Preliminary Economic Evaluation of Cattle Distribution Practices on Mountain Rangelands

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Highlight

The grazing capacity of mountain rangelands can be increased by management practices which improve cattle distribution. In this study, the increased economic returns resulting from pond construction, spring development, and trail construction appear to justify investment in these projects by either private operators or the federal government. Guzzler construction may be a sound investment for the stockman, but does not appear profitable for the federal government. Under the conditions of this study, fencing mountain rangelands was not profitable for either stockmen or the federal government. Both strategic salting and cattle herding (drifting) appear to be profitable practices for the rancher.

The carrying capacity of mountain ranges can often be increased by improved livestock distribution which results in more uniform forage utilization. It has long been known that practices such as fencing, trail building, herding, and manipulating water and salting locations improve cattle distribution on mountain ranges (Cook, 1967; Cook, 1964; Cook and Jefferies, 1963; Skovlin, 1965; and Skovlin, 1957). However, very little has appeared in the literature regarding the economic soundness of such practices. The purpose of this paper is to present an economic evaluation of the increased grazing capacity resulting from practices designed to improve cattle distribution on mountain rangelands.

Methods

During the summer grazing seasons (June 10 to September 10) of the years 1960 to 1966, a study was conducted on the Cache National Forest of northern Utah to determine the effects of water development, trail construction, fencing, salting, and herding on cattle distribution and the resulting forage utilization. The study area consisted of 25,000 acres located in aspen, sagebrush-grass, and mountain brush summer range types typical of much of the Intermountain area. A total of 300 random study sites were used to determine the degree of forage utilization throughout the study area. Basic data provided by this study were taken from Cook (1967).

Water development, trail construction, and fencing represent capital investment and the results of these practices were therefore subjected to economic analysis on the basis of the present value of a future annual income stream for a definite number of years. Calculations of the "internal rate of return" (Nielsen, 1967) could be made but, for the sake of simplicity in this preliminary study, a simple present-worth analysis was used. Present values of future income streams follow those set forth by the American Institute of Real Estate Appraisers (1964). Annual costs of maintaining facilities have been ignored in this preliminary investigation. The annual costs are small in magnitude and have little effect on investment decisions.

Since capital investment might be undertaken by either public or private interests, the costs and returns of these practices were analyzed from the points of view of both the stockman and the federal government. An interest rate of 8% was used as the rate necessary to justify investment by ranchers in range improvements on federal lands. Eight percent is higher than the 6¾ to 7½% which ranchers must pay for production credit. However, the uncertainty associated with federal grazing permits appears to justify a rate of at least 8%. An interest rate of 7% was used as the rate necessary to justify investment by ranchers on private land. Seven percent is approximately the average rate which ranchers pay for production credit and, of course, improvements on private rangeland are not associated with the uncertainty of federal grazing permits.

Because the Federal government acts as an agent of the people, attempts to measure the economic efficiency of investments in public lands must include all benefits to society, not merely returns to the U. S. Treasury. Although all benefits, primary and secondary, both tangible and intangible, should be measured, in this preliminary study only grazing receipts were included in benefits to show that range improvements are profitable even when the only benefits measured are returns to the U. S. Treasury.

A 4% interest rate was deemed sufficient to justify capital investment by the federal government since government credit is obtained at a rate of about 3¾%. The 4% rate is consistent with guidelines established by Senate Document 87–97 (U. S. Senate 1962). This document states the rate of interest to be used in benefit-cost analyses is that rate payable by the Treasury on interest bearing marketable securities with 15 years or more of maturity upon issue.

The rates used ignore opportunity costs of capital and are for illustrative purposes only. The reader may wish to use different rates in similar calculations.

Because of ever increasing competing land uses, federal grazing permittees cannot necessarily expect additional AUMs to become available even if an increase in carrying capacity does result. Increases in AUMs can be thought of, however, as AUMs which might otherwise be cut from the allotment. The forestalling of a cut of one AUM for a given time period is, in effect, the same as gaining one additional AUM annually for the same time period.

Since drifting and strategic salting represent increased operating costs rather than capital investment, the costs and returns of these practices were analyzed on an annual basis and only from the viewpoint of the stockman. Most ranchers willingly accept the responsibility for these two practices on public as well as private land. Otherwise, only those areas in which livestock graze of their own accord can be classified as usable range.

