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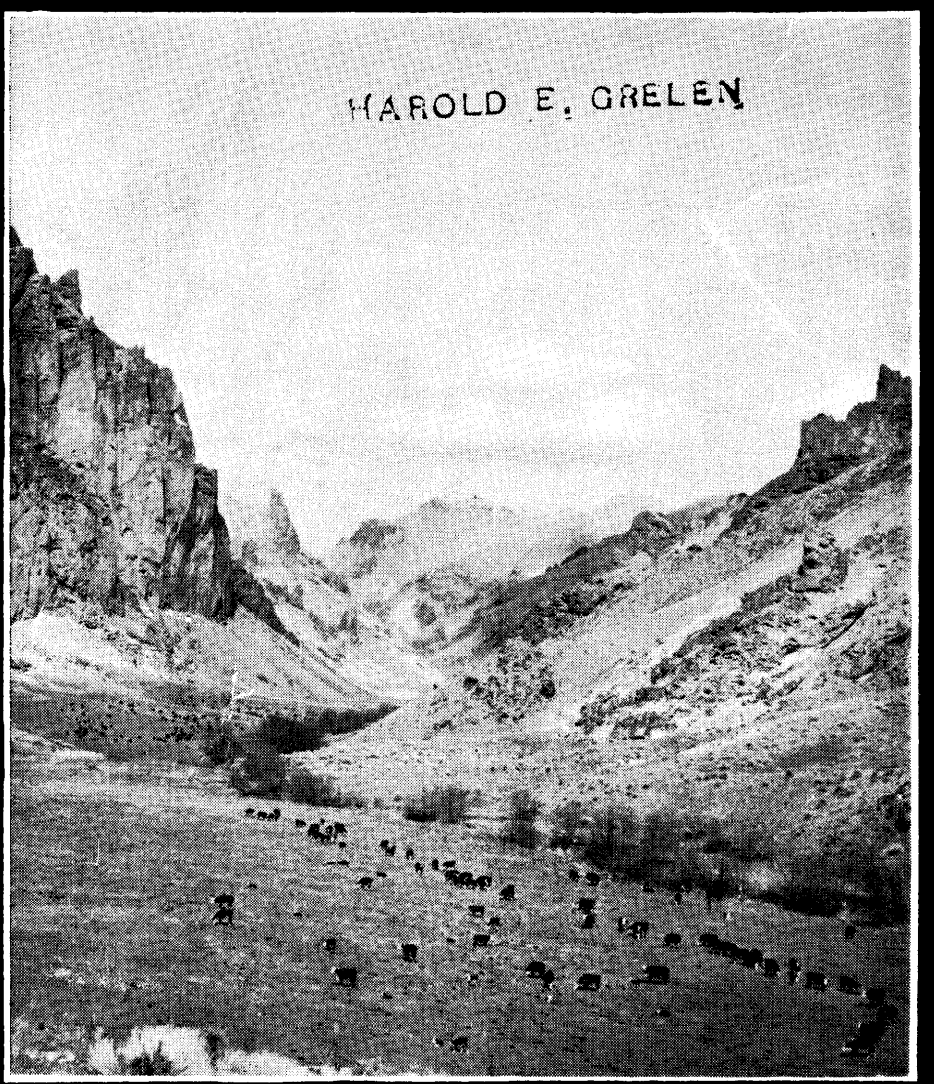

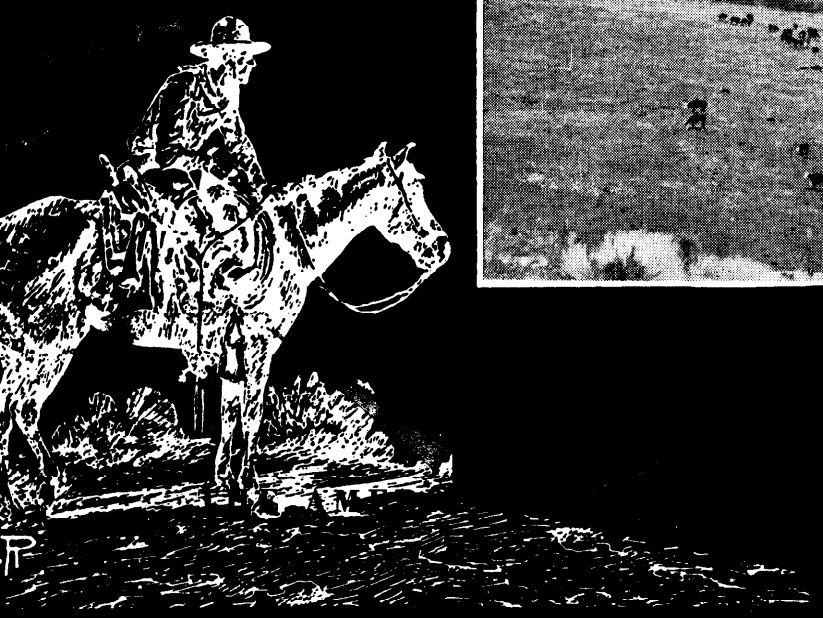

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SUMMER FIELD MEETING

CUSTER, SOUTH DAKOTA

JULY 14-16, 1960

Board of Directors' meeting on July 14 is open to the membership. Field tours for the 15th and 16th will be developed by the South Dakota Section. The change in date from that announced in the March Journal was made to avoid conflict with the Gold Discovery Convention.

IN THIS ISSUE

Cover Photo—"Along the Owyhee Breaks"

Grand prize photograph. Contest 13th Annual Meeting

Journal of
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A Lysimeter Study of Sulfur Fertilization of an Annual-Range Soil[1]

CYRUS M. McKELL AND WILLIAM A. WILLIAMS

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Deficiency of the plant nutrient sulfur is widespread on California soils. The majority of 242 responding sites recorded in a recent sulfur deficiency survey are on range or dry-farmed land (Martin, 1958). The Leguminosae are the group of plants that respond to sulfur fertilization most frequently. Several authors have pointed out the benefits from supplying additional sulfur where deficiencies occur (Conrad, 1950; Bentley and Green, 1954; Arkley, *et al.*, 1955 and Walker, 1957). The economics of the practice appear promising, because carriers of the sulfur are relatively inexpensive. However, choosing a rate and frequency of sulfur fertilization and source of sulfur that will maximize returns is a problem. The solution depends on detailed knowledge of such factors as the availability of sulfur in the soil, sulfur supplied by precipitation and air contact, leaching losses, erosion losses, and the differential uptake by various plant species. The first of a series of lysimeter investigations to study these factors in relation to the nutrition and production of a range legume was initiated at the San Joaquin Experimental Range[2]. Lysimetery was the technique chosen for studying these problems because sulfur leaches readily as the sulfate ion (Stauffer and Rust, 1954) and, therefore, study of the percolate was of prime interest. Several workers (Kohnke, *et al.*, 1940; Harrold and Dreibelbis, 1951; Stauffer and Rust, 1954, and Dreibelbis and McGuinness, 1957) reviewed the literature on lysimeter construction and discussed the advantages and problems of lysimetery. The radioisotope S^{35} was incorporated in the gypsum fertilizer so that the fate of applied sulfur could be distinguished from that of sulfur from natural sources.

Methods

The lysimeters used for this study are 74 inches in diameter with side walls 25.5 inches deep. Each contains an 8-inch deep conical bottom drained by a polyethylene pipe leading to a 5-gallon glass carboy (Fig. 1). Lysimeter interiors were painted with asphaltum paint. During February 1957 the lysimeters were installed on a hillside terrace with rims extending 2 inches above the ground surface.

A soil profile was reconstituted in the tanks by stockpiling soil from 0 to 1 inch, 1 to 6 inches, 6 to 12, and 12 to 24 inches, and then placing this soil in the proper sequence in the lysimeters. The soil settled approximately 2 inches during the first spring and summer with essentially no later subsidence. The soil used in this study is Vista sandy loam, an upland soil derived from granitic parent material. The soil contains 75 percent sand, 17 percent silt and

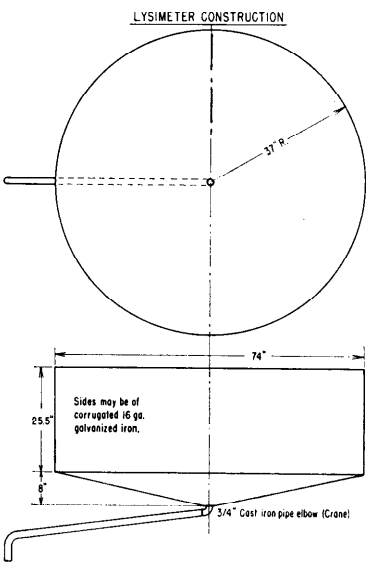

FIGURE 1. Diagram of lysimeter construction.

[1] *Cooperative investigations of the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and the Department of Agronomy, University of California, Davis.*

[2] *The cooperation of the Pacific Southwest Forest and Range Experiment Station, U. S. Forest Service, is gratefully acknowledged.*

8 percent clay and has a mean bulk density of 1.43 gms/cc in the lysimeters. It was characterized by analysis of the 6-12 inch depth in the lysimeters: pH 6.2; organic matter 0.61 percent; P 12.1 ppm; K 0.20 ppm; Ca 2.8 ppm; Na 0.50 ppm; Mg 0.35 ppm; total N 0.029 percent; conductivity 0.40 mmhos/cm, and cation exchange capacity 4.16 me/100 g. The Vista series is a permeable soil with depth of 21 to 36 inches and occurs extensively in the 10- to 20-inch rainfall zone of the Sierra Nevada foothills.

In October 28, 1957 the following treatments were randomized among the lysimeters: Check, 100, 200, and 300 pounds gypsum per acre. There were three check lysimeters, and two of each gypsum rate. The gypsum used at the 100- and 300-pound rates was labeled with approximately 2.5 mc. S^{35} activity per lysimeter and was broadcast as fine powder. All the lysimeters and the adjacent area were seeded with inoculated rose clover (*Trifolium hirtum* All.) at a rate of 50 pounds per acre and covered with ¼ inch of soil previously removed from the surface. A high rate of seeding was used to insure a complete stand of plants. As a precautionary measure against rodent and bird damage and contamination of the surrounding area with the radioisotope, each lysimeter was provided with a wire enclosure.

Percolate and rain water were collected during each storm period, and sulfur was precipitated as barium sulfate and determined gravimetrically (A.O.A.C., 1955). Rain was caught in glazed pots which were covered with aluminum foil during dry periods. The clover was harvested on May 9, 1958, at the full-bloom stage for yield determination. Clover samples were oxidized by the magnesium nitrate method (A.O.A.C., 1955) and sulfur determined (Johnson and Nishita, 1952). Radio-sulfur activity was determined on infinitely thick samples of barium sulfate (Hendricks, *et al.*) in a windowless gas flow counter. Smaller samples were corrected to infinite thickness from an appropriately determined calibration curve. Lead peroxide candles were exposed at the location to determine the sulfur dioxide content of the atmosphere (Alway, *et al.*, 1937).

Soil samples were obtained from four depths (0 - 1, 1 - 6, 6 - 12 and 12 - 24 inches) at the end of the growing season. These samples were extracted with Morgan's reagent (sodium acetate in acetic acid, pH 4.8) and analyzed by the method described by Johnson and Nishita (1952) for the microestimation of sulfur[3].

Results and Discussion

As might be anticipated from knowledge of the solubility of calcium sulfate in the soil solution (Vanoni and Conrad, 1942), the sulfur in gypsum is very susceptible to leaching loss when applied to a coarse-textured soil. In this experiment sulfate sulfur[4] was lost from all treated tanks at a rapid rate in the initial percolates from early-winter rains (Fig. 2). The magnitude of the loss was proportional to the amount of gypsum applied. As the rainy season progressed the rate of sulfur loss per unit of percolate gradually declined and towards the end of the season approached asymptotic values for all treatments. The curves in Figure 2 also show that roughly comparable amounts of sulfur between adjacent treatment levels were leached by the end of the 1957-58 season: 15.0 pounds per acre for the first 100 pound increment of gypsum applied per acre, 18.5 pounds for the second increment, and 11.1 pounds for the third increment.

In view of this observation and because of the similarity in shape of the cumulative leached sulfur curves, Figure 3 was drawn. The cumulative amount

[3] *The authors wish to express sincere appreciation to J. E. Ruckman, S. S. Winans, and D. P. Ormrod, who helped in the collection of samples and the performance of chemical and radiological analyses. Preparation of radioactive fertilizer by Fertilizer Investigations Research, ARS, USDA is also appreciated.*

[4] *For simplicity subsequent references to sulfate sulfur in percolate will be designated as sulfur.*

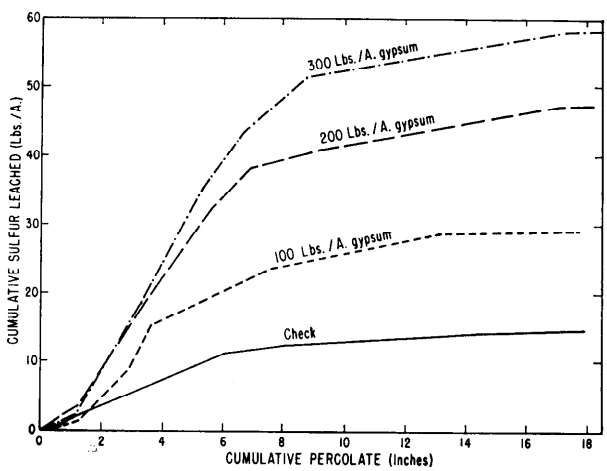

FIGURE 2. Cumulative amount of sulfur leached as a function of the amount of percolate from lysimeters receiving several rates of gypsum.

of sulfur lost by leaching was plotted as a percent of the total against the cumulative percolate expressed as a percent of the total percolate. The near equivalence of the curves for the three rates of gypsum and also the check treatment is striking. Each treatment, including the check, lost essentially the same percentage of the total leached sulfur with each increment of percolate. The curves of Figure 3 indicate that the amount of water passing through the soil was sufficient to maintain maximum solubility. Figure 3 also illustrates that the first 50 percent of the percolate carried down an average of 89.4 percent of the total leachable sulfur for all treatments. In 1957-58, a year of exceedingly heavy rainfall (31.8 inches), the first 50 percent of the percolate resulted from an amount of precipitation very nearly equal to the annual mean for the site (19.4 inches).

A large proportion of the sulfur applied in the gypsum was lost in the percolate as indicated by recovery of the radioisotope S^{35}. 77.0 and 77.9 percent of the sulfur applied in the 100- and 300-pound rates, respectively, were accounted for in the percolate collections (Fig. 4). The gypsum applied in the 200-pound treatment was not labeled, but there is no reason to expect that its fate would differ appreciably from the 100- and 300-pound treatments.

The sulfur brought down in rainfall was 21.4 pounds per acre during the 1957-58 season, a rather appreciable amount for an agricultural area (Jordan, *et al.*, 1959). There was considerable variation in the sulfur content of rain from the season's storms (Table 1). Concentration of sulfur in rain water ranged from a low of 0.50 ppm to a high of 4.70 pp. It was expected that the sulfur concentration would be high in the first fall rains and then would decline as sulfur in the air was washed out by additional storms (Seay, 1957). However, the data indicate that sulfur content of rain was as high in the last storms of the season as it was in the first storms, and no particular trend was evident.

Lead peroxide candles at the site did not show any appreciable amounts of sulfur in the local atmosphere; 100 sq. cm. of the exposed surface of the candles absorbed 0.50 + 0.11 mg. sulfur.

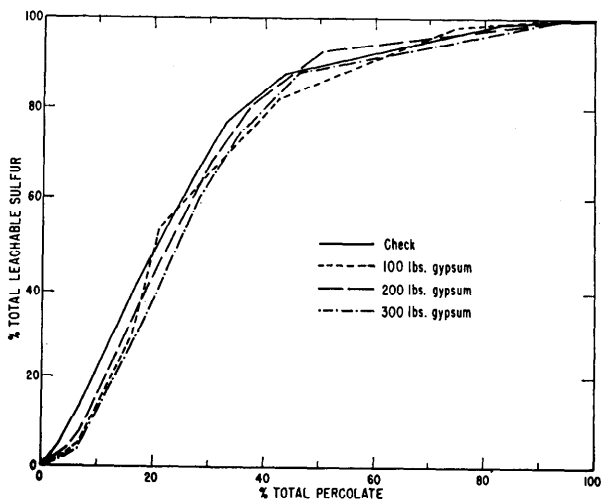

FIGURE 3. Relative rate of loss of sulfur by leaching as influenced by the rate of gypsum application.

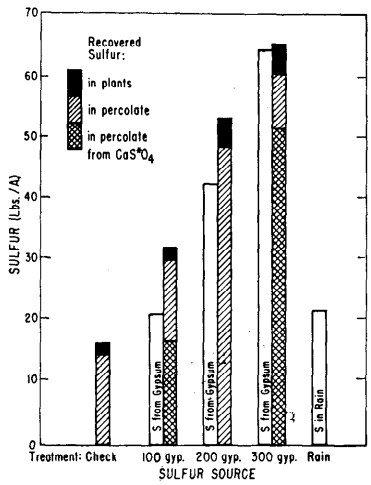

FIGURE 4. Sulfur added in gypsum and rainwater and recovered in clover plants and percolate.

Using a conversion value of 22 percent (average of data from Alway, *et al.*, 1937) to relate the surface absorption of the candles to soil absorption, the amount of sulfur absorbed from the atmosphere by the soil surface was almost negligible, 0.1 pound per acre. Apparently the sulfur brought down in the rain was

Table 1. Sulfur content of rainwater collected at the San Joaquin Experimental Range lysimeter site July 1, 1957 to June 30, 1958.

Collection interval	Rain (in.)	Sulfur content (ppm)
9/17 - 12/3	2.99	2.75
12/4 - 5	.54	.50
12/6 - 16	1.73	3.61
12/17 - 18	.54	3.25
12/19 - 22	.18	4.70
12/23 - 1/9	.27	2.32
1/10 - 24	2.10	3.88
1/25 - 27	1.66	2.35
1/27 - 2/5	2.73	3.45
2/6 - 13	.68	1.32
2/14 - 19	1.30	.85
2/20 - 25	2.57	2.50
2/26 - 3/17	6.14	2.73
3/18 - 24	3.20	3.47
3/25 - 4/7	5.14	3.61
Season total	31.77	W'td. mean 2.97

picked up in air masses some distance from the site.

Clover growth was stimulated by the gypsum applications. Yields of clover were significantly greater on the 200- and 300-pound treatments than on the check and 100-pound treatments (Table 2). The increases in sulfur content of the plant tissues were not significant. Often an increase in sulfur occurs when gypsum is applied to legumes growing on sulfur-deficient soils (Arkley, *et al.*, 1955; Bentley, *et al.*, 1955, and Walker, 1957). However, most of the leachable sulfur had been lost by the first week of March in this experiment. Rapid spring growth was initiated by the clover at approximately this time, and as a result, high concentrations of sulfur were not available for luxury consumption during the period of rapid plant growth.

Radioassay indicated that clover grown on the 100- and 300-pound treated lysimeters obtained an average of 30.8 and 57.4 percent of the sulfur, respectively, from gypsum, the proportion increasing at the higher level of application. Recovery of sulfur from applied gypsum by the clover amounted to a 2.8 and 6.7 percent, respectively.

A sulfur-balance sheet was constructed for each treatment using the data for additions to and losses from the soil (Table 3). Additions to the soil were from gypsum, rain water, air contact, and seed. The losses resulted from leaching and crop removal, the former being the greater in magnitude, by far. Calculation of the net change shows that the soil adsorbed more sulfur than it released in all treatments. The net adsorption varied from 4.9 pounds per acre for the check up to 19.6 pounds per acre for the lysimeters receiving the 300-pound rate of gypsum. Ensminger (1954) demonstrated sulfur adsorption capacity up to as high as 411 ppm in a sandy loam under laboratory conditions. The sulfur adsorbed by the soil from the label gypsum amounted to 20.2 and 15.4 percent of the sulfur applied in the 100- and 300-pound rates, respectively. These data lend support to the conclusion of Kramprath, *et al.* (1956) that the amount of sulfate adsorbed by soil is directly related to the concentration of sulfate in the applied solution. Because of the overriding adsorption effect there is no way to determine whether any sulfur was released from the native soil sulfur content.

Based on the net adsorption of sulfur by the soil of the check lysimeters it is apparent that the heavy rainfall did not leach all available native soil sulfur, but added to it. However, it is ex-

Table 3. Additions, losses, and apparent adsorption of sulfur by Vista sandy loam treated with gypsum.

Item	Sulfur per acre (lbs.) from lysimeters treated with indicated gypsum per acre			
	0	100 (lbs)	200 (lbs)	300 (lbs)
Sulfur added from:				
Gypsum	0.0	21.3	42.7	74.3
Rain	21.4	21.4	21.4	21.4
Air	0.1	0.1	0.1	0.1
Seed	0.1	0.1	0.1	0.1
Total	21.6	42.9	64.3	85.9
Sulfur lost in:				
Percolate (gypsum)		—16.4	—47.7*	—50.1
Percolate (rain, air and seed)	—14.2	—12.8		— 8.7
Crop removal (gypsum)		— 0.6		— 4.3
Crop removal (rain, air and seed)	— 2.5	— 1.3	— 6.0*	— 3.2
Total	—16.7	—31.1	—53.7	—66.3
Calculated sulfur absorption from:				
Gypsum		4.3	10.6*	9.9
Rain, air and seed	4.9	7.5		9.7
Total	4.9	11.8	10.6	19.6

* Non-labeled gypsum used; thus source of sulfur not distinguishable.

Table 2. Yield and sulfur content of rose clover grown in lysimeters treated with various amounts of gypsum.

Gypsum treatment (lbs/A.)	Clover yield (lbs/A.)	Clover sulfur content (%)	Sulfur in clover obtained from gypsum (%)	Clover recovery of S from gypsum (%)	Area[1] cover of clover (%)
0	2,480	0.10	.....	....	62
100	1,351	.14	30.8	2.8	50
200	4,433	.11	.....	....	98
300	5,357	.14	57.4	6.7	96
LSD (5%)	3,025	N. S.	.....	....	....

Table 4. Effect of rate of gypsum application on soil adsorption of sulfur—a balance sheet check.

Sulfur source	Sulfur per acre (lbs.) from lysimeters treated with indicated gypsum per acre				
	0 (Check)	100 lbs.	200 lbs.	300 lbs.	Gypsum mean
Total S adsorbed 1958-59 (Table 3)	4.9	11.8	10.6	19.6	
Gypsum S adsorbed 1958-59*	....	6.9	5.7	14.7	9.1
Total S extracted by Morgan's reagent	37.5	49.7	41.9	48.8	
Gypsum S extracted by Morgan's reagent*	....	12.2	4.4	11.3	9.3

* Values obtained by subtracting sulphur absorbed in check lysimeters from amounts of sulphur absorbed in treated lysimeters.

pected that the contribution of sulfur from rainfall might be less in normal or subnormal rainfall years.

Chemical analysis of the soil at the end of the season showed an average increase of 9.3 pounds per acre of extractable sulfur in the treated lysimeters relative to the checks (Table 4). The increase can be attributed to the adsorption of added gypsum. The above value does not differ significantly from the average increase of 9.1 pounds per acre of sulfur adsorbed from the applied gypsum, as calculated from the balance-sheet data by comparing the amount of sulfur adsorbed in the treated lysimeters with that in the checks. The lack of close agreement among rates of applied gypsum is not surprising since the differences in extractable sulfur represent concentration differences in the neighborhood of 1 ppm extractable sulfur, which stretches the sensitive chemical method used to the lower limit of accuracy. However, these data serve as a worthwhile check on the balance sheet results given in Table 3.

It may be concluded from the preceding discussion that in a wet year gypsum applied to correct a sulfur deficiency may be subject to considerable leaching loss. A high rate of sulfur application intended to last for several years could be lost as easily as a lower sulfur application rate intended for one year. Further study under less intense rainfall conditions is desirable.

Summary

A lysimeter study was initiated in the annual-range type to study the fate of sulfur applied in gypsum to an annual-legume, rose clover, on Vista sandy loam. The gypsum leached rapidly in a season of heavy rainfall. Sulfur contributed by rainfall amounted to 21.4 pounds per acre, and sulfur adsorbed from the atmosphere contributed approximately 0.1 pound per acre.

Use of the radioisotope S^{35} permitted identification of fertilizer sulfur in the percolate. In the growing season following fertilization 77.0 percent of the sulfur applied in the 100-pound gypsum rate and 77.9 percent of the sulfur applied in the 300-pound gypsum rate were accounted for in percolate collections.

Rose clover yield responded significantly to the higher levels of gypsum. The clover took up 30.8 and 57.4 percent of its tissue sulfur content from 100 and 300 pound applications, respectively.

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A Range Man's Library

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As an amateur range man I should not attempt to discuss the technical working tools of the profession. I would soon be out of my depth. On the other hand I should not write as an established collector of the literature of the range. A collector has been defined as one who tries to accumulate all that has been written on a subject—the worthy and the unworthy. Certainly it would be out of place to urge that you buy the unworthy and become an all out collector of range books. The late Charlie Everitt, beloved Americana dealer of New York City, tells this tale in his delightful book, THE ADVENTURES OF A TREASURE HUNTER (Boston, 1951). A man walked into his shop one day and said, "I'll buy any damn thing that mentions a cowboy." Note the mark of the collector, "any damn thing." Some minutes later Charlie ran a total on his adding machine. The stranger tore off a piece of Charlie's wrapping paper and wrote a check for $1,243. The check was signed, Philip Ashton Rollins. Rollins wrote THE COWBOY (New York, 1922), one of the classics on the cowboy, his equipment and his work. He revised and enlarged it in 1936 and that is the best edition. Rollins was one of the great collectors of range life books and the collection is still intact in the Princeton University Library.

[1]*Prepared for the annual meeting of the American Society of Range Management, February 1960, by J. C. Dykes, Assistant Administrator for Field Services, Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C., and presented by F. G. Renner.*

My recommendations are restricted to the more recent books and pamphlets on the men and events of the range. They are also selective, mentioning mainly the worthy books that will help build a library rather than a collection. There are two primary reasons for sticking to the more recent books—cost and availability. While it does not hold for all kinds of books, most of the older range life books are both expensive and hard to find.

Balance Needed

There should be balance in a range man's library. There should be books about the range country; biographies and autobiographies of cowboys and cowmen; histories of their associations; accounts of the trails and trail drivers; ranch histories; studies of the range wars; books about cows, sheep and range horses; and the literature of the range including the novels, ballads, and art. These are the books that a range man should read and reread for pleasure and for an understanding and essential background of his profession.

It is perhaps happenstance that I am in a position to discuss recent range books. I am a collector of range books but also I have two close associates, B. W. (Bill) Allred and F. G. (Fred) Renner, who collaborate on a monthly review column, WESTERN BOOK ROUNDUP, carried by several magazines. In each of the past five years we have reviewed about 150 Western books. Practically every new range book issued during that period has been reviewed by one of the three of us.

The Start

An indispensable first book in any range man's library is a good bibliography. Until December 31, 1959, when THE RAMPAGING HERD (Norman, 1959) by Ramon F. Adams was issued such a book was not available. It lists a total of 2,651 books and pamphlets on men and events in the cattle industry. While it is by no means selective, it will provide much guidance to any range man building a library. As a collector, I have found J. Frank Dobie's GUIDE TO LIFE AND LITERATURE OF THE SOUTHWEST (Austin and Dallas, 1942, and revised and enlarged, Dallas, 1952) very useful. In the chapters on Range Life, Cowboys, Cattle, Sheep; Cowboy Songs and Other Ballads; Horses, Mustangs and Cow Ponies; and The Bad Man Tradition, Dobie comments on range books in his own particularly pithy and penetrating fashion. You will find this book highly entertaining as well as useful. Make no mistake—Frank Dobie is a range man with a deep love of the land, grass and animals that shines through everything he has written.

The greatest single book about a major segment of the range country is Dr. Walter Prescott Webb's THE GREAT PLAINS (Boston, 1931). The first printing is now a collector's item. A much more recent book, GRASSLANDS OF THE GREAT PLAINS, THEIR NATURE AND USE (Lincoln, 1956) by J. E. Weaver and F. W. Albertson, with contributions by other experts including Bill Allred, brings together a tremendous amount of knowledge about the vegetation of the mid-continent prairie between the Saskatchewan and the Rio Grande. Carl Frederick Kraenzel's THE GREAT PLAINS IN TRANSITION (Norman, 1955) is worthwhile.

