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DETERMINING MARKET AREAS
FOR LIVESTOCK GRAZING

by

Robert G. Williams

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Agriculture Economics

UTAH STATE UNIVERSITY
Logan, Utah

1969

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Robert G. Williams

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ABSTRACT

Determining Market Areas
for Livestock Grazing

by

Robert G. Williams, Master of Science

Utah State University, 1969

Major Professor: Dr. Darwin B. Nielsen
Department: Agricultural Economics

Differentials between rancher costs of operating on private and public range were studied in an attempt to define market areas for livestock grazing in western United States.

The problem of defining market areas is basically a problem of grouping differentials between rancher costs of grazing on private leased range and National Forests that are reasonably homogeneous and statistically testing differences among means of the different groups.

Several methods were used to group forests with reasonably uniform differentials into market areas for cattle. A grouping of forests which have the same average grazing fee does not, however, yield market areas which are statistically different from each other.

Available data are not conclusive enough to define market areas for sheep.

(95 pages)

INTRODUCTION

Establishing grazing fees has long been a problem for those who administer policies on our public lands. Presently a wide range of grazing fees exists on our National Forests. In 1967, fees ranged from \$.21 to \$1.80 per cow month¹ for cattle and \$.04 to \$.41 per sheep month for sheep.

Current fees for grazing on National Forests are related to a base fee structure derived from a study undertaken in the 1920's. Following this study base fees were established in 1931 based on an analysis of rental rates on private rangeland and determination of grazing values on comparable National Forest lands. As a result of differences in location of allotments, grazing capacity, and other factors, a large number of base fees were established. Currently there are 19 different base fee rates for cattle and 17 for sheep on the western National Forests. Annual fees are derived by adjusting base fees according to differences between current livestock prices in the 11 western states and an established set of base livestock prices.²

¹ A cow month is the amount of feed required to sustain one head of livestock (cattle) for one month. A cow with a calf less than six months of age is considered as one cow month. Five sheep months equal one cow month.

² U. S. Departments of Agriculture, Defense and Interior, "Review of Federal Land Administration for Livestock Grazing," Report of the Interdepartmental Grazing Fee Committee, Washington, D.C.: Government Printing Office, January 1967.

The Problem

It is apparent that changes have occurred which have affected factors that were originally considered when the first base fees were established. Annual adjustments to grazing fees based on livestock prices do not reflect supply and demand conditions for livestock grazing. Although grazing fees have been adjusted each year, they do not necessarily reflect the market conditions for forage. In addition, as population continues to increase more demand is being placed on our National Forests for recreational purposes. As a result of these factors policies governing grazing and especially the area of grazing fees are coming under close scrutiny.³ It is anticipated that the policy governing grazing fees will require considerable up-dating.

In 1964, The Bureau of the Budget set principles and guidelines to be followed by Federal Agencies in establishing grazing fees. These principles provided that "a uniform basis should be used by all Federal agencies in establishing fees; fees should be based on the economic value of the use of public grazing lands to the users . . ."⁴

If the fee is to be based on the economic value of the use to the user, the fee should reflect what users of public lands are willing to pay for grazing on comparable private lands within the same area. This follows because supply and demand factors set the price which prevails

³Edward P. Cliff, "Grazing on the National Forests." Address to American National Cattlemen's Association, Memphis, Tennessee. January 28, 1964, p. 2. (Mimeographed)

⁴U. S. Forest Service, Division of Range Management, "U. S. Forest Service Grazing Fees Program." Report to the American Farm Bureau Federation Special Multi-State Grazing Fee Conference, Salt Lake City, Utah, January 16, 1968, p. 2. (Mimeographed)

for private grazing in a given area. The permit system currently in use on Forest Service lands, however, does not allow the fees for use of public lands to reflect what the forage is actually worth to the user. This problem will be discussed in more detail in a later section.

Originally the Forest Service set its base fees under the assumption that supply and demand factors were different in different areas and market areas were thus defined. The problem now is to determine if supply and demand factors are significantly different in the various areas of the west and if market areas can be defined for livestock grazing today. If market areas for grazing can be defined, each market area could have a separate fee based on the economic value of the range to the user.

Objectives of the Study

The objectives of this study are: (1) To define an area for each National Forest in the six Forest Regions of the western United States, showing where base properties of permittees on each forest are located, and determine where ranchers from these areas go to lease private rangeland that would substitute for grazing on each National Forest. (2) To compare the total cost of using public range with the total cost of using comparable private leased range, where the smallest unit of aggregation is a National Forest. (3) To determine if grazing market areas exist which could be used to determine a fee for grazing that would be based on the economic value of grazing to users within that market area.

REVIEW OF LITERATURE

Although literature in the area of defining market areas for livestock grazing is limited, various studies have advanced at least two different methods of defining market areas for livestock grazing.

Permit Value Method of Determining
Market Areas

Gardner demonstrates that the permit system is a rationing device, which is necessary to allocate the services of public grazing land to users. This system becomes necessary as a result of the cost of operating on public lands being less than the value of the marginal product of the grazing. The permit, or authorization to graze on Forest Service lands has taken on value, as a result of the owner being able to transfer the permit. Where transferability is allowed a market for permits exists among the group of prospective holders.⁵

Jensen used permit values to define market areas for grazing in the state of Utah. He defines a market area as "an area or region in which a uniform price per unit of grazing or permit value prevails." By taking permit value data from the various National Forests in Utah,

⁵B. Delworth Gardner, "Transfer Restrictions and Misallocation in Grazing on Public Range." Journal of Farm Economics, XXXIV, No. 1, (February, 1962).

definite market areas were defined.⁶ Although the study was conducted only within the state of Utah, it is conceivable that if permit value data were available the same procedure could be used to determine market areas for all National Forests.

Certain problems are encountered, however, when one deals with grazing permit values. Gardner states that there are impediments that do not allow grazing permits to be freely transferred. Common impediments to free transferability are ownership of cattle and land, dependency upon Forest Service lands for year-round operation and commensurate property. In addition to these rather obvious impediments, attention is brought to others not so obvious. Until recently it had been the Forest Service policy to cut grazing when permits were transferred. Although this practice has been discontinued, stockmen are not necessarily convinced it has been abandoned entirely.⁷ If ranchers fear a transfer will result in a cut obviously they will not be willing to pay as much for the permit as it would be worth if the fear did not exist.⁸ Topham concludes that because of this fear of permit cuts, ranchers avoid purchasing permits. He found that permit values have leveled off in the last ten years because of past, and fear of future

⁶Bartell C. Jensen, "Determining Grazing Fees on National Forests," Utah State University, Logan, Utah. Unpublished Report (September 12, 1967).

⁷B. Delworth Gardner, "A Proposal to Reduce Misallocation of Live-stock Grazing Permits." Journal of Farm Economics, XXXV, No. 1, p. 111, (February, 1963).

⁸N. K. Roberts and Mardell Topham, Discovering Grazing Values. Utah Agriculture Experiment Station Ag. Ec. Series 65-3, 1965. p. 13.

permit reductions. In contrast the value of private rangeland has continued to increase.⁹

It can be assumed that these impediments to permit transfer will vary from area to area. We can thus conclude that in some cases permit values will be influenced by restrictions placed on their transfer, or fears resulting from cuts. In addition, on some forests permits tend to be exchanged rather infrequently.

The Forest Service after analyzing permit values collected by the Statistical Reporting Service, which represented actual transfer prices over the past five years, concluded that there were not enough permit value observations to allow them to reliably stratify forests into market areas.¹⁰ Where this is the case the permit value is not an accurate indicator of economic value and as such, would not be an effective tool in defining market areas for the purpose of determining grazing fees.

Total Cost Method of Determining Market Areas

The Forest Service defined market areas by using the total cost of operating on Forest Service land. By taking the total operating cost

⁹ Mardell D. Topham, "The Economic Value of Forage for Livestock on Public and Private Ranges in Utah" (unpublished M.S. thesis, Utah State University Library, Logan, Utah, 1966), p. 63.

¹⁰ U. S. Forest Service, "Forest Service Grazing Fees Program." Report presented at the Fees and Directives Conference with the American National Cattlemen's Association and the National Wool Growers Association, 1967. p. 7. (Mimeographed)

of permittees on each National Forest in the six Forest Regions of the western United States and statistically testing for the differences among the total cost means, 18 major market areas for cattle were thus defined. These market areas are shown in Table 1.¹¹

Procedure and Source of Data

This thesis will attempt to define market areas by obtaining a differential between the total rancher non-fee cost of operating on each National Forest and the cost of operating on comparable private range. Market areas will then be defined by grouping these differentials into regions which are reasonably uniform.

