The Economic Effects of Three Changes in Public Lands Grazing Policies

ALLEN TORELL, J.R. GARRETT, AND C.T.K. CHING

Abstract

Linear programming was used to analyze the impact of potential changes in federal policies. The amount of federal grazing used by ranchers was found to be relativley unresponsive to grazing fee increases. However, allotment reductions and adjustments in the allowed season of use for federal grazing had a large impact on the quantity of beef supplied and the net income of the ranches studied.

Leased grazing for privately owned domestic livestock has been an important use of public lands throughout Nevada. Availability of federal grazing leases plus relatively low grazing fees led to the development of extensive range resource use by the livestock industry. Mitchell and Garrett (1977) reported range property values closely related to availability of federal grazing permits. Of the 56 ranches surveyed in northeastern Nevada, only four did not use federal lands; and, the average ranch depended upon federal range for about 49% of its annual feed requirements.

Recently Bureau of Land Management (BLM) and U.S. Forest Service (FS) proposed increasing fees for grazing on public rangelands to the fair market value (FMV) of private leases. Other proposals include elimination of early spring grazing and/or a temporary reduction of grazing to rejuvenate overgrazed range resources. Because of the large amount of federal grazing lands in Nevada, these changes in public lands policies could have a significant effect on Nevada's livestock industry.

The purpose of this paper is to present estimates of the economic impact on a sample of 36 ranches in Elko County of three public land use policy changes: (1) increase in BLM and FS grazing fees; (2) elimination of spring grazing on BLM range; and, (3) reductions in BLM grazing allotments of 20, 40, and 60%.

Procedure

A linear programming (LP) model was developed which depicts seasonal use of herbage resources by cattle on a typical Elko County, Nevada, ranch such that net revenue (sales minus costs) is maximized. Table 1 contains a brief description of each activity used in the model and its associated per unit cost or return.

To be realistic, the LP model must account for the amount of forage available from any one forage source (e.g., deeded rangeland, BLM rangeland, hay, and hay aftermath), and seasonal availability and nutrient quality of the forage source in the different grazing periods. This is accomplished in the model through a series of linear equations which express the interrelationship of forage quantity, quality, seasonal availability, and livestock requirements during each grazing period.

Constraints in the model included maximum and minimum number of cows to be raised, bull and horse requirements, and land restrictions, both deeded and public. Production parameters included death losses, selling weights, and calving percentages.

Authors are research associate, associate professor, professor, respectively, in Division of Agricultural and Resource Economics at the University of Nevada, Reno, Nevada, 89557.

Manuscript received January 8, 1980.

Table 1. Description, costs and prices for the major activities in the model.

Activity	Units	Cost
Cost activity		
Growing and harvesting alfalfa hay	acre	$95.00
Growing and harvesting grass hay	acre	22.00
Grazing irrigated pasture	AUM	13.50
Grazing range land	AUM	3.50
Grazing BLM land	AUM	6.54
Grazing FS land	AUM	6.60
Purchase grass hay	ton	60.00
Purchase alfalfa hay	ton	70.00
Purchase protein supplement	ton	130.00
Feeding cost of hay	ton	1.38
Purchase price of bulls	head	890.00
Cost of raising cows (excl. feed)	head	7.00
Return activity		
Price received for alfalfa hay	ton	$60.00
Price received for cull cows	cwt	24.50
Price received for cull bulls	cwt	34.00
Price received for calves	cwt	40.50
Price received for yearlings	cwt	38.50

Minimum and maximum numbers of cows were imposed as restrictions on the model to preclude ranches from going out of business or greatly increasing herd size in the short run. As such, the analysis is short-run in nature.

The economic impact of changes in federal lands policies was measured in terms of aggregate net income to the ranches studied, quantity of beef supplied, and amount of range and hay resources used. For a detailed mathematical description of the LP model used see Torell et al. (1979).

Elko County was selected for study because it contains Nevada's most productive grazing resources and, thus, is an important area for the state's livestock economy. A sample of 36 Elko County ranches from the Mitchell and Garrett (1977) survey was the primary data source. The ranches were aggregated into six groups according to size and whether winter feed or spring (April) grazing was the most limiting resource. For a more detailed discussion and rationale for the aggregation method use, see Ulrich et al. (1979).

It should be pointed out that each of the six ranch groups has different resource combinations and reacted differently to the policy changes considered. The existence of six different groups of ranches tends to explain some of the minor variations in the estimated behavior of ranches to policy and/or price changes. For example, at the lowest beef price level considered, most ranches would produce the minimum number of cows (imposed as a constraint). However, two ranch groups would find it profitable to produce above the minimum. These two ranch groups would reduce their herd size to the minimum number of cows when there are changes in grazing policy such as elimination of spring grazing. This explains the slight reduction in total beef supply.

