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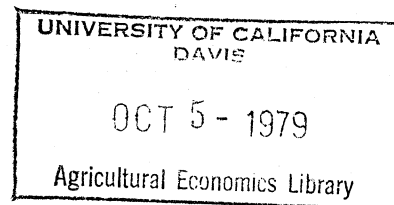
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ABSTRACT

Federal lands comprise 36 percent of the total area of Colorado. At present the primary use of these lands is livestock grazing. Pressures exist to reduce or, in some instances, eliminate livestock grazing. This study, through the use of typical ranch models structured by herd size and regional characteristics, examines how the range livestock industry would respond to hypothesized reductions in federal forage availability.

Mack, L. E.

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SOME ECONOMIC EFFECTS OF RESTRICTED GRAZING ON PUBLIC LAND IN COLORADO

by L. E. Mack and R. G. Taylor*

"For most of the 19th Century, disposal of the public domain was a chief public issue. For the last half century or so, it has been management. Questions of public land management are still far from settled. With a shifting and growing population and with changing economics and social conditions, the question of public land is forever new" (Upchurch, 1961).

As so succinctly stated in the above quotation, competing uses for public lands in the West is not a recent phenomenon. It is an evolutionary process that continually attracts those disciplines studying past conflicts, those attempting to promote order in the present, and those striving to better illuminate a path to the future so that conflicts can be minimized. Nowhere, perhaps, is this public lands conflict more pronounced than among competing uses in Colorado.

Objectives

In Colorado there are approximately 24 million acres of federal land. This area constitutes 36 percent of the total land area of the state. Competitors for these public lands are use factions that represent the traditional as well as the more recent esoterical. The former--composed of interests representing mining, energy, water, forest products, and grazing--are often in conflict with the latter. These latter interests represent recreation, preservation, open space, and the idea that "it is simply there in some natural state." There is also much conflict within, as well as between, these broad use group categories. In fact, there is often use conflict within a single resource category classification, such as the use

*L. E. Mack is assistant professor, Department of Agricultural Economics, North Dakota State University; R. G. Taylor is research associate, Department of Range Science, Colorado State University.

of forage produced on public land. Resolution of these use conflicts is seldom subjected to a single valued function carefully and accurately defined.

This paper, toward the end of evaluating a single resource for a single use, presents losses incurred by the ranching industry in the event that it is restricted in its use of forage from federal lands. A second complementary objective is that of assessing the secondary economic costs to the Colorado economy of restricted grazing on public lands.

Related Research

Some of the first research dealing specifically with the economics of public land use in Colorado was undertaken by Burdick and Clawson (1936). This 1936 study was concerned primarily with establishing a grazing permit distribution policy based on local conditions. At issue were the following: (1) the long-term integrity of the grazing resource, (2) providing a satisfactory standard of living for a farm family (of imminent concern in immediate postdepression western Colorado), and (3) judicious land use and social welfare for affected communities. Also hinted at in the study by Burdick and Clawson was the question of grazing fees. These same issues and concerns are still a major focus of current research efforts relating to public land management. For example, in 1970 the Public Land Law Review Commission recommended that the public lands should be used so as to "attain maximum efficiency in the production and use of forage, and to support regional economic growth" (1970).

Other studies concerned with the effects of changes in grazing policy on public land are numerous. Many have dealt with problems in range restoration brought about because of past abuses. Others have pursued deferred use as a means of attaining long-term range improvement. Caton (1965) examined the effect of a 20 percent reduction in permit use on cattle and sheep ranches

in specific areas throughout the Western states. Gee and Skold (1970) examined and evaluated alternatives to federal land grazing in Colorado. Recent additional studies have evaluated rancher responses to potential reductions of federal grazing permits. The bulk of these have analyzed cattle ranching operations in specific areas. A brief list of the more recent studies includes areas such as Capital Reef, Utah (Chapman, 1970); west central Wyoming (Peryam and Olson, 1975); south central Wyoming (Olsen and Jackson, 1975); Bighorn County, Wyoming (Lewis and Taylor, 1977); and the Tonto National Forest, Arizona (Stubblefield and Robertson, 1979). A listing of public land grazing fees and a bibliography of related study issues can be found in a recent report to the U.S. Congress from the secretaries of the Departments of Agriculture and the Interior (USDA, 1977).