The Statistical Reporting Service in cooperation with the Forest Service and the Bureau of Land Management undertook the data collection project. In addition to the Bureau of Land Management and National Grasslands, this project was designed to provide data necessary to estimate grazing values on 98 National Forests located in 17 western states. Some 10,000 individuals were interviewed in the survey. These included Forest Service and Bureau of Land Management grazing permittees and ranchers (permittee and non-permittee), who lease private grazing lands. Information was obtained on grazing permit values, lease rates on private lands and non-fee costs of using public and private lands. Table 2 shows these itemized costs for National Forests and National Grasslands as an average for the entire survey area. Although the data included 17 western states, this study is primarily concerned with data

¹¹U. S. Forest Service, "Forest Service Grazing Fees Program," p. 14.

Table 1. Market areas for cattle as determined by the Forest Service using the total cost method

Forest	Total non-fee cost per AUM of operating on Forest Service land
Area A:	
Umpqua, Willamette, Mt. Hood	\$4.19
Deschutes	5.62
Umatilla	4.02
Wallowa-Whitman	3.89
Payette	4.42
Boise	5.32
Nezperce	4.32
Rogue River	4.50
Winema	4.54
Six Rivers	4.85
Klamath	4.41
Shasta-Trinity	4.56
Mendocino	3.70
Los Padres	3.23
Siskiyou	6.69
Weighted Average	4.25
Range	3.23-6.69
Area B:	
Angeles, Cleveland, San Bernardino	9.65
Area C:	
Tahoe	5.44
Eldorado	7.03
Stanislaus	5.34
Sierra	6.17
Inyo	4.45
Sequoia	4.45
Weighted Average	5.17
Range	4.45-7.03
Area D:	
Modoc	3.14
Lassen	3.63
Plumas	3.68
Fremont	3.47
Ochoco	3.14
Malheur	2.75
Weighted Average	3.16
Range	2.75-3.68

Table 1. Continued

Forest	Total non-fee cost per AUM of operating on Forest Service land
Area E:	
Okanogan	\$3.65
Mt. Baker, Gifford Pinchot, Snoqualmie	3.59
Siuslaw	3.84
Wenatchee	4.87
Weighted Average	3.73
Range	3.59-4.87
Area F:	
Clearwater	5.53
St. Joe	6.57
Coeur d'Alene	4.58
Weighted Average	6.19
Range	4.58-6.57
Area G:	
Colville	2.67
Kaniksu	3.35
Kootenai	2.94
Weighted Average	2.80
Range	2.67-3.35
Area H:	
Flathead	2.21
Lolo	2.18
Lewis & Clark	1.68
Weighted Average	1.77
Range	1.68-2.21
Area I:	
Custer	2.50
Black Hills	2.73
Bighorn	3.17
Medicine Bow	2.62
Weighted Average	2.73
Range	2.50-3.17
Area J:	
Nebraska	1.65

Table 1. Continued

Forest	Total non-fee cost per AUM of operating on Forest Service land
Area K:	
Deerlodge	\$3.27
Helena	3.63
Bitterroot	3.65
Beaverhead	2.90
Targhee	3.77
Teton	3.60
Shoshone	4.04
Bridger	3.40
Caribou	3.23
Ashley	3.06
Sawtooth	3.43
Gallatin	4.61
Weighted Average	3.44
Range	2.90-4.61
Area L:	
Salmon	2.41
Challis	2.04
Weighted Average	2.16
Range	2.04-2.41
Area M:	
Toiyabe	3.42
Humboldt	3.66
Dixie	3.14
Weighted Average	3.47
Range	3.14-3.66
Area N:	
Wasatch	4.61
Cache	4.21
Uinta	4.80
Manti-Lasal	4.57
Fishlake	4.77
Weighted Average	4.63
Range	4.21-4.80
Area O:	
Kaibab	3.29
Prescott	4.02
Coconino	3.43
Coronado	4.12
Tonto	3.07

Table 1. Continued

Forest	Total non-fee cost per AUM of operating on Forest Service land
Weighted Average	3.61
Range	3.07-4.12
Area R:	
Sitgreaves	\$5.76
Apache	3.99
Cibola	7.27
Gila	4.75
Lincoln	6.35
Weighted Average	5.19
Range	3.99-7.27
Area S:	
Carson	5.11
Santa Fe	6.05
Weighted Average	5.54
Range	5.11-6.05
Area T:	
San Juan	3.89
Rio Grande	3.37
San Isabel	4.02
Gunnison	3.24
Grand Mesa	3.07
White River	4.16
Pike	1.85
Arapaho	2.88
Routt	3.80
Roosevelt	3.50
Weighted Average	3.47
Range	1.85-4.16
Survey Weighted Average	3.75
Range	1.65-9.65

Table 2. Itemized rancher non-fee costs per animal unit month for grazing livestock on National Forests and grasslands

Cost item	Cattle	Sheep
Lost animals	\$.61	\$.72
Association fees	.19	.05
Veterinary	.13	.10
Moving livestock to and from allotment	.33	.39
Herding	.47	1.48
Salt and feeding	.41	.29
Travel to and from allotment	.41	.50
Water	.04	.07
Horses	.23	.24
Fence maintenance	.27	.08
Water maintenance	.18	.08
Development depreciation	.13	.06
Other costs	<u>.17</u>	<u>.28</u>
Total costs-		
National Forest and National Grasslands in survey ^a	3.59 ^b	4.35 ^b
National Forests, 11 Western States	3.75 ^b	4.49 ^b

^aSummation may not equal total costs due to rounding.

^bDoes not include grazing fee or cost of holding permit.

on National Forests within the 11 western states. Exceptions are:
two forests which are partly in South Dakota, and one which is completely
in Nebraska.¹²

Costs of operating on each National Forest were summarized. Cost
data for private rangeland was made available by the Forest Service.
These data contained the same cost items as data for Forest Service lands
(see Table 2). Private cost data required aggregation as the appropriate
areas were defined.

¹²

U. S. Forest Service, "U. S. Forest Service Grazing Fees Program."

DETERMINING MARKET AREAS FOR CATTLE

Market Areas for Grazing onNational Forests

Over time ranchers have bid for control of forest grazing by buying grazing permits as they were offered for sale. Therefore, it is appropriate to locate the current permit holders and define the geographic area which encompasses these permittees as the market area for grazing permits.

The addresses of permittees on 98 National Forests in the western states were available from Forest Service data. By using these addresses, the geographic location of permittees on each forest was determined. With permittees for each forest thus geographically located, it was possible to define grazing permit market areas for each forest. These market areas include those counties in which permittees on a given National Forest are located. Market areas for permits for each of the National Forests in the western states are shown in the Appendix. These areas provide a base from which a market area can be defined for private range that could be used as a substitute for grazing on each National Forest.

Market Areas for Grazing onPrivate Leased Range

Suppose permittees on a given National Forest are located in a five county area. This would then be the grazing permit market area for that

forest, (assuming that over time ranchers have been bidding for control of the forest grazing permits). Ranchers (both permittee and non-permittee) in this five-county area undoubtedly lease private rangelands for grazing. Data were available which listed the location of the ranchers who leased rangeland and the location of the rangeland leased. By taking all ranchers in the five counties who lease rangeland and locating the rangeland leased, one can determine a market area for private range for each forest. The private lease cost data include all items listed for forest lands (Table 2) plus the actual cash cost of the lease. Private lease data are summarized on a county basis. Therefore, the market area for private leased range includes all counties where ranchers for each forest go to lease rangeland.

Only private leased rangeland that would substitute seasonally for National Forest grazing was included in the analysis. Using this procedure, market areas for private grazing which would substitute for grazing on each National Forest were determined. Cost of operating on private rangeland could then be compared with the cost of operating on the associated National Forest to give a basis for a grazing fee.

Private lease data were analyzed in much the same manner as data on costs of grazing forest lands. The private lease areas for each National Forest are shown in the Appendix. There is some overlap in the private lease areas, i.e., the same county may appear in more than one market area. This is to be expected, however, since private range in a given county can substitute for grazing on more than one National Forest.

Costs of Grazing on National Forests

Compared to Costs of Grazing on

Private Leased Range

Costs of grazing on private rangeland were summarized for each county, based on private lease cost data provided by the Forest Service. The same cost items used by the Forest Service (Table 2), for determining the cost of operating on Forest Service land, were used to determine private costs. After aggregating costs and AUM's¹³ for each county, totals for each area of private grazing were computed. By dividing total costs for each area by total AUM's, it was possible to determine the per AUM costs for the private lease area associated with each National Forest.

Costs of operating on each National Forest had previously been determined by the Forest Service. By comparing costs of operating on Forest Service land with those of operating on private lands in the same area, a differential was obtained for each forest. This differential represents the full value differential for forage on that forest. Table 3 shows costs of operating on National Forests and private leased range summarized for each forest, along with full value differentials and permit values where available.

It should be noted that several of the forests show a negative differential when rancher costs of operating on National Forests are

¹³ An animal-unit-month (AUM) is the amount of feed required to sustain a cow or its equivalent for the period of one month. Five sheep are considered the equivalent of one cow.

