An Economic Analysis of Public Range Investments on the Vale Project, 1960-1969

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AN ECONOMIC ANALYSIS OF PUBLIC RANGE INVESTMENTS ON THE VALE PROJECT, 1960-1969

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Background

The arid rangelands of Eastern Oregon, like many other rangelands in the West, have undergone substantial change since the turn of the century. In common terms, there have been substantial changes in species composition, range condition, and forage productivity. The reasons for these changes are complex and reflect a variety of cultural and physical circumstances. The arid nature of these lands and the limited acreage that could be homesteaded caused them to be bypassed by early white settlers, and thereby largely retained in the public domain. At present, the Bureau of Land Management of the U.S. Department of the Interior is responsible for the management of over 13 million acres in those Oregon counties east of the Cascades. This amounts to nearly 30 percent of the land area of those counties. Three counties (Harney, Lake, and Malheur) have half or more of their land under BLM supervision.

The evolving nature of public institutions with respect to these arid rangelands is in itself a complex of cultural and historical factors. Initially, the guiding concept was that of disposition of the land through homesteading or sale. Passage of the Taylor Grazing Act brought a "stewardship" concept to the management of public domain lands in 1934. In the two decades following passage of this Act, the Grazing Service and later the Bureau of Land Management attempted to bring grazing pressure into line with the fragile nature of the land. The limited success of this "extensive management" phase of evolving public range institutions was to give way to an "intensive management" phase which began in the 1950's. Within the latter (and current) concept, rehabilitation of deteriorated rangeland has risen to new prominence.

The dividing line between these phases is not at all sharply drawn. On the other hand, there is little doubt that increased emphasis has been placed on range rehabilitation in recent years. The limiting constraint has been the availability of public appropriations. Private ranchers, faced with a continuing cost-price squeeze, have also turned increasingly to range rehabilitation on private lands in order to increase their scale of operations.

The Vale Project of the Bureau of Land Management is of particular significance in that it provided one of the first opportunities to demonstrate the potential of intensive range rehabilitation. Approved by Congress in 1962, the Vale Project was envisioned by one of its prime sponsors as a demonstration area to show how a large appropriation for range improvements could "...advance conservation work in four key areas where erosion and ravages of time had largely destroyed the ability of several million acres of public land to make their proper contribution to the economy of the West."[1/]

An allocation of over $20 million was originally proposed for the Vale Project, of which $13.6 million would be devoted to brush control, seeding, fencing, and water development. Although this amount has never been fully appropriated, about $4.2 million was appropriated and invested between 1962 and 1969. Foremost among these investments have been the seeding of 209,345 acres, brush control on 311,837 acres, 1,341 miles of fencing, and 193 miles of pipelines to complement 771 new reservoirs, springs, and wells. As a consequence, the livestock carrying capacity of the Project roughly doubled over this period.

Objectives of the Study

The Vale Project has indeed shown that "two blades of grass can be made to grow where one grew before." Thus, it has demonstrated that rehabilitation of deteriorated rangeland is possible in a physical sense. The question remains, however--was the end product a desirable one? Obviously, this would depend on one's point of view. Many Malheur County residents have benefited from the project, especially those ranchers who have held Vale Project grazing permits. Federal taxpayers, on the other hand, have financed the project while enjoying a much smaller portion of the benefits.

One question that can be posed is this: "Was the Vale Project a profitable investment from the viewpoint of the public at large?" This is a more narrow question than the preceeding one since it avoids value judgments about how income should be distributed. To answer this question in a com-

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1/ Morse, Wayne L. Message to the National Advisory Board Council, March 22, 1965. In: United State Bureau of Land Management. Proceedings of the National Advisory Board Council. Washington, D.C., 1965. (Appendix No. 4) plete sense requires an accounting of all benefits and who pays the costs. Many of the project objectives involve benefits and costs which are very difficult to quantify in dollar terms; therefore, this study did not undertake to evaluate all components of the project. Instead, the study focused on what apparently was the key objective of the Project, that is, the augmentation of forage production and use by range livestock. Given this focus, then, the main question addressed by this study was the following:

> Did the value of the increased livestock forage on the Vale Project exceed the costs of providing this forage?

A secondary purpose of the study was to assess the Vale Project as a means of rural community development. Investment in natural resources, by both private individuals and by government, has long been a means of community development in Oregon and throughout the West. Today, Federal and state governments are assisting rural communities in evaluating a variety of ways, including natural resource development, through which they might attempt to keep pace with a rapidly changing world. Although considerable judgment will need to be used by leaders in other communities in applying the lessons of the Vale Project to their own local circumstances, hopefully, something can be learned from the Vale Project.

A Summary of the Vale Project: 1960-1969[2/]

The Vale Project, located within the Vale District of the BLM in the southeastern corner of Oregon, is one of the most sparsely populated areas in the United States. Bordered by Nevada on the south and Idaho on the east, it comprises an area of approximately 6.5 million acres and represents nearly 30 percent of the total land area administered by the BLM in Oregon.

The major agricultural industries within the District are row cropping in the northeastern corner and ranching in the remainder. The rangeland is typical of most high mountain desert areas in the Western United States. Elevations vary between two thousand and eight thousand feet. The long-run average yearly rainfall varies from seven inches at lower elevations to thirteen at higher elevations. Summers are dry and generally hot, with readings in the nineties not uncommon. Winters are generally cold; the average mean daily temperature for December through March is in the low thirties.

With the major portion of the land being used for ranching by a relatively small population, it is not surprising that the use of BLM lands and investment in new forage are of crucial importance to the economy and the people of the area. The dramatic increases in grazing capacity brought about by Vale Project investments in twenty selected grazing allotments between 1960 and 1969 are apparent from Table 1.[3/] At the time the Project was approved, the range condition on these twenty allotments (Figure 1 and Table 2) had declined to the point where a reduction in grazing use of 98,307 Animal Unit Months (AUM's) was anticipated by the BLM. A few of the allotments faced drastic grazing reductions--up to 80 percent in some cases. The "new" forage produced by the Project between 1960 and 1969 on these twenty allotments equaled 92,031 AUM's, or roughly the same as the anticipated "cut" in grazing use.

