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Costs and Benefits of Reseeding Range Lands in Southern Idaho

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Summary

The per-acre costs of range reseeding in southern Idaho averaged $7.52 on 27 private and public seedings. This figure included the cost of seedbed preparation, the cost of seed, and the cost of seeding. Average costs of fencing were found to be $759.00 per mile.

The per-acre cost of range reseeding decreased as the size of the area seeded increased. Seedings of less than 1,000 acres had average per-acre costs of $8.00 to $9.00 while seedings of 2,000 acres or more had per-acre costs of $6.00 to $7.00.

According to results obtained at the Point Springs experimental range, beef animals on crested wheat grass range gained from 2.27 to 2.70 pounds per day during the spring grazing season. Fall gains ranged from 0.06 to 0.60 per day.

At Point Springs, the carrying capacity of crested wheat grass range was found to vary from a low of 1.27 acres per animal-unit month to a high of 1.10 acres.

Acknowledgment

Incorporated in this bulletin are the contributions of several researchers working on various aspects of the problem of range improvement in Idaho as well as other areas of the West. The authors are indebted to: L. A. Sharp, Associate Professor, Range Management, College of Forestry, University of Idaho, who was responsible for carrying out certain aspects of the underlying field work and assisted in the preparation of the manuscript; M. A. Fosberg, Associate Agronomist, Idaho Agricultural Experiment Station, who prepared the soils map of southern Idaho and wrote the section dealing with the soils and climate of the area; W. P. Lehrer, Associate Animal Husbandman, Idaho Agricultural Experiment Station, for making available the information on livestock gains on the Point Springs experimental range; J. A. Edwards, Assistant Agricultural Economist, Idaho Agricultural Experiment Station for his critical appraisal of the final draft of this bulletin.

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Costs and Benefits of Reseeding Range Lands in Southern Idaho

D. D. CATON AND CHRISTOPH BERINGER*

Introduction

A large proportion of the 16,000,000 acres of native sagebrush-grass rangeland in Idaho produces forage at a rate considerably below its productive capacity. Prior to and at the initiation of large scale grazing, these rangelands were estimated to be capable of producing from 0.20 to 0.33 animal-unit months of grazing per acre. A survey of these same ranges by the Bureau of Land Management in 1954 placed the average capacity at approximately 0.025 animal-unit months per acre.

The capacity of a range to produce livestock products is directly related to the quantity and quality of the forage plants growing on it. Grazing use during the past half-century has resulted in diminution, and, in some instances, the complete disappearance of high-quality perennial forage plants. As the number of these plants has decreased they have been replaced by sagebrush or annual grasses of low forage-producing capacity, the quantities of which are highly variable. The renovation of these ranges, if undertaken, requires the removal of the existing sagebrush cover and the establishment of one or more species of high-value perennial forage plants. Reseeding with crested wheatgrass, or other grasses, has enabled the restoration of many ranges to higher production levels.

Range reseeding has been a comparatively recent development. The Bureau of Land Managment has reseeded approximately 385,693 acres of rangeland in Idaho since 1935. However, about 50 percent of this has been accomplished since the passage of the Halogeton Control Act in 1951. In 1957, reseedings by the Bureau were equal to more than 10 percent of all previous reseedings. Comparable data for other agencies are represented in Table 1.

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Table 1.—Area seeded in southern Idaho by three federal agencies and private landowners in soil conservation districts.[1]

ORGANIZATION	Area seeded in 1957	Area seeded prior to 1957	Total area seeded
		acres	
Bureau of Land Management	39,234	346,459 [2]	385,693 [2]
Forest Service	7,772	131,375	139,147
Fort Hall Indian Agency	400	44,215	44,615
Private landowners in soil conservation districts in southern Idaho [3]	22,100	148,464	170,564
Total	69,506	670,513 [2]	740,019 [2]

[1] Information on area seeded supplied through the courtesy of the Idaho State Office of the Bureau of Land Management, the Regional Office of the Forest Service, th Idaho State Soil Conservation Service office, and Frellin Owl, Superintendent, Fort Hall Indian Agency.

[2] Approximate

[3] Of all land seeded in private ownership, 50 to 70 percent is estimated to be within soil conservation districts.

Description of the Area

TOPOGRAPHY

Southern Idaho is made up of the large flat to rollling volcanic Snake River Plain, extending from the Oregon border at Weiser eastward across the state into Wyoming. The elevation varies from a low of 2,123 feet at Weiser to a high of 5,883 feet at Spencer in the northeast. The Snake River Plain is bounded by foothills and mountain ranges both to the north and south. The elevation of these mountainous areas is extremely variable, attaining 10,000 feet in some places. There are many valleys within these mountain ranges and a large, high plateau area extending across Owyhee and Twin Falls counties of Idaho south into Nevada.

CLIMATE

Climate is the key to the distribution and development pattern of both vegetation and soils. Due to the nature of the topography, similar patterns of vertical zonation have developed for climate, vegetation, and soils. These patterns are well illustrated by the generalized precipitation map in Figure 1. There are increases in precipitation in going from west to east on the Snake River Plain and in going up mountain slopes to the north and south. Extreme contrasting variations in climate occur locally in the mountain valleys.

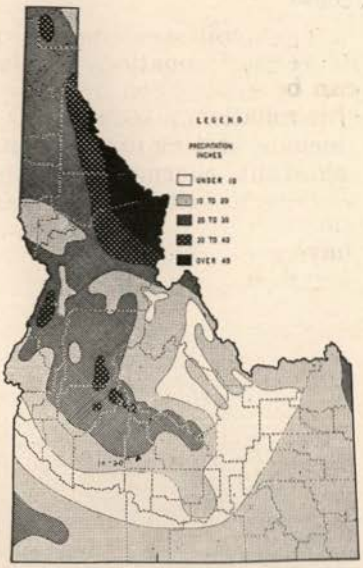


Figure 1.—Rainfall distribution in Idaho

Source: Parrott, Charles F., and G. Orien Baker, Land Capability for Soil and Water Conservation in Idaho, Idaho Agricultural Experiment Station Bulletin No. 286.

The typical seasonal distribution of precipitation in the southern Idaho range area is indicated by the weather data obtained at the Burley weather station (Figures 2 A and 2 B). The averages indicate that the major amount of total rainfall occurs during the months of November through May. July is generally the driest and hottest month. The figures presented are averages, and considerable variation exists from year to year in the monthly amount of precipitation received.

Although the absolute amount of rainfall received may be different in various localities, the typical relative distributions of rainfall and temperature are the same.

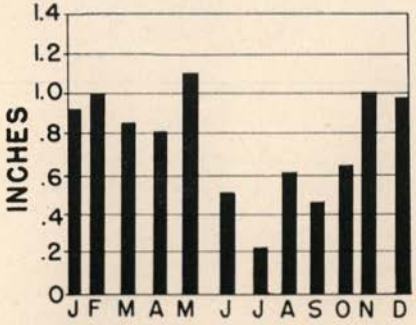


Figure 2-A.—Average monthly precipitation Burley, Idaho (1930-1952 average).

