil, consequently, the plants stay green for only short periods.

Hawaiians believe that pili grass is native because they thatched their huts with the grass for centuries. Records state that where the weather was dry, the thatched huts lasted 10 or 12 years. Where the precipitation was high the thatch of pili soon rotted and had to be replaced frequently.

The ravines and draws of the arid sections of Molokai once dominantly covered with pili grass had a scattered overstory of dryland trees. Drought periods doubtless occurred in the early days, as they do today. However, the native vegetal cover under non-grazing use permitted the soil to absorb moisture rapidly. As a result, the grass stayed greener longer than it now does.

Pigs were brought to the islands by the early Polynesians and have been here for hundreds of years. The first cows, horses, sheep, and goats, however, were brought to the Territory of Hawaii by Vancouver late in the 1700's and early 1800's.

The first cattle brought to the Island of Molokai in 1830 were put ashore on the grassy plain at the village of Paalau. A "tabu" by the island chief against killing cattle shortly after their arrival prevented all slaughter. Sheep and goats were introduced a few years later and were also protected by a "tabu." Springs near the village of Paalau supplied the only livestock water for the large arid area. Under a favorable environment all livestock multiplied rapidly. As numbers increased, they grazed all the grass within several miles of the springs, with the result that for several miles above Paalau a dry, eroded, barren area developed as the pili grass was destroyed. Deep gullies developed and fertile topsoil washed away. For example, an artificial 500-acre saltwater fishpond maintained by the natives along the low lying coastline immediately below Paalau was filled to a depth of 4 feet with a part of the fertile topsoil from the 20 square miles tributary area.

About the turn of the century the increasing numbers of cattle, sheep, and goats reached such numbers that the plant complex was markedly deteriorated. Under the impact of the uncontrolled grazing and increasing numbers of animals even the trees in sheltered spots and ravines died, and for a long time no plants replaced them. A corollary development was the introduction of kiawe (*Prosopis chilensis*) that first covered the coastal lowlands, and later spread to the uplands. Seeds of other plants were introduced with imported livestock feeds. In this way a number of annual grasses and weeds gained a foothold, furnishing some seasonal feed, but they failed to protect the soil even as well as the weak rooted pili grass. Erosion increased, and good range feed became scarce. The plant cover deteriorated though pili grass was still the most abundant species, particularly in spots where it was not excessively overgrazed.

Many new plants have been introduced during the past century. They came from all parts of the world—Australia, South Africa, California, Southwestern United States, and the Mediterranean. Some of the introductions were tested in local

grass gardens where most of them proved to be ill adapted. Oddly enough, today many species once tried have been forgotten and are being tried again. Among plants being tried are yellow bluestem and African sandbur, which show promise. Other grasses that will adapt themselves to this dry site will doubtless be found.

Fuzzytop

About 1905, George Munro introduced a new bunchgrass to Molokai. He received the seed from Jared Smith, agronomist for the Department of Agriculture. Locally the grass is called "fuzzytop." In the United States it is called cane beardgrass or plume beardgrass.

Fig. 1. Fuzzytop successfully invading the original pili grass stand.

Fuzzytop is a strong-rooted perennial that greens up after each rainstorm. Fuzzytop is a native to the southwestern part of the United States and the northern part of Mexico. This perennial bunchgrass usually has a basal rosette of leaves shorter than pili grass leaves. The leaves emerge from the base of the rosette and on the older plants, leaves clothe the stems. The stems often 3 feet high are topped by a silvery appearing head of fuzzy-like seeds. When the seeds ripen and shatter they may be carried some distance by the wind. The root structure of fuzzytop, in contrast with pili, develops a mass of fibrous roots that reach from one to four feet into the ground on all sides. Grazing cattle do not pull this plant from the ground after it is once established. Furthermore, its greater root system enables the plant to utilize moisture deeper in the soil. Fuzzytop stays greener longer than pili grass and greens up as readily after rains. It is liked by cattle even more than pili.

For a long time fuzzytop was regarded as a stranger and was little appreciated as a forage plant. It was first established in a localized area near the center of Molokai called the Hoolehua plains. More seed was imported, some of which appears to have produced a strain that seems even better adapted to the Molokai climate than the original introduction.

Fuzzytop is now well established in the west central section of Molokai, and it is spreading to the drier sections of the island, but not fast enough to halt the erosion on a number of potential grazing areas. The Molokai Ranch, which owns most of the arid part of Molokai, plans to harvest fuzzytop seed with a seed stripper adapted from plans received from the Soil Conservation Service nursery in Texas. With increased seed supplies more of the dry land areas will be seeded in an effort to halt as rapidly as possible the terrific erosion caused by heavy rains on the depleted range lands.

FIG. 2. AFRICAN FOXTAIL. A. Becoming established on a heavily used stock trail. B. A group of Hawaiian cattle ranchers inspect a good stand.

It may be that fuzzytop will eventually displace the pili grass, as it seems to be doing in certain sections now (Fig. 1). The two grasses grow together but the pili is overtopped by the fuzzytop.

AFRICAN FOXTAIL

In 1935 a third range plant was commercially introduced from South Africa. African foxtail is the Hawaiian name. In South Africa it is called bufflehead, in India it is called Anjan dhaman. The species also occurs in Sicily and the Canary Islands.

African foxtail is a semi-prostrate perennial bunchgrass. It forms large, round clumps, sometimes 6 feet in circumference, one to three feet high. It is pale green in color, with soft drooping leaves. Many cylindric dense seedstalks bend outward and slightly downward as a canopy over the basal leaves. The grass is aptly called bufflehead. The length of the seed head varies from 3 inches to nine inches. The seeds in the head circle the stem, and are enclosed in a bristly chaff, easily carried by wind of even moderate velocities. The roots are strong, heavy and numerous, and reach 2 to 6 feet into the ground. A few short rhizomes are produced. On good soil and with adequate moisture, African foxtail plants reach good size the first year of planting. The plant enlarges rapidly and produces large amounts of seed. The plants green up and produce more seed heads after each rain of 1/2 inch or more.

African foxtail with a large number of other grass species was tested in rod rows some 15 years ago in a grass garden near the Molokai Ranch slaughterhouse located in central Molokai. This is an extremely dry part of the island. Indication of the hardiness of the 3 grasses discussed here is the fact that today in this

grass nursery, only African foxtail, pili grass, and fuzzytop remain. African foxtail dominates the old nursery site, now abandoned.

An area of open range with deep but hard, exposed subsoil, long overgrazed and depleted of organic matter, lies adjacent to the old nursery. African foxtail is also slowly invading this site, and where it has gained a foothold covers it sufficiently to stop erosion. It gives much promise of being a species adapted to these tough, dry sites (Fig. 2).

The foxtail was also observed invading a moderately thick stand of tree size kiawe. The grass in this instance is growing vigorously 2 to 3 feet high, lush and green after the other grasses are dry, while the soil underneath the grass clumps is soft and mellow—a decided contrast to the condition of the soils generally over the dry area.

The palatability of foxtail has been questioned by some of the people of the islands. Reports from other countries show that in India this grass is considered excellent forage for cattle and horses. In Africa it is considered a good forage plant. In Australia, when extremely dry conditions prevail, it is said to be eaten to the ground by the livestock even when dry. On Molokai some cattlemen who have watched the cattle graze believe cattle prefer it to pili grass. It probably is not the most palatable of forage plants, but for the arid sites on Molokai Island its palatability compares favorably with other forage plants growing there.

Summary

This is the story of three grases on the Island of Molokai—pili grass, fuzzytop, and African foxtail—that currently seem best adapted to the dry, depleted range lands of Molokai Island.

Pili grass, the native or a very old introduction, appears to be giving way to the two newer grasses. The reasons for this are (1) the superior root system of the newer plants, (2) superior seed producing habits, and (3) cattlemen actively reseeding selected areas of the depleted range to fuzzytop and African foxtail.

Other plants are also being tried and some may prove superior. Examples are yellow bluestem and African sandbur, two plants tried this year that show promise. Others adapted to this dry site doubtless will be found.

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Range Problems of Marginal Farm Lands

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THE scope of this discussion is limited to the northern great plains. This region includes the east half of Montana; the parts of North and South Dakota west of the 98th Meridian; northeast Wyoming; and northwest Nebraska. The principles however, will apply to other regions.

This is the region of the mixed prairie type of range grassland. Important to the discussion of my subject is the fact that in this region, soils and climate are generally favorable for the regeneration of a grass cover on plowed farm lands. Probably nature favors the northern plains region in this respect more than any other major range region of the west.

In area, the northern plains region comprises some 140 million acres of land. Approximately 25 million acres of the region now are in dryland grain farming use. Ten years ago, that figure stood at about 19 million acres. Besides the present dry-farming acreage, an estimated twelve to fifteen million acres of the land of this region has at some time been plowed for farm crop uses. Some six million acres of this once-plowed land, abandoned for crop farming, have been reseeded for range use. Probably a considerable part of this reseeded land has been replowed and now figures in the expansion of the dry-land grain farming acreage of the past decade. In addition to the present dry-land grain farming acreage of this region, I estimate that five to seven million acres of land are dry-farmed for the production of livestock feed and forage crops.

We see, then, that approximately a third of the land area of the region has at one time been plowed. What, where, and why are the marginal farm lands, in this crop land use picture of the region?

Occasional Acres

It is my belief that sixty percent of the lands of the region now in dry-land grain farming will, over a period of time, yield ninety percent of the grain crop. This is based on a study of the wheat yield characteristics of all of the Montana farms in the U. S. D. A. agricultural conservation program from 1928 to 1946. Though the other forty percent of the dry-farm wheat acreage of these farms did in the occasional favorable year yield a good wheat crop, in most of the years they failed to produce a crop. The analysts who made the yield study to which I refer had a name for these acres of the forty percent. They called these acres "The occasional acres".

There have been some important new developments in western dry-farm technology in the past decade, and these may have some influence upon the margin for dry-farm crop uses of land. The favorable effects of these developments apply best to the better lands, however—to those of the lands with the better soil and moisture conditions. Of the twenty five million acres of land now in dry-farm grain production in the northern plains, the best fifteen million acres of it likely will, over a period of time, yield ninety percent of the wheat. The other ten million acres may yield a good crop in the year of good moisture and temperature conditions, but through the years these ten million acres will produce only ten percent of the total wheat crop.

These ten million acres are the mar-

ginal farm lands of the northern plains region. They are now in dry-land wheat farming use mainly because of the past decade of generally favorable weather conditions, of our artifically maintained agricultural prices since the war, and of the past subsidies of our agricultural "conservation" programs. These marginal farm lands of the northern plains have limited soil fertility, wind erosion hazards, and insufficient precipitation. We find these lands not only in those areas that are marginal in their entirety; we find them on the fringes of the areas that do have good dry-farm crop land resources.