Unfortunately, so far as I know there is no book about the intermountain ranges that is comparable in environmental coverage to these three. A book that will be harder to find but worth the search is WESTERN GRAZING GROUNDS AND FOREST RANGES (Chicago, 1913) by Will C. Barnes. Leon V. Almirall in FROM COLLEGE TO COW COUNTRY (Caldwell, 1956) has some pertinent remarks to make on ranching at the nine thousand foot level. Two books which give considerable information on desert ranges are worth mentioning—Earl J. Larrison's OWYHEE, LIFE OF A NORTHERN DESERT (Caldwell, 1957) and Edmund C. Jaeger's THE NORTH AMERICAN DESERTS (Stanford, 1957). THIS IS THE WEST (N.Y., 1957) edited by Robert West Howard has much to say on the whole of the range country. It was issued first as a paper-back at 35 cents and then in hard covers, with numerous fine illustrations, at 6 dollars—a bargain either way.

The Trail Driving Era

The days of the spread of cattle from Texas into the Northern Plains and of trail driving to rail heads in Kansas is one of the most thrilling periods in the history of the West. This period has been very thoroughly documented in both fact and fiction. No book on trail driving will compare with Andy Adams' THE LOG OF A COWBOY (Boston and New York, 1903). Frank Dobie in his GUIDE puts it so well—"If all other books on trail driving were destroyed, a reader could still get a just and authentic conception of trail men, trail work, range cattle, cow horses and the cow country in general from THE LOG OF A COWBOY." The first printing of this book is getting scarce but the publisher keeps it in-print with colored illustrations (added in 1927) by another range man, R. Farrington Elwell—former manager of Buffalo Bill's Wyoming ranch and well known Western artist now living in Phoenix, Arizona. Frank Dobie's UP THE TRAIL FROM TEXAS (New York, 1955), primarily for younger readers, is a dandy book about real trail drivers. Wayne Gard's THE CHISHOLM TRAIL (Norman, 1954) is the best book in print on that drove road just as the late Walter S. Campbell's (Stanley Vestal) QUEEN OF COW TOWNS, DODGE CITY (New York, 1952) is the best book in print on Kansas cowtowns. The late Floyd B. Streeter's PRAIRIE TRAILS AND COWTOWNS (Boston, 1936) was issued in a small edition and is now very scarce and expensive but most of the text, revised and expanded, is available in his later book, THE KAW (New York, Toronto, 1941). THE CATTLE DRIVES OF DAVID SHIRK FROM TEXAS TO THE IDAHO MINES, 1871 and 1873 (Portland, Oregon, 1956) was edited by Martin F. Schmitt and includes some later experiences of Shirk as a cattleman in eastern Oregon.

Cattle Kings

Some cowmen started as cowboys, many cowboys never became owners, and some owners were never cowboys. CHARLES GOODNIGHT (New York and Boston, 1936) by J. Evetts Haley is the best biography ever written of a range man and may be the best biography ever written about a Westerner. The first printing of this great book is scarce and expensive but it has been kept in print by the University of Oklahoma Press since 1949. Edward F. Treadwell's THE CATTLE KING (New York, 1931) is good on California's big cowman, Henry Miller. Like the Goodnight book the original publisher permitted Miller's biography to go OP but another publisher recognized its value and reprinted it. Roscoe Sheller's BEN SNIPES, NORTHWEST CATTLE KING (Portland, Oregon, 1957) is a rags to riches story of a man whose cattle ranged over much of central Washington. He had competition from Pete French of Oregon. There is a book about French, too, and while it is classed as novel it is said to follow closely the life of this well known cowman. It was written by Elizabeth (Lambert) Wood and is entitled PETE FRENCH, CATTLE KING (Portland, Oregon, 1951). Here is one more—PIERRE WIBAUX, CATTLE KING (Bismarck, 1953), a pamphlet reprinted by the State Historical Society of North Dakota. It is about a Frenchman who did well in cattle and became a well known cowtown banker. Frazier Hunt's CAP MOSSMAN (New York, 1951) is a top biography. Mossman made his reputation as manager of the Hashknife in Arizona where his success in dealing with rustlers led to his appointment as Captain of the Arizona Rangers. Later Cap and his associates controlled a million acres of range, all under fence, in South Dakota. There are many books about cowmen but none better than these—and these have the added advantage of being readily available.

Associations

Historically, cowmen, beginning with the roundup, have worked together in solving their mutual problems. The books about their associations are a part of the history of the range. Maurice Frink's COW COUNTRY CAVALCADE (Denver, 1954) is on the 80 year old Wyoming association. Lewis Nordyke's GREAT ROUNDUP (New York, 1955) is the saga of the Texas and Southwestern. Ray H. Mattison's ROOSEVELT AND THE STOCKMEN'S ASSOCIATION (Bismarck, 1950) is

of much interest. Teddy was quite an organizer.

Autobiography

The books about cowboys are many. The first was Charles A. Siringo's A TEXAS COWBOY, OR FIFTEEN YEARS ON THE HURRICANE DECK OF A SPANISH PONY (Chicago, 1885). The first printing is exceedingly rare, but it has been reprinted many times. Siringo claimed that a million copies of it were sold in his lifetime. This seems to be an exaggeration but it was justifiably popular—a rollicking account. Fortunately, it is again in print with an entertaining and informative introduction by J. Frank Dobie, illustrations by Tom Lea, typography by Carl Hertzog, and the Sloane imprint (New York, 1950). Rated just below the Siringo, and not much at that, is Ike Blasingame's DAKOTA COWBOY (New York, 1958). Ike was a Matador cowboy and bronc peeler and this is a tremendously entertaining book that is also down to earth on all cow country happenings. Fred Gipson's COWHAND (New York, 1953) is matter-of-fact on the day-to-day jobs of a working cowboy. Richmond P. Hobson, Jr. has written two very entertaining books about the discovery and development of the last great cattle frontier on this continent—GRASS BEYOND THE MOUNTAINS (Philadelphia, New York, 1953) and NOTHING TOO GOOD FOR A COWBOY (Philadelphia, New York, 1955). Ranch life beyond the mountains in British Columbia was high adventure indeed. Walt Coburn's STIRRUP HIGH (New York, 1957) is his story of his first summer on the family ranch in Montana—it is completely charming.

Ranch Histories

Ranch histories include much on the owners and their hired help as well as operations, financing and stocking. THE KING RANCH (Boston, 1957) by Tom Lea, talented Texas writer and artist, is a handsome two volume set, designed by the equally talented Texas typographer, Carl Hertzog. It belongs in any range man's library. LIFE ON THE KING RANCH (New York, 1951) by Frank Goodwyn, is good on the life and legends of the Mexican vaqueros, who make up the working force on the ranch. Frank was raised on the Norias division where his father was the manager. J. Evetts Haley in THE XIT RANCH OF TEXAS (Chicago, 1929) spoke quite plainly about some folks who started their herds with XIT cows. A suit was filed and the unsold remainder of the first edition was impounded by the court. It is a very scarce and expensive book. However, with some changes, it is now again available with the imprint of the University of Oklahoma Press. The State of Texas traded the land which became the XIT to a Chicago syndicate for the Capitol building in Austin. FLAT TOP RANCH (Norman, 1957), edited by Bill Allred and the writer, is a different kind of a ranch history. It is the story of the creation of a ranch from a number of eroded, cropped-out farms and some depleted, brush-infested range. It also is the story, about the only one in book form as yet, of modern conservation ranching. Since neither Bill nor I receive a royalty from the sale of the book I am not too modest to say it also belongs in every range man's library. WYOMING'S PIONEER RANCHES (Laramie, 1955) is a big handsome encyclopedic volume on ranches of the Laramie Plain by three native sons, R. H. (Bob) Burns, A. S. (Bud) Gillespie and Willing G. Richardson. There are other ranch histories, of course, and nearly all of them are worth having.

The Women's Viewpoint

The viewpoint of the women on range life is entertaining and sometimes informative. Agnes Morley Cleaveland's NO LIFE FOR A LADY (Boston, 1941) is generally conceded to be about the top account. It is certainly spritely enough without an overdose of sentiment but so is Sallie Reynolds Matthews' INTERWOVEN (Houston, 1936 and El Paso, 1958). The beautiful reprint, designed by Carl Hertzog, is illustrated by E. W. (Buck) Schiwetz. Mary Kidder Rak's A COWMAN'S WIFE (Boston and New York, 1934) and MOUNTAIN CATTLE (Boston and New York, 1936) are sound matter-of-fact ranch history. Mary Taylor Bunton's A BRIDE ON THE OLD CHISHOLM TRAIL (San Antonio, 1939) refutes the contention that women didn't go up the trail. Emerson Hough's good historical novel NORTH OF 36 (New York, 1923) really stirred up the critics because he has the young woman owner of the herd on the trail with it.

Range Wars

The range wars, the big owner versus small owners or nesters and cattle versus sheep, were often bloody. The moves and counter-moves by the participants make interesting reading. The Johnson County Wyoming affair is perhaps the most widely publicized of all range wars. A. S. Mercer's THE BANDITTI OF THE PLAINS (Cheyenne, 1894) was the first of several books on it and is now exceedingly rare. It has been reprinted several times. THE LONGEST ROPE (Caldwell, 1940) as told by Bill Walker to Mrs. D. F. Baber seems to be the only other account of the Johnson County troubles still in print. Will A. Keleher's VIOLENCE IN LINCOLN COUNTY (Albuquerque, 1957) is by far the most authoritative book on the so-called Lincoln County War. ARIZONA'S

DARK AND BLOODY GROUND (Caldwell, 1936 and revised and enlarged, 1948) by Earle R. Forrest is an entertaining account of the Pleasant Valley War in Arizona.

County Histories

I want to call attention here to another type of book—the county history—which often contains biographies of early cowmen, accounts of the establishing of the first ranches, and something of the range troubles. I hope you will carefully scan the county histories available in your own State, for in them you will find range history not available elsewhere. Here are some of the recent examples of county histories of considerable range interest: George Francis Brimlow's HARNEY COUNTY, OREGON AND ITS RANGE LAND (Portland, Oregon, 1951), Ira A. Freeman's A HISTORY OF MONTEZUMA COUNTY, COLORADO (Boulder, 1958), Cornelia Adams Perkins' SAGA OF SAN JUAN (Monticello, Utah, 1957), Harry N. Campbell's THE EARLY HISTORY OF MOTLEY COUNTY (San Antonio, 1958). The latter is essentially the history of a great ranch, the Matador. Minnie Dubbs Millbrook's NESS, WESTERN COUNTY, KANSAS (Detroit, 1955) has a place of honor in my own collection because it was in Ness County that I learned some forty years ago that a cowboy is no longer "a hired man on horseback" much of the time.

Range Livestock

"No cows, no cowboys. No sheep, no shepherds. No livestock, not much American West." This quotation, I believe, should be credited to the late Colonel Eddie Wentworth, teacher, author, and long-time educational director for Armours. A range man's library will include books about the critters. The number one book is J. Frank Dobie's THE LONGHORNS (Boston, 1941) based on a terrific amount of research and written as only *Mr. Southwest* could write it—a major contribution to the history of the West. The cattlemen took the lead in settling much of our west and it was the longhorns, walking to their new homes, that went with them. Paul C. Henlein's CATTLE KINGDOM IN THE OHIO VALLEY (University of Kentucky Press, 1959) adds some important links in the spread of the British breeds westward from the Atlantic. It was on the prairies and savannahs of the Ohio Valley that these breeds were first crossed with the longhorns of Spanish origin. Today the Hereford is the dominant beef breed in this country. The newest and best book about the whitefaces is Don Ornduff's THE HEREFORD IN AMERICA (Kansas City, Missouri, 1957). Robert J. Kleberg, Jr. of the King Ranch has written a pamphlet about the first beef breed to be developed in this country, THE SANTA GERTRUDIS BREED OF BEEF CATTLE (Kingsville, nd, and revised and improved in format by Carl Hertzog, El Paso, 1954). The Santa Gertrudis are becoming popular in the Gulf Coast country. Frank W. Harding's MOSTLY ABOUT SHORTHORNS (privately printed, 1947) is a little harder to find but real Shorthorn fans will do it. The books by Alvin H. Sanders on the Hereford, Shorthorn and Angus are now scarce but worthwhile. His THE CATTLE OF THE WORLD (Washington, D. C., 1926) is profusely illustrated and somewhat easier to come by. The number one book about range horses is J. Frank Dobie's THE MUSTANGS (Boston, 1952). This is one of the best, if not the very best of all of Dobie's books. In it his love of the wild and free sings on every page. Rufus Steele's MUSTANGS OF THE MESA (Hollywood, 1941) is well written but no longer easy to find. Walker D. Wyman's THE WILD HORSE OF THE WEST (Caldwell, 1945) is based primarily on the written records and has a fine bibliography. Luis B. Ortega's CALIFORNIA STOCK HORSE (Sacramento, 1949) is well illustrated with photographs and is informative. John A. Gorman's THE WESTERN HORSE (Danville, Illinois, 1939) is always in demand and therefore, in print. Wayne Gard's FABULOUS QUARTER HORSE: STEEL DUST (New York, 1958) is the story of one of the famous sires of this purely American breed so popular as cow horses.

Despite the importance of sheep in our range economy they have been practically ignored in range literature. A range man's library, to maintain balance, should include some books on sheep. Fortunately there are some very good ones. The best of all is the late Archer B. Gilfillan's SHEEP (Boston, 1929), truly a Western classic. It was reissued by the University of Minnesota Press in 1957 with an illuminating introduction by J. Frank Dobie. Hughie Call's GOLDEN FLEECE (Boston, 1942) is good social history as well as informative on sheepherders. Winifred (Thalmann) Kupper's two books THE GOLDEN HOOF (New York, 1945) and TEXAS SHEEPMAN (Austin, 1951) are about sheep and sheep folks in the Hill Country of Texas where she grew up. Both are authentic and charming. Towne and Wentworth's SHEPHERD'S EMPIRE (Norman, 1945) is based on the writings of others but worthwhile. Colonel Wentworth's AMERICA'S SHEEP TRAILS (Ames, Iowa, 1948) brings together much information. It is not a book for reading but does have considerable reference value. Will C. Minor's FOOTPRINTS IN THE

TRAIL (Denver, 1959) is a delightful book of nature stories by a scribbling shepherd. Minor says sheepherding allows him more opportunity to study the whole of nature than any other manner of making a living he has yet discovered. He may be a worthy successor to Archie Gilfillan.

Literature Diverse

The literature of the range is certainly diverse. It encompasses the ballads and other verse, the legends and tall tales, the novels and short stories, the writings of certain range men, cartoons and art, and the heraldry of the range. I am also including here two additional books by Ramon F. Adams, COWBOY LINGO (Boston, 1936) and WESTERN WORDS (Norman, 1944). Both were labors of love in which Ramon strives to preserve for posterity, in dictionary form, the idiom of early range days. With the possible exception of the Negro spirituals, cowboy songs and ballads are believed to be the major contribution of this country to folk songs. John A. Lomax spent thirty years collecting and preparing such ballads for publication. Any of the books of cowboy songs he has compiled and his ADVENTURES OF A BALLAD HUNTER (New York, 1947) are worthwhile. The late Badger Clark's SUN AND SADDLE LEATHER (Boston, 1915) received the approval of the severest critics of all, the old-time range men. It is in print and enlarged to include the poems which appeared in a number of other small books of verse by Badger. "The Badger Hole," his log cabin bachelor home near Custer, South Dakota is now a State shrine. Omar Barker's SONGS OF THE SADDLE MEN (Denver, 1954) speaks to all those who love grass, blue skies, cattle and horses.

Novels

The novels of Andy Adams and of Eugene Manlove Rhodes are a part of the literature of the range but all are now believed out of print. Several of the Rhodes novels were reprinted in paperback series and can occasionally be found in the used book and magazine stores. Conrad Richter's THE SEA OF GRASS (New York, 1937) is a beautifully written novel with a sound range conservation moral. Owen Wister's THE VIRGINIAN (New York, 1902) was the beginning of the deluge of "Westerns." It is still in print and while it does not smell strongly of cows, it has become an American range classic. The short stories and tall tales of Charles M. Russell, the great cowboy artist, are terrific. Many of them are included in TRAILS PLOWED UNDER first issued in 1927 but still in print. His GOOD MEDICINE contains a number of brilliantly illustrated letters. It was first issued in 1929 and is still available. Both the illustrations and Russell's words mirror the range. Russell illustrated many other range books but unfortunately nearly all of them are out of print. Mody C. Boatright's TALL TALES FROM TEXAS COW CAMPS (Dallas, 1934) is no longer easy to find but worth seeking. Dr. James Cloyd Bowman's PECOS BILL (Chicago, 1937) is the best of several books on this legendary cowboy.

Cartoons and Photographs

The late J. R. Williams' COWBOYS OUT OUR WAY (New York, 1951) is a highly enjoyable true-to-life book of cartoons. J. Frank Dobie liked it and gave his reasons in the introduction he wrote for it. Ace Reid's COWPOKES (Kerrville, Texas, 1958) won't equal Jim Williams' expert work but Ace is a comer. The photographs by certain pioneer cameramen do much to document the flavor of the range. Brown and Felton's BEFORE BARBED WIRE (New York, 1956) reproduces many of the pictures of range life made by the pioneer Montana photographer, L. A. Huffman, LIFE ON THE TEXAS RANGE (Austin, 1952) is profusely illustrated with the very fine photographs made by the pioneer Texas camera artist, Erwin E. Smith. The text is by J. Evetts Haley. Ed Borein, like his friend Charlie Russell, was never a top cow hand because he was too interested in sketching the man, cow and horse action that is inevitable on the range. After Ed's death his friends published two handsome volumes—ETCHINGS OF THE WEST (Santa Barbara, 1950) and BOREIN'S WEST (Santa Barbara, 1952)—in which most of his great range sketches are saved for our future edification. Harold Bugbee illustrated several Haley books; Tom Lea several by Dobie; Ross Santee many of his own books as well as range books by others. Will James stuck pretty much to illustrating his own works. These and such other great western artists as "Buck" Dunton, Maynard Dixon, R. Farrington Elwell, Nick Eggenhofer, Harvey T. Dunn, and Frederic Remington illustrated range books. Watch for books with drawings by these artists. They are marks of quality.

Life on the Range

A range library should also include books that cover the sweep of men, cattle, horses, and country in their relation to one another. Such a book, for example, is Ernest Staples Osgood's THE DAY OF THE CATTLEMAN (Minneapolis, 1929 and reprinted 1954). Here, too, belongs Granville Stuart's FORTY YEARS ON THE FRONTIER (Two volumes, Cleveland, 1925 and in one volume, Glendale, Calif., 1959). E. C. Abbott, better known as Teddy Blue, was Stuart's son-in-law. Teddy told his story to

Helena Huntington Smith and the book which resulted from their collaboration, WE POINTED THEM NORTH (New York, 1939 and Norman, 1955, with Eggenhofer illustrations) is frank and highly entertaining. Walker D. Wyman's NOTHING BUT PRAIRIE AND SKY (Norman, 1953), based on the notes of Bruce Siberts, is just as frank on the early days on the Dakota range. Both deserve high literary ratings.

Three books have been compiled recently in which the records left by pioneer range men and those who reported their doings are made available to modern readers—Ramon F. Adams' THE BEST OF THE AMERICAN COWBOY (Norman, 1957), THE COWBOY READER (New York etc., 1959) edited by Lon Tinkle and Allen Maxwell and Clifford P. Westermeir's TRAILING THE COWBOY (Caldwell, 1955). Westermeir also wrote what is probably the most realistic book on the rodeo, MAN, BEAST, DUST (Denver, 1947). The classic book on brands is Oren Arnold and John P. Hale's HOT IRONS (New York, 1940) but Duncan Emrich' THE COWBOY'S OWN BRAND BOOK (New York, 1954) is a minor classic for readers 7 to 70. It was only after reading Hortense Warner Ward's CATTLE BRANDS AND COWHIDES (Dallas, 1953) that I learned why I couldn't read the Mexican brands I had encountered in the lower Rio Grande Valley thirty years ago. One or two of his own State or county brand books should be in each range man's library.

British Books

Some of the best writing ever done about the range is by educated men from the British Isles. The investment of foreign capital in livestock enterprises in the American West was a major financial phenomenon of the late seventies and early eighties. Younger sons, experienced breeders, and British visitors followed their capital to the West. Unfortunately, there isn't a book by one of these educated gentlemen in print today. Mostly, they are expensive and hard to find, yet a range man's library should include one or more of these volumes. Perhaps the best of all, and probably the most expensive, is John Clay's MY LIFE ON THE RANGE (privately printed in Chicago, 1924). Clay, an educated Scot, was tenderfoot, ramrod, manager, owner and founder of a great commission firm. His book is tops in writing style and content. William French's SOME RECOLLECTIONS OF A WESTERN RANCHMAN (London, 1927) and John Culley's CATTLE, HORSES AND MEN (Los Angeles, 1940) rate just below Clay's book. R. B. Townshend's A TENDERFOOT IN COLORADO (London, 1923), A TENDERFOOT IN NEW MEXICO (London, 1923) and LAST MEMORIES OF A TENDERFOOT (London, 1926) are all good. They were reissued in this country in the twenties and are somewhat less expensive than those mentioned above. The one range book by an English author you are most likely to find, MY REMINISCENCES AS A COWBOY (New York, 1930) by Frank Harris, is utterly worthless. It was issued in wraps in what must have been a huge printing and is still rather common. There are many others, fortunately, and most of them are good.

Western Frontier Library

There never was a time before when so many good range books could be bought for so little. For example, Savoie Lotinville, the canny businessman and scholar, who heads the University of Oklahoma Press, is issuing a well printed, hard board covered series, The Western Frontier Library at $2 per volume. In this Library of classic western reprints of particular interest to range men are: Mercer's THE BANDITTI OF THE PLAINS (1954) with a long introduction by William H. Kittrell; Pat F. Garrett's THE AUTHENTIC LIFE OF BILLY THE KID (1954), a major Lincoln County War item with an introduction by the writer which shows it isn't so authentic; Charles L. Martin's A SKETCH OF SAM BASS (1956), a cowboy and trail driver who turned train robber, with an introduction by Ramon F. Adams; Nelson Lee's THREE YEARS AMONG THE COMANCHES (1957) with an introduction by Dr. Walter P. Webb (Lee was a horse and cow trader and trail driver to Louisiana before he was captured); Will Hale's TWENTY - FOUR - YEARS A COWBOY AND RANCHMAN IN SOUTHERN TEXAS AND OLD MEXICO (1959), one of the rarest and most sought-for range books; and General James I. Brisbin's THE BEEF BONANZA or HOW TO GET RICH ON THE PLAINS (1959), one of the books credited with inducing eastern and foreign financiers to invest in the cattle business in the West. It was first issued in 1881 and was really an expansion of the first promotional piece of its type done for the Union Pacific Railroad — Dr. Hiram Latham's TRANS-MISSOURI STOCK RAISING (Omaha, 1871), a very rare range book.

Other Reprints

The famous reprint house Grosset and Dunlap has included two great books in the Grosset Universal Library, issued in paper covers, to sell at $1.25—Dobie's THE LONGHORNS (1957) and Webb's THE GREAT PLAINS (1957). Bantam Frontier Classics, issued in 1959 in paper covers to sell at four bits include Dobie's THE MUSTANGS, Gip-

son's COWHAND, Santee's LOST PONY TRACKS and Campbell's (Vestal) DODGE CITY. Pennant Books issued Dobie's A VAQUERO OF THE BRUSH COUNTRY in wraps in 1954 to sell for two bits—this is a somewhat abridged edition of the 1929 *First* that is one of my favorites among all of Frank's fine books. Watch the racks of paperbacks in the book stores, newsstands and drug stores. More and more good range books are showing up on them. Also watch the remainder tables (sometimes labled "Publisher's Overstocks") in the bookstores—occasionally a publisher overestimates the number of copies of a good range book the public will take at the original price and has to sell them cheaper.

Two other reprints in 1959, both by the Antiquarian Press of New York, rank in importance with the issuing of THE RAMPAGING HERD as news in the field of range books. They are cheap only in comparison with the prices commanded by the originals when one or the other does infrequently appear on the market. James Cox's HISTORICAL AND BIOGRAPHICAL RECORD OF THE CATTLE INDUSTRY AND THE CATTLEMEN OF TEXAS AND ADJACENT TERRITORY (St. Louis, 1895) and James W. Freeman's PROSE AND POETRY OF THE LIVESTOCK INDUSTRY (Denver and Kansas City, 1905) were the two reprinted in handsome numbered editions of 500. The Cox, in two volumes, has a new introduction by J. Frank Dobie—the Freeman one by Ramon Adams. The price of each is $100. This is the first reprint of each of these exceedingly rare books. A good copy of the first of either brings $500.

If you have the time, the patience, and the money, by all means get the first edition of all the books mentioned. The *firsts* will give you a feeling of pride of ownership as long as you live and will constitute a substantial addition to your estate. But, first editions are not mandatory in a range man's library. The reprints provide the same or an improved text at much less cost and can be had now. There is no valid reason for a range man to be without a library to supplement his working tools and to enrich his understanding of his calling.

The Rangeland's Northern Frontier[1]

W. R. HANSON

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Since the time of Columbus there has been a movement of western man from Europe toward the northwest. Following the early discoveries in America, people sought anxiously, but in vain, for a northwest passage to the Orient. This search opened up a lucrative fur trade in America which remained the chief commercial enterprise in the northwest for nearly 200 years. Agricultural settlement and modern industry have gradually replaced the fur trade. In most cases, ranching with its use of open rangeland, was the first type of agricultural use of land with farming following in its wake. In a few cases settlement was not established on an agricultural basis, but moved westward in the search of gold with farming and ranching coming along to supply meat and farm produce to the miners. Such was the case in parts of California, Montana, and the interior of British Columbia.

An expansion of the use of rangeland for livestock production is still going on today in Canada but has become northward instead of westward. This northern extremity of the ranch country may be termed its Northern Frontier.

Northern Frontier

Most of British Columbia is occupied by the Appalachian Highlands. In between the mountain ranges lie warm valleys which are often semi-arid in the rain shadows of high ranges to their westward.

East of the Rockies lies the northern extension of the Northern Great Plains, the Boreal Forest and the Arctic Tundra. The northern plains fall into two vegetative regions; the open prairies in the south and the parkland (alternate poplar bluffs and moist prairies) toward the north.

By the year 1900 ranching was established on most of the open plains country and in the southern valleys of British Columbia. During the next three decades, grain farming east of the Rockies and fruit farming in British Columbia began to take over the rangeland and to push northward even beyond the limits of ranching. The demand for food in the first world war and the development of short-season wheats sent farmers into the valley of the mighty Peace River, 500 miles north of the 49th parallel. Surprisingly enough it be-

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[1] *Presented at the Convention of the American Society of Range Management at Phoenix, January 29, 1958.*

came a good grain country with the world wheat crown being held there for many years.

But now the rangeland frontier is again on the move. With increase in population and the demand changing from wheat to meat, enterprising stockmen have looked for new frontiers. Some of these movements have been just as adventuresome as the opening up of the West a century ago.

Grass Beyond the Mountains

The drier valleys in the Rockies and westward offered good opportunities for ranching and the largest ranch in the British Commonwealth, the Gang Ranch, was established in the southern interior of British Columbia. But man soon began to look to the little-known valleys farther north. Anyone who has read Richard Hobson's book "Grass Beyond the Mountains" has enjoyed an epic of the northern movement of the rangeland. The author and his partner, by themselves, moved a herd of cattle through timberland and muskeg and over the top of a mountain range to pioneer ranching in a big new district. With this and similar undertakings the frontier of the rangeland moved 200 miles farther north and Vanderhoof and Prince George replaced Kamloops as the centres of the northern ranch frontier.

The Mighty Peace

East of the Rockies in Alberta and British Columbia the northern wheatlands and the rough country adjacent are undergoing a transition into ranch country. The old march of events from open range to wheatfields is being reversed and cattle are replacing wheat. The stockmen in southern Alberta who have breeding stock to sell are looking northward for their market.