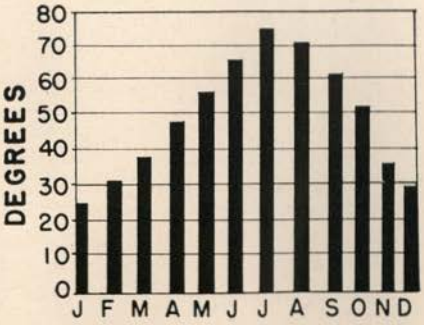


Figure 2-B.—Average monthly temperatures Burley, Idaho (1930-1952 average).

SOILS

The soil development in southern Idaho follows a pattern of vertical zonations similar to that displayed by climate. This can be easily seen by comparing Figures 1 and 3. As a result of this zonation, a sequence of great soil groups has developed. They include, starting in the driest position, grey desert, sierozem, brown, chestnut, chernozem, and prairie—the latter developed under the dominant influences of calcification and sagebrush-grass vegetation. At higher elevations, forest cover and more effective climate have given rise to podzolization, and, consequently, western brown forest and grey wooded soils are predominant.

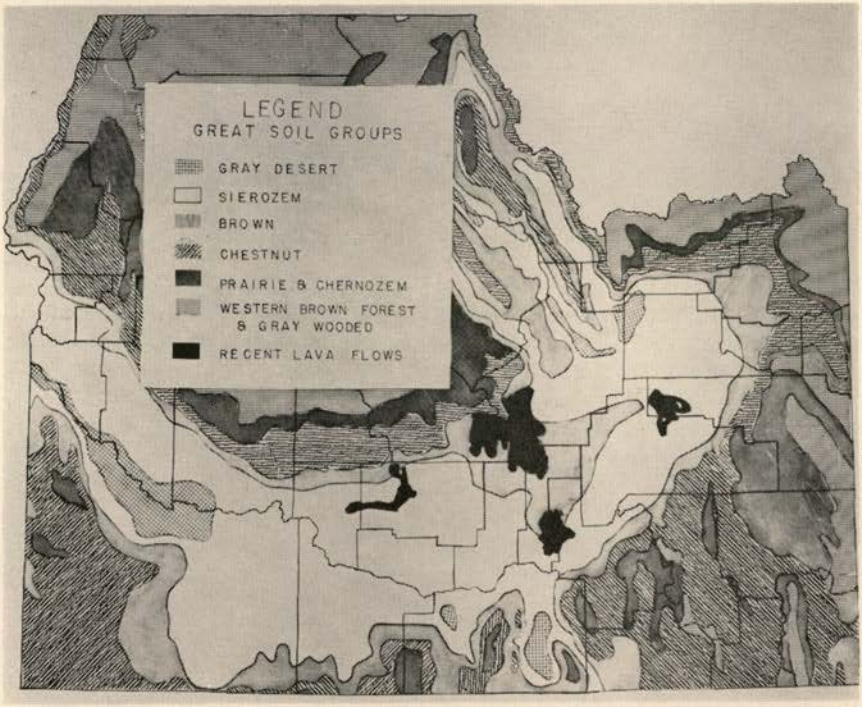


Figure 3.—Distribution of great soil groups in southern Idaho.

Sierozem soils occupy the major portion of the Snake River Plain. In conjunction with this group are extensive areas of raw lava and shallow soils over lava. However, many soils in this zone are formed from deeper loess and alluvium and are influenced strongly by these parent materials. They are characterized by very low levels of organic matter and by high lime accumulation. Native vegetation growing on these soils has been severely depleted.

The brown soils are light colored soils occuring at slightly higher elevations with more effective moisture. They have slight-

ly higher organic matter and high lime zones. These soils are still strongly influenced by the parent materials.

The chestnut, chernozem, and prairie soils are darker soils showing higher accumulation of organic matter, deeper lime zones, and clay movement and accumulation in the subsoil. These soils have been developed in areas located at still higher elevation and where moisture is more effective.

These great soil groups become increasingly productive in going from the grey desert to prairie soils, i. e., as elevation increases. However, inherent differences in soil series within each group make for variability. In general, the topography of the sierozem and brown soils lends itself more to reseeding than does the steeper and more irregular relief of the chestnut to prairie soils.

Costs of Reseeding

The usual method of reseeding rangelands in southern Idaho is to remove the existing, undesirable vegetation either by burning or by mechanical means—plowing or disking—during the summer or fall. The seed is drilled into the ground during the fall of the year. Normal fall and winter precipitation followed by adequate spring and early summer moisture permits the seed to germinate and the seeding to become well-stablished during the first season following planting. The seeding is protected from livestock grazing for two growing seasons, light use being permitted in the fall of the second year after planting .

In this proceedure there are four types of cost involved:

1. the cost of seedbed preparation,
2. the cost of seed,
3. the cost of seed application, and
4. the cost of protecting the seeding.*

The cost data used in this study were obtained primarily from ranchers and public land agencies in Idaho. Information on sites as far north as Arco and Salmon were included. In southern Idaho, each area in which a significant amount of reseeding has been done was included. Forty-seven seedings in all were studied, although cost information was not available for all cost categories on all of the seedings. To a large extent, the costs presented here represent only variable costs since a considerable number of the reseedings on public lands were done under contract.

COST OF SEEDBED PREPARATION

Of the 47 seedings for which costs were secured, 17 had adequate information on the number of man-hours which were re-

* An additional cost which may be incurred is the cost associated with deferring the area being improved from grazing for a one - or two-year period.

quired for mechanical seedbed preparation. The size of these seedings varied from 10 to 7,500 acres. Appendix Table I shows the total and per acre labor requirements of these seedings. Labor requirements per acre tended to decrease as the size of the seeding increased. This is demonstrated graphically in Figure 4 which relates the labor requirement per acre to the size of the seeding.

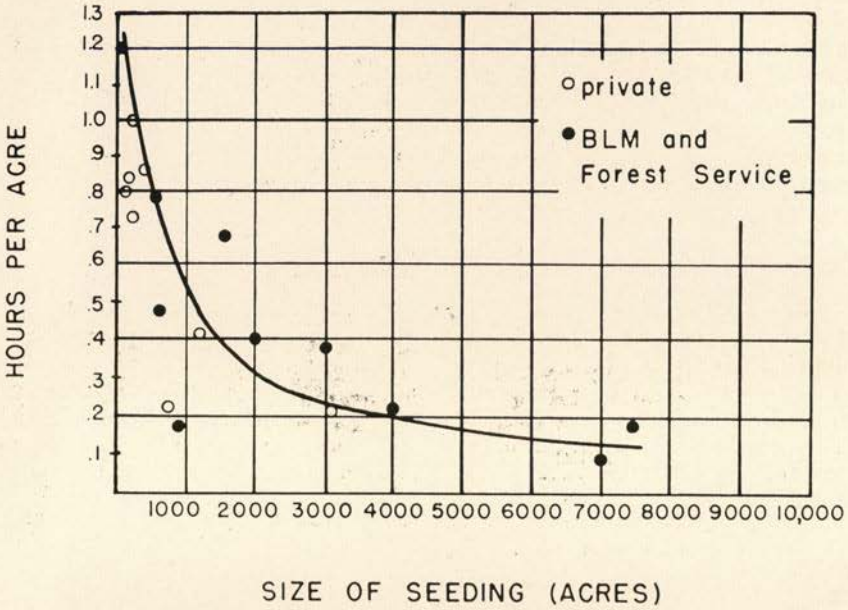


Figure 4.—Relationship between size of seeding and hours of labor per acre required for mechanical seedbed preparation.