These "marginal farm lands" are not farm lands—they are range lands. We should recognize and use them for such. We hear discussion of a policy for these lands that sounds wise and good, but it doesn't fit. That policy is one of using these lands in grain production during the favorable years and returning them to grass when their grain production isn't needed. Such a policy assumes that the marginal lands can easily be reseeded to range grasses when the good weather runs out. That isn't realistic. If we must have a program-stimulated western dry-land wheat production, we can get more wheat for less cost by applying the subsidy to the better grades of the dry-farm crop land. Beyond the financial cost of the subsidy, there is a large and real social cost in maintaining agricultural settlement and agricultural crop land uses on the marginal farm lands.

Our public measures in agriculture have done much to keep people on these marginal lands. The most consistent "crop" of those lands has been their subsidies. Once such a subsidy is put on the land, there always is local resistance to any removal of the subsidy. That entails a shrink in the local population, town business, and public revenues. The cost of shaking marginal farm lands out of such uses always is locally severe. One might even argue that if we *must* have that ten percent of the wheat from the "occasional acres" we had best get it through the speculative "suitcase" type of wheat farming rather than through family farm occupancy and farming use of these lands.

Our agricultural policy for these lands should be that of getting them entirely and permanently out of crop farming uses. They cannot practically be shifted between crop farming and range uses. Farming their soils lowers their naturally limited nitrogen reserves and deteriorates the soil structure so that reseeding with range grasses is problematic even in the favorable years.

Successful opportunity for a grass-wheat long-time rotation lies with the better grades of the dry-farm lands of the northern plains, rather than with the "occasional acres". In time such a rotation plan will have to come, if we are to maintain even the best of the dry-farm lands of the northern plains in crop agriculture. Such a rotation would have to be a fairly long one, for soil nitrogen restoration in an arid climate. It is difficult to envision the economic change that any extensive use of such a rotation would entail, in the northern plains. We have yet to face the "facts of life" in that, for it would mean much less wheat acreage and much more of a livestock agriculture, for the western dry-land farm.

Some such rotation is feasible and an increasing amount of it is now being done, as the agricultural statistics of the northern plains clearly indicate. But, it is feasible for the better of the dry-farm crop lands, not for the "occasional acres". Those lands belong in permanent rangeland use.

What are some features of our agricultural policies and programs that can aid in keeping these occasional acres in range?

In my view, our first and most important step is to "tag" these lands—to locate, map and classify them and to show how and why they are marginal, for crop farming uses. Then, the programs should be pointed at getting and *keeping* these lands in range. If the programs cannot attain that result, for the privately-owned lands, then public rural zoning measures to regulate private land uses, or acquisition into public ownership, may be the only answer for averting the eventual loss of the resource.

We can have programs and programs for conservation and good resource use, but while we have the lure of high wheat prices, the programs won't be very effective. If we must have the unusually high wheat prices to stimulate the production needed in international affairs, then it is doubtful whether any programs can hold the line against the farming of the "occasional acres". We have seen the struggle of some of the U.S.D.A. program administrators to keep the "L.U." submarginal purchase lands from being sold, at the behest of local pressures from those who would use them to try for the "fast buck".

Local taxation and tax policy are important in keeping marginal farm lands out of farm use and in rangeland. Where these lands are classed as range, their taxes will run five cents to fifteen cents an acre. But when they are classed as farm land, the tax jumps to five or ten times the amount of the rangeland tax. Such a change becomes a definite and important force against the good use of these lands. It forces them into crop agriculture uses, and prevents the return of the "occasional acres" to rangeland use. The cause of good land use is served best where the suitable uses of the land are clearly recognized and carefully classified.

In summary, we now have an unwarranted optimism among many agricultural people concerning the possibilities for shifting the marginal farm lands of the northern plains between crop farming and rangeland uses. But, these lands will not add appreciably to our total wheat supply in dry-farm crop uses, and they give us high social costs in family farm settlement. From both the human welfare and the resource welfare standpoints, we should try to keep these lands out of crop agriculture uses.

The marginal farm lands of the northern great plains region or of any other region will, eventually, support more people and add more to the agricultural product value in their use as rangelands

Timber Milk Vetch Poisoning on British Columbia Ranges

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TIMBER milk vetch (*Astragalus serotinus*), a perennial legume, which may be found on burned-over land, open stands of the montane forest zone and adjacent areas of the upper grassland zone (Tisdale, 1947), of interior British Columbia, is poisonous to livestock. Observations indicate that it most seriously affects lactating females. Average annual death losses of 3 to 5 percent are not uncommon, while in many areas a higher percentage of losses has been reported. In many areas losses in weight of 20 to 30 percent or reductions in rate of gain through timber milk vetch poisoning are of considerable economic importance.

Because of these adverse results many stockmen hesitate to fully utilize sections of the upper grassland and montane forest zones. This practice often results in overgrazing the middle and lower grassland zones which are in relatively short supply in British Columbia.

The result of timber milk vetch poisoning differs considerably from the conditions produced by other toxic species of *Astragalus* and the locoism produced by the genus *Oxytropis*. While confined to interior British Columbia and a small portion of northern Washington because of the ecological distribution of the plant, the disease has many common names. These names include timber milk vetch poisoning, timber paralysis, timber trouble, timber grass poisoning, jack pine fever, mountain fever, Kamloops cattle disease, Clinton horse disease, roaring disease, knocking disease, and husky. This variety of names often leads to confusion. However, since timber milk vetch is the common name for the plant causing this poisoning or disease, the term timber milk vetch poisoning is preferable.

The Dominion Range Experimental Station, Kamloops, B.C., has undertaken a series of studies, accompanied by a review of literature, in an attempt to reduce or eliminate, by practical means, losses from timber milk vetch poisoning. A popular summary of some of this data has been presented by Clarke (1948).

Symptoms of Timber Milk Vetch Poisoning

Poisoning is most common in lactating females but instances of dry stock, males, and young stock suffering the disease have been reported. Poisoned animals show a variety of symptoms (Fig. 1). While emaciation is general, some animals though affected remain fat. Grinding of the teeth and faulty ingestion is common. When excited, nasal discharges frequently occur. Other animals show a continuous discharge from the nostrils. With exertion rapid difficult respiration accompanied by a wheezing or roaring and coughing is common. A partial or complete loss of voice may be observed. When moved, affected animals may urinate repeatedly. Faeces may or may not be of normal consistency. Knocking and crossing of the hind legs accompanied by an arching of the back is common when walking. In general, paralysis is more marked in the hindquarters than in the forequarters. Animals often remain bright eyed and alert even when unable to rise. In attempting to rise an animal may

frequently skid for some yards on its knees having attained a standing position with the hind legs. In other cases the hind quarters may be dragged.

FIG. 1. Experimental cow showing timber milk vetch poisoning symptoms. Note the gauntness and awkward stance.

Autopsies of affected farm animals (Bruce, 1927) show symptoms of cardiac failure and respiratory disorders but no outstandingly distinctive symptom is noticed. Experimental guinea-pigs at Kamloops which consumed lethal quantities of timber milk vetch showed severe myocarditis and lung haemorrhages. One animal showed evidence of pneumonia as well. The poisonous principle in timber milk vetch is not known.

DESCRIPTION OF TIMBER MILK VETCH

This species is a member of the large loco-milkvetch (*Astragalus*) genus of the pea family (Leguminosae). In the early literature this species of *Astragulus* was referred to by Bruce (1927) and others as *Astragalus campestris* Gray, which is common on American ranges south of interior British Columbia. However further investigation by Eastman (1947) showed that the name *Astragalus campestris* Gray is untenable, being preoccupied by a Linnaean species. Our plant is *Astragalus serotinus* Gray.

In appearance timber milk vetch is from 8 to 16 inches high and grows in rounded tufts, the taller specimens being found in the moister locations (Fig. 2). It is a pretty, fragile vetch, with fine stems, small, narrow leaves and pea-like pinkish-mauve blossoms. The colour of the flowers varies considerably, some specimens being almost white and other bluish; the majority however, are pinkish mauve.

Henry (1915) describes timber milk vetch as follows: "Slightly pubescent, tufted 2–4 dm. high, stipules membranaceous below, less so above; leaflets 7–13, distant, 2 cm. long; narrowly oblong to nearly linear; peduncles long and slender; flowers few to many, whitish to mauve, tinged with purple, 8–19 mm. long; calyx-teeth $\frac{1}{3}$ the length of the tube, some black hairs among the pubescence; pod lenial-oblong,

not much flattened 2–2.5 cm. long, lightly pubescent or glabrous, finally deflexed. Very common, Lytton eastward."

Samples of timber milk vetch gathered at random for feedstuffs analyses throughout the growing season of 1949 show the average content summarized in Table 1.

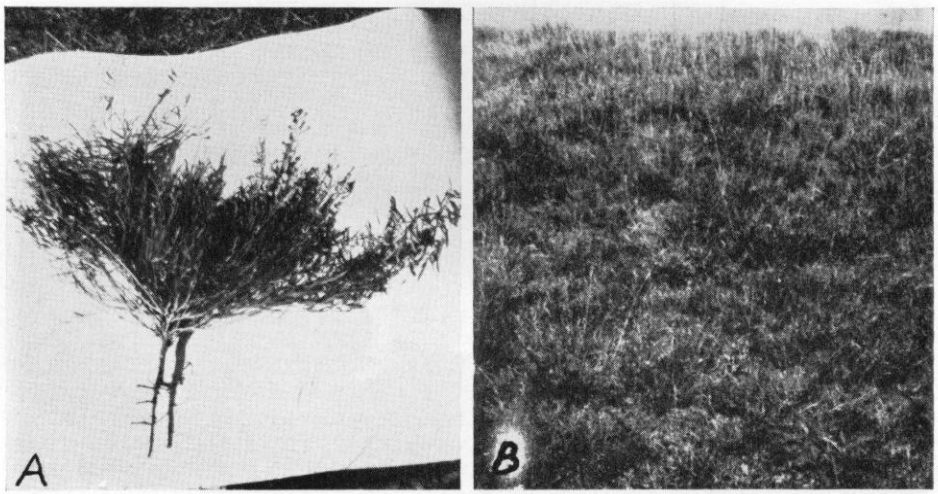

FIG. 2. TIMBER MILK VETCH. A. A typical plant (background 18 inches high). B. A badly infested range area.

TABLE 1

Feedstuffs Analysis, Timber Milk Vetch 1949

TIMBER MILK VETCH	PROTEIN N × 6.25	ETHER EXTRACT	CRUDE FIBRE	TOTAL ASH	CALCIUM	PHOSPHORUS
	Percent					
Average	12.37	2.65	30.80	5.48	0.86	0.36
Variation +	6.56	0.59	6.90	2.20	0.34	0.12
Variation −	2.42	1.14	5.07	1.22	0.16	0.09

AREAS AFFECTED BY TIMBER MILK VETCH POISONING

Reports of timber milk vetch poisoning are confined to the dry belt and Rocky Mountain trench areas in British Columbia while cases have been reported in border counties in the state of Washington. It is estimated that approximately ten thousand square miles of range is affected. The plant may be found growing in the upper grassland and lower montane forest zones between the altitudes of approximately 2000 and 4000 feet but may be found at higher or lower elevations. In British Columbia incidents of the disease have been reported in the Chilcotin and Caribou areas and the Thompson, Nicola, Okanagan, Similkameen and Windermere Valleys.