Results and Discussion

Water Development

From 85 to 150 additional AUMs (animal unit months) were obtained annually from each added water development. The present cost of these water developments ranged from $90 each for small ponds to \$2,000 each for guzzlers (surfaced areas to provide water runoff and storage). Springs or seeps were developed at a cost of about \$200 each.

Ponds.—A value of \$0.60/AUM (representative fee charged by U. S. Forest Service) was assigned to the increased grazing capacity resulting from investment by the federal government. For the \$90 spent on pond construction, a return of at least 85 AUMs × \$0.60 = \$51 (disregarding a nominal annual maintenance cost and benefits other than Treasury receipts from grazing) can be expected annually for the life of the pond. Assuming a life of 10 years, the present value of such an income stream is \$413.61.[1] It is conceivable that the present value of the return might be in the neighborhood of 150 AUMs × \$0.60 × 8.11 = \$729.90. An annual increase of 18.5 AUMs is required to break even with a \$90 expenditure by the federal government under current grazing fee rates.[2] For a private operator, experiencing a value per additional AUM of \$2.40, the increase in grazing capacity necessary to break even on a \$90 investment on public lands is 5.6 AUMs.[3] On private lands, each additional AUM has a value of \$3.00 and an increase of only 4.3 AUMs is required to justify investment by the rancher. With a higher marginal return, the stockman can, of course, afford to intensify to a greater degree than can the federal government.

Springs.—The development of a spring at a cost of \$200 will result in a gain of at least 85 AUMs annually for 15 years. The present value of such a gain is 85 × \$0.60 × 11.12[4] = \$567.12. If the spring development results in a gain of 150 AUMs, the present value of the increased grazing capacity is 150 × \$0.60 × 11.12 = \$1,000.80. An AUM increase of 30 is required to break even with a \$200 investment by the federal government.[5] Again, the higher marginal return which the stockman receives allows greater intensification with private capital than is possible with federal government capital. The increased grazing capacity necessary for a private operator to break even on a \$200 investment is 9.7 AUMs on public lands and 7.3 AUMs on private lands.

Guzzlers.—At present (ignoring benefits other than grazing receipts), federal government investment in guzzlers does not appear economically feasible, even if each of the structures results in 150 additional AUMs annually for 20 years. The present value of 150 additional AUMs of grazing capacity annually for 20 years is 150 × \$0.60 × 13.59 = \$1,223.10, which is nearly \$800 less than the construction cost of a guzzler.[6] An increased grazing capacity of 245 AUMs annually is necessary to offset a \$2,000 investment by the federal government.[7] However, since guzzlers are sometimes the only available method of water development on high plateaus, the resulting improvement in wildlife habitat may justify public investment in these structures.

Guzzler construction may be a sound investment for the private operator on public lands since only 85 additional AUMs of annual carrying capacity are necessary in order to break even. On private lands, only 63 additional AUMs are required to justify guzzler construction by ranchers.

Trail Construction

Trails built through rocks, down timber, and heavy brush which had formerly prevented livestock movement increased available grazing by 75 to 100 AUMs per \$100 cost. Trails built through brush and timber will become grown over with time, but those built through rocks will last indefinitely. An average life expectancy of 10 years was assigned to all trails constructed. The present value of an annual increase of 75 AUMs is \$364.95.[8] If a trail results in an annual increase of 100 AUMs, the present value of the increase is \$486.60. An AUM increase of 20.5 is the necessary break even point for a \$100 investment by the federal government.[9] The increased grazing capacity necessary for a private operator to break even on a \$100 investment in trail construction on public lands is 6.2 AUMs. On private lands, only 4.7 additional AUMs are required to offset trail construction by ranchers.

Fencing

Fencing mountainous pastures across drainages to form pastures of 700 to 1,000 acres increased utilization by 4.4% on areas with 35 to 55% slopes. Fencing had very little effect on forage utilization of slopes other than those in the 35 to 55% category. The average air-dry forage production was 517 lb/acre and areas sloping between 35 and 55% made up 22% of the total area fenced. If one cow

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[1] The present value of one dollar per annum for 10 years at 4% compound interest is \$8.11. \$51 × 8.11 = \$413.61.

[2] The present value of 18.5 additional AUMs annually for 10 years at 4% compound interest is 18.5 × \$0.60 × 8.11 = \$90.