Three major revegetative alternatives were used on the Vale Project--spraying, spraying and seeding, and plowing and seeding. The key variable from a management viewpoint was the extent to which the desirable native species (particularly bluebunch wheatgrass, *Agropyron spicatum*) had deteriorated. If the native species were largely "gone," the primary practice was either plowing and seeding (if the soils and topography permitted) or spraying for sagebrush control followed by seeding (in the case of thin topsoil or steep slopes). Seeding was generally to crested wheatgrass (*Agropyron cristatum* and/or *Agropyron desertorum*). Both types of seeding practices were used in several of the allotments, and at least one seeded

2/ Although some range investments had been made in the Vale District prior to authorization of the Vale Project in 1962, most of the total investments were made possible by this authorization and subsequent funding. The choice of the end years for analysis, 1960 and 1969, was made solely on the basis of data availability.

3/ The twenty allotments selected for study comprised all those for which reliable forage data were available.

Table 1. "Grazing Capacity" on Twenty Selected Vale Project Allotments, 1960 and 1969 [a/]

Practice	Acres	Total AUM's 1960	Total AUM's 1969	Total AUM's Increase	Total AUM's Percent Increase	Acres per AUM 1960	Acres per AUM 1969
Improved Areas:							
Spraying	194,444	13,293	36,589	23,296	175%	14.6	5.3
Spraying & Seeding	82,711	3,780	16,380	12,600	333%	21.9	5.0
Plowing & Seeding	66,797	3,459	19,505	16,046	464%	19.3	3.4
"Old Rehab" [b/]	41,364	2,772	8,779	6,007	217%	14.9	4.7
(Total Improved)	(385,316)	(23,304)	(81,253)	(57,969)	(249%)	(16.5)	(4.7)
Native Areas:	1,327,520	76,719	110,781	34,062	44%	17.3	12.0
Total:	1,712,836	100,023	192,054	92,031	92%	17.1	8.9

a/ In the judgment of the BLM range managers, these grazing capacities reflect the amount of livestock forage that could be utilized without decreasing the future productivity of the range. In effect, these are sustained yield grazing levels for years of normal precipitation. As such, they will not necessarily equal the amount of forage actually utilized by livestock.

b/ These are lands which had been seeded and/or sprayed prior to 1960. Investments between 1960 and 1969 were limited to supplemental fencing, water development, and a minor amount of re-spraying.

Table 2. Range Investments in the Twenty Selected Allotments and in the Total Vale Project 1960 and 1969 [a/]

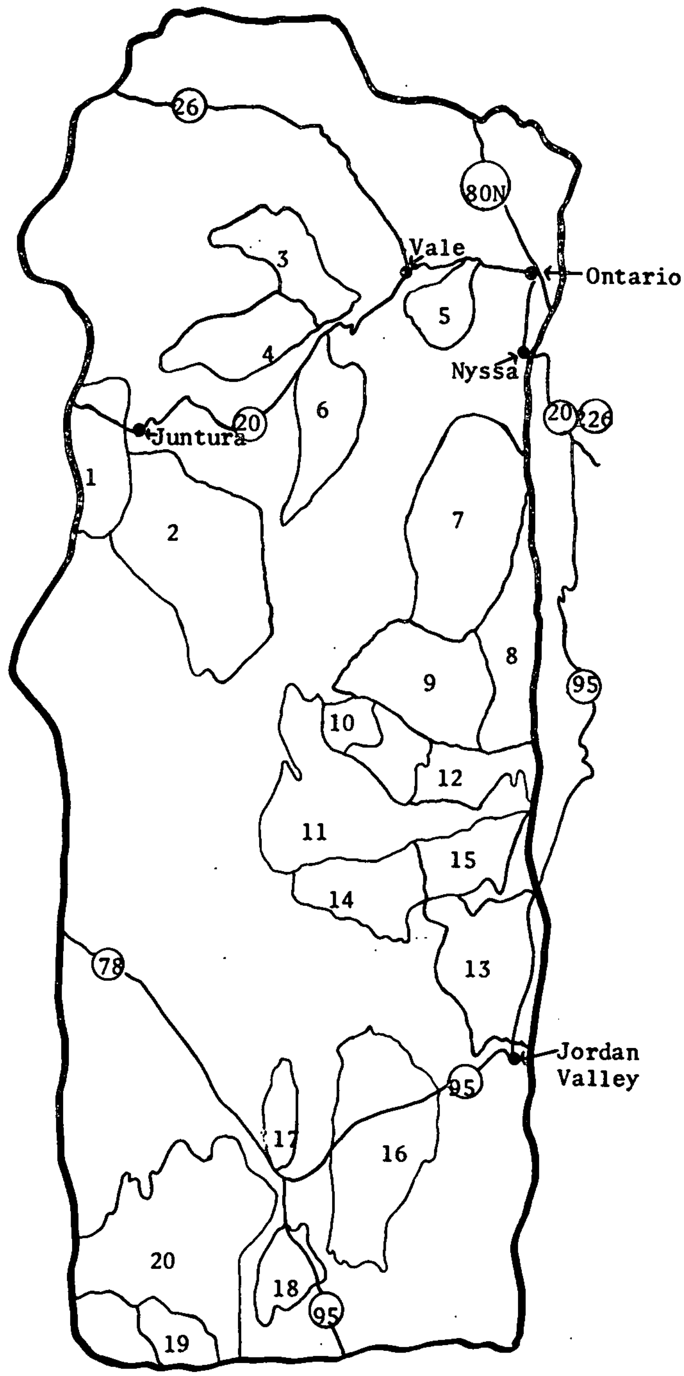
	Twenty Allotments	Total Vale Project	Allotments as % of Total
Seeding & Brush Control	$1,404,192	$2,014,327	70%
Fencing [b/]	651,171	1,104,483	59%
Water Developments [c/]	596,089	1,009,318	59%
	$2,651,452	$4,128,128	63%

a/ Of the forty allotments within the Project where investment occurred, reliable forage data were available for only the twenty shown in Table 1 and Figure 1. These twenty allotments comprised 1.7 of the 6.5 million acres within the Vale Project.

b/ Includes cattleguards.

c/ Includes reservoirs, wells, pipelines, and spring development.

Figure 1. The Twenty Allotments on the Vale Project



area was located in each allotment (with only one exception). On a per acre basis, the two seeding practices were the most expensive alternatives (Tables 3 and 4), with average costs of $12.96 per acre for plowing and seeding and $7.59 for spraying and seeding.

If an adequate understory of native grasses existed, the primary improvement practice was spraying for brush control (at an average cost of $4.57 per acre). As with the two seeding practices, this alternative involved two years of deferment from grazing. Spraying, by itself, was used extensively on the Vale Project; nearly 50 percent of the "improved" acres were treated in this fashion.