Table 3. Summary of rancher costs for grazing cattle on National Forests and private leased range^a

Forest	Rancher non-fee costs of operating on National Forests	Rancher cost of operating on private leased range	Differential between rancher costs of operating on private leased range and Permit value	
			National Forests	Permit value
Forest Region 1:				
Beaverhead	\$2.90	\$4.19	\$1.29	\$21.75
Bitterroot	3.65	4.32	.67	b
Clearwater	5.53	4.47	-1.06	b
Couer d'Alene	4.58	3.44	-1.14	b
Colville	2.67	3.45	.78	16.44
Custer	2.50	4.14	1.64	11.34
Deerlodge	3.27	4.89	1.62	32.03
Flathead	2.21	4.20	1.99	48.64
Gallatin	4.61	4.88	.27	25.07
Helena	3.63	5.43	1.80	22.89
Kaniksu	3.35	3.40	.05	b
Kootenai	2.94	2.72	-.22	b
Lewis & Clark	1.68	6.43	4.75	15.03
Lolo	2.18	4.63	2.45	5.06
Nezperce	4.32	6.70	2.38	9.55
St. Joe	6.57	3.19	-3.38	32.20
Average Range	3.54 1.68-6.57	4.41 2.72-6.70	.87 -3.38-4.75	21.82 5.06-48.64
Forest Region 2:				
Arapaho	2.88	6.45	3.57	29.11
Bighorn	3.17	2.72	-.45	26.84
Black Hills	2.73	3.43	.70	25.64
Grand Mesa	3.07	4.73	1.66	21.76
Gunnison	3.24	5.02	1.78	18.23
Medicine Bow	2.62	4.80	2.18	7.02
Nebraska	1.65	4.81	3.16	b
Pike	1.85	5.34	3.49	26.75
Rio Grande	3.37	5.84	2.47	26.90
Roosevelt	3.50	4.77	1.27	39.34
Routt	3.80	5.92	2.12	29.45
San Isabel	4.02	5.22	1.20	59.47
San Juan	3.89	4.70	.81	24.20
Shoshone	4.04	6.66	2.62	35.81
White River	4.16	4.20	.04	25.04
Average Range	3.20 1.65-4.16	4.97 2.72-6.66	1.77 -.45-3.57	28.47 7.02-59.47

Table 3. Continued

Forest	Rancher non-fee costs of operating on National Forests	Rancher cost of operating on private leased range	Differential between rancher costs of operating on private leased range and National Forests	Permit value
Forest Region 3:				
Apache	\$3.99	\$4.97	\$.98	\$52.25
Carson	5.11	5.06	- .05	20.27
Cibola	7.27	4.64	-2.63	29.51
Coconino	3.43	5.29	1.96	10.76
Coronado	4.12	4.89	.77	b
Gila	4.75	5.09	.34	23.30
Kaibab	3.29	4.87	1.58	37.48
Lincoln	6.35	6.07	- .28	9.98
Prescott	4.02	4.80	.78	32.20
Santa Fe	6.05	4.86	-1.19	17.53
Sitgreaves	5.76	5.96	.20	50.77
Tonto	3.07	5.39	2.32	37.48
Average	4.77	5.17	.40	29.23
Range	3.07-7.27	4.64-6.07	-2.63-2.32	9.98-52.25
Forest Region 4:				
Ashley	3.06	6.82	3.76	18.03
Boise	5.32	4.37	- .95	18.26
Bridger	3.40	6.04	2.64	11.77
Cache	4.21	5.05	.84	10.87
Caribou	3.23	4.53	1.30	14.75
Challis	2.04	6.11	4.07	23.58
Dixie	3.14	4.60	1.46	15.02
Fishlake	4.77	4.80	.03	15.86
Humboldt	3.66	4.44	.78	32.27
Manti-Lasal	4.57	5.23	.66	16.43
Payette	4.42	3.86	- .56	75.86
Salmon	2.41	4.75	2.34	15.71
Sawtooth	3.43	5.14	1.71	24.04
Targhee	3.77	4.58	.81	19.69
Teton	3.60	7.03	3.43	10.93
Tioyabe	3.42	4.35	.93	35.43
Uinta	4.80	5.81	1.01	21.01
Wasatch	4.61	5.51	.90	7.99
Average	3.77	5.17	1.40	21.53
Range	2.04-5.32	3.86-7.03	- .95-4.07	7.99-75.86
Forest Region 5:				
Angeles	9.65	4.65	-5.00	b
Cleveland	9.65	3.73	-5.92	b
Eldorado	7.03	6.05	- .98	16.08

Table 3. Continued

Forest	Rancher non-fee costs of operating on National Forests	Rancher cost of operating on private leased range	Differential between rancher costs of operating on private leased range and National Forests	
				Permit value
Inyo	\$4.45	\$4.60	\$.15	\$ 4.97
Klamath	4.41	2.99	-1.42	6.86
Lassen	3.63	5.42	1.79	9.67
Los Padres	3.23	5.02	1.79	b
Mendocino	3.70	5.20	1.50	b
Modoc	3.14	4.22	1.08	26.28
Six Rivers	4.85	7.50	2.65	b
Plumas	3.68	5.19	1.51	25.92
San Bernardino	9.65	4.67	-4.98	b
Sequoia	4.45	6.83	2.38	8.61
Shasta-Trinity	4.56	5.58	1.02	b
Sierra	6.17	4.30	-1.87	2.65
Stanislaus	5.34	4.41	-.93	b
Tahoe	5.44	4.22	-1.22	b
Average	5.47	4.98	-.49	12.63
Range	3.14-9.65	2.99-7.50	-5.92-2.65	2.65-26.28
Forest Region 6:				
Deschutes	5.62	4.46	-1.16	8.03
Fremont	3.47	5.41	1.94	40.36
Gifford Pinchot	3.59	4.04	.45	25.58
Malheur	2.75	6.21	3.37	20.36
Mt. Baker	3.59	8.20	4.61	25.58
Mt. Hood	4.19	2.29	-1.90	28.39
Ochoco	3.14	4.13	.99	17.82
Okanogan	3.65	2.86	-.79	12.31
Olympic	b	4.71	b	b
Rogue River	4.50	5.21	.71	7.61
Siskiyou	6.69	4.57	-2.12	b
Siuslaw	3.84	4.13	.29	b
Snoqualmie	3.59	3.55	-.04	25.58
Umatilla	4.02	4.38	.36	2.78
Umpqua	4.19	4.85	.66	28.39
Wallowa-Whitman	3.89	5.07	1.18	14.30
Wenatchee	4.87	3.45	-1.42	2.99
Willamette	4.19	3.47	-.72	28.39
Winema	4.54	5.46	.92	b
Average	4.13	4.54	.41	19.23
Range	2.75-6.69	2.29-8.20	-2.12-4.61	2.78-40.36

^aAll values are computed on an AUM basis.

^bData not available.

subtracted from costs of operating on private leased range. It is normally assumed that the private leased range costs per AUM would be higher than the non-fee costs of operating on National Forests. If this were not the case, the operator would be better off economically speaking to discontinue grazing on Forest Service lands and lease private range.¹⁴ If the costs of operating on private land were less expensive than Forest Service land, we would also expect the permit on the forest to have no value. On some of these forests, however, the Forest Service had determined that a permit value does exist (see Table 3). The presence of this permit value strongly suggests that a cost differential exists, with the cost of operating on National Forests being less than the cost of operating on private leased range.¹⁵ On the other hand, on some forests there appears to be a very high differential, where the relative low permit value would suggest that the differential should be less than the data would indicate. Several factors can be considered to explain the above conditions.

On many forests having a negative differential (costs of operating on National Forests are higher than costs of operating on private leased range), it is noted that most and in some cases all of the permits are temporary. Temporary permits are issued to accomplish certain objectives of the Forest Service which cannot completely be met with the more common term permit. Temporary permits are issued for one year and may or may not be reissued, depending on the availability of forage.

¹⁴U. S. Forest Service, "Forest Service Grazing Fees Program."

¹⁵Ibid.

Ownership of base ranch property is not required to hold a temporary permit, the requirement of commensurability is also waived. On the other hand, to be eligible to hold term permits, a rancher must own commensurate ranch property. Term permits are normally issued for a period of ten years.¹⁶

Due to the differences that exist between temporary and term permits it is obvious that forests which have mostly temporary permittees would differ to a large degree from those that are largely term. These differences would be expected to influence the cost of operating on Forest Service lands. It is noted that in many cases the forests with few term permittees are also the ones whose costs differentials seem to be "out of line." In most cases the result is a high cost of operating on the Forest Service land, which results in a negative differential. High costs of operating on National Forests can largely be attributed to relaxing of the requirements for holding temporary permits, as well as to the nature of the permit itself. To be eligible to hold temporary permits it is no longer necessary for the permittee to own a livestock operation which is dependent on Forest Service grazing to operate. In fact the operation need not even be located near the forest on which the permit is issued. Use of temporary permits would quite naturally result in higher moving and travel costs for the permittee than for the term permit. Because temporary permits are not necessarily renewed each year, permittees are not in a position to take advantages of inherent

¹⁶U. S. Forest Service, "Title 2200; Range Management," Forest Service Manual; Washington, D.C. n.d.

economics which could result from a continual operation in the same area year after year. It does not then seem unreasonable to expect that costs of operating on public lands would be higher than usual where we are dealing with mostly temporary permits. Forests which have less than 25 term permittees are shown in Table 4.