Methods employed by past analysts to assess impacts of reduced grazing have varied. Some have simply assumed that decreases in the number of livestock grazing on federal land would cause a proportional reduction in livestock production (Chapman, 1970 and Caton, 1960). Others have employed linear programming and input-output models in analysis to determine primary and secondary economic effects.

Conclusions most generally reached in these studies are that reductions in federal grazing permits would have quite severe effects on what is already a marginal industry. Two related Wyoming studies showed that impact severity was a function of dependency on federal grazing (Peryam and Olson, 1975; Olsen and Jackson, 1975). Bromley (1968) and Lewis and Taylor (1977) related hypothesized reductions in livestock revenues to impacts on regional economies. In Oregon (Bromley, 1968) a 20 percent reduction in federal grazing reduced gross income of the ranch sector by 11 percent and total output of the region by 1.4 percent. In Wyoming (Lewis and Taylor, 1977) an elimination of federal

grazing was found to cause a 60 percent reduction in the number of livestock and a 2.2 percent loss in total regional output.

Model Specification and Method of Analysis

Aggregate data on ranches using public range were obtained from Bureau of Land Management (BLM) and U.S. Forest Service (USFS) offices in Colorado. Information relating BLM administered public land was readily available from state office sources. Data on holdings administered by the USFS was obtainable only at the individual forest headquarters.

Property held and used in conjunction with either BLM or USFS managed land was generally available from BLM and USFS records. However, it was later determined that much of the listed commensurate property held by ranchers using public lands was inaccurate. In many instances, listed property had been disposed of years earlier. In others, a considerable amount of property had never been incorporated into the commensurate property listing.

In order to obtain up-to-date information on all aspects of ranching operations throughout the state, it was necessary to obtain basic data from individual ranchers. This was done through the selection and interviewing of a random sample of Colorado ranchers. Lists of ranching operations provided by the BLM and USFS were arrayed by herd size. A sample of ranches was selected in a manner such that regions of the state, numbers of ranches, and numbers of animals were adequately represented. As shown in Figure 1, there are 2,085 ranches in Colorado which graze livestock on either BLM or USFS lands. Of these 2,085 ranch operations, a sample of 145 was selected. From this sample of 145 operators, 135 provided usable information. The distribution of ranch operations using federal lands and the number of operations sampled by study regions is shown in Figure 1. Study region boundaries were structured along Forest Service boundaries, BLM grazing districts, and/or what was thought to be major trade area boundaries.