Two other types of investment were also made. One, termed "Old Rehab" by the BLM, involved supplemental fencing and water (and a minor amount of respraying) on improved areas which had been rehabilitated (seeded and/or sprayed) prior to 1960. Another practice, used to bring about a more even utilization of existing forage rather than to produce new forage, was the provision of water and fencing on "native areas."[4/] This practice was used on more than 1.3 million acres within the 20 allotments.

The sizeable increase in AUM's on the native areas (from 76,719 in 1960 to 110,781 in 1969) deserves the reader's attention. To fully appreciate the reasons for this increase, one must understand the process by which the augmentation in range capacity, throughout the entire Project, took place. The increased capacity on the native areas comes from two sources. On one hand, the provision of new fencing and water allowed portions of the native range to be utilized more uniformly and fully than before. On the other hand, the native areas benefited from the "rest" afforded them through the substitution of new forage source--the improved areas. The following model was developed to unravel the relative sizes of these two effects.

Use Rates and Forage Production On Improved and Native Areas

The basic idea in the model is that the rate and timing with which Vale Project forage was used had an effect on the production of forage in following time periods. This need not always be the case. As a matter of plant physiology, it is possible to remove (utilize) forage at a rate such that future production by the plant remains at a constant level. Although possible, this equilibrium situation characterized neither the historical deterioration of rangelands on the Vale District nor the attempt at reversal of this deterioration through the Vale Project. In the former case, excessive use over a prolonged period caused the native forage to become reduced in vigor and often replaced by inferior species. In the latter case, the additional forage produced by the seedings worked in the direction of reversing the process by which the range had become depleted. The time dimensions of the process are shown in Figure 2.

If additional forage can be provided through seedings which provide early spring grazing, then utilization can be shifted from native to improved areas in time period 1.[5/] This decline in use rates on native areas provides for rest and natural regeneration on these areas, and thus leads to increased native production in time period 2. In the following period, utilization can be shifted back to the native areas, providing for increased production from improved areas. Figure 2 indicates the physical potential of range investment. If the initial increment of new forage is large enough to provide great flexibility in setting use rates (i.e., reducing pressure on the native areas), and if the desire to quickly utilize new native forage can be resisted, then the chain of causation can extend over a number of time periods and the ultimate increase in range capacity can be substantial.

4/ Throughout the remainder of the bulletin, "native" areas will refer to those acreages on which only water and/or fencing improvement were made. Sprayed, sprayed and seeded, plowed and seeding, and Old Rehab areas will be referred to "improved" areas.

5/ This process can be accomplished without range investment; livestock can be fed on hay, grazed on private lands, or herd sizes can be reduced. The central fact of public range history has been, however, that such alternatives have not been popular with ranchers.

Table 3. Investment Costs on the Twenty Selected Allotments, 1960-1969

Practice	Acres	Direct[a/] Investment Costs	Deferred Costs [b/]	Average Total Cost Per Acre	Number of Allotments
Spraying	194,444	$ 733,771	$155,555	$ 4.57	18
Spraying & Seeding	82,711	583,843	43,837	7.59	9
Plowing & Seeding	66,797	825,413	40,078	12.96	13
Old Rehab	41,364	101,162	0	2.45	6
Native	1,327,520	420,544	0	0.32	20
	1,712,836	$2,664,733	$239,470	--	20[c/]

[a/] Several assumptions were necessary to allocate costs. For example, it was assumed that fences established around an improved area were primarily for the protection of this area during the deferred grazing period. Thus, a fence that separated a native area from an improved area was charged to the improved area. Cross fences that were put in primarily to facilitate rotational grazing, however, were charged to the areas that contained these fences. If a fence bordered two different types of improved areas, such as a plow and seed and a spray area, half the cost of the fence was charged to each area. Wells and springs with extensive pipeline systems often served several allotments and presented the largest number of problems associated with cost allocation. The marginal cost incurred in the development of any one pipeline was nearly impossible to determine. Therefore, the costs of the full system were allocated on a "per trough" basis.

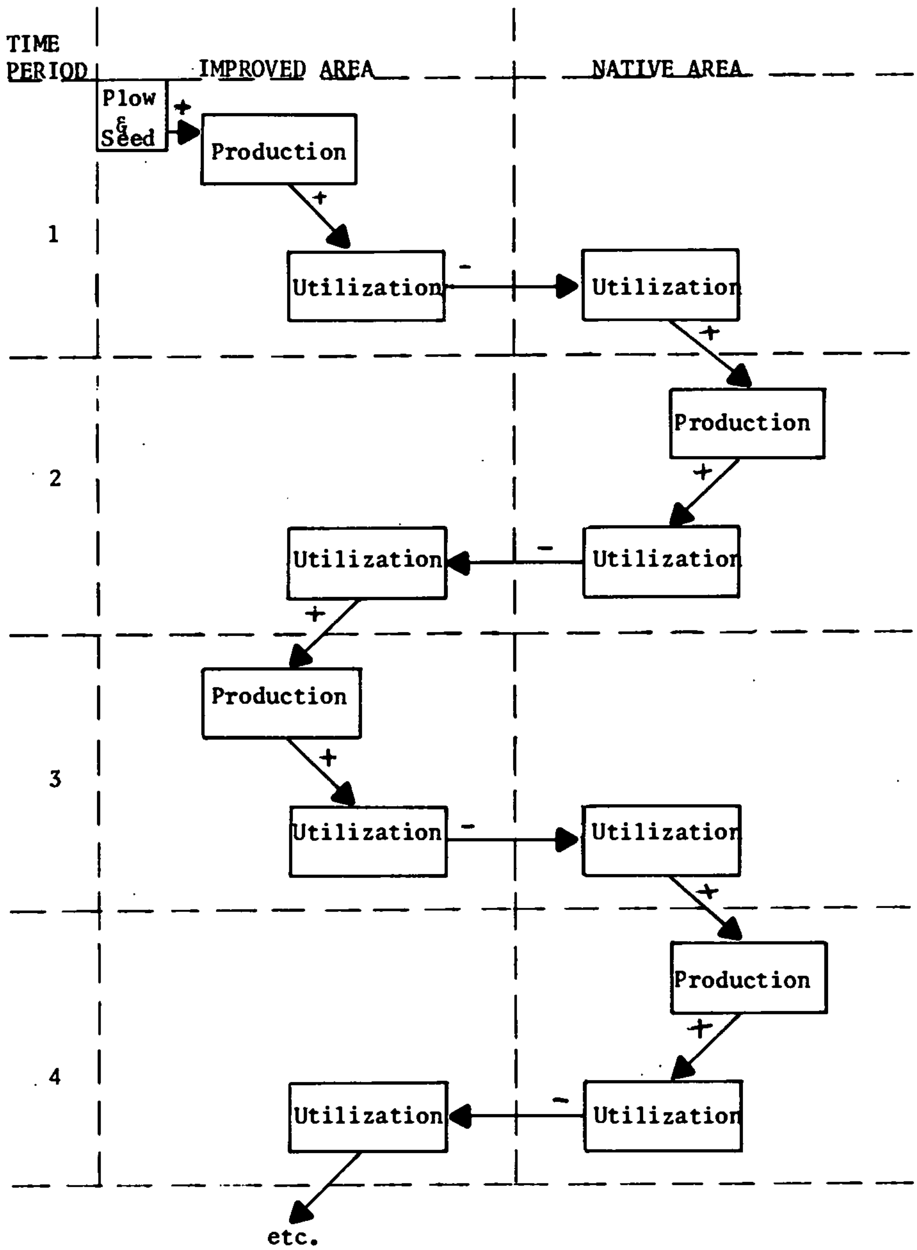
[b/] Deferred costs were based on costs of feeding hay at $6.00 per AUM. Leasing private forage for $3.00 per AUM would reduce average total cost per acre to $4.17, $7.32, and $12.66 for the first three practices.

