Economic Aspects of Range Management

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RANGE management in its broadest aspects is the management of nontillable lands for multiple use purposes including soil and water conservation, recreation, and sustained forage production. This definition then becomes a definition of resource management. In a more restricted sense, range management can be defined as management of range lands for maximum sustained forage production.

Economics, when applied to the broad field of conservation and multiple use, is generally termed conservation or resource economics. This branch of economic thought is perhaps too extensive and theoretical for purposes of this paper. Therefore, the following discussion will concern itself only with certain economic aspects of producing forage for grazing animals.

Range Economics

The field of range economics is inexactly described because of multiple use implications of range lands. In this discussion, range economics will be comparable to production economics as applied to forage and livestock. If one of the purposes of range management is to produce forage for domestic livestock, then from the viewpoint of production economics, range economics can be closely allied with ranch management. In this manner the theory of the firm is used to analyze the economic aspects of range forage production.

In cropping regions we do not place any emphasis on "agronomy economics". Agronomical practices, just one of the many groups of inputs in farm (ranch) management, have soil conservation implication as do range practices. We speak of range economics because much of our range lands in the West is in federal ownership and the intricate nature of land tenure and multiple use tends to conceal the true position of range lands in production economics. Lands anywhere, whether they be cropped by men or animals, are not free of multiple use implications. It would seem that most, if not all, lands may have several possible alternative uses. Comparative advantage in any period of time determines the uses of, and combinations of, private land. Range lands do not belong in any special category that requires a new set of land economic principles.

Private land, including range land, is owned and operated as part of the firm. The owner or operator attempts to maximize his income. His costs and returns are subject to the law of variable proportions. Public range lands are subject to the same economic laws. The differences in costs and returns between private and public lands exist in the allocation of some of the intangible or unmeasurable benefits. Society may receive some of the returns from public range lands in the form of social benefits. In addition, society may have a different time preference for land-investments returns than does the individual rancher. This may be the case in conservation requirements and practices. Although some of these social returns are real and tangible, they are not readily isolated by usual (or understandable) economic analysis.

Ranch Economics

If our main interest is the production economic aspects of range management rather than the theoretical principles of

soil and resource conservation economics, what then are some of these economic aspects? The economics of range management lead directly to the factors of input-output in production economics and ranch management. However, soil conservation requirements cannot be denied. They can be considered as part of the ranch input-output in the same manner as "range management" is a production factor of ranch management.

The immediate measurable returns from range lands come not from forage production but from grazing animals; from domestic livestock tangible returns, from wild life less tangible returns.

There are some range watersheds in the West where grazing by domestic animals has been excluded. These lands have watershed values so high that multiple use does not maximize income of society. Protection of agricultural lands from floods and delivery of irrigation water to high value lands becomes an exclusive use of those range lands. In this case, graziers using this type of range have conflicting interests with a larger segment of society and if exploitation maximizes their income they can transfer some of their costs to society. Society can obtain the exclusive use of this land by, (1) immediate condemnation proceedings where the majority dictates to the individual for the benefit of the majority or, (2) when marginal returns from grazing do not equal marginal returns from an alternative competing use; in this case, water and soil conservation. Where destructive floods are present society usually will act more quickly than economic forces to protect itself. Therefore, to study the direct economic aspects of range management, we must first study the firm. The ranch is the firm using range forage resources as input-output factors.

Economics of ranch management might logically be separated into three main categories. These are: economics of range forage production, economics of livestock production, and financial management.

It would be incorrect to maintain that these three categories are wholly separate entities. Interacting factors affect all. However, it is desirable in this discussion to draw some line of demarcation. Under economics of range forage production, of which this paper is principally concerned, a partial listing would include:

1. Range improvements to include stock water developments, fencing, rodent control, reseeding, and brush control.
2. Systems of grazing to include deferred and rotational grazing.
3. Adaptations to weather variability.
4. Adaptations to land tenure relationships.

Livestock production is concerned with types of stock, breeding practices, supplemental feeding, and perhaps many others. Financial management includes factors of investment allocation, indebtedness, selling practices, taxes, land values, and comparative costs.

