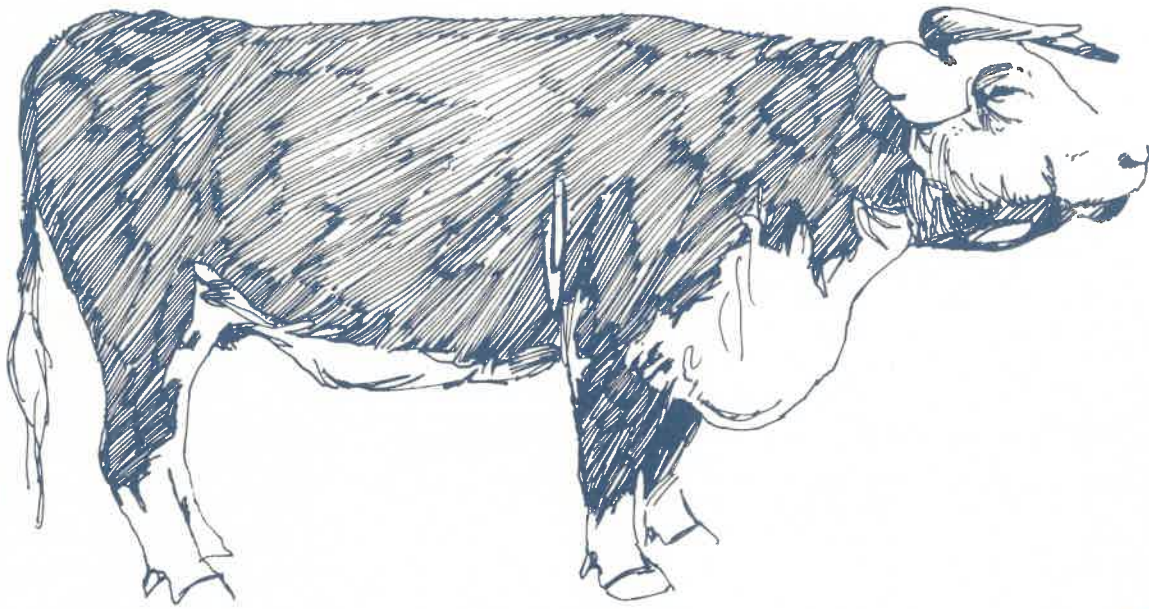




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RESEARCH JOURNAL 96

NOVEMBER 1975



**The Impact of Change in
Federal Grazing Policies on
South Central Wyoming
Mountain Valley Cattle
Ranches**



AGRICULTURAL EXPERIMENT STATION

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The Impact of Change in Federal Grazing Policies on Southcentral Wyoming Mountain Valley Cattle Ranches

Carl E. Olson and John W. Jackson*

INTRODUCTION

Many ranchers in the mountain valley areas of Wyoming depend on Forest Service and Bureau of Land Management lands for a portion of their summer feed base. Federal lands in the mountain valley areas are usually grazed in the late spring, summer and early fall. The dependence of the ranchers on Federal land varies considerably. The use of Federal lands is necessary for survival of many of the individual ranch firms.

Problems arise because of the many potential uses of these Federal lands. There are many interest groups competing with each other for use of the limited acreage of available public land. These lands have use for big game habitat, camping, fishing, hiking, watersheds, mining and timber production as well as for the grazing of domestic livestock. Some of the interests are compatible with each other while others compete for the same resources.

Grazing of Federal land has been criticized and opposed by many different groups over the years. With the increased demand for non-agricultural use of Federal lands it appears that the grazing policies and fee systems used by the administrators of Federal land will come under increasing pressure from interest groups other than agriculture.

Many of the non-agricultural groups feel that the Federal grazing fees are too low and the ranchers are not paying the "fair market value" for the forage utilized. The livestock industry, at the same time, has been claiming that increased fees are reducing their ranches' viability as economic units.

The number of animals permitted on Federal range land has come under considerable fire in much the same way as the fees and fee system. Range depleting practices and, at times, grazing

of any type on public lands are opposed by non-agricultural interest groups. Ranchers claim that reductions in permitted numbers will reduce the size of their operations and hence their incomes, reduce their loan acquiring ability and, in some cases, even force them out of business.

PURPOSE AND OBJECTIVES

The purpose of this study was to determine the impacts of changes in fee levels and permitted grazing numbers on publicly owned lands, on mountain valley cattle ranches in Southcentral Wyoming. The specific objectives were:

1. To estimate the impact of changes in grazing fees and numbers of permitted livestock on resource use and net ranch income of mountain valley cattle ranches in southcentral Wyoming.
2. To identify possible alternatives for maintaining economical ranch operations should use of public lands be partially or totally lost.

DATA COLLECTION

The data used in this study were obtained by interviews with mountain valley cattle ranchers located in southcentral Wyoming close to the Medicine Bow National Forest. All of the ranchers interviewed were utilizing Federal lands for part of their feed base. These Federal lands include both Forest Service (F.S.) and Bureau of Land Management (B.L.M.) administered lands.

The ranches included in the sample had basic herd sizes between 150 and 400 head of breeding cows. The sample drawn was developed from lists of permittees furnished by the B.L.M. and Forest Service and from information provided by the University Extension agents in Albany and Carbon counties, Wyoming. A total of 31 ranch operators were included in the sample. The interviews were conducted in 1973.

The purpose of the interviews was to obtain data that would be used to develop typical or

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model ranch organizations to be used in the analysis. The data obtained from the ranch operators included information on acres of different crops produced including hay, numbers of different types of livestock, production practices for both crops and livestock and the number and timing of permitted AUM's of Forest Service and B.L.M. grazing.

FIRM ORGANIZATIONS

The 31 ranches were reduced to 27 by omitting four atypical ranches.¹ The data from the 27 ranches indicated that they ranged from 2.6% dependent on Federal range land for their total feed base to 36.9% dependent. The ranches were divided into three groups for analysis according to dependence on Federal range land. The low dependence ranches ranged from 2.6% to 15.0% dependent with the average 9%. The medium dependence ranches ranged from 17.4% to 22.7% dependent with the average 20%. The high dependence ranches ranged from 28.8% to 36.9% dependent with the average 32%. The percent

¹These ranchers include those that had just changed ownership and/or had a sizable number of sheep included in their livestock inventory.

dependency was calculated on an annual basis. There were ten ranches included in the low dependence group, 11 in the medium dependence group and six in the high dependence group. A model ranch was determined for each of the three dependency groups from the data collected in the survey.

The resources available to the three model ranches are shown in Tables 1, 2, and 3. The tables are divided into three parts. The first part is the inventory of the available land resources for each ranch. The second part is the inventory of the land resources actually used as the starting point in the analysis. The third part is the statement of forage production in AUMs per acre. The pounds of production per animal unit are shown at the bottom of each table. The livestock inventories and sales for the three models are shown in Table 4.

Tables 1 through 4 show that all three ranches are of a comparable size. The comparability of size makes a direct comparison of the sensitivity of the ranches to varying levels of dependence on Federal grazing lands a reasonable method of analysis of the importance of these lands.

Table 1. Low dependence model ranch—available resources inventory and statement of production.

Resource	Amount available		Amount used initial situation		Production or yield/unit
	Owned	Leased	Owned	Leased	
Land (acres)					AUMs ^a /Acre
Alfalfa hay	65	20	65	0	7.47
Native hay	385	30	385	0	4.15
Irrigated pasture	489	37	489	0	1.23-2.05
Private range	1490	608	1490	440	.23
State range	—	414	—	414	.23
Permits (AUMs)					
Forest Service	—	258	—	258	—
B.L.M.	—	234	—	234	—
Livestock (AUs ^b)	378	—	378	—	Pounds/AU ^c
Calf					158.6
Yearling					64.6
Cow					72.95

^aOne AUM is the amount of forage required by one 1,000-lb. cow for 1 month. See Appendix I.