The average cost per acre for mechanical seedbed preparation on the seedings which were studied was $3.61 * Costs for seedbed preparation ranged from a low of $1.42 to a high of $11.07 per acre.

There are two reasons for the wide variation: first, the terrain on which these seedings were made is not uniform; secondly, some of the seedings were plowed by contract—others by the operators themselves. The two are not separated here. Appendix Table II shows the costs incurred on individual seedings for seedbed preparation and specifies the type of equipment used on each seeding; Appendix Figure I shows the frequency distribution of associated per acre costs.

Controlled burns were carried out on eight private and Bureau of Land Management seedings. Six reported the time requirements per acre. The time requirements ranged from .182 to 1.30

* All cost figures which appear in this report are adjusted by the 1956 index of prices paid by farmers.

hours per acre. Here, too, the labor requirement per acre decreased as the size of the burn became larger (see Appendix Table III).

COST OF SEED

The average-per-acre cost for seed on the seedings included in this survey was $4.15. However, seed costs ranged from a low of $0.61 per acre to a high of $12.17 per acre. The typical seeding was made using approximately 6 pounds of crested wheatgrass seed per acre. Of 47 seedings for which data was obtained, all but four used either crested wheatgrass alone or a mixture of crested wheatgrass and legumes. In most mixtures, crested wheatgrass made up at least five-sixths of the seed. Two of the remaining four seedings used intermediate wheatgrass.

COST OF SEED APPLICATION

The average cost of seed applications on all the seedings studied was $1.67 per acre. Depth of seeding was less than 1 inch on most of the seedings. On some of the seedings, the drill was used to broadcast the seed. The per acre costs for seed application ranged from a low of $0.38 to a high of $6.05 per acre as indicated in Appendix Table V and Appendix Figure III. Per acre costs ranging between $0.50 and $2.00 were reported on the majority of the seedings.

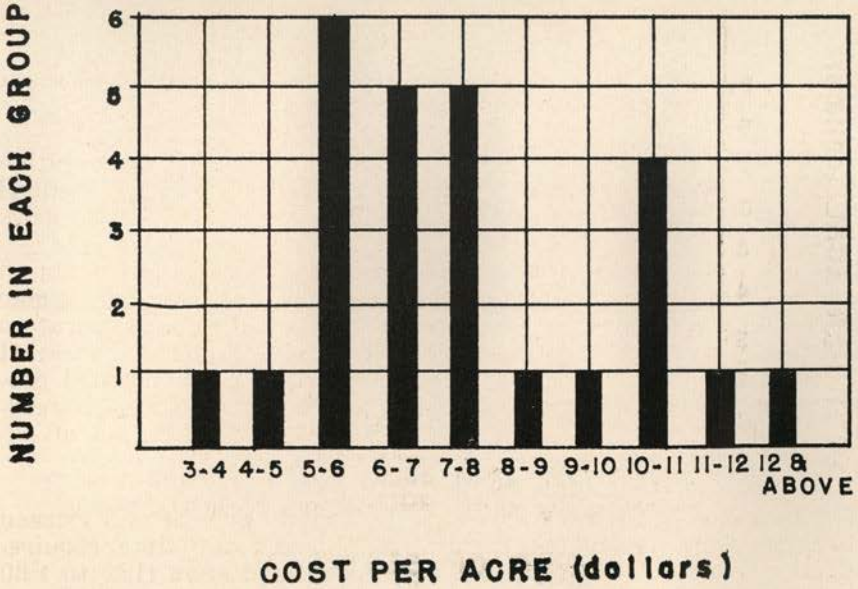


Figure 5.—Frequency distribution of total costs of range reseeding.

COST OF PROTECTING THE SEEDING

Eleven of the cooperators included in the study indicated that they established fences to protect their seedings (Appendix Table VI). The average cost per mile was $759.36. Costs of fencing ranged from a low of $479.48 per mile to a high of $1,117.00 per mile.

TOTAL COST OF RANGE RESEEDING

The average total cost on those seedings which used mechanical seedbed preparation was $7.52 per acre. This includes the cost of seedbed preparation, the cost of seed and the cost of seeding. It does not include cost of protecting the seeding or any costs of deferred use. Figure 5 indicates that the majority of the seedings had total costs between $5.00 and $11.99 per acre.

Appendix Table VII and Figure 6 indicate that the average total cost on seedings of less than 1,000 acres is considerably greater than it is for larger seedings. In appears that, once a certain size seeding is reached, total costs per acre tend to remain constant.

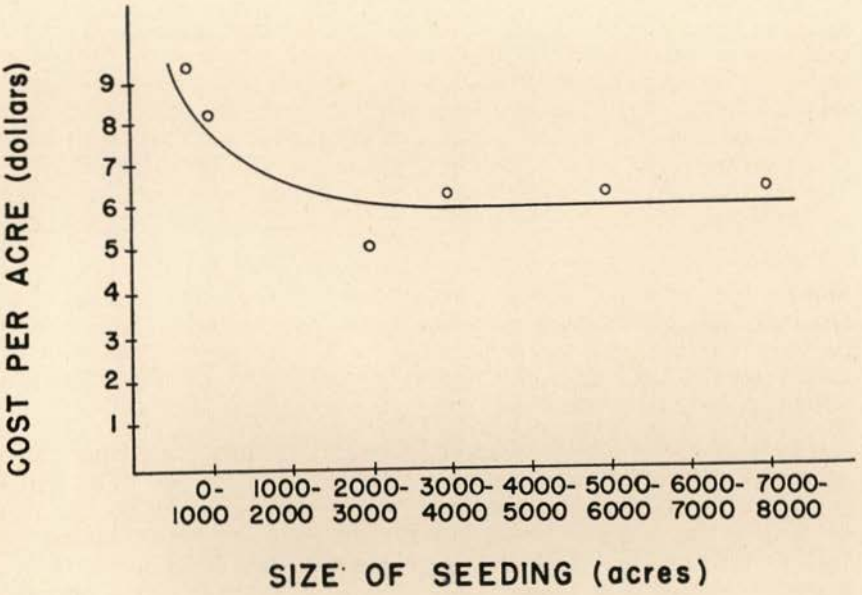


Figure 6.—Relationship between size of seeding and total cost per acre.