Economic Aspects of Forage Production and Use

Economic aspects of producing forage from range and pasture lands are concerned with obtaining optimum production (use) of forage at the minimum cost. In addition, it is inferred that long time soil conservation requirements are satisfied. Emphasis is placed on long time soil requirements, because from an economic viewpoint it is unlikely that the grazier can always stock to proper capacity or desirable utilization each year. Extreme variation in weather, among other factors, precludes this.

Costs and returns or the benefit-cost ratio are factors that each ranch must calculate in producing and harvesting forage from range lands. This is also true for public range lands, although perhaps to a lesser extent because of the intangible returns.

A pessimistic note on benefit-cost analysis as applied to public lands is sounded by Kelso (1948). He writes:

"... economic analysis and criteria (will have only) a minor role in guiding public investments on public lands. (All that economists) can accomplish in this regard will be some slight aid in guiding public investment policy ..."

Kelso continues by indicating that political considerations will outweigh the economic in making final decisions. This would seem to be a defeatist policy from the economic viewpoint. Others maintain that public land policy should be amenable to economic analysis, although perhaps the criteria for calculating costs and returns may differ from those of private lands. In addition, it may be emphasized that considerable of our public range lands do not differ greatly from the adjoining private lands and as such should not differ as to potential or future value.

The levels of production of forage, and investment in range lands to increase forage production, depend on the net product of any factor of input. The net product is reflected in the net income to the firm. For private lands, and public lands used in association with private lands, the gain or loss from inputs can best be determined by analyzing the complete ranch organization. For example, the value of forage produced on one seasonal range should be considered in its association with adjacent or complementary range having differing seasons of use.

Budget analysis of the ranch offers a convenient tool for a determination of the costs and benefits of range management practices. Given sufficient data one practice (input) can be varied while holding all other ranch inputs constant. In this manner the net effect on ranch income of certain range management practices can be determined.

Range Improvements

It is difficult to conceive of a situation wherein range improvement practices will not result in increased net productivity of the range. At least increased productivity of forage or livestock is perhaps the principle aim of range improvements. However, the increase in productivity as measured in gross returns to the individual firm or to society is not the prime factor in deciding if range improvement expenditures are economically feasible. The factor is, does the improvement create a net increase in returns over the short term or a net increase in capital investment capable of paying an adequate return over the long term?

For private lands there can be no alternative to measurable net returns. If the ranch as organized cannot obtain an adequate net return on capital investment, then the investment becomes economically unsound. For public lands the same situation exists, except that government may have a different time preference or can charge off a portion of the costs to intangible or tangible social benefits. In addition the cost is spread over a broad base of society and if disinvestment occurs the net effect is small.

Reseeding of range lands is an excellent example of the economic implications of range improvements. It is known that under certain soil, site, and moisture conditions, reseeding can be accomplished with various degrees of success. At present in most reseeding projects *some* of the costs and *some* of the returns are obtained. However, complete input-output data on range reseeding is lacking. In addition, net returns to the firm are an unknown or an indefinitely known quantity.

Capital investment on private lands must secure an adequate return or the capital will seek alternative opportunity.

Investment in reseeding on public lands includes an inherent charge to soil and water conservation. On the basis of net production of forage it is probable that considerable of the reseeding on public lands would exhibit a low benefit-cost ratio. Range reseeding has not progressed far on many acres of private lands adapted to this treatment because the rancher may not be convinced that it is the best investment opportunity for his capital.

The above is not an indictment of range reseeding, past, present or future—far from it. Reseeding seems to be the most promising activity for increasing production on range lands. However, it behooves the range manager and agricultural economist to develop a set of criteria whereby the rancher can determine the economic feasibility of reseeding. Successful reseeding performances on public lands in which returns to total ranch organization are not evaluated do not answer the benefit-cost problems on private lands.

Similar situations exist for many other range improvements practices. Each practice or combination of practices must result in increased net returns to the firm. If not, capital investment will not flow in that direction. The difference between investment in reseeding and in other types of improvements is one of certainty or risk. The high risk factor is an unknown item of cost in much range reseeding. The risk (failure) factor is such as to deter the actuarial calculation of the weather variant in benefit-cost ratios.

Economic Aspects of Fluctuating Forage Production

Variation in range forage production resulting from variation in precipitation is one of the more important range management economic problems viewed from the ranch organization and income aspect. The grazing economy of the range area depends in large part on range forage and the over-all level of range forage production is determined primarily by annual precipitation.