Statistical Analysis

Once the differential between the cost of operating on private leased range and National Forests is obtained for each forest, the problem of defining market areas is essentially the problem of statistically testing for the difference among the means of two or more populations.¹⁷ For example, if the differentials are grouped into n groups with cost differentials $\mu_1 \mu_2 \dots \mu_n$ an application of analysis of variance procedure can be used to test the hypothesis that all means are equal, i.e., $\mu_1 = \mu_2 = \dots = \mu_n$. If the hypothesis is accepted it could be concluded that no significant difference exists among the group's cost differential means and that the groups would not represent separate market areas. If, on the other hand, the hypothesis is rejected, one could conclude that separate and distinct market areas exist for livestock grazing. A different fee could then be justified for different areas. The problem is how to group the forests into fee or market areas that will prove to be statistically different. Several different methods of grouping were used in an attempt to define market areas.

¹⁷ Bartell C. Jensen, "Determining Grazing Fees on National Forests." p. 7.

Table 4. National Forests which have less than 25 term permittees

Forest	No. of term per- mittees	Total permittees	Differential between rancher costs of operat- ing on private leased range and National Forests	Permit value
Clearwater	0	18	-\$1.06	a
Couer d'Alene	9	35	-1.14	a
Flathead	0	30	1.99	\$48.64
Kootenai	17	64	- .22	a
St. Joe	0	43	-3.38	32.20
Angeles	1	1	-5.00	a
Cleveland	2	2	-5.92	a
Inyo	22	45	-1.42	6.86
Mendocino	9	33	1.50	a
San Bernardino	4	13	-4.98	a
Shasta-Trinity	12	37	1.02	a
Deschutes	25	30	-1.16	8.03
Gifford Pinchot	8	14	.45	25.58
Mt. Baker	1	1	4.61	25.58
Mt. Hood	16	17	-1.90	28.39
Olympic	1	1	a	a
Siskiyou	10	16	-2.12	a
Siuslaw	0	41	.29	a
Snoqualmie	5	6	- .04	25.58
Umpqua	7	11	.66	28.39
Wenatchee	25	37	-1.42	2.99
Willamette	0	8	- .72	28.39
Winema	15	28	.92	a

^aData not available.

Source: Barton F. Bailey, "An Analysis of Forest Service Grazing Statistics and a Case Study of Public Grazing in Rich County, Utah." Unpublished M.S. Thesis, Utah State University Library, Logan, Utah, 1969.

The first and perhaps the most obvious method is to study the differentials to determine if any obvious groupings are recognizable. The private-public cost differentials were arranged in numerical order and studied to determine if there were any obvious breaks or gaps in the data. By looking at the differentials in this manner it was determined that they could be broken into 15 distinct groups. Each group contained differentials which were fairly homogeneous, numerically speaking. At the same time the groups were separated from each other for the most part by a considerable and obvious gap.

As would be expected, when the hypothesis $\mu_1 = \mu_2 \dots = \mu_{15}$ was subjected to an analysis of variance the results were highly significant and the hypothesis was rejected (Table 5). Table 6 shows the forests within each of the 15 market areas.¹⁸

Table 5. Analysis of variance for the 15 market areas determined by numerical grouping

Source of variation	Degrees of freedom	Mean squares	F
Total	95	--	
Treatments	14	23.9462	219.8550**
Experimental Error	81	.1090	

** Significant at the 1 percent level.

¹⁸ Only 96 National Forests are used in the analysis instead of the expected 98. The Manti and Lasal National Forests have been combined into one observation. No public costs were available for the Olympic National Forest.

Table 6. Market areas for cattle as determined by numerical grouping

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area A:	
Cleveland	-\$5.92
Angeles	-5.00
San Bernardino	-4.98
St. Joe	-3.38
Cibola	-2.63
Average	-4.38
Area B:	
Siskiyou	-2.12
Mt. Hood	-1.90
Sierra	-1.87
Average	-1.96
Area C:	
Klamath	-1.42
Wenatchee	-1.42
Tahoe	-1.22
Santa Fe	-1.19
Deschutes	-1.16
Couer d'Alene	-1.14
Clearwater	-1.06
Eldorado	- .98
Boise	- .95
Stanislaus	- .93
Average	-1.15
Area D:	
Okanogan	- .79
Willamette	- .72
Payette	- .56
Bighorn	- .45
Lincoln	- .28
Kootenai	- .22
Average	- .50
Area E:	
Carson	- .05
Snoqualmie	- .04
Fishlake	.03
White River	.04
Kaniksu	.05
Average	.006

Table 6. Continued

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area F:	
Inyo	\$.15
Sitgreaves	.20
Gallatin	.27
Siuslaw	.29
Gila	.34
Umatilla	.36
Gifford Pinchot	.45
Average	.29
Area G:	
Umpqua	.66
Manti-Lasal	.66
Bitterroot	.67
Black Hills	.70
Rogue River	.71
Coronado	.77
Prescott	.78
Humboldt	.78
Colville	.78
San Juan	.81
Targhee	.81
Cache	.84
Wasatch	.90
Winema	.92
Toiyabe	.93
Apache	.98
Ochoco	.99
Uinta	1.01
Shasta-Trinity	1.02
Modoc	1.08
Average	.84
Area H:	
Wallowa-Whitman	1.18
San Isabel	1.20
Roosevelt	1.27
Beaverhead	1.29
Caribou	1.30
Average	1.25

Table 6. Continued

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area I:	
Dixie	\$1.46
Mendocino	1.50
Plumas	1.51
Kaibab	1.58
Deerlodge	1.62
Custer	1.64
Grand Mesa	1.66
Sawtooth	1.71
Gunnison	1.78
Lassen	1.79
Los Padres	1.79
Helena	1.80
Average	1.65
Area J:	
Fremont	1.94
Coconino	1.96
Flathead	1.99
Average	1.96
Area K:	
Routt	2.12
Medicine Bow	2.18
Average	2.15
Area L:	
Tonto	2.32
Salmon	2.34
Sequoia	2.38
Nezperce	2.38
Lolo	2.45
Rio Grande	2.47
Average	2.39
Area M:	
Shoshone	2.62
Bridger	2.64
Six Rivers	2.65
Average	2.64

Table 6. Continued

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area N:	
Nebraska	\$3.16
Malheur	3.37
Teton	3.43
Pike	3.49
Arapaho	3.57
Ashley	3.76
Challis	4.07
Average	3.55
Area O:	
Mt. Baker	4.61
Lewis & Clark	4.75
Average	4.68

It should be recognized that even though the areas are highly significant statistically speaking, one cannot attach too much importance to the results. In view of the fact that the groups were selected from data which is arranged in numerical order one would expect the analysis of variance to reject the hypothesis. Furthermore, if a different number of groups had been used, say 12 or even 20, the results would still prove to be significant from a statistical point of view. Taking one or more forests from one group and moving them to another still does not change the conclusion that there is a significant difference among the 15 groups.

The second method of grouping forests was to use the 18 market areas defined by the Forest Service (see Table 1). By using these areas and subjecting the cost differentials to an analysis of variance,

it was determined that the hypothesis $\mu_1 = \mu_2 \dots = \mu_{18}$ was rejected (Table 7). Results of this test would tend to substantiate the results of the Forest Service, even though the Forest Service market areas were defined using total public cost figures as opposed to the method of cost differentials. The fact that both our results will statistically support the same market areas would indicate that the Forest Service would be justified in using the 18 market areas previously defined to determine grazing fees.

As has been pointed out previously, there is a wide range of fees presently being charged by the Forest Service. Base fees were originally computed from private lease data similar to that used in this study. If changes in costs of private leased range have not occurred to any great extent, or if these changes have occurred equally in all areas, market areas could be defined as those forests which have the same average grazing fee. Over time, adjustments were made in all base fees as a result of changing livestock prices. Changing livestock prices would be added equally to the base fee for each forest, and as such would not be a factor in defining market areas based on current fee data.

Table 7. Analysis of variance for 18 market areas defined by the Forest Service using the total cost method

Source of variation	Degrees of freedom	Mean squares	F
Total	95	--	
Treatments	17	12.9754	8.1142**
Experimental Error	78	1.5991	

** Significant at the 1 percent level.

An average grazing fee was obtained for each National Forest from the 1967 fee data as computed by the Forest Service. The Forests were then grouped into 33 separate market areas, with each group having a different average grazing fee. As was previously noted there are 19 different base fees currently in effect. Some forests, however, are broken into grazing allotments with a different fee being charged on each allotment. Where this is the case an average of the different fees was used to determine the overall fee for that forest. This then accounts for the 33 different fees instead of the expected 19. Table 8 shows the forests within each of the 33 fee areas.