There are indications that timber milk vetch may be found growing north of Latitude 52°.

The inaccessibility of many of our ranges and the reticence of the owners to admit losses of livestock and fleshing makes it difficult to determine the exact extent of the affected areas or the economic loss due to this disease.

Timber milk vetch is found on a variety of soil types but is rare or absent on areas of restricted drainage. Like other forest herbs, it is usually more abundant where the tree cover is fairly open. A study of some 75 plots in the Kamloops area (Spilsbury and Tisdale, 1944) indicates that timber milk vetch is confined mainly to areas of the upper grassland and montane forest zones (Table 2).

Throughout the Caribou and Kamloops districts it is suggested the timber milk vetch is most abundant on timber range which has been burned fairly recently.

Conditions Conducive to Poisoning

Overgrazing is undoubtedly the greatest single factor contributing to timber milk vetch poisoning. Grazing trials conducted by this station have shown that in the upper grassland zone, timber milk vetch is unpalatable when adequate forage is available but upon the depletion of desirable range forage stock will consume large quantities.

TABLE 2

Occurrence of Astragalus serotinus on Grassland and Forest Zones of The Tranquille Range

ZONE	FREQUENCY	ELEVATION
	Percent	*Feet*
Lower Grassland	0	1100–2300
Middle Grassland	0	2300–2800
Upper Grassland	63	2800–3200
Montane Forest	60	3200–4000
Lower Sub-alpine	0	4000–5800
Upper Sub-alpine	0	5800–6100

Early spring turnouts are also dangerous since at times timber milk vetch is often four to six inches tall before dominant grasses have attained two inches in height. Under such conditions cattle consume large quantities of the plant.

It is generally considered that more cases of timber milk vetch poisoning occur in years which the summer is unusually dry or there is a late spring. This is typical of many poisonous plants. During late springs or in dry years grazing livestock may consume and show symptoms of poisoning as early as the latter part of May while other cattle may not show symptoms until August. However, the majority of cases appear during the latter part of June and through July. The consumption of timber milk vetch after it has dried up on the range fails to produce any indications of poisoning.

As previously mentioned lactating cows and ewes are by far the most susceptible animals as far as cattle and sheep are concerned. It is not uncommon to find many affected while dry females and males are not showing symptoms. As a general rule the latter classes if affected are not as badly poisoned as females in milk.

Immunity does not appear to exist since animals may be repoisoned year after year. However, the greatest losses occur in animals which are new to interior British Columbia ranges. First calf cows show the highest percentage of poisoning. Nursing lambs and calves are rarely affected probably because of their failure to consume sufficient quantities of *Astragalus* to cause poisoning.

Dr. E. A. Bruce reports (1917) that in horses the death rate as a rule, is not high, but secondary pneumonia is liable to occur, and the slightest exertion will bring on an alarming attack of difficult breathing, which often results in death. Some of these cases recover but the majority are never much use for hard or fast work.

Treatment for Timber Milk Vetch Poisoning

Since stock ranching in British Columbia is a most extensive form of agriculture a practical treatment of timber milk vetch poisoning must not be time consuming or involve a highly technical procedure. The procedure recommended and followed by practical stockmen is as follows.

Affected animals are removed from the poisonous areas as soon as symptoms develop. This is usually done by moving the stock to a lower or higher elevation than that at which timber milk vetch may be found. It is suggested that if

possible the stock should be moved to lower elevations since high elevations may possibly aggravate the condition either through the increase in altitude or the exertion of attaining the higher elevation. Poisoned animals should be moved slowly and quietly to avoid undue excitement.

In the event that affected animals are too weak to travel good quality forage and fresh water should be provided for them until they gain enough strength to be removed to a low altitude area where they may have access to good quality roughages and water. If conveniently possible nursing stock should be weaned. Extra care and attention must be provided for poisoned cows during the wintering period since they are often weak and susceptible to cold.

Prevention of Timber Milk Vetch Poisoning

As in the case of most poisonous plant problems prevention lies in limiting or in preventing the consumption of this plant by animals which may be affected. The abundance of timber milk vetch and the general topography of most British Columbia ranges makes elimination of the plant by chemical, mechanical, or cultural means impossible.

Instances where large percentages of a herd are poisoned are almost invariably connected with shortages of other palatable forage either as a result of overgrazing or too early a spring turn out. Prevention of losses through timber milk vetch poisoning as with other poisonous plants undoubtedly lies in religiously practicing the principles of good range management whereby potentially poisonous ranges are grazed by properly distributed herds of correct size.

Because dry females and males are less susceptible to poisoning they should be allowed to graze in timber milk vetch bearing areas provided overgrazing is not permitted. Since lactating cows and ewes are susceptible they should be kept off heavily grazed upper grassland and montane forest ranges at least until the timber milk vetch has dried up. This would necessitate keeping the wet herd at lower elevations until the forage at higher levels is ready for grazing. Normally the wet herd could be trailed to the higher elevation during early July.

Summary

Astragalus serotinus Gray, commonly called timber milk vetch, is a poisonous plant which is indigenous to British Columbia. It causes losses in cattle, sheep, and horses; lactating females being more susceptible than dry females and males. Timber milk vetch is abundant throughout the upper grassland and montane forest zones of British Columbia. Instances of poisoning are evident from the end of May until late August although most cases occur in late June and July.

Upon autopsy symptoms of cardiac failure and respiratory disorders are common. The poisonous principle in *Astragalus serotinus* is not known. Beef cattle and sheep show such symptoms as loss of voice, nasal discharges, roaring, incoordination of the legs and rapid difficult breathing.

In grazing experiments conducted on an upper grassland range, timber milk vetch was found to be relatively unpalatable to cattle.

A management practice to prevent serious losses from timber milk vetch poisoning has been outlined.

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PRODUCTIVE LAND

Productive land is much more limited than has commonly been supposed. It occurs only on the surface of the earth, and only on part of this surface. It is not permanent—it is not a renewable natural resource. It cannot be stockpiled or shipped in from other countries like rubber, tin, or copper. Once the fertile topsoil is washed or blown away, it cannot be restored or replaced in any practical way for generations. And what is left —subsoil—usually is far less productive, less stable, and less absorptive of rainfall. There are not substantial undiscovered reserves of productive land anywhere. And we cannot dig deeper into the earth and find new productive soil. We cannot pump it from wells, plant it with seeds, or dig it from mines. We must keep what we have or do without.

Dr. H. H. Bennett
in Scientific Monthly
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Growth Characteristics of Blue Grama in Northeastern Colorado

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BLUE grama (*Bouteloua gracilis* (H.-B.K.) Lag.) is an important grass throughout the Great Plains. In eastern Colorado it furnishes nearly three-fourths of the native forage supply, and is highly effective in combating both wind and water erosion. Knowledge of the growth characteristics of this valuable plant and its response to different grazing treatments is of great importance in the management of short-grass ranges.

Wide variation in the volume of herbage produced by short-grass ranges from year to year continually plagues range livestock operators. A study was made at the Central Plains Experimental Range in northeastern Colorado between 1940 and 1948 to:

a. Gain a better understanding of the manner in which blue grama responds to variations in growing conditions.

b. Determine the effects of different periods and intensities of clipping on herbage production by blue grama.

c. Determine whether or not the herbage of blue grama normally declines in weight as it matures.

Previous Work

Blue grama has been studied by numerous investigators. Wilson (1931), Forsling and Dayton (1936), Fults (1936), Hoover (1939), Reitz and Morris (1939), and Savage (1939) have discussed many of the growth habits of blue grama. Riegel (1940–41) reported on its life history, habits, and variations in growth from seed produced in various sections of the Great Plains. Lang and Barnes (1942), working at Archer, Wyoming, found that frequent clipping during the growing season resulted in yields 48 to 51 percent larger than those obtained when the herbage was removed only once, and at the end of the growing season. Holscher (1945), working at Miles City, Montana, found that clipping blue grama to 2- and 4-centimeter stubble heights and at intervals of 2 and 4 weeks during the summer reduced both the total production of herbage and the plant vigor.

Limited space does not permit discussion of numerous other clipping studies. However, insofar as we were able to determine from available literature, nothing has been published on the natural decline in weight of blue grama herbage.

Methods of Investigation

Growth of blue grama was measured by recording length of leaves and height of flower stalks and by harvesting several series of plots at periodic intervals during 1941, 1942, 1946, and 1947. Before growth started each year, a site that supported a uniform cover of blue grama and that had been moderately grazed the previous year was fenced to exclude livestock. Belt transects 2 feet wide and approximately 80 feet long were established within the fenced area by stretching strands of smooth wire between iron stakes. Transects were separated by work areas 2 feet wide. Ten transects were used as sampling strata in 1941 and 1942, and

[1] Maintained by U. S. Dept. of Agri., Forest Service, in cooperation with Colorado A&M College, Fort Collins, Colorado.

20 were used in 1946 and 1947. Twenty to 25 plots of varying length along the transect, but each containing, in total, an estimated 1 square foot of 10/10 density of blue grama, were laid out in each transect. Thus, all plots had nearly equal areas of blue grama sod (Fig. 1). Plots were numbered consecutively within each transect, and the clipping dates for individual plots were assigned at random. The size of each plot was measured in order to compute herbage yields on a per-acre basis. All samples were clipped to the root crown. The blue grama herbage from each plot was weighed immediately after clipping in 1941, 1942, and 1946, and placed in labeled paper sacks. The samples were weighed again when air-dry to determine air-dry weight. Air-dry weights only were taken in 1947. All yields are expressed in pounds per acre, air-dry.

partial removal on different dates and repeated partial clipping treatments were applied. Some variations in field procedures from year to year provided wider coverage of climatic and clipping responses, and additionally confirmed the significance of findings. Data were analyzed through the use of Student's "t" Test to determine statistical reliability.

Variation in Growth of Blue Grama

The manner in which blue grama responds to variations in growing conditions was clearly demonstrated during the study period. Rainfall in 1941 was abundant and well distributed during the growing season. Leaves of blue grama attained their greatest average length of 3.3 inches by June, but remained fairly green until September. Moisture content reached a maximum of 62 percent in mid-May and decreased gradually

Fig. 1. Study plots to ascertain growth characteristics of blue grama by clipping, Central Plains Experimental Range near Nunn, Colorado.