Forage Production on Reseeded Ranges

A cooperative study involving the University of Idaho, the Bureau of Land Management, and several livestock producers of Cassia County was initiated in 1954. The purpose of this study has been to evaluate the effects of season and intensity of livestock use on forage and animal production on reseeded ranges.

During the fall of 1954, six 160-acre pastures, located on the northeast side of a 7,000-acre crested wheatgrass seeding, were fenced by the Bureau of Land Management. Three pastures were selected for each season of use, spring (May 1 - June 15) and fall (October 1 - November 15). Attempts were made to graze one pasture each season at levels which would result in the utilization of 50 percent, 65 percent, and 80 percent of the available forage. Due to favorable growing conditions and a limitation in the number of animals available, these levels of use were not reached until the fall of 1957. Information on forage production and animal gains is presented in Table 2. Information on animal weights and gains by season, year, and pasture is presented in Appendix Table VIII.

Cattle for the experimental pastures were provided by ranchers who had permits to graze the adjacent area. The animals used in the grazing trials were primarily yearling Hereford heifers and steers. Each animal was individually weighed, ear tagged, dye branded, graded for type and stocker condition, identified by sex and ownership, and then distributed randomly to the three pastures. The animals were weighed three times during the 6-week trial period—at the beginning of the trial, at the end of a 28-day period, and at the conclusion of the trial. All weights were taken after the animals were held from feed and water for 12 to 16 hours. The animals grazing in the spring had an average beginning weight of 392.5 pounds while those in the fall weighed 604.5 pounds.

Forage production for the pastures grazed in the spring was determined prior to May 1; consequently, these values do not show the increased production resulting from growth during the grazing period. Production measurements for the pastures grazed in the fall were obtained in early September after the growth of crested wheatgrass was completed.

Animal gains were greatest during the spring grazing period at which time crested wheatgrass is most nutritious. The greatest average daily gain was made in the spring of 1956, the year in which the initial forage production was lowest. During the fall period, crested wheatgrass is apparently little more than a maintenance forage unless conditions are favorable for a substantial production of fall growth.

Table 2.—Forage production, animal weights, gains, and stocking rates[1] for two seasons in three years on the Point Springs experimental pastures.

Season	Year	Forage production per acre	Average initial animal weight	Average total gain per animal	Average daily gain	Gain per acre	Average unit months	Acres per animal unit month
		pounds						
Spring	1955	332[2]	396	106.6	2.37	32.64	112.5	4.27
	1956	279	402[3]	121.8	2.70	38.06	119.5	4.02
	1957	489	387	102.4[3]	2.27[3]	42.13[4]	160.4	2.99
Fall	1955	587	602	2.3	0.06	0.59	132.4	3.62
	1956	710	625	12.9	0.29	6.25	215.3	2.23
	1957	891	594	27.1	0.60	23.64	437.6	1.10

[1] Expressed in animal unit months. Animals used were equated to animal units on the basis that requirements of various weight animals are proportional to the three-fourths power of the body weight. On this basis a 400-pound animal is equivalent to 0.5 animal units and a 600-pound animal is equivalent to 0.68 animal units.

[2] Spring forage production figures are taken prior to grazing and do not include the increased production resulting from growth during the grazing period

[3] These weights are for the animals that were placed on the pastures at the beginning of the trial and do not include the 135 head added at the time of the 28th day weighing. The 135 head had an average initial weight of 408.4 pounds and an average daily gain of 1.89 pounds for the two-week period they grazed the pastures.

[4] Includes all animals that grazed in the pastures.

Value of Range Reseeding

The problems involved in the evaluation of a range reseeding program are numerous and often complex. The evaluation procedure itself is relatively simple. As a consequence of an investment in reseeding, certain outputs of beef are expected to be forthcoming over an expected period of time which can be sold at some price. Thus, a stream of expected incomes resulting from the program can be conceived, which, when summed over the lifetime of the reseeding, are indicative of the value of the improvement in terms of total expected income.

The presence of expected values—outputs, prices, lifetime, etc., —introduces the first complication into the valuation procedure. The future, of course, is unknown or, at best, known only in a conditional sense, e. g., the chances may be 50-50 that the price of beef 10 years from now will be greater than $0.20 per pound. Furthermore, uncertainty exists regarding the results which will, or could, result in one particular situation, even though knowledge is complete concerning the results obtained in a similar situation. An example is provided in the uncertainty concerning typicalness, or applicability, of the results obtained at Point Springs when compared to other range areas.

Despite these uncertain conditions, the rancher, or other agent, considering an investment in range reseeding must arrive at some grouping of expected values. Insofar as possible, he attempts to base his expectation on previous experience, either his own or that of others, thereby reducing as much as he can the uncertainty involved.

Further complications are introduced when consideration is given to the use to be made of the valuation. Placing a value upon a range reseeding investment serves little purpose unless it is used to answer some question such as whether or not this investment, or some other investment, or no investment at all, should be made. Interest is centered in the relationship between the costs of making the investment relative to the expected returns. Indirectly, the cost-return analysis for the particular investment attempts to consider the cost-return relationship of all other (alternative) investments as well.

The usual procedure under these circumstances is to compare the initial investment cost with the sum of the discounted future net returns resulting from the investment. The sum of discounted future returns can be expressed mathematically as follows:

$$V_o = \sum_{t=1}^{n} \frac{R_t - C_t}{(1+r)^t}$$

V_o - sum of discounted net returns (present value)

R_t - gross receipts resulting from the investment

C_t - annual costs of the investment

r - rate of discount

t $(=1 \ldots\ldots n)$ - year from date of investment to termination life of the investment.

C_t in the above expression represents annual costs arising from the investment and not the costs of the investment itself, These costs, like the returns mentioned previously, are expectational.

The definition of the rate of discount is quite flexible. It is essentially a cost item comprised of an interest rate representing the cost of using borrowed funds, or the interest income foregone if the funds are not borrowed, and an adjustment for the amount of risk which the investor feels subjectively to be involved in undertaking the investment. Since subjective risk is not measurable, the valuation example presented below does not include this factor in the discount rate. For simplicity in presentation, therefore, an assumed market rate of interest is used for discounting purposes. Comparisons between investment alternatives, of equal risk, are possible as long as all alternatives are evaluated using the same rate of discount.

In order to illustrate the valuation procedure, as well as to emphasize the effects of variations in expectations and discount rates, the following situation is considered. A rancher has 640 acres of native range capable of carrying 76 steers at a rate of gain of 0.0 pounds per animal per day during the fall (October 1 - November 15) and 1.0 pounds per animal per day during the spring (May 1 - June 15). He can borrow, or lend, sufficient capital for reseeding the 640 acre tract at a certain rate of interest. If he decides to reseed, he can reseed the entire tract at one time, or he can reseed 50 percent now and 50 percent at some later date (e.g., 3 years from now). If he reseeds, he can carry 200 steers at daily gains of 2.4 pounds and 0.0 pounds per head during the spring and fall periods respectively. The problem is to decide whether he should reseed and, if so, which reseeding program to follow. It may also be relevant to consider whether or not there exist any alternatives which are preferable to reseeding.