Many factors are correlated with plant growth, but annual precipitation and its seasonal distribution seems to be the dominating factor over large areas of the West.

In an analysis of range condition and annual precipitation, Clawson (1948) states:

"There are comparatively few range areas which will not produce more forage in a year of relatively high annual precipitation than in a year of relatively low annual precipitation. An unfavorable seasonal distribution of precipitation may render a relatively high annual total precipitation less effective. . . but (mainly) it is total annual precipitation which dominates total forage production on any given site."

Lantow and Flory (1940) arrive at essentially the same conclusion.

The average rancher is concerned each year with the level of production to be accomplished the following year. In his deliberations he is guided by two important factors both beyond his individual capacity to control. Price is one determinant in when he will sell, and whether he will maintain, increase, or decrease his livestock inventory. Another factor is his range forage supply. These two factors contain much of the economic forces that determine the income from a ranch.

A study by Hochmuth and Goodsell (1948) indicates that cattle ranch income fluctuated tremendously over the 1930–50 period. Net ranch income fluctuated from a low of 20 dollars in 1934 to a high of almost 11,000 dollars in 1948 (Table 1). The index of net ranch income (1937–41 = 100) for comparable years was 1 percent and 382 percent respectively. The

fluctuation in income over the 1930–50 period resulted from the action of economic and physical forces on ranch organization and operations. The low in 1934 was due to a combination of low prices and drouth. This situation spells disaster in the range area.

in unit dollars from a ranch. The influence of price on income can be reduced to a large extent by using average weighted prices of a base year or years. It is to be expected that all price influence can not be eliminated because price affects inventory numbers and selling practices.

TABLE 1

Index numbers of income, production, precipitation, and range feed condition (1937–41 = 100). Family-size cattle ranches, Intermountain region, 1930–50

YEAR	NET RANCH INCOME		TOTAL RANCH PRODUCTION[2]		PRECIPITATION		RANGE FEED CONDITION	
	Annual[1]	Index 1937–41 = 100	Annual	Index 1937–41 = 100	Annual	Index 1937–41 = 100	Annual	Index 1937–41 = 100
	dollars	*percent*	*units*	*percent*	*inches*	*percent*	*percent*	*percent*
1930	2,889	102	3,639	107	15.4	87	90	106
31	1,506	53	3,240	94	13.8	78	79	93
32	1,229	43	3,508	103	15.8	89	84	99
33	976	34	3,286	97	15.0	85	78	92
34	20	1	2,135	63	13.3	75	70	83
1935	1,665	59	2,740	81	13.4	76	78	92
36	1,963	69	3,206	94	16.0	91	83	98
37	2,369	83	3,087	91	18.6	105	83	98
38	2,303	81	3,288	97	17.9	101	89	105
39	2,139	75	2,959	87	12.6	71	79	93
1940	2,775	98	3,436	101	18.3	104	83	98
41	4,627	163	4,236	125	21.0	119	91	107
42	5,237	184	4,034	119	17.6	100	86	101
43	5,417	191	3,979	117	15.2	86	84	99
44	4,910	173	3,774	111	15.3	87	83	98
1945	5,882	207	3,965	117	19.6	111	85	100
46	6,722	237	3,856	113	17.5	99	83	98
47	9,191	324	3,834	113	16.5	93	85	100
48	10,842	382	4,010	118	15.6	88	81	96
49	7,799	275	3,551	104	15.0	85	78	92
1950	8,835	311	3,332	98	15.2	86	79	93

[1] Net income plus perquisites and inventory change.

[2] The total quantity of ranch products produced during year. To eliminate the influence of price all items of income and expense were weighted by base prices. The base prices were weighted by the quantities of each item purchased or sold in the base years. The formulas used are:

$$\text{for income, } \frac{\Sigma q^1 p^1}{\Sigma q^0 p^0}\text{; for quantity } \frac{\Sigma q^1 p^0}{\Sigma q^0 p^0}\text{; and for price } \frac{\Sigma q_1 p_1}{\Sigma q_1 p_0}$$

pl and ql are current prices and quantities and po and qo are weighted average prices and quantities respectively in the base years.