Effect of partial removal of blue grama upon total herbage production was added to the study in 1946 and 1947. One-time

to 25 percent the first of October. Flower stalks were produced in abundance during the latter part of June. They attained an

average height of 12 inches in August. The air-dry weight of herbage increased steadily to a maximum of nearly 1,500 pounds per acre in the middle of August (Table 1).

TABLE 1

Seasonal trend in herbage weight of blue grama, 1941–1947.

APPROXIMATE DATE OF CLIPPING	YEARS OF OBSERVATION			
	1941–42	1942	1946–47	1947–48
	Pounds per acre, air-dry			
May 1	253	—	—	—
May 16	553	718	428	926
June 1	738	788	518	958
June 16	939	783	535	1422
July 1	1098	816	521	1297
July 16	1279	873	504	1269
August 1	1328	794	472	1241
August 15	1485	762	435	—
August 22	—	[1]673	—	—
September 1	—	—	379	—
October 1	977	—	472	—
October 15	—	—	492	1289
November 15	890	—	410	—
February 15	—	—	396	1050
April 9	870	—	346	965

[1] Field work discontinued after August 22.

Flower stalks accounted for most of the increase in herbage weight during July and August. Between August 15 and October 1, the air-dry weight of herbage declined over 500 pounds per acre or 34 percent. An additional loss of about 85 pounds occurred prior to the middle of November. Although a small reduction in weight during the winter months is indicated, it is not reliable due to sampling error.

Growing conditions in 1942 were again above average, and blue grama had produced 873 pounds of air-dry herbage per acre by the middle of July. By the latter part of August the yield had declined 25 percent or about 200 pounds per acre. Only a few seed stalks were produced. Moisture content of the fresh clipped herbage ranged from 35 percent down to 21 percent during the period of weight decline. The full extent of weight loss was not determined in 1942, due to departure of personnel for military service.

Unfavorable growing conditions prevailed in 1946. Rainfall was limited and generally ineffective from June 1 through August 20. Heavy rains fell in late August and again in mid-October. The August rains induced the range vegetation to green up and produce considerable new growth. Leaves of blue grama averaged only 1.8 inches in length on June 1 compared with 3.3 inches in 1941. Their greatest length of 2.5 inches was reached in late September. The maximum moisture content of 34 percent was found on June 16. The minimum of 5 percent occurred on August 15 when the early growth was well cured on the ground. Flower stalks did not appear until mid-September. The crop was small and the stalks attained a height of only 5 inches. Air-dry herbage weight reached a maximum of 535 pounds per acre on June 16. Production that year was about one-third of the 1941 production. Herbage yield declined 29 percent or about 150 pounds per acre from June 16 to September 1. The rate of decline was gradual. A second peak of nearly 500 pounds was reached in mid-October from growth following late August rains. Moisture content increased to 26 percent during this late growing period. A weight decline of about 80 pounds developed between October 15 and November 15. Another reduction of 50 pounds occurred between February 15 and April 9. By April 1947 the air-dry weight of herbage produced in 1946 had declined 35 percent.

Rainfall was adequate and its distribution was almost ideal for blue grama growth in 1947. Over 900 pounds of air-dry herbage per acre was harvested when the first plots were clipped in mid-May.

Two weeks later, during which the weather was cold and damp, herbage weight had increased only 32 pounds per acre. Warm weather and adequate moisture stimulated rapid growth during early June. The maximum yield for the year, over 1,400 pounds of air-dry herbage per acre, was harvested on June 16. Seedstalk production, however, was far short of the 1941 crop. Maturing of the blue grama vegetation became evident during the following 2 weeks. The yield dropped 125 pounds to just under 1,300 pounds per acre by July. Favorable moisture conditions kept the plants fairly green until mid-September. Yields of 1,269 and 1,241 pounds of air-dry herbage per acre were obtained on July 16 and August 1. The check plots harvested in October averaged 1,289 pounds per acre. Weight of the air-dry herbage declined from October to the following April in close proportion to the time interval between clippings. On April 9 the herbage weighed nearly one-third less than it did at the peak of production in 1947.

Seed stalks contributed approximately 25 percent of the herbage weight in 1941. In 1947, a year of similar herbage productivity, they accounted for less than 10 percent of the air-dry weight. The ability of blue grama to make prompt, full use of favorable growing conditions whenever they occur is a major factor contributing to its dominance in Great Plains vegetation.

The air-dry weight of blue grama herbage declined during the time the plants were curing or maturing, as well as during fall and winter months. The extent of this decline varied from year to year. During summer and fall months it ranged from 9 to 34 percent of the maximum production in the 4 years of this study. By the following spring, weight losses amounted to 30 or 40 percent.

Causes of the decline in herbage weight were not investigated in this study. It appears, however, that translocation, leaching, and oxidation may be important factors. In California (U. S. Forest Service, 1949), losses in air-dry weight of crested wheatgrass, smooth brome, and other reseeded grasses amounted to as much as 40 percent between mid-June and late September. Those losses were attributed mainly to the dropping of leaves and dissemination of seed. In the present study, there was little evidence that leaves had been broken off and blown away, and reduction in weight occurred whether or not seed stalks were produced. Disintegration of herbage remaining from a previous year might account for a portion of the loss. Herbage from 1940 growth remaining on the newly established plots in early April 1941 averaged 127 pounds per acre. This herbage, had it remained intact until the time of peak production in mid-August and then disintegrated, could have accounted for only 25 percent of the 500-pound decline in weight between August 15 and October 1, that year.

Effect of Complete Removal of Herbage on Subsequent Growth

The effect of one complete removal of herbage upon subsequent growth within the same year was measured in this study. Air-dry weight of regrowth harvested in October of 1941 and 1947 varied with the time it had to develop following the first clipping (Table 2). Plots clipped for the first time after August 1 did not produce sufficient regrowth to harvest in either of these years. The summer drouth in 1946 retarded regrowth on plots clipped after June 1. Growth following rains in late August was fairly uniform on all plots. This accounts for the similar yields in October from plots that had been harvested the first time from June 16 to September 1, 1946.

Regrowth harvested in October 1941 from plots that were clipped on April 25 and May 2 averaged 968 and 985 pounds of air-dry herbage per acre. These yields were practically equal to the 977 pounds per acre total production harvested from check plots that were clipped in October. Very little new growth was present when the plots were harvested in April and early May. Leaves and flower stalks on those plots attained the same length by October as those on check plots. Early removal of herbage from the plants apparently had little effect upon subsequent growth. The natural decline in weight of this full-season regrowth appears to have been the same as that of original growth.

TABLE 2

Regrowth and total herbage of blue grama when clipped to crown level once during the growing period.

DATE CLIPPED FIRST TIME	1941		1946		1947	
	Regrowth	Total yield[1]	Regrowth	Total yield	Regrowth	Total yield
	Pounds per acre, air-dry					
May 1	985	1238	—	—	—	—
May 16	776	1329	166	594	448	1374
June 1	640	1378	144	632	368	1326
June 16	560	1499	90	625	305	1727
July 1	407	1505	98	619	142	1439
July 16	295	1574	93	597	131	1400
August 1	177	1505	97	569	81	1322
August 15	—	1485	95	530	—	—
September 1	—	—	85	464	—	—
October 1–15	—	977	—	492	—	1289

[1] Sum of initial yield and regrowth harvested in October from the same plots.

Flower stalks produced after complete removal of the foliage in late May and early June, 1941, were 3 inches shorter than the flower stalks produced on the check plots that year. The regrowth leaves on these late May and early June clipped plots were one-half inch shorter in October than the regrowth leaves produced on plots that were clipped in late April and early May. Complete removal of blue grama herbage after the seed stalks appeared did not stop their production. A second crop of seed stalks was produced on plots that were clipped to the root crown during late June and July, although the stems were short and scattered.

Table 2 shows that plots completely harvested once during the growing season and again in October produced more herbage than check plots. The only exception is the yield from plots first harvested on September 1, 1946. This apparent increase in production contains two interrelated factors: (1) natural decline in weight of mature herbage; and (2) stimulation of growth due to clipping. The effect of clipping on total production, based on weight, is difficult to evaluate. When the natural decline in weight of herbage is considered, the apparent increase in production is less and often disappears entirely. Clipping during the growing season and again at the end of the growing season removes a greater total weight of herbage from the range than clipping the herbage only once at the end of the growing season. The increased yield from two or more clippings, if larger than the natural decline in weight from growing season peak production to fall yield would indicate a stimulation of production due to clipping during the growing season. If it were smaller than the natural decline, it would indicate reduced production due to clipping during the growing season.

Effect of Partial Removal of Herbage on Total Production

Plots from which one-third of the herbage present had been harvested repeatedly on June 1, July 1, and August 15, 1946 produced approximately the same total yield as the check plots. Here again, the effect of partial clipping was confounded with natural decline in weight of herbage. As noted previously, peak production

in 1946 was reached on June 16, after which the herbage started to mature and decline in weight. As there was no increase in production from recurrent clipping to offset the natural decline in weight of the check plot herbage, it is quite probable that recurrent clipping that year actually reduced the total production of herbage by blue grama.

Frequent light clipping of blue grama vegetation in 1947 resulted in an average total production of 1,202 pounds of air-dry herbage per acre. This was 87 pounds less than the yield from check plots. Although the difference is small, it is statistically significant at the .05 level. Considering the natural decline in herbage weight on check plots, the real difference due to frequent clipping is probably somewhat greater.

The average total production of plots from which approximately 30 and 50 percent of the herbage had been removed one time during the growing season was practically the same as that of check plots.

Application of Results

Fluctuation in the size of the forage crop produced by blue grama indicates the difficulty of determining practical stocking rates for short-grass ranges. Prediction of the size of the crop for a given year seldom is reliable because blue grama growth depends largely upon the amount and distribution of rainfall during the growing season. This year to year variation in the volume of forage produced emphasizes the importance of two factors in the organization of ranching enterprises: (1) stocking rates should allow for a substantial margin of safety in the forage supply; and (2) high flexibility in the livestock-herd organization needs to be maintained in order to adjust livestock numbers to the available feed supply.

Results of this study indicate that the natural decline in weight of blue grama herbage should be considered in measuring forage production on short-grass ranges, especially if reliable comparisons between years or seasons are desired. Some measure of this decline is definitely needed for accurate interpretation of the results of clipping studies involving blue grama herbage weights. Reduction in weight may also have a bearing on the measurement and interpretation of nutritive values of blue grama. It appears likely that this decline is at least partially associated with physiological processes of the plant, especially during the summer and fall months.

The effect of the natural decline in weight of herbage on utilization measurements is readily seen from an example. Assume that peak production of a range in a given year is 600 pounds per acre. The same herbage ungrazed weighs only 400 pounds in the fall due to the natural decline in weight. Herbage remaining on the grazed range at the end of the season weighs 200 pounds per acre. A comparison between the weight of herbage remaining and the weight at peak production would indicate grazing use of 67 percent. Comparison between the weight of herbage remaining and weight of mature ungrazed herbage would indicate a grazing use of 50 percent. The latter is logically the proper comparison as it accounts for the natural decline in weight.