The data used in estimating costs and returns from reseeding were obtained from grazing studies conducted in Idaho, Montana,

and Utah. The costs of reseeding and maintenance for each of the possible programs are presented in Table 3. The costs are incomplete to the extent that those additional costs associated with an increase in herd size from 76 to 200 steers are not included. In the absence of relevant data, these costs have been excluded.

Using data presented in Appendix Table VII, the cost of reseeding a tract of 640 acres can be presumed to be greater than the average of $7.52 per acre. If the reseeding were done in one opration, the per acre cost is estimated to be about $9.52; if 320 acres are reseeded in each of two operations, the cost of reseeding is estimated at $11.12 per acre.

Under the two-period reseeding program, the costs of reseeding and fencing in the first year are $5,928.40. In year 3, fencing costs are reduced by $790, the cost of fencing between the two tracts which had been fenced in year 1.

Table 3.—Costs of range reseeding under two alternative programs.

COST ITEM	Alternative I (640 acres)	Alternative II (2-320 acres)
Reseeding cost,[1] year 1	$ 6,092.80	$ 3,558.40
Fencing[2]	3,160.00	2,370.00
Reseeding cost, year 3		3,558.40
Fencing		1,580.00
Total costs, year 3 discounted at 5 percent[3]		4,438.76
Total initial cost, year 1	$ 9,252.80	$ 10,367.16

[1] Includes cost of mechanical seedbed preparation, seed, and seeding.
[2] Estimated cost of $790.00/mile.
[3] ($5,138.40) / $(1.05)^3$ = ($5,138.40) x (0.86384)

The total cost of reseeding 320 acres in year 3 is $5,138.40. However, since this capital could be employed in some other use at an assumed return of 5 percent per year during years 1 and 2, the actual cost in year 1 of reseeding in year 3 is $4,438.76. The total cost, then, of reseeding two 320-acre tracts in terms of capital requirements in year 1 is $10,367.16.

Undoubtedly, maintenance costs such as spraying to reduce or prevent reinvasion of the reseeding by brush can be expected to occur during the lifetime of the reseeding. These costs will not be considered here.

The rancher is assumed to hold the following expectations:

1. The entire 640 acres, whether reseeded in one or two steps, will have a carrying capacity of 200 steers at 2.4 and 0.0 pounds gain per animal per day for the spring and fall seasons respectively;

2. The reseeded range will not permit grazing for the first two years after reseeding, and, then, during successive years will be grazed at 80, 90, and 100 percent of capacity;

3. The lifetime of the seeding will be 20 years;

4. The price of beef will be either 15 cents or 20 cents per pound and the price at which he can buy or sell steers of equal weight will be identical.

In estimating returns, only the returns actually attributable to the reseeding are of interest. Thus, it is necessary to deduct from the gross return each year that income which would have been obtained in the absence of reseeding, i. e., the annual return obtainable from the native range. Since the native range is assumed to produce 3,496 pounds of beef per year, the "opportunity cost" for the 640 accre reseeding is $524.40, or $699.20, depending upon whether beef is priced at 15 or 20 cents.

Annual returns, net of "opportunity costs" are presented in Table 4 below. The relevant time period for alternative II involving two 320-acre reseedings, is two years longer than for alternative I, since the second 320 acre tract with expected life of 20 years is not reseeded until year 3.

Table 4.—Annual returns, net of "opportunity cost," for alternative reseeding programs and beef prices.

Year	Alternative I price of beef		Alternative II price of beef	
	$ 0.15	$ 0.20	$ 0.15	$ 0.20
1	$ -524.40	$ -699.20	$ 0.00	$ 0.00
2	-524.40	-699.20	0.00	0.00
3	2,125.20	2,833.60	800.40	1,067.00
4	2,456.40	3,275.20	966.00	1,287.80
5	2,787.60	3,716.80	2,456.40	3,275.20
6	.	.	2,622.00	3,496.00
7	.	.	2,787.60	3,716.80
8				
9				
.	.	.	.	.
20	2,787.60	3,716.80	2,787.60	3,716.80
21	.	.	1,393.80	1,858.40
22	.	.	1,393.80	1,858.40
Total	$ 46,368.00	$ 61,823.60	$48,658.80	$ 64,878.00

The above figures are, of course, total incomes obtained over the grazing period. However, the value of a dollar in year 20 cannot be considered equal to that of a dollar today. If the rancher were interested in obtaining 1 dollar 20 years from now, it would be possible, if the rate of interest on farm mortgages were 5 percent, to loan $0.38 in the mortgage market which, at the end of 20 years would have grown to $1.00. Thus, $1.00 in year 20 is equal to only $0.38 at the time at which the reseeding cost is incurred. In order to compare present costs with future returns it is desirable to use figures having a common time dimension. This is achieved by discounting the returns at the appropriate rate of interest. The revelant comparisons are presented in Table 5.

Table 5.—Total returns, discounted returns, and rate of return for alternative reseeding programs, beef prices and rates of discount.

Item	Alternative I price of beef		Alternative II price of beef	
	$ 0.15	$ 0.20	$ 0.15	$ 0.20
Total returns	$ 46,368.00	$ 61,823.60	$ 48,658.80	$ 64,878.00
Total discounted returns (@ 5%) [1]	27,582.94	36,777.25	26,934.82	35,912.76
Total costs	9,252.80	9,252.80	10,367.16	10,367.16
Return above cost	18,330.14	27,524.45	16,567.66	25,545.60
Rate of return on investment [2]	198.1%	297.5%	159.8%	246.4%
Total returns	46,368.00	61,823.60	48,658.80	64,878.00
Total discounted returns (8%) [1]	20,511.94	27,302.61	19,685.08	29,248.32
Total costs	9,252.80	9,252.80	10,367.16	10,367.16
Return above cost	11,259.14	18,049.81	9,317.92	15,881.16
Rate of return on investment [2]	121.7%	195.1%	89.9%	153.2%

1

$$V_o = \sum_{t=3}^{20} \left[\frac{R_t}{(1+r)^t} \right] + \sum_{t=1}^{2} \left[R_t \ (1+r)^t \right]$$

2

$$r_r = \frac{V_o - k_o}{k_o}$$ where k_o is the total cost of the investment.

Despite the fact that the two-period seeding program has a greater tot al income (net of opportunity costs) over the investment life, the additional two years income at the end of the period when discounted is too low to offset the longer period of reduced income at the beginning of the life.

The above situation, perhaps, tends to overstate the profitability of range reseeding. For one thing, it fails to include the additional capital costs resulting from increasing the herd size from 76 to 200 steers, as well as the variable costs involved in handling more animals. Moreover, the situation considered tends to favor a reseeding program by assuming that the only stock involved are yearling steers. The returns to reseeding in a cow-calf operation may not be as great.

However, it should be emphasized that the rate of return above cost is very high even when the reseeding is made using funds borrowed at 8 percent interest. Returns, of course, will decrease as the response of the reseeding decreases. Responses materially different from those experienced in the Point Springs area are probable and the rates of return will vary accordingly.