Results

The results of the impact analysis are discussed in four subsections: (1) the influence of beef price levels on production and resource use; (2) effects of increased grazing fee levels on federal lands, both BLM and FS; (3) allotment reductions on BLM lands; and (4) elimination of early spring grazing on BLM lands.

Beef Price Level Increases

Tables 2, 3, and 4 contain estimates of aggregate ranch output and resource use associated with varying grazing fees, BLM allotment reduction, and elimination of spring grazing on BLM lands, respectively. These changes in grazing policy are analyzed for six levels of beef price, which are weighted average of all beef sold, including cull cows and bulls. As noted in Table 1, initial beef prices for calves and yearlings are about $40.00 per cwt. This price level corresponds to weighted average price of $34.72 for all animals sold. As beef prices are increased, the weighted beef price level increases accordingly. Thus at $80.00 per cwt for calves and yearlings, the corresponding weighted beef price is $74.81.

As beef prices increase, changes in ranch output and resource use are consistent with expectations. With increases in the beef price level, there are corresponding increases in net income, total beef supply, hay purchases, and use of forages from irrigated pastures and range sources. Also, when beef prices increase, the amount of hay sold off ranches decreases.

Two beef price levels require specific discussion. The first beef price level is $24.32, which is the lowest beef price level considered in the analysis. At this level of beef price, ranchers are not able to meet variable costs, and if permitted, would get out of the cow business. As previously noted, a minimum cow constraint has been imposed on the study ranches to preclude ranches from going in and out of business in the short run. Thus, at the $24.32 price level, ranchers in the area would produce the minimum number of cows. Again, if the minimum cow constraint had not been imposed, ranchers would find it more profitable to sell their cow herd and raise and sell hay.

At the next beef price level of $34.72, ranchers are on the borderline between profitable production of beef and letting resources go unused. This fact should be kept in mind as grazing policy changes are considered in the following paragraphs.

Increase in Federal Grazing Fees

Four federal grazing fee levels were considered in the analysis (Table 2). As expected, increased grazing fees decrease net income. For example, at the beef price level of $24.32 and the initial grazing fee level of $1.51 per AUM, net income is $133,300. When the grazing fee level is increased to $2.50 per AUM, net income drops to $71,200.

Note, however, that as grazing fee levels increase, physical production or beef supply is relatively unresponsive (inelastic). For example, at the beef price level of $44.80, total beef supply, hay purchases, hay sales, use of irrigated pastures, and federal range use are practically invariant with respect to changes in the grazing fee level. This relationship holds for other beef price levels as well. Accordingly, the results in Table 2 show that as grazing fee levels increase, there is a corresponding decrease in net ranch income for the ranches studied. However, beef supply and forage resource use does not change appreciably.

BLM Allotment Reductions

Three levels of BLM allotment reductions were considered in the analysis (Table 3). As the level of allowable allotment use is decreased, there are corresponding decreases in net income and total beef supply. Hay purchases decline through a 20% and a 40% BLM allotment reduction. At the 60% allotment reduction, hay purchases increase in order to make up for the reduction in BLM forage. Further, as allotment reduction levels are increased, hay sales also increase, although at the higher beef prices, the amount of increase is nominal. In fact, at the highest beef price level, there are no hay sales.

As expected, as BLM allotment reductions are imposed there is increased use of irrigated pasture and FS range. For all practical purposes, at the beef price level of $34.72, FS range is used to a maximum of 34,000 AUMs.

With the imposition of allotment reductions on BLM lands, ranchers in the area tend to use all of the available or permitted

Table 2. Aggregate ranch output and resource use at varying grazing fees and beef prices.