When the hypothesis $\mu_1 = \mu_2 = \dots = \mu_{33}$ is subjected to an analysis of variance, the hypothesis is accepted (Table 9). Thus the statistical evidence indicates that the current fee areas cannot be used for new base fee areas. This would substantiate the hypothesis that factors which were used to determine the original base fees have changed to the extent that they no longer represent values of Forest Service grazing, when compared to private lease rates.

The final attempt at grouping was undertaken with the objective of a compromise between cost differentials and geographic location. That is to say, forests were grouped by looking at geographic location first and then cost differentials. In this manner forests were grouped into 19 market areas in such a manner that they conform reasonably close geographically and still have cost differentials that are relatively homogeneous. Because of careful attempts to insure that each group have differentials which are fairly homogeneous, when the hypothesis $\mu_1 = \mu_2 = \dots = \mu_{19}$ is subjected to the analysis of variance, the results are highly significant (Table 10). This grouping results

Table 8. Market areas for cattle as determined by average grazing fee

Forest	Average fee	Differential between rancher costs of operating on private leased range and National Forest
Area A: Santa Fe	\$.32	-\$1.19
Area B: Carson	.33	- .05
Area C: Lincoln Gila	.34	- .28 .34
Area D: Kaibab Cibola	.35	1.58 -2.63
Area E: Siskiyou Apache	.37	-2.12 .98
Area F: Kootenai Flathead Prescott Sitgreaves	.38	- .22 1.99 .78 .20
Area G: Tonto	.39	2.32
Area H: Coronado	.40	.77
Area I: Coconino	.41	1.96
Area J: Clearwater Salmon	.42	-1.06 2.34
Area K: St. Joe Humboldt	.46	-3.38 .78
Area L: Bitterroot	.47	.67

Table 8. Continued

Forest	Average fee	Differential between rancher costs of operating on private leased range and National Forest
Area M:	\$.48	
Boise		-\$.95
Six Rivers		2.65
Challis		4.07
Area N:	.49	
Deschutes		-1.16
Area O:	.50	
Couer d'Alene		-1.14
Colville		.78
Lolo		2.45
Black Hills		.70
Area P:	.51	
Payette		- .56
Nezperce		2.38
Kaniksu		.05
Teton		3.43
Area Q:	.52	
Tioyabe		.93
Area R:	.53	
Manti-Lasal		.66
Willamette		- .72
Mt. Hood		-1.90
Ochoco		.99
Umpqua		.66
Area S:	.54	
Targhee		.81
Bridger		2.64
Ashley		3.76
Area T:	.55	
Wasatch		.90
Area U:	.56	
Wenatchee		-1.42
Medicine Bow		2.18

Table 8. Continued

Forest	Average fee	Differential between rancher costs of operating on private leased range and National Forest
Area V:	\$.57	
Rogue River		\$.71
Klamath		-1.42
Shasta-Trinity		1.02
Mendocino		1.50
Inyo		.15
Modoc		1.08
Malheur		3.37
Okanogan		- .79
Mt. Baker		4.61
Gifford Pinchot		.45
Snoqualmie		- .04
Siuslaw		.29
Sawtooth		1.71
Fishlake		.03
Gunnison		1.78
Grand Mesa		1.66
Area W:	.58	
Wallowa-Whitman		1.18
Dixie		1.46
Area X:	.61	
Umatilla		.36
Lassen		1.79
Angeles		-5.00
Cleveland		-5.92
San Bernardino		-4.98
Tahoe		-1.22
Eldorado		- .98
Stanislaus		- .93
Sierra		-1.87
Sequoia		2.38
Los Padres		1.79
Plumas		1.51
Custer		1.64
Uinta		1.01
Area Y:	.62	
Fremont		1.94
Area Z:	.63	
Deerlodge		1.62
Beaverhead		1.29
Gallatin		.27

Table 8. Continued

Forest	Average fee	Differential between rancher costs of operating on private leased range and National Forest
Area AA:	\$.64	
Caribou		\$1.30
Cache		.84
Rio Grande		2.47
Pike		3.49
Arapaho		3.57
Area AB:	.67	
Lewis & Clark		4.75
Shoshone		2.62
San Juan		.81
White River		.04
Routt		2.12
Area AC:	.69	
Helena		1.80
Area AD:	.70	
Bighorn		- .45
Area AE:	.71	
Nebraska		3.16
Area AF:	.82	
Roosevelt		1.27
Area AG:	.98	
Winema		.92

Table 9. Analysis of variance for 33 market areas defined by using average grazing fees

Source of variation	Degrees of freedom	Mean squares	F
Total	95	--	
Treatment	32	3.3718	
Experimental Error	63	3.7529	.8985*

*Not significant at the 5 percent level.

Table 10. Analysis of variance for 19 market areas defined by using geographic location

Source of variation	Degrees of freedom	Mean squares	F
Total	95	--	
Treatment	18	17.5313	
Experimental Error	77	.3736	46.9128**

**Significant at the 1 percent level.

in areas which have similar characteristics when differential between rancher costs of operating on private leased range and National Forests are compared and at the same time the areas lie within a definite definable geographic area. Table 11 shows these market areas.

Table 11. Market areas for cattle as determined using geographic location

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area A:	
Cleveland	-\$5.92
Angeles	-5.00
San Bernardino	-4.98
Average	-5.30
Range	-4.98 - -5.92
Area B:	
St. Joe	-3.38
Siskiyou	-2.12
Mt. Hood	-1.90
Wenatchee	-1.42
Deschutes	-1.16
Couer d'Alene	-1.14
Clearwater	-1.06
Okanogan	- .79
Willamette	- .72
Klamath	-1.42
Stanislaus	- .93
Eldorado	- .98
Tahoe	-1.22
Sierra	-1.87
Average	-1.44
Range	- .72 - -3.38
Area C:	
Boise	- .95
Payette	- .56
Average	- .76
Range	- .56 - - .95
Area D:	
Cibola	-2.63
Santa Fe	-1.19
Lincoln	- .28
Carson	- .05
Sitgreaves	.20
Gila	.34
Average	- .60
Range	-2.63 - .34

Table 11. Continued

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area E:	
Big Horn	-\$.45
Area F:	
White River	.04
Fishlake	.03
Average	.035
Range	.03 - .04
Area G:	
Kootenai	- .22
Gallatin	.27
Bitterroot	.67
Colville	.78
Targhee	.81
Kaniksu	.05
Average	.39
Range	- .22 - .81
Area H:	
Inyo	.15
Humboldt	.78
Tiyoabe	.93
Modoc	1.08
Shasta-Trinity	1.02
Gifford Pinchot	.45
Umatilla	.36
Siuslaw	.29
Umpqua	.66
Rogue River	.71
Winema	.92
Ochoco	.99
Wallowa-Whitman	1.18
Snoqualmie	- .04
Average	.68
Range	- .04 - 1.18
Area I:	
Manti-Lasal	.66
Cache	.84
Wasatch	.90
Uinta	1.01
Caribou	1.30

Table 11. Continued

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area I: (continued)	
San Juan	\$.81
San Isabel	1.20
Roosevelt	1.27
Grand Mesa	1.66
Gunnison	1.78
Average	1.14
Range	.66 - 1.78
Area J:	
Black Hills	.70
Area K:	
Coronado	.77
Prescott	.78
Apache	.98
Average	.84
Range	.77 - .98
Area L:	
Beaverhead	1.29
Deerlodge	1.62
Custer	1.64
Helena	1.80
Flathead	1.99
Sawtooth	1.71
Average	1.68
Range	1.29 - 1.99
Area M:	
Dixie	1.46
Kaibab	1.58
Coconino	1.96
Tonto	2.32
Average	1.83
Range	1.46 - 2.32
Area N:	
Mendocino	1.50
Plumas	1.51
Lassen	1.79
Los Padres	1.79

Table 11. Continued

Forest	Differential between rancher costs of operating on private leased range and National Forests
Area N: (continued)	
Fremont	\$1.94
Sequoia	2.38
Six Rivers	2.65
Average	1.94
Range	1.50 - 2.65
Area O:	
Pike	3.49
Arapaho	3.57
Ashley	3.76
Rio Grande	2.47
Nebraska	3.16
Routt	2.12
Medicine Bow	2.18
Average	2.96
Range	2.12 - 3.76
Area P:	
Salmon	2.34
Nezperce	2.38
Lolo	2.45
Challis	4.07
Lewis & Clark	4.75
Average	3.20
Range	2.34 - 4.75
Area Q:	
Shoshone	2.62
Bridger	2.64
Teton	3.43
Average	2.90
Range	2.62 - 3.43
Area R:	
Malheur	3.37
Area S:	
Mt. Baker	4.61

MARKET AREAS FOR SHEEP

In an attempt to define market areas for sheep, the same process was used as for cattle. The same geographic areas for permits and private leased range land would hold equally as well for sheep as for cattle.