^bOne AU (animal unit) is the equivalent of one 1,000-lb. cow for 12 months.

^cPounds/AU were calculated by dividing total pounds liveweight sold by the total AU's of the model ranch.

Table 2. Medium dependence model ranch—available resources inventory and statement of production.

Resource	Amount available		Amount used initial situation		Production or yield/unit
	Owned	Leased	Owned	Leased	
Land (acres)					AUMs ^a /Acre
Alfalfa hay	74	—	74	0	7.47
Native hay	387	7	387	0	4.15
Irrigated pasture	130	—	130	—	1.23-2.05
Private range	1783	224	1783	112	.27
State range	—	531	—	531	.27
Permits (AUMs)					
Forest Service	—	434	—	434	—
B.L.M.	—	497	—	497	—
Livestock (AUs ^b)	392	—	392	—	Pounds/AU ^c
Calf					184.9
Yearling					68.5
Cow					71.8

^aOne AUM is the amount of forage required by one 1,000-lb. cow for 1 month. See Appendix I.

^bOne AU (animal unit) is the equivalent of one 1,000-lb. cow for 12 months.

^cPounds/AU were calculated by dividing total pounds liveweight sold by the total AU's of the model ranch.

Table 3. High dependence model ranch—available resources inventory and statement of production.

Resource	Amount available		Amount used initial situation		Production or yield/unit
	Owned	Leased	Owned	Leased	
Land (acres)					AUMs ^a /Acre
Alfalfa hay	45	—	45	0	7.47
Native hay	387	11	387	0	4.15
Irrigated pasture	198	59	155	0	1.23-2.05
Private range	4641	430	4641	0	.06
State range	—	767	—	0	.06
Permits (AUMs)					
Forest Service	—	386	—	386	—
B.L.M.	—	1165	—	1165	—
Livestock (AUs ^b)	388	—	388	—	Pounds/AU ^c
Calf					108.98
Yearling					137.41
Cow					50.89

^aOne AUM is the amount of forage required by one 1,000-lb. cow for 1 month. See Appendix I.

^bOne AU (animal unit) is the equivalent of one 1,000-lb. cow for 12 months.

^cPounds/AU were calculated by dividing total pounds liveweight sold by the total AU's of the model ranch.

Table 4. Fall livestock inventories for the three model ranches.

Class of stock	Low dep. ranch (head)	Med. dep. ranch (head)	High dep. ranch (head)
Cows 2+	243	233	238
Yearling heifers	36	34	28
Weaned heifers	59	46	58
Weaned steers	15	27	58
Bulls	12	15	14
Horses	10	7	10
Livestock Production Sold			
Heifer calves	56	62	49
Steer calves	99	85	53
Yearling heifers	22	13	29
Yearling steers	15	28	57
Cull cows	28	26	20

The statement of livestock production shows a different pattern for marketing the animals produced. The high dependence ranch tends to sell more yearlings than the other two ranches. Table 5 gives a statement of the livestock sales and returns for the initial situations. Gross sales by the three ranches are within a range of about \$1,500.

Table 5. Livestock sales for the three model ranches.

Type of stock sold	Number (head)	Average weight (lb.)	Total weight (cwt.)	Price per(cwt.) ^a	Value
Low Dependence Ranch					
Calves ^b	155	387	599.51	\$48.75	\$29,226
Yearlings ^c	37	660	244.19	41.39	10,107
Cull cows	28	1,000	275.75	25.54	7,043
Total					\$46,376
Medium Dependence Ranch					
Calves	147	397	583.84	\$48.21	\$28,147
Yearlings	41	655	268.52	41.74	11,208
Cull cows	26	1,000	281.46	25.54	7,188
Total					\$46,543
High Dependence Ranch					
Calves	102	415	422.84	\$47.29	\$19,996
Yearlings	86	620	533.15	42.84	22,840
Cull cows	20	1,000	197.45	25.54	5,043
Total					\$47,879

^aPrice is 1972 weighted average Omaha price adjusted for trend.

^bTotal of heifer and steer calves.

^cTotal of yearling heifers and yearling steers.

The operating costs experienced by each ranch are displayed in Table 6. The basic animal unit costs are the costs that are of a fixed nature or that can be considered fixed for this analysis. Examples of these costs are taxes on land, machinery, livestock, depreciation, bull replacement, veterinary costs, transportation, insurance and interest paid on machinery and cattle inventories.

The other costs in Table 6 are the variable costs associated with the ranch operations. These costs vary with the level of livestock production or technique of producing hay or grazing.

The only feed that was found to be commonly purchased by these 27 mountain valley ranches was cake or protein supplement. It was assumed cake could be purchased at \$.04/lb. Hired labor was assumed to be available at \$2.00/hour in the study area.

Production and harvest costs of producing hay are the cash costs of fertilizing, irrigating, dragging meadows, and cutting, baling and stacking the hay. The hay feeding costs are the machine costs, fuel and lubrication costs, associated with feeding the hay to the cattle.

Variable grazing costs are the costs of running cattle on the different types of range exclusive of labor costs. These costs are included in

the hired labor and operators labor categories. The cost of grazing on the range lands includes fence maintenance costs, water hole maintenance, distributing salts and checking cattle.

Table 6. Initial estimated annual production costs for the three model ranches.*

Total costs ^a	Low dep. ranch	Med. dep. ranch	High dep. ranch
Basic ranch costs ^b	\$12,587	\$14,644	\$13,495
Feed (cake)	1,164	1,121	1,655
Hired labor ^c	6,546	6,037	5,732
Production and harvest costs			
Alfalfa hay	1,674	1,906	1,159
Native hay	5,652	5,697	5,689
Variable grazing costs			
Owned range	103	144	84
Lease deeded range	237	70	—
State range	104	156	—
Irrigated pasture	1,281	334	407
Variable hay feeding costs	894	928	834
Forest Service fees	206	347	309
B.L.M. fees	122	258	606
Total operating cost	\$30,570	\$31,642	\$29,969

*See Appendix II for detailed cost breakdowns.

^aInterest operating costs is imputed at 7% and is included in variable costs.

^bThese are the fixed costs of owning the operation and include: taxes, depreciation, interest on investment on cattle and machinery, bull replacement, veterinary costs, transportation costs, insurance.

^cHired labor is calculated at \$2.00/hr.

The Forest Service grazing fees are based on \$.80/AUM of grazing while the B.L.M. grazing fees are based on \$.52/AUM. These fees are assumed fees that include the cost of maintaining fences, water holes, and trails. The cost is equal to \$.10/AUM.

Table 7 is the income statement for the three model ranch organizations. The total sales value is added to the perquisites to get the total receipts. The perquisites were assumed to be \$1,500 for this study.

Operator's labor is assumed to be valued at \$2.00/hour, the same as hired labor. The total operator's labor available is assumed to be 3000 hours/year. A return to the operator's management is assumed to be five percent of the gross sales. The opportunity costs of operator's labor and management are subtracted from net ranch income to get the return to operator's "land". The return to operator's "land" is actually the return to the operator's capital investment in land, buildings, and improvements. The percent return to operator's investment in "land" varies from 2.29% for the medium dependence ranch to 3.13% for the high dependence ranch.

Table 7. Model ranch—initial income statements for the three model ranches.

