

Economic Importance of Federal Grazing: An Interindustry Analysis¹

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Highlight

An important, yet overlooked aspect of public land management involves the economic significance to rural areas of grazing and lumber production on federal lands. To illustrate the relative importance of these two uses, a mathematical technique was used to quantify the economic interdependence of all business activity in an eastern Oregon county. In addition to a description of the existing situation, changes in magnitude of grazing and logging use in the county were simulated to illustrate likely impact on the local economy.

Through the years, the *Journal* has carried many articles concerned with economic problems. The grazing fee issue and the economics of range improvements seem to prevail as standard fare. One area receiving little attention is the relationship of ranching and logging interests, both dependent upon public lands, to other economic activities in a rural area. As the demand for competing uses of the public domain and national forests increases, the identification of this economic interdependence takes on added significance.

In a recent study sponsored by the Forest Service and the Bureau of Land Management, the U.S.

Department of Agriculture's Economic Research Service investigated the effects on gross ranch income from a grazing fee increase and a 20% reduction in federal grazing. That the respective agencies are concerned about these changes on ranch incomes is heartening. But administrators would be the first to admit they know little of the indirect impact upon those who buy from, and sell to, the ranching community. By overlooking these secondary effects, a much too incomplete picture is presented.

To help bridge this void, a study was undertaken by the Department of Agricultural Economics at Oregon State University in 1965. Its purposes were threefold: 1) to depict the extent of grazing of domestic livestock on public lands in Oregon; 2) to ascertain the extent of economic activity attributable to the use of public lands as a source of feed for cattle operations in Grant County, Oregon; and 3) based upon the findings of objective 2, to project the impact of adjustments in federal grazing on total sales of businesses in the County and the resultant changes in household income of the area's residents (Bromley, 1967). In addition, the expected economic impact from an increase in receipts of the County's lumber industry was detailed (Bromley, Blanch, and Stoevener, 1968).

The account will emphasize the importance of grazing and logging on public lands to a rural economy. However, the significance also lies in acquainting decision-makers with a technique for detailing the interrelationships between commercial uses of federal lands and economic activity in a local area.

Grant County, in central eastern Oregon, lies in a transition zone between the deserts of southeastern Oregon and the mountainous northeastern portion of the state. Federal lands comprise about 60% of the land area of the County. The agricul-

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Table 1. Dollar flows from sectors across top to those listed along left margin, Grant County, Oregon, 1964.

Item	No.	Dependent ranches (1)	Other Agric. (2)	Lumber (3)	Mining (4)
Dollars					
Dependent ranches	(1)	42,713 (.01)	76,373 (.07)	42,570 (Trace)	0 (.00)
Other agriculture	(2)	41,529 (.01)	17,278 (.02)	1,722 (Trace)	0 (.00)
Lumber	(3)	0 (.00)	0 (.00)	1,154,776 (.08)	0 (.00)
Mining	(4)	0 (.00)	0 (.00)	0 (.00)	0 (.00)
Lodging	(5)	1,680 (Trace)	1,200 (Trace)	4,488 (Trace)	0 (.00)
Cafes & taverns	(6)	0 (.00)	0 (.00)	0 (.00)	0 (.00)
Agricultural services	(7)	197,982 (.05)	37,926 (.04)	45,000 (Trace)	30,000 (.08)
Automotive	(8)	991,910 (.27)	201,120 (.19)	1,088,086 (.08)	10,089 (.03)
Communications & transportation	(9)	1,735 (Trace)	517 (Trace)	43,750 (Trace)	692 (Trace)
Professional	(10)	73,321 (.02)	41,243 (.04)	11,670 (Trace)	0 (.00)
Financial	(11)	113,816 (.03)	30,256 (.03)	72,036 (.01)	0 (.00)
Construction	(12)	33,829 (.01)	5,839 (.01)	3,440 (Trace)	1,720 (Trace)
Product oriented	(13)	181,571 (.05)	63,926 (.06)	749,265 (.05)	5,876 (.02)
Service oriented	(14)	112,453 (.03)	49,617 (.05)	87,521 (.01)	0 (.00)
Totals		1,792,539 (.48)	525,295 (.51)	3,304,324 (.23)	48,377 (.13)