Public costs were made available by the Forest Service. Private costs were obtained in the same manner as those of cattle. By subtracting rancher costs of operating on Forest Service lands from costs of operating on private leased range, differentials were determined. Table 12 summarizes rancher costs for grazing sheep on each of the National Forests.

It should be noted that in examining the cost differentials for sheep that an even wider variation exists than does for cattle. Also a large number of the cost differentials are negative. Much of this variation can be explained by the small number of observations for obtaining private costs. In some of the counties surveyed there was no private leased range for grazing sheep. As a result the private cost data for a given area may be taken from only a few observations. In several cases cost figures were available for less than half of the counties in a given area. The Forest Service in attempting to define market areas for sheep by using the total cost method were unable to obtain satisfactory results. They cite insufficient cost data on many

Table 12. Summary of rancher costs for grazing sheep on National Forests and private leased range^a

Forest	Rancher non-fee costs of operating on National Forests	Rancher cost of operating on private leased range	Differential between rancher costs of operating on private leased range and Permit value	
			National Forests	Permit value
Forest Region 1:				
Beaverhead	\$3.79	\$5.41	\$1.62	\$16.57
Bitterroot	b	4.37	b	b
Clearwater	6.90	4.74	-2.16	c
Couer d'Alene	c	4.29	c	c
Colville	6.33	4.18	-2.15	c
Custer	3.09	3.55	.46	
Deerlodge	b	2.85	b	b
Flathead	b	4.37	b	b
Gallatin	7.43	4.29	-3.14	13.68
Helena	4.54	4.67	.13	c
Kaniksu	c	4.02	c	c
Kootenai	b	c	b	b
Lewis & Clark	9.41	4.46	-4.95	c
Lolo	c	4.37	c	c
Nezperce	3.58	9.70	6.12	.68
St. Joe	4.65	c	c	c
Average	5.52	4.74	- .51	10.31
Range	3.09-9.41	2.85-9.70	-4.95-6.12	.68-16.57
Forest Region 2:				
Arapaho	4.64	4.91	.27	19.69
Bighorn	3.25	5.12	1.87	22.50
Black Hills	5.14	3.53	-1.61	15.93
Grand Mesa	3.87	4.26	.39	6.75
Gunnison	6.07	5.65	- .42	28.67
Medicine Bow	5.15	5.43	.28	c
Nebraska	b	11.23	b	b
Pike	4.85	7.15	2.66	13.93
Río Grande	5.66	8.64	2.98	9.63
Roosevelt	3.62	4.01	.39	c
Routt	4.50	4.15	- .35	27.71
San Isabel	4.00	6.42	2.42	20.41
San Juan	4.63	4.37	- .26	18.58
Shoshone	4.75	4.98	.23	c
White River	6.52	3.73	-2.79	23.69
Average	4.76	5.57	.43	18.86
Range	3.25-6.52	3.53-11.23	-2.79-2.98	6.75-28.67

Table 12. Continued

Forest	Rancher non-fee costs of operating on National Forests	Rancher cost of operating on private leased range	Differential	Permit value
			between rancher costs of operat- ing on private leased range and National Forests	
Forest Region 3:				
Apache	\$5.53	\$5.31	-\$.22	c
Carson	5.40	6.24	.84	\$17.77
Cibola	2.57	3.36	.79	c
Coconino	5.58	5.31	-.27	c
Coronado	b	5.31	b	b
Gila	b	6.45	b	b
Kaibab	5.21	6.51	1.30	c
Lincoln	5.24	6.32	1.08	c
Prescott	c	6.24	c	c
Santa Fe	4.30	14.51	10.21	c
Sitgreaves	3.03	5.31	2.28	17.92
Tonto	3.59	5.31	1.72	c
Average	4.49	6.35	1.97	17.85
Range	2.57-5.58	3.36-14.51	-.27-10.21	17.77-17.92
Forest Region 4:				
Ashley	4.19	5.39	1.20	16.55
Boise	3.84	5.54	1.70	c
Bridger	3.41	6.02	2.61	c
Cache	5.76	4.89	-.87	17.76
Caribou	3.65	6.00	2.35	18.21
Challis	4.76	6.31	1.55	12.00
Dixie	4.42	5.20	.78	c
Fishlake	6.26	4.54	-1.72	37.41
Humboldt	3.39	6.15	2.76	18.11
Manti-Lasal	4.49	5.10	.61	19.65
Payette	4.23	5.07	.84	10.34
Salmon	3.75	6.17	2.42	c
Sawtooth	3.94	5.52	1.58	25.62
Targhee	5.34	6.81	1.47	14.29
Teton	9.26	6.24	-3.02	c
Tioyabe	6.23	5.88	-.35	c
Uinta	5.50	5.05	-.45	23.89
Wasatch	5.69	5.58	-.11	41.63
Average	4.90	5.64	.74	21.29
Range	3.39-9.26	4.54-6.81	-3.02-2.76	10.34-41.63

Table 12. Continued

Forest	Rancher non-fee costs of operating on National Forests	Rancher cost of operating on private leased range	Differential	Permit value
			between rancher costs of operating on private leased range and National Forests	
Forest Region 5:				
Angeles	\$4.34	\$6.64	\$2.30	c
Cleveland	4.34	6.59	2.25	c
Eldorado	c	5.32	c	c
Inyo	4.95	6.26	1.31	c
Klamath	c	5.70	c	c
Lassen	6.93	6.62	-.31	c
Los Padres	b	6.34	b	b
Mendocino	b	7.84	b	b
Modoc	5.63	6.15	.52	c
Six Rivers	b	16.06	b	b
Plumas	4.01	6.23	2.22	c
San Bernardino	4.34	6.23	1.89	c
Sequoia	b	6.41	b	b
Shasta-Trinity	6.37	6.66	.29	c
Sierra	b	6.77	b	b
Stanislaus	c	5.16	c	c
Tahoe	6.66	3.28	-3.38	c
Average	5.29	6.72	.80	c
Range	4.01-6.93	3.28-16.06	-3.38-2.30	c
Forest Region 6:				
Deschutes	5.84	5.22	-.62	c
Fremont	6.64	6.43	-.21	c
Gifford Pinchot	5.05	4.32	-.73	10.90
Malheur	5.19	4.99	-.20	c
Mt. Baker	5.05	c	c	10.90
Mt. Hood	b	6.62	b	b
Ochoco	4.37	2.41	-1.96	c
Okanogan	6.19	4.75	-1.44	c
Olympic	c	4.02	c	c
Rogue River	b	4.80	b	b
Siskiyou	b	4.93	b	b
Siuslaw	1.60	5.19	3.59	c
Snoqualmie	5.05	4.44	-.61	10.90
Umatilla	2.58	5.09	2.51	c
Umpqua	b	c	b	b
Wallowa-Whitman	4.12	4.38	.26	c
Wenatchee	6.59	4.97	-1.62	2.94
Willamette	b	7.78	b	b
Winema	4.36	6.45	2.09	c

Table 12. Continued

Forest	Rancher non-fee costs of operating on National Forests	Rancher cost of operating on private leased range	Differential between rancher costs of operating on private leased range and National Forests	Permit value
Average	\$4.82	\$5.11	\$.09	\$ 8.91
Range	1.60-6.64	2.41-7.78	-1.96-3.59	2.94-10.90

^aAll values are computed on an AUM basis.

^bNo sheep permits.

^cData not available.

forests as the major problem.¹⁹ It would appear then, that the available public cost figures are also somewhat unreliable.

Because of the uncertainty of the cost figures no attempt was made to define market areas for sheep. Although market areas could be defined using the available differentials, it is apparent that the results would not be statistically sound due to the limited data available. Additional data will be required if meaningful market areas are to be defined for sheep using a cost differential approach.

¹⁹U. S. Forest Service, "Forest Service Grazing Fees Program."

SUMMARY AND CONCLUSIONS

Because of pressures by the Federal Government and as a result of an increasing population, many of whom use National Forests for recreation purposes, livestock grazing is coming under careful study by those who administer these lands.

Grazing fees are one of many problems confronting Forest Service personnel. Factors which were originally used to set base fees have changed. Adjustments to grazing fees have not kept pace with supply and demand conditions. Generally, the price of private grazing has increased more rapidly than comparable Forest Service grazing. This increase in the price of private leased range has resulted in a widening of differentials between rancher costs of operating on private leased range and National Forests. Considerable up-dating of fees must be undertaken to bring present fees in line with conditions as they exist today. If grazing fees are to capture for society the full value of the forage, it follows that these fees should be adjusted so that the cost of using public lands is the same as that of comparable private leased range. It will not be enough to bring fees in line with present day private range costs. Supply and demand conditions affecting private range will continue to change from year to year, causing private lease costs to fluctuate. It becomes necessary to have a policy of annually adjusting grazing fees to reflect these changes.