Weighted price per cwt	Fee level	Net income (thous. $)	Total beef supply (mil lb)	Hay bought (tons)	Hay sold (tons)	Irrigated pastured used (AUM's)	Federal range used (AUM's)
$24.32	$1.51	$ 133.3	6.91	1,937	5,088	0	93,309
	1.64	125.7	6.91	1,937	5,088	0	93,309
	2.00	103.2	6.91	1,937	5,088	0	93,309
	2.50	71.2	6.87	1,937	5,088	0	93,309
34.72	1.51	927.6	8.94	5,141	628	4,849	121,817
	1.64	918.1	8.93	5,116	628	4,849	121,715
	2.00	888.0	8.71	4,216	628	4,849	118,241
	2.50	843.8	8.34	2,924	637	4,849	113,618
44.80	1.51	1,846.3	9.48	7,144	401	4,849	123,352
	1.64	1,836.8	9.48	7,144	401	4,849	123,352
	2.00	1,832.6	9.48	7,144	401	4,849	123,352
	2.50	1,756.4	9.45	7,255	422	4,849	123,334
54.80	1.51	2,813.9	9.70	7,896	369	7,607	125,079
	1.64	2,804.2	9.70	7,896	369	7,607	125,079
	2.00	2,773.9	9.70	7,896	369	7,607	125,079
	2.50	2,719.1	9.67	7,917	390	7,607	124,942
64.81	1.51	3,845.9	10.89	13,348	369	31,996	125,596
	1.64	3,836.4	10.89	13,348	369	31,996	125,596
	2.00	3,806.4	10.89	13,348	369	31,996	125,596
	2.50	3,748.1	10.85	13,385	390	31,996	124,942
74.81	1.51	4,937.8	10.93	13,382	0	31,996	125,596
	1.64	4,928.4	10.93	13,382	0	31,996	125,596
	2.00	4,898.5	10.93	13,382	0	31,996	125,596
	2.50	4,836.3	10.93	13,403	0	31,996	124,942

Table 3. Aggregate ranch output and resource use at varying BLM allotment reductions and beef prices.

Weighted price per cwt	Percent BLM allotment reduction (%)	Net income (thous. $)	Total beef supply (mil lb)	Hay bought (tons)	Hay sold (tons)	Irrigate pasture used (AUM's)	BLM range used (AUM's)	FS range used (AUM's)
$24.32	0	$ 133.3	6.91	1,937	5,088	0	83,448	9,861
	20	102.7	6.82	2,200	5,110	852	71,137	18,059
	40	63.9	6.72	2,491	5,132	2,592	53,351	30,756
	60	-103.4	6.66	4,499	5,055	9,422	35,569	33,607
34.72	0	927.6	8.94	5,141	628	0	89,266	32,551
	20	855.4	8.00	3,915	2,340	852	71,482	34,086
	40	755.0	6.99	2,750	4,252	2,593	53,696	34,086
	60	562.8	6.72	4,757	4,889	9,422	35,914	34,086
44.80	0	1,846.3	9.48	7,144	401	4,849	89,266	34,086
	20	1,698.4	8.87	5,280	411	12,494	71,482	34,086
	40	1,546.0	8.39	4,013	422	21,676	53,696	34,086
	60	1,336.5	8.17	5,941	853	29,205	36,239	34,767
54.80	0	2,813.9	9.70	7,896	369	7,607	90,596	34,483
	20	2,620.2	9.25	6,633	379	17,597	72,477	34,767
	40	2,423.4	8.81	5,401	390	27,588	54,357	34,767
	60	2,168.7	8.37	6,477	400	31,158	36,329	34,767
64.81	0	3,845.9	10.89	13,348	369	31,996	90,596	34,483
	20	3,616.1	10.40	13,643	379	31,996	72,477	34,767
	40	3,379.5	9.91	13,997	390	32,266	54,357	34,767
	60	3,092.0	9.73	17,817	400	32,642	36,329	34,767
74.81	0	4,937.9	10.93	13,382	0	31,996	90,596	34,483
	20	4,659.1	10.44	13,943	0	31,996	72,477	34,767
	40	4,373.4	9.95	13,997	0	32,266	54,357	34,767
	60	4,067.4	9.76	17,817	0	32,642	36,329	34,767

AUM's from BLM lands. For example, at the $44.80 beef price level and no reduction on BLM lands, ranchers in the area utilize approximately 89,000 AUM's of BLM forage. With a 20% reduction in BLM allotment, ranchers in the area would use approximately 80% of the 89,000 AUM's previously used.

Elimination of Early Spring Grazing

Elimination of BLM grazing during the month of April and during the months of April and May combined were considered in the analysis (Table 4). As expected, as early spring grazing is eliminated, there is a decline in net income. Ranchers would adjust to the elimination of early spring grazing by substituting, to the extent possible, irrigated pastures, deeded rangeland and forest service range for the early spring BLM grazing. In addition, ranchers would increase the amount of hay purchased in order to make up for the loss in early spring grazing. Because it was assumed that the total number of AUMs available for the BLM lands would not change, the increased purchase of hay for spring use enabled the ranchers in the area to maintain larger herd sizes and, hence, sale of beef. For example, at the higher beef price levels, starting with $54.80, beef supply increases as spring grazing

Table 4. Aggregate ranch output and resource use with elimination of BLM spring grazing and at varying beef prices.