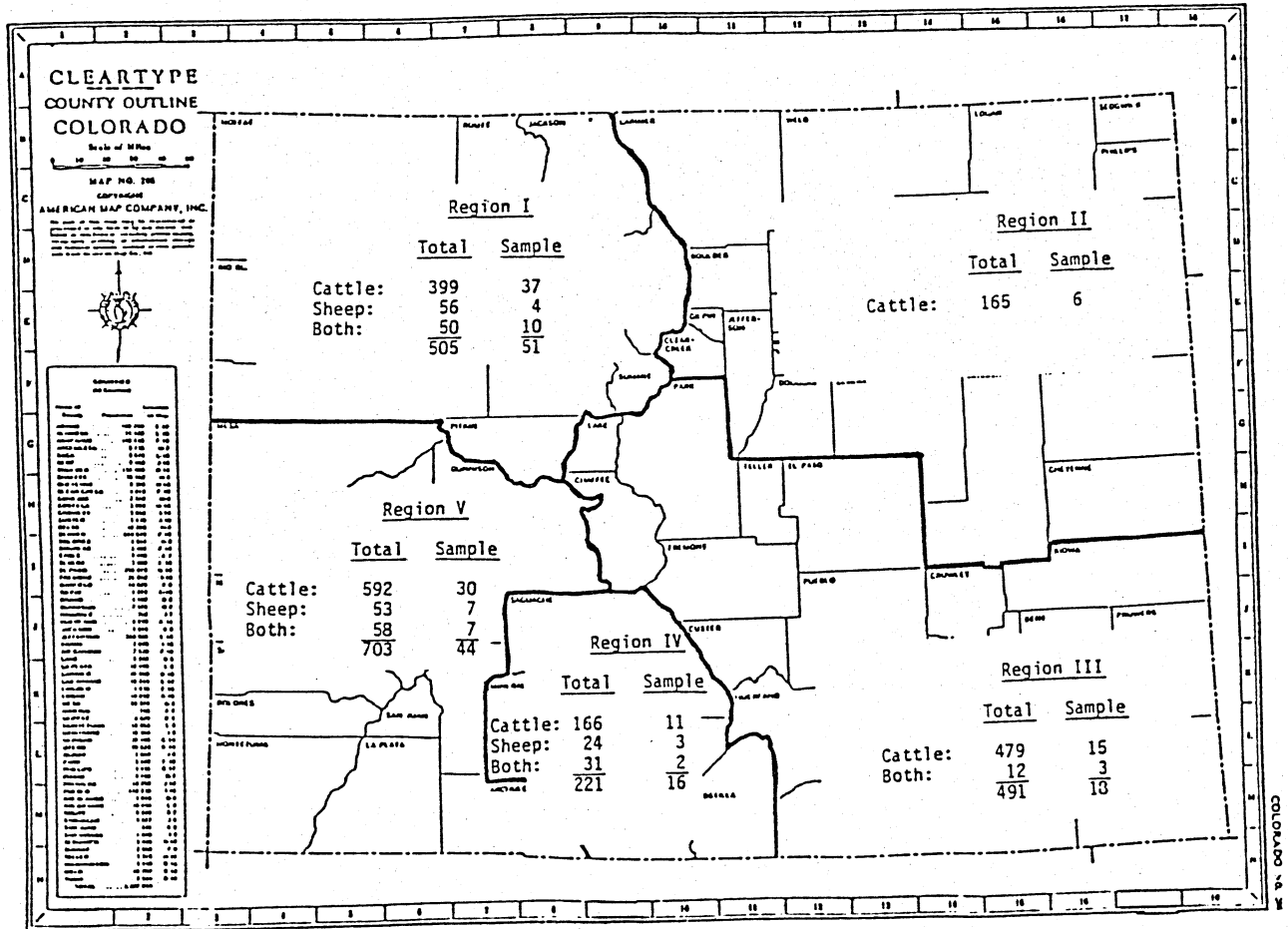


Figure 1. Regional study boundaries, number of ranches using federal land, and number of ranches in sample in each region, Colorado, 1978

The personal interview employing a rather lengthy questionnaire was used to obtain information from the individual ranchers. As stated previously and shown in Figure 1, 135 interviews provided usable information. Data obtained included such factors as all resources used--whether owned or leased, herd size and types of animals, length of grazing seasons on all areas from which grazing was obtained, livestock feeding systems, hired and family labor, and all available data relating to costs of operation.

Basic survey data, as well as secondary information on such factors as normalized prices for livestock (Conklin and Young, 1977), were formulated into model ranch budgets consistent with the original sample ranch size categories based on ranch location and size. This yielded a total of 25

individual ranch models. Models representing cattle numbered 15, those representing sheep numbered 4, and models representing ranches combining cattle and sheep numbered 6.

Budget data were incorporated into linear programming formats for each ranch model by region. These linear models provided the basic tool through which changes in the amount of public land grazing were analyzed. Estimates of aggregate response of ranch output to changes in the availability of public forage were obtained.