Item	Low dep. ranch	Med. dep. ranch	High dep. ranch
Sales	\$46,376	\$46,543	\$47,879
Perquisites	1,500	1,500	1,500
Total receipts	\$47,876	\$48,043	\$49,379
Expenses	\$30,570	\$31,642	\$29,969
Net ranch income	\$17,306	\$16,401	\$19,410
Operator's labor	\$ 6,000	\$ 6,000	\$ 6,000
Management return ^a	2,319	2,312	2,394
Returns to operator's "land"	\$ 8,987	\$ 8,099	\$11,016
Percent return to "land" ^b	2.64	2.29	3.13

^aManagement return is 5% of sales.

^bBased on a \$900/AU investment in land, buildings, and improvements.

METHOD OF ANALYSIS

This study is attempting to determine the maximum returns that can be earned by a ranch operator with a given set of resources as the cost of using Federal lands and the amount of grazing on the Federal lands are varied. An analytical technique that aids in determining maximum returns from a set of resources is linear programming. The linear programming technique seeks to maximize or minimize an objective function subject to limitations and constraints. In this study the objective function to be maximized is the returns to ranch operator's labor, management and land equity, or net ranch income.

The mathematical form of the linear programming problem is:²

$$Z = C_1X_1 + C_2X_2 + \dots + C_nX_n$$

Subject to the constraints:

$$b_j > a_{1j}X_1 + a_{2j}X_2 + \dots + a_{nj}X_n \\ j = \overline{1, \dots, m} \quad X_i > \overline{0}$$

Where:

Z = operator's returns

C_i = costs or prices associated with an activity X_i

X_i = activity

b_j = amount of a given resource available

a_{ij} = amount of a resource required by an activity X_i

The output from the linear programming shows the amount of returns as well as the resource mix which results from each change in the level of fees and permit availability for the public lands for each of the three model ranches. The results of the analysis apply directly to the model ranches. Since the three model ranches were developed from data obtained from a specific type and size of ranch in an area of Wyoming, the results would only apply to these ranches. However, several generalizations can be made to all mountain valley cattle ranches using the public land for part of their feed base.

ASSUMPTIONS

In linear programming analysis, many assumptions need to be made regarding variables that are not of prime concern in the analysis but will influence the results. In this study it is assumed that there is no change in the prices paid for inputs and no change in the prices received for products sold. Also held constant is the initial amount of non-Federal land resources available to the model ranch organizations. (The initial situations did not always use all the resources available.) Technology used by the operators was allowed to change under certain situations. The program was set up to allow the substitution of feeding hay for grazing as an alternative practice when feeding was more profitable than grazing. The program also enabled the adoption of the most profitable or least costly method of improving forage production on non-Federal

lands such as improved hay production through better water management and fertilization.

It is assumed that the ranch operator can work a maximum of 60 hours/week for 50 weeks for a yearly total of 3000 hours. Any labor need above what the operator can provide is assumed hired at \$2.00/hour. The labor requirements varied among the three model ranch situations and the technologies being utilized.

The livestock inventory is assumed to remain at its 1972 level. This is done because we are interested in how the model ranch organization will adjust to changes in fees and public land availability. It is assumed that the model ranches would tend to operate in the future as they have in the past and new practices or technologies would be used to replace lost Federal grazing permits. All changes in resource use and/or the adoption of new technologies or practices occurs when the indicated changes result in a higher net ranch income than is possible without the change. The programming technique has the model ranches make the least costly adjustments first and go to the most costly adjustments later.

EFFECTS OF INCREASES IN FEDERAL GRAZING FEES

The effects of increases in Federal grazing fees are estimated for a range in fees from the 1972 level to \$3.60 per AUM.³ Net ranch income is used to measure the effects of increases in Federal grazing fees on survival and growth of the firm. The Federal grazing fees are increased in \$.10 increments to determine the level of fees where Federal grazing land becomes uneconomical to use as a portion of the ranch's feed base.

Tables 8, 9 and 10 show the changes in the resource combinations that the model ranches made because of the increases in Federal grazing fees.

Table 8 shows the increase for the low dependence model ranch in the acres of leased range, 168 acres, and the decrease in AUMs of Federal grazing, 39 AUMs. Net ranch income decreased from \$17,305 to \$15,922 with Federal grazing fees increased to \$3.60 per AUM.

Table 9 shows that the medium dependence model ranch increased the amount of leased range

²See John W. Jackson, *The Impact of Changes in Public Land Administrative Policy on Mountain Valley Ranches*, unpublished M.S. thesis, Division of Agricultural Economics, University of Wyoming, January 1974, for a detailed description of the linear programming model used in this study.

³The 1972 adjusted fee levels were 52¢ per AUM for B.L.M. and 80¢ per AUM for Forest Service grazing. See Jackson, *ibid.*, pages 39-43 for this study. The B.L.M. and Forest Service fees were brought up to \$1.00 per AUM and then increased together to the \$3.60 per AUM level.

land used due to increases in Federal grazing fees. Leased range is doubled to 224 acres. The added 112 acres of leased range replace 30 AUMs of Federal grazing. Net ranch income is decreased by \$2,697.

Table 8. The effects of changes in Forest Service and B.L.M. grazing fees on resource use and net ranch income—low dependence model ranch.

Resource	Amount available	Amount used in init. situation (1972 Fee)	Amount used in fin. solution (\$3.60/AUM)	Net change in resources used and net ranch Income
Land (acres)				
Owned range	1490	1490	1490	0
Leased range	608	440	608	168
State range	414	414	414	0
Permits (AUMs)				
Forest Service	258	258		
B.L.M.	234	234	453 ^a	—39
Hired labor (hours)				
	—	3,273.1	3,266.93	—6.17
Net ranch income				
	—	\$17,305	\$15,922	—\$1,383

^aThe decrease could be in either Forest Service or B.L.M. grazing or a combination of both types of grazing.

The high dependence model ranch has a slightly different situation as shown in Table 10. This situation has 430 acres of range land available to lease, 767 acres of state range land available to lease, and 43 acres of unused owned irrigated pasture. The reason for this is that the model ranch is apparently underutilizing all of its resources. The prices assumed in the programming analysis for owned, private lease, state lease and Federal grazing lands indicate that it is more profitable to utilize the owned and Federal lands first and then use the state and private lease lands. The forage requirements of the assumed livestock inventory for this ranch are such that the state and private leased lands available are not needed initially. When the Federal grazing fees get high enough, the available but unused sources of forage, which are available only in the amounts shown in Table 10, become less costly and are utilized as part of the feed base. When Federal grazing fees were increased to \$1.40/AUM, the high dependence model ranch found

Table 9. The effects of changes in Forest Service and B.L.M. grazing fees on resource use and net ranch income—medium dependence model ranch.

Resource	Amount available	Amount used in init. situation (1972 Fee)	Amount used in fin. solution (\$3.60/AUM)	Net change in resources used and net ranch Income
Land (acres)				
Owned range	1783	1783	1783	0
Leased range	224	112	224	112
State range	531	531	531	0
Permits (AUMs)				
Forest Service	434	434		
B.L.M.	497	497	901 ^a	—30
Hired labor (hours)				
	—	3,018.37	3,013.56	—4.81
Net ranch income				
	—	\$15,395	\$13,698	—\$2,697

^aThe decrease could be in either Forest Service or B.L.M. grazing or a combination of both types of grazing.

it more favorable to use the 43 acres of unused irrigated pasture and to cease use of 131 AUMs of Federal grazing. Further increases in Federal grazing fees to \$2.00/AUM induced the high dependence ranch to stop utilizing an additional 76 AUMs of Federal grazing. The 76 AUMs were replaced by leasing 767 acres of available state range land. The next change in the resources used occurred between a Federal grazing fee of \$2.30/AUM and \$2.40/AUM. At this point it became more profitable to lease the 430 acres of available private range land and to stop using another 25 AUMs of Federal grazing. The fee increases also encourage the high dependence ranch to employ more intense farming practices and to feed hay to replace grazing as it is less costly to produce hay than it is to obtain grazing. The increased Federal fees led to a \$4,175 decrease in net ranch income.