[c/] Total number of allotments.

Table 4. Average Costs per Acre

	Spraying	Spraying & Seeding	Plowing & Seeding	Old Rehab	Native
Rehabilitation	$2.23	$4.69	$ 8.56	$0.24	--
Fencing	0.88	1.07	1.67	0.14	$0.15
Cattleguards	0.07	0.13	0.36	0.14	0.01
Water Development	0.57	1.16	1.76	1.93	0.14
Other	0.02	--	0.01	--	0.01
Deferred Costs	0.80	0.53	0.60	--	--
Total Cost per Acre	$4.57	$7.59	$12.96	$2.45	$0.32

Figure 2. Relationships between Range Investments, Use Rates, and Forage Production[a/]



a/ Positive effects are indicated by "+", negative effects by "-".

Although Figure 2 illustrates what is technically feasible, it does not indicate what private or public range managers should do or what they are likely to do. No attempt was made here to specify how the process should have occurred on the Vale Project. Instead, estimates were made (after the fact) of the actual outcome.[6/]

In order to quantify the effects of each of the forces discussed to this point (i.e., the investment alternatives and the ability to shift utilization between areas), the following model was estimated:

$$\frac{\Delta I}{A_I} = f\left(\frac{SS}{A_I}, \frac{S}{A_I}, \frac{PS}{A_I}, \frac{OR}{A_I}, \frac{\Delta N}{A_I}\right)$$

and

$$\frac{\Delta N}{A_N} = f\left(\frac{FW}{A_N}, \frac{\Delta I}{A_N}\right),$$

where

ΔI = increase in AUM's (1960 to 1969) from improved areas

ΔN = increase in AUM's (1960 to 1969) from native areas

A_I = acres in improved areas

A_N = acres in native areas

SS = investment in spraying and seeding "improved areas" (in thousands of dollars)

S = investment in spraying "improved areas" (in thousands of dollars)

PS = investment in plowing and seeding "improved areas" (in thousands of dollars)

OR = investment in "Old Rehab" areas (in thousands of dollars)

FW = investment in fencing and water on native areas.

An observation on each of these variables was recorded for each of the 20 allotments (Appendix Table 1). Multiple regression analysis was used to estimate the coefficients shown in Appendix Table 2.

The empirical results for improved area investments are illustrated in Figure 3. The direct impact of these investments is labeled as "first-round" since these supplied the initial "jolt" to the existing range system. Each of the four types of investment had a <u>different</u> first-round effect on the productivity of the improved areas. Ranked from "most productive" to "least productive," the effects were as follows:

(First-round)

> One thousand dollars invested in Old Rehab produced an increase in range capacity of 53.7 AUM's, followed by plowing and seeding (22.8 AUM's), spraying (15.0 AUM's), and spraying and seeding (8.7 AUM's).

The second round effect indicates what happened to native area capacity when a 1.0 AUM increase in improved area capacity was obtained, regardless of the type of practice which gave rise to the latter increase. In other words, if increased forage is made available on improved areas (whether by seeding, spraying, or whatever), then the native range can be rested and made more productive. The analysis indicates that this second-round effect is substantial--nearly half again as large as the initial (seeding and/or spraying) effect. To be specific:

(Second-round)

> For each 1.0 AUM increase in the capacity of the improved areas, an additional 0.41 AUM was added to the capacity of the native areas. Thus, the total increase through the second-round was 1.41 AUM, instead of just the initial 1.0 AUM increase.

The third-round effect in Figure 3 shows the impact, on improved area capacity, of a 1.0 AUM increase in native area capacity, again irrespective of the source of the latter increase (whether from rest and natural regeneration or from improved utilization through water and fencing).

[6/] These results no doubt reflect the desires and objectives of the public range managers, who might have leaned toward continued "re-investment" of the new forage and an ultimately higher level of production, and of the ranchers, who may have leaned toward earlier "consumption" of the fruits of the initial investment.

To summarize:

(Third-round)

The third-round increase (.26 AUM) is somewhat smaller (and statistically less significant) than the first or second-round effects, since it is farther down the chain of causation. Also, it might be expected that the response to rest might be less on new seedings of durable crested wheatgrass than on well-used native range.

From Table 5, one can also look at the first, second, and third-round effects of investment in fencing and water on native areas. The first-round effect is fairly small (an increase of 18.4 AUM's for each thousand dollars invested) and is not statistically significant. The second-round effect is the 0.26 AUM increase described above, and the third-round effect is the 0.41 AUM increase, also described above. Thus, the total effect of the fencing and water investment on native areas was to increase the range capacity by 26.0 AUM's per $1,000 of investment.

The full impact (through all three rounds) of each of the five investment alternatives is shown in Table 5. The "Old Rehab" alternative was clearly the most productive practice in an economic sense (84.6 AUM's per $1,000 invested), although less than 4 percent of total Project costs could be expended in this manner. Of the three revegetative alternatives, plowing and seeding was the most productive (35.9 AUM's), followed by spraying (23.6 AUM's) and spraying and seeding (13.7 AUM's).