ture is primarily livestock oriented with 86% of the total agricultural sales during 1964 coming from cattle and calves. Crops consist primarily of hay, wheat, barley, and oats. The majority of the forested regions of the County are covered by ponderosa pine with lesser amounts of larch, Douglas fir, lodgepole pine, and spruce. Range vegetation is characterized by sagebrush-grass communities. The mountainous regions provide summer range while the foothills are used during spring and fall.

Methods

The technique used to trace the flow of money through an economy is input-output analysis. The economic model is a system of simultaneous equations, one equation for each sector in the economy under study. Each equation will have as many variables as there are sectors in the economy. Thus, the complete model is a square matrix, with as many unknowns as equations.

In Grant County, 14 economic sectors were defined and thus, the model used was a 14×14 system of simultaneous

equations. Twelve of the 14 sectors were for commercial businesses, and two for agricultural firms. Each of the commercial business sectors consisted of firms selling somewhat similar products or services. The 12 commercial sectors were: Lumber, Mining, Automotive, Lodging, Cafes and Taverns, Agricultural Services, Communications and Transportation, Professional, Financial, Construction, Product Oriented, and Service Oriented. There were 288 firms in the above categories in 1964.

The two remaining sectors were for agricultural firms. The Dependent Ranches sector was comprised of all cattle ranches in the County possessing a permit or license to graze cattle on the federal range. The Other Agriculture sector consisted of all other agricultural producers in the County. Of the 225 full-time agricultural enterprises in the County, 143 had federal grazing privileges and 82 did not.

Interviews were conducted with randomly selected firms in each of the 14 sectors. By accounting for income sources and expenditure destinations, it was possible to construct the 14×14 matrix, part of which is presented in Table 1.

Table 2. Sectors of the Grant County economy showing gross receipts, value of exports, and household incomes paid, 1964.

Item	No.	Total receipts (1)	Exports (2)	Exports as a percent of gross receipts (3)	Payments to households (4)	Household coefficient Column 4 ÷ Column 1 (5)
		\$	\$	%	\$	
Dependent ranches	(1)	3,721,243	3,084,097	83	363,792	.10
Other agriculture	(2)	1,066,298	836,869	78	190,650	.18
Lumber	(3)	13,886,670	12,567,000	90	4,180,952	.30
Mining	(4)	358,000	358,000	100	70,907	.20
Lodging	(5)	415,600	306,050	74	72,700	.17
Cafes & taverns	(6)	763,500	305,900	40	233,161	.31
Agricultural services	(7)	384,000	0	0	36,000	.09
Automotive	(8)	8,027,277	902,578	11	800,805	.10
Communications & transportation	(9)	1,088,453	513,889	47	457,309	.42
Professional	(10)	1,110,118	62,596	6	544,832	.49
Financial	(11)	922,831	0	0	134,040	.15
Construction	(12)	780,135	25,783	3	130,227	.17
Product oriented	(13)	11,812,485	1,787,672	15	1,097,451	.09
Service oriented	(14)	1,002,819	50,861	5	403,399	.40
Totals		45,339,429	20,801,295		8,716,225	

Interindustry Analysis

The dollar figures in Table 1 indicate the flow of money, in exchange for goods and services, from firms in those sectors listed across the top to firms in those sectors listed along the left margin. The table is read in the following manner: the dollar figures going down, say, column 1, reveal that ranches in the Dependent Ranches sector spent; \$42,713 for the purchase of supplies from ranches within the same sector; \$41,529 for these types of purchases from ranches in the Other Agriculture sector; \$1,680 in the Lodging sector; \$197,982 for supplies from the Agricultural Services sector; and similarly down column 1. Likewise, those firms classified as Other Agriculture spent \$76,373 within the Dependent Ranches sector for supplies; \$17,278 was paid to firms within the same sector and so on down column 2. Thus, the column entries show the purchasing pattern of firms in the four sectors listed across the top and how they spent money for the purchase of supplies from firms in sectors listed down the left side.