Appendix

COST OF RANGE RESEEDING DATA (SUPPLEMENT)

Appendix Table I.—Total labor requirements and labor requirements per acre used in seedbed preparation.

Size of seeding	Owner	Total labor requirements	Labor requirements per acre
acres		hours	
10	Public	12	1.200
25	Private	20	.800
160	Private	132	.825
232	Private	200	.862
250	Private	180	.720
575	Public	416	.723
654	Public	302	.462
680	Private	160	.235
900	Public	154	.171
1,204	Private	500	.415
1,600	Public	1,040	.650
2,200	Public	880	.400
3,000	Public	1,028	.343
3,185	Private	800	.251
4,000	Public	960	.240
7,053	Public	600	.085
7,500	Public	1,371	.183

Appendix Table II.—Equipment and costs of mechanical seedbed preparation.

Size of seeding	Owner	Total cost	Cost per acre [1]	Tractor H. P. [2]	Equipment Type [3]	Size	Number
acres		dollars				feet	
10	Public	35.49	3.55	59.33	Plow	10	1
125	Private	573.16	4.59	59.33	Disk (2)	12	1
160	Private	770.60	4.82	83.28	Disk (2)	10	2
180	Private	1,094.70	6.08	83.28	Disk (2)	10	2
190	Private	388.06	2.05	30.22	Plow	7½	1
232	Private	532.49	2.29	29.03	Disk (2)	10	1
250	Private	954.48	3.82	83.28	Disk (2)	12	1
320	Private	1 615.64	5.05	83.28	Disk (2)	10	2
320	Private	1,960.09	6.12	83.28	Disk (2)	12	2
350	Public	2,124.80	6.07	59.33	Disk	—[4]	1
524	Public	2,819.80	5.38	83.28	Disk (2)	—	1
575	Public	2,635.97	4.59	85.34	Plow	10	2
840	Private	2,526.48	2.97	39.35	Plow	10	1
1,204	Private	4,781.21	3.97	39.35	Plow	10	1
1,237	Forest Service	4,052.45	3.28				
650				83.28	Pipe Harrow	—	1
250				59.33	Disk	—	1
337				83.28	Plow	16½	1
1,292	Private	3,542.34	2.74	83.28	Plow	10	3
1,700	Public	9,621.05	5.66		Disk (2)	—	—
1,900	Forest Service	13,052.70	5.80	83.28	Disk	14	1
2,500	Public	5,608.13	2.24	30.32	Rotobeater	—	—
2,700	Public	3,827.83	1.42	85.34	Disk	20	1
				85.34	Disk (2)	10	2
3,000	Public	11,865.40	3.96	59.33	Disk (2)	16	1
3,185	Private	7,561.21	2.72	85.34			
				83.28	Plow	10	6
4,454	Public	9,278.21	2.08	85.34	Disk	10	2
4,480	Public	29 032.64	6.48	30.22			
				39.35	Plow	9	3
5,000	Public	12,462.50	2.49	85.34	Plow (2)	12[5]	1
5,120	Public	15,975.68	3.12		Disk (2)	—	—
7,053	Public	27,776.09	3.94	249.84	Plow	10	—

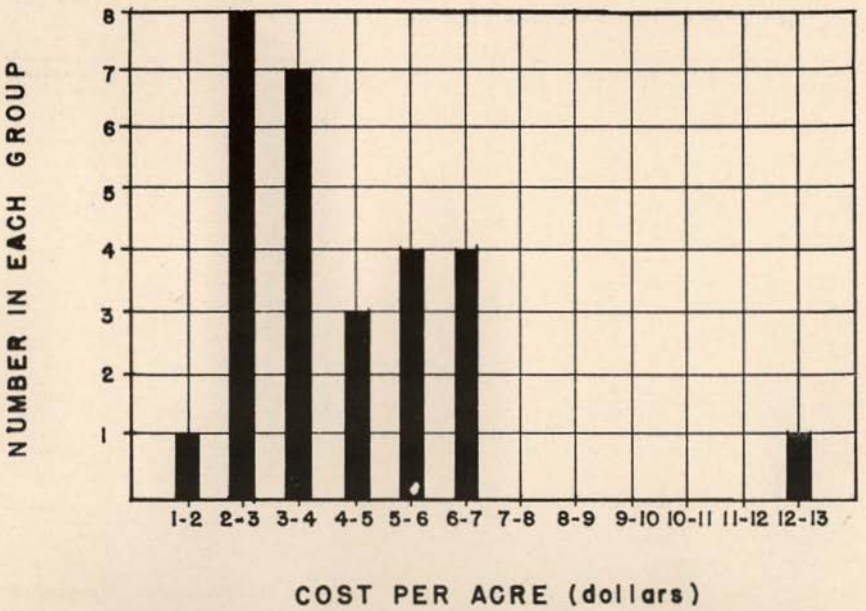
[1] /Adjusted to 1956 price level by index of prices paid by farmers.

[2] / Rated drawbar horsepower.

[3] / Plow is wheatland type; disk is offset disk type. Numbers in parenthesis indicate number times seeded area was plowed or disked.

[4] / Dashes indicate not determined.

[5] / Used on 2,500 acres.



Appendix Figure I.—Frequency distribution of costs per acre for mechanical seedbed preparation.

Appendix Table III.—Total labor requirements and labor requirements per acre of seedbed preparation by burning.

Size of burn	Total labor requirements	Labor requirements per acre
acres	hours	
30	27	.90
230	300	1.30
600	672	1.12
785	144	.183
1,180	400	.34
1,600	292	.182

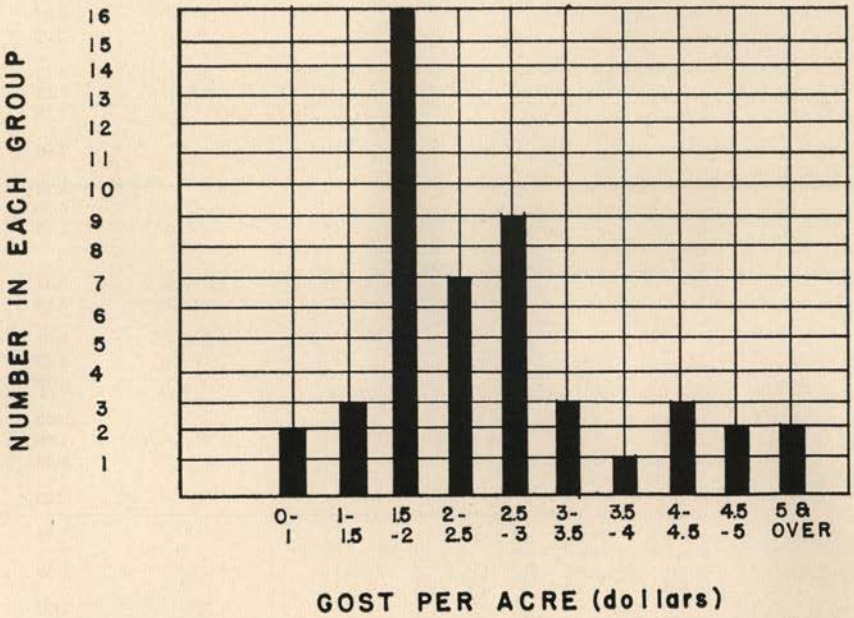
Appendix Table IV.—Cost of seed, seed mixtures used, and rate of seeding per acre on 47 range seedings in southern Idaho.