Average length of blue grama leaves is only a fair indicator of the weight of herbage on the ground. Herbage weight may increase or decline substantially after the leaves have attained their greatest average length. Harvesting sample plots and weighing the clipped vegetation provides a much more reliable measure of herbage production than height measurements.

Summary

Growth of blue grama and its response to different systems of clipping were

measured during four years of variable growing conditions on the Central Plains Experimental Range in northeastern Colorado. Herbage production was measured periodically by recording the length of leaves and flower stalks, and by harvesting plots that contained approximately the same amount of blue grama sod. The effects of complete and partial harvesting were observed.

Blue grama responds quickly to favorable and unfavorable growing conditions. The volume of herbage produced varies widely from year to year, depending largely upon the amount and distribution of rainfall. Chances for reliable prediction of the size of the crop are small. The herbage crop can be produced in a few weeks when growing conditions are favorable. Weight of seed stalks may account for as much as 25 percent of the total herbage weight. The ability of blue grama to make prompt, full use of favorable growing conditions is an important factor contributing to its dominance in the native vegetation of the central Great Plains.

Harvesting of blue grama vegetation to the root crown once during the growing season and again in October removed a greater total weight of air-dry herbage from the range than harvesting only in October. A single close clipping during the growing season may or may not stimulate additional growth. Repeated clipping of one-third of the herbage present at 4- to 6-week intervals in 1946 had no effect on total herbage yield. Seven light clippings at 2-week intervals in 1947 reduced the total weight of herbage by 7 percent. Removal of 30 to 50 percent of the herbage one time during the growing season did not affect total production.

Air-dry weight of blue grama herbage reaches a maximum during the active growth period, and then declines as the plants mature. The amount and period of weight decline vary from year to year. Reductions of over 30 percent of the maximum herbage weight were observed during summer and fall months. Additional losses occurred during winter months. The magnitude of these losses is important and necessary in the interpretation of clipping studies involving blue grama herbage weight. Recognition of this natural decline is necessary in making reliable estimates of the grazing use of the vegetation.

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Making the Most of the Research Dollar

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RESEARCH workers of today have the responsibility for providing a sound scientific basis for the conservation and use of range lands. This obligation extends to more than 950 million acres of range lands in the United States alone, about two-thirds of which are privately owned. The most productive ranges are generally in private ownership. Additional millions of acres exist in Canada and other neighboring countries. If their obligation is to be met and satisfied, even in part, range research workers must make the best use of every available research dollar. Today, with Federal agencies, State agricultural experiment stations, stockmen, and ranchers engaged in research of one type or another that relates to range lands there is urgent need for cooperation and integration of effort at all levels.

Such questions as, where should the program begin?; what should it include?; and where should it stop?, must be answered as a first step in outlining a range research program. This initial effort will reveal major unsolved problems and will determine which ones fall properly within the range research field.

Information concerning the type of range, how, when, and by what kind of livestock it is used, its relationship to other lands, and many other facts are essential for a full understanding of the situation. All of this information is gotten through a review of research already done, field examination of typical areas and through consideration of this information with stockmen, public land administrators, and others interested in the research program.

In establishing priorities, problems of greatest importance to the region and its economy are usually placed highest on the list. However, consideration must be given to the need for meeting exigencies. In any program there are often opportunities to study some particular problem of great immediate importance. Such opportunity to perform a needed service that is in current demand cannot be regarded lightly even though the problem may have low priority in the over-all research program. As an example, about three years ago the Congress appropriated money for forest research in northeastern Washington where livestock production now largely provides the basis for local economy. Originally a heavy timber producing area, and perhaps best suited for that use in the long run, this area needed answers to local range problems. After thoroughly considering the situation with private land administrators and State and Federal agency representatives about a third of the money appropriated was directed to range reseeding and noxious range plant research. Behind the scenes, the regional analysis which is basic to a long-time research program is steadily going forward.

Once priorities are established many other considerations must be met in selecting the research to be undertaken. For example, personnel is a strong factor in selecting research to be done. There is only one specification for personnel to analyze a situation and formulate a program and that is that the very best man

or men possible should be selected. In every case men assigned to range research should have sufficient background, experience, and judgment to know and understand the problems.

Close working relations with other research groups and individuals and knowledge of their programs are other factors which help to govern the selection of research to be undertaken. Free exchange of ideas and thoughts should be the aim at all times. Many examples of successful application of this guide are known throughout the country where State and Federal groups work closely together and separately or in combination with ranchers and stockmen. The exchange of project analyses, and working plans for review and criticism as well as preliminary reports of results for verification and further test greatly, facilitate this effort. This makes for inter-regional coordination and prevents unnecessary duplication of effort. In the case of reseeding research in the Intermountain region, the decision to concentrate on the sagebrush zone was reached only after all parties concerned had agreed on first priority for that zone. The Utah deer study also illustrates how several State and Federal agencies often work together for a common goal. In this case the Congress specifically appropriated funds for certain kinds of research, then the Fish and Wildlife Service, the Forest Service, the Utah State Game Department and the Utah Agricultural Experiment Station jointly took on the job.

Thorough consideration of all factors is basic to the selection of research to be undertaken. But why make such an analysis at all? Simply because properly done it provides a logical, common sense means of determining *what* is needed, *when* it is needed, and *why* it is needed. Such an analysis is applicable particularly to a new undertaking. In many respects there is also direct application where research has been in progress for years. Regardless of how familiar researchers are with regional situations a thorough analysis provides a means of "taking stock" of what has been done and of placing in writing the ideas, opinions, and knowledge of the most competent man, or men available. Without it, particularly in a new undertaking, popular opinion and local pressures might direct the effort into nonproductive fields at considerable loss of time, money, and effort.

Methods of study, throughout any project, should be sound to insure accurate, usable data, and as nearly as possible in accordance with proven techniques to insure acceptance and application of results. The project should be suitably located to insure reasonable freedom from disturbance for a sufficient time to accomplish stated objectives. Public ownership of land and facilities frequently offers advantages in this respect. Livestock, if involved, of the kind and class predominantly produced in the region should be selected for the project. Administration of the project should recognize practical aspects of range and livestock management yet remain scientifically sound throughout. Yearly analyses and a complete analysis of resulting data at the end of three years with definite plans to publish worth-while findings that have been adequately tested should be the goal in every undertaking.

Pilot Testing of Results

Because of costs involved and the physical impossibilities of effectively studying vast range areas and large numbers of grazing animals, range research frequently must be conducted on a small scale. This is especially true at the outset of most projects.

Pilot testing of results developed from small areas and few animals on a practical

ranch or range basis makes for greater confidence in results and insures speedier application of sound findings. It consists merely of systematic testing under one or a few conditions, management practices, grazing systems, or other range aids on a large enough scale to furnish cost and return data and other important practical information.

In July 1950, the Journal of Range Management (3:190–197) carried an article by E. E. Meik concerning a pilot test of this sort relating to reseeding research results. Several years ago, Mr. Stanley Antrim, a sheep operator in the Bitterroot Valley of Montana, made available to the Forest Service about 10 acres of cheatgrass infested range land for reseeding research. Small row plots of various forage species were first established. Later, fractional acre plots of cereal grains such as barley, winter rye, and wheat were established by plowing and drilling. Following harvest of the cereal crop, forage species, mostly crested wheatgrass, were drilled into the grain stubble without soil preparation. Because of the need for greater and more reliable range forage production on his ranch Mr. Antrim began to use this method to convert formerly plowed cheatgrass infested lands to productive range. At first he pilot-tested research results on a rather small scale—50, 100, or 160 acres per year. Finally nearly 600 acres were included in the test. In addition, Mr. Antrim has reseeded three times the test acreage by the now well known preparatory crop method to increase his range production of lambs and wool. The preparatory crop method, with variations in some cases, is being used by other ranchers in western Montana today, not only because they have seen the small plots and are sold on what they saw but also because they have seen the research findings put to work on a practical scale by Mr. Antrim. Many other examples of pilot tests could be quoted, from all parts of the country.

Putting Research Results into Practice

The range researcher's principal measure of accomplishment and satisfaction lies in making his findings and results available to range users and co-workers. This is done primarily through publications. Thorough analyses of situations and adequate selection and planning of research to be undertaken insures a rather steady flow of publications, with reasonable effort, from the start to final termination of each range research undertaking. These publications may be of many kinds; trade journal articles, research notes, technical articles, USDA bulletins, or perhaps even textbooks. Each has its place, its audience, and depending upon how well it is done, each does its part in bringing a problem solution to the rancher, stockman, and public land administrator.

Field days, such as Ranch Day at the Jornada Experimental Range, and show-me trips give stockmen and public land administrators an opportunity to discuss research results on the ground as they apply to their individual operations. These are particularly valuable for small local groups.

The final test of whether the range research dollar has been well spent lies in the extent to which results are accepted by range users and applied in practice and in the improvement in operation which is shown as a result of that acceptance and application.

When range research first came into the picture 40 or 50 odd years ago, little was known about native ranges or how they should be managed. Limited early efforts were followed by organized experiments throughout the western range

country. Rancher experience and "know-how" supplemented research throughout this development and their operations helped to provide needed proving grounds in many cases.

This trend is indicative of the growth of range research as a science and of the increasing recognition of the importance of thorough planning in every step of the research job. These early studies not only cut the pattern for range research as we know it today but together with ranch experience laid the foundation for many of the range management practices which are now in use. In some cases recommended practices based on early results were only stop-gap measures that have since been refined or completely replaced by improved methods. More refinements are needed and will continue to be needed as maximum sustained production from range lands becomes more urgent.

The need for refinements in range grazing practices requires a closer look, and a more careful research approach. This means small scale, very intensive experiments on the range. Such experiments based on thorough analysis of situations, careful selection of research to be done, and adequate planning followed by pilot testing of results and good extension hold promise of full use of the research dollar

THE PUBLICATION OF RESEARCH—1.

The ultimate aim of research is publication. . . . Unfortunately, much scientific writing . . . is loose and indefinite in its expression, verbose often to the point of being tedious, and out of harmony with the ordered, exact, and logical nature of science itself. . . . The aim in publishing research, . . . is to leave the *field clearer than you found it.*—E. W. Allen.

BOOK REVIEWS

The Practice of Wildlife Conservation

By Leonard W. Wing. 412 pp. John Wiley and Sons, Inc., New York. 1951. $5.50.

With this book Dr. Wing becomes the author of a dominant wildlife management text, and John Wiley and Sons, publishers of many important forestry and conservation books, toss their hats into the ring of wildlife science as a part of wildland management.

Dr. Wing always has stressed, in talk and now upon his book jacket, his uniqueness as the first student to receive his Ph.D. under Professor Aldo Leopold while at Wisconsin. This master-disciple relationship prompts comparisons between Dr. Wing's book and Leopold's classic *Game Management* (1933).