While the dollar figures are interesting, a more meaningful picture is revealed by the coefficient immediately under each dollar entry. This is the "trade coefficient" and each entry shows the proportion of every dollar of gross receipts of the sectors listed across the top which went for the purchase of supplies from those sectors listed at the left. For example, for every dollar of gross receipts of the Dependent Ranches sector, its firms spent \$0.01 for supplies from ranches in the same sector; \$0.01 was spent in the Other Agriculture sector; \$0.05 was spent in the Agricultural Services sector; \$0.27 in the Automotive sector and so on down column 1.

The total amount of money spent within the County by firms in each of the four sectors listed across the top is found at the bottom of the respective columns. The coefficient below this figure is the sum of the coefficients in that column and reflects what proportion of the sector's

gross receipts (how much out of every dollar) was spent in the County for the purchase of supplies to be used in the further production of goods and services.

Table 1 shows that the Lumber industry was responsible for more than \$3 million in purchases from the County's businesses, although the proportion of its gross receipts spent locally (0.23) was less than half of the proportion spent by either agricultural sector.

Table 2 presents some additional characteristics of Grant County commercial and agricultural businesses. Exports are the value of goods leaving the economy (Grant County), generating a flow of income into the area. Column 3 indicates the proportion of each sector's income which consisted of receipts from outside Grant County. The "Household Coefficient" is merely the total wages and salaries, as well as dividends and interest, paid by the sector divided by that sector's gross receipts. This indicates the approximate quantity of labor and management services required per one dollar worth of receipts in that sector.

With the information in Tables 1 and 2 it is possible to discuss the trade relationships which exist in Grant County and to draw some inferences about the relative importance of those economic activities which depend upon federal lands.

In 1964, the Dependent Ranches and Lumber sectors accounted for almost 40% of the total business receipts in the County (\$17.6 million out of \$45.3 million). The Dependent Ranches sector generated over \$3 million worth of new money in the County (value of exports) while the Lumber

Table 3. Business and household income multipliers for Grant County, 1964.

Item	No.	Business income multipliers (1)	Household income multipliers (2)
Dependent ranches	(1)	1.56	1.80
Other agriculture	(2)	1.60	1.53
Lumber	(3)	1.28	1.17
Mining	(4)	1.15	1.08
Lodging	(5)	1.52	1.48
Cafes & taverns	(6)	1.60	1.26
Agricultural services	(7)	1.06	1.09
Automotive	(8)	1.19	1.25
Communications & transportation	(9)	1.20	1.07
Professional	(10)	1.04	1.02
Financial	(11)	1.01	1.02
Construction	(12)	1.29	1.22
Product oriented	(13)	1.08	1.14
Service oriented	(14)	1.12	1.05

sector brought in \$12 million. These two activities accounted for over 75% of the new money brought into Grant County in 1964.

The \$5 million spent by the Dependent Ranches and Lumber sectors (sum of columns 1 & 3, Table 1) accounted for 57% of the total spent by all businesses in the County for purchases of necessary goods and services. The Lumber sector alone accounted for 40% of the total wage and salary payments made in the County in 1964 (column 4, Table 2).

Changes in Land Use

Two types of multipliers for Grant County are presented in Table 3: a business income multiplier and a household income multiplier. The business income multiplier reveals how much total business receipts in the County would change for a \$1.00 change in receipts of the sector at the left. For example, a \$1.00 increase in gross receipts of the Automotive sector would cause total receipts in the County (businesses in addition to those in the Automotive sector) to increase \$0.19.

