ECONOMIC EVALUATION OF NEVADA RANGE MANAGEMENT INVOLVING DEER

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Abstract: The objectives of the study were to estimate the demand for deer hunting, and to use this value in evaluating range improvement activities for livestock and deer. The State was divided into eight hunting areas. Demand estimates were based on average variable trip expenditures and the number of trips taken per hunting population for each area. Consumer surplus was used to derive valuation estimates which range from $24,000 to $275,000 and a total value for the State of slightly over $1,000,000. The values were converted to values per deer-day use for each area and used to evaluate five range management practices. Three of these practices were designed to increase the carrying capacity of livestock and the cost of taking the land out of deer habitat was found. Two areas were improved for deer use and the benefit-cost ratio using the discounted deer values was found to be greater than one. These range management evaluations depended upon the deer population in the winter range actually increasing. There is yet no evidence of the overall increased number and hence the positive benefit-cost ratio in this case would provide tentative estimates of potential benefits.

Economics is generally defined as the allocation of scarce resources among alternative and competing ends. It is becoming increasingly obvious that the resources supporting wildlife, particularly big game, are scarce (i.e. more would be preferred), and according to the multiple-use concept, there are usually alternative uses for these resources. According to definition, then, the management of the big game resource is indeed an economic problem. The allocation of scarce resources implies a goal to be met by the individual or society. It is not necessary that this goal be profit maximization, although it is all too often assumed to be the one existing particularly for individual firms. If these resources can be used to produce alternative products which are measured in different units, a problem arises as to how these alternative products satisfy the stated goals. In the analysis of business firms, this problem is overcome by converting the various products to a common denominator--namely the dollar value. In resource management the values of the product are often not known and hence the benefits from alternative practices cannot be compared. The purpose of the study recently completed at the University of Nevada, Reno, in cooperation with the Nevada Department of Fish and Game and the Bureau of Land Management, was to derive the value of the range resource as it is being used to provide big game habitat. This value must be usable in evaluating the physical benefits of various range management practices and be comparable to the existing values of the range resource in providing grazing for domesticated livestock.

The most commonly used method of appraising the land resource in the production of livestock is through income capitalization. This capitalized value, since livestock are traded in the market place, can be estimated within reasonable limits. This is not so for wildlife resources. It is the absence of a market that makes value determination difficult and not the presence of aesthetic values. Practically all commodities have some degree of aesthetic values associated with them, but since they do move through an organized market, their value can be determined by observing the price that people are willing to pay. To determine the resource values for products not moving through the market place, two different techniques have been used to date. One was the nondiscriminating monopolist approach used by Brown (1964) to evaluate the salmon-steelhead industry in Oregon. The second was the consumer surplus method used by Wennergren (1967) in estimating the mule deer habitat in Utah. For comparative purposes both methods were used in the study at Nevada with the consumer surplus method selected to evaluate management practices.

The nondiscriminating monopolist approach assumes that the number of times a person participates in an activity is a function of the cost of participation. This is a traditional demand concept in which the amount consumed decreases as the cost increases. Typically, on any given demand curve there is a point at which the percentage increase in price just equals a percentage decrease in consumption, and if an agency, for example, had full control of the resource so that it could charge for the privilege of participating, this would be the point at which total revenue to the agency would be maximized. According to Brown, this "net economic value" is the value that comes closest to computing a value to the resource comparable to what its value might be if it were privately owned.

The consumer surplus approach similarly uses the demand function but attempts to measure the net satisfaction derived from hunting in dollar terms. It assumes that the maximum amount paid by any group of hunters to hunt in a particular area is representative of all hunters' willingness to pay for the privilege of hunting in that area. Those hunters that actually had to pay less, in fact, did receive more for their money and the difference between what they would have been willing to pay and what they had to pay is a measure of this extra satisfaction. Since it is a net satisfaction expressed in dollar terms, it may be argued that the value is analogous to net income derived from ranching in the same area. If this consumer surplus value is then capitalized, it becomes comparable to the capitalized value of the grazing resource. It was because of this analogy that consumer surplus value was used rather than the nondiscriminating monopolist value in the evaluation of management practices.

In both the nondiscriminating monopolist and the consumer surplus approaches a demand estimate was needed. To estimate the demand for a product, such as deer, not moving through a market place, a substitute for the price that people are willing to pay is needed. This price proxy was assumed to be the variable cost associated with a hunting trip. These variable costs per trip were assumed to be the factor determining the number of trips that a hunting population will take to an area. The necessary variables for the study were determined using data obtained from mail questionnaires of persons licensed to hunt in Nevada, including residents and nonresidents.

The State of Nevada was divided into eight hunting areas, each of which follow the Nevada Department of Fish and Game boundaries and somewhat approximated BLM District boundaries. For each of these hunting areas, the demand curve was determined. 1/

The results of the evaluation procedures are shown in Table 1. The logic of consumer surplus is illustrated in the table. First, it was expected that hunting areas close to large population centers would have a high surplus value because of the relatively low cost of hunting in areas adjacent to home. Observe Area 8, which is around the largest metropolitan center in the State of Nevada--Las Vegas. Although the quality of hunting is relatively poor in the southern part of the State, it does have a high surplus value

Table 1. Annual imputed values for eight hunting areas.

Area	Consumer Surplus	Nondiscriminating Monopolist
1	$ 24,107	$ 9,700
2	90,523	33,708
3	274,713	125,356
4	155,042	75,408
5	72,134	31,755
6	121,965	48,846
7	183,454	67,672
8	115,938	44,775
TOTAL	$1,037,876	$437,220

1/ A more detailed description of the methodology used to determine both consumer surplus and nondiscriminating monopolist values can be found in the bulletin reporting the results of this study. See Garrett (1970).

because of the large population. Secondly, areas of quality hunting will have high consumer surplus values because they attract a large number of hunters. Areas 3 and 4 in the northeastern part of the State, even though large distances are involved to population centers, have high consumer surplus values because of the quality of hunting. Area 7, on the other hand, is reasonably close to the large population center of Carson City and Reno and reflects good quality thus illustrating the combined effects of the two factors.