Cattle and Muskrats

East of The Pas in Manitoba, on the northwest shores of Lake Winnipeg, lie extensive delta lands built up from alluvium carried from the Rockies by the Saskatchewan River. On These delta lands a great muskrat fur industry grew up. With the great slump in fur prices the industry faced ruinous conditions. One enterprising fur trader decided to do something about it. Tom Lamb obtained 2,000 acres of rich delta land and lease rights to adjacent areas and moved a herd of cattle 75 miles down the Saskatchewan by barge to a new ranch home. The deep alluvial soils grow heavy crops of native grass and sedges and even heavier crops of introduced species such as brome, timothy, alfalfa and clover. The grazing season extends from mid-April to mid-November and feed in the form of hay and grain is supplied for the winter. If this enterprise is successful, another frontier will be established and The Pas saloons will ring to the song of the cowhand as well as those of the trapper, the gold miner and uranium prospector.

At present, the northern extremity of ranching operations might be marked by a line from Vanderhoof through the Peace River country and southeastward to The Pas, Manitoba, and thence south to the United States border (Figure 1).

How Far North?

There is a tremendous territory between the present range country and the Arctic (1000 miles from Peace River to Aklavik at the mouth of the Mackenzie). It is interesting to speculate how far north the frontier of the rangeland may be pushed. Will there come a time when the northlands of western Canada will produce its own meat supply? Might we see cattle ranches

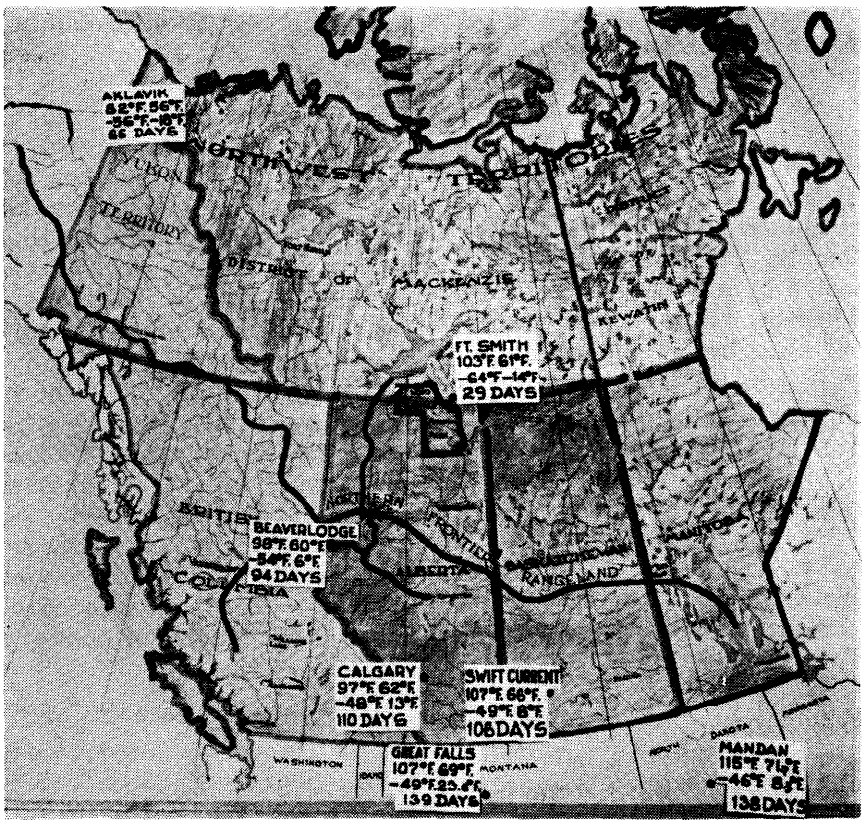

FIGURE 1. Map of western Canada showing rangeland's northern frontier, maximum and mean temperatures for summer and winter and growing season for selected stations.

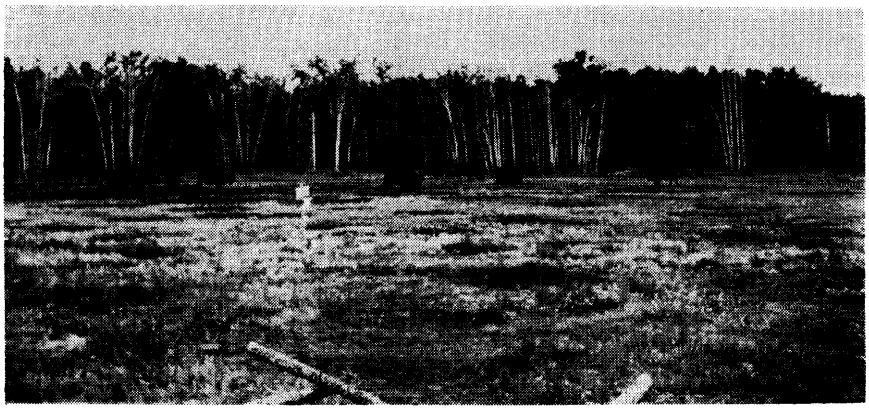

FIGURE 2. Wood buffalo in Northwest Territories.

on the lower Peace and large-scale commercial reindeer ranches on the Mackenzie? It is not the intention here to do more than raise the point and to present two situations which encourage speculation.

Wood Buffalo Park

In the northern part of Alberta and extending into the Northwest Territories, about 700 miles north of the 49th parallel lies an area of about 17,000 square miles set aside as a refuge for the wood buffalo or northern bison *(Bison bison athabascae)*. This is a slightly larger and darker colored relative of the plains bison with rather a different behavior. After nearing extinction the species was protected by a Federal Act of 1893 which prohibited all shooting of the wood buffalo. Wood Buffalo Park was set up as a refuge in 1922. The herd is estimated to have increased from about 500 to about 1,500 between 1893 and 1922. Shortly thereafter (1925-28) a herd of plains bison *(Bison bison bison)* was shipped from Wainwright Park in east central Alberta to the Wood Buffalo Park.

The plains buffalo herd at Wainwright had become polluted with disease and parasites, especially tuberculosis and liver flukes. The diseased and parasite-ridden animals were introduced into the park and intermixed with the aborigines. Although the parasites seemed to disappear the herd still carries a high infection of tuberculosis. The two races have interbred until at present there is only a small herd of the original Wood Buffalo in the extreme reaches of the park.

Nevertheless, the hybrid race seems to thrive there. The herd in the park is estimated at 12,000 and they have spread into two adjacent areas. At the same time 200 to 500 head have been slaughtered each year.

The aims of the Government have now gone beyond preserving the herd from extinction for their aesthetic attraction and the long-range plan considers the herd as a resource with economic value. Slaughter in recent years has provided meat for relief purposes to Indians in the vicinity. A surplus of bison and a shortage of fresh meat exist side by side in the Northwest Territories and supplying the commercial market is being considered.[2]

If the plains bison can be transplanted to the prairies of the lower Peace and Slave Rivers, is there a place for domestic livestock?

Reindeer on the Arctic

The Canadian Government purchased some 2,370 reindeer in Alaska and moved them to Aklavik with hopes of raising the standard of living of the Eskimos on the Mackenzie delta. The animals have done well but the Eskimos have not taken to the pastoral life of herdsmen. Jobs on the DEW line in recent years have been more attractive than tending a small herd of reindeer which offers only scant returns.

Reindeer range is the same as that of the caribou. They prefer the various lichens during winter but also eat sedges and grasses along the lake shores. Summer forage includes the leaves of willows, birch and various herbs.

The problem of improving the Eskimo status with reindeer is a socio-economic one. Although losses from straying due to poor management have been high, the last annual round-up in July 1957 gave a count of 2,600 in the government herd and 3,150 in three Eskimo herds. Unless more Eskimos will accept the life of a reindeer herder the industry will probably not grow beyond its present size.

Some Climatic Factors

To understand the north country one must consider certain climatic factors. Vegetational growth is much greater than one would expect. One of the contributory factors to this rapid growth is the very long days during the growing season. Even though there is perma-frost in the entire Mackenzie River valley good vegetable gardens are produced at the settlements.

The data in Table 1 shows a marked increase in length of days in summer from south to north. The longest day at Beaverlodge in the Peace River country is more than 10 per cent longer than at Mandan, North Dakota. At the Arctic circle the

[2]*Sport hunting of buffalo was allowed in the area adjacent to the northeast boundary of Wood Buffalo Park from September 15 to November 30, 1959. Thirty licenses were issued for the first season.*

Table 1. Some meteoroligical data for selected stations

Meteorological Station	Temperature in Degrees Fah. July Max.	July Mean	Jan. Min.	Jan. Mean	Mean Frost-free-Period	Hours from Sunrise to Sunset June 21
Northern Great Plains						
Mandan, N. D.	115	71.7	-46	8.5	*138 days	15 hrs. 55 min.
Great Falls, Montana	107	69.0	-49	23.6	*139 days	16 hrs. 2 min.
Swift Current, Sask.	107	66.0	-49	8.	106 days	16 hrs. 22 min.
Calgary, Alberta.	97	62	-49	13.	97 days	16 hrs. 33 min.
Beaverlodge, Alberta.	98	60	-54	6.	94 days	17 hrs. 30 min.
Mackenzie River Basin - Boreal Forest						
Fort Smith, N. W. T.	103	61	-71	-14	57 days	19 hrs.
Arctic Tundra						
Aklavik, N. W. T.	82	52	-56	-18	66 days	24 hrs.

* Mean Period without killing frost.

sun never sets in mid-summer. The mean and maximum temperatures for July are much higher than might be expected. Plant growth fairly jumps and summer forage is abundant outside the dense forests.

Even the winters are less severe than the latitude would indicate. Beaverlodge has a January mean of only 2.5° F. below Mandan and the minimum temperature is only 8° F. lower. Blizzard conditions are less severe in Northern Alberta than in the Dakotas. Nevertheless, winters are long and periods of sub-zero temperatures may be extensive. Therefore, winter is the limiting factor. Although domestic livestock can survive the cold, even in the Arctic regions, the supply of feed and necessary shelter are the major problems. Even if the suggestion that the wood buffalo or the Caribou be substituted for cattle proves practical, the problem of feed supplies for a long winter period would make meat production costly.

The Future

The northern movement of the livestock industry in the last half century is real but there must be a point beyond which climate makes it impossible to extend. North of the chinook belt in Alberta, even though the summer conditions at a place like Beaverlodge are conducive to growing forage, wintering cattle on the range is very hazardous or impossible, and feeding over a long winter is costly. Good prices in the last decades have made it economical to raise beef farther north than before. As a result, ranching has moved into the Caribou country of British Columbia and Alberta. The development of the livestock industry farther north will depend upon the demand for meat and the prices which prevail. If prices are high enough, meat could be produced economically on the Arctic, but undoubtedly, a point will be reached beyond which it is cheaper to ship the meat supply from farther south than to produce it locally. This point may not have been reached. The recent oil and mineral development, with attending settlement in the north are, no doubt, having their influence and there are those who dream of thriving ranches in legendary valleys of the far north.

FIGURE 3. Reindeer on Summer Range in Mackenzie delta.

College Facilities and Enrollments in Range Management[1]

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The art of range management has been practiced, at least to some degree, since man first domesticated livestock. The science of range management has been practiced only a relatively short time and has yet to reach its optimum development. Some few schools of the West have offered curricula in range management for several years. Other schools have only recently added such courses to their curriculum.

Range training at the college level is restricted primarily to western United States. The institutions offering this training have only limited facilities, even though range technicians need at least a B.S. degree. It logically follows that facilities for training technicians may become critical as demands for technicians increase.

Graduates and Enrollments

In the fall of 1958 a questionnaire was sent to all colleges and universities west of the Mississippi River known to offer training in range management. The purpose was to investigate the possibilities of training more technicians and to assay the facilities available for training them. Results of the survey suggest that the number of range-trained students is increasing, especially at the undergraduate level. The total fall 1958 enrollment of range students in the 15 institutions was 279 (Table 1). A total of 214 students graduated in the years 1956 through 1958 (Table 2). In 1956, 43 received the B.S. degree. Thus there has been a strong percentage increase to the 82 expected to graduate in 1959 (Tables 1 and 2).

If it can be assumed that half of the M.S. students enrolled in 1958 were graduated in the spring of 1959 then the increase at this level is even more spectacular than at the B.S. level. In 1956, 13 students graduated with the M.S. If the assumption made is valid, 33 graduated with that degree in the spring of 1959.

According to the survey, 26 students were working toward the Ph.D. degree in range management in 1958. It may be assumed that many of these students were studying on an intermittent basis. The time required to complete requirements for a Ph.D. is also longer than that required for an M.S. degree. Thus, it may be reasonably assumed that only one-fourth of those enrolled for Ph.D. work completed their requirements by spring 1959. If this assumption is correct, about six Ph.D. degrees were earned in 1959. Reference to Table 2 will show that though this is a notable increase over 1958, it is only one more than graduated with the Ph.D. in 1956 or 1957.

Table 1. Student enrollment in 15 college departments offering training in range management, academic year 1958-59.[1]

Classification	Enrolled 1958-59
Juniors	104
Seniors	82
M. S.	67
Ph.D.	26
Total	279

[1] Training to qualify as Range Conservationists with the Civil Service Commission.

Factors Affecting Enrollments

It is impossible to list or even be aware of all factors affecting student enrollment in range management. However, it does seem plausible to discuss some of the more obvious.

Most students tend to be mercenary in their choice of a career. Frequently when discussing career opportunities with students, the first question and main interest concern the beginning salary. Certainly beginning salaries in range management have not held up to those in many other fields, such as engineering and physical sciences. The war and defense industries with their supersonic aircraft missiles, space probes, and high appropriations have captured

Table 2. Recent graduates of 15 schools offering training in range management.[1]

Academic year	B.S.	M.S.	Ph.D.	Total
1957-58	71	11	1	83
1956-57	51	14	5	70
1955-56	43	13	5	61
Total	165	38	11	214

[1] Training to qualify as Range Conservationists with the Civil Service Commission.

[1] *Presented to the Pacific Northwest Section of the American Society of Range Management, December 1-2, 1958, Spokane, Washington, as part of a panel discussion concerning professional needs in the field of Range Management.*

[2] *Colleges and Universities listed at end of paper.*

the interest and mercenary mind of a lion's share of science students.

Apparently relatively few high school students are aware of range management as a career. Many first get acquainted with the field through contact with other students and faculty members after reaching college.

Some students seeking outdoor careers choose range management as a field of study. Certainly those seeking adventure as "professional cowboys" are drawn to the field. There is small justification, however, for emphasizing this phase. The complex job of managing our range resources calls for sound basic training and the ability to observe closely and make logical interpretations.

Range management as a career has been recognized in only relatively recent years. The inception of the American Society of Range Management in 1948 laid the foundation for this recognition and undoubtedly added considerable prestige to the career. Even so, our Society is not well known and recognized even among stockmen. As Society activities increase it is assumed that more students will be attracted to range management.

After entering the field of range management, some of the more serious students recognize the necessity for and see the opportunities offered by an advanced degree. Certainly if the student anticipates a career in research or education, an advanced degree is required. Basic research is receiving more emphasis even in the field of range management. To prepare adequately for the research job, a student must have training beyond the B.S. and M.S. degrees. In education, the additional training for a Ph.D. is also highly desirable. Most schools, especially those now attempting to strengthen their range departments, give high priority to Ph.D. training. Present trends indicate that in the not too distant future a Ph.D. will be a minimum requirement for anyone anticipating a career of research or college education.

Trends generally begin at the bottom. Thus, an increase in number of Ph.D. candidates should normally follow rather than precede an increase in students at the undergraduate level. If present upward trends in undergraduate enrollment continue it is reasonable to believe that there will be a proportionate increase in candidates for the Ph.D. degree.

Institutional Facilities

Answers to the portion of the survey dealing with institutional facilities and curricula were not so clear as those concerning enrollment (Table 3). The majority of schools reported adequate classrooms but over half indicated deficiencies in laboratory space.

Half of the schools reported adequate teaching staffs. The other half, with inadequate teaching staffs, indicated a need for a total of 13 more teachers on a half-time basis. The majority of the schools indicated the need for a larger research staff. A need for 18 more range researchers was indicated. Thirteen of these would be used half-time to account for the other half time indicated for the teaching positions. In indicating a need for increased faculty the schools did not necessarily mean that these positions are now open, but that the increased personnel would be required to do the job considered necessary for their institutions.

The relative needs for trained personnel and job opportunities may be reflected in the fact that nearly two-thirds of the schools emphasize institutional or government employment in their curricula (Table 3). It is encouraging to note that over half of the range schools have college-operated experimental ranges at their disposal and two-thirds require annual field trips by range majors. Although few schools require an agricultural background for their students, nearly half of them require summer camp or summer field experience for graduation (Table 3).

Apparently most of the schools included in the survey could train at least a few more stu-

Table 3. Response of 15 schools offering range management training to the questions concerning facilities and curriculum.[1]

Question	Response Yes	No
Adequate classrooms?	11	4
Adequate laboratory space?	6	7
College operated experimental range?	8	7
Adequate teaching staff?	7	8 (13) [2]
Adequate research staff?	2	12 (18)
In your range management program do you emphasize or tend to prepare your students for government and college employment?	9	6
Do you require an annual special field trip for range students?	10	4
Do you require an agricultural background for your range students?	3	11
Do you require a summer camp or special summer employment for your students?	6	8

[1] Training to qualify the student as a Range Conservationist with the Civil Service Commission.

[2] Figures in parentheses refer to numbers of additional staff members required.

Table 4. Response of 15 schools offering training in range management to question concerning increased facilities and student placement.[1]

Question	Response—Number of Schools					
	0%	10%	25%	50%	100%	Over 100%
How many more students could you handle with your present facilities?	1	2	3	2	0	6
How many more students than you graduate could you place?	0	2	1	7	1	2

[1] Training to qualify the student as Range Conservationist with the Civil Service Commission.

dents with their present facilities. Only one school indicated that its capacity was filled, but six indicated they could accommodate more than twice the present enrollment.

The job outlook for students of range management is very good. All schools included in the survey could place more trained men than they are now graduating (Table 4). Seven of these schools reported that they could place 50 percent more and two that they could place over 100 percent more trained people than they are graduating.

Thus graduates in range management occupy a very favorable position in the employment field, at least insofar as number of positions is concerned. Certainly the large number of positions available in relation to the number of graduates had much to do with the recent upgrading of starting salaries by the Civil Service Commission.

Conclusions

On the basis of a survey of 15 schools offering instruction in range management it appears that college facilities are generally adequate to accommodate present enrollments. There is, however, an upward trend developing which may overcrowd present college facilities if it continues. Research and teaching facilities in the range schools need strengthening by an estimated 13 additional half-time instructors and 18 half-time research technicians. At present there are more positions than range trained men, with the Federal Government being the primary employer, especially at the undergraduate level. Students with advanced degrees usually find ample opportunities for employment in research and teaching positions with state institutions or government agencies.

College enrollment in range management has increased greatly during the past three years. This trend has been more evident at the B.S. and M.S. levels than at the Ph.D. level. It seems logical to assume that an increase in Ph.D. candidates will follow the trend in undergraduate enrollment.

Colleges and Universities Responding

1. A. and M. College of Texas, College Station, Texas
2. Brigham Young University, Provo, Utah
3. Colorado State University, Fort Collins, Colorado
4. Fort Hays Kansas State College, Hays Kansas
5. New Mexico College of A. and M.A., State College, New Mexico
6. North Dakota Agricultural College, Fargo, North Dakota
7. Oklahoma State University, Stillwater, Oklahoma
8. Oregon State College, Corvallis, Oregon
9. South Dakota State College, Brookings, South Dakota
10. Washington State University, Pullman, Washington
11. University of Arizona, Tucson, Arizona
12. University of Idaho, Moscow, Idaho
13. University of Nevada, Reno, Nevada
14. University of Wyoming, Laramie, Wyoming
14. Utah State University, Logan, Utah

Notice To Sections

I have been requested by the Board of Directors to solicit, from the sections, popular or rancher type articles for the Journal. I'm ready! Let's have them, but make them good! One per issue is the goal.

—The Editor

Preliminary Investigations of Harvester Ants on Southern Idaho Rangelands[1]

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The western harvester ant, *Pogonomyrmex occidentalis* (Cresson), is one of the more common and conspicuous insect pests of the western range. The circular area it clears around its nest results in thousands of acres of rangeland being denuded of vegetation. This causes a reduction in livestock-carrying capacity and an increased potential for soil erosion. The ant is also responsible for the destruction of an inestimable amount of seed which may result in a reduction of vegetation or a change in plant composition in areas where the ant is common.

Numerous studies indicate that many range pest problems are directly related to range condition. Plants and animals that become pests are often present in nominal amounts even under good and excellent range condition. Such potential pests become major problems for the range manager and livestock producer only when range condition declines. These pests are a result rather than a cause of poor range condition and it appears that the harvester ant falls in this category.

The widespread occurrence of harvester ant clearings in southern Idaho led to the initiation of intensive research on this insect in 1956. It is the purpose of this paper to present preliminary findings of one phase of this research involving population studies on harvester ants at three locations in south central Idaho.

Review of Literature

Harvester ants occur over vast areas of rangeland in the western states. This ant is reported to have denuded 90,000 acres of grazing land in the Big Horn Basin of Wyoming (Killough and LeSueur, 1953). These workers found 30 percent of this basin had an average of 32 ant colonies per acre with the cleared areas averaging 18 feet in diameter. In Kansas, Fritz and Vickers (1942) found the clearings to be relatively small with the largest measuring 150 to 200 square feet. Knowlton and Nye (1946) reported a range in diameter of 10 to 43 feet for ant clearings and Bohart and Knowlton (1953) state that individual clearings may occupy 500 square feet or more in Utah. List (1954), working on Colorado rangelands, found 4 to 20 harvester ant clearings per acre ranging from 6 to 30 feet in diameter. Haws and Knowlton (1951) found 733 clearings in a 100-acre dryland alfalfa field in Utah. The number, however, varied with the different sections of the field and ranged from an average of 2.13 per acre on one 30-acre section to 11.75 per acre on a 40-acre section of the same field. Actual measurements showed that 1.9 acres were kept bare of alfalfa by the ant. Weber (1959), observing ant clearings in Utah from the air, calculated that 30,976 clearings per square mile or an average of 48.8 per acre could be present in certain areas. A report on the harvester ant in the Twin Falls area of Idaho by Cole (1932b) lists a range of from 7 to 28 clearings in one-tenth square mile on different soil types found in the area. The number of clearings listed in this study would amount to less than one clearing per two acres of surface area which is far less than found by Haws and Knowlton (1951), Killough and LeSueur (1953), List (1954), or Weber (1959).

The amount and nature of the vegetation is undoubtedly a prime factor in determining the success of harvester ant colonies. Cole (1933) states that the ant is nutritionally dependent upon seeds from vegetation adjoining its nest and that an abundance of annual and perennial grasses with readily available seeds is an inducement to establishment and a factor influencing the continued existence of the granivorous species of ants. Bohart and Knowlton (1953) report that harvester ants may range about 100 feet from their nest and that seeds are their principal diet, but other dry, protein-rich substances such as pollen and dead insects may be taken also. Cole (1932a) found clearings more closely aggregated in peppergrass, *Lepidium perfoliatum*, openings in sagebrush vegetation than in any of the other areas of this community.

Procedure

Three study areas were selected in the Raft River Valley of Cassia County in the fall of 1956. Two of these were located in the saltsage, *Atriplex nuttallii*, type of vegetation. The vegetational

[1]*Published with the approval of the Directors of the Forest, Wildlife & Range Experiment Station, College of Forestry, and the Idaho Agricultural Experiment Station as research paper number 479.*

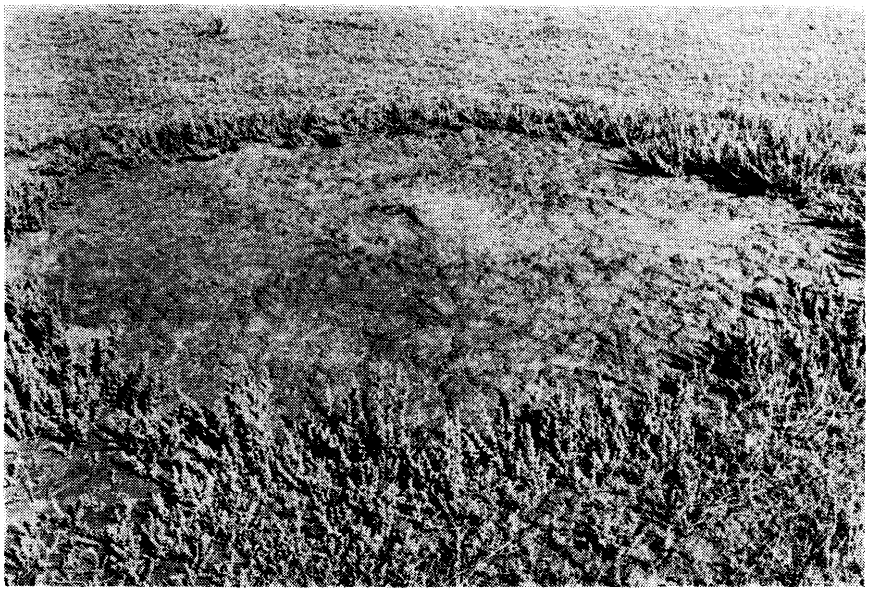

FIGURE 1. Harvester ant clearing in the depleted saltsage area. Clearing is approximately 13 feet in diameter and completely surrounded by halogeton.

cover of one of these saltsage sites consisted primarily of annuals, with halogeton, *Halogeton glomeratus,* predominating (Figure 1). The annual plant cover in this stand resulted from past misuse of the saltsage vegetation. At the second area the plant cover consisted of a vigorous stand of saltsage (Figure 2). The third area of study was located in a shadscale, *Atriplex confertifolia,* community (Figure 3).

Six adjacent one-acre plots measuring 132 x 330 feet were laid out in the depleted saltsage and the saltsage areas. Twelve plots of the same size were located in the shadscale type.

At the initiation of the study in the fall of 1956, all the ant clearings in one plot of each of the saltsage and depleted saltsage areas were mapped by use of compass bearings and measurements from permanently marked points approximately 15 feet south of the edge of each clearing. Two diameter measurements of each clearing were taken in the other plots, and the position located on a map. Due to the indistinct margins of the clearings in the shadscale type, position only was plotted. It was anticipated that the number and size of the clearings would vary yearly. Consequently, in 1957 and 1958 all clearings in the study areas were located on overlay maps and checked with the previous mappings. In addition, diameter measurements of each clearing were made in the plots at the two saltsage locations.

Results and Discussion

Number of Clearings

The counts of clearings of harvester ant colonies made during this study period at the three locations are presented in Table 1. Only a slight variation in the average number of clearings per acre was found in the two areas with stands of perennial plants. However, a large difference in the number of clearings between the annual and perennial plant areas is evident (Figures 4 and 5). Each year the depleted saltsage plots had approximately three to four times as many clearings per acre as either the shadscale or saltsage plots. These data suggest that a stand of annual plants is more favorable to the establishment of a larger number of colonies than a perennial cover of saltsage or shadscale.

Changes in the number of clearings occurred within each of the plant stands over the three-year period (Table 1). The number of clearings per acre in the shadscale stand was similar to that found in the saltsage. On the other hand, the net increase in number of ant colonies was similar in the shadscale and depleted saltsage stands. However, the yearly colony mortality was

FIGURE 2. Harvester ant clearing in a vigorous stand of saltsage. Clearing is approximately 16 feet in diameter and bordered by saltsage.

Table 1. Counts of harvester ant colonies per acre at three locations, Raft River Valley, Idaho.

Vegetation Type	Plot	1956 Total Colonies	1957 New Colonies	1957 Dead Colonies	1957 Total Colonies	1958 New Colonies	1958 Dead Colonies	1958 Total Colonies
Depleted Saltsage	1	30	2	3	29	8	4	33
	2	42	2	1	43	4	3	44
	3	38	6	3	41	4	2	43
	Mean	36.7	3.3	2.3	37.7	5.3	3.0	40.0
Saltsage	1	11	0	0	11	0	0	11
	2	10	0	2	8	0	0	8
	3	8	0	0	8	0	0	8
	Mean	9.7	0	0.7	9.0	0	0	9.0
Shadscale	1	9	5	0	14	0	0	14
	2	7	1	0	8	1	0	9
	3	9	4	1	12	3	0	15
	4	5	3	0	8	1	1	8
	5	10	0	1	9	2	0	11
	6	14	3	1	16	0	0	16
	Mean	9.0	2.7	0.5	11.2	1.2	0.2	12.2

greatest in the depleted saltsage. The relatively small loss of clearings in the shadscale vegetation reflects a greater stability than for the depleted saltsage.