Weighted price per cwt	Months of BLM grazing eliminated	Net income (thous. $)	Total beef supply (mil lb)	Hay bought (tons)	Hay sold (tons)	Irrigated used (AUM's)	BLM used (AUM's)	FS used (AUM's)
$24.32	None	$ 133.3	6.91	1,937	5,088	0	83,448	9,861
	April	14.4	6.71	3,263	4,573	0	75,632	7,163
	Apr & May	-142.2	6.71	4,787	4,109	7,475	62,976	6,374
34.72	None	927.6	8.94	5,141	628	0	89,266	32,551
	April	797.3	9.48	7,587	617	0	89,159	24,807
	Apr & May	573.0	8.18	7,703	617	7,767	76,651	9,567
44.80	None	1,846.3	9.48	7,144	401	4,849	89,266	34,086
	April	1,737.8	9.78	10,842	401	3,633	89,151	34,086
	Apr & May	1,468.3	9.59	14,135	401	9,971	83,959	16,610
54.80	None	2,813.9	9.70	7,896	369	7,607	90,596	34,483
	April	2,732.0	9.96	11,479	369	5,586	90,546	34,426
	Apr & May	2,506.2	11.06	21,880	369	11,991	90,479	34,426
64.81	None	3,845.9	10.89	13,348	369	31,996	90,596	34,483
	April	3,788.3	11.22	17,212	369	31,996	90,546	34,426
	Apr & May	3,730.6	12.09	27,531	369	30,325	90,479	34,426
74.81	None	4,937.9	10.93	13,382	0	31,996	90,596	34,483
	April	4,913.8	11.27	17,320	0	31,996	90,546	34,426
	Apr & May	4,848.1	12.22	28,232	0	32,063	90,479	34,426

is eliminated. The increase in beef supply comes about from increased use of hay during the early spring and a larger herd size to utilize BLM forage available later in the grazing season. Thus, at the $54.80 price level, beef supply increases from 9.7 million pounds when there is no elimination of spring grazing to approximately 11 million pounds when there is an elimination of spring grazing during both the months of April and May. Even though herd size and beef supply are increased, net income is reduced.

At the lower beef price levels, the results are somewhat more erratic. At the lowest beef price level, the elimination of early spring grazing reduces herd size close the minimum allowed with corresponding decreases in the amount of beef produced and sold.

At the next two price levels, beef supply increases when there is only a reduction in April grazing but shows a decrease when both April and May grazing are eliminated. With the elimination of 2 months of grazing in the early spring, ranchers would not find it profitable to feed additional hay to make up for the lost grazing. They do substitute hay to some extent but do not entirely make up for the lost BLM grazing during the early spring.

Conclusions

The results of the three grazing policy changes considered in this paper are interesting in that they are real possibilities and they show different economic impacts on the ranching sector. All three grazing policy changes are being discussed by public land managers. In fact, there is also some speculation that all three policy measures considered could be implemented simultaneously.

Each of the grazing policy changes considered has different impacts on the ranching sector. In the most general sense, grazing fee increases have obvious impact on net ranch income but not appreciably affect the production of beef or the use of forage resources. On the other hand, allotment reductions and elimination of early spring grazing have significant effects. Allotment reductions have, perhaps, the most serious impact on the ranching sector—as analyzed in this paper. Ranchers are forced to substitute higher cost forages in order to maintain herd sizes even at the minimum. On the other hand, early spring grazing eliminations as considered at this paper have the effect of reducing net income but increasing beef supply. Again, this results because there is no reduction in overall forage use on BLM lands, but simply an elimination of grazing during the early spring. Thus, although net incomes would be lower, ranchers would logically substitute other sources of forage (e.g., hay, irrigated pasture, other range) during the early spring and hence have more BLM resources to utilize during later parts of the grazing season.

Economic theory and common sense suggest the direction of changes resulting from these modifications in public lands policies. To a large extent, the results reported here confirm the direction of these changes. In addition, this study presents specific estimates of the net income generated, quantity of beef supplied, and the amount of range and hay resources used by the sample of Elko County ranches. These estimates provide public land use managers and planners with information to assess the policy changes prior to their implementation. Equally important, these estimates provide decision makers with information on the relative economic severity of the three policy changes considered.

Literature Cited

Federal Register. 1978. Grazing and livestock use on the national forest system. Dep. of Agr. Vol. 43, No. 241. Dec.

Mitchell, B., J.R. Garrett. 1977. Characteristics of the range cattle industry 1972 region III northeastern Nevada. Nevada Agr. Exp. Sta. Bull. 242

Torell, A. J.R. Garrett, C.T.K. Ching. 1979. The impact of changes in public lands policies on a sample of 36 ranches in Elko County, Nevada. Nevada Agr. Exp. Sta. Bull. MS117.