It is possible to calculate with some accuracy the influence of precipitation and forage production on total production

When the year to year price changes on input-outputs is eliminated by using weighted base prices, the influence of

other factors on ranch income becomes apparent. The index (1937–41 = 100) of total ranch production shows much similarity to the index of precipitation (Fig. 1). The inference to be drawn is that precipitation has a direct effect on forage production and hence, ranch production. This is not a new revelation. However, the foregoing discussion is made to point out the economic nature of fluctuating climatic factors and their effect on forage (ranch income) production. *This is perhaps the most important and least understood of the many economic aspects of range management.*

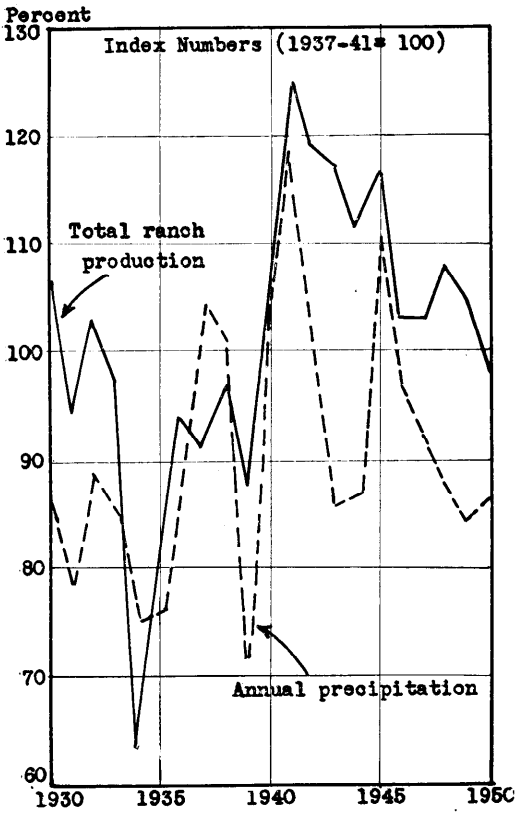

FIG. 1. Total ranch production and annual precipitation. Family-size cattle ranches. Intermountain Region, 1930–50.

The rancher is always faced with the necessity of adjusting his livestock numbers to the fluctuating forage supply. Reports by Nelson (1934), and Craddock and Forsling (1938), reveal the infeasibility of stocking rates based on average forage production or average precipitation.

Range technicians, pointing to the unstable character of precipitation in the Western states and the resulting unstable forage supply, have recommended various range management practices. Perhaps the principle recommendation is to leave from 25 to 40 percent of the forage ungrazed for a feed reserve, for soil protection, and for protection of plant vigor. However, in the extremely dry years even this program does not suffice to furnish adequate forage for livestock and still maintain soil and plant protection.

Large reductions in livestock numbers over short periods generally are financially undesirable to the rancher. Drought creates a situation which even a conservative grazing policy cannot solve over the short run. Perhaps crop insurance (financial reserve) is the answer rather than the now recommended procedure of leaving forage on the range as partial insurance against the weather risk factor. However, there are no actuarial determinations of forage production probabilities to aid a crop (forage) insurance program for the range area. Range technicians can make a valuable contribution to range and ranch management by developing a lengthy series of data on forage production and range plant responses to climate under a wide set of soil, site, and climatic conditions.

A reduced supply of range forage culminating in reduced production of livestock and income is not in itself the critical factor in ranch management and survival. The critical point is reached when individual ranch income falls below family income survival. If range forage is reduced to a critical level in terms of numbers of livestock necessary to return a critical minimum income, no amount of range management practices will greatly

assist the financial management of the ranch at this time. The problem is not one to be wholly solved by balancing the forage supply. At this critical time it can only be ameliorated by drawing on a financial reserve. Range forage (crop) insurance could be a feasible answer if the basic range data were available.

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MESQUITE SPRAYING

Small, trainer-type planes, their booms filled with a potent new hormone herbicide—2,4,5-T—are spraying an estimated 100,000 acres of infested pastureland in five counties around Wichita Falls, Texas. Thanks to the work of Charles Fisher of the Spur, Texas, Agricultural Experiment Station, the thousands of dollars being spent are not wasted in a fantastic gamble. It has been firmly established that 2,4,5-T will provide virtually 100 percent top-kill and about 80 percent root kill. With $1.75 per acre PMA aid, the cost to the farmer or rancher for the spraying is only about $1.50 per acre.—*Glenn Shelton.* The Cattleman (Fort Worth). August, 1951.