The saltsage stand exhibited the greatest stability in number of ant colonies. New clearings did not appear in this area in either 1957 or 1958. Moreover, the average survival of the 1956 colonies in the two following years was high. The number of clearings did not change in two of the three plots over the three-year period. The loss of two colonies in the third plot in 1956 and 1957 was the only change that took place.

Size of Colonies

Measurements of the diameter and area of harvester ant clearings were made in the saltsage and depleted saltsage plots. Such measurements were not made in the shadscale plots. However, it was estimated that the average diameter of the clearings in the shadscale approximated that of depleted saltsage and that the percentage of area cleared was less than 1 percent.

The depleted saltsage generally had smaller clearings than the saltsage. The diameter of clearings in the saltsage averaged approximately one and one-half to nearly two times those in the depleted saltsage (Table 2). Observations indicate that the diameter of clearings in the shadscale are smaller than those in depleted shadscale areas having an annual plant cover. It is not possible to explain the reasons for these differences at this time.

The ant clearings occupied about 3.5 percent of the area in saltsage and approximately 5 to 8 percent of the area in depleted saltsage during the three years of study (Table 2). The size of the clearings in the saltsage area increased slightly each year. Yearly removal of the perennial saltsage plants from the edge of the clearings resulted in a continuous enlargement of the clearings. This results from the slow establishment of the perennial saltsage in comparison with the annual plants that surround the clearings in the depleted saltsage area. Clearings in the depleted saltsage increased and then decreased over the three years of the study.

FIGURE 3. Harvester ant clearing in shadscale vegetation. Tape is stretched to 18 inches.

FIGURE 4. Aerial view of depleted saltsage area. Area shown is approximately 10-15 acres.

FIGURE 5. Aerial view of ant clearings in saltsage stand of vegetation. Area shown is approximately 15-20 acres.

Summary

The western harvester ant is one of the more important insects on the rangelands of the west.

This paper reports results obtained from studies on the number and size of clearings made by the harvester ant at three locations in the Raft River Valley of southern Idaho. One of the three locations had a vegetation cover of saltsage, one a cover of annual plants in a depleted saltsage area and the third a cover of shadscale vegetation.

Plots in the depleted saltsage location had three to four times as many clearings per acre as either the shadscale or saltsage plots. Yearly changes in the number of clearings was greatest in the depleted saltsage and least in the saltsage.

The largest clearings were found in the saltsage community and the smallest in the depleted saltsage community. Measurements were not taken in the shadscale plots. The total area occupied by ant clearings was approximately 3.5 and 5 to 8 percent at the saltsage and depleted saltsage locations respectively.

A greater number of clearings as well as a greater total area cleared was found in the poor condition than in the good condition saltsage. Increased ant activity is thought to be a result rather than a cause of poor range condition.

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Table 2. Measurements of harvester ant clearings at two locations, Raft River Valley, Idaho

		Average Diameter of Clearings			Area Cleared		
	Plot	1956	1957	1958	1956	1957	1958
		(feet)			(percent)		
Depleted Saltsage	1	9.9	11.3	8.5	5.8	7.3	5.2
	2	7.4	10.0	8.4	4.7	8.4	6.3
	3	7.0	9.3	8.3	4.7	7.8	6.4
	average	7.9	10.1	8.4	5.1	7.8	6.0
Saltsage	1	13.0	13.2	13.3	3.6	3.8	3.8
	2	12.8	13.7	14.0	3.1	3.4	3.8
	3	14.7	15.4	15.9	3.2	3.4	3.7
	average	13.5	14.0	14.3	3.3	3.6	3.7

Historical Highlights of Grazing in the Central and Southern Great Plains

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Historically the Great Plains region is an ancient pasture. The Jura-Triassic and Cretaceous beds hold the fossils of giant plant-eating dinosaurs and the fossil trees and herbs on which these ravenous animals grazed. Elevation of the Rocky Mountains ended the reign of dinosaurs and their disagreeable kind. Ancestors of both mammals and grasses probably appeared about this time. Some authorities believe that grasses are the descendants of Cretaceous sedges. The evolution of grasses in the Great Plains region apparently coincided with the evolution of the horse, camel and many other grass-eating mammals which originated in North America after the elevation of the Rockies. There were no cowboys or rangemen in those days as man did not show up until the early Ice Age.

The ancient land bridge across the present Bering Sea is believed to have been the pathway over which grass-eating mammals and other animals crossed between America and Asia. Many of their descendants, which include the bighorn sheep, Rocky Mountain goats, and others, found their way southward along the Old North Trail up the Yukon Valley. From there their course led over the low pass into the McKenzie Valley and southward to the Great Plains. While the North American Indians of the Pre-Columbian era had domesticated dogs and turkeys, they also hunted the wild grazing mammals like buffalo, deer and elk. Around the kitchen middens of ancient Yuma and Folsom man are found the cracked bones of horses, camels, bison, pigs and Ice Age elephants. It is not known why, but camels, horses and elephants disappeared from North America in the late Ice Age. The only members of these groups found when the white man arrived were bison, javelinas in Central and North America and llamas and alpacas in South America.

European horses were introduced to horseless North America by Ponce de Leon to Florida in 1513 and Cortez to Mexico in 1515. Around 1540 the descendants of these early horses which had escaped the Spaniards and ran wild were being tamed and ridden by Indians in Mexico. By 1760 horses were being used by the Indians from the Rockies to the eastern prairies and hardwood savannahs. Prairie and Plains Indians were hunting on the descendants of the horses brought over by the conquistadors 100 years before they came into active contact with white settlers from eastern United States. Except for the very southernmost tip, the Great Plains region was the last American frontier settled by Anglo-Saxons. Mounted Great Plains Indians became some of the best cavalry men and hunters of all time.

The first Europeans to cross the Southern Great Plains were the Spaniards, Cabeza de Vaca and Doriantes, and the negro, Esteban. After having been shipwrecked near the mouth of the Sabine River on the Texas gulf coast they wandered from there through the Pecos Valley and on to Culican, Mexico, on the Gulf of California during the period 1528 to 1536. Much of the time they nearly starved, living off dogs, rodents, snakes, worms, snails, roots, fruits of cactus, berries, offal and any other digestible vegetable and animal matter that they could find. They lived best in the "land of the people with cattle" in the southern Pecos River Valley. There, the Indians lived on buffalo, deer, antelope, rabbits, mesquite beans, pine nuts, squashes, corn and beans.

Cabeza de Vaca and Esteban learned many Indian dialects and probably while in Sonora, the imaginative Arab Moor Esteban heard tales from Indians about the self-sustaining Zuni pueblos and others in the Rio Grande Valley in New Mexico. With his colorful retelling the pueblos became the famous golden cities of Cibolo, a tale that put in motion a set of circumstances that tapped off the Coronado Expedition. Coronado brought with him the first European cattle, sheep, goats and horses to enter the Great Plains. In 1540 he crossed the present U.S. border with 6,500 head of livestock, of which 500 head were cattle. His trail on this misguided fortune hunt took him from the New Mexican pueblos on the Rio Grande across the high plains. Here he sent his main army back to Bernalillo and with 30 chosen warriors continued on to the locality of Salina, Kansas, before he gave up his abortive gold hunt and headed back to Mexico. The cattle, sheep and goats were used for food and it is doubtful if any of these animals survived to reproduce their kind. The Catholic padres later brought in livestock that served the various missions. Seed stock for the ranges originated from these sources. Di-

aries kept by some members of Coronado's entourage make special mention of the excellent grasslands that fed their grazing animals.

Cowboys were branded before cattle. Cortes conquered the Aztecs and branded them on the cheek with the letter G., meaning guerra or war. He trained the Indians to become herdsmen and as Mexican ranches developed, brands were used to identify cattle and horses of each ownership.

The term "cowboy" originated among the colonials of the eastern seaboard who kept cattle which were herded by day and kept in cowpens at night. The herding was done by boys too young for heavy labor so it was natural that they should inherit the name cowboy.

The western cowboy learned the art of his trade from the Mexican vaquero, meaning a man who works with cattle. Riding, roping, branding, and trailing were learned from Mexican vaqueros.

As cattle multiplied beyond the missions the great ranches of Texas developed. One man wrote "other States were carved or born; Texas grew from hide and horn." The first long drive across Texas occurred in 1721. Cattle and sheep were driven from San Antonio in Nuevo Leon, Mexico, to the military post of Los Adoes near the Louisiana-Texas Border. The distance was nearly 1,000 miles.

One hundred years of Spain's military, missionary, and cattle-raising colonization of Texas was followed by Mexico's fight for freedom from Spain. in 1821. Texas made her successful revolt against Mexico in 1836.

Another type of cattle figured importantly in the development of the West. These were the oxen that dragged the freight wagons. In 1856 Russell, Majors and Waddell, the largest single freight outfit, had 350 wagons, 50,000 oxen and 1700 employees. Oxen left to die on the trail often survived winters on native grass between Omaha and Salt Lake City, hence wintering of cattle on northern plains ranges was proved to be possible.

The Great Plains region occupies ⅕ of the land area of the United States, but we are concerned in this discussion with only the central and southern portions. It is a land of alternating fat and lean years where there has evolved a unique spiritual climate—an area of conflict and change, where there is no strengthening social force to bind people into a large smoothly functioning group. Ranchers and farmers have been unfriendly. There is no unity of action between industry and other groups. European humid-area schemes of settlement replaced the ranching economy which once flourished. The wrong type of land settlement program was superimposed on an area unsuited to 160 and 320 acre homesteads.

Hunting by Indians on horseback and ranching by white men were the only two cultures that ever proved themselves in the Great Plains until irrigated farming developed late in the 19th century. The flexibility inherent in the first two economies made it possible for them to survive.

For 40 years the Great Plains region has been the number one problem area in the United States, but conservation ranchmen have found the solution to Great Plains needs. One of these is A. P. "Red" Atkins, Guymon, Oklahoma, past president of the American Society of Range Management. If all ranchmen followed Red's example of conservation land management there would be fewer land problems in the Great Plains.

Unprotected crop land is the greatest problem. While many conservation farmers have learned how to farm and protect such land, there will be no stability in the Great Plains until most farmers practice crop land conservation and ranges are grazed less heavily.

In 1879 Major John Wesley Powell suggested a land classification which would have permitted disposition of grazing land in units large enough to support a family. Powell's idea was that such a unit should not be less than 2,560 acres in size. When annexed to the United States, Texas held on to her land which later was sold to settlers. A man declaring himself a farmer got 177 acres; if he called himself a rancher he could obtain 4,440 acres for the sum of $180.00.

One of the notable events of settlement was the Oklahoma Run of April 22, 1889. A large area of the Indian Territory was released by the United States Government for homesteading. Some 50,000 people took part in the "run." Each was seeking to be the first to settle on one of the 160-acre homestead tracts. This acreage obviously was too small to support a family.

Texas ranges filled up with Spanish cattle following Texas independence and condition of ranges declined. Marketing was soon a major problem but a few hide and tallow factories were established on the Texas gulf coast which provided a small outlet.

A few herds were trailed to New Orleans prior to 1821. By 1840 numerous herds were driven to Shreveport, Louisiana, and loaded on flat boats for New Orleans. This became the major market for Texas cattle for the next 12 years. Price received by some trail drivers was $10 per head for steers delivered at Shreveport. The buyers often received $45 for them at New Orleans.

Thousands of Texas cattle were driven to California after

the Gold Rush. In 1856 cattle bought in Texas for $14 per head brought from $60 to $150 a head in California.

Between 1842 and the start of the Civil War thousands of cattle were trailed to Missouri and Kansas, many of these eventually winding up in Kansas City and points as far east as New York City. During the war, Texas numbers increased to 6 million head and cattle went begging for markets and often sold from $4 to $5 per head.

With the close of the Civil War, reduction of buffalo herds and settlement of the central and northern Great Plains, Texas trail herds flooded north over four major cattle trails. Ten million head were moved by this method during the next 30 years. During this period the cowboy of American folklore came into being. He worked cattle mean as buffaloes, bucked drought, floods, rain, snow; dodged lightning; and risked his life in cattle stampedes. He found Indians, outlaws, and rustlers and dickered for protection against tick quarantines. For occasional fun he loaded up on poisonous trader's whiskey, shot up towns, gambled and patronized floozy parlors. His constant companions were his horse and six shooter. It seems that his dare-devil riding, shooting and hell-raising escapades were the attributes that identified him as the key American folklore hero.

The gun toting cowboy had a short tenure on the American scene but he is now immortalized in story, rhyme, song, theatre, television and movies. Revenue every five years from these sources probably brings in more cash than the whole 10 million head of Longhorn cattle that went up the trails out of Texas during the Trail Driving era, the time when the cowboy made his name in American folklore.

Perhaps it was the Colt 45 or the handgun which gave the cowboy independence and made men of all sizes equal except for one thing — the speed of their draw. The cowboy became half knight, half outlaw, a Robinhood on horseback. The reckless freedom that a horse and gun gave him appears to have been the features that made him immortal.

Ernest S. Osgood says, "The range cattleman has more solid achievements to his credit than the creation of a legend. He was the first to utilize the semi-arid plains. Using the most available natural resource, the native grasses, as a basis, he built up a great and lucrative enterprise, attracted eastern and foreign capital to aid him in the development of a new economic area, stimulated railroad building in order that the product of the ranges might get an eastern market, and laid the economic foundation of more than one western commonwealth."

As the breeding herds filled the ranges, ranches developed and a form of feudal ranching economy reigned until the sodbuster and nester moved in. Barbed wire and fenced ranges forced ranchmen to settle down in one locality. Competition forced the Longhorn cowman to better breeding and ranching methods. Durham bulls were brought in from the East to improve the beef-producing qualities of range cattle. The central and southern Great Plains have continued to be largely cow and calf operations.

Later as the superior rustling qualities of the Hereford were recognized and bull supplies were available, this breed soon dominated the ranching country. Angus cattle have been rapidly increasing in the ranch country for the last 15 years.

Crossbreeding with Brahma cattle has been carried on for over 60 years in the Southern Great Plains. The crossbred with Brahman blood is liked by border ranchers for these cattle stand the heat and insects better, they think, than English-bred cattle. Several new breeds have been developed from Brahma and English cattle. These breeds are concentrated in southern United States from California to the Atlantic Coast but are being tried out over the nation. Charolais, the large cream-colored French beef breed, is becoming popular in crossbreeding. There are only around 3500 registered Charolais in the United States.

With the break-up of free range brought on by homesteading and fencing came the era of ranch improvement practices. Introduction of the windmill opened up large areas to year-around use and fences kept herds from straying. Use of supplemental feed as a safeguard against drought and heavy snows increased. Actually this has tended to put more pressure on ranges because too often such areas have been turned into big feeding grounds causing a loss in range condition.

As United States cattle numbers increased meat processing plants for grass beef became necessary. A slaughter house was built in Chicago 1827. Later, cattle rolled out of the Great Plains to Chicago and enlargement of Chicago stockyards followed in 1864. During the 1870's Swift and Armour began shipping beef in "ice boxes on wheels" from Chicago to challenge eastern meat competition. Commission firms developed along with stockyards. Stockyards operators and packers gradually set up business in Kansas City, Omaha, Denver, Sioux City, St. Joe, Fort Worth, San Antonio, Houston, and Oklahoma City. Recently thousands of local cattle auctions have sprung up to supplement central markets.

In the 1860's and 1870's the railroads tapped the heart of the Great Plains, drew off herds

to market and by 1890 most trail driving was over. Livestock organizations came into being; the first was in Wyoming in the 1860's.

At present the range livestock business is a thriving major industry and that in the Great Plain compares with the rest of the country as follows:

Area	Cattle	Sheep
United States	93 million	31 million
Great Plains	31 million	15 million
Southern Great Plains	18 million	8 million

Since domesticated animals were introduced, Great Plains ranges have lost productivity. Loss of good range plants has been greatest in the southern part, least in the northern part. Both the Federal Government and organized ranchers began range improvement programs as early as 1900, but there have been increases since 1930.

Research on range started much later than on crops and livestock, but two range experiment stations were started in 1898 by the U. S. Department of Agriculture under H. L. Bentley and Jared Smith. One of these was in Channing, Texas, in the Panhandle and the other at Abilene, Texas, in the rolling red plains. A system of deferred rotation grazing was practiced on part of the pastures. Both late and early deferments were used on two different pastures. One area was cut with a disk harrow, cattle were held off until June 1, and then grazed until winter. Filaree and burr clover were seeded on native sod in some pastures.

A committee of stockmen was appointed to set up stocking rates and to make follow-up range checks. A 3-year experiment was planned. The only results reported show that disked pasture produced about 25 percent more grass than the undisked area. Resting and alternate grazing were the two major practices used. Hay and silage were used to supplement native grass. Stock water developments were added.

These early stations recommended long-term leases of rangeland to enlarge small personal holdings. No report is available on results of these experiments. Other major experiment stations started range research as follows:

1912—U. S. Department of Agriculture, Jornado, New Mexico

1912—U. S. Department of Agriculture, Akron, Colorado

1920—Colorado State, Ft. Collins, Colorado

1920—Manhattan and Hays, Kansas

1926—New Mexico A&M Range Station

1930's—U. S. Forest Service, Nunn, Colorado

Soil Conservation Service, Bushland, Texas

Southern Great Plains, Woodland, Oklahoma

Texas A&M, Barnhart, Texas

1940's—Soil Conservation Service, Cheyenne, Oklahoma

Texas A&M, Sonora, Texas

Range courses are being taught in colleges in all Great Plains States, supplying greatly needed range men.

Federal assistance to range programs has come under several different programs:

Bureau of Plant Industry, Forest Service, and Agricultural Research Service, since 1900.

Soil Conservation Service, Agricultural Adjustment Administration (now ACP) during the 1930's. Also, the Bureau of Land Management.

Soil Conservation Districts, farmer and rancher organized conservation entities set up under State laws cover most of the Great Plains.

During the 1950's soil bank programs were added to ACP activities and watershed and the Great Plains conservation programs have become important appendages to Soil Conservation Service responsibilities.

The Great Plains region is an area of unsolved opportunity where the potential is as great as men want to make it. A large part of it is unsuited to cropping and must always remain as rangeland.

The Effect of a Leaf Feeding Beetle on Big Sagebrush in British Columbia

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This is a report of a startling natural phenomenon that occurred when an insect population multiplied to such proportions that it all but eliminated a common range plant over a very large area. This does not presume to give any final answers or explain why or how this situation developed, or where it will eventually end. It is designed primarily to relate what has happened to date regarding the sagebrush that has been affected. If it does nothing else it should impress upon us that nature herself sometimes takes matters into her own hands to help right the wrongs caused by man.

In July 1954 a beetle identified as *Trirhabda pilosa* Blake, hereafter referred to as *T. pilosa,* was discovered by the author on big sagebrush *(Artemisia tridentata* Nutt) near Kamloops, British Columbia. At this time a patch of sagebrush less than two acres in extent was seen to have turned a rusty brown color. Closer examination revealed myriads of small metallic blue larvae stripping the surface layers from the leaves. A few mature insects were collected and subsequently identified through the Field Crops Insect Laboratory, Science Service in Kamloops. Final identification was made by Mrs. D. H. Blake, who originally named the species.

FIGURE 1. *T. pilosa* adult on big sage brush approximately nine times actual size.

Description of the Beetle

T. pilosa, a beetle of the *Chrysomelid* family, has a shiny green lustre and is about 5 to 7 mm. long, (Figure 1). A full description is given by Blake (1931). Pringle (1955) outlined the life history as follows: the insect overwinters as an egg which is laid under the bark or in the duff at the base of the plant. Larvae emerge during early June and chew the sage leaf surface during which times they pass through several stages. Mature larvae are about a centimeter long, bluish black with a metallic lustre. Early in July larvae concentrate in the debris and soil at the base of the plant where they pupate. The pupal stage lasts 1 to 2 weeks at the end of which time adults emerge. Arnott (1957), made a study of the life history of the insect and reported that mature larvae caged on sagebrush in the laboratory on July 13 had stopped feeding by July 21 and entered the soil, by which date some in the field had pupated. The first adults emerged from these caged pupae on July 28. Heavy infestations of adults persist in the field throughout August during which time oviposition takes place. Adult populations apparently die out gradually during September.

The beetles were considered host specific to big sagebrush because they starved to death in the laboratory on four other sagebrush species common to the area as well as rabbit brush and goldenrod.

Spread of the Insect Over 4 Years

During the year of discovery the beetles emerged in large numbers and by August had spread out and were visible on sagebrush up to a mile from the original site. Spread must have been accomplished by flight but no beetles were seen flying that year. In the spring of 1955, visual observations showed that 90 percent of the sagebrush over the original two-acre patch was dead. It was most interesting that the shrubs used by ants as aphid pasture were not damaged to any degree and hence survived to stand out like flags. In some cases the ants died out and plants protected in this manner were utilized and killed in the following season by hatching larvae. Figure 2 shows this situation on a single plant growing close to an ant hill that was active in 1955 but was abandoned sometime in 1956 and a residual population of *T. pilosa* all but killed it during 1957.

During 1955 larvae showed up in abundance on sagebrush over an estimated 1500 acres. By June

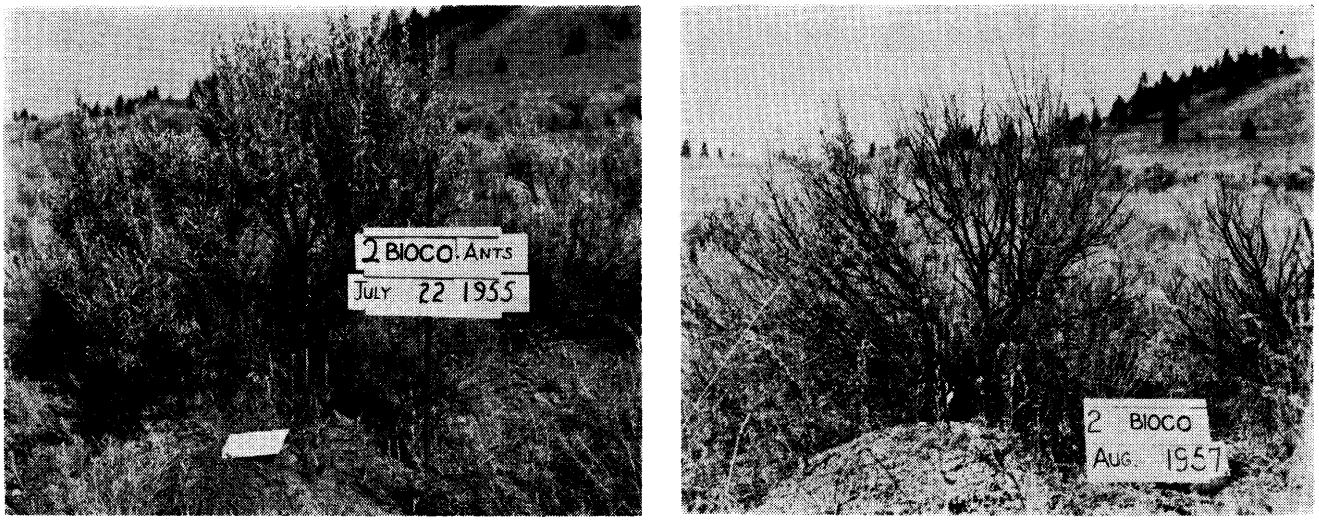

FIGURE 2. *Left:* A single big sagebrush plant growing near an ant hill pictured in 1955 showing lush foliage. *Right:* The same plant two years later after the ant hill had died, allowing beetles to feed and almost kill it.

of 1956 the sagebrush on this acreage appeared 70 to 80 percent dead. It was during July 1956 that beetles became extremely numerous over a wide area and were observed in full flight during one very warm bright day. Lack of suitable host plants no doubt forced them to seek fresh sagebrush that had not been defoliated by larval chewing. At this time it was estimated that between 2500 and 3000 acres of sagebrush range had been affected. During 1958 insects were active in localized areas of sage range up to 5 miles from their origin.

Ecology of T. pilosa

It should be pointed out that sagebrush over the affected area occurs between 2000 and 3000 feet altitude. The insects were first seen at the higher altitude on an area which was at one time homesteaded, hence the sagebrush here must be regarded as an invader. On this type of land the insect has caused a high degree of kill. On the dryer sites at lower altitudes between 1100 and 2000 feet, which is the native range of big sagebrush, little or no damage is done. This lack of damage may be attributed to the dryer, warmer environment. It is apparent that the insect is unable to build high enough populations to cause extensive damage to sagebrush on the lower grassland sites. Where it occurs on brown or dark brown soils of the mid or upper grassland its depredations have not slackened pace.

Huffaker (1957) using *Hypericum perforatum* Linn., and simulating destruction by *Chrysolina gemellata* Rossi., demonstrated that death is not caused directly by the loss of foilage or from competition for sunlight but was the result of the inability of the greatly reduced foliage to maintain a sufficiently extensive root system, associated with the absence of adequate subsurface soil moisture during summer. Perhaps this same reasoning may hold true in the rapid destruction of big sagebrush by *T. pilosa.*

Recording Changes in Plant Cover

When it was seen how rapidly changes in the plant cover could occur through the action of *T. pilosa* it was decided to utilize 100-foot line transects as a means of recording changes in the sagebrush stands. This work was started in July 1955 with the establishment of studies on four sites. The first year only one line was laid out with two more being added the following season. The name used for this project was BIOCO contracted from Biological Control. Intercepts were read for living foliar material as well as dead stems and branches. A scale of 1 to 5 was set up denoting the extent of damage to the shrub. Each segment on this scale was considered a condition class.

1. Undamaged.
2. Slightly chewed.
3. Medium damage, turning brown.
4. Severe damage, plant completely brown and dying, or only one or two branches living.
5. Plant dead. Twigs and branches brittle.

Notation was also made as to the presence of larvae, beetles, ants, and height of the plant and general condition of the sagebrush stand.

The lines were recharted each year and totaled for number of plants and percent total sagebrush. This was then broken down to percent occurring in each of the five condition classes.

The four original sites were at varying altitudes and exposures. Site 1 was lost the first

Table 1. Changes occurring to sagebrush plants over the 4-year period on Site 2

Year	Number of plants per line	Ground cover of sagebrush	Condition class 1	2	3	4	5
		(Percent)					
1955*	16	30.5	100	—	—	—	—
1956	16	22.8	1.7	2.0	8.8	1.7	6.6
1957	17	24.6	—	4.0	20.4	25.0	50.6
1958	18	21.1	20.3	3.4	2.7	28.6	45.0

* One line only, rest are averages of three 100-foot lines.

year when the stakes were stolen. Site 3 was lost after two years when it was completely churned up in a strip-mining operation during a search for copper ore. Sagebrush on this site located at almost 3000 feet was very vigorous and uniform. At the time of site establishment beetles were present. One year later on the three 100-foot transects only a single plant appeared alive of 50 plants tallied. This was located in close proximity to an ant hill. It was indeed unfortunate in view of the high percentage kill that this area could not be sampled the next season to determine if any regrowth had occurred.

Site 2 was located in a mixed stand of big sagebrush having both mature and small plants at an altitude of 2300 feet. On this site grazing was continuous and heavy. A few beetles were present when the first line was established in 1955. The data in Table 1 present the changes that occurred to the sagebrush plants over the 4-year period.

Site 4 was located, after Site 1 was lost, at 2400 feet in a fairly vigorous stand of sagebrush representative of a large area of north-facing slope over which the beetles were prevalent in 1956. In 1957 the area had the appearance of a badly killed stand with an occasional patch of living or recovering sagebrush centered around an ant hill. Table 2 presents the changes in sagebrush plants on Site 4 over a 3-year period.

In a third area where beetles appeared in large numbers in 1957 and where the sagebrush was too large to operate a line transect, 40 plants were tagged along a line and notes made on their condition. Tagged plants ranged from 2 to 7 feet in height with the majority being over 5 feet. Table 3 shows that the number of dying and dead plants jumped in one year from 5 to 85 percent of the stand due largely to beetle activity. Most plants had only one or two minor branches surviving with the majority of the plant being dead and brittle. Plants in this condition were placed in Class 4. This accounts for the high number of Class 4 plants and a relatively low number of dead sagebrush. Of the 11 plants harboring beetles in 1958, 6 had ants in 1957.