The absolute value of the eight hunting areas is of limited value, however, because of differences in location, size and quality.

To place these values on a more meaningful common denominator will increase their usefulness considerably. Table 2 shows the values of consumer surplus converted to a value per deer population, value per hunter day, and a value per deer AUM. The appropriate per unit value to use depends upon how the physical benefits derived from a management practice standpoint are measured. The management practices which this study attempted to evaluate were measured in increased deer usage. Consequently, the surplus value per deer was used.

Table 2. Annual surplus values per unit of measurement by areas.

Area	Value per Deer	Value per Hunter Days	Value per Deer AUM
1	$ 4.19	$1.37	$4.09
2	8.16	6.40	3.31
3	4.23	9.05	2.93
4	4.08	9.58	1.53
5	5.77	3.34	1.12
6	5.36	5.67	2.42
7	7.17	4.97	5.06
8	15.01	5.74	5.89

The effect of time is an important factor which must be considered in the analysis. All costs and benefits associated with the project had to be placed on a comparable time period. This was accomplished by discounting future benefits using the standard discounting formula, $PV = \Sigma v/1+i)^n$. Selection of an appropriate discount rate (i) for comparing values in different time periods is a key factor to good planning. The Water Resources Council recommends an interest rate based upon the average rate of interest payable by the U.S. Treasury on interest bearing marketable securities outstanding at the end of the fiscal year preceding the computations and rounded to the nearest one-eighth percent. The rate currently used by BLM in Nevada is 5.5 percent. For evaluation, the economic life of a project is considered to be the period of time over which the project will serve a useful purpose. According to BLM, the average economic life (n) of a range rehabilitation project in Nevada is 20 years. Table 3 shows the discounted values of the deer-day use over a 20-year period at 5.5 percent interest.

Table 3. Discounted values per deer-day use.[a]

Area	Value per Deer-Day Use
1	$ .1372
2	.2669
3	.1383
4	.1335
5	.1889
6	.1754
7	.2347
8	.4913

[a] Discounted over 20 years at 5.5 percent.

The rehabilitation measures included in this analysis were divided into two general categories: (1) crested wheatgrass seedings, and (2) pinyon-juniper controls.

The crested wheatgrass seedings, of which there were three, each showed a reduction in the amount of deer-day use, ranging from 98,571 to 165,745. By multiplying these lost deer-days by the value per deer-day use and then dividing by the number of acres involved in each reseeding project, a cost per acre was determined. This cost per acre should be included in the cost of these reseeding projects as a cost representing the value of the wildlife which can no longer use the areas. These values ranged from $11.30 per acre to $22.55 per acre.

The two pinyon-juniper controls, which were investigated, showed an increase of deer-day use and when multiplied by the value per deer-day use, each showed a benefit-cost ratio in excess of 2.0. It should be pointed out, however, while the range utilization increased on these controlled areas, there is yet no evidence that deer numbers and the total winter range area is actually increased nor is there evidence that reproduction has been enhanced. If this is, in fact, the case, obviously little or no economic benefits have accrued as a result of the rehabilitation projects. It would seem that the potential benefits do in fact remain as a result of these rehabilitation projects. One would logically assume that there are other factors limiting the increased population of the deer herd, whether they be hunting pressure, summer range availability, or whatever. If these limiting factors could be changed to permit an increased deer population, these rehabilitation projects would show a true economic improvement.

There are always certain limitations existing when a highly theoretical model such as consumer surplus is used. These limitations to a large part rest on the validity of the assumptions made. The most questionable assumption used in this analysis was that all deer hunters in the State have the same set of values. This, of course, is not true. The methodological approach attempted to reduce the seriousness of this assumption by using average expenditures and average number of trips taken per hunting population assuming that on the average, people's values will be the same. Another assumption which was made was that expenditures represent willingness to pay. Since deer hunters recognize that they are often limited to the number of trips that they may take by bag limits, the amount that they are willing to pay may be seriously misrepresented by actual expenditures. The values derived are probably underestimates of the true value inasmuch as hunters would be willing to make additional trips at the same cost if they were so permitted.

It is impossible to test the validity of the findings in this study. As long as hunters are not required to pay on a competitive basis for the privilege to hunt, any value imputed to the resource will be theoretical and impossible to judge. Logically, these results appear sound to the extent that the assumptions are valid. One is inclined to believe that the relative magnitude of the values imputed to the different hunting areas would be more useful than the absolute magnitude. This is the primary concern of management agencies with a given quantity of dollars to spend for management practices. The concern of the agencies is where will expenditures represent the greatest benefit. Values imputed in this study represent these relative differences in terms of increased satisfaction to the hunting population.

LITERATURE CITED

Brown, W. O. 1964. Measuring recreational benefits from natural resources with particular reference to the salmon-steelhead sport fishery of Oregon, Economic Research in the Use and Development of Range Resources, W.A.E.R.C. Range Committee, Report No. 6.

Garrett, J. R., G. J. Pon, and D. J. Aristeguy. 1970. Economics of big game resource use in Nevada. Nevada Agric. Exper. Station Bull., B. 25. Univ. Nevada, Reno.

Wennergren, E. B. June 1967. Demand estimates and resource values for resident deer hunting in Utah. Utah Agric. Exper. Station Bull. 469. Logan, Utah.