At this point, the transition from a physical criterion to an economic criterion becomes more evident. Had the alternatives been equal in cost, plowing and seeding would have been the most efficient of the five practices since the range capacity on those areas increased by 464 percent between 1960 and 1969 (Table 1). In fact, the alternatives did vary in cost; Table 5 provides a common denominator in terms of their effectiveness per $1,000 of investment funds.

Rates of Return to the Vale Project Investments

Although the analysis to this point has identified the efficiency of the various investments, relative to each other, it is possible to go a step farther and look at their efficiency in an absolute sense.[7] Thus far, attention has been on the translation of investment dollars into increased range capacity in the form of additional AUM's. If the value of an additional AUM were known, then it would be possible to state--in monetary terms--the dollar values on both the costs of and the returns from investments in range forage augmentation in the Vale Project. Knowing these values, and assuming a certain finite life-span of the practices, the internal rate of return on public investment for each of the practices could be calculated.

An alternative to this approach was adopted for two reasons. First, the value of an additional AUM can vary due to a number of factors, including livestock prices, weather conditions, availability of hay or other forage, and season and length of use. Second, the notion that the lifetime of a range investment can safely be assumed as "given" clearly runs contrary to earlier reasoning that use rates can and do influence forage production in subsequent time periods. The

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7/ Different groups may have different interests in the issue of absolute versus relative efficiency. Private ranchers are interested in both aspects; their ability to correctly perceive the absolute profitability of investments determines how profitable their ranches will be. Those responsible for allocating public funds are also interested in both aspects. At some levels of government, decision-makers are most interested in the absolute efficiency of different types of public investment (e.g., to allocate funds between education and natural resource development). Once decisions such as these are made, attention then turns more to relative efficiency (e.g., to allocate range investment funds to different practices). The latter was the situation faced by local BLM officials in implementing the Vale Project.

Figure 3. First, Second, and Third-Round Effects of the Improved Area Investments

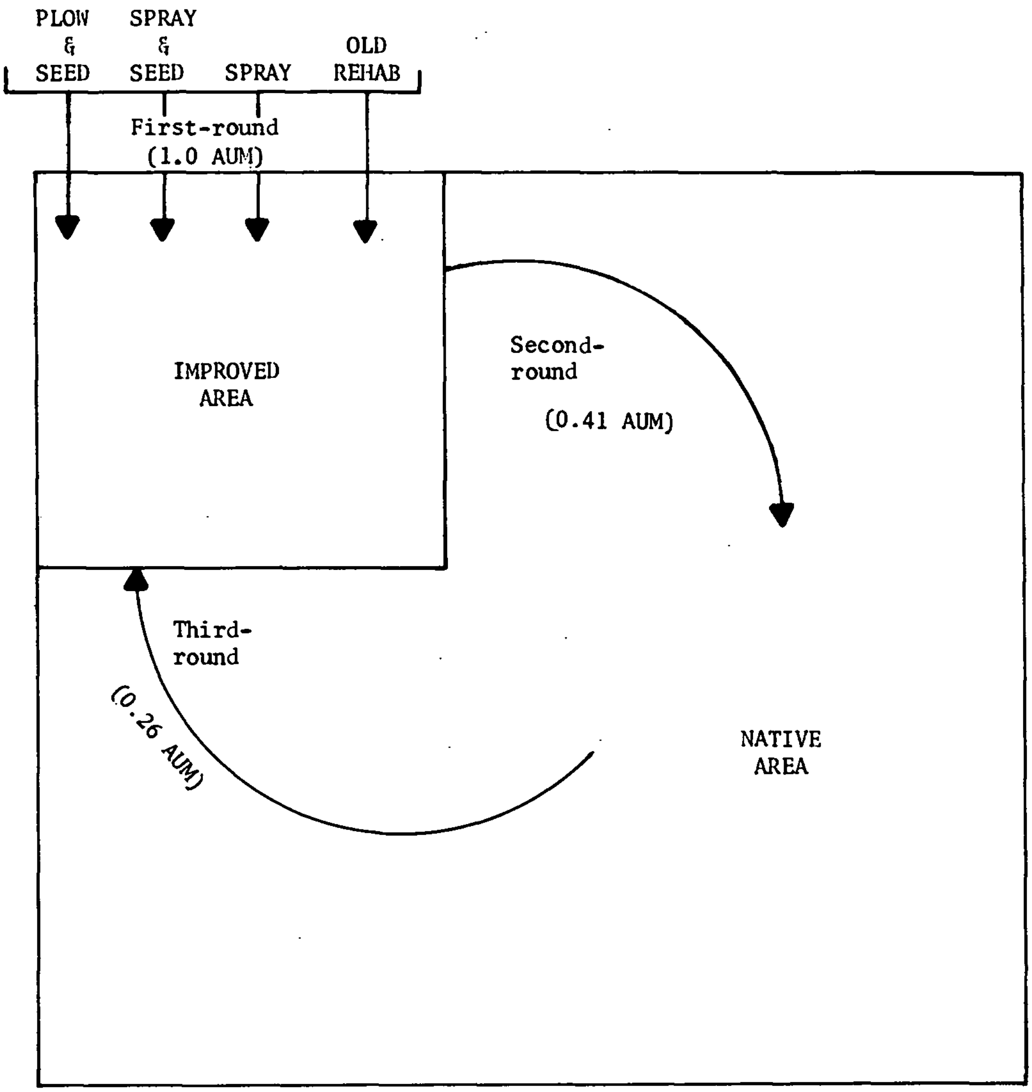

Table 5. Increase in AUM's, per Thousand Dollars of Investment

	Cumulative Effect [a]		
	First Round	Second Round	Third Round
Improved Areas:			
Spraying	15.0	21.1	23.6
Spraying & Seeding	8.7	12.2	13.7
Plowing & Seeding	22.8	32.1	35.9
"Old Rehab"	53.7	75.6	84.6
Native Areas:			
Water & Fencing	18.4	23.2	26.0

[a] The formula for computing the cumulative effect of an improved area investment is:

$$\left[\frac{1}{1-(.41)(.26)}\right] \text{ times } \left[1.41 \text{ times the first-round effect}\right]$$

For the fencing and water investment on native areas, the formula is:

$$\left[\frac{1}{1-(.41)(.26)}\right] \text{ times } \left[1.26 \text{ times the first-round effect}\right]$$

alternative procedure (Table 6) was to derive solutions for what an additional AUM would have to be worth in order to yield various rates of return.[8] The lifetime of the investment was allowed to vary, recognizing that "excessive" use rates (in a physiological sense) could reduce the lifetime of a seeded or sprayed area.