Size of seeding	Type of seed	Rate of seeding	Cost of seed	Cost per acre
acres		pounds	dollars	
10	Michigan Hybrid Crested wheatgrass	1.0 8.0	15.65	1.57
10	Michigan Hybrid Crested wheatgrass Crested wheatgrass	1.0 8.0	15.65	1.57
10	Michigan Hybrid Crested wheatgrass	1.0 12.0	17.46	1.75
10	Michigan Hybrid Crested wheatgrass	1.0 8.0	15.65	1.57
10	Intermediate wheatgrass	12.0	121.68	12.17
77	Crested wheatgrass Sweet clover	10.0 1.0	316.21	4.11
125	Yellow sweet clover Crested wheatgrass	1.7 5.2	256.68	2.05
155	Crested wheatgrass Alfalfa	6.0 1.0	397.15	2.56
160	Scandia alfalfa Crested wheatgrass	——[1]	638.82	4.00
180	Crested wheatgrass	6.1	447.45	2.48
190	Crested wheatgrass	6.0	857.85	4.52
250	Sweet clover Crested wheatgrass	1.0 9.0	953.91	3.82
320	Crested wheatgrass	10.5	1,314.71	4.11
320	Crested wheatgrass	9.0	813.85	2.55
337	Crested wheatgrass	6.0	751.95	2.23
350	Crested wheatgrass and Alturus (sweet clover) mixed	8.8	717.57	2.05
350	Crested and Blue Bulbous wheatgrass	6.0	1,672.81	4.78
515	Crested wheatgrass	2.0	1,643.07	3.19
524	Crested wheatgrass	4.8	616.46	1.18
575	Mixture of: Intermediate Whitmar Beardless, Blue bunch and Crested wheatgrass	8.0	1,993.55	3.47
600	Blue Crested wheatgrass	2.7 0.9	413.96	0.69
600	Crested wheatgrass	2.7	366.90	0.61
840	Crested wheatgrass	5.0	1,788.70	2.13
860	Yellow sweet clover Crested wheatgrass	2.0 5.0	2,350.90	2.73
900	72 percent Crested wheatgrass	6.0	2,294.17	2.55
1,100	Crested and Blue wheatgrass	6.0	1,651.40	1.50
1,204	Yellow sweet clover Crested wheatgrass	1.0 4.9	2,105.07	1.74
1,240	3 percent Yellow sweet Clover 97 percent Crested wheatgrass	6.5 6.5	3,479.18	2.80
1,280	Yellow sweet clover Crested wheatgrass	0.2 5.0	2,264.72	1.76
1,285	Sand dropseed Crested wheatgrass	22.4 3.1	2 069.83	1.56
1,600	Yellow sweet clover Crested wheatgrass	0.6 4.5	3,037.11	1.90
1,700	Yellow sweet clover Crested wheatgrass	0.5 6.0	4,786.07	1.90
1,800	Crested wheatgrass	5.4	3,992.34	2.22
2,200	Crested wheatgrass	6.0	6,652.00	3.02
2,250	Mixture	8.0	3,727.00	2.99
2 500	Crested and intermediate wheatgrass	——[1]	3,663.98	1.47
2,550	Crested wheatgrass	4.8	4,644.07	1.82
2,700	Crested and Blue wheatgrass	6.5	4,645.16	1.72

(continued on next page.)

Size of seeding	Type of seed	Rate of seeding	Cost of seed	Cost per acre
acres		pounds	dollars	
3,000	Yellow sweet clover Crested wheatgrass	1.3 7.3	5,903.00	1.97
3,000	Mixture	6.0	4,612.50	1.54
3,185	Crested wheatgrass and Yellow sweet clover	6.0	5,923.18	1.86
3,315	Yellow sweet clover Crested wheatgrass	1.5 3.0	5,328.90	1.60
4,480	Crested wheatgrass	7.8	11,621.26	2.59
4,484	Crested wheatgrass	5.0	8,189.31	1.79
5,000	Crested and Intermediate wheatgrass	---[1]	7,327.95	1.47
5,120	Yellow sweet clover Crested wheatgrass	0.2 6.7	14,164.48	2.77
7,053	Yellow sweet clover Crested wheatgrass	1.1 5.5	17,407.42	2.47

[1] Dashes indicate no rates indicated.

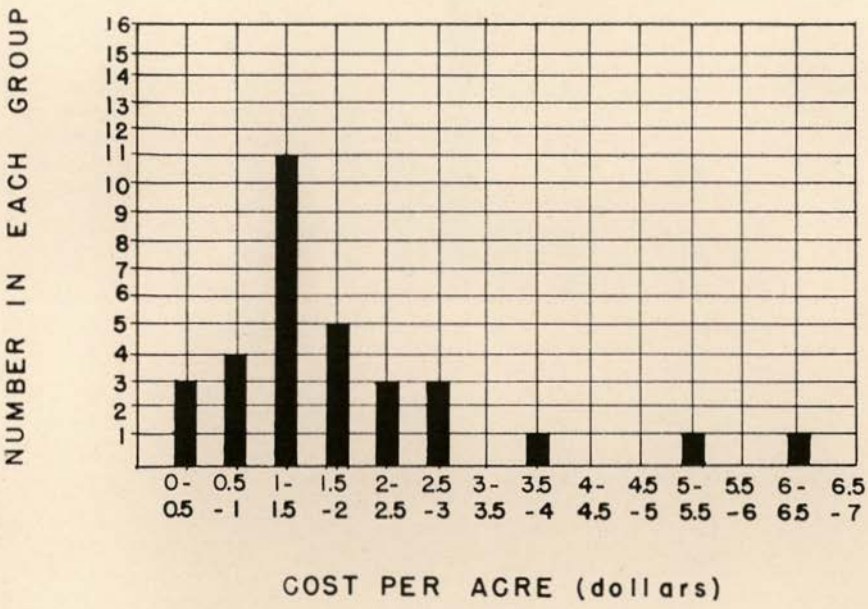


Appendix Figure II.—Frequency distribution of seed cost per acre on 47 southern Idaho seedings.

Appendix Table V.—Equipment used and cost of seed application.