The analysis indicates that at a Federal grazing fee of between \$2.30 and \$2.40/AUM it becomes feasible for all three model ranches to lease all the land that is available at \$2.35/AUM. At a fee of about \$2.35/AUM the model ranches would stop grazing Federal range if enough private range was available. If the private range leased for a higher or lower price/AUM, the ranches would find it profitable to stop using

Federal grazing at either a higher or lower Federal grazing fee. That is, the ranch would stop using Federal grazing land when the Federal

grazing fee and the cost of running on Federal range is more than the cost of leasing and running on private lease range.

Table 10. The effect of changes in Forest Service and B.L.M. grazing fees on resource use and net ranch income—high dependence model ranch.

Resource	Amount Available	Initial situation (1972 Fee)	Amount used			Changes between the initial situation and final solution
			Fee changes			
			\$1.40 to \$1.80	\$2.00 to \$2.30	\$2.40 to \$3.60	
Land (acres)						
Owned range	4641	4641	4641	4640	4640	-1
Leased range	430	0	0	0	430	430
State range	767	0	0	767	767	767
Irrigated pasture	198	155	198	198	198	43
Permits (AUMs)						
Forest Service	386	386	1420	1344	1319 ^a	-232
B.L.M.	1165	1165				
Alfalfa Hay Alternative Two (acres) ^b	—	0	0	2.14	2.14	2.14
Grazing replacement (AUMs) ^c	—	0	0	11	11	11
Hired labor (hours)	—	2866	2903	2906	2902	36
Net ranch income ^d	—	\$19,410	\$17,533	\$16,942	\$15,235	-\$4,175

^aThe decrease could be in either Forest Service or B.L.M. grazing or a combination of both types of grazing.

^bAlfalfa hay alternative two is a more intensive level of hay production than the model ranch was using. The net ranch income reflects the higher cost associated with the more intensive practices.

^cReplacing grazing with feeding hay.

^dNet ranch incomes are for the initial situation and Federal grazing fees of \$1.80, \$2.30, and \$3.60.

EFFECTS OF DECREASES IN PERMITTED AUMs OF FOREST SERVICE AND B.L.M. GRAZING

The analysis of the effects of decreases in available Federal grazing is quite similar to the analysis of the effects of increased grazing fees. The initial situation previously discussed is also the starting point for the analysis of the effects of decreased permitted Federal grazing. Federal grazing was decreased in nine 10% increments giving a maximum reduction in Federal grazing of 90%. Federal grazing is not completely taken away at this point because total loss of Federal grazing is to be considered separately later.

Tables 11, 12, and 13 show the effects on resource use and on net ranch income for decreases in Federal grazing for the three model ranches.

The first adjustment for the low dependence model ranch was to lease all of the available private grazing land to provide required feed (Table 11). The next change was the use of increased intensity in producing native hay, Native Hay Alternative Two⁴ for additional hay. The hay produced from this activity is fed as grazing replacement. The low dependence model ranch increased the use of available leased pasture by 168 acres and applied increased technology to about 39 acres of native hay and fed 171 AUMs of hay as grazing replacement.

The medium dependence model ranch responded to the 90% reduction permitted in Federal grazing by leasing 112 more acres of available private range and using increased fertilizer on the native hay meadows to make up for the forage lost (Table 12). Native Hay Alternative Two is applied to about 193 acres of native hay and 820 AUMs of native hay are fed as grazing replacement.

⁴See Appendix III for a detailed description of the alternative haying methods considered.

Table 11. The effects of decreasing the permitted number of AUMs of grazing on the Federal lands on resource use and net incomes—low dependence model ranch

Item	Amount of resource used and returns for selected decreases in Federal grazing				
	Initial situation	20% Decrease	40% Decrease	60% Decrease	90% Decrease
Resources					
Leased range (acres)	440	608	608	608	608
Native hay alternative two (acres)	0	.73	11.73	22.74	39.24
Grazing replacement fed (AUMs)	0	7	54	101	171
Net ranch income	\$17,305	\$17,235	\$16,995	\$16,755	\$16,394

Table 12. The effects of decreasing the permitted number of AUMs of grazing on the Federal lands on resource use and net income—medium dependence model ranch

Item	Amount of resource used and returns for selected decreases in Federal grazing				
	Initial situation	20% Decrease	40% Decrease	60% Decrease	90% Decrease
Resources					
Leased range (acres)	112	224	224	224	224
Native hay alternative two (acres)	0	36.92	81.51	126.10	192.98
Grazing replacement fed (AUMs)	0	158	347	536	820
Net ranch income	\$16,397	\$15,563	\$14,613	\$13,663	\$12,238

The first response by the high dependence model ranch was to use 43 acres of unused irrigated pasture for needed forage (Table 13). The next responses were to lease all available private range, 430 acres, and to lease all available state range 767 acres, as the availability of public lands

is reduced. Native Hay Alternative Two was also used in increasing amounts as the reductions in permitted Federal grazing increased. The hay produced by Alternative Two was fed to replace 1,178 AUMs of Federal grazing.

The three model ranch situations responded similarly to the reduction in permitted Federal grazing. The first response was to use all available unused owned grazing land. The next response was to lease all available State and private range. The cheapest state range would be leased first. The last alternative adopted is for the ranches to use increased amounts of fertilizer to produce hay to replace lost Federal grazing. If sufficient private range is available for lease, this would be the only alternative used by the low and medium dependence model ranches. The high dependence model ranch would use the unused irrigated pasture first followed by state range land and the balance required would be made up from private range if enough is available.

Table 13. The effects of decreasing the permitted number of AUMs of grazing on the Federal lands on resource use and net income—high dependence model ranch

Item	Amount of resource used and returns for selected decreases in Federal grazing				
	Initial situation	20% Decrease	40% Decrease	60% Decrease	90% Decrease
Resources					
Irrigated pasture (acres)	155	198	198	198	198
Leased range (acres)	0	430	430	430	430
State range (acres)	0	767	767	767	767
Native hay alternative two (acres)	0	20.5	94	167	277
Grazing replacement (AUMs)	0	89	400	711	1,178
Net ranch income	\$19,410	\$18,809	\$17,229	\$15,648	\$13,278

**EFFECTS OF BOTH INCREASES IN
FEDERAL GRAZING FEES AND
DECREASES IN PERMITTED AUMs OF
FEDERAL GRAZING**

This section considers the effects of changes in both grazing fees and available Federal grazing permits at the same time. Figures 1, 2, and 3 show the effects on the initial situation for selected decreases in permitted Federal grazing and increases in Federal grazing fees from the 1972 level up to \$3.60/AUM for the low, medium, and high dependence model ranches, respectively.

In all three cases the pattern is the same. All curves are declining but the slope tends to flatten out as the portions of the feed base made up by

Federal grazing decreases. Here, as before, the ranches are affected to a greater degree as their dependence on Federal grazing lands increase.