From the data it is obvious that *T. pilosa* is capable of destroying sagebrush to the extent of 50 percent of the stand. It is also obvious that many factors such as altitude, micro-climate, extent of grazing and age of stand enter into the degree of killing.

Looking at figures for Site 2 we see that 1957 showed the highest amount of kill and by 1958 many plants which were in Class 3 had completely recovered. This means that the insect must do a complete job in the first or second year. Indeed this has been observed. When the wave of beetles moves on it rarely leaves behind enough survivors to mop up the living plants.

On Site 4 a slightly different story was told. Here the high population of ants prevented the beetles from overcoming any more than 40 percent of the plants. During 1958 many Class 2 and 3 plants returned to normal.

To date *T. pilosa* has made some spectacular changes in plant associations where it has occurred in abundance. Perhaps the depredations have been more spectacular to the eye than to the measuring tape, at least so it would appear from the limited

Table 2. Changes occurring in sagebrush plants over the 3-year period on Site 4

Year	Number of plants per line	Ground cover of sagebrush	Condition class 1	2	3	4	5
		(Percent)					
1956	16.3	15.7	3	1.0	53.2	—	29.2
1957	19.0	21.5	15.6	22.7	15.7	15.0	39.0
1958	19.0	16.5	31.0	4.0	10.0	15.0	39.0

Table 3. Changes in the condition of 40 sagebrush plants from 1957 to 1958

Year	Number of plants harboring Beetles	Ants	Condition class 1	2	3	4	5
			(Number of plants)				
1957	38	10	6	12	20	1	1
1958	11	1	0	1	5	26	8

data presented. When first discovered it was thought to be a small local outbreak which, for natural reasons, would be gone the next year. It has now held on for over four years and increased meteorically.

Long Range Plantings

Anticipating the value of this insect as a means of reducing big sagebrush some artificial moving of them has been attempted. To do this about 1000 adult beetles were collected and transported to a new area where they were released on sagebrush, preferably where it appeared to be an invader. Of four transplants made during 1956 only one has shown any degree of success to date.

T. pilosa a Native Insect

Several questions still remain unanswered. Where did the beetle come from and how was its population build-up enhanced? The insect is alleged to be native of British Columbia. W. J. Brown, Entomology Division, Ottawa, informed Arnott (1957) that in the Canadian National collection there are specimens of *T. pilosa* from Seton Lake, Nicola and Summerland in British Columbia. The author corroborated this with an inspection of these collections.

We may hazard an answer to its explosive build-up by examining conditions which favor its reproduction. In the areas where it has achieved most success the sagebrush is a weed. Under such conditions sagebrush has prevented the grazing which aided its entry in the first place. Litter build-up was accelerated and sagebrush plants for the most part became mature, putting the whole plant complex in a delicate balance. Climatic factors, too, may have enhanced this native insect which found conditions in these stands more than suitable for existence and the population "exploded".

Another explanation is that perhaps the insect is a physiological form which has arisen through mutation and is better adapted to live under existing conditions. Because of this, the population "exploded" causing spectacular results in the sagebrush stands near Kamloops.

Whether these insects will remain with us long enough to serve as agents in the control of big sagebrush is a matter for speculation. Perhaps their natural parasites will catch up and level them to insignificance. To date the amount of damage done, if compared with the cost of chemicals to bring about the same control of sagebrush, warrants a good deal of study. If nothing else, it will point the way to looking more closely at our plant-insect relationships with a view to making a practical contribution toward the control of unwanted plants. If it is found that the recently discovered population of *T. pilosa* can be utilized to control big sagebrush on certain locations it must be emphasized that range rehabilitation through its use could only be achieved if accompanied by good range management.

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Economics of Improvement of Western Grazing Land[1]

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Over the past several years economists in the West have attempted, under a regional research project (W-16, Economics of Rangeland Improvement), to evaluate the costs and benefits of range improvement. Analysis of material assembled to date, while by no means conclusive, points up a few relevant considerations and shows some of the main gaps in data and methods.

An economic evaluation of range improvement, traced out through particular practices, can be approached with identical results in either of two ways. From the cost side the particular answer provides a statement that "these costs will be incurred," and from the returns side "that this level of cost would be covered." A basis for decisions about the economic feasibility of rangeland improvement is attained only after the cost and returns sides of the question have been brought together.

Despite the obvious validity of this generalization, a great deal of research relating to rangeland improvement has been done piecemeal. Costs, for example, have been studied frequently without adequate consideration of the intensity of the range improvement practice or costs of alternative practices and usually with inadequate consideration of physical and economic benefits resulting from different kinds and levels of practices. However, in fairness to what has been accomplished it should be emphasized that definitive data on rangeland production are very scarce and difficult to obtain. More will be said about data requirements later.

[1] *Giannini Foundation paper No. 188*

Background for Range Improvement

Ranchers and public land managers are becoming increasingly interested in range improvement. This interest seems to stem from three basic sources: (a) increasing competition for land, (b) a favorable economic enviroment, and (c) deterioration of significant acreage of the forage resources. The livestock industry in most, if not all, areas is primarily concerned with the feed supply, of which native or improved grasses are the most limiting item.

Many changes in the organization and use of range resources are in evidence. Investments in brush removal, reseeding, adjustments in the timing and rate of forage use, and fertilization are being made at an increasing rate. Investments of this nature are not confined to private sources. Clawson and Held (1957) state that the change from custodial management to intensive management of Federal lands, including investments to increase production, has greatly speeded up since World War II.

Relevant Economic Relationships

Before illustrating some of the results of the economic research on range improvement, let us examine the relevant relationships for economic analysis which are associated with range improvement. In the first place, a relationship exists between improvement practices and the use or uses of the rangeland. Brush control and reseeding may be the best practice for cattle range, whereas deferred grazing and fencing may be the best for watershed or game range purposes.

Secondly, costs of range improvements will vary with the size or scale of the project, the method selected, and the techniques and intensity of the practices. Costs are greater when juniper trees are grubbed by hand than when cabling is used. Costs are greater when all of the trees are killed rather than 90 percent of them. Reseeding in ashes from a brush fire generally is cheaper than in a plowed and prepared seedbed.

Third, the benefits from range improvement, determined by the nature of response, are related to (a) the method of improvement selected, (b) the level or intensity of application of the method, and (c) the type and intensity of utilization. What is done, the methods employed and their intensity, the response that is obtained, and how the improved range is used are the main factors to evaluate in range improvement work.

Emphasis should be placed on time as an economic factor in range improvement. The time between incurring costs and realizing benefits may be one of the big factors. It has a direct cost in terms of interest on the investment and may have substantial indirect costs in terms of deferred income or reorganization of operations while wait-

ing for the treated range to be ready for use.

Time and the "timing" of range improvement procedures are important also in evaluating the benefits of range improvement. Additional forage produced by the improvement may be worth a great deal more if available during a season of short feed supply than if available at a season of plentiful feed. This suggests that the benefits from range improvement can be evaluated properly only in the context of the total ranch operation, or, for public lands in the context of social criteria.

If this is true, then a great deal of information other than air dry weight of forage or pounds of beef produced is needed to appraise the benefits of range improvement. To the individual rancher, the size of ranch, accessibility to other rangeland, opportunities for reorganizing livestock and feed management, and many other considerations are involved. To the public land manager, the opportunity to relieve overgrazing, the improvement of game habitat, increased watershed values, and other similar benefits are important. Consequently, evaluation of range improvement simply in terms of weight of forage or pounds of gain on animals under limited grazing conditions usually is not adequate.

Evaluating Costs and Returns

The cost of range improvement to a rancher or public agency is uniquely determined by specific site characteristics, the machinery and related equipment selected, and operational skills. Therefore, an "average cost" of range improvements over a wide area has meaning only within limits. However, costs for representative situations can be used as guides to probable costs provided the resources, the operational sequence, and the cost accounting procedure are fully identified. From these representative situations a rancher can obtain some indication of the level of costs to expect for a given project.

The initial cash costs may not account for the bulk of all costs incurred during the life of the improvement. Other cash and noncash, deferrable and nondeferrable costs must be considered. These include the cost, if any, of deferred grazing, increased tax assessments, increased interest cost because of the timing of the use of credit, and maintenance costs of improvements. A complete analysis of the economics of an improvement program must include all of the associated elements of costs. However each element of cost need not be known precisely before a decision is reached to go ahead with a range improvement program.

Efficiency in doing the work, and risk involved may be very important in the selection of improvement practices and costs incurred. The efficiency of operations in doing such jobs as the removal of brush can depend as much on skill as on selection of equipment. With respect to each purpose and level of achievement close identity among several methods of range improvement may exist. In such instances, it would be a matter of cost indifference which method to select. Less costly methods that are also less efficient in a physical sense will probably later require additional costs because of the need for further renovation.[2]

Risk and/or uncertainty about future events must be taken into account. Failure to get a stand of grass (partial or total), variability in forage response to climatic variations, and price risk with respect to the products produced and factors purchased must be evaluated. Many ranchers may heavily discount expected returns.

Costs of associated practices must also be considered. Fencing may be required to control the grazing on the improved area or to protect it from damage by wildlife. Water may have to be developed on the area before it can be utilized by livestock. Purchases of additional livestock often are required. Therefore, the cost of range improvement may be quite different from the total direct cost of any practice. In fact, in many instances direct costs do not constitute the major portion of total cost.

In developing and carrying out range improvement, the rancher is interested in three types of cost: (a) the average cost for each different method of range improvement as a partial basis for determining relative profitability of alternatives, (b) the added or marginal cost to determine how far he should go with his improvement program by comparing added returns and costs, and (c) the opportunity costs to compare the net return from range improvement with the net return from alternative investments.

To illustrate, let us assume that the cost of preparing a seedbed and seeding an acre of land is constant at $7.50 an acre regardless of the quality of soil, and that the improvement of four different areas of rangeland, each of a different soil

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[2] *We are not concluding that any measure of range improvement is perfect or that it can be applied perfectly. The statement merely implies that a better job can be done with some methods than others and that future maintenance cost is in large measure determined by the method which is selected.*

Capital rationing may require that range improvement be undertaken by selected steps or it may require selection of less thorough and less costly methods with renovation cost being paid out of the earning power of the less profitable but nevertheless economically feasible methods.

capability class adds, in order of capability, 100, 80, 60, and 20 pounds of beef per acre to the total beef production. Should any or all of the four areas be improved? When beef is priced at 15 cents, improvement of the first area adds $15 to returns per acre; of the second, $12; of the third, $9; and of the fourth $3 per acre. At a cost of $7.50 (no other costs being considered for the moment) improvement of each acre of the fourth area adds $7.50 to costs but only $3 to returns. It would not be worthwhile to improve the fourth area, at least by the given practice, until the price of beef was greater than 37.5 cents per pound. (Limitations of this type of evaluative procedure are pointed out above.)

The same considerations apply to the problem of level of range improvement, regardless of the inherent capacity of the soil. Let us assume that the best land specified above is class IV land, and that successive increments of range improvement give the same addition per acre to total beef production as in the above example. The increments might be different quantities of the same inputs, such as heavier rates of seed application or better seedbed preparation to kill more of the existing vegetation, or they might be different quantities of such other materials as fertilizer. If the four levels add, in succession, 100, 80, 60, and 20 pounds of beef per acre, and cost respectively $7.50 each, only the first three are profitable.

With beef at 15 cents per pound, the return per dollar of investment in either of the foregoing illustrations are $2.00, $1.60, $1.20, and $0.40 respectively.[3] At this point the rancher should evaluate any other investment opportunities he may have. If he has an opportunity to make a return of $1.25 per dollar of investment in some other investment opportunity, he will improve only the first two areas or will apply only the first two levels of improvement to the single acre of land, unless he has enough capital to undertake both types of investment.

Benefits of range improvement programs are not easily appraised for a number of reasons. Benefits may not take an easily recognizable form. Further, a market value may not exist with which to make ready comparisons between benefits from alternative practices. Rental fees may be available for comparison but rental costs often reflect other than productivity value for livestock production. Grazing fees on public lands are established through administrative procedures and are not a usable measure of economic returns from land.

In the course of estimating the net worth to him of securing a particular kind and quantity of forage, the rancher must compare utilization alternatives as well as the steps that must be taken to create the forage supply. Forage utilization requires that the grass be grazed during the season when it is available and at its particular location. If the cost of equivalent purchased feed is to be used as the basis of determining whether to raise or purchase feed, the appropriate figure for comparison includes the market price of purchased feed plus the cost of hauling and feeding in relation to the cost of producing the same quantity of feed through range improvement. An added consideration is the reliability of securing the amount of feed that is needed from the respective sources. If rental rates are used for comparison, the cost of driving or hauling livestock to rented or leased pasture must be included.

The type of returns which accrue to improvement programs vary in form and timing. The most obvious return is that obtained from range forage use. As indicated, the amount of direct or indirect benefit will depend on the inherent productive capacity of the land site, what improvement program is selected, and how the forage and related products are utilized. The amount and quality of forage may be highly relevant, but are not the sole criteria.

The relevancy of examining the relationship between benefits and costs has already been noted. If capital limitations exist, the rancher may have insufficient funds to obtain the number of animals needed to utilize all of the forage produced. Or, a change in the basic livestock system may be required to take full advantage of the improvement program. The extent to which this can be done will depend on the fixity of resources in their present use and on the amount of capital available.

Additional considerations in estimating costs and benefits in range improvement are introduced by Federal conservation programs. Under terms of the conservation features of agricultural programs, the cost of certain specific practices of range improvement may be shared with the Federal Government. Ranchers participating in any of several conservation programs may get help in financing costs of improvements. Rates of payment vary by State and local areas for approved soil and water conservation practices.

Tax provisions must also be considered in evaluating alternative range improvement programs. All government pay-

[3] *These comparisons are valid only under the assumption that all inputs in the improvement practice were fully consumed in the one production period. Treatment of residual benefits is included in a subsequent empirical example.*

ments, such as those for approved conservation practices, must be included in gross income. A depreciation deduction may be claimed for any investments which are of a depreciable nature. Tax laws contain a special provision which permits a rancher to deduct as business expenditures, a list of qualified expenditures made for conservation or for the prevention of erosion.

In summary, for each range improvement program a stream of costs will be incurred through time. It is assumed that costs associated with each practice in the program are minimized through selection of least-cost methods to accomplish the desired level of performance. Interdependence usually exists between inputs and their costs in one time period and those in other time periods. The input and cost structure for a given range improvement program on an individual ranch may be generalized as follows:

$$TC = \sum_{i=1}^{m} \left(\sum_{j=1}^{n} q_j p_j \right)_i$$

where: TC = total costs
i = year in the improvement program
j = specific practice
q = input for a specific practice
p = cost of specific input

and where:

$$\left(\sum_{j=1}^{n} q_j p_j \right)_m = f\left[\left(\sum_{j=1}^{n} q_j p_j \right)_{m-1}, \left(\sum_{j=1}^{n} q_j p_j \right)_{m-2}, \ldots\ldots \right]$$

Associated with a range improvement program is a stream of returns accruing through time. It is assumed in estimating returns from the utilization of improved range forage that optimum utilization practices for the available kinds and amounts of forage are approximated. Grazing practices and production are interdependent through time. The output and revenue structure for a given quantity of forage and method of utilization can be expressed as follows:

$$TR = \sum_{k=1}^{r} \left(\sum_{i=1}^{s} q_i p_i \right)_k$$

where: TR = total revenue
i = utilization practices
q = output of a specific utilization practice followed
p = net price of specific utilization practice followed
k = year in utilization program

and where:

$$\left(\sum_{i=1}^{s} q_i p_i \right)_r = f\left[\left(\sum_{i=1}^{s} q_i p_i \right)_{r-1}, \left(\sum_{i=1}^{s} q_i p_i \right)_{r-2}, \ldots\ldots \right]$$

Since costs are incurred and returns accrue over time, allowances must be made for the time element in comparing alternative improvement and utilization programs. This is accomplished by discounting future values to their present worth. Either the cost and income stream can be discounted separately or the net return for each year can be estimated and these net values discounted. The latter method involves less calculation. Present value of future net returns can be determined as follows:

$$PV = \sum_{k=1}^{n} \frac{NR_k}{(1+d)^k}$$

where: PV = present value of future net returns
NR_k = net returns in k^{th} year
d = discount rate

Alternative improvement programs are then compared on the basis of their respective present values of net returns through time.

The foregoing reveals the complex nature of the problem of evaluating range improvement programs. Each major relationship was included in order to indicate clearly the scope and character of the task of a complete economic analysis. While the task is formidable, it is certainly not without hope. The rate of progress will depend in part on the rate at which information concerning essential physical relationships as specified becomes available. Even without complete information, tentative specifications concerning the economic relationships can be formulated in a system of logical hypotheses. These may be developed largely on present observation and experience together with good judgment.

Certainly the range livestock industry has wanted for better information but decisions have been made and will continue to be made by "rules of thumb". That these "rules of thumb" have at least been positively directional is reflected in the economic growth of the western livestock industry. The contention here is that a more systematic expression of relationships will result in better grounds for decisions in spite of the absence

of extensive quantitative proof. By the processes of inductive reasoning, the economist must determine to what extent general truths with respect to profitability of range improvement practices can be drawn from particular instances.

The rancher in substance concerns himself with the following questions in range improvement: (a) to what extent and under what conditions forage productive capacity can be profitably increased, (b) the levels above which resource inputs and management practices are no longer profitable, (c) the extent to which labor and capital restrictions and shifts in demand require a shift to a different type livestock production program, and (d) the changes which take place with respect to risk and uncertainty and opportunity cost as use of capital on rangeland increases. The use of credit is likewise an important part of cost. As far as the cost of credit goes, skill in borrowing can materially influence the magnitude of the cost. Essentially two elements are involved: (1) to borrow only so much as is needed at the lowest possible cost and (2) to insure, at the outset of the improvement program, that the required amount of credit can be obtained as it is needed.

Costs of Western Range Improvement

Some progress is being made in evaluating benefits (Caton and Beringer, 1959; Pingrey and Dortignac, 1957). But despite the generalizations made in the preceding sections about evaluating costs and benefits of range improvement most of the work done by economists in recent years in this area has dealt with costs only. Part of the data on costs of range improvement which were developed in contributing projects to regional research project W-16 are summarized below.

Data from studies in two states, Idaho and New Mexico, were selected to illustrate costs of eradicating and reseeding sagebrush rangelands. In New Mexico the costs of mechanical clearing of sagebrush and seeding 5 pounds of crested wheatgrass on national forest sites varied from $6.20 to $8.95 an acre depending on the type of equipment used. Estimated costs incurred by the Bureau of Land Management for clearing and seeding sagebrush to crested wheatgrass on its lands in New Mexico during the period 1948 to 1954 averaged $7.87 per acre. This compares with a cost of $7.57 an acre for seeding native grasses on abandoned or idle cropland. Clearing and seeding costs, where the work was done under contract, during the same period, varied from $4.67 to $8.84 per acre—averaging $6.37. Land clearing and seeding represent two-thirds and seed one-third of the contract cost.

On southern Idaho rangeland, the average cost for mechanical seedbed preparation for typical seedings was $3.61 per acre at 1956 prices, ranging from $1.42 to $11.07. On most seedings, the cost fell between $2.00 and $7.00 per acre with heaviest concentration in the $2.00 to $4.00 range. Variation in cost per acre was due to differences in (a) terrain and soil characteristics; (b) height, size, and density of vegetative cover; (c) type and size of equipment and labor force; (d) size of seeding and (e) the price of the respective inputs.

The average per-acre cost of application of seed was $1.67 in Idaho. Most of these costs fell within the range of $0.50 to $2.00 per acre. The average per-acre cost for seed for selected seedings was $4.15. However, costs of seed ranged from a low of $0.61 per acre to a high of $12.17. The per-acre cost of seed for most seedings fell between $1.50 to $3.00. Crested wheatgrass was the major component of the seed mixture used. Consequently, the cost was materially affected by the price of crested wheat seed and the amount of this seed used.

The average cost for seeding, including the seed, mechanical methods for preparing the seedbed, and seeding was $7.52 per acre. For the majority of seedings, costs fell between $5.00 and $12.00 per acre. A very definite inverse correlation was found between the size of the tract reseeded and cost per acre up to about 3,000 acres.

In addition to costs of mechanical seedbed preparation and associated practices, some data were obtained in Idaho on costs of using fire as a tool for brush clearing. Sample costs per acre for burning averaged $1.69 in 1956 with a range of $0.49 to $5.99 per acre. Size of burn and costs were inversely correlated. (Table 1.)

Labor is a big item of cost in using fire for range improvement. Labor requirements declined from 1.30 hours per acre for a burn of 230 acres to 0.182 hour per acre for a burn of 1,600 acres. Some part of the irregularity in costs per acre is inherent in the characteristic differences from site to site, but part is due to the fact that there is a tendency to add inputs in blocks or complements. Consequently, a surplus in input capacity may exist. Minimum levels of per-acre costs are approached as the full capacities of equipment and labor are utilized.

Table 1. Total Cost and Cost Per Acre for Seedbed Preparation by Burning, Selected Burns in Idaho at 1956 Prices.

Acres	Total Cost	Cost Per Acre
350	$2,096.50	$5.99
515	834.30	1.62
600	2,202.20	3.67
860	404.20	.47
1,300	642.00	.49

Many range seedings, to be successful, must be protected from livestock grazing until ready for use. Fencing to protect seedings in southern Idaho cost $760 per mile on the average for a 4-wire fence. Cost of fencing ranged from a low of $480 per mile to a high of $1,117 per mile. Fencing costs have been estimated to be between $1.00 and $7.00 per acre depending on type of fence, topography, and size of area fenced.

The average initial total cost for clearing and seeding in Nevada (1955 price level) was $7.61 per acre with a range of $0.60 to $9.92 per acre. The average total cost in Oregon ran somewhat higher. Both estimates were derived from limited samples.

Much different costs are incurred in improvement of brush rangeland in the Sierra Nevada foothills and coast ranges in California. Because of greater variation in climatic, soil and topographic conditions, considerably greater variation exists between sites and vegetative conditions. Consequently, a greater variation in costs is encountered. The brush areas of California are cleared primarily by burning in conjunction with mechanical preparation and clearing. The minimum mechanical preparation is the construction of firelines, though mechanical treatment often evtends to the mashing or piling of brush for burning. The presence of trees, some of which may have to be removed by mechanical means, adds materially to the cost. Estimates of per-acre costs for brush removal by fire on California rangelands are:

Size of burn	Fireline Construction	Burning	Total Cost per Acre
80-120 acres	$ .15-.30	$2.10	$2.25-2.40
320-400 acres	.10-.20	1.00	1.10-1.20
700-1,000 acres	.05-.10	.50	.55- .60
1,000 acres and over	.04-.08	.40	.44- .48

These data may be compared to costs of mechanical brush removal of $8.00 to $11.00 an acre depending on the size and density of the brush and many other factors. However, the results obtained are rarely identical and relative costs can be correctly compared only in light of relative returns.

Labor and equipment requirements for using fire as a tool in rangeland improvement are illustrated in Figure 1. As in other situations an inverse correlation exists between size of tract and the inputs required per acre. In this instance, relatively little cost advantage is gained with increasing size if tracts are larger than 400 acres in size, but the per-acre costs mount quite steeply as tracts decrease below 100 acres.

Burning is often an effective method of eradicating brush, but it requires thorough planning for proper control and best results. Reseeding after burning is necessary if there is insufficient understory of desired perennial or annual grasses, if it is desired to change the grass composition, or if the desired grasses are severely damaged by the fire. Proper burning and the management required after burning are the two critical features of this method. Frequently reburns are necessary where the first burn was not effective or where sprouting species were not destroyed.

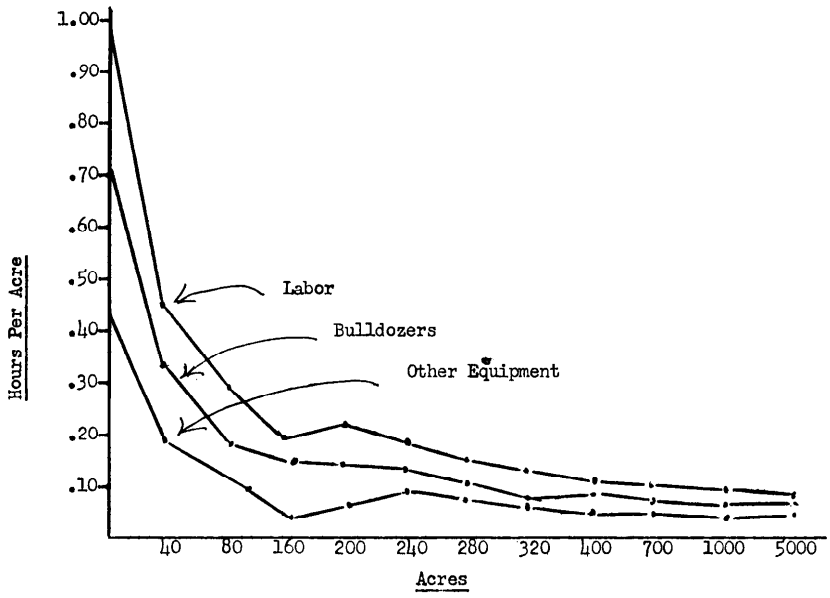
Chemical sprays 2-4-D, 2-4-5-T, and others have been used successfully to control brush and trees for range improvement. New chemicals are being developed and tested. In California the two primary uses of chemical brush control are to kill brush and trees prior to burning and to control brush sprouts and seedlings following initial improvement. In other range types, chemical methods have been used alone and in combination with mechanical treatments and fires. Sufficient data have not been obtained on the costs of chemical methods in the course of the work reported here to permit generalization about it. Bohmont (1954) lists the cost for material and airplane application on sagebrush as $3.00 to $6.00 per acre, with an average of $3.50 to $4.00. Heavier rates of application will, of course, average more cost per acre. Present total costs for spraying brush in California would probably run $8.00 to $10.00 per acre. Topography and method of application are important in determining success of chemical control and its cost.

One of the purposes of this paper has been to point up the need for considering all factors in appraising range improvement practices. Range managers are provided only limited answers by budgets that concentrate strictly on the input or output side of the improvement practice. More complete budgeting that would appraise alternative ranch operations may be required to give adequate information for management decisions.

Evaluation of Alternative Reseeding Programs—An Example

The procedure for evaluation of an investment such as reseeding would be relatively simple if it were not for the presence of uncertainty in determining expected values—yield, price, and life of the stand. Uncertainty exists about the results that are to be expected in each particular situation even though considerable information may be available about the results in similar situations.

Placing a value on reseeding has little usefulness unless it helps answer particular questions. What effect does the investment have on other costs or



a/ Data from report being prepared on Costs and Methods of Clearing California Brushlands.

FIGURE 1. Requirements per acre of labor, bulldozers and other equipment by size of burn in using fire and associated practices for range improvement in California.

operational aspects of the ranch operation? Should this investment be made, or some other investment, or no investment? In the example that follows, no attempt is made to carry the evaluation beyond what could be reasonably expected to be the pounds of beef forthcoming. Comparisons are made between alternative plans. The returns are "net" of the return from unimproved range.

In the following illustration Plan II is Plan I modified primarily through the rate of development. This type of modification was introduced to show the sequence followed by the respective values where the rate of improvement is controlled by a capital restriction.

The returns were determined as follows: (a) the accounting period is twenty years (b) on improved range the gain per head is 1.5 pounds per day in the spring grazing period (May 1-June 15) and 0.5 pound per day during the fall grazing period (September 15-September 30). The comparative gains from unimproved range were estimated to be 1.0 pound and 0.5 pound for the respective periods; (c) the seedings were assumed to reach full capacity at the grazing level specified in the fourth year. That is, they were not grazed the first two years, grazed lightly the third year, and grazed at a level which would maintain the stand from the fourth year through the twentieth year.

The procedure used in this example is to compare the initial investment cost with the sum of the discounted future "net" returns from the investment. The costs associated with two alternative plans for reseeding a 500-acre tract are indicated in Table 2. Under Plan I the entire 500 acres is reseeded the first year; under Plan II 250 acres are cleared and seeded the first year and the remaining 250 acres are cleared and seeded in the third year. Since the capital required in the third year could be employed in other uses, the actual present third year cost is $3,535.27. Costs which may occur, but which are not shown, are: (a) added labor, (b) maintenance cost (spraying), (c) failure to obtain a stand, and (d) water development. Further, fencing may not be required. If this were the case, the initial costs would be materially reduced.