The household income multiplier indicates how much all household incomes in the County would change for a \$1.00 change in the household incomes of the sectors listed at the left. For example, when household incomes in the Construction sector increase by \$1.00, household incomes in the rest of the economy will increase by \$0.22. Those sectors with the larger multipliers will have a greater secondary effect upon the health of the economy per dollar change in their total receipts than will the sectors with the smaller multipliers.

To illustrate the use of these multipliers, a change in gross receipts of two sectors dependent upon federal lands will be simulated. In addition

to estimating the total impact, the distribution of this effect by sectors within the Grant County economy will be illustrated.

Reduction in Federal Grazing

A 20% reduction in federal grazing has been estimated to cause an 11% decrease in gross ranch income (Caton, 1965).² To simulate this reduction in Grant County, ranches were categorized by size to correspond to Caton's classification. The income reduction in each of five size-groups was totaled to arrive at an estimate for all Dependent Ranches in the County. The estimated reduction is \$399,578. With lower gross receipts, the firms in the Dependent Ranches sector could be expected to curtail purchases of supplies from other firms in the County. As those businesses serving ranchers experience reduced sales, they in turn will reduce purchases from their suppliers. Because of this interdependence, the original reduction in the ranching sector is increased to \$404,691 as firms in the County now buy less from the Dependent Ranches sector.

The total expected loss in business receipts for the other 13 sectors in the County is \$219,048. Thus, the reduction in the Dependent Ranches sector, plus this reduction in the other 13 sectors, brings the total reduction in business receipts to \$623,739. Multiplying the business income multiplier for the Dependent Ranches sector times the direct reduction in that sector ($1.56 \times \$399,578$) yields a total reduction in receipts of \$623,342. This number is slightly smaller than the previous figure due to different computation procedures.

The use of the business income multiplier gives no indication of the sectoral distribution of this reduction. The solution of the system using a computer consists of first finding the reduction in each sector, and then finding the sum of the sector changes. The results of the computer solution showing allocation of the reduction by sector are presented in Table 4. The greatest absolute loss, though not percentage loss, occurs in the Automotive sector. The Agricultural Services sector experiences the greatest proportionate loss in gross receipts—5%.

The reduction in business incomes in the County would not be the only ramification from changes in grazing use. As gross receipts of the Dependent Ranches sector decline, the income of households in that sector (the ranch family) could be expected

² It is recognized that ranchers might undertake improvement of private lands if faced with a reduction in grazing and thus, gross receipts *may* not change in the long run. However, the concern here is to illustrate how grazing and logging uses influence a rural economy. The results are still relevant; an 11% reduction in receipts of the ranching sector, from whatever the cause, could be expected to precipitate the secondary effects detailed.

Table 4. Effects and distribution of changes in gross receipts of all County businesses resulting from changes in receipts of 2 sectors dependent upon federal lands, Grant County, 1964.

Item	No.	Gross receipts 1964 (1)	Expected decrease (ranches) (2) ^a	Expected increase (lumber) (3) ^b
dollars				
Dependent ranches	(1)	3,721,243	404,691	4,844
Other agriculture	(2)	1,066,298	4,667	311
Lumber	(3)	13,886,670	—	1,514,612
Mining	(4)	358,000	—	—
Lodging	(5)	415,600	212	503
Cafes & taverns	(6)	763,500	—	—
Agricultural services	(7)	384,000	21,705	5,196
Automotive	(8)	8,027,277	128,102	141,176
Communications & transportation	(9)	1,088,453	2,625	7,770
Professional	(10)	1,110,118	8,471	1,819
Financial	(11)	922,831	12,705	8,271
Construction	(12)	780,135	3,754	454
Product oriented	(13)	11,812,485	23,949	88,948
Service oriented	(14)	1,002,819	12,858	10,339
Totals		45,339,429	623,739	1,784,243

^a Expected decrease in receipts by sector, caused by reduction in receipts of dependent ranches sector.