Table 14 shows how the low dependence model ranch changed its resource use. Owned range used declined from 1,490 acres to 1,466 acres over the 90% reduction in available Federal grazing permits. The decline was to provide an area to feed the hay as grazing replacement. It was assumed that for each AUM of hay fed as grazing replacement about .6 acres of owned range would be converted to a feedlot. Available leased range use increases by 168 acres while Native Hay Alternative Two is increased to 95 acres to make up for the loss of forage from the Federal lands. Grazing replacement increases to 408 AUMs.

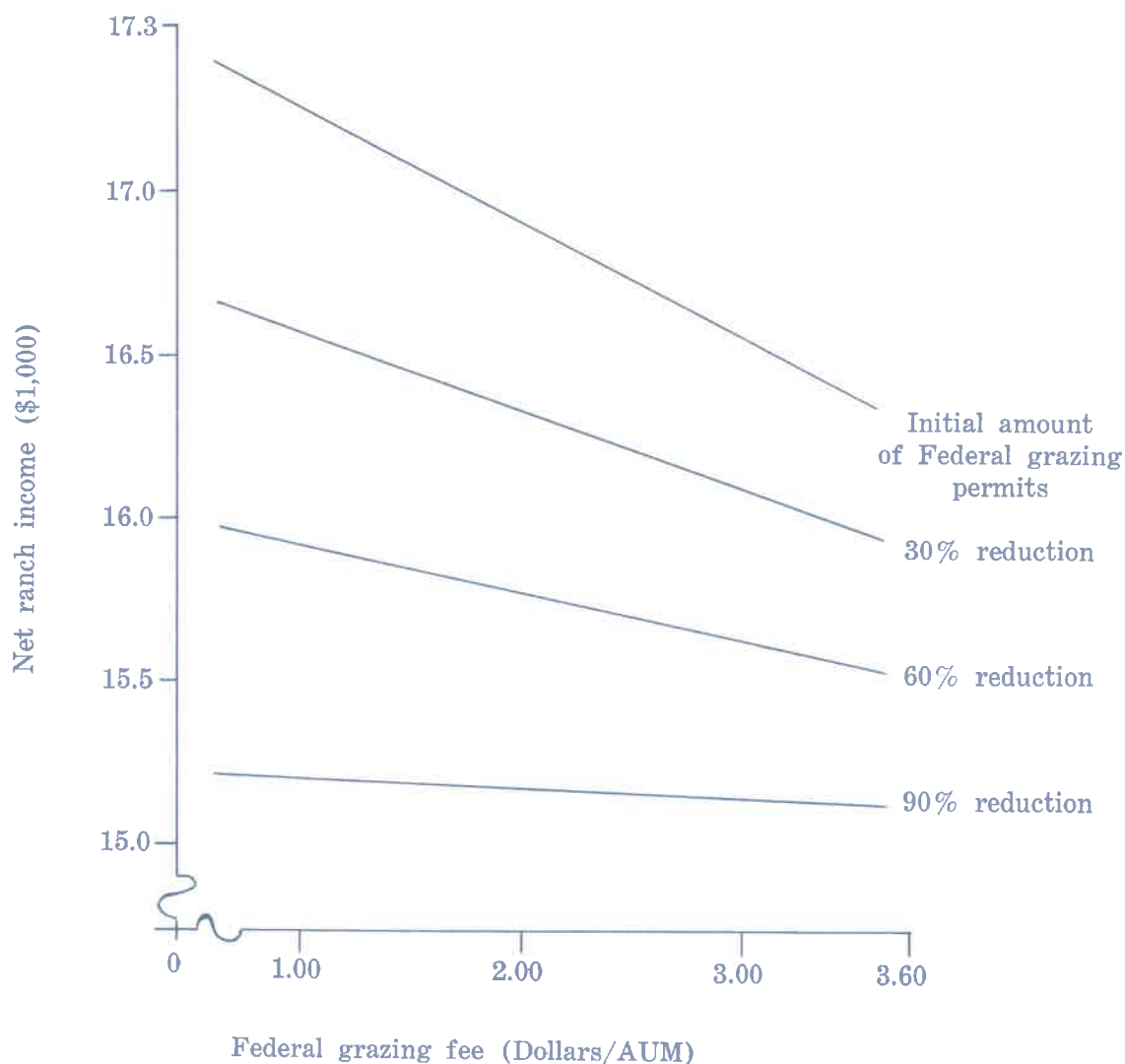


Figure 1. Effects of increased Federal grazing fees and selected decreases in permitted AUMs of grazing on net ranch income—low dependence model ranch

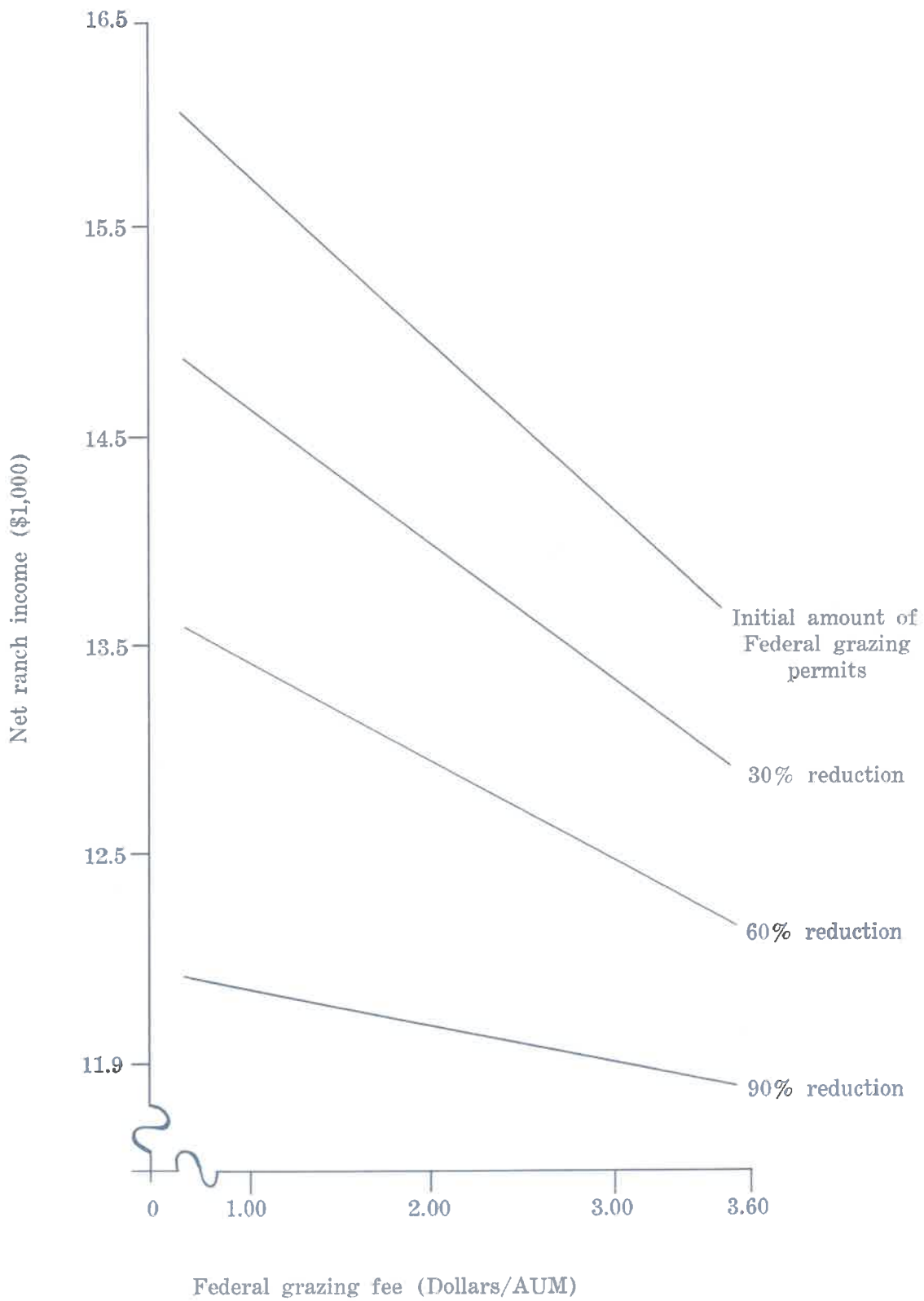


Figure 2. Effects of increased Federal grazing fees and selected decreases of permitted AUMs of grazing on net ranch income—medium dependence model ranch