Leopold explored the fundamentals. In his preface, which most readers ignore or forget, he promised only to deal with natural laws related to all species in all places. Before a decade passed, younger men, more adept in techniques than philosophies, were saying that much wildlife knowledge discovered since 1933 needed recording between hard covers.

Other books appeared. Gabrielson, emphasizing the need for educating the public, wrote his highly readable, and general, *Wildlife Conservation* (1941) and *Wildlife Management* (1951). Graham's *Natural Principles of Land Use* (1944) and *The Land and Wildlife* (1947) stressed lands conditioned for their own good and for wildlife production. Trippensee's *Wildlife Management* (1948) compiled detailed information for individual species in particular places, and repeated Leopold's principles sparingly.

Wing strives "to blend the theoretical and scientific aspects with actual field practice;" a heroic task for as few as 364 pages of text, including 15 pages of suggested readings. The book covers both principles and application, including, in addition to discussions of usual game animals and birds, one chapter upon fur-bearer management, one upon waterfowl, two dealing with fish, one chapter upon Songbird and Non-Game Conservation and Management, and one upon The Treatment of Rare, Threatened, and Persecuted Species. Four chapters concern administration and regulation under Canadian and U. S. state, provincial, and federal controls.

Principles discussed lack Leopold's profundity and philosophical orientation. Many float in space, unassociated by discussion with earlier works. For example, Leopold's "cruising radius" is unmentioned in Wing's discussion of mobility. Wing's species analyses are less detailed than those in Trippensee's longer book.

In Wing's quest for brevity, minor inconsistencies occur. He implies that "ecological, biological, and management jargon" will be unused, yet associates wolf packs and *peck order* in a paragraph causing those unfamiliar with such jargon to suspect typographical errors, and uses scientific names undefined by English counterparts. Discussions of food quantity and quality are confused. Several ambiguous sentences slow the reader. The chapter governing waterfowl is entitled "Wildfowl," but blue, spruce, Franklin, and ruffed grouse, wild turkey, mountain quail, and woodcock are grouped under the chapter on Game Birds of the Forest. Sage grouse, prairie

chickens, and sharp-tailed grouse are discussed in the short chapter upon Game Management in the Open Range, along with bison and antelope. With amazing rashness, Wing demagogically denies existence of the "sportsman's dollar," and advocates its inclusion within general funds.

The book, like many today, despairs of acquainting lay readers with scientific literature citations, even in their least obnoxious forms, and so fails to school laymen in the wealth of writers and their contributions.

Despite these minor weaknesses, the book richly portrays the author's scholarly familiarity with his field and, since he is young enough to revise it in due time, it becomes a useful handbook, though scarcely an encyclopedia. It is most valuable for the man who wants a single reference to both principles and data. It is a challenging and informative book for the advanced conservation specialist or student partly familiar with ecological fundamentals. We at Colorado A and M College shall use it upon our senior game management spring trip, as a final survey of student knowledge and of the subject, quite complete and yet with abridgements and minor omissions which alert faculty and students into complete analyses.—*J. V. K. Wagar*, Department of Forest Recreation and Wildlife Conservation, Colorado A and M College, Fort Collins, Colorado.

Grasses of Southwestern United States

By Frank W. Gould. 352 pp., drawings and maps. Univ. of Arizona Biol. Sci. Bul. No. 7, 1951. $3.00.

This book is essentially a technical manual of the grasses of Arizona. There are, however, a few extra features not found in all manuals that add to its value. There is a short comprehensive description of the grasslands of Arizona by geographic plant zones written by Forrest Shreve—formerly in charge of the Carnegie Institute at Tucson. Ecologists may criticize this report as describing the present vegetation without consideration of its state of depletion. There are two small maps to show the range of altitude in Arizona and place names commonly used to designate the locality for grasses but the value of the map is reduced by the small scale. There is also an extremely brief historical statement of grassland research in Arizona. The book contains a bibliography of nomenclatorical publications on the common genera for the student of taxonomy which includes a few references of general nature on grasses in addition to those on taxonomy.

There is a good description of the grass plant, designed to show its structure and its nomenclature. This section is well illustrated with very good line drawings and will be a valuable aid to students of grasses, especially to beginners in taxonomic nomenclature.

There are a number of good line drawings of the more important species which, while not to scale, will be helpful to the student. However, line drawings such as these are of doubtful value to illustrate grasses for the layman.

In nearly all cases the distribution of species in Arizona is given by counties. This is often supplemented by the elevational range and sometimes by the names of mountain ranges, valleys, and place names to more definitely circumscribe

the known habitat of the species in Arizona.

The taxonomic description of grasses is based on sub-families, tribes, genera and species with appropriate keys for each division. The greatest amount of detail is given in the technical description of species and this book should be considered as above average in the description of species. This work does not have a fault frequently ascribed to plant manuals: that of not adequately describing each species when a genus has several similar species to consider. Plants are described in the key on the basis of reproductive characters but there is some attention to vegetative features. Also, the forage values and uses are discussed briefly for the more important species; but the book leaves much to be desired in this respect.

Gould has revised some of the common genera in this work as compared with the most common grass manuals. The most notable variation from the widely used Hitchcock's manual of grasses is that he has reclassified most of the members of the genus *Agropyron* to the genus *Elymus*. The common *Sitanion* species are also shifted to *Elymus*. *Pappaphorum wrightii* has been placed in the genus *Enneapogon* and is listed as the only representative of this genus in North America. It is beyond the scope of this review to consider the validity of the genus classification and changes made by Mr. Gould, which he says have been made to simplify the classification. Range people will generally welcome simplification. However in the opinion of this reviewer, the changes made here will not be endorsed by range men who are accustomed to the classification established in Hitchcock; at least not until Mr. Gould can persuade Hitchcock and other standard manuals to revise their works.

The use of this work is limited pretty much to people with a technical knowledge of taxonomy. Its makeup is too technical and its terminology too complex to be of any considerable value to the layman who is looking for a simple means to identify common grasses. This book will be valuable to technical students of grasses and to taxonomists in considering Arizona grasses, first, because it has a good description of each species; and second, it describes the distribution and the forage value and uses of some of the most common species in Arizona. It will have a limited use in adjacent areas where some of the situations are very similar to Arizona.—*J. S. McCorkle*, U. S. Soil Conservation Service, Albuquerque, New Mexico.

Farm Crops: Judging, Identification and Grading

By Hi W. Staten and Melvin D. Jones. 251 pages. Illus. The Blakiston Company, Philadelphia. 1951. $4.50.

This is a book that has been written to meet the needs of a general crops judging and identification course in high schools and colleges. It will probably be particularly successful as a text in those high schools where supplementary material is limited. The prevalence of this condition would seem to justify, more than anything else, the reproduction of a large number of illustrations of plants and seeds, most of which are available in many other publications in the average college library.

The book consists of a preface and

three parts. In the preface the writers imply that good judges are "born", and state that "the training or development of the mind then comes easily and naturally". Even if this were true, it hardly appears that such a statement would inspire the hard work necessary to bring out the best from high school or college students.

The first part, 88 pages, deals with judging. Scorecards from different sources and for different crops occupy 22 pages. Any rancher who buys seed would surely be a more discriminating buyer and have a greater appreciation for good quality seed if he studied these score cards. The section on judging also contains helpful suggestions to anyone who enters exhibits at state or county fairs, whether they be of crops or bottled fruit, etc.

The second part of the book, covering 116 pages, deals with identification of crops (including grasses and legumes), weeds, and diseases. This section is profusely illustrated, but the illustrations are not as effective as they might be since they are neither numbered nor referred to in the written descriptions. In the introduction to part two, the authors state that following the name, the region is listed where the crop, weed or disease is best adapted. This brings up the difficult question of what is meant by "best", and the reader will be confused if he lives in the Northern Rocky Mountain Region (map, page 93), to read on page 135 that crested wheatgrass is best adapted in the Pacific Northwest and Northern Great Plains. This map, defining the 12 crop regions of the country, is not adhered to in stating the region of best adaptation. Thus, there is no "Pacific Northwest" region on the map.

In part two, there are 23 native and 18 introduced grasses. The descriptions are non-technical, and together with illustrations will no doubt help ranchers to identify their more important species.

The third part of the book, about 26 pages, deals with grain, hay, and cotton grading. Ranchers who buy or sell hay or grain will find that this brief section will help them to appreciate the various market classes, the factors on which they are based, and how they are determined.

This is a time when ranchers are becoming increasingly aware that they must know more about the forage plants their animals depend on. Range revegetation through artificial reseeding is on the increase, and ranchers need to know more than ever before how to recognize good quality seed. This book will help the rancher with some of these problems. This reviewer would hesitate to recommend it as one of the better sources for such aid, but in fairness to the authors, perhaps that would be expecting too much from a book written to serve as a high school and college text in crops judging and identification.—*Wesley Keller*, Bureau of Plant Industry, Soils, and Agricultural Engineering, Logan, Utah.

Introductory Animal Husbandry

By Arthur L. Anderson. Revised edition. 701 pp., 301 figures. The Macmillan Company, New York, 1951. $6.00.

This is a text-book intended to acquaint the student with the fundamental problems and essential general concepts of livestock production in the United States. The subject matter covered and the arrangement of the material are exactly

as in the first edition. One part of the book is devoted to cattle, beef, dairy and dual-purpose cattle, other parts to swine, sheep, horses and mules. In each part we are given first a general view, then discussions of types, of markets, of products and by-products, of feeding and management, and of breeding. The subject matter is brought up-to-date, statistical tables give recent figures, many of the illustrations are new, the references in the appendix have been brought up-to-date.—*Helen Boyd*, Librarian, Louisiana Branch, U. S. Department of Agriculture.

BRIEFS

The one thing that hurts more than paying an income tax is not having to pay an income tax. —Thomas R. Dewar.

There's nothing surer than death and taxes, but not in that order.—Tom Clifford.

CURRENT LITERATURE

Prepared by Robert R. Humphrey, Department of Botany and Range Ecology, University of Arizona, Tucson, Arizona.

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NEWS AND NOTES

Society Members on Foreign Assignments

Joseph F. Pechanec, Pacific Northwest Forest and Range Experiment Station, U. S. Forest Service, left Washington, D. C. August 21 for Rome on a four-months' detail with the agricultural division of the Food and Agriculture Organization. He was a member of a four-man team studying the agricultural situation in Somalia for the purpose of recommending a program for its development and improvement. Mr. Pechanec served as range specialist.

F. A. Ralston, Montana State College, left in the fall for Iran where he is serving as a livestock specialist under the Point IV Program. He is with the office of Foreign Agricultural Relations.