[3] The difference between (say) \$3/AUM paid on the open market and (say) \$0.60/AUM charged by the Forest Service is the true value of each forest AUM saved by ranchers (excluding variable non-fee user costs). Fixed costs such as interest on investment do not enter into the calculations. Thus 5.6 × \$2.40 × 6.71 = \$90.

[4] The present value of one dollar per annum for 15 years at 4% compound interest is \$11.12.

[5] The present value of 30 additional AUMs annually for 15 years at 4% compound interest is 30 × \$0.60 × 11.12 = \$200.

[6] The present value of one dollar per annum for 20 years at 4% compound interest is \$13.59.

[7] The present value of 245 additional AUMs annually for 20 years at 4% compound interest is 245 × \$0.60 × 13.59 = \$2,000.

[8] 75 × \$0.60 × 8.11 = \$364.95.

[9] 20.5 × \$0.60 × 8.11 = \$100.

and calf consume 35 lb of air-dry forage daily, 4.9 AUMs can be added on a 1,000-acre pasture by fencing.[10] If the expected life of the fence is 20 years, the value of this increase to the federal government is $39.95 under current Forest Service grazing rate.[11] The value to the stockman of an annual increase in grazing capacity of 4.9 AUMs on public lands is $4.9 \times \$2.40 \times 9.82 = \$115.48$. On private land, the value of the increase is $155.67.

The cost of constructing fences on areas similar to the one studied is about $1,000 per mile. If an isolated 1,000-acre pasture is completely fenced, about 5 miles of fencing will be required. However, since natural barriers such as cliffs, talus slopes, high ridges, and thick brush can be incorporated into the pasture design, and since some of the fences will be common to at least two pastures, the amount of fencing required will be considerably less than 5 miles. On typical mountain rangelands, about one-fourth of the necessary boundaries must be provided by fences and the remaining three-fourths are furnished by natural barriers, bringing the cost of fencing a 1,000-acre pasture to about $1,250 (1¼ miles of fencing at $1,000/mile). Thus, it does not appear economically feasible for the federal government to invest in fencing since the added grazing capacity necessary to break even is 153 AUMs for a $1,250 investment.[12] Fencing also appears unprofitable for the private operator on range similar to the study area since the added grazing capacity necessary to break even on a $1,250 investment is 53 AUMs[13] on public land and 39 AUMs on private land. The above analysis does not include other benefits of fencing accruing to the federal government and private owners such as improved management, reduced costs of administration, and reduced trespass problems.

Salting

Since livestock distribution on federal lands is largely a responsibility of the stockman, increased utilization gained through increased annual operating costs should be evaluated from the point of view of the private operator rather than from that of the federal government. Therefore, the additional carrying capacity gained on public lands by proper salting was assigned a value of $2.40 per AUM. Strategic salt placement (salt placed in forage producing areas where cattle do not go by preference) increased forage utilization by 18.6%. Thus, on a federal area currently yielding 1,000 AUMs of grazing, improved distribution through proper salt placement can be expected to result in 186 additional AUMs annually valued at $446.40. On private lands, the value of such an increase is $558.

Since most cattlemen currently feed a salt supplement anyway, the cost of the salt itself should not be charged to obtaining improved cattle distribution. The cost of strategic salting includes the man and horse hours necessary to pack the salt to the proper locations and to drift cattle into the new salt areas. Since about 2 lb of salt are required for each AUM, slightly less than 2,400 lb of salt would be placed at proper sites on the area in question. Under typical mountain range conditions, such a project would require one rider, one saddle horse, and two pack horses for three days. If the rider received $10/day for his labor and $2/horse per day for the use of his three horses, the total annual cost of salt distribution would be $48. The net return, then, to the salting practice would be $398.40 on public lands and $510 on private lands. The increased grazing capacity necessary to break even on a $48 investment in salting on public lands is 20 AUMs. On private lands, an increase of 16 AUMs is necessary to cover all costs.

Herding

Drifting cattle out of the stream bottoms and onto adjacent slopes increased forage utilization 20% on the areas sloping less than 35%. Forty percent of the study area (10,000 acres) was composed of range which was adjacent to stream bottoms and which had less than a 35% slope. The average air-dry forage production of the range falling into this category was 630 lb/acre. Thus, on the 25,000 acres studied, 1,200 AUMs were added by drifting.[14] Drifting, like salting, is the responsibility of the rancher rather than the Forest Service and represents an increase in annual operating costs rather than a capital investment. For this reason, the increased carrying capacity resulting from drifting on public lands was assigned a value of $2.40 per AUM and the value of the 1,200 AUM annual increase on public lands is $2,880. The value of such an increase at a rate of $3 per AUM on similar private land is $3,600.