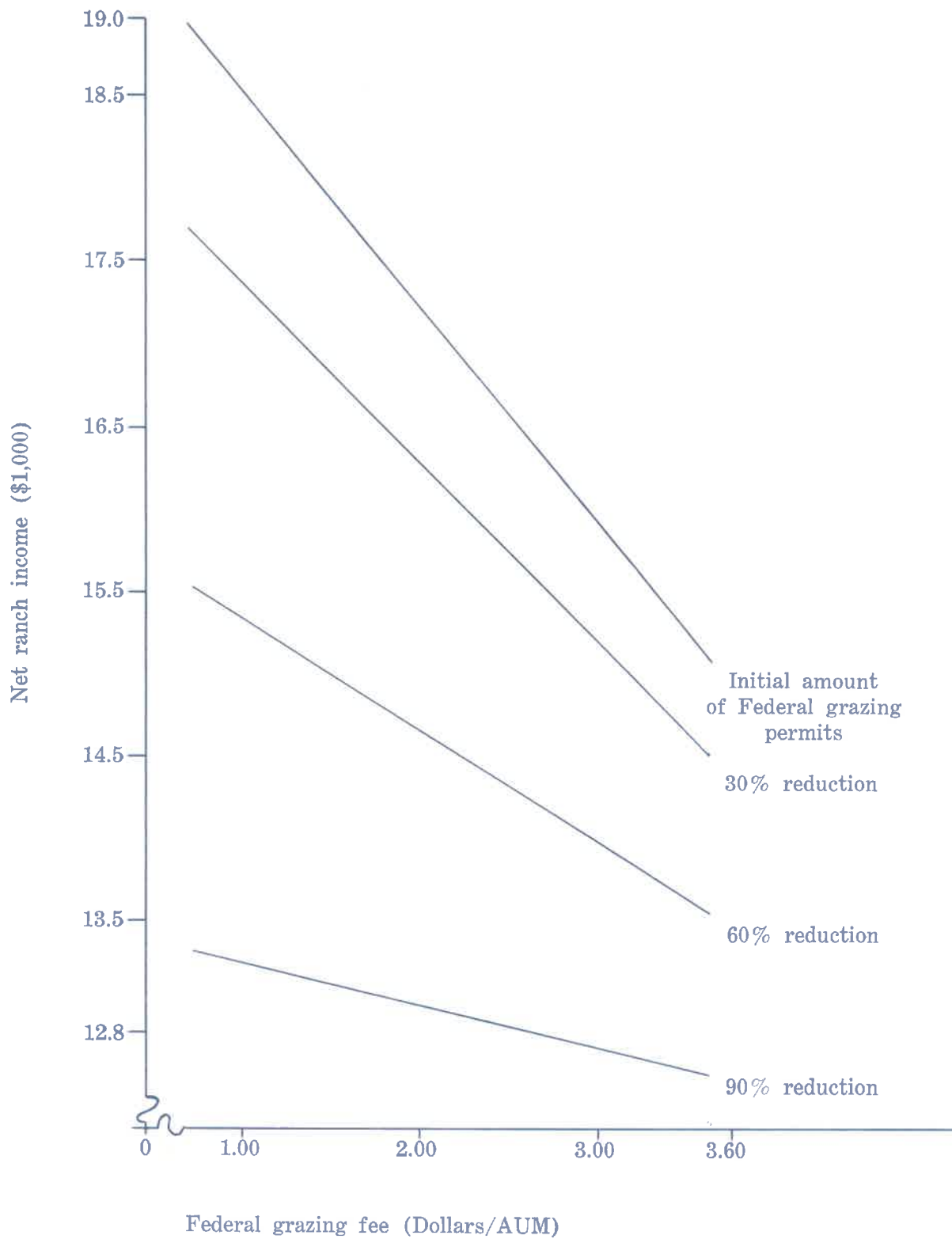


Figure 3. Effects of increased Federal grazing fees and selected decreases in permitted AUMs of grazing on net ranch income—high dependence model ranch

Table 14. Effects on the resource use of Federal grazing fee increases and decreases in permitted AUMs of Federal grazing—low dependence model ranch.

Resource or Practice	Amount available	Amount used with			
		Initial situation	30% Decrease	60% Decrease	90% Decrease
Land (acres)					
Owned range	1,490	1,490	1,483	1,474	1,466
Leased range	608	440	608	608	608
State range	414	414	414	414	414
Permit (AUMs)					
Forest Service	258	258	180	102	24
B.L.M.	234	234	165	96	27
Native Hay Alternative Two (acres)	358	0	25	60	95
Grazing Replacement (AUMs)	—	0	110	259	408
Hired labor (hours)	—	3,273	3,333	3,420	3,507

Table 15 shows the effects on net ranch income of the low dependence model ranch when fees are increased and permitted AUMs of grazing are decreased. The loss of the grazing permits causes a greater decrease in net ranch income than does the increasing of fees. The reason is that the technology and practices used to make up lost forage from the loss of public lands grazing permits is more costly than the increased fees.

Table 16 shows the effects on resource use by the medium dependence model ranch of the combined increases in grazing fees and decreases in permitted AUMs. The major changes are increased use of available leased range of 112 acres, increases in Native Hay Alternative Two of 193 acres, and increases in grazing replacement of 820 AUMs to replace the loss of forage from Federal lands. Table 17 shows how the net ranch income is affected by the increase in fees and decrease in Federal permit availability for the medium dependence ranch.

Table 15. Effects on net ranch income of selected Federal grazing fees and selected decreases in permitted Federal grazing—low dependence model ranch.

Federal grazing fees/ AUM	Net ranch income			
	0% Decrease	30% Decrease	60% Decrease	90% Decrease
\$1.00	\$17,219	\$15,114	\$14,417	\$13,711
2.00	15,846	14,769	14,219	13,669
3.60	13,735	14,217	13,902	13,587

Table 16. Effects on the resource use of Federal grazing fee increases and decreases in permitted AUMs of Federal grazing—medium dependence model ranch.

Resource or Practice	Amount available	Amount used with			
		Initial situation	30% Decrease	60% Decrease	90% Decrease
Land (acres)					
Owned range	1,783	1,783	1,768	1,751	1,734
Leased range	224	112	224	224	224
State range	531	531	531	531	531
Permits (AUMs)					
Forest Service	434	434	305	176	47
B.L.M.	497	497	347	197	47
Native Hay Alternative					
Two (acres)	—	—	59	126	193
Grazing Replacement (AUMs)	—	—	253	536	820
Hired labor (hours)	—	3,017	3,159	3,325	3,490

Table 17. Effects on net ranch income of selected Federal grazing fees and selected decreases in permitted Federal grazing—medium dependence model ranch.