John F. Reed, associate professor of botany, University of Wyoming, has been granted a year's leave of absence to participate in a soil analysis and classification project in the Congo. The project is one in which the United States is cooperating as part of its international efforts to improve conditions which prevail in the backward and undeveloped portions of the world. He will be under contract to the Belgian government, and will work with the National Institute for Agricultural Studies in the Belgian Congo.

Rain-increasing Program

Pros and cons of rain-increase programs were discussed from scientific and practical angles by experts attending the 15th annual Great Plains agricultural council meeting in Laramie last summer. The majority of a panel of six experts declared their belief in the value of a program already covering a substantial portion of the southwest and reaching into Wyoming and other states of the Great Plains.

Oregon State College News

Charles E. Poulton, Associate Professor of Range Management in the Departments of Animal Husbandry and Farm Crops, has taken educational leave to do graduate work for his Ph.D. at the State College of Washington. His graduate program will be under the direction of Professor Daubenmire in plant ecology.

During Professor Poulton's absence, Dr. D. W. Hedrick, formerly of the University of California Agricultural Experiment Station, will handle his teaching and research duties. Dr. Hedrick has been appointed Assistant Professor in the Departments of Animal Husbandry and Farm Crops.

Dr. James E. Oldfield has been appointed Assistant Professor, Department of Animal Husbandry (livestock feeding and nutrition), effective September 1. Dr. Oldfield has his B.S.A. and M.S.A. from the University of British Columbia and his Ph.D. from Oregon State College.

Woodward Field Day

The Fifteenth Annual Range Improvement Field Day was held October 13, by the USDA Southern Great Plains Field Station at Woodward and Fort Supply, Oklahoma.

Ten years of grazing and feeding results with beef cattle on native range and reseeded pastures were presented to the general public. Economic returns obtain-

able from various range management practices were featured as a major phase of the discussions led by representatives of the U. S. Department of Agriculture and the Oklahoma Agricultural Experiment Station.

The economic theme of the meeting was highlighted during the noon-hour barbecue program with an address on "Financial Problems of the Cattle Industry" by Fred R. Merrifield, President of the Wichita Bank for Cooperatives and General Agent for the Farm Credit Administration in Wichita.

Dr. Irving P. Krick, nationally-known Director of the Water Resources Development Corporation of Denver, Colorado, discussed possibilities of increasing and controlling rainfall. Applying scientific principles of artificial rain increase, developed by Dr. Irving Langmuir, Vincent Shaeffer, and co-workers of General Electric and Project Cirrus, Dr. Krick's W.R.D.C. has established weather control as a private enterprise through extensive areas of the West.

Dr. Krick is a weather scientist of well-recognized ability, training, and experience. He set up the first modern air line forecasting service. In World War II he headed the long range forecasting unit which gave General Eisenhower the weather information for "D" Day. Then he started his aerological institute. His weather forecasting has been rated as something like 90 percent correct. It constitutes a background for his newest venture, the artificial nucleation of clouds to increase rainfall.

HASKELL IN NEW POSITION

Horace S. Haskell, formerly of the School of Forestry, Utah State Agricultural College at Logan, has accepted a position with the California Forest and Range Experiment Station, U. S. Forest Service, Berkeley, California. He has been working with J. R. Bentley on the brush range improvement project. Their major project work for the past summer involved the completion of field data from exploratory plots in central California and the analysis and reporting of results from two years of exploratory work.

WITH THE SECTIONS

Colorado

The annual summer field meeting of the Section July 10–11 at Gunnison featured the results of management and improvement studies on irrigated mountain meadows and adjacent ranges.

Meeting jointly with ranchers and agency representatives attending the second Colorado Mountain Meadow Field day, the group inspected the feeding plant used to test livestock gains on hays from experimental meadows and a grass-legume nursery at the C. C. Goodwin ranch. Field fertility trials on hay meadows were observed at the V. Spann ranch, and factorial experiments dealing with irrigation, fertilization, overseeding, and harvesting systems were shown at the Blackstock ranch. Preliminary first year results indicated that the application of 150 pounds of nitrogen per acre or this amount of nitrogen in combination with 250 pounds of P_2O_5 resulted in about one ton of additional hay per acre on intermittently irrigated plots on the Spann ranch. Under continuous irrigation the response to fertilizers was much less, and no definite response to phosphorus was noted the first year under either irrigation system. First year results of the factorial experiments indicate that the addition of 40, 80, and 160 pounds of nitrogen per acre resulted in greater tonnage of hay, percent crude protein, and pounds of crude protein per acre. These responses were reported to be economical in terms of increased livestock weight gains when the hay was fed. Late cutting of hay resulted in slightly greater tonnage of hays, but early cutting resulted in a higher percentage of crude protein and more pounds of crude protein per acre.

Rodney Tucker, chairman of the committee to promote grass judging contests, reported that the Section will sponsor an entry in the seed show which is held in connection with the National Western Livestock Show in January. The contest entry will be for grass display boards prepared by FFA, 4-H or similar clubs. These displays will be scored according to a score card including attractiveness, representativeness and completeness, and proper identification. Tucker, manager of the seed show, asked the Section to furnish a committee to judge the displays. Premiums are to be made available for this contest out of funds granted to the Section by George E. Weaver of Fort Collins.

The evening program considered game range problems, with Gilbert N. Hunter, Game Manager of the State Game and Fish Department, presiding. C. D. Tolman and Paul Gilbert, state game biologists, reviewed the history of game range use in the Gunnison and Middle Park areas and emphasized the loss of browse and increase of grass. An outline of the new program for game range revegetation in Colorado, which will include browse seedings, was given by Robert Elliott. The proposed interagency reseeding demonstration project for the Gunnison Valley was reviewed. Ways and means of implementing this program were discussed. Hunter summed up the program with a resume of the general policies guiding the game management program.

A tour of range condition and improvement studies in the Black Mesa and Crawford areas was held the second day. Frank Smith, Assistant Supervisor of the Uncompaghre National Forest, reviewed the methods and steps involved in classifying range condition and classified the

condition in Kentucky bluegrass, needlegrass-weed, Thurber fescue, and perennial weed types. George Turner reviewed the infiltration, erosion, and forage yield studies at each area visited on Black Mesa. Thurber fescue range in good condition produced more forage, had a more rapid infiltration rate, and prevented soil erosion better than other types.

A short business meeting was held the evening of July 10 with approximately 50 members and guests in attendance. Chairman Clint Wasser gave a brief history of the objectives and activities of the Society, stating that the national membership has grown to over 2000 and the Section membership to 140. New officers of the Section elected in April were: C. H. Wasser, Chairman; Worthington Karn, Timpas, Vice-Chairman; and new council members Louis Visintainer of Craig and Kenneth Conrad of Wray. Carry-over council members are Carl Fonte of Grand Junction and Harvey Harris of Sterling with retiring chairman Herb Schwan of Denver becoming a council member according to the Section's Constitution. Due to his being transferred to Denver, Larry Riordan relinquished the Secretary-Treasurer's office to Robert R. Elliott of Fort Collins. It was announced that the next sectional meeting and range tour would be held at Wray, October 5–6 with sandhill range management as the main topic.

Larry Riordan, substituting for Chairman Don Hervey, told of the membership committee's plans to increase membership. Area chairmen have been appointed and they are to appoint one member to supervise the solicitation in each agency operating in the area. Area chairmen are as follows: Northwest, Bill Campbell; Lower Grand Valley, Carl Fonte; Southwest, Bob Bement; Southeast, Vic Pra Sisto; Northeast, Will McCorkle; Denver, L. E. Riordan; San Luis Valley, Grant Rodgers.

An appetizing lunch served by the Crawford Cowbelles on the shady lawn of the Dan Meek ranch refreshed the 72 members and guests making the dusty trip.

Bill Colt outlined the Bureau of Land Management grazing policies and told of their reseeding work on depleted sagebrush and pinon-juniper ranges. He indicated that some success had been had from airplane seeding of sagebrush lands disked or plowed.

Clyde Doran reviewed the species adaptability and date of seeding trials at the Crawford Nursery. Excellent stands of grasses, shrubs, legumes, and weeds were noted. Several field trials of reseeding sagebrush and pinon-juniper ranges were visited. Doran stressed the importance of adequate seedbed preparation which eliminated competing vegetation and left a firm seedbed and indicated that such land treatment is economical.

The program and arrangements committee consisted of Carl Fonte, Chairman, George Turner, and John Elliott. *Robert R. Elliott* and *C. H. Wasser.*

Kansas—Oklahoma

Beginning in mid-June the officers of this Section sent a series of letters to the members in a drive to increase membership and activity. Each member was urged to secure at least one new member before November 1. In a month eleven new members were recruited. A letter sent by E. H. McIlvain to the members was headed "Why Join the American Society of Range Management," developed the following six reasons for use in soliciting new members: 1. You will put more money in your pocket, your children's pocket, and your grandchildren's pocket. 2. You will get six copies a year of the only Journal devoted solely to grass and

livestock production. 3. You will have the opportunity of meeting with men interested in grass and livestock—your interests! 4. You will have a very definite part in guiding the future of the range livestock industry. 5. You will be proud to belong to an organization whose purpose is to promote the welfare of those living in and making a living from natural vegetation in areas of low precipitation—THE WEST. 6. You will help greatly to make America stronger, healthier, wiser, more democratic, and a better home for you, your children, and grandchildren. Those interested may obtain copies from E. H. McIlvain.

This Section met October 12 on the McClure Ranch near Woodward, Oklahoma, where over 2,000 acres of depleted farmland have been put back into some of the best grazing land out-of-doors. The group then attended the 15th Annual Field Day of the U. S. Southern Great Plains Field Station, Woodward, where 600 Hereford steers were to demonstrate what they know of (1) the beef producing qualities of various native and introduced reseeded grasses, (2) grassland with and without sagebrush, (3) heavy, moderate, or light stocking rates, (4) rotation grazing of dryland native range, (5) yearlong or summerlong grazing, (6) self feeding with salt meal versus regular hand feeding, (7) 41 percent cake versus 20 percent, (8) wintering on none, one, or two pounds of 41 percent cake, and a great many other tests that they know about after spending 10 years at the game.—*E. H. McIlvain.*

NORTHERN INTERNATIONAL MOUNTAIN

The point of assembly for the summer field meeting, August 30 through September 1, was the ghost town of Virginia City, Montana. Once the State Capital, Virginia City has been restored, so the members and their wives had a chance to visit the homes, stores, saloons, and other buildings of early gold miners and vigilantes, and to see an old time melodrama, while enjoying modern accommodations at the Fairweather Inn, or motels.