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[10] 4.4% increase $\times$ 517 lb = 23 lb/acre additional forage.
$\frac{\text{23 additional lb}}{\text{35 pounds daily}} = 0.66$ added animal unit days/acre.
22% $\times$ 1,000 acres = 220 acres sloping 35 to 55%.
220 acres $\times$ .66 = 147 animal unit days.
$\frac{\text{147 AUDs}}{30} = 4.9$ AUMs.

[11] $4.9 \times \$0.60 \times 13.59 = \$39.95$.

[12] $153 \times \$0.60 \times 13.59 = \$1{,}250$.

[13] $53 \times \$2.40 \times 9.82 = \$1{,}250$.

[14] 20% increase $\times$ 630 lb = 126 additional lb/acre.
$\frac{\text{126 lb}}{\text{35 lb daily}} = 3.6$ additional AUDs/acre.
40% $\times$ 25,000 acres = 10,000 acres. 10,000 acres $\times$ 3.6 AUDs = 36,000 AUDs.
$\frac{\text{36,000 AUDs}}{30} = 1{,}200$ AUMs.

The cost of the drifting practice included a wage of $250/rider per month for two riders, $40 food allowance/month for each rider, and $2/horse per day for the animals in actual use. Thus, the total cost of cattle drifting was $2,100 for the three-month summer grazing period and the net return was $780 on public range. The increased grazing capacity necessary to break even on an investment of $2,100 is 875 AUMs on public lands and 700 AUMs on privately owned lands.

Summary and Conclusions

On the particular area studied, some methods of improving cattle distribution appear economically feasible for private investment only, some appear profitable for both private and federal investment, and some appear unprofitable for investment by either interest group. Each new water development increased annual grazing capacity by 85 AUMs. Under conditions similar to those of the study area, the increased annual grazing capacity resulting from each pond construction required for federal investment is 18.5 AUMs and that required for private investment is 5.6 AUMs on public lands and 4.3 AUMs on private lands. Federal expenditure for spring development requires an increase of 30 AUMs annually per development while private spring development on public lands is justified by an annual increase of 9.7 AUMs. On private lands, only 7.3 additional AUMs are required. Guzzler construction is an unprofitable investment for the federal government since an annual increase in grazing capacity of 245 AUMs is necessary to offset construction costs. Guzzler construction may be a sound investment for the private operator since only 85 additional AUMs are required annually to justify guzzler construction on public lands and only 63 additional AUMs are required on private lands.

Trail construction appears profitable for both the federal government and private operators since at least 75 additional AUMs annually can be expected to result from each $100 invested. An annual AUM increase of 20.5 is the necessary break even point for a $100 investment in trail construction by the federal government. An increase in annual grazing capacity of 6.2 AUMs is necessary to justify a $100 expenditure by a private operator on public lands. Only 4.7 additional AUMs are required on private lands.

Based on increased utilization in the study area, fencing on mountain rangelands appears unprofitable for both public and private investment. A $1,250 investment in fencing yielded an increase of only 4.9 AUMs annually while increases of 153 AUMs and 53 AUMs are necessary to cover the costs incurred on public lands by the federal government and private operators, respectively. On private lands, 39 additional AUMs are necessary to justify investment in fencing by ranchers.

Annual investment in strategic salting appears to be a highly profitable venture for the rancher. An additional 186 AUMs of grazing capacity resulted from a $48 investment in improved salt placement. An increase of only 20 AUMs was required to cover all costs on public lands and an increase of 16 AUMs was sufficient to offset all costs on private lands. Increased annual operating costs which the stockman incurs from herding practices are easily justified by the annual increase in carrying capacity. An increase of 1,200 AUMs resulted from the $2,100 spent on herding while an increase of 875 AUMs was necessary to cover all costs on public lands and an increase of 700 AUMs would cover all costs on private lands.

Specific recommendations are not to be inferred from these data. Recommendations must be based on detailed analysis of individual areas and must take into account the intensity of management and the many combinations of the above distribution practices possible. However, methods and calculations reported here serve as an indication of the economic feasibility of cattle distribution practices on mountain ranges of the Intermountain area.

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