By comparing areas of private leased range with National Forests, market areas for livestock grazing can be defined. A uniform fee could

then be justified for all National Forests within the same market area. Each National Forest has a definite market area for permits. Each National Forest has an associated area of private leased range. Market areas for livestock grazing can be determined by grouping those areas which have a uniform differential between the rancher cost of operating on private leased range and National Forests.

Several market areas can be defined which are statistically significant. A grouping of forests which presently have the same average grazing fee does not, however, produce market areas which are statistically different. It can thus be concluded that factors which were originally used to establish base fees have changed to the extent that original base fees no longer represent conditions as they exist today.

Although several methods were used to group forests into market areas which have reasonably uniform cost differentials, the method of grouping the forests such that they conform reasonably close geographically appears to be the most fruitful for establishing grazing fees. With forests thus grouped we have the advantage of a uniform grazing fee being charged on forests within a given geographic area. This allows for ease of administration and at the same time a uniform fee would be charged on forests which have similar characteristics geographically. The fee can thus be justified from a geographic standpoint as well as being based on a uniform differential between rancher costs of operating on private leased range and National Forests.

Present available data is not conclusive enough to attempt to define market areas for sheep. Perhaps a more exhaustive sample procedure will be required before enough information will be obtained to accurately calculate the cost of grazing sheep on private leased range.

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APPENDIX

Location of permittees for individual National Forests; and area of associated private leased range

FOREST REGION 1

Beaverhead National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Idaho	Fremont Lemhi	Idaho	Fremont Lemhi
Montana	Beaverhead Chouteau Deer Lodge Jefferson Madison Park Silver Bow Yellowstone	Montana	Beaverhead Chouteau Dawson Deer Lodge Jefferson Madison Park Silver Bow Yellowstone

Bitterroot National Forest

Idaho	Gem	Idaho	Gem Valley
Montana	Missoula Ravalli	Montana	Missoula Park Ravalli

Clearwater National Forest

Idaho	Clearwater Idaho Lewis Nez Perce	Idaho	Benewah Clearwater Idaho Kootenai Latah Lewis Nez Perce Shoshone
Montana	Missoula		
Washington	Asotin Grant		
		Montana	Missoula
		Oregon	Wallowa Wasco

Clearwater National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
		Washington	Asotin Ferry Grant

Couderc 'Alene National Forest

Idaho	Kootenai Shoshone	Idaho	Benewah Kootenai Latah Shoshone
Montana	Mineral Sanders	Montana	Mineral Sanders
		Washington	Franklin

Colville National Forest

Washington	Ferry Grant King Okanogan Pend Orille Spokane Stevens Yakima	Washington	Chelan Ferry Grant King Lincoln Okanogan Pend Orille Spokane Stevens Yakima
		Idaho	Kootenai

Custer National Forest

Montana	Big Horn Carbon Carter Custer Dawson Fallon Powder River Richland Rosebud Stillwater Yellowstone	Montana	Big Horn Carbon Carter Custer Dawson Fallon Powder River Richland Rosebud Stillwater Yellowstone
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Custer National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
North Dakota	Adams Billings Bowman Cass Dunn Golden Valley McKenzie Mountrail Ransom Richland Sargent Slope Stark	North Dakota	Adams Billings Bowman Cass Dunn Golden Valley Hettinger McKenzie Mountrail Ransom Richland Sargent Slope Stark
South Dakota	Corson Harding Lawrence Meade Pennington	South Dakota	Butte Corson Day Harding Lawrence Meade Pennington Perkins Shannon Ziebach
Wyoming	Big Horn Sheridan	Wyoming	Big Horn Crook Park Sheridan Washakie

Deer Lodge National Forest

Montana	Broadwater Deer Lodge Fallon Granite Jefferson Madison Missoula Powell Silver Bow	Montana	Broadwater Carter Deer Lodge Fallon Granite Jefferson Madison Missoula Park Powell Silver Bow
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Flathead National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Montana	Flathead Lake Lincoln Missoula Sanders	Montana	Flathead Lake Lincoln Missoula Park Sanders

Gallatin National Forest

Idaho	Bonneville Jefferson Madison	Idaho	Bingham Bonneville Clark Fremont Jefferson Madison Teton
Montana	Beaverhead Daniels Fergus Gallatin Jefferson Lewis & Clark Madison Park Stillwater Sweet Grass	Montana	Beaverhead Daniels Dawson Fergus Gallatin Jefferson Judith Basin Lewis & Clark Madison Park Stillwater

Helens National Forest

Montana	Broadwater Cascade Custer Deer Lodge Gallatin Jefferson Lewis & Clark Meagher Powell	Montana	Broadwater Cascade Custer Deer Lodge Gallatin Jefferson Lewis & Clark Meagher Powell
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Kaniksu National Forest

Idaho	Bonner Boundary Kootenai Latah	Idaho	Benewah Bonner Boundary Kootenai Latah
Montana	Sanders		Shoshone

Kaniksu National ForestPublic Range

<u>State:</u>	<u>Counties:</u>
Washington	Grant Pend Orille

Private Leased Range

<u>State:</u>	<u>Counties:</u>
Montana	Sanders
Washington	Ferry Franklin Grant Pend Orille

Kootenai National Forest

Montana	Flathead Lincoln Sanders
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Montana	Flathead Lincoln Sanders
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Lewis & Clark National Forest

Montana	Broadwater Cascade Chouteau Fergus Glacier Golden Valley Judith Basin Lewis & Clark Liberty Meagher Musselshell Pondera Sweet Grass Teton Wheatland Yellowstone
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Montana	Broadwater Cascade Chouteau Fergus Glacier Golden Valley Judith Basin Lewis & Clark Liberty Meagher Musselshell Pondera Sweet Grass Teton Wheatland Yellowstone
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Lolo National Forest

Montana	Flathead Granite Lake Mineral Missoula Powell Sanders
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Montana	Flathead Granite Lake Mineral Missoula Park Powell Sanders
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Nez Perce National ForestPublic Range

<u>State:</u>	<u>Counties:</u>
Idaho	Adams Idaho Lewis Valley

Private Leased Range

<u>State:</u>	<u>Counties:</u>
Idaho	Adams Bear Lake Clearwater Idaho Lewis Nez Perce Valley

St. Joe National Forest

Idaho	Benewah Clearwater Latah Shoshone
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Idaho	Benewah Clearwater Latah Shoshone
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FOREST REGION 2

Arapaho National Forest

Colorado	Clear Creek Denver Douglas Eagle Gilpin Grand Jackson Jefferson Logan Mesa Rio Blanco Saguache Summit
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Colorado	Dolores Douglas Eagle Elbert Garfield Gilpin Grand Gunnison Jackson Jefferson Larimer Logan Mesa Moffat Park Rio Blanco Rio Grande Routt Saguache Summit
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Wyoming	Carbon
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Wyoming	Carbon Fremont
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Utah	Grand
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Big Horn National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Montana	Big Horn	Montana	Big Horn
Nebraska	Douglas	Wyoming	Big Horn
Wyoming	Big Horn		Campbell
	Johnson		Converse
	Natrona		Johnson
	Sheridan		Natrona
	Washakie		Park
			Sheridan
			Washakie

Black Hills National Forest

Colorado	Kiowa	Colorado	Kiowa
Nebraska	Dawes	Kansas	Sherman
	Sheridan	Montana	Carter
	Sioux		Silver
South Dakota	Butte	Nebraska	Dawes
	Custer		Sheridan
	Edmunds	South Dakota	Butte
	Fall River		Corson
	Haakon		Custer
	Hughes		Edmunds
	Jackson		Fall River
	Jones		Haakon
	Lawrence		Jackson
	Lyman		Jones
	Meade		Lawrence
	Miner		Lyman
	Pennington		Meade
	Stanley		Pennington
	Walworth		Shannon
	Washabaugh		Stanley
	Yankton		Washabaugh
Wyoming	Crook	Wyoming	Ziebach
	Natrona		Campbell
	Weston		Converse
			Crook
			Goshen
			Natrona
			Niobrara
			Weston

Grand Mesa National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Colorado	Alamosa Boulder Delta Denver El Paso Gunnison Kiowa Mesa Montrose Ouray San Miguel	Colorado	Alamosa Boulder Delta Eagle El Paso Fremont Garfield Gunnison Jackson Kiowa Larimer Mesa Moffat Montezuma Montrose Ouray Park Pitkin San Miguel Teller
Kansas	Sedgwick		
Utah	San Juan		
		Kansas	Sherman Neosho
		Utah	Grand San Juan

Gunnison National Forest

Colorado	Chaffee Delta Denver Eagle Garfield Gunnison Jefferson Mesa Montrose Pueblo Rio Grande Saguache	Colorado	Chaffee Custer Delta Eagle Fremont Garfield Gilpin Gunnison Jackson Jefferson Larimer Mesa Moffat Montrose Ouray Park Pitkin
Kansas	Sumner		
Texas	Midland Tarrant		