In Table 3 the year-by-year annual returns net of opportunity cost have been discounted at 5 percent. The purpose of discounting is to indicate the present value of future incomes for purposes of comparison. The present value of a dollar to be received 10 years from now is 61 cents at 5 percent rate. Therefore, if a rancher is interested in obtaining one dollar 10 years from now, he may invest 61 cents now, and, with a compound interest rate of 5 percent, at the end of 10 years it will have increased to one dollar. Future income for each of the years, 1 through 20, is given in terms of present value at the time the reseeding cost is incurred (Table 3).

Table 2. Cost of Reseeding a 500-Acre Tract, Under Two Alternative Programs, Sagebrush-Grass Rangeland Reseeded to Crested Wheatgrass.

Cost item	Plan I 500 acres	Plan II 250 acres (2)
	Dollars	
Reseeding cost, year 1[a]	5,025.00	2,512.50
Fencing[b]	3,160.00	2,370.00
Reseeding cost, year 3	.....	2,512.50
Fencing, year 3	.....	1,580.00
Total cost, year 3 discounted at 5%[c]	.....	3,535.27
Total initial cost, year 1 basis	8,185.00	8,417.77

[a] Mechanical clearing $4.25 per acre, seed (crested wheatgrass) and seeding $5.80 per acre, total $10.05 per acre.

[b] Estimated cost $790.00 per mile.

[c] ($4,092.50)/(1.05)^3=(4,092.50) (0.86384).

Table 3. Annual Returns, Net of Opportunity Cost For Alternative Reseeding Programs.

Year	Discounted at 5 Percent			
	Plan I		Plan II	
	With beef at 15c per pound	With beef at 20c per pound	With beef at 15c per pound	With beef at 20c per pound
	Dollars			
1	— 374.99	— 499.99	0	0
2	— 357.14	— 476.19	0	0
3	242.96	323.94	48.20	64.27
4	833.11	1,110.81	410.94	547.92
5	793.44	1,057.92	502.44	669.91
6	755.66	1,007.55	755.66	1,007.55
7	719.67	959.56	719.67	959.56
8	685.40	913.87	685.40	913.87
9	652.76	870.35	652.76	870.35
10	621.68	828.90	621.68	828.90
11	592.08	789.43	592.08	789.43
12	563.88	751.85	563.88	751.85
13	537.03	716.04	537.03	716.04
14	511.46	681.95	511.46	681.95
15	487.11	649.47	487.11	649.47
16	463.91	618.54	463.91	618.54
17	441.82	589.09	441.82	589.09
18	420.78	561.04	420.78	561.04
19	400.74	534.32	400.74	534.32
20	381.66	508.87	381.66	508.87
Total	9,373.02	12,497.32	9,197.22	12,262.93

Returns and costs are brought together in Table 4. The profitability estimates have some definite limitations. In the first place, no variation in forage yield was allowed for; but it seems safe to assume that weather variation would affect unimproved and improved range proportionately. Another type of livestock system than the one used could not be expected to give the same results. Some of the variable costs have, in all likelihood, been omitted. At the same time, if the reseeding could be reasonably expected to last longer than the period indicated the additional return would continue to help offset the reduced income at the beginning of the period. And viewed from the over-all ranch operation, the reduced initial income from this particular tract may not be important when the expected total income is considered. These are but a few of the ways of evaluating profitability; there are many other ways.

Evaluation of Research Findings

The extensive nature of range improvement techniques has precluded a thorough study of each technique in the time devoted to the contributing projects under the regional research program on the economics of range improvement. Not all improvement techniques nor all range types have been examined. Adequate economic evaluation of common range improvement practices in all major range types would be an enormous job. Resources available made it necessary to select only sample situations for study.

Of the techniques considered, some were not studied initially because it was soon learned that adequate physical information was not available. Economic studies on chemical control of sagebrush have not been made up to this point; however, Wyoming, a state in which considerable work on chemical control of sagebrush has been done in recent years, is undertaking such a study.

The physical burden of studying a large number of techniques used in each state led to selecting one or two of the practices in use in each state. Some duplication was necessary from state to state because of the dissimilarity of physical and climatic features. Heterogeneity of the physical bases also reduced the applicability of cost and other estimates below that desired.

Despite the large task remaining on the "cost side" of the economics of range improvement, the most formidable task facing economists working in this field lies in the evaluation and analysis of benefits. Some very worthwhile work has been done but much work remains, especially in analysis of range improvements in the total context of range, livestock, and ranch management and in the evaluation

Table 4. Total Returns, Net of Opportunity Cost, Discounted Returns and Rate of Return on Investments, Alternative Plans at Two Different Price Levels.

	Plan I		Plan II	
	With beef at 15c per pound	With beef at 20c per pound	With beef at 15c per pound	With beef at 20c per pound
	Dollars			
Return	23,796.30	31,203.40	22,292.55	29,723.40
Returns discounted at 5 percent	9,373.02	12,497.32	9,197.22	12,262.93
Total costs	8,185.00	8,185.00	8,417.77	8,417.77
Return over costs	1,188.02	4,312.32	779.45	3,845.16
Rate of return on investment	14.5 %	52.7 %	9.3 %	45.7%

of the so-called "nonmarket" benefits of range improvements. Here range technicians and public land agencies can make a very significant contribution.

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TECHNICAL NOTES

A TECHNIQUE FOR STUDYING FORAGE REMOVAL BY GAME AND LIVESTOCK

ARTHUR D. SMITH AND ARTHUR M. SHEETS, JR.

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On western ranges domestic livestock and big game often compete for range forage. Exclosures, which may be of various sizes, are commonly used to secure information on competition. They have several shortcomings, not the least of which is their cost. In an attempt to overcome these shortcomings, we have used the "basket" or "cage" approach to separate the effects of deer and livestock.

Plots are arranged in sets of four. Thus, four "treatments" are applied: total protection, protection during winter from deer, protection during summer from livestock and an unprotected plot. A sufficient number of these sets are employed to satisfy sampling requirements.

Since but two of the plots are under protection at any one time, only two baskets need be provided for each set of four plots. In the fall before deer have congregated in the area and after livestock have departed, the basket is removed from the plot protected from livestock and placed upon that to be protected from deer. In the spring this movement is reversed. Thus, the effect of each kind of animal, the effect of both combined, and the result of total protection can be observed.

Production estimates are made in the fall. Utilization determinations are made both in the spring and fall. We have used ocular estimates, but any accept-

FIGURE 1. Basket of non-welded wire protecting a bitterbrush plant.

able utilization technique can be employed.

This procedure can only be used effectively where there is a seasonal separation of use by game and livestock. This condition is satisfied on many ranges in our areas which deer occupy during winter and early spring and which are used by livestock in late spring or fall.

Because browse plants are of especial concern under the conditions described, the usual "basket" or "cage" in use elsewhere is inadequate. The low basket normally in use, although satisfactory in reseeded areas or wherever the stature of plants is low, is not sufficiently tall to cover plants of interest to us which may grow to several feet in height. These and other considerations led to the type of cage shown in Figure 1. This is a simple cylinder, 4.55 feet in diameter, open at the top, made of heavy gauge wire cut to the desired size and placed around the plot to be protected. The wire is cut on the ground at the time of installation, hence transportation difficulties are minimized since the original roll is compact. Upon installation the free ends of the wire are secured by means of number two hog rings. Tent stakes driven alongside the baskets provide adequate means of anchoring the wire in most situations.

Several types of wire were tried. All were of the same 2 x 4 inch rectangular size (2″ horizontal, 4″ high). Two gauges of wire were used, number 11 and number 9, and welded and nonwelded types were used. The most satisfactory in our opinion is the welded wire, 11 gauge and 4 feet high. This height is satisfactory for all shrubs of moderate height. Where taller shrubs must be enclosed, five foot wire has been used, although we have yet to see evidence of animals reaching into the four foot cages to browse. Wire of this gauge and construction forms more rigid cages than does the unwelded wire in the same gauge. It is, moreover, lighter in weight. One disadvantage to the welded wire is that 11 gauge wire is not every where available for purchase.

Wire of the kinds tried is available in 100 foot rolls and each roll can be made to provide seven baskets (14.3 ft. in circumference). This encloses an area adequate to encompass most shrubs encountered on winter ranges in our area. It will also accommodate a plot of 9.6 square feet, either round or square, which is a convenient size if weight estimates are to be the basis for forage inventory. Other sizes could be used.

At the outset we felt some concern regarding the possibility of the baskets being displaced by rubbing. To date, cattle have not caused any disturbance of the baskets. A few instances of deer running into them have been noted. Elk have been seen rubbing on baskets placed near their feeding grounds.

A METHOD FOR RANDOM LOCATION OF SAMPLE UNITS IN RANGE INVESTIGATIONS[1]

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Plots, transects, or tagged plants often must be located randomly to allow greatest statistical interpretation in range investigations. One of the most common means of randomizing the position of range sample units is by gridding out an area into squares or rectangles with a large number of possible locations. Developing such a grid on an area involves considerable time and expense, especially if the study units need to be relocated. For this reason, it was considered desirable to devise a technique wherein a minimum number of marker stakes would need to be set in order to permanently locate study units.

A system of radius vectors was used successfully during the 1958 field season to locate sample units in range investigations. Clusters of sample unit locations were randomly determined on aerial photographs for herbage production and basal area studies. The centers of these clusters were marked on the aerial photographs and the point then located as nearly as possible in the field. A 7-foot steel fencepost was driven approximately 3 feet into the ground at the determined cluster centers. These cluster marker posts were each assigned a number and were painted with yellow stripes to aid in relocation.

An area with a 20-foot radius around the post was expected to receive excessive use due to livestock concentration and was not included in the sampling area. The area between the inner circle of 20 feet and an outer circle with a radius of 120 feet was designated at the area in which sample units could be located. This "doughnut shaped" area was subdivided into ten equal parts by concentric circles of appropriate varying radii by the following method:

The area of the individual subdivisions (A_i) is found by

Let r_m = maximum radius
r_o = minimum radius
r_i = radius of one of the ten subidivisions
r_{i-1} = radius of the next smaller subdivision

The area of the entire sampling unit (A_t) is found by

$$A_t = pi(r_m^2 - r_o^2)$$

The area of the individual sub-

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[1]*Acknowledgement is extended to Dr. F. S. McFeely of the Statistical Laboratory for his aid in this work.*

divisions (A_i) is found by

$$A_i = \frac{pi\,(r_m^2 - r_o^2)}{10}$$

The radius of the individual concentric circles is found by taking

$$10\,(r_i^2 - r_{i-1}^2) = r_m^2 - r_o^2$$

or more simply

$$r_i = \frac{\sqrt{r_m^2 - r_o^2}}{10} + r_{i-1}^2$$

The radii were determined in this example by starting with $r_{i-1} = 20$ feet. The derived r_i then became the r_{i-1} for the next larger radius determination.

Each of these concentric circles was then divided into ten equal area parts by straight lines passing through the center of the circles at 36° intervals, thus delineating 100 sub-units of equal area. The intersections of the circumferences of the concentric circles with the radial lines designates a sampling point. Each sampling point then represented one point of an infinite number of points in each of 100 equal areas. Each of the 100 sampling points had an equal chance of being selected as a sample unit location.

The sample points were determined by selection of two numbers from a random numbers table. The first random number determined the direction from the cluster marker stake and the second number determined the distance from the same stake. A sample unit was located in the field by setting a compass on a tripod over the cluster marker stake and first locating the specified direction with the compass; and secondly, the specified distance from the marker stake was determined by the use of a steel tape.

Directions and distances to locate study unit points within a distance from 20 to 120 feet from the marker stake are shown in the following table. A lightweight chain 20 feet long connects the marker post and the zero end of the measuring tape. The sampling points closest to the center marker post are 42.4 feet from the marker post and the farthest sampling points are 120 feet away.

Random number	Direction from marker (degrees)	Distance from marker (ft. on tape)
0	0	22.4
1	36	36.6
2	72	47.8
3	108	57.5
4	144	66.1
5	180	73.8
6	216	81.0
7	252	87.7
8	288	94.0
9	324	100.0

This system allows for random location of study units and provides for rapid relocation of permanent plots, permanent line transects, and permanently tagged individual plants for range studies with only one marker post.

OCULAR POINT FRAME

An ocular point frame has been used satisfactorily in sampling bitterbrush *(Purshia tridentata)* and sagebrush *(Artemisia tridentata)* communities in central Oregon. This frame was developed by Dr. W. W. Chilcote and students for use by Oregon State College ecology classes. It consists of two sets of cross hairs forming a square with 25 points at approximately three-inch spacing. The two sets are attached to the frame with the points vertically aligned. The frame is supported at convenient heights with metal legs.

This unit was found to be particularly well adapted for securing an objective measure of cover in sparse vegetation. On the ranges studied, temporary 100-foot square plots served as sampling units for obtaining plant composition data. Twenty-five points were recorded at each setting of the frame. Sufficient mechanically spaced settings were taken to total 1000 observations per plot. All vegetation up to a height of approximately four feet can be measured.

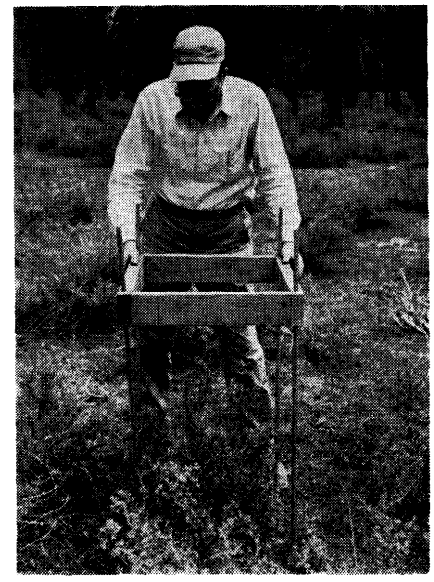

FIGURE 1. Ocular point frame.

The legs are easily removed from the frame, making it a compact, lightweight unit, yet one sufficiently rugged for field use.

Frank W. Stanton
Game Biologist
Oregon State Game Commission

CALL FOR PAPERS FOR 1961 ANNUAL MEETING

Members wishing to present papers at the Society's next annual meeting, the 1961 "Homecoming" convention in Salt Lake City, are urged to submit titles and short abstracts to the Program Committee now. Final date for titles and abstracts of volunteer papers to reach the committee is July 15, 1960. W. O. Shepherd, Program Committee Chairman, Intermountain Forest and Range Expt. Station, Forest Service, Ogden, Utah.

BOOK REVIEWS

Edited by Lowell K. Halls, Forest Service, U. S. Department of Agriculture, New Orleans, Louisiana

Soil Conservation. By Helmut Kohnke and Anson R. Bertrand. **McGraw-Hill Book Company, Inc., New York. 298 pages. 1959. $6.75.**

This is an excellent textbook on problems and some of the solutions of soil, water, and plant conservation. It should be of interest to everyone concerned with land use—especially farm management specialists, soil conservation workers, county agents, and even to laymen interested in the subject.

The authors treat soil erosion and deterioration as a problem of humanity and make an excellent case of the fact that soil is an irreplacable resource. They point out that advanced technology has kept pace, but it may not continue to do so with our present population increase. All nations that have neglected their soil are now in oblivion.

The book is a concise presentation of the fundamental nature and causes of soil erosion, the aims of soil conservation, and the principles and methods of saving the soil and maintaining its productivity.

Technicians have pointed out during the past quarter century, that soil erosion problems can best be solved in a coordinated manner. This book deals with the subject in that light. Fundamental principles are emphasized in order to show how the various conservation methods can be fitted together and applied directly on the farm.

The authors give no "recipe" for soil management and other problems involved in soil conservation; instead, they present basic facts to help the reader understand the soil and what happens to it under various kinds of land use. The reader can then work out the solution to any soil conservation problem.

The first chapter deals with problems of soil erosion and deterioration.

The second chapter discusses the soil, and the third, soil's greatest hazard—erosion.

Chapter four very ably presents the aims and principles of soil conservation, while chapters five and six deal with special problems and methods of conservation.

Chapter seven presents economic aspects of conservation, and chapter eight, the techniques used in farm and ranch planning.

In chapter nine, the author points out that the rapid increase in population is putting heavy pressure on our remaining land. Also discussed are ways of getting public attitude attuned to the need for proper planning, both in urban and rural communications.—*Wayne Fallin,* Soil Conservation Service, Alexandria, Louisiana.

The National Forests. By Arthur H. Carhart. **Alfred A. Knopf, Inc., New York. 289 pages. 1959. $4.75.** (Published simultaneously in Canada by McClelland and Stewart, Ltd.)

The National Forests is a notable addition to Carhart's many writings on conservation and the out-of-doors.

This book is not a travelog, a "where-to-go, what-to-see, where-to-stay guidebook," or a textbook. It primarily records the experiences, observations, and impressions of the author from his forty years of association with various conservation movements and his many travels in the various National Forests. Much of the book is written either in the first person singular or as though he were addressing the reader directly. The resulting intimate and informal style makes it possible for the author to discuss rather weighty subjects without overburdening the nontechnical reader.

The author sometimes relates personal experiences at some point of interest he is describing. He frequently tells how mountains, rivers, and cities received their names. Important events in our Nation's history that occurred on or near our National Forests are recalled. This book owes much of its charm to these many little anecdotes.

The National Forests contains eleven chapters. The first chapter is a brief history of the Forest Service and its functions. Each of the remaining ten chapters is devoted to one of the Forest Service Regions.

In Chapter I, Mr. Carhart briefly describes the events leading to the establishment of the Bureau of Forestry, the withdrawal of the forest reserves, and finally, the establishment of the present Forest Service. He reminds us that the basic reasons for establishing the Forest Service were to insure a continuing supply of timber and to secure conditions favorable for streamflow. All other forest uses, such as grazing, game, and recreation, are "permissive" uses. There are excellent brief discussions on why the forests should be managed for maximum use (rather than completely protected as are the National Parks) and on multiple use (which usually turns out not to be multiple use). The first chapter concludes with an explanation of the administrative organization of the Forest Service.

As he describes each of the Forest Service Regions, in the ten remaining chapters, the author explains how the geologic history has produced the topography, microclimatic patterns, and vegetation that characterize and, to some extent, unify each Region. Rather than describe each Forest within the Region in detail, he has described a number of points of interest that are characteristic of that particular Region. Some aspect of Forest Service work, such as grazing management, timber management, pest control, fire suppression, wilderness preservation, etc., receives detailed consideration.

Of particular interest to range managers is the chapter on the Southwestern Region, for it is here that Mr. Carhart tells something of the history of grazing use on the National Forest. The controversy of

the late 1940's between the Forest Service and the livestock interests ("The Great Land Grab") is rehashed. He then speaks of the present watershed program in Arizona's Salt River Watershed as being ". . . tin-roof brainstorm, which actually may be a scheme fostered by land-greedy stockmen with the irrigationists as a big, enthusiastic claque." He roundly condemns this program because he feels that the grass will be severely grazed after the trees and shrubs are controlled and erosion will then be abundant and severe.

Also of interest to range managers is the chapter on the Intermountain Region. Here, the author describes the chain of events that led to an over-population of deer on the Fishlake National Forest and tells of some of the sociological problems involved in controlling and managing this deer herd.

Many readers will take exception with some of the philosophies expressed by Mr. Carhart. As examples: He implied that only forest cover with a thick duff layer is adequate watershed protection because grasslands are usually overgrazed. While he condemns the overgrazing of western range lands, he condones the rape of the forests in the Lake States. He probably is unduly severe in placing the blame for overgrazing on the livestock interests.

The book contains numerous errors of fact and interpretation. Many of these errors are relatively minor. There is also considerable repetition throughout the book.

While the author discusses most of the activities of the Forest Service in some detail, Forest Service Research is largely ignored. Although a few experimental areas are mentioned, research could have been discussed in one chapter as a Forest Service activity rather than writing about fire twice.

Because of its subject, *The National Forests* will undoubtedly receive very wide circulation. Non-technical laymen and professional conservationists will gain much from the book and both will find it enjoyable reading. This book could well be placed on the required reading list for the neophyte in the Forest Service to quickly and pleasantly give him a broad perspective of its' work and problems.—*William J. McGinnies,* Agricultural Research Service, Fort Collins, Colorado.

Grass Productivity. By Andre Voison. (Translated from the French by Catherine T. M. Herriot) *Philosophical Library Inc., New York. 335 pages. 1959. $15.00.*

This book is an excellent example of what one man can accomplish by careful observation, study, and experimentation. Voison is a true lover of grass. His system of "rational grazing" is based upon sound biological principles. The proof of his system lies in the productivity of his pastures. Throughout the book he stresses the concept that the cow and the grass are inseparable, and that management should be conducted ". . . in such manner as best to satisfy the demands of each." A good summary sentence of his philosophy is: "We must help the grass to grow and guide the cow in harvesting it."

The author is a farmer and biochemist who had practiced rational grazing on his 60-acre farm near Dieppe, France since 1945. He was trained in Heidelberg University in Germany, and still gives an annual series of lectures at the French National Veterinary College.

Rational grazing is based upon the sigmoid growth curve which is common to all organisms. Grazing is so managed as to take advantage of the rapid period of growth. With regard to grazing periods, he states: "Overgrazing must be avoided, but so equally must under-grazing. There is an optimum degree of utilization which allows re-growth of the grass under the practical conditions realizable in the conduct of grazing." In speaking of management possibilities, he says: ". . . it is largely within the power of the farmer, by appropriate management of grazing, to decide which [plants] shall predominate, and which shall be suppressed."

Voison concludes from observations and study that the time spent by a cow in grazing is approximately 8 hours per day and that the trait is inherited. Grazing time of the herd is determined largely by the grazing habits of the majority. Moreover, grazing is most efficient where grass is of medium height (about 6 inches).

Interesting data and ideas are presented on palatability. Smell is believed to be the basic sense in palatability with rumination an important secondary factor. Experimental studies are cited to the effect that cows prefer a varied diet; that they seek forage which has a balance between high water content and dry matter; and that the preferred diet is not necessarily the one of highest protein content.

Laws of rational grazing (fourth law applying to milk production omitted) are stated as follows: *First Law*—"Before a sward, sheared with the animal's teeth, can achieve its maximum productivity, sufficient interval must have elapsed between two successive shearings to allow the grass: (a) to accumulate in its roots the reserves necessary for a vigorous spurt of re-growth; (b) to produce its 'blaze of growth' (or high daily yield per acre)." *Second Law*—"The total occupation period on one paddock should be sufficiently short for a grass sheared on the first day (or at the beginning) of occupation not to be cut again by the teeth of these animals before they leave the paddock." *Third Law*—"The animals with the greatest nutritional requirements must be helped to harvest the greatest quantity of grass of the best possible quality."

This is a book that deserves reading by all researchers interested in pasture and range improvement through grazing management. Many administrators and stockmen will find the philosophy and accomplishments refreshing, although the practice of "rational grazing" will surely require amendment and adaptation before it can be applied to specific situations. Finally, the accomplishments of Voison should serve as an inspiration to all as to what can be accomplished in grazing management by study, observation, effort and devotion.—*H. G. Reynolds,* Rocky Mountain Forest and Range Experiment Station, Tempe, Arizona.

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WITH THE SECTIONS

NEBRASKA

RANCH GETS "THE FULL TREATMENT"

Elmer Prokop, a rancher from Hay Springs, Nebraska, gave his 1,400 acre ranch "the full treatment" under the Great Plains Program this past season.

Located in the Pine Ridge Hills in northern Sheridan County, the ranch needed several conservation practices to get a complete range management job done on it. The ranch is in the "hard land" area.

Three miles of terraces were built on crop land that is to be seeded in 1960 to a mixture of 5 lbs. of needle grass, 5 lbs. of western wheatgrass, 2 lbs. of crested wheatgrass, and 2 lbs. of intermediate wheatgrass seed to the acre.

Two hundred fifty acres of range land in "fair" condition were contour furrowed and this pasture will be completely deferred from grazing until the 1961 grazing season.

Fencing and the water problem get the Great Plains Treatment next. Several old fences will be torn out and a mile of new fence constructed to insure ease of handling the cattle. One new windmill and tank are a part of the plan and also a new dam that was built at the bottom of a deep heavily wooded canyon.

One of the most important phases of Prokop's long range plan calls for proper stocking the unit and Mr. Prokop believes that when the Great Plains Plan has been completed, he can carry one cow and calf for a 6 months grazing season on every 12 to 15 acres.

NEVADA

A very successful ninth annual meeting was held in Caliente, March 3rd and 4th. Chairman Jack Artz presided and 50 members attended.

On Thursday, the first day, reports were given by James Sharp, Nevada Farm Bureau; Graham Hollister, Nevada Association of Soil Conservation Districts; Fred Harris, Nevada State Cattle Association; Joe Robertson, Max C. Fleischmann College of Agriculture; H. M. Kilpatrick, Extension Service, University of Nevada; Dudley Zoller, Nevada State Department of Agriculture; George Hardman, Nevada State Department of Conservation; George Zapattini, Nevada State Forestry Division; Marshall Humphreys, Nevada State Fish and Game Department; Dick Eckert, Agricultural Research Service; Howard Summers, Agricultural Stabilization and Conservation Service; Gerald F. Horton, Forest Service; Edmund Naphan, Soil Conservation Service; Max Bridge, Bureau of Land Management; George Wiseman, Bureau of Sports Fisheries and Wildlife; and Jim Long, Indian Service.

At the banquet Charles Mathews, a Panaca rancher, told of the history and development of Lincoln County. Also, the Rural Development Program of Lincoln County was described by Phil Busteed, Warren Miller and Dick Varney.

Friday was devoted to technical papers and reports by Vance Agee, Wells rancher; Fred Harris, Range Consultant; Gene Mullings, S.C.S.; A. Perry Plummer, Intermountain Station; Dwight Kimsey, Forest Service; Russell Lloyd, A.R.S.; William Neely, University of Nevada; Ralph Holmgren, Intermountain Station; Charles Rouse, Fish and Wildlife Service; John McCormick, University of Nevada; and W. C. Behrens, University of Nevada. A short field trip concluded the convention.

Lenard Smith
Publicity Chairman

NEW MEXICO

The fall field meeting was held in the high country around Eagle Nest, New Mexico, September 25 and 26. Ralph Miller and his local arrangements committee did a fine job of conducting the field tour with stops on various ranches. On Friday afternoon, the group inspected the LeBus Brothers post and pole treating plant near Eagle Nest and watched the equipment in operation. Afterwards, several sites were inspected where LeBus Brothers have been thinning ponderosa pine for a three-fold purpose; (1) to obtain material for the wood treating plant, (2) to thin young ponderosa pine for better grass growth, and (3) to improve the remaining ponderosa pine stand. Photo 1 illustrates the pine thinning on the LeBus ranch. Photo 2 shows high quality herefords and good grass land on the LeBus ranch.

On Saturday morning, the group inspected seedings on the Gallagher, Gorman, Cunico, Swanson, and Myers ranches. On the Gallagher ranch, a seeding completed in the spring of 1951, included smooth brome, intermediate wheatgrass and crested wheatgrass. Gallagher grazes this 300-acre field with 150 animal units from May 1 to July 1 and from September 15 to October 15 each year, sometimes longer, depending on forage produced. The Cunico ranch seeding was completed in the summer of 1952 with crested wheatgrass, intermediate wheatgrass, smooth brome, and sweet clover. Cunico is grazing this 200-acre field with 54 animal units spring, summer and fall.

Miller next led the group to the Joe and Filemon Torres ranches. Grass improvement in a 320-acre pasture made up of mountain slopes, small meadows and parks has been accomplished through management. During the last four years the Torres have used the pasture with 35 animal units from March 15 to May 15. Production has run about 663 pounds of dry forage per acre, a good level for this high country. A state land pasture leased to E. Espinosa was observed in excellent condition, but because of loco could not be used before late summer or fall. Espinosa avoids livestock losses by practicing late season grazing. Production has run around 2900 pounds, dry weight, per acre.