The final step in this analysis was that of obtaining multipliers through which changes in ranch output could be traced through the ranching sector and the nonranching sectors of the Colorado economy. Since multipliers were not available for each of the grazing study areas, it was necessary to obtain and review all available input-output models that contained data or structures that were similar to grazing study areas.¹ Through this process, estimates of business, income, and employment multipliers were obtained.

Study Results

Detailed results on all study aspects are available.² Only a brief summary of highly aggregated results is presented herein. These results relate exclusively to the following three study aspects: (1) the relative magnitude of, and ranch dependence on, forage obtained from federal land; (2) the revenue changes that can be expected from changes in the availability of forage now obtained from federal land sources; and (3) the secondary effects that would be experienced by the total Colorado economy.

¹Dr. J. R. McKean, Economics Department, Colorado State University, completed this part of the analysis.

²R. G. Taylor, Economist, Range Science Department, Colorado State University.

The data shown in Table 1 illustrate the dependence of Colorado ranches on forage obtained from federally-owned rangeland. This forage source is particularly important when viewed in a seasonal use context. The great bulk of this forage can be harvested commercially only through current grazing practices. For all practical purposes, it cannot be stored but must be used in place. A loss of any part of this forage in any season can be, and usually is, very detrimental to a ranch operator. Managing around temporary grazing cuts due to droughts, etc., is possible. However, this practice is economically practical only on an extremely short-term basis and then only for those ranchers who are very well capitalized.

Table 1. Forage Harvested From Federal Land as a Percentage of Total Forage Used by Species by Season (Sheep and Cattle), Colorado, 1978

Species/Source	Season			
	Spring	Summer	Fall	Winter
	-----percent of annual use-----			
Cattle				
Forest Land	8	44	5	1
BLM Land	18	6	4	5
Total	26	50	9	6
Sheep				
Forest Land	3	53	2	0
BLM Land	15	4	36	42
Total	18	57	38	42

Effects of reductions in the availability of forage from federal land sources are shown in Table 2. The results are averages based on reductions from 0 to 100 percent on ranches in all regions of Colorado. A graphic illustration of these data for the northwest and southwest ranch models is shown in Figure 2. The extreme dependency of sheep ranches on forage obtained from federal land sources is evident. This is particularly true in the major sheep-raising regions of the northwest and southwest.

Table 2. Reduction in Livestock Production Per 1 Percent Reduction in Federal Forage

Region and Model	Percent Reduction by Model	Percent Reduction by Region ^a
Northwest		
Cattle 1	.6565	
Cattle 2	.65305	
Cattle 3	.73094	
Cattle 4	.44003	
Cattle 5	.2956	.60761
Sheep 1	.55157	
Both 1 Cattle	.41686	
Sheep	.56355	
Both 2 Cattle	.26577	
Sheep	.85983	
Northeast		
Cattle 1	.58978	.57161
Cattle 2	.53425	
Southeast		
Cattle 1	.37397	
Cattle 2	.41756	.38126
Both 1 Cattle	.27347	
Sheep	.31249	
San Luis		
Cattle 1	.6116	
Cattle 2	.80861	
Sheep 1	.95184	.66219
Both Cattle	.34422	
Sheep	.87431	
Southwest		
Cattle 1	.44679	
Cattle 2	.76399	
Cattle 3	.62888	
Cattle 4	.32648	
Sheep 1	.85609	.54264
Sheep 2	.8596	
Both 1 Cattle	.42744	
Sheep	.67552	
Both 2 Cattle	0	
Sheep	.85964	
STATE TOTAL ^a		.53757

^aWeighted average by number of ranches within each model.

Cattle ranches, when compared to sheep operations, are generally less dependent on federal forage sources. However, the results do indicate that in some regions of Colorado cattle ranchers do rely heavily on federal grazing. There appears to be slightly greater dependence by small ranchers on federal forage. This is not, however, true across all study regions.