Gunnison National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Utah	Carbon	Colorado	Pueblo Rio Grande Routt Saguache
		Texas	Tarrant
		Utah	Carbon Duchesne Grand

Medicine Bow National Forest

Colorado	Jackson Moffat	Colorado	Jackson Moffat Weld
South Dakota	Fall River Pennington	Montana	Big Horn Silver Bow
Utah	Davis	Nebraska	Kimball Sioux
Wyoming	Albany Campbell Carbon Converse Crook Laramie Natrona Platte Sheridan Uinta Weston	South Dakota	Custer Fall River Lawrence Pennington Shannon
		Utah	Box Elder Davis Salt Lake Summit Tooele
		Wyoming	Albany Campbell Carbon Converse Crook Fremont Laramie Natrona Niobrara Platte Sheridan Uinta Weston

Nebraska National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Nebraska	Blaine Cherry Dases Sioux Thomas	Nebraska	Blaine Brown Cherry Custer Dawes Kearney
South Dakota	Brule Fall River		Keya Paha Sioux Thomas
		South Dakota	Custer Fall River Todd
		Wyoming	Niobrara Goshen

Pike National Forest

Colorado	Boulder Chaffee Denver Douglas El Paso Fremont Jefferson Lincoln Mesa Park Prowers Teller	Colorado	Baca Boulder Chaffee Douglas Eagle Elbert El Paso Fremont Garfield Gilpin Gunnison Jackson Jefferson Larimer Lincoln Mesa Moffat Park Prowers Teller
Texas	Harris	Utah	Grand

Rio Grande National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Colorado	Alamosa Arapaho Chaffee Conejos Costilla Custer Denver Mineral Montrose Pueblo Rio Grande Saguache	Colorado	Adams Alamosa Arapaho Chaffee Conejos Costilla Custer Eagle Gunnison Jackson Larimer Mineral Montrose Park Pueblo Rio Grande Saguache
Oklahoma	Garfield		
Texas	Castro Comal Hutchinson	New Mexico	Rio Arriba
		Texas	Castro

Roosevelt National Forest

Colorado	Boulder Denver Jackson Jefferson Larimer Logan Phillips Weld	Colorado	Boulder Dolores Eagle Gilpin Grand Jackson Jefferson Larimer Logan Park Phillips Weld
Nebraska	Kimball Cheyenne		
Wyoming	Albany Crook Platte	Nebraska	Cheyenne Kimball Morrill Sioux
		Wyoming	Albany Carbon Converse Crook Platte

Routt National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Colorado	Eagle Grand Jackson Mesa Moffat Routt	Colorado	Eagle Garfield Grand Gunnison Jackson Mesa Moffat Rio Blanco Routt Weld
Utah	Uintah	Utah	Duchesne Grand Uintah
Wyoming	Carbon	Wyoming	Carbon Fremont

San Isabel National Forest

Colorado	Baca Bent Chaffee Custer Eagle El Paso Fremont Garfield Huerfano Lake Las Animas Mesa Montrose Otero Prowers Pueblo	Colorado	Baca Bent Chaffee Custer Eagle El Paso Fremont Garfield Gunnison Huerfano Lake Las Animas Mesa Moffat Montrose Otero Park Prowers Pueblo Routt Teller
Kansas	Morten Stanton	Kansas	Morten
Oklahoma	Cimarron Cleveland	New Mexico	Lincoln Union
Texas	Dawson Gray Hood		

San Isabel National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
		Oklahoma	Cimarron
		Texas	Dallas Gaines Gray
		Utah	Grand

San Juan National Forest

Colorado	Alamosa Archuleta Conejos Dolores Garfield Jackson La Plata Larimer Montezuma Montrose Rio Blanco Routt San Miguel	Colorado	Alamosa Archuleta Cheyenne Conejos Costilla Dolores Eagle Elbert Garfield Gunnison Hinsdale Jackson La Plata Larimer Mesa Moffat Montezuma Montrose Ouray Rio Blanco Routt San Miguel
New Mexico	Bernalillo Rio Arriba San Juan Valencia		
Utah	San Juan		
		New Mexico	Bernalillo Catron Grant Quay Rio Arriba Sandoval San Juan Valencia
		Utah	San Juan

Shoshone National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Montana	Carbon	Montana	Big Horn Carbon
Nebraska	Lancaster		
Wyoming	Big Horn Fremont Hot Springs Park Sweetwater Washakie	Wyoming	Big Horn Fremont Hot Springs Lincoln Natrona Park Sweetwater Washakie

White River National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
Colorado	Delta Denver Eagle Garfield Gilpin Grand Mesa Moffat Pitkin Rio Blanco Routt	Colorado	Delta Eagle Garfield Gilpin Grand Gunnison Jackson Larimer Logan Mesa Moffat Ouray Park Pitkin Rio Blanco Routt Weld
Oklahoma	Jackson		
Utah	Uintah		
		Utah	Duchesne Grand Uintah

FOREST REGION 3

Apache National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
Arizona	Apache Graham Greenlee Maricopa Navajo Pinal Yuma	Arizona	Apache Coconino Graham Greenlee Maricopa Navajo Pima Santa Cruz

Apache National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
New Mexico	Bernalillo Catron	Arizona	Yuma
		New Mexico	Bernalillo Catron Sandoval

Carson National Forest

Arizona	Apache Cochise Pima	Arizona	Apache Cochise Pima Santa Cruz
Colorado	Alamosa Archuleta Conejos Pueblo	Colorado	Alamosa Archuleta Cheyenne Conejos Costilla Custer Elbert Pueblo
New Mexico	Bernalillo Catron Colfax Los Alamos Mora Rio Arriba San Juan San Miguel Santa Fe Taos Torrance Valencia	New Mexico	Bernalillo Catron Colfax Grant Mora Rio Arriba Sandoval San Juan San Miguel Santa Fe Taos Torrance Valencia

Cibola National Forest

New Mexico	Bernalillo Catron Grant Lincoln McKinley Rio Arriba Sandoval	Arizona	Greenlee
		Colorado	Huerfano
		New Mexico	Bernalillo Catron Grant

Cibola National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
New Mexico	Sierra Socorro Taos Torrance Valencia	New Mexico	Hidalgo Lincoln McKinley Rio Arriba Sandoval Socorro Taos Torrance Valencia
Texas	Brewster Dallas El Paso	Texas	Sherman Dallas

Coconino National Forest

Arizona	Coconino Gila Pinal Yavapai	Arizona	Coconino Gila Maricopa Yavapai
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Coronado National Forest

Arizona	Cochise Coconino Graham Maricopa Navajo Pima Pinal Santa Cruz	Arizona	Cochise Coconino Graham Greenlee Maricopa Navajo Pima Santa Cruz
New Mexico	Grant Hidalgo	New Mexico	Hidalgo Sandoval

Gila National Forest

Arizona	Apache Graham Greenlee Maricopa Pima	Arizona	Apache Coconino Graham Greenlee Maricopa Pima Santa Cruz
California	Los Angeles San Diego		

Gila National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
New Mexico	Catron Chaves Dona Ana Grant Hidalgo Luna Otero Sierra Socorro	California Colorado New Mexico	Kern Los Angeles San Diego Ventura Moffat Huerfano Catron Chaves De Baca Dona Ana Grant Hidalgo Luna Mora Otero Sandoval Socorro Valencia

Kaibab National Forest

Arizona	Coconino Maricopa Navajo Pima Pinal Yavapai Yuma	Arizona	Coconino Maricopa Navajo Pima Santa Cruz Yavapai Yuma
Utah	Iron Kane Washington	Nevada Utah	Clark Emery Iron Kane Washington

Lincoln National Forest

New Mexico	Bernalillo Chaves Dona Ana Eddy Lincoln Otero	Arizona Colorado New Mexico	Greenlee Huerfano Moffat Bernalillo
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Lincoln National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Texas	Dawson El Paso Erath Lynn Midland	New Mexico	Catron Chaves De Baca Dona Ana Eddy Lincoln Luna Otero Sandoval Valencia
		Texas	Gaines

Prescott National Forest

Arizona	Maricopa Yavapai Yuma	Arizona	Coconino Maricopa Yavapai Yuma
California	Imperial Los Angeles	California	Imperial Kern Mono Los Angeles Ventura

Santa Fe National Forest

New Mexico	Bernalillo Mora Rio Arriba Sandoval San Miguel Santa Fe	New Mexico	Bernalillo Catron Grant Mora Rio Arriba Sandoval San Miguel Santa Fe
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Sitgreaves National Forest

Arizona	Apache Coconino Navajo	Arizona	Apache Coconino Maricop Navajo
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Tonto National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Arizona	Gila Maricopa Pinal Yavapai	Airzona	Coconino Gila Maricopa Yavapai
FOREST REGION 4			

Ashley National Forest

Utah	