UTAH

RANGE FRATERNITY

During the February meeting of the Utah State Chapter of A.S.R.M. a step towards the establishment of an honorary fraternity for Range Management students was taken. A committee working under Dr. Thad Box was directed to draw up proposed constitution and by-laws for such an organization. This step is being taken with the approval and

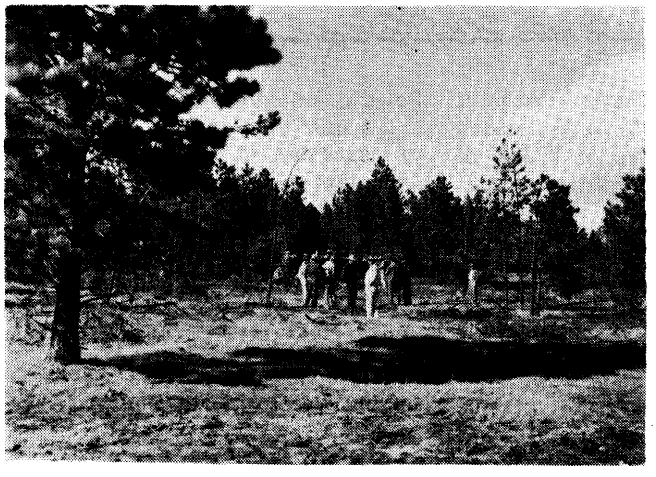

PHOTO 1

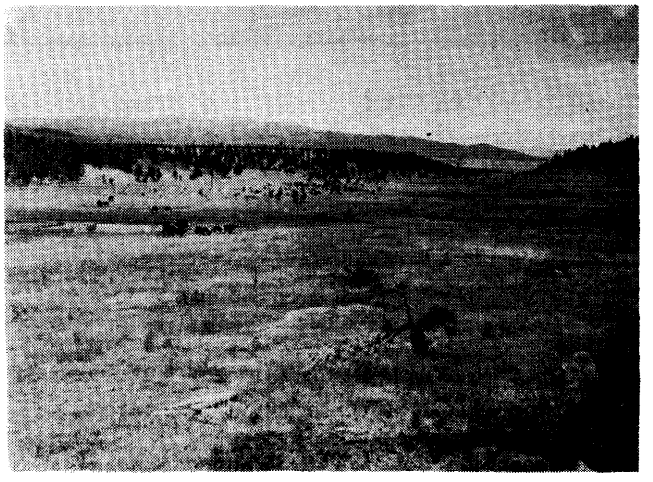

PHOTO 2

encouragement of the National A.S.R.M. Officers.

UTAH STATE PLACES SECOND

The U. S. U. range plant judging team yielded first place to Colorado State in the Range Plant Identification Contest at Portland. However, Colorado won over Utah State by only 11 out of 1200 points.

Team members were Frank Bingham, Roosevelt; Bob Morrow, Wells, Nevada; John Carlson, Fillmore, and Noel March, Prescott, Arizona. Jim Bowns of Castel Gate competed for individual honors only. Bob Morrow was 4th high individual at the contest with 394 out of 400 points; John Carlson was 5th; Jim Bowns was 6th, and Frank Bingham was 7th.

Team coach, Dr. Thadis Box, expressed appreciation for the donations made by alumni and section members that enabled the team to make the trip.

SOUTHERN

RANGE RESOURCES OF THE SOUTH, published by the Section in cooperation with the Georgia Agriculture Experiment Station, has proved to be a popular bulletin. Of the 7,000 copies printed, 5,640 copies have been distributed through 48 states and 48 foreign countries. Frank P. King, Director of the Coastal Plain Experiment Station, reports that there are still 1,360 prints available—any takers?

M. E. McCULLOUGH of the Georgia Experiment Station will present an invitation paper entitled "The Influence of Pasture, Hay, Silage, and Type of Animal on Forage Evaluation and Utilization," at the 8th International Grassland Congress at Reading, England, during the July 10-21 meeting. He will attend a pre-Congress tour of Scotland from June 29 to July 10, and a tour of France, Holland, Norway, Denmark, and Sweden from July 21 through August 10.

GLEN W. BURTON will present an invitation paper at the International Grassland Congress entitled "The Genetics and Manipulation of Obligate Apomixis in Common Bahia Grass *(Paspalum notatum,* Flugge)." The details of Glen's trip are not known.

Wayne W. West
Sec.-Treas.

NEWS AND NOTES

SCS Announces New Range Assignments

LEWIS L. YARLETT, Range Conservationist, SCS, Sebring, Florida, was recently transferred from Stephenville, Texas. In his new assignment Yarlett will have statewide responsibility of the Range Conservation phases of the Soil and Water Conservation progam in Florida.

Florida has approximately 15,000,000 acres of native or natural range. Of this total, 10,000,000 acres are within a 40-county area in South and Central Florida. Technical assistance to Soil Conservation Districts for the conservation and management of these native ranges is provided by this assignment.

Yarlett was born and raised on a ranch in western Montana and for short periods managed hay and cattle operations in that section. Prior to employment by the Soil Conservation Service, he held various positions in the U. S. Forest Service in Idaho, Washington, and Montana. He served in the armed forces during World War II. During thirteen years with the Soil Conservation Service in Texas, three years were as Range Specialist, six years as Work Unit Conservationist, and four years as Range Conservationist in Work Units. Yarlett also served for two years as instructor in Range Conservation at the SCS Training Center at Stephenville, Texas. He is a graduate of the University of Montana School of Forestry and Range, and has a M.S. degree in Range Management from Texas A & M College. Professional memberships include Soil Conservation Society of America, and American Society of Range Management.

THOMAS N. SHIFLET, Range Conservationist with the Soil Conservation Service, transferred from Fredricksburg, Texas to Lake Charles, Louisiana, February 7, 1960.

In his new assignment Shiflet will serve as Range Conservationist in the Coastal Marsh and Woodland-range areas of Louisiana. His principal duties will be the development and improvement of range technical guides, training of SCS personnel in range work, and assisting livestock operators who are cooperating with their local Soil Conservation Districts in developing and applying conservation ranch plans.

Shiflet graduated from Texas A & M College in 1951 with a B.S. degree in Range Management and started work with SCS at Jacksboro, Texas. After two years in the army, 1951-53, he filled assignments at Fredricksburg and Bandera, Texas. From 1954-1957 he was Work Unit Conservationist at Johnson City, Texas, and for the past three years has served as Range Conservationist for the Brownwood and Fredricksburg areas. He has been active in the Texas Section A.S.R.O.N. and served on the Youth Camp Committee two years.

Multiple Use Bill

On February 16 (legislative day, February 15), 1960 Mr. Ellender (by request) introduced in the Senate of the UNITED STATES the following bill; which was read twice and referred to the Committee on Agriculture and Forestry.

A BILL—S. 3044

To authorize and direct that the national forests be managed under

principles of multiple use and to produce a sustained yield of products, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that it is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes. Nothing herein shall be construed to affect the authority of the Secretary of the Interior provided by law with respect to mineral resources.

Sec. 2. The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained therefrom. In the administration of the national forests due consideration shall be given to the relative values of the various resources in particular areas.

Sec. 3. In the effectuation of this Act the Secretary of Agriculture is authorized to cooperate with interested State and local governmental agencies and others in the development and management of the national forests.

New SCSA Publication Available

The latest in a series of professional publications published by the SCSA is Snow Surveys and Water Supply Forecasts.

The five papers included are from the Snow Survey Panel program presented August 27, 1959, during the 14th annual meeting of the SCSA at Rapid City, South Dakota. They are "Objectives, Conduct, and Techniques of Snow Surveys" by R. A. Work and M. W. Nelson; "Agricultural Uses of Snow Surveys and Seasonal Water Forecasts" by J. R. Barkley; "Uses of Snow Surveys in Reservoir Storage Control, Energy Generation, and Flood Mitigation" by H. A. Shamberger; "Can Water Forecasts be Refined?" by H. G. Wilm; and "Push Button Snow Surveying Research Needs and Progress" by C. C. Warnick.

There is an introduction by Carl B. Brown who moderated the original panel program and a "Further Reading List" of 29 titles.

The 20-page proceedings 8½ x 11 inches is self-covered with an attractive frontpage design prepared by Felix Summers.

Copies are available at the given prices. All prices include shipping expenses.

1- 9 copies	$0.50 each
10-24 copies	.45 each
25-49 copies	.40 each
50-99 copies	.30 each
100 or more	.25 each

Orders should be placed with and checks made payable to The Soil Conservation Society of America, Inc., 838 Fifth Avenue, Des Moines, 14, Iowa.

RANGE MANAGEMENT VISITORS FROM OVERSEAS

The year 1959 was good for overseas visitors to this country concerned with range management and closely related subjects. A complete record is not available but, of overseas visitors interested in range management, 10 were from Spain; 7 from Greece; 4 from Turkey; 3 each from Israel and Nigeria; 2 each from Chile and Japan; and one each from Iceland, Philippines, South Africa and Sudan. A number of these have already joined the Society.

The year 1960 promises to be of greater importance. Some who came in 1959 are continuing their studies into 1960. Eleven attended the Annual meeting in Portland. Twenty-five or more will attend the Fifth World Forestry Congress August 29 to September 10 in Seattle, Washington. Sections VII, Forest and Range Watersheds, and VIII, Forest Recreation and Wildlife, will be of direct interest to range men.

Among those known to the Committee who will be here for part or all of 1960 are the following:

Jorge M. Brun, Assistant Technician in Pasture Management, Buenos Aires, Argentina, studying at Montana State College.

Eduardo Doberti of Chile, also at Montana State College.

Leonides Liacos of Thessilonika, Greece, at Berkeley, California.

Athanasios G. Choyliaris, County Agricultural Agent, Larissa, Greece, at Utah State University.

George S. Koukouzelis, County Agricultural Agent, Ioannina, Greece, also at Utah State University.

Ingvi Thorsteinsson, Research Analyst, University Research Institute, Reykjavik, Iceland, at Montana State College.

Z. Naveh of Israel, at Berkeley.

Nastali Tadmor, Jerusalem, Israel, also at Berkeley.

Koji Kaneko, Technical Officer (Grass Breeding), Hokkaido National Agricultural Experiment Station, Japan, at University of Wisconsin.

Abdus S. Swathi, Divisional Forest Officer, Quetta, West Pakistan, with Soil Conservation Service at Temple, Texas.

Rufino A. Sabado, Director Experiment Station, Razal, Philippines.

P. deV. Booysen, Plant Physiologist, Lecturer, University of Natal, Pietermaritzburg, South Africa, at University of California, Berkeley.

Rasheed Abdel-Magid, Acting Senior Range Management Officer Khartoum, Sudan, at Utah State University.

Hashim A. M. Mukhtar, Assistant Range Management Officer, Omdurman, Sudan, at Utah State University.

Ismail H. Akbay, Assistant Director Ulas, Sivas Seed Increase Farm, Ankara, Turkey, at State Polytechnic College, San Luis Obispo, California.

Hasan-Namik Arkun, Assistant Director Section XI Agricultural Directorate, Ankara, Turkey, at Utah State University.

Mustafa Bedestenci, Range Management and Pasture Specialist, Konya, Turkey, at Utah State University.

Naim Dincer, Pasture and Forage Specialist, Eskishehir, Turkey, at Utah State University.

Omer S. Firat, Ankara, Turkey, with Soil Conservation Service in Oklahoma.

Urfi Guney, Veterinarian, Karacabey, Bursa, Turkey, at Utah State University.

Muhlis Tan, Pasture and Forage Crop Specialist, Eskishehir, Turkey, California State Polytechnic College, San Luis Obispo, California.

Mithel Yener, Pasture and Forage Specialist, Adana, Turkey, at Utah State University.

The Committee would appreciate being informed of any other visitors from other countries interested in range management who may be in the United States during any part of 1960.

The Committee has informed Dr. K. V. L. Kesteven, Director Animal Production and Health Division,

Food and Agriculture Organization of the United Nations, Rome, Italy, of members of the Society working on range and pasture problems in the Near East and they in turn were informed of the First Near East Meeting on Animal Production and Health held in Cairo, Egypt, April 4-14, 1960.

W. R. Chapline
Secretary

Committee for Cooperation with Organizations in other Countries

Ben S. Markham

Ben S. Markham, Utah State Range Conservationist, died in Spanish Fork, Utah, on December 12, 1959, after having been seriously ill for the past year. Ben was educated at the Brigham Young University and taught at the Utah State University, Logan, before entering Government service. He worked for the BLM for approximately 19 years. He married IdaMar Redd, and they had two children, Ben Stephen and Judith. His fellow workers said about him: "Those of us who knew Ben and worked closely with him realize the pace he set in his job. Ben was recognized as one of the outstanding conservationists in the state of Utah. His broad knowledge of the over-all Bureau program and his good working relations with the employees and with other agencies will long be remembered."

Charles W. Waters

News stories have told the circumstances which caused the untimely death of Dr. Charles W. Waters, Professor of Botany at Montana State University since 1926.

"Doc," as his many students affectionately called him, was first of all a teacher. He regarded teaching as an art. His lectures were enjoyed by students for their clarity of organization and for their freshness of presentation. His preparation for laboratory teaching was meticulous.

While Dr. Waters considered that his first obligation was to teaching, he had an insatiable curiosity, particularly in his field of major interest, Forest Pathology. His office was his work room, and he usually went from class to the particular research problem which at that time offered the greatest challenge to his curiosity.

His knowledge of the fungus diseases of trees was comprehensive and he was concerned with the economic drain which these diseases had on valuable forest stands. He had carried out, since coming to Montana, many investigations among which were critical studies of: white pine blisterrust, Christmas tree blight, mistletoe infestations, needle cast of larch, ponderosa pine, western juniper and other coniferus species.

His most recent problem was concerned with the needle cast (caused by *Elytroderma*) of ponderosa pine; and he recently presented a paper on this work before the Seventh Annual International Forest Disease Work Conference at Pullman, Washington.

Since he was in the field much of the time, Dr. Waters early saw that proper land management was poorly understood by the average person. He realized that democracy in action required a grassroots approach, and became an aggressive advocate of good conservation practices.

In earlier years, Dr. Waters was active in the affairs of the Montana Conservation Council. But as he became more and more engaged in the many pressing research problems dealing with forest pathogens, he was compelled to reduce many of his outside activities. But his interest in the work of the Council continued.

Dr. Waters will be missed by all who were acquainted with his work and the integrity of his professional judgment.

Dr. J. W. Severy

SOCIETY BUSINESS

EXECUTIVE SECRETARY'S REPORT

Balance Sheet
December 31, 1959

ASSETS

Cash	$ 3,961.69
Life Membership Trust	3,456.00
Life Membership Trust Savings Acct.	514.33
U. S. Bonds, Savings	16,558.62
Savings Account	5,037.50
Furniture, Fixtures, Equipment (Less allowance for depreciation)	3,471.63
Accounts Receivable	1,625.54
	$34,625.31

LIABILITIES

Accounts Payable:		
Federal Withholding Taxes	138.60	
State Withholding Taxes	36.90	
F.I.C.A. Withholding and Employees Tax	55.06	
	230.56	

CAPITAL

Operating Reserve		
Balance January 1, 1959		$23,855.58
To restore Petty Cash Item		+1.61
To correct Acc'ts. Recv'ble		—5.00
To Transfer to Life Trust Capital account		—500.00
Balance December 31, 1959		23,352.19
Net Profit from Operations		7,068.38
		$30,424.42
Life Membership Trust		
Balance January 1, 1959		3,386.50
Interest earned 1959		83.83
Transfer from Operating Reserve		500.00
Balance December 31, 1959		3,970.33

Total Liabilities and Capital	$34,625.31

BUDGET FOR 1960

A. President		$ 200.00
		$ 200.00
B. Executive Secretary		
1.	Furniture, fixtures, equipment	200.00
2.	Telephone & telegraph	175.00
3.	Travel & Subsistence	750.00
4.	Stationary, printing & supplies	1,300.00
5.	Postage	750.00
6.	Freight, express and drayage	50.00
7.	Annual Audit	45.00
8.	Rent & Janitorial Service	1,050.00
9.	Salary expense	4,800.00
10.	Miscellaneous	200.00
11.	Employers F.I.C.A. Tax	144.00
		$ 9,464.00
C. Editor		
1.	Personal Services	200.00
2.	Stenographic & Postage	400.00
		$ 600.00
D. Journal		
1.	Printing Volume XIII	11,250.00
2.	Postage & Copyright	250.00
3.	Service of mailing, etc.	250.00
		$11,750.00
E. Special Projects		
1.	Youth Publication	$ 300.00
2.	Youth Award & Dies	300.00
3.	Committee Expense	200.00
		$ 800.00
Total		$22,814.00

ESTIMATED INCOME FOR 1960

Dues and Subscriptions	$22,500.00
Advertising	1,500.00
Reprint Profit	400.00
Journal Sales	350.00
Index Sales	100.00
Emblem Sales	100.00
Total	$24,950.00

BOARD OF DIRECTORS MEETING

Multnomah Hotel, Spruce Room February 2, 1960

The meeting was called to order at 8:30 A. M. by Presidnt Donald F. Hervey. The following were present: President Hervey, Vice President Fred Kennedy; Directors: Kenneth Conrad, E. Wm. Anderson, James L. Finley, Melvin S. Morris, C. H. McKinnon and Executive Secretary John Clouston. A special welcome was given to new Director Karl G. Parker, and Editor E. J. Woolfolk. Gerald W. Thomas, a new Director, arrived a few minutes later. Others in attendance were Wm. Allred and Warren C. Whitman.

The minutes of the Gunnison meeting were approved after a correction in the name of Dr. John Olive was made.

President Hervey appointed the following to the Budget & Audit Committee: Fred Kennedy, Chairman, E. J. Woolfolk and Jim Finley. He will also meet with the Committee. Appointed to serve on the Resolutions Committee were R. S. Campbell, Chairman, E. Wm. Anderson and Melvin Morris.

Committee reports were then given.

Contest & Display Committee: Graham Rice, Chairman reported on the work of his committee, giving a complete and detailed report. Among the recommendations made were that the files be turned over to the incoming chairman or the Executive Secretary at the annual meeting in order that committee work can begin immediately, and that the Society continue to donate the prizes and trophies as the awards will have more meaning coming from the Society. He further recommends the consideration of the proposed slide library.

The Board approved the recommendation that files of all revolving committees be brought to the annual convention and turned over to the new chairman.

Jim Finley stated that he thought it was an obligation of the Society to give the awards. After discussion the Board recommended to the Budget Committee that the expense of awards be considered in the 1960 budget.

Editor Woolfolk stated that he would use the prize winning photos on the cover of the Journal.

Preliminary Arrangements Committee: Howard Passey, co-chairman gave the report. The 1961 convention will be held in Salt Lake City on January 24-27, 1961 with headquarters at the Hotel Newhouse, where the Society was organized. He recommended that this be called The Homecoming Meeting. He reconfirmed the arrangements reported to the Board at the Gunnison meeting, and assured them that the Utah Section has pledged its full support of this meeting.

Program Committee: Co-chairman David Costello reporting, stated that the program committee would make recommendations at the Friday meeting. He expressed his appreciation to those who had carried on for him during his hospitalization.

Local Arrangements Committee: George Roskie, chairman reported that the registration fee of $3.50 had been based on an expected attendance of 400-450. A statement of actual and estimated expenses showed a total of approximately $1200.00. He wished to acknowledge the help received in preparing the Abstracts, stating that it was through the cooperation of B.L.M., B.I.A., U.S.F.S., S.C.S. and the Department of Interior that the book had been prepared at no cost other than the cover and paper. A full report of this committee will be given on Friday.

Report of Executive Secretary was given at this time in order that he could spend some time in the Section Officers Meeting.

Mr. Clouston stated that although we had realized a gross profit of $7152.21 in 1959 we had underspent the budgeted items by $1742.43, partly because some of the work was not done until January 1960 and some work planned was not accomplished. Due to this we "caught up" in 1959, receipts exceeding expenditures by $551.82.

The new Addressograph-Kardex system is working well, and records are kept more up-to-date and better service is being given to Sections.

The office of the Executive Secretary was moved in November to larger, warmer more adequate quarters without change of address or telephone number, but at an increase in rent. He invited all Board members to visit the office during their stay in Portland.

Mr. Clouston thanked the Board for the cooperation and support during the past year.

The Annual Audit report was presented to the Board, and a tentative budget for 1960 has been prepared for the consideration of the Budget & Audit Committee.

Mr. Clouston recommended that the Board consider (1) the printing of the revised By-Laws in the Journal, with extra prints which could be sent to the Sections and others requesting them; (2) that a new die be purchased for emblems as he was not satisfied with the present die.

Discussion followed and a number of the Board expressed the opinion that they would like to see an emblem consisting of the Trail Boss in outline rather than incorporated in a round emblem as at present. They

also believed that the words American Society of Range Management could thereby be eliminated, as the Trail Boss itself would supply the recognition.

The meeting was recessed at this time and President Hervey, Vice President Kennedy, Editor Woolfolk and Executive Secretary Clouston joined the Section Officers Meeting where they addressed the group briefly.

The meeting reconvened at 11:00 A. M. and committee reports continued.

1962 Convention City Committee: Bob Ross, Chairman reported. Mr. Ross gave a complete and comprehensive report from this committee which had investigated possible convention cities in Montana, Idaho, Alberta and North and South Dakota. Because conventions had previously been held in Idaho and Montana these states were not considered favorably. Calgary offered the best facilities but C. H. McKinnon, a committee member, felt that it was better suited for a summer meeting than a winter meeting at this time. South Dakota lacked adequate facilities for a meeting, and the committee recommended that Bismarck, North Dakota be given preference as the site of the 1962 convention city.

Discussion followed. Fred Kennedy raised the question whether the annual meeting could be held in the summer. Gerald Thomas stated that there was not enough emphasis placed on the fact that the summer meeting was an official Society meeting. President Hervey reminded the Board that the summer meeting was not a "paper meeting" but one where those attending could get the feel of the land. He also felt that we should strive to build the prestige of the summer meeting. Ken Conrad added that rancher members want to see more emphasis placed on the summer meeting as they wanted to see more range improvements in addition to papers when they attend a meeting.

Burton Brewster, Chairman of the Northern Great Plains Section appeared before the Board and stated that the Section would be glad to sponsor the 1962 meeting in Bismarck and would support it. A letter to that effect will be sent to President-elect Kennedy and the Executive Secretary.

Melvin Morris moved that the 1962 Convention be held in Bismarck, North Dakota. Jim Finley seconded. Motion unanimously carried.

Director Finley at this time introduced members of the Arizona Student Chapter who are here as members of the Plant Identification Team. Raymond Mapston, Chairman of the Student Chapter introduced the members of the team—Christopher Williams, William Warskow and Mr. Herrera. He thanked the Society for the fine example they have set and expressed the hope that Student members could carry on the good work.

R. S. Campbell, Chairman of the Committee on Cooperation with Scientific Organizations introduced Jim Keith, a member of his committee, to report:

Committee on Agricultural Pests, a committee set up at the request of Walter Howard to work with the National Academy of Science-National Resource Council's Committee on Agricultural Pests, Sub-Committee on Vertabrates. The purpose of the committee is to accumulate information on damage and make a realistic appraisal of the place of pests in our national economy. It is limited to three classes of animals on rangelands—big game, predators, and rodents. Each professional society represented on the committee will work on the phase that affects their field. The plan is to appeal for help through the Journal and the Sections. The ultimate objective is to publish a report on the work, develop a bibliography, and fulfill their obligation to the National Academy of Science.

Lengthy discussion followed. Suggestions that the name of the committee be changed to Range-Wildlife Relation and Animal Ecology were made. Jim Finley urged that the Society stay out of the controversy of big game and cattle on range lands, and stated that he would regret to see the Society obligated to any group, N.A.S. or otherwise.

Meeting adjourned at 12:15 P. M. for lunch.

The meeting reconvened at 1:30 at which time Dr. Vernon Young, President-elect for 1961 joined the group.

Discussion continued on the work of Jim Keith's committee. George Bradley stated that the subject was too controversial at the present time and felt that the Society should avoid becoming involved.

E. Wm. Anderson presented a motion that the Society retain liaison with the N.A.S. and N.R.C. Committee on Agricultural Pests and for the time being take no action that will commit the Society. Seconded by R. S. Campbell. Motion carried.

Committee on Cooperation with Foreign Organizations reported on by George Bradley, committee member. Mr. Bradley stated that he felt the Society should concentrate on securing as members those visitors from other countries who are now in the U. S. and forget about those who have returned home. Section contacts are important and he urged that all Sections have committees to work with the national committee, rather than one-man representation. The Society should consider international cooperation as a part of our program, and perhaps cooperate with ICA in sending ASRM representatives to other countries for the purpose of setting up similar organizations abroad rather than establishing Sections of the Society abroad. He further felt that we should expand our efforts to recognize foreign visitors at our National Meetings, and keep in contact with F.A.O. on regional conferences and send speakers or papers to these meetings.

Arrangements were made to have the foreign members and visitors present at this meeting with the Board and others. Special recognition will be given them at the banquet.

President Hervey commended this new committee for the splendid job they have done in the short time they have been working.

Professional Standards and Civil Service Committee report was given by Joe Wagner, chairman. This committee has compiled a list of institutions offering degrees in Range Management and the type of degrees offered. This list was published in the November 1959 issue of the Journal. Ready for future publication is a table showing the number of students enrolled in Range Management during the 1959-60 school year. The Civil Service Commission has been advised of these reports. The committee is now working on a composite curriculum of colleges offering Range Management.

The Board was pleased to note that for the first time a representative of the Society, Joe Wagner, had been invited to sit in on a meeting with the Civil Service Commission. They felt this recognition gratifying.

Committee on Cooperation with Scientific Organizations report was given by R. S. Campbell. This report covers the groups listed below, as well as the report previously given by Jim Keith.

1. *The Joint Revised Pasture and Range Research Techniques Committee.* The work of this committee has been completed and sent in to

the chairman of the Inter-Society Committee, Dr. Robert Wagner at the University of Maryland, according to the written report of Joseph H. Robertson, Chairman of the A.S.R.M. group.

2. *Methods Census of Production of Grazing Lands.* W. O. Shepherd is our representative on this Inter-Society Committee, and his report was read. After discussion it was agreed that the Board approve the report of the committee in principle and agrees to Mr. Shepherd's proposal to expand A.S.R.M. representation on the committee. The committee will remain under the Committee on Cooperation with Scientific Organizations.

....3. *National Watershed Congress.* A meeting of this group will be held April 18-20. The Board will ask Ben Osburn to attend this meeting and report at the Summer Board Meeting.

The Executive Secretary was instructed to write to Mr. Gutermuth stating that we feel it is too late for this organization to participate in the 1960 meeting, but we will keep Ben Osburn as our representative. A copy of the letter is to be sent to Ben Osburn.

4. *American Institute of Biological Sciences.* The invitation to join this group at the $300 per year membership rate was discussed. On the motion of Gerald Thomas, seconded by Karl Parker, the Board voted unanimously to defer action at this time.

5. It is the opinion of our representatives to the *American Society of Agronomy,* Jack Harlan; *Society of American Foresters,* Reg DeNio; and the *Soil Conservation Society of America,* Les Albee that we continue these associations.

6. *American Grassland Council.* Robert E. Williams, our representative urges that the Society take leadership in the work of this group. No Board action. (Note: The ASRM is now a paid member of this group.)

7. *Agricultural Research Institute.* Kenneth W. Parker has been our representative. As a follow-up of the Gunnison meeting proposal for membership in the National Research Council's Agricultural Board, a tabulation of our membership has been sent to Frank Campbell. They have recommended our affiliation to their Board.

Publication Committee report was given by Warren C. Whitman, editor of Volumes X, XI and XII of the Journal, and Chairman of the committee. Following the report Mr. Whitman expressed his appreciation and that of the North Dakota Agricultural College for being able to assist the Society during the past three years.

Dr. Hervey expressed the appreciation of the Board for the many hours devoted to editing the Journal by Mr. Whitman, and stated that he would write a letter expressing our appreciation to the N. D. Agricultural College.

E. J. Woolfolk, the new Editor of the Journal, reported on the amount of material now on hand for publication. He suggested that a change be made for lengthy articles, and asked for a larger Editorial Board. The suggestion was made that more new writers and ranchers be encouraged to contribute and that the Editorial Board not be too harsh in their editing and criticism of these people.

R. S. Campbell made a motion that the Editorial Board be increased to a membership of nine and that the three new members added be considered for terms of 3, 2 and 1 years. Seconded by Fred Kennedy. Motion carried.

Committee on Cooperation with Youth Organizations report was given by Garlyn O. Hoffman. The work of this committee is mainly with 4-H, F.F.A. and Vocational Agriculture groups.

Mr. Hoffman's committee proposes to standardize the preface for Range Mannuals, and will submit such a preface for consideration of the Board.