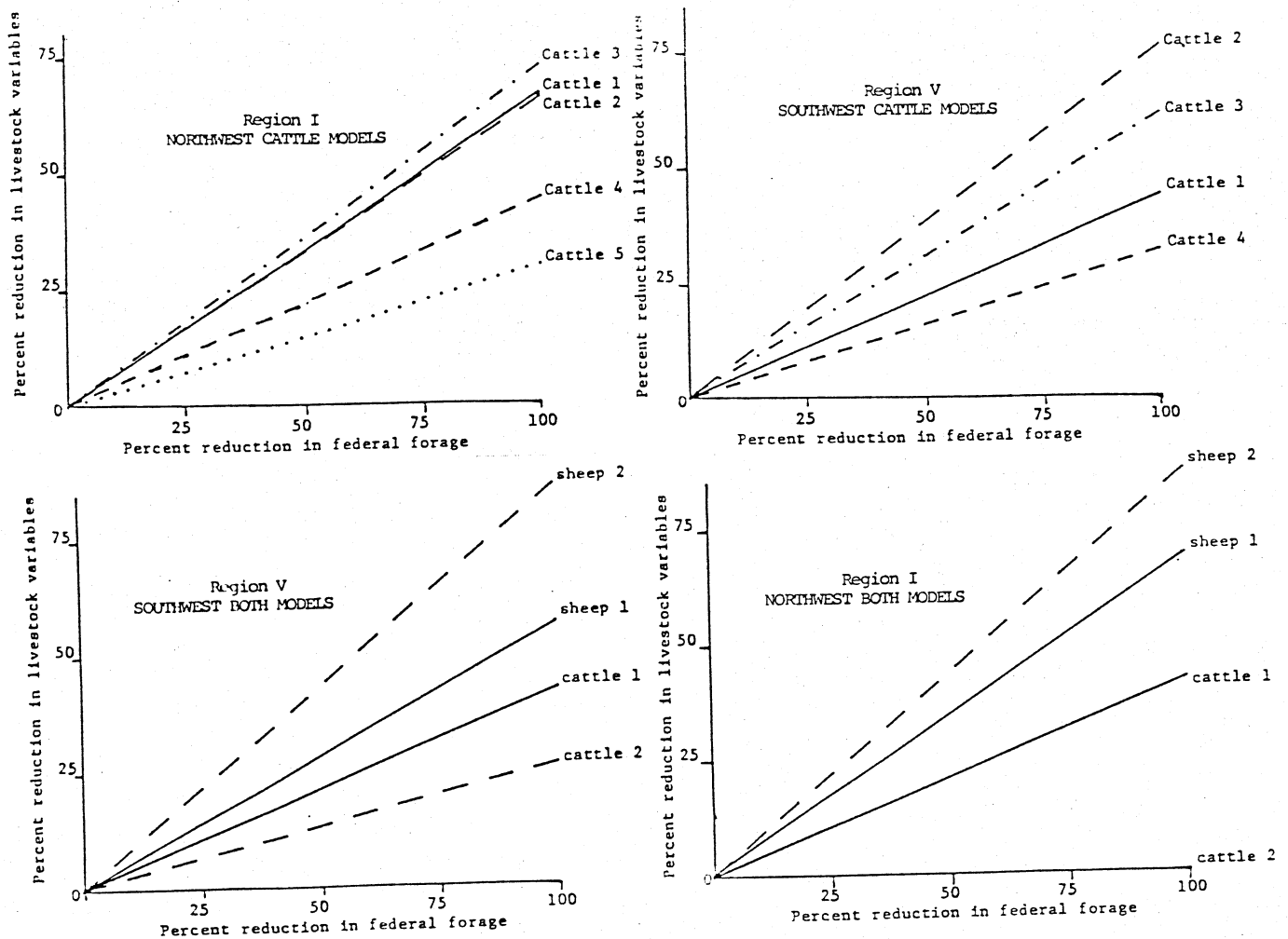


Figure 2. Reduction in livestock affected by federal forage reduction, northwest and southwest models, Colorado, 1978. (See Figure 1 for region location.)