For example, if one were to require that an investment yield 5 percent or more, and if the management objective[9] were to make a sprayed area last for 12 years (before re-treatment was needed), then spraying on the Vale Project would have been profitable only if an additional AUM were worth at least $5.24. If the sprayed area were to have a 25 year lifespan, then spraying would have been profitable if an additional AUM were worth at least $3.30. On the other hand, if one required an 8 percent rate of return, the alternative AUM value would have to rise to $6.53 (for a 12 year lifespan) or 4.61 (25 year lifespan) for the practice to be profitable. In each of these cases, leasing of additional forage at $3.00 per AUM would have been more profitable than spraying.

Another way to understand the values in Table 6 is with reference to the results of Table 4. From Table 4, it can be seen that a thousand dollars invested in plowing and seeding "produced" 35.9 AUM's. If other forage sources would otherwise have to be leased at $3.00 per AUM, a revenue stream of $107.70 has, in effect, been created by the investment. The question then is: how many years would be required to recover the investment cost? Present value computations are involved; e.g., the present value of a $107.70 revenue stream which would occur ten years later is only $66.12 if discounted at a five percent interest rate. Using five percent as the discount rate, the following lifespans would have been required to recover an initial $1,000 investment:

"Old Rehab"	5 years
Plowing and seeding	13 years
Water and fencing on native areas	23 years
Spraying	28 years
Spraying and seeding	> 50 years.

These lifespans appear to be within the ranges which are commonly expected for the first three practices, but substantially in excess of common expectations for the practices of spraying (10 to 15 years) and spraying and seeding (15 to 20 years). Again, it is recognized that the lifespan of a revegetative practice depends very much on the rate and timing of utilization.

Conclusions and Implications

At this point, it might be beneficial to paraphrase the two major questions posed by this study:

"Did the value of the livestock forage produced by the Vale Project exceed the costs?"

8/ The internal rate of return could be computed by solving for i in:

$$C = (M \cdot V) \left[\frac{1-(1+i)^{-f}}{i}\right] \left[(1+i)^{-d}\right]$$

where C = present value of investment plus deferred costs; M = marginal physical productivity of an investment dollar from Table 5; V = value of AUM; f = lifetime of investment; d = years of deferment from grazing. The alternative used here was to solve for V, assuming various discount rates (r) and project lifetimes (f). That is:

$$V = \frac{C}{\left[\frac{1-(1+r)^{-f}}{r}\right] \cdot M \left[(1+r)^{-2}\right]}$$

9/ For a private investor, the optimum lifespan of a range investment would be subordinate to a more central objective--maximizing the present net worth of the firm. If livestock prices were quite high, for example, the optimum strategy might be to use a new seeding heavily (thus reducing its lifespan), then to re-invest later in another seeding. The optimum strategy for forage users on the public domain is much less clear, since the decision to re-invest is usually outside their control.

Table 6. Value Required per AUM for Various Interest Rates and Projected Life-Spans[a/]

Spraying

Interest Rate	Life of Investment (Years): 9	12[b/]	15	25	40
1/2%	$4.88	3.38	2.97	1.82	1.18
2%	5.37	4.14	3.41	2.25	1.61
5%	6.54	5.24	4.48	3.30	2.72
8%	7.87	6.53	5.75	4.61	4.14

Spraying & Seeding

Interest Rate	Life of Investment (Years): 15	18[b/]	21	30	40
1/2%	$5.11	4.29	3.71	2.65	2.04
2%	5.92	5.08	4.47	3.39	2.78
5%	7.77	6.90	6.29	5.25	4.69
8%	9.97	9.10	8.52	7.58	7.14

Plowing & Seeding

Interest Rate	Life of Investment (Years): 15	20[b/]	25	40	50
1/2%	$1.95	1.48	1.20	0.78	0.64
2%	2.26	1.77	1.49	1.06	0.92
5%	2.96	2.47	2.18	1.79	1.68
8%	3.80	3.31	3.05	2.73	2.66

"Old Rehab"

Interest Rate	Life of Investment (Years): 15	20	25[b/]	40	50
1/2%	$0.82	0.62	0.50	0.33	0.27
2%	0.92	0.72	0.61	0.43	0.38
5%	1.14	0.95	0.84	0.69	0.65
8%	1.38	1.20	1.11	0.99	0.97

Water & Fencing (Native Areas)

Interest Rate	Life of Investment (Years): 15	20	25[b/]	40	50
1/2%	$2.67	2.03	1.64	1.06	0.87
2%	2.99	2.35	1.97	1.41	1.22
5%	3.70	3.08	2.72	2.24	2.11
8%	4.48	3.91	3.59	3.23	3.14

[a/] Unshaded areas are less than $3.00, the estimated market value for AUM's of comparable quality; hence, these are "profitable" investments, given the circumstances.

[b/] Most commonly expected life-spans.

and

"What about range investment as a means of community development?"

Prior to drawing any inferences from the Vale Project with respect to these questions, several points should be made about the Vale Project itself.

1. It is obviously not possible to make inferences about range investment, in general, from just one observation--the Vale Project. Such inferences are neither warranted nor intended. To ignore what has been learned from past range investment projects, however, is equally unwarranted.

2. The Project was justified, in part at least, on the basis of providing large-scale experimentation with different methods of rehabilitating over-used rangelands. To the extent that the experience thus gained has been incorporated into subsequent activities, experimentation has been of value in and of itself.

3. That the Project would be a "profitable" investment as a source of range forage alone was never argued by its proponents at the time of its authorization. Instead, it was promoted as contributing to a variety of objectives, including conservation, community stability, erosion, fire control, and recreation. Some of these objectives, notably erosion control are probably measured to a large degree through estimating the benefit from increased forage production. Others, notably recreation, are not dealt with in this study.

It should also be noted that the two questions above have much in common with each other. One of the principal commonalities is that the viewpoint or perspective of the respondent must be made explicit before the response can be fully understood. In other words, the questions can be answered from the viewpoint of (a) the Federal government, (b) the BLM, (c) the State of Oregon, (d) Malheur County, (e) ranchers who utilize the Vale Project, or (f) a private rancher located adjacent to the Project.