The Gravelly Range sheep allotments of the Beaverhead National Forest were first on the program. In addition to ranchers, representatives from a number of agencies and institutions formed the caravan driving to the range. The U. S. Forest Service, the Eastern Rockies Forest Conservation Board of Alberta, Canada, the University of Montana, Montana State College, Extension Service, Montana Conservation Council, Soil Conservation Service, and Montana Fish and Game Commission were represented. In all, approximately 65 people were present. In the vicinity of Crockett Lake, the group examined the vegetation on a plot that had excluded grazing for 35 years. Tom Lommasson of the U. S. Forest Service, Missoula, Montana, presented an interesting discussion of stocking rates and vegetational changes that have occurred. Tom pointed out that, contrary to popular belief, the range was in poor condition when first viewed by white man. Huge herds of buffalo grazed these high meadows during the summer months, and evidence of this early abuse of the range could be seen in the numerous shallow depressions, "buffalo wallows," that are now found on the range. These "wallows" were probably bare of vegetation and the weeds that formed the first cover on them made the area well suited for sheep grazing when it became a National Forest in 1908. Severe overstocking during World War I caused some decline in the condition of range, but moderate grazing by sheep since 1926 has resulted in an excellent stand of grass. Due to the many years of grazing by sheep, the forb population has declined. It would be excellent range

for cattle, but the short grazing season and scarce watering facilities limit this use. Dams sealed with bentonite have been constructed to catch runoff water from snow melt and these have increased the number of watering areas.

In a discussion of the ecology of the abandoned central bedding grounds, Tom Lommasson stated that the plant succession in these fertile areas is mountain brome followed by meadow barley and finally a stand similar to that near the bed ground. A one-night bedding system is now used.

climate above 9000 feet in the Gravelly Range. Some of the grasses planted in the Lazyman nursery that remained vigorous were meadow foxtail (*Alopecurus pratensis*), bearded wheatgrass (*Agropyron subsecundum*), slender wheatgrass (*A. trachycaulum*), smooth brome (*Bromus inermis*), meadow brome (*B. erectus*), and Kentucky bluegrass (*Poa pratensis*).

From a rocky point overlooking the Ruby Valley and much of the Gravelly Range, R. R. Schulz, Ranger, Beaverhead National Forest, explained the management plan on the Lazyman sheep allot-

Northern International Mountain Section members at the Camp Creek Wyethia control test plots, Beaverhead National Forest. E. J. Woolfolk is addressing the group.

Following lunch at Lazyman Hill, Carolyn Madden of the Montana Conservation Council led the group in singing of western songs. A short business meeting was conducted by Chairman W. ("Wally") R. Hanson.

At the top of Lazyman Hill Roald Peterson of the Northern Rocky Mountain Forest and Range Experiment Station, Missoula, presented graphs showing the responses of grasses to the rigorous

ment. The present plan includes: one night bedding, no camp wagons, camp unit system, limited time on each camp unit, and inspection of use on camp units.

Use of the same sheep trail for a series of many years resulted in rather severe gully erosion on one slope of Lazyman Hill. The erosion control program for this area described by E. E. Redman, Beaverhead Forest Supervisor, includes: rerouting of sheep driveways, diversion of water

that had caused severe gulleys, reseeding, and placing small trees in gullys to discourage trampling by sheep and hold the soil in place.

A banquet, an informative lecture on the history of Virginia City, and a play by the Virginia City Players furnished the climax for the first day's activities.

The car caravan proceeded up the Ruby River to Camp Creek the morning of the second day. E. J. ("Joe") Woolfolk, Chief, Division of Range Research, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, started the meeting with a brief statement of the Forest Service range research program in western Montana. One project underway at the Vigilante Experimental Forest is a study of the ecology and control of Wyethia or mules-ears.

Jack E. Schmautz, in charge of the Vigilante Experiment Station, described Wyethia and gave some information on the experimental plots. Plot studies indicated that as many as 43,000 plants per acre occurred on some of the area. This represents an almost complete coverage by this noxious plant since large plants cover nearly a square foot. Jack had samples of roots of wyethia that measured about three inches in diameter. In attempting to dig the roots out, it was found that they penetrated the soil more than six feet. The test plots showed that concentrations as low as 2,000 p.p.m. of 2,4-D in 100 gallons of water per acre gave a nearly complete kill.

After lunch at Fawn Creek, power wagons and pick-ups took members of the group across the Ruby River and up to the sagebrush eradication and reseeding trials. Men who spoke at this point were E. E. Redman, W. A. Schowe (Ranger, Beaverhead National Forest), R. G. Johnson (Extension Range Specialist, Bozeman, Montana), and Roald Peterson.

Browse condition on winter deer range was the topic discussed at the next stop. F. C. Curtiss, U. S. Forest Service, Dillon, Montana, stated that over 90 percent of the current growth of some important browse species had been used and that there was evidence of some of these species dying out due to the heavy concentration of deer on the Timber Creek area during the winter. Several men familiar with the area reported that death loss of deer in winter was very high. It was suggested that a greater take by hunters, especially of does, would result in better condition of the range and more desirable trophies for the hunters.

A joint meeting of the council and nominating committee was conducted by Chairman Hanson the night of August 30. It was granted that there be more flexibility of the border between the Northern Plains Section and the Northern International Mountain Section regarding meetings and memberships. The suggestion was made that more attention should be given to the youth phase of activities of the section. Frank O'Connell, rancher of Helena, Montana, was appointed chairman of the committee to handle this phase of activities. The meeting was followed by a smorgasbord dinner and a play by the Virginia City Players.

The Forest Service personnel who planned the program and were hosts for the meeting are to be commended for this informative and enjoyable meeting.—*Farrel A. Branson.*

PROGRAM

Fifth Annual Meeting

The American Society of Range Management

Hotel Boise, Boise, Idaho

January 30, 31 and February 1, 1952

WEDNESDAY FORENOON, January 30

Registration

President's Address, Dan A. Fulton

Business Meeting

WEDNESDAY AFTERNOON

Range Management and Water Conservation

Chairman: Reed W. Bailey, Director, Intermountain Forest and Range Exp. Sta., U. S. Forest Service, Ogden, Utah.

Introduction to the Southern Idaho Setting of Meeting; with Special Reference to Range and Water Resources, Reed W. Bailey.

Impact of River Basin Programs on Range Management, Carl B. Brown, Asst. Chief of Operations, U. S. Soil Conservation Service, Washington, D. C.

Mutual Watershed and Grazing Interests, W. R. Hanson, Asst. Chief Forester, Eastern Rockies Forest Conservation Board, Calgary, Alberta, Canada.

Storing Rainfall For the Grass Roots, Ben O. Osborn, Range Conservationist, U. S. Soil Conservation Service, San Angelo, Texas.

Discussion and Summation

Range Plant Identification, Student Contest

Judge: Liter E. Spence, Extension Service, Kamiah, Idaho.

THURSDAY FORENOON, January 31

Livestock Nutrition on the Range

Chairman: R. T. Clark, National Coordinator, Beef Cattle Research, U. S. Bureau of Animal Industry, Denver, Colorado.

Range Management as it May Affect Livestock Nutrition, R. T. Clark.

Livestock Nutrition on Ranges of Western Canada, With Special Reference to New Sources of Supplemental Protein, A. J. Wood, University of British Columbia, Vancouver, B. C., Canada.

The Nutritive Values of Winter Range Forage in the Inter-Mountain Area, C. Wayne Cook, Utah Agricultural Exp. Sta., Logan, Utah.

Nutritional Values of Range Forage on the Plains of Eastern Montana, Gene F. Payne, Montana State College, Bozeman, Montana.

High-Lights of Range Nutritional Research by the Bureau of Plant Industry, D. A. Savage, Superintendent, U. S. Southern Great Plains Field

Station, Woodward, Oklahoma.

Discussion and Summation

THURSDAY AFTERNOON

Effects and Control of Range Forage Pests

Chairman: David F. Costello, Chief of Range Research, Rocky Mountain Forest and Range Exp. Sta., U. S. Forest Service, Fort Collins, Colorado.

Jackrabbits and Prairiedogs; Control Measures and Effects on Range Land, Edson Fichter, Idaho State College, Pocatello, Idaho.

Relations Between Grasshoppers and Range Vegetation of the Northern Plains, John C. Wright and Norman L. Anderson, Montana State College, Bozeman, Montana.

Pocket Gophers on Range Lands, E. H. Reid, Asst. Chief of Range Research, U. S. Forest Service, Washington, D. C.

Halogeton Studies in Idaho (with color slides), E. W. Tisdale and George Zappettini, University of Idaho, Moscow, Idaho.

Discussion and Summation

Range Photography Exhibition and Contest

All attending members invited to view photos and vote choices.

THURSDAY EVENING BANQUET

Elks Temple—Toastmaster: Albin D. Molohon, Regional Administrator, U. S. Bureau of Land Management, Billings, Montana.

FRIDAY FORENOON, February 1

Significant Developments in Range Management and Research

Chairman: Herman Oliver, Rancher, John Day, Oregon.

The Range Story of the Land Utilization Projects, Edw. G. Grest, Chief, Land Management Division, U. S. Soil Conservation Service, Washington, D. C.

Experiment Shows Relative Value of 12 Grazing Treatments on Crested Wheatgrass, Neil C. Frischknecht, Intermountain Forest and Range Exp. Sta., U. S. Forest Service, Ogden, Utah; Lorin E. Harris, Utah Agricultural Exp. Sta., Logan, Utah; and Harry K. Woodward, U. S. Soil Conservation Service, Tooele, Utah.

A Three-Point Program for Conservation on the California Annual Forage Range (with color slides), H. W. Miller, A. L. Hafenrichter and W. R. Frandsen, U. S. Soil Conservation Service, Portland, Oregon.

The Washington "Cattleman of the Year Program" in Rela-

tion to Range Management, Dale Ausman, President, Washington Cattlemen's Association, Asotin, Washington.

FRIDAY AFTERNOON

Applications of Range Science

Chairman: Leon R. Nadeau, Range Conservationist, U. S. Bureau of Land Management, Portland, Oregon.

How Soil Conservation Districts Operate to Apply Knowledge of Range Technicians, Kenneth Fiero, Secretary, Wyoming Association of Soil Conservation Districts, Lyman, Wyoming.

The Planning and Applying of Range Conservation on an Individual Idaho Ranch, Wesley Cruikshank, Rancher, Boise, Idaho.

Management of Reseeded Range and Its Place in Ranch Operation, D. S. Winn and H. B. Passey, Range Specialists, U. S. Soil Conservation Service, Ogden and Coalville, Utah.

Wyoming Range Management (with sound and color film), A. A. Beetle and Kenneth Lane, University of Wyoming, Laramie.

STUDENT PLANT IDENTIFICATION CONTEST

One of the features of the Annual Meeting will be a Plant Identification Contest for three-man teams representing the Colleges and Universities who wish to participate. The contest will include grasses, broadleaved herbs and browse plants that are typical of our range areas. Specimens will be included from the 11 Western States.

The contest last year was received with a lively interest and we hope each school represented at the meeting will plan to enter.

For further information, contact Liter E. Spence, Extension Conservationist, State of Idaho, Boise, Idaho.