As can be seen from Table 2, the San Luis Valley Region of Colorado is the most heavily dependent upon federal grazing. The southeast region is the least dependent. A weighted state average dependency of all ranches using federal grazing is slightly greater than 53 percent.

Changes in gross revenue from livestock sales that accompany changes in federal forage availability are shown in Table 3. These revenue changes are weighted averages across all models by species within each study region. They are structured in dollars per animal unit month. An interpretation of the northwest cattle model's revenue change in dollars per AUM is that for

every AUM reduction in cattle grazing a gross revenue reduction of \$31.29 is expected. The weighted average for the state is \$30.37 as shown in Table 3.

Table 3. Weighted Average of Changes in Gross Livestock Revenue Per Federal AUM Reduction

Region	Model	Dollars/AUM
Northwest	Cattle	31.29
	Sheep	33.93
Northeast	Cattle	26.57
Southeast	Cattle	23.62
	Sheep	28.61
San Luis	Cattle	30.82
	Sheep	39.28
Southwest	Cattle	26.67
	Sheep	38.39
State Total		30.37

In addition to the gross revenue changes already presented, estimates of other direct and indirect effects were calculated. This was accomplished by applying the business, income, and employment multipliers in Table 4 to changes in ranch sector inputs and outputs. Results per AUM are shown in Table 4. These estimates for the economy of the state indicate dollar per AUM reductions of 73 and 13 for revenue and income, respectively, and a .73 man-day change in employment per AUM reduction.

Conclusions

To advocate a complete phase out of livestock grazing on public land in Colorado is concomitant to supporting, at a minimum, a 50 percent reduction in direct livestock production much of Colorado. Economic activity in many areas of the state would be substantially reduced. Reductions in income and employment would be evident throughout much of the nonranching economy of the state.

Table 4. Multipliers on Ranch Sales to Export by Region Expanded to Assess Direct and Indirect Losses in Regional and State Economic Output and Employment Per AUM Reduction in Federal Forage

Regions	Multipliers			Direct and Indirect Effects		
	Business ^a	Income ^b	Employment ^c	Revenue (\$/AUM)	Income (\$/AUM)	Man-Days (Man-Days/AUM)
Northwest	1.96	2.71	55	Cattle	61.33	9.43
				Sheep	66.50	10.35
Northeast	2.40	3.03	66	Cattle	63.29	21.63
Southeast	1.85	2.25	52	Cattle	42.28	9.11
				Sheep	52.93	6.53
San Luis	1.30	1.60	39	Cattle	40.07	12.98
				Sheep	51.06	18.66
Southwest	2.12	2.92	60	Cattle	56.54	8.00
				Sheep	81.39	19.74
State	2.40	3.03	66	Total	72.89	13.36

^aDollars of regional sales per dollar of ranch sales to final demand.

^bDollars of regional income per dollar of ranch payment to labor.

^cNumber of man-years of employment per million dollars of ranch sales to final demand.

As currently structured, the 2,200 federal grazing permittees in Colorado raise an estimated 614,000 cattle and 581,000 sheep. This is approximately one-fifth of the cattle in the state and essentially all of the sheep. For each animal unit month reduction in forage currently obtained from federal land, an average gross livestock revenue of \$30.37 is lost. This is direct loss to the ranching sector. Additional losses in business activity and household income of \$42.52 also occur. Employment changes of .73 man-days could also be expected.

While no current established group advocates complete elimination of livestock grazing from public lands, several do advocate reduced grazing or elimination of grazing on parts of the public domain. Others advocate a use fee structure administered and determined in a way such that some parts of the public domain may go unused.

One can analyze many fee structures and sets of administered regulations. In a final analysis, if there can ever be one concerning the public domain, we trust we will not view the antithesis of the "Tragedy of the Commons." (Hardin, 1968)

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