^b Expected increase in receipts by sector, caused by increase in receipts of lumber sector.

to drop also. The household coefficient in Table 2 indicates that portion of a dollar of gross receipts which is paid to households for labor and management services, dividends and interest, so a reduction in gross receipts of \$404,691 would be expected to cause household incomes to fall \$40,469 ($404,691 \times .10$). When this is multiplied by the household income multiplier for the Dependent Ranches sector (1.80), a total loss of \$72,844 results, \$32,375 of which occurs in households outside of the Dependent Ranches sector.

Increase in Receipts of the Lumber Sector

A similar procedure was followed to derive the economic impact from an increase in the gross receipts of the Lumber sector. The lumber industry in Grant County, like ranching, is dependent upon federal lands as over 75% of the logs harvested in 1964 were from national forests. A 10% increase in receipts would amount to \$1,388,667. This would cause an increase of \$269,631 in the receipts of the other 13 sectors in the economy and a \$125,945 increase in trade within the Lumber sector. The total increase for all County businesses (including the Lumber sector) would be \$1,784,243. The distribution of this increase by sector is presented in Table 4.

County household incomes would increase \$1.17

for every \$1.00 increase in household income in the Lumber sector. The 10% increase in receipts would cause a \$456,013 increase in household incomes in that sector, and a subsequent additional increase in household incomes in the other 13 sectors of \$77,408 bringing the total impact on household incomes in the County to \$553,414.

Discussion

The primary significance of the above account lies not with the indicated results for Grant County but rather with the methodology. However, the figures presented for Grant County are, with certain qualifications, reasonably indicative of the relationships in many other rural economies in the West. Since production of beef cattle involves approximately the same combination of inputs among somewhat similar regions, ranchers with federal grazing in much of the Intermountain area can be expected to purchase approximately the same proportion (i.e., per dollar of gross receipts) of supplies from the Agricultural Services sector, the Automotive sector, and the other sectors, as do ranchers with federal grazing in Grant County.

There are certain differences, however. The first is the relative importance of federal lands to the beef industry in the area. Another consideration is the relative importance of beef production in the total economic environment of the region. The lumber industry in Grant County is more important to the local economy than in most other regions of the Intermountain area so changes in receipts of this sector will be more significant than would be the case in general. In regions where range livestock production is the dominant activity, changes in the ranching sector would have a more pronounced effect on the local economy. A third consideration is the self-sufficiency of the economy in question. The economy studied here is not large geographically, nor is it a very developed one; rail transportation is non-existent and there are several large towns within easy driving distance. These and other factors have tended to inhibit the development of small manufacturing and processing industries. As a result, a considerable amount of intercounty trade exists, termed "leakage." If the economy under study covered a larger geographic area, more of the necessary business purchases would likely be made within the economy. This would have the effect of increasing the proportion of gross receipts spent for supplies in the economy. With larger coefficients in Table 1, the resulting business income multipliers would be larger. Therefore, while the trade coefficients and income multipliers cannot be assumed *exactly* applicable to every county in the Intermountain region, they would seem to be a good first approximation.

In conclusion, it should not be inferred from the two changes in land use investigated here that they necessarily represent the expected future trend in Grant County. The reduction in federal grazing was utilized because of available information on reductions in gross ranch incomes from such action. The increase in receipts in the Lumber sector was purely arbitrary; a reduction could also have been discussed. Recent research in northeastern Oregon indicates that improved timber management practices are generally conducive to greater forage production. Thus increased timber harvests could occur simultaneously with increased carrying capacity for livestock (Hedrick et al., 1968).

The model used here did not permit the isolation of recreation expenditures but it should be recognized that this is another use of federal lands which can be significant to the rural economy. The expenditures of these users are usually well publicized while much less attention is paid to expenditures by ranchers, loggers, or mining interests. If administrators are made aware of the relative importance to the local economy of all

uses of federal lands, policy decisions could be made in the light of more complete knowledge than is now the case.

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