Size of seeding	Owner	Total cost	Cost per acre [1]	Tractor	Equipment		
					Type	Size	Number
acres		dollars		H. P. rating		feet	
10	Public	11.15	1.12	59.33	Drill	12	2
40	Public	16.00	.40	39.35	Drill	12	3
100	Private	111.66	1.12	30.22	Drill	12	1
160	Public	261.22	1.63	26.30	Drill	12	—[2]
160	Private	413.71	2.59	29.03	Drill	10	1
190	Private	111.55	.59	30.22	Drill	12	1
232	Private	382.28	1.65	20.00	Drill	10	1
250	Private	1,334.67	5.34	20.00	Drill	12	1
320	Private	1,132.76	3.54	83.28	Drill	12	1
320	Private	260.15	.81	20.00	Drill	12	1
350	Public	2,117.01	6.05	29.03	Drill	12	3
515	Public	695.40	1.35	26.30	Drill	12	3
524	Public	665.55	1.27	[3]	Drill	—	1
575	Public	1,572.93	2.74	[3]	Drill	12	1
600	Public	1,522.61	2.54	26.30	Drill	12	—
785	Public	297.25	.38	67.08	Drill	—	3
840	Private	2,512.69	2.99	29.03	Drill	12	3
860	Public	1,501.43	1.75	26.30	Drill	12	3
1,100	Public	1,635.47	1.49	39.35	Drill	12	3
1,204	Private	389.65	.33	29.03	Drill	10	3
1,220	Public	1,830.60	1.50	[3]	Drill	10	1
1,240	Public	1,645.47	1.33	83.28	Drill	10	3
1,280	Public	1,892.77	1.48	59.33	Drill	12	3
1,292	Private	1 507.11	1.17	83.28	Drill	14	3
1,600	Public	847.45	.53	22.36	Drill	10	3
1,800	Public	2,079.94	1.16	29.03	Drill	12	3
2,250	Public	5,026.50	2.23	30.67	Drill	10	2
2,500	Public	5,982.00	2.39	30.32	Drill	10	2
3,000	Public	2779.05	.93	67.08	Drill	—	3
3,000	Public	4,034.40	1.34	85.34	Drill	10	6
3,185	Private	3,852.39	1.21	92.01	Drill	10	6
5,000	Public	11 964.00	2.39	30.32	Drill	10	2
5,120	Public	9,218.98	1.80	[4]	Drill	10	2

[1] Adjusted to 1956 by index of price paid by farmers.
[2] Dashes indicate not determined.
[3] Pulled behind plow; plowing and drilling were done in one operation.
[4] Power wagon.



Appendix Figure III.—Frequency distribution of costs of seed application.

Appendix Table VI.—Cost of fencing.

Owner	Length of fence	Type of fence	Total cost	Cost per mile [1]
	miles		dollars	
Forest Service	1.50		1,521.90	1,014.60
Forest Service	2.00	4-strand barbed wire	1,615.10	807.56
Public	4.25		4,054.93	954.12
Public	4.50		4,385.69	974.60
Private	1.75		1,195.95	687.40
Public	8.25		3,955.54	479.48
Forest Service	4.75	4-strand barbed wire	5,305.56	1,117.00
Private	5.75		3,320.56	577.36
Private	2.50	4-strand barbed wire	1,881.25	752.52
Public	3.75		2,029.83	541.28
Public	12.00		9 461.47	788.48

[1] Adjusted to 1956 price level by index of prices paid by farmers.

Appendix Table VII.—Summary of costs of range reseeding.

Size of seeding	Cost of seedbed preparation	Cost of seed	Cost of seeding	Total cost per acre [1]
			dollars	
10	3.55	12.17	1.12	16.84
125	4.59	2.05	1.12	7.76
160	4.82	4.00	2.59	11.41
180	6.08	2.48	-- [2]	8.56
190	2.05	4.52	.59	7.16
232	2.29	4.11	1.65	8.05
250	3.82	3.82	5.34	12.98
320	5.05	2.55	3.54	11.14
320	6.12	4.11	.81	11.04
350	6.07	2.05	-- [2]	8.12
524	5.38	1.18	1.27	7.83
575	4.59	3.47	2.74	10.80
840	2.97	2.13	2.99	8.09
1,204	3.97	1.74	.33	6.01
1,237	3.28	2.46	1.50	7.24
1,292	2.74	2.92	1.17	6.83
1,700	5.66	1.90	.53	8.09
1,900	5.80	2.99	2.23	11.02
2,200	--	3.02	-- [2]	14.02
2,500	2.24	1.47	2.39	6.10
2,700	1.42	1.72	.95	4.09
3,000	3.96	1.54	1.34	6.84
3,185	2.73	1.86	1.21	5.80
4,480	6.48	2.59	-- [2]	9.07
5,000	2.49	1.47	2.39	6.35
5,120	3.12	2.77	1.80	7.69
7,053	3.94	2.47	-- [2]	6.41

[1] Adjusted to 1956 price level by index of prices paid by farmers.
[2] Dashes indicate costs of seeding could not be obtained separately and this item is included under Cost of Seedbed Preparation for these cases.

Appendix Table VIII.—Summary of average weight gains of beef cattle grazing crested wheatgrass 1955 - 1957.

Year	Season intensity	Number of animals	Weight			Gain [1]			Average daily gain [2]		
			Initial	28-day	45-day	First period	Second period	Total	First period	Second period	Total
			Pounds								
1955	SPRING										
	Light	37	389	459	488	70	29	99	2.69	2.23	2.54
	Medium	50	399	472	495	73	23	96	2.81	1.77	2.46
	Heavy	60	397	456	483	59	27	86	2.27	2.08	2.21
	FALL										
	Light	45	605	[3]	605			0			0.02
	Medium	35	599		602			3			0.06
	Heavy	45	601		605			4			0.10
1956	SPRING										
	Light	41	389	435	519	46	84	130	1.62	4.94	2.87
	Medium	59	409	442	530	33	88	121	1.17	5.19	2.69
	Heavy	50	403	463	519	60	56	116	2.15	3.28	2.58
	FALL										
	Light	93	628	638	637	10	- 1	9	0.35	0.05	0.20
	Medium	60	631	642	642	11	0	11	0.39	0.04	0.26
	Heavy	79	618	634	637	16	3	19	0.60	0.15	0.43
1957	SPRING										
	Light	45	378	438	478	60	40	100	2.13	2.36	2.22
	Medium	68	387	451	496	64	45	109	2.25	2.67	2.41
	Heavy	45	397	468	492	71	24	95	2.53	1.42	2.11
	SPRING (late herd)										
	Light	44	[4]	391	421		30			1.79	
	Medium	55		422	455		33			1.91	
	Heavy	36		409	434		25			1.46	
	FALL										
	Light	96	593	617	622	24	5	29	0.86	0.27	0.64
	Medium	151	587	612	612	25	0	25	0.91	0.01	0.57
	Heavy	171	600	629	628	29	- 1	28	1.04	- 0.10	0.61

[1] First period—first 28 days; second period—next 17 days; and total — total of 45 days.
[2] Total gain divided by number of days in each period.
[3] Blanks for fall, 1955, indicate 28-day weights not taken due to adverse weather conditions.
[4] Blanks for spring, 1957 indicate late herd introduced due to heavy growth of forage.

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