At issue is the question of incidence--who pays the costs and who receives the benefits. Thus, an unprofitable investment from the viewpoint of the Federal government may be very profitable from a local viewpoint, and may serve as an effective stimulus to rural development in that area. On the other hand, range investments which are profitable from the viewpoint of the private rancher-investor may not always add appreciably as an economic stimulus in rural areas. Thus, the two questions are related, but the answers are not always obvious.

Profitability of the Vale Project Range Investments

From the viewpoint of the Federal government, the results shown above leave little doubt that many of Vale Project range forage investments were "unprofitable", provided that one accepts the notion that public investments should meet much the same criteria as private investments. Of the revegetative alternatives, only plowing and seeding (30 percent of total Project costs) appears to have produced new forage at a cost ($2.50 to $3.00 per AUM) which was lower than the cost of alternative sources of forage during the 1960-1969 time period. Extremely long lifespans and low rates of returns, both unattractive to private investors, would be required to justify the spraying or spraying and seeding alternatives (31 and 22 percent of total Project costs, respectively) as an economical source of new forage.[10/] The provision of water and fencing to Old Rehab and native areas (3 and 14 percent of total Project costs, respectively) appears to have been fairly profitable, although the return to the latter investment varied widely among allotments. Overall, given the more common expectations of Project life (Table 6) and

10/ It should be noted that disagreement exists as to the general need for deferment from grazing following spray treatments, although the need for deferment following new seedings is well recognized. Our attention has been directed to research in Wyoming which indicates that deferment on sprayed sagebrush areas has no significant effect on forage production in areas of ten inches of annual precipitation or more (See: Smith, Dixie R., "Is Deferment Always Needed After Chemical Control of Sagebrush?", Journal of Range Management, 22:261-263, July, 1969). If grazing had not been deferred on the sprayed (and sprayed and seeded) areas of the Vale Project, the costs of these alternatives would have been reduced substantially. In addition, the benefits from use would have accrued earlier in time.

the government borrowing rate of the early 1960's (4 1/2 to 5 percent), one would have to conclude that substantial "learning value" would have had to ensue from the Project for it to have been a profitable public investment on an overall basis.

The same implication can be drawn with respect to future investment decisions by private ranchers--if there is good reason to believe that their rangeland will respond to investment in the same manner as did the Vale Project range, and if the long-run expectations are that relative livestock prices and investment costs will be roughly the same as in 1960-1969. If these assumptions are reasonable ones, then the results of Table 6 may be helpful to private decision-makers.[11/] Implicit in this statement is the notion that "on-the-ground" familiarity with the Vale Project (and with developments there subsequent to 1969) and with the outcome of public and private range investments elsewhere in the state is fundamental to making a knowledgeable decision on whether to invest.

In light of recent prices increases, including those for meat and fuel in particular, this study is probably more informative on the relative profitability of the investment alternatives than on the absolute profitability. This should hold true for either private investors or for the BLM and other public agencies.[12/] If today's technology for range rehabilitation is much the same as existed in 1960-1969, the primary implication is that plowing and seeding may be substantially more profitable than either spraying alone, or spraying and seeding, at least under range conditions resembling those which existed on the Vale Project in 1960. A more general and subjective implication is that not every acre on the range needs to be treated. The return to treatment may be fairly high for the first few acres or few seedings, but then may decline quite rapidly.[13/]

Range Investment as a Means of Community Development

Although range forage investments on the Vale Project were generally "unprofitable" from the Federal government's viewpoint (assuming that public investment should be judged by the same standards as private investment), they did cause additional economic activity in the Vale Project area. An approximation to the extent of this increase can be gained through the results of earlier research in nearby Grant County.[14/] In that study, an input-output model was used to identify the dollar flow of goods and services among the various sectors of the Grant County economy, and between each of these sectors and the rest of the U.S. economy.

A total of 14 sectors were identified within Grant County, including "dependent ranches" or those which rely on Federal grazing rights (BLM and/or Forest Service). For each sector, estimates were made for the "business multiplier" and the "income multiplier". The former is defined as the change in sales of goods and services within the total Grant County economy, assuming that the output of a certain sector changed by one dollar. For "dependent ranches," the business multiplier was 1.56. That is, total sales of goods and services in Grant County would increase by $1.56 if

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11/ Of principal concern in this regard (and outside the scope of this report) are the substantial changes which have taken place since 1969 in both livestock prices and investment costs. The primary implication that can be drawn here is that expected long-run prices have more relevance to investment planning than those prices which exist at any one point in time. One way to recognize the high degree of uncertainty on these expectations is for a private investor to be conservative on the "pay-back" period, e.g., to expect that his costs would be recovered in 10 years instead of 15.

12/ Again, the need (or lack of need) for deferment from grazing of sprayed areas (footnote 10) is a critical issue.

13/ One reason for the low profitability of Vale Project range investments may have been the large amount of funds that were mandated to the Project, thus driving down the rate of return as less and less productive sites were reclaimed (see footnote 7). One suspects that this may not be a very common occurrence, especially with private investors.

14/ See: Stevens, Joe B. and E. Bruce Godfrey, "Use Rates, Resource Flows, and Efficiency of Public Investment in Range Improvements," American Journal of Agricultural Economics, November 1972, and Haroldsen, Ancel and Russell Youmans, Grant County, Oregon: Structure of the County Economy, Extension Service Oregon State University, Special Report 358, May 1972.

sales of dependent ranches increased by $1.00. The income multiplier, on the other hand, was an estimate of the change in total household incomes in Grant County, assuming that incomes in a certain sector changed by one dollar. For "dependent ranches," the income multiplier was 1.80. That is, total household incomes in Grant County would increase by $1.80 for every $1.00 increase in household incomes of dependent ranchers.

These multiplier estimates for Grant County provide reasonable first-approximations to what might have happened in Malheur County, had the Vale Project investments not taken place. Had none of the investments been undertaken on the twenty allotments under study, it appears likely that about 95,000 fewer AUM's of forage would have been utilized.[15] The adjudication process, which was in effect circumvented by the Vale Project, would ultimately have brought about a decline in range use of this magnitude in order to bring forage utilization back into balance with the reduced levels of forage production.