Federal grazing fees/ AUM	Net ranch income			
	0% Decrease	30% Decrease	60% Decrease	90% Decrease
\$1.00	\$14,572	\$13,361	\$12,033	\$10,706
2.00	13,641	12,709	11,660	10,631
3.60	12,198	11,665	11,064	10,462

Table 18 shows the effects on the resource use of the high dependence model ranch of changes in Federal grazing fees and permitted Federal grazing. The major changes are the use of 430 acres of available leased private range, 767 acres of leased state range, and 43 more acres of irrigated pasture used. The number of acres of native hay put into Native Hay Alternative

Two increases to 277 acres. The added hay produced from this use of fertilizer is fed as 1,178 AUMs of grazing replacement. Table 19 shows how the high dependence model ranch's net income is affected by the combined effects of increased fees and loss of Federal grazing permits.

The model ranches with the higher dependence on Federal grazing show the most reduction in net ranch income when both Federal grazing fees are increased and when Federal grazing is decreased. The high dependence ranches also need more AUMs of grazing replacement.

EFFECTS OF TOTAL LOSS OF FEDERAL GRAZING

The result of the total loss of the use of Federal grazing lands was a reduction in net ranch income for all three ranches. As in the previous analyses, the ranches who were dependent on Federal range were affected the most.

Table 18. Effects on the resource use of Federal grazing fee increases and decreases in permitted AUMs of Federal grazing—high dependence model ranch.

Resource or Practice	Amount available	Amount used with			
		Initial situation	30% Decrease	60% Decrease	90% Decrease
Land (acres)					
Owned range	4,641	4,641	4,626	4,598	4,570
Leased range	430	0	430	430	430
State range	767	0	767	767	767
Irrigated pasture	198	155	198	198	198
Permits (AUMs)					
Forest Service	386	386	269	152	35
B.L.M.	1,165	1,165	817	469	121
Native Hay Alternative					
Two (acres)	—	—	57	167	277
Grazing Replacement (AUMs)	—	—	244	711	1,178
Hired labor (hours)	—	2,866	3,038	3,310	3,582

Table 19. Effects on net ranch income of selected Federal grazing fees and selected decreases in permitted Federal grazing—high dependence model ranch.

Federal grazing fees/ AUM	Net ranch income			
	0% Decrease	30% Decrease	60% Decrease	90% Decrease
\$1.00	\$17,219	\$16,073	\$13,893	\$11,713
2.00	15,846	14,987	13,272	11,557
3.60	13,735	13,249	12,278	11,307

Interestingly, with the use of high applications of fertilizer to native hay meadows, the ranches were all able to produce sufficient hay to replace

the lost Federal grazing that could not be replaced by increased use of available leased private or state range lands. The model ranches in all cases were able to maintain their initial number of animal units. Private range land, if enough additional were available, could reduce the effect of loss of Federal grazing.

Table 20 shows the effects on resource use and net ranch income of the three model ranches of the loss of Federal range. The loss of Federal range is difficult to cope with. However, if the ranches are able to increase productions on their hay meadows and are willing to feed the increased hay production as grazing replacement it appears the ranches can survive at their initial size in terms of livestock numbers and systems.

Table 20. A comparison of resource use and net ranch income of the initial ranching situation with the total loss of Federal grazing situation—three model ranches.

Item	Effects of total loss of Federal Grazing on the resources used					
	Low dependence		Medium dependence		High dependence	
	Initial situation	After loss	Initial situation	After loss	Initial situation	After loss
Forage						
Owned range (acres)	1,490	1,462	1,783	1,728	4,641	4,561
Leased range (acres)	440	608	112	224	0	430
State range (acres)	414	414	531	531	0	767
Native Hay Alternative						
Two (acres)	0	107	0	216	0	314
Grazing Replacement (AUMs)	0	460	0	916	0	1,335
Animal units	378	378	392	392	388	388
Net ranch income	\$17,305	\$14,978	\$16,397	\$11,759	\$19,410	\$12,481

Returns to operator's investment in land is an alternative measure of how well a ranch operation is doing financially. Changes in returns to operator's investment in land can be used to show the effect of changes in fees and permit availability for the Federal lands on the financial viability of the three model ranches. Table 21 shows how the percent return to land investment is in effect for selected levels of fees and permit availability for the three model ranches. In all instances the return to land investment decreases. The returns are positive in all cases but the financial viability was considerably reduced.

Table 21. Effects on the return to the investment in land of increased Federal grazing fees and decreased Federal grazing—the three model ranches.

	Percent returns with selected decreases in Federal grazing				
	No decrease	30%	60%	90%	100%
<u>Low dependence</u>					
Initial situations	2.64%	2.47%	2.25%	2.03%	1.96%
Final fees \$3.60/AUM	2.23%	2.17%	2.08%	1.99%	
<u>Medium dependence</u>					
Initial situations	2.29%	1.92%	1.52%	1.11%	0.98%
Final fees \$3.60/AUM	1.53%	1.37%	1.21%	1.03%	
<u>High dependence</u>					
Initial situations	3.13%	2.76%	2.08%	1.39%	1.17%
Final fees \$3.60/AUM	1.96%	1.82%	1.54%	1.26%	

In conjunction with the total loss of Federal grazing, the alternative of converting native hay land to irrigated pasture was analyzed. Conversion of native hay to irrigated pasture is considered under three assumptions. The first assumption is that the converted pasture would be grazed during the summer months only. The second assumption is that it would be grazed during both the summer and fall months. The third assumption is that the converted pasture would be grazed in the fall months only. The yields on converted native hay land are assumed to be about two AUMs of grazing/ton of hay that could have been harvested. The yields are assumed to vary slightly with the three assumptions due to the difference in maturity of the forage.

Conversion of native hay was employed in varying degrees by the three model ranches. The low dependence model ranch employed the most

conversion, 181 acres. The medium and high dependence model ranches converted only very nominal amounts. The conversions by the medium and high dependence model ranches were identified by the program but are considered to be infeasible due to the small changes they cause.

It appears that the conversion of native hay to pasture would be a workable solution in some cases but not as advantageous to others. The organizational make-up and the resources available to a ranch would determine the degree of feasibility of conversions of native hay to pasture. The low dependency model ranch is the least affected because it is easier to replace a smaller number of AUMs and still not hurt the winter feed base provided by hay.

SUMMARY

The main objective of this research was to determine the impact of changes in Federal grazing fees and Federal permit numbers on resource use and net ranch incomes of mountain valley-type cattle ranches in southcentral Wyoming. Data were obtained from 27 cattle ranches in the study area to establish three model ranches. The model ranch organizations were based on their dependence on public lands for feed base.

Linear programming was used to analyze the effects of increases in Federal land grazing fees and decreases in the number of grazing permits on the Federal lands on the resource use and net ranch income of the three model ranches. (Net ranch income in this study is returns to operator's labor, management and land investment).

The increase in grazing fees on Federal lands caused proportional decreases in the net ranch incomes of the three model ranches. The magnitude of the decrease varied directly with the percent dependency on Federal grazing for forage. The low dependency model ranch had an 8.75% decrease in net ranch income as Federal grazing fees were increased from 1972 levels to \$3.60/AUM. The medium dependency model ranch had an 18.11% decrease and the high dependency model ranch had a 23.31% decrease in net ranch income with the change in fees. Also, there was some change in resource use and production practices and technology used as the Federal fees were increased (see Tables 8, 9 and 10). These changes occurred when alternative methods of forage production became less costly than the use of Federal grazing permits as Federal grazing fees increased.

It appears from our analysis that the greater the dependency on Federal lands for feed base, the greater the impact on resource use and net ranch income as the fee increases. It should be noted, however, that even the high dependency ranch was able to maintain a positive net ranch income with the highest level of fees under the price assumptions used in this study.