The program of awards was explained. Awards will be given to top youth at State and Section levels, County level as well as National level. He showed sketches of proposed awards and told of the cost of dies for such awards.

At the suggestion of Gerald Thomas, the Board advised that the Trail Boss on the awards should be the official Society emblem with no background added.

Mr. Hoffman will meet again with the Board on Friday.

Advertising Committee. A report has been filed with the President. There is nothing new to report here, according to Chairman John Chohlis.

Election Committee, Frank Stanton, Chairman. A full report has been filed by this committee.

Historial Committee. All material of historical value that is not passed on to the incoming-president by President Hervey will be sent to Alan Beetle for the Archives. Similar papers are sent by the Executive Secretary's office.

Membership Committee. Report to be given on Friday.

Nominations Committee Report has been filed with no recommendations for changes.

Program of the Future Committee report was given by Melvin Morris, Chairman. The committee will continue to investigate the possibility of publishing a Range Management Science Journal.

No further changes in the Constitution and By-Laws are anticipated.

A prepared inventory of Range Management personnel in the U. S., Canada and Mexico in terms of planning our membership development in ASRM is being considered. It may first be tried in the International Mountain Section.

At the present time the committee feels that they have two big jobs, membership and placing more focus as to what constitutes Range Management as a profession.

Robert Campbell, E. Wm. Anderson and Ken Conrad who are completing their terms on the Board were thanked for their efforts and help in furthering the development of the Society. They in turn express appreciation for being able to serve the Society.

No further business. The meeting was adjourned at 6 P.M.

BOARD OF DIRECTORS MEETING

Mu'tnomah Hotel, Spruce Room February 5, 1960

The meeting was called to order at 8:40 A. M. by President Fred H. Kennedy. Present were President-elect Vernon A. Young, Directors C. H. McKinnon, Jim Finley, Melvin S. Morris, Karl Parker, Past President Donald F. Hervey and Executive Secretary John G. Clouston.

The President called for invitations to the Board for the 1960 Summer Meeting. South Dakota Section through Paul Howard and Les Albee invited the Board to meet with them at Custer. The Arizona Section invitation was presented by Ted Moeller and Jim Finley. Hal Miller represented the California Section. Burton Brewster and Gene Payne invited the Directors to meet with the Northern Great Plains Section. The Texas Section invitation was presented in a lettr from Clyde Doran. The Board advised the five Sections that they would consider their invitations and vote on the matter later in the day. The Board did agree that the tentative dates of the 1960 Summer Meeting would be July 21st for the Board meeting, and July 22 and 23 for the Section field meeting.

Bill Colt presented the plan of his

committee for a *Slide Library* which would make available visual aid material. He stated that the University of Wyoming was willing to assume custodial duties. Don Hervey commended the committee for analyzing the problem, stating that the desirability of such a project is unquestionable, but that two or three policy problems are involved, i.e., (1) problem of who handles it, (2) financial aspects, (3) method of acquisition. Jim Finley raised the question of how much the Society would be involved financially, and asked for more definite information.

Karl Parker moved that the Committee on Slide Library be instructed to investigate the matter more thoroughly by contacting one or more institutions to determine if they are willing to act as a depository and ascertain what arrangements can be developed. The Committee is to report back at the Salt Lake City meeting. Seconded by Don Hervey. Motion carried.

Mr. Colt showed some color slides illustrating examples of sequences such as he had in mind for the Slide Library.

Range Conservation Stamp. Les Albee urged that the Society ask the Post Office Department to consider a Range Conservation Stamp for release at the Salt Lake City meeting. He felt that the ASRM should be the sponsor of this and urged a Range rather than a grass stamp. Fred Renner urged that the ASRM send a letter to the Postmaster General urging the Range Conservation Stamp and offering to help create the design. President Kennedy stated that he would write the letter to the Postmaster General, and asked Fred Renner to work with the Post Office Department in Washington, D. C. on this matter.

The Resolution Committee reported that it had a resolution covering the Range Conservation Stamp which reads as follows:

"Whereas the U. S. Post Office Department plans to prepare a grazing stamp in its conservation series Whereas the A.S.R.M. is devoted to the science and art of grazing land conservation and management,

"Be it resolved by the Board of Directors in regular session on February 5, 1960

1. That the Post Office Department be urged to first release the grazing stamp as a range conservation stamp at a regular annual meeting of the A.S.R.M.
2. That the A.S.R.M. offer its services in preparing the design of the stamp, and in publicizing its release.
3. That President Kennedy write to Postmaster General Summerfield stating the Society's qualifications and sentiments, and designating a Society member in Washington, D. C. to represent the A.S.R.M. in this matter."

Don Hervey moved that the Resolution and its implications be adopted. Dr. Young seconded. Motion carried.

Program Committee: Dave Costello, Chairman of the 1960 and W. O. Shepherd of the 1961 committee appeared before the Board. Dr. Costello recommended that (1) the work of the 1961 committee get underway immediately, (2) that session chairmen assume responsibility and be given leeway in selecting the program, but that they should be willing to accept suggstions, (3) that a balance of agencies and areas should be kept in mind in making up the program, (4) that there should be a time schedule on the programs, (5) that names of speakers be printed in bold face type, and that (6) a call for papers be made in the Journal of Range Management and that those who volunteer papers specify whether they are technical or general and into which session they will fit best.

President Kennedy reminded the Board that the President-elect is overall Chairman of the Annual Meeting.

It was suggested that in developing the Homecoming theme for the Salt Lake City meeting that we should look ahead at the next 15 years.

Jim Finley urged that time be allowed in the general business meeting for members to get on the floor and present or discuss matters. He felt that this would make for sustained cooperation and strength in the Society.

Range Bibliography. Speaking on this proposed project by John Valentine, Fred Renner stated that he thought the idea was good, but it was a big job and that it should be done as it will have great value in teaching and research. However, it is not a one-man job and a strong steering committee will be needed. Furthermore, it must be a selective bibliography. People at the schools are in the best position to do the work as they realize the work must be done accurately with original articles checked. After the scope of the Bibliography is decided it should be set up on a subject rather than regional basis.

Don Hervey indicated that the Southern Section has a similar project underway. As the market for such a Bibliography is limited, he raised the question as to whether the Society do it alone or ask help from the National Research Council. Don Hervey then made the motion that the idea be accepted as a project of the Society and a steering committee appointed. Melvin Morris seconded. Motion carried.

Cooperation with Youth Committee, Garlyn O. Hoffman, reporting. Mr. Hoffman requested the same committee as the past year plus David Osterli. He stated that the preface for Youth Manuals would be revised and that no dies would be ordered until the design had the approval of the Board. Vernon Young made the motion that we endorse the program presented by Garlyn O. Hoffman and give the committee the $600 they requested for their work during the coming year. Seconded by Jim Finley. Motion carried.

Melvin Morris raised the question of how the Sections fit into the Youth program and it was suggested that each Section have a contact man or representative to work with Mr. Hoffman's committee. Don Hervey suggested that all Youth Range Manuals published be sent to members of the Board so they would be up-to-date on the progress of this work.

Range Management Educational Council was reported on by Gene F. Payne. This Council is composed of representatives of schools granting degrees in Range Management. At the present time the Council is studying the present 4 year curricula and attempting to determine what constitutes a degree in Range Management and would like to have the support of the A.S.R.M. in this effort. They would also like to hold their meeting the evening preceding the morning of the opening day of the annual ASRM meeting. Their meetings are open but non-council members do not have the right to make motions or vote. Don Hervey moved that the Range Management Educational Council will operate separately but have the support of the ASRM. Seconded by Vernon Young. Motion carried.

Discussion followed which included the possibility of a liaison man from the ASRM and recognition of the Range Management Educational Council.

Mr. Payne was told that there would be no objection to the Council holding their meeting at the time requested, and that it could be noted in the program for the annual meeting.

Nominations Committee chairman for 1961, Don Cornelius, appeared before the Board to receive any instructions or information they had for his committee. He was given the files of the 1960 committee, and instructed to report at the Summer Board meeting, at which time he should present a list of potential candidates for Board approval.

Section Chairmen Meeting recommendations were presented by E. Reade Brown. These were: (1) That the return of Society dues to Sections be increased from 75¢ to $1.00 per member. (2) That Sections be assigned the responsibility of obtaining rancher articles for the Journal with the understanding that these must meet editorial standards as established by the Editorial Board. (3) That the Nominations Committee seek representation on the Board of Directors from each of the five established geographical divisions of the Society, and that each Section within the subdivision be solicited for their nomination for the Director to represent their geographical subdivision.

In addition to the recommendations, Mr. Brown reported that six Sections had sponsored Youth Camps, three had sponsored University scholarships and two were attempting to organize scholarships. A number of Sections were working on Youth Manuals. The standardized accounting system and record keeping as recommended by the Executive Secretary had been adopted by a number of Sections. Membership of the Society depends on Section strength and the Section Officers suggested as a means of strengthening and increasing membership that (1) more controversial issues be discussed and brought into the open at meetings, (2) more cooperation on Section level with livestock and similar organizations within Section and that this cooperation come from the member as a member of ASRM rather than a representative of a government agency, (3) better balance of technician-rancher membership, (4) more trips to actual range operations, (5) small livestock owners are the best potential members as they have more time to devote than large operators, and (6) more newsletters.

The meeting was recessed for lunch.

Meeting reconvened at 1:30 P.M. The recommendations of the Section Chairmens Meeting were considered. Jim Finley made the motion that the Board is very much in sympathy with and has given due consideration to the needs of the Sections, but at the present time cannot grant the request to raise the amount of dues remitted. Seconded by Vernon Young. Discussion. Motion carried.

The 2nd recommendation was adopted on the motion of Don Hervey. Seconded by Vernon Young. Carried.

The 3rd recommendation was discussed and the Board in attempting to carry out the recommendation entertained a motion by Melvin Morris that this recommendation be referred to the Nominations Committee and to the standing Committee for By-laws Revision. Seconded by Don Hervey. Motion carried.

Contest & Displays Committee final report was given by Graham Rice, who stated that the files had been turned over to A. C. Hull. His committee recommends that the Plant Identification Contest be made a better contest, with more emphasis placed on knowledge and understanding rather than on memory.

Committee of Inventory of Range Research was reported on by Kenneth W. Parker, who stated that the committee has authority to revise prospectus and review a similar project by the Society of American Foresters, and contact organizations who might finance work. He asked that the present committee be continued with the addition of Don Hervey to its membership.

Local Arrangements Committee report given by George Roskie, who stated that approximately 480 were registered and that the committee hoped to have a profit. He said he felt that the convention as a whole had been successful and the extra things done for people had been appreciated, particularly in the Ladies program. A full written report with recommendations will be given to the 1961 Local Arrangements Committee.

Editorial Board. The written recommendations of the committee were read. On the motion of Don Hervey; F. A. Branson, L. T. Burcham and Lynn Rader were chosen for three year terms on the Editorial Board: George Glendening for a two year term. Seconded by Jim Finley. Motion carried.

Melvin Morris made a motion that Clair Terrill be elected for a one year term on the Editorial Board. Seconded by Don Hervey. Motion carried.

Budget Committee presented the 1961 budget which totaled $22,814.00. Jim Finley made a motion that the Budget for 1961 be accepted. Seconded by Dr. Young. Carried.

Committee Appointments were read by President Kennedy. Don Hervey made a motion that the appointments be confirmed. Seconded by Melvin Morris. Motion carried. The list of these committees will be published in the May issue of the Journal.

On the motion of Dr. Young the *selection of the 1962 Convention City* was reopened. Seconded by Don Hervey. Motion carried.

Dr. Young moved that we shift the 1962 annual meeting from the North to the Southwest and that a committee be appointed to study the possibility of holding summer meetings in the north and winter meetings in the south, this committee to report back to the 1961 business meeting at Salt Lake where their findings will be considered at the general business meeting of the Society rather than by the Board of Directors. Seconded by Don Hervey. Motion carried.

President Kennedy appointed a committee of Melvin Morris, Chairman, Charles McKinnon, Les Albee and Tom Willis to present and transmit to the International Mountain and Northern Great Plains Sections a statement explaining the situation.

Summer Meeting 1960. Jim Finley moved that the ASRM hold the summer meeting at Prescott. Seconded by Don Hervey. Discussion followed. Motion lost.

After further discussion Burton Brewster, Chairman of the Northern Great Plains Section was called into the meeting and asked to explain more fully the accommodations offered for the proposed summer meeting at Birney, Montana.

Jim Finley moved that pending further discussion at the meeting next January that the summer meeting be held in Prescott. Seconded by Vernon Young. After discussion this motion was withdrawn.

Don Hervey moved that the Board accept the South Dakota Section offer to hold the summer meeting at Custer and that the Northern Great Plains and Wyoming Sections be encouraged to co-sponsor the meeting. Seconded by Karl Parker. Motion carried. The dates will be July 21, 22 and 23. The Executive Secretary will notify the South Dakota Section of the acceptance of their invitation, with a copy to Dr. Young.

Resolution Committee report was read. Motion by Karl Parker, seconded by Dr. Young that the report be adopted. Unanimously carried. The Executive Secretary was instructed to carry out the instructions of the resolution.

Program of Future Committee
Chairman Melvin Morris raised the question of working on a better understanding of problems of grazing land use as involves operator and public land administrator in order to better resolve their differences. He suggested panels at national, state and county or local meetings so that instead of quarreling about validity of techniques, those involved get to the heart of the management problem. He felt that we should have an understanding of what we have to deal with and how to get it done. Discussion followed. No action taken.

Section Chairmen

The Board of Directors was pleased with the apparent success of the meeting of Section representatives held here on February 2. It feels that the welfare of the Society was uppermost in that meeting's deliberations and that the enthusiasm shown will be carried back to the Sections and be reflected in better Section programs throughout the entire organization.

The Board accepted and approved your recommendation that the responsibility for obtaining rancher articles for the Journal be assigned to Sections by the Editor.

Your recommendation concerning the solicitation of the Sections for nominations for Director was referred to the Nominations Committee and to the By-Laws Revision Committee for report back to the Board. Present instructions to the Nominating Committee direct it to consider for nomination men from various areas and from various groups within the Society. The aim is to keep a balance between groups and between regions.

Concerning the recommendation that Section dues be increased from 75¢ to $1.00 the Board took unfavorable action. The reasons behind this action were:

1. The Society is only now getting on its feet financially. For the first year we shall be operating on current year income.
2. Many of the expensive activities of the Society are designed to be helpful to the Sections. The acquisition of new record files and machinery makes it possible to furnish Sections without cost more frequent and more current information on membership. The publication of "Out on the Range," "Range, Its Nature and Use" and the Society brochure are helpful.
3. The Board felt that Sections have ways of raising essential funds not open to the Society.
4. While the amount to be paid each Section would be small—about $75 per year to the largest—the aggregate cost to the Society would amount to over $800.

The Board hopes for you a busy and successful year.

A motion for adjournment was made by Jim Finley. Seconded by Karl Parker. Motion carried. Meeting adjourned at 6:45 P. M.

—John G. Clouston,
Executive Secretary

REPORT OF THE SECTION CHAIRMEN'S MEETING

February 2, 1960

Meeting was called to order at 8:30 a.m. by Chairman Reade Brown.

Representatives of seventeen Sections were present, also several visitors or observers.

The meeting got under way with the reading of the annual reports from each Section. Some of the highlights of these reports were:

1. Six Sections are sponsoring camps for youth. Some of these camps have been highly successful.
2. Three Sections are now sponsoring fellowships for students to study range management, and several others are starting to build up funds for this purpose.
3. Two Sections are sponsoring some type of technical publication. These are the National Capitol Section and the Southern Section.
4. Many Sections reported they had already revised, or were in the process of revising, the Range Manual for Youth Groups, to adapt it to their Section areas.
5. Most of the Sections report adoption of the standardized bookkeeping and accounting system as recommended by Executive Secretary, John Clouston.

The group was then visited by: President, Don Hervey; President-elect, Fred Kennedy; Executive Secretary, John Clouston, and Editor, Joe Woolfolk.

Discussion:

1. Annual reports at the Section Chairmen's Meeting:
   Some representatives felt that these reports are largely routine, time consuming, and that the time might better be spent in discussing more important topics. Others felt they were of value in getting acquainted with the activities of other Sections. After considerable discussion, the motion was made and carried:
   "That a brief written report be prepared by each Section and submitted, not later than January first each year, to the current Chairman of the Section Chairmen's Meeting. The Chairman shall be responsible for summarizing these reports and listing the highlights for discussion at the meeting."
   It was also recommended that these reports should list any points to be included on the agenda for discussion at the Section Chairmen's Meeting.
   The discussion brought out the fact that the outgoing Chairman of the Host Section for the National Meeting is automatically the Chairman of the Section Chairmen's Meeting.
2. Membership:
   No formal action was taken, but the following points were brought out in the discussion:
   a. The need for strong, active Sections, since it is the Sections that must carry the ball in holding old members and securing new ones.
   b. Sections should seek to reach a balance between ranchers and technicians.
   c. The largest potential group of members are the small livestock operators.
   d. The discussion of more controversial subjects at meetings stimulates interest, as well as it brings issues out into the open.
   e. Individuals should take a more active part as representatives of the Society in the activities of livestock and other type organizations.
   f. Take more trips to actual ranch operations and get more ranchers to take an active part in meetings and discussions.
   g. Send out more newsletters, since this is the only means by which a Section can keep in touch with its members.
3. Finances:
   It was pointed out that the amount returned to the Sections was not increased when the Society dues were increased. Most Sections felt that an increase in the dues kickback would serve to strengthen their activities. Therefore, the following motion was made and carried:
   "That Section Chairmen rec-

ommend to the Board of Directors that the return of Society dues to the Sections, be increased from $0.75 to $1.00."

4. Journal Policy:
The general consensus of opinion was that the Journal needed to be made more interesting for rancher members. Two ways of accomplishing this were suggested:
   a. Articles by technicians should be written in a language that a rancher can understand.
   b. More articles by ranchers, for ranchers.

Concerning the second point, it was pointed out that very few such articles are ever submitted for publication. As a possible solution to this problem, the following motion was made and passed:

"That Section Chairmen recommend that the Board of Directors, or that the Board of Directors working through Journal Editor, assign to the Sections, on a rotational basis, the responsibility for obtaining rancher articles for the Journal, with the clear understanding that any such articles would be published only if they meet the editorial standards as established for the Journal."

Other possibilities that were mentioned were: (1) including a section in the Journal devoted to tips or hints to ranchers, (2) a joke section, and (3) publishing any abstracts of technical papers, rather than the entire article.

5. Nomination of Directors and Assignments to National Committees:
It was pointed out that the Sections have very little voice in the nomination of Directors, or in the appointment of individuals to serve on national committees. Also, that often it would be desirable to have representation from the various Section areas on these committees. No action was taken concerning committee assignments, but the following motion was made and passed concerning nomination of Directors:

"Section Chairmen recommend to the Board of Directors that they memorialize the nominations committee to seek representation on the Board of Directors from each of the five geographical subdivisions of the Society, and that each Section within the geographical subdivision be solicited for their nomination for the Director to represent their geographic subdivision."

With no further business to conduct, the meeting was adjourned at 12:45 p.m.

Respectfully submitted:
HURLON RAY,
Acting Secretary
Southern Section
E. READE BROWN,
Acting Chairman
Pacific Northwest Section

MEMBERSHIP COMMITTEE REPORT

	Section	Total Members 1/22/60	New Members & Transfers	Total Members 3/10/60	Unpaid No. 3/10/60	Unpaid % 3/10/60	Suspended 3/12/59
A	Arizona	301	13	314	95	30.3	93
B	California	268	7	275	51	18.5	32
C	Colorado	261	—4	257	80	31.1	34
D	Idaho	141	0	141	38	27.0	26
E	Kansas-Oklahoma	139	4	143	39	27.2	34
F	Nebraska	119	2	121	50	41.3	29
G	Nevada	91	7	98	23	23.5	10
H	New Mexico	156	—1	155	40	25.8	22
I	N. Great Plains	141	7	148	37	25.0	28
J	Intermountain	167	4	171	49	28.7	44
K	Pacific Northwest	328	16	344	87	25.3	53
L	South Dakota	113	6	119	34	28.6	30
M	Southern	86	—2	84	32	38.1	11
N	Texas	258	11	269	113	42.0	114
O	Utah	213	3	216	67	31.0	44
P	Wyoming	134	3	137	38	27.7	27
Q	National Capitol	85	1	86	14	16.3	7
R	International	....	....	....	....		....
S	Mexico	52	1	53	30	56.6	18
	SECTION TOTALS	3,053	78	3,131	917	29.3	656
	Unaffiliated	103	4	107	27	25.2	18
	Subscr.-Domestic	180	1	181	14	7.7	12
	Subscr.-Foreign	131	2	133	23	17.3	13
	TOTAL OTHER	414	7	421	64	15.2	43
	GRAND TOTAL	3,467	85	3,552	981	27.6	699

Section Officers on record in Office of Exec. Secretary
February 17, 1960

SECTION	CHAIRMAN	SECRETARY
Arizona	THEO L. MOELLER P. O. Box 1700 Flagstaff, Arizona	RAY M. HOUSLEY, JR. P. O. Box 1490 Flagstaff, Arizona
California	LISLE R. GREEN 299 Ramona Drive San Luis Obispo, California	BURGESS L. KAY Field Station Admin., U. of C. Davis, California
Colorado	CARL HERZMAN Extension Service Colorado State University Fort Collins, Colorado	J. ROSS MCLAUGHLIN 1120 Ruppel Pueblo, Colorado
Idaho	CLAIR WHITLOCK 2340 Miller Avenue Burley, Idaho	IRA CLARK Box 1407 Pocatello, Idaho
Kansas-Oklahoma	CLARENCE KINGERY 2726 Wilshire Blvd. Oklahoma City, Oklahoma	CLARENCE E. BUNCH Extension Service, O.S.U. Stillwater, Oklahoma
Nebraska	WILLIAM STUART Soil Conservation Service Rushville, Nebraska	EUGENE DANIELS Soil Conservation Service Rushville, Nebraska
Nevada (will elect 3-4-60)	L. THOMAS TURNER P. O. Box 427 Wells, Nevada	H. M. KILPATRICK Agric. Bldg., U. of N. Reno, Nevada
New Mexico	SAMUEL H. LAMB 1803 Otowi Drive Santa Fe, New Mexico	LAWRENCE K. SANDOVAL 1929 Hopi Road Santa Fe, New Mexico
Northern Great Plains	BURTON BREWSTER U Ranch Birney, Montana	WILLARD FALLIS 2116 Patricia Lane Billings, Montana
International Mountain	MELVIN S. MORRIS University of Montana Missoula, Montana	WILFRED DUFOUR Philipsburg, Montana
Pacific Northwest	WILBUR F. CURRIER U.S.F.S. Box 4137 Portland 8, Oregon	CARL W. SIMPSON 1236 N. E. 80th Avenue Portland 13, Oregon
South Dakota	E. MALCOLM STROM Soil Conservation Service Mobridge, South Dakota	RALPH S. COLE 1645- 32nd Rapid City, South Dakota
Southern	D. M. BAIRD Georgia Experiment Station Experiment, Georgia	WAYNE W. WEST 4479 Cain Circle Tucker, Georgia
Texas	MARION EVERHART 2302 Hancock Amarillo, Texas	CLYDE DORAN 3518 Concord Road Amarillo, Texas
Utah	DUWAYNE L. GOODWIN Dept. Range Management Utah State University Logan, Utah	JOHN F. VALENTINE Dept. Range Management Utah State University Logan, Utah
Wyoming	FRANK RAUZI A.R.S., Plant Science Div. University of Wyoming Laramie, Wyoming	A. A. BEETLE Agronomy Dept., U. of W. Laramie, Wyoming

National Capital	Evan L. Flory 3451 N. Venice Arlington 7, Virginia	Myrvin Noble 6465 Hibbling Avenue Springfield, Virginia
Mexico	Gilberto Valdez R. Edif. Union Ganadera Desp. 204 Chihuahua, Chih., Mexico	Martin Gonzales Edif. Union Ganadera Desp. 201 Chihuahua, Chih., Mexico

AMERICAN SOCIETY OF RANGE MANAGEMENT

NATIONAL COMMITTEES FOR 1960

Advertising

G. John Chohlis, *Chairman*
2850 Stafford Way
Sacramento 21, California
W. Harlan Owen
W. C. Whetsell

Cooperation with Foreign Organizations

Thomas L. Ayers, *Chairman*
Agricultural Conservation Program Service, USDA
Washington 25, D. C.
Loyd M. Adcock
Geo. E. Bradley
W. R. Chapline
Marion Clawson
Roy C. Dawson
Henry Edmunds
Bradford Knapp
L. L. Roux

Cooperation with Scientific Organizations

Robert S. Campbell, *Chairman*
704 Lowich Bldg.,
2026 St. Charles Avenue
New Orleans 13, La.
Agricultural Research Institute
K. W. Parker
American Grassland Council
R. E. Williams
American Society of Agronomy
Wesley Keller
National Academy of Sciences, National Research Council
Range-Wildlife Relations
James O. Keith
Policy Committee for Scientific Agricultural Societies
Evan L. Flory
Society of American Foresters
R. M. DeNio
Soil Conservation Society of America
Leslie R. Albee
ASRM Representative to National Research Council Agricultural Board
Herbert C. Hanson

Cooperation with Youth Organizations

Garlyn O. Hoffman, *Chairman*
Texas A & M College
College Station, Texas
Walter Armer
Lester M. Bermer
Clarence Bunch
Donald Burzlaff
Barry Freeman
Grant A. Harris
Carl Herzman
H. M. Kilpatrick
Liter Spence
John F. Valentine

Meetings

Vernon A. Young, *Chairman*
733 W. Second Street
Mesa, Arizona

a. Program

Weldon O. Shepherd, *Chairman*
Forest Service Bldg., 25th St. & Adams Ave., Ogden, Utah
Arthur D. Smith
Harold S. Crane
Joseph F. Pechanec
Joseph H. Robertson
George E. Bradley
Harold A. (Bud) Paulsen
Gerald W. Tomanek
Arnold M. Schultz
Russell J. Penny
Gene Etchart
D. L. Goodwin

b. Local Arrangements

William D. Hurst, *Chairman*
U. S. Forest Service, Forest Service Bldg., Ogden, Utah
V. B. Richman, *Co-chairman*
Bill K. Cooperrider
J. D. Hansen
Howard B. Passey
Wm. L. Reevley
Julian Thomas
Mr. & Mrs. Neale Nelson
Dr. D. L. Goodwin
Dr. L. A. Stoddart
Dr. John F. Vallentine
J. Kent Giles
Oliver Cliff
Howard Clegg
Max Rees
Dan Freed

c. Displays and Contests

A. C. Hull, Jr., *Chairman*
Utah State University
Logan, Utah
Subcommittee on Photographic Contest & Displays
J. L. Jacobs, *Chairman*
U. S. Forest Service, Forest Service Bldg., Ogden, Utah
Richard S. Greenland
Howard R. Foulger
Norman V. Hancock
Vinson L. Duvall
Subcommittee on Range Plant Contests
Richard Driscoll, *Chairman*
Bend Research Center, P. O. Box 1048, Bend, Oregon
Thadis W. Box
Oliver Cliff
Barry N. Freeman
Lowell K. Halls
James K. Lewis

d. 1962 Preliminary Arrangements

Gerald W. Thomas, *Chairman*
Dean of Agriculture
Texas Technological College
Lubbock, Texas
Theo. L. Moeller
C. E. McDuff

Special Committee on Annual Meetings Locations

Melvin S. Morris, *Chairman*
School of Forestry
University of Montana
Missoula, Montana
Leslie R. Albee
Chas. H. McKinnon
Burton B. Brewster
Thomas G. Willis

Elections

Kenneth A. Burkholder, *Chairman*
2331 NE Brazee Street
Portland 12, Oregon
Alex E. Smith
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The growth of California must be constant, and her future great and glorious. If sky and earth and man remain the same, her attractions cannot be neglected. Her progress may be relatively slow, until some of her large, dry valleys shall be provided for irrigation, and until her tule lands shall have been securely reclaimed; but so soon as extensive areas, now unfit for secure tillage, on account of the lack of the excess of water, shall have been protected against flood and drought, there will be a rapid increase in her population and wealth, and a decided improvement in the character of her industry. She can and will sustain a population of 20 millions.

—J. S. Hittell, 1863.

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