If a unit value of $4.00 per AUM were attached to each of these 95,000 AUM's, the Vale Project made it possible to avoid a reduction of $380,000 per year in gross output of the dependent ranches.[16] The total purchases by these ranchers would have then declined, had their output been reduced. In turn, those from whom the ranchers made purchases (e.g., implement dealers, feedstores, etc.) would also have made fewer purchases from other firms. This chain of events is summarized in the "business multiplier" of 1.56, which indicates that the $380,000 (in reduced output by dependent ranchers) would have been translated into a total reduction of $592,800 per year in the Malheur County output of goods and services. This would have been a substantial jolt to the local economy, thus the Vale Project contributed to community stability in Malheur County by avoiding the jolt.[17]

The same sort of analysis can also be done in terms of household incomes. Had the Vale Project investments not been made on the twenty allotments, household incomes of dependent ranchers would have declined by about $38,000 per year.[18] The income multiplier" of 1.80 is a summary of the chain effects which would have occurred; total household incomes in Malheur County would have declined by about $68,000 per year. Assuming that the Project investments will have a lifespan of 30 years, the averted reduction in local incomes over the life of the Project, was about one million dollars.[19] From the viewpoint of economic self-interest on the

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15/ The antipated reduction on the twenty allotments was 98,307 AUM's; the "new" forage produced on these allotments was 92,031 AUM's. Thus, 95,000 AUM's is used here for convenience of rounding-off. It is assumed that the reductions in AUM's which the BLM was planning to make could, in fact, have been implemented through the adjudication process.

16/ This assumes, in effect, that ranchers would be willing to pay up to $4.00 for an AUM because the value of their beef output would increase by $4.00 if this AUM were used.

17/ The Project also contributed to local economic activity through purchase of fuel, supplies, and labor to carry out the Project. An estimate of this impact is not available.

18/ The Grant County study indicated that for every $1.00 of output (sales) by dependent ranchers, $0.10 was retained as household income.

19/ One million dollars approximates the present value of future income streams over the thirty year period (dated from the mid-1960's), each discounted at a five percent rate.

$$\text{I.e.,}\quad \$1,000,000 \cong \frac{\$68,000}{1.05} + \frac{\$68,000}{(1.05)^2} + \frac{68,000}{(1.05)^3} \cdots + \frac{68,000}{(1.05)^{30}}$$

part of Malheur County residents, then, augmentation of range forage on the Vale Project was not an unprofitable public investment; instead, it was a million dollar spur to community development.[20/] This apparent contradiction to the earlier conclusion (that the Project was not a profitable venture) is due to differences in who pays the costs and who benefits. In this case, the costs were borne primarily by Federal taxpayers, of which Malheur County residents make up only a tiny proportion. The benefits, on the other hand, were captured primarily by dependent ranchers and others in Malheur County.

With respect to implications for other communities where range investments are being considered as a source of economic development, the following questions are relevant:

1. Who will bear the costs?

2. What outputs (including additional AUM's) can reasonably be expected, given the investment dollars and the present range conditions?

3. What type of ranch organization will exist after the project is completed?

4. Who will be the beneficiaries, and to what extent will they benefit?

Some of these issues are factual in nature; others, although more conjectural, need to draw on a base of informed judgment. Numerous Federal, state, and local agencies, as well as private firms and individuals, are available as resources for aiding communities in the discussion of these issues.

20/ In addition to the increment in household incomes, an enhancement of property values (and hence, the local tax base) would also have occurred. These effects could not be quantified here. From a local viewpoint, these obviously reflect benefits both to individuals (e.g., dependent ranchers) and to groups (e.g., local school districts). From a national viewpoint, on the other hand, the counting of secondary benefits (e.g., through improved local job opportunities and business sales by merchants) is legitimate only if substantial underemployment of resources exists in the local area. Likewise, enhanced local property values would not be counted as national benefits if these are either (a) associated with secondary beneficiaries (e.g., enhanced property values of local merchants), or (b) already counted in another form (e.g., the increment in net incomes of dependent ranchers).

Appendix Table 1. Values of the Variables for the Twenty Allotments[a/]

	Increase in AUM's		Acres		Investments				
Allotment Number	ΔI	ΔN	A_I	A_N	S	SS	PS	OR	FW
1	1,638	2,099	11,514	34,019	$32,059	$ 0	$ 19,230	$ 0	$ 16,179
2	3,884	6,297	27,591	111,442	90,576	3,665	28,883	0	35,898
3	2,292	4,802	11,336	62,244	22,688	6,815	91,984	0	14,697
4	846	0	8,952	42,623	0	18,390	71,231	0	14,539
5	3,948	1,585	31,899	24,893	101,474	0	33,218	0	0
6	1,293	1,323	7,920	18,976	12,738	61,716	0	0	4,694
7	2,329	99	20,372	176,842	88,464	0	37,718	0	27,233
8	3,004	215	18,440	43,333	32,617	0	83,928	0	14,066
9	3,315	1,251	22,486	47,842	50,360	0	36,729	2,744	14,514
10	1,195	919	6,792	11,219	19,331	0	0	0	400
11	3,619	0	35,109	104,028	64,752	49,033	129,727	0	8,447
12	3,420	1,056	17,992	27,688	11,840	0	69,301	11,166	11,888
13	3,076	767	15,470	45,974	11,703	46,498	0	21,062	12,047
14	3,490	1,345	17,992	46,904	9,754	0	7,014	64,581	23,532
15	3,696	922	17,157	36,310	12,679	0	133,228	989	14,896
16	3,323	5,472	34,008	122,485	61,521	87,175	0	0	32,516
17	4,302	1,657	8,800	41,412	0	0	83,222	0	26,794
18	211	79	6,343	7,122	32,853	0	0	0	3,962
19	750	1,310	6,850	47,153	7,895	53,255	0	0	14,733
20	8,338	2,864	49,638	275,011	70,467	257,296	0	620	121,968

[a/] See page 8 for definition of variables.

Appendix Table 2. Regression Results[a/]

Equation	Dependent Variable	Independent Variables: Investment Costs per Acre (in thousands of Dollars): Spray	Spray & Seed	Plow & Seed	Old Rehab	Native	$\frac{\Delta N}{A_I}$	$\frac{\Delta I}{A_N}$	R^2 [b/]	n [c/]
(1)	$\frac{\Delta I}{A_I}$	15.0	8.7	22.8	53.7	--	.2619	--	.838	20
		(1.79)	(1.20)	(4.27)	(2.40)		(1.33)			
(2)	$\frac{\Delta I}{A_N}$	--	--	--	--	18.4	--	.4080	.657	20
						(0.78)		(3.47)		

a/ Numbers in parentheses are t-values of the regression coefficients; a t-value of about 2.00 or greater would indicate, with 95 percent confidence, that the independent variable did, in fact, influence the dependent variable.

b/ Percentage of variation in the dependent variable which is explained by the independent variables.

c/ Numbers of observations (allotments).