All three model ranch organizations had decreases in net ranch income and changes in resource use and practices and technology used when the number of grazing permits available were decreased (see Tables 11, 12 and 13). The low dependence model ranch had a 5.2% reduction in net ranch income when there was a 90% reduction of Federal grazing permits. The medium dependence model ranch had a 25.4% reduction in net ranch income with the 90% reduction in permits. The high dependence model ranch had a 31.6% reduction in net ranch income with the 90% decrease in available Federal grazing permits.

Again, all three model ranch organizations had decreases in net ranch income and change in resource use and practices and technology used when fees were increased and permits decreased (see Tables 14, 15, 16, 17, 18 and 19). The low dependence model ranch had the smallest changes and the high dependence model ranch had the largest changes.

An alternative for maintaining net ranch income was examined. The conversion of native hay to pasture was a workable alternative in some instances. The organizational make-up and the resources available to a ranch determine the feasibility of converting native hay to pasture.

^aKearl, W. Gordon, *Ranch Management*, draft copy, Division of Agricultural Economics, University of Wyoming, Laramie, Wyoming 1970.

CONCLUSIONS

The conclusions of this study are that if the ranches maintain their present operation patterns, then:

1. Increased grazing fees will tend to reduce a ranch's financial viability by reducing net ranch income. These reductions in net ranch income would not force any of the three ranches to a negative net ranch income at the costs and returns used in the analysis. These findings correspond to the findings of the Economic Research Service administrative report to the B.L.M. and Forest Service.
2. Decreased numbers of permitted AUMs of Federal grazing cause effects on net ranch income similar to increased Federal grazing fees.
3. Complete loss of Federal grazing will reduce net ranch income and possibly force reduced enterprise sizes. The magnitude of the effects would depend on the ranch's dependency on Federal grazing lands for its feed base.

APPENDIX I

The calculations of animal unit months (AUMs) was done by the method outlined by Kearl.^a The basic formula used was:

$$\text{Animal Unit Coefficient} = \frac{W^{.75}}{1000^{.75}}$$

W = the physiological weight

This formula gives an animal unit coefficient of 1 for a 1,000 lb. animal. A calf or yearling would be a percent or part of an animal unit. Bulls would be more than equal to one animal unit. One animal unit is equal to 12 animal unit months.

Appendix Table 1 gives the coefficients used in this study for each ranch by livestock type and season.

APPENDIX I

Appendix Table 1. Animal-unit-month coefficients for average weight of livestock for ranches by dependency.

Class of livestock	Winter period		Spring-fall period	
	Average weight	AUM coefficient	Average weight	AUM coefficient
<u>Low dependence model ranch</u>				
Cows 2+	1000.00	1.000	1000.00	1.000
Yearling heifers	820.50	.862	650.00	.724
Weaned heifer calves	438.15	.539	—	—
Nursing heifer calves	—	—	225.64	.327
Nursing steer calves	—	—	238.34	.341
Weaned steer calves	369.52	.475	—	—
Yearling steers	—	—	547.64	.638
Bulls	1300.00	1.215	1300.00	1.215
Horses	1100.00	1.074	1100.00	1.074
<u>Medium dependence model ranch</u>				
Cows 2+	1000.00	1.000	1000.00	1.000
Yearling heifers	836.00	.875	665.00	.736
Weaned heifer calves	452.50	.554	—	—
Nursing heifer calves	—	—	233.00	.335
Nursing steer calves	—	—	240.00	.342
Weaned steer calves	405.00	.507	—	—
Yearling steers	—	—	583.00	.669
Bulls	1300.00	1.215	1300.00	1.215
Horses	1100.00	1.074	1100.00	1.074
<u>High dependence model ranch</u>				
Cows 2+	1000.00	1.000	1000.00	1.000
Yearling heifers	885.00	.913	710.00	.773
Weaned heifer calves	475.50	.573	—	—
Nursing heifer calves	—	—	235.50	.338
Nursing steer calves	—	—	258.50	.362
Weaned steer calves	336.00	.440	—	—
Yearling steers	—	—	515.00	.608
Bulls	1300.00	1.215	1300.00	1.215
Horses	1100.00	1.074	1100.00	1.074

APPENDIX II

Appendix Table 2. Basic cost and return data used in the linear programming analysis.

Activities	Values per unit		
	Low dependence	Med. dependence	High dependence
Basic fixed cost/AU	\$30.30	\$37.37	\$34.78
Forest Service fee/AUM	.80	.80	.80
B.L.M. fee/AUM	.52	.52	.52
Owned range cost/acre	.069	.081	.018
Leased range cost/acre	.540	.630	.141
State range cost/acre	.251	.294	.065
Grazing replacement cost/AUM	.43	.43	.43
Alfalfa hay alternative one cost/acre	25.75	25.75	25.75
Alfalfa hay alternative two cost/acre	40.39	40.39	40.39
Alfalfa hay alternative three cost/acre	64.60	—	—
Native hay alternative one cost/acre	14.72	14.72	14.72
Native hay alternative two cost/acre	31.99	31.99	31.99
Native hay alternative three cost/acre	35.27	35.27	35.27
Irrigated pasture cost/acre	2.62	2.62	2.62
Leased irrigated pasture cost/acre	12.90	12.90	12.90
Buy alfalfa hay cost/AUM	9.45	9.45	9.45
Buy native hay cost/AUM	9.00	9.00	9.00
Buy cake cost/pound	.04	.04	.04
Hired labor cost/hour	2.00	2.00	2.00
Sell calves price/pound	.4875	.4821	.4729
Sell yearlings price/pound	.4139	.4174	.4284
Sell cows price/pound	.2554	.2554	.2554

APPENDIX III

Three alternatives are considered in the analysis for both alfalfa hay and native hay production. The first alternative, referred to as Alternative One, for both alfalfa and native hay is the method presently being used. Alternative Two assumes that the hay is being farmed under more intensive practices, mainly the application of fertilizer. Alternative Three assumes the present level of farming practices but the hay land is leased. Appendix Tables 3 and 4 show the production costs and yields for the three hay alternatives for alfalfa and native hay, respectively.

Preharvest costs are those costs incurred in producing one acre of alfalfa hay but not to harvest it. The preharvest costs include: tractor hours, machinery hours, truck miles, manure,

commercial fertilizer, and chemical pest control.^{aa} The cost of added fertilizer for alfalfa hay is the amount it was assumed to cost to increase phosphate application by 90 lb./acre. The harvest costs were on the basis of \$6.44/ton.^{bb}

Appendix Table 3. Costs of Producing Alfalfa Hay, 1972 Prices.

Item	Hay producing assumptions		
	One	Two	Three
Cash Cost per Acre			
Preharvest costs	\$12.74	\$14.15	\$12.74
Cost of added fertilizer	—	8.01	—
Harvest costs	13.01	18.23	13.01
Rent	—	—	38.85
Total Cash Costs	\$25.75	\$40.39	\$64.60
Yield: AUMs ^a /Acre	7.47	10.49	7.47
Tons/Acre	2.02	2.83	2.02

^aOne AUM of alfalfa hay is equal to 540 lb. of hay.

^{aa}Stevens, Delwin M., *Costs and Returns for Irrigated Crops in Wyoming*, Wyoming Ag. Exp. Sta. Bulletin 407, March 1967.

^{bb}Hamm, Don R., *An Economic Analysis of Hay Harvesting Methods in Wyoming*, unpublished M.S. thesis, University of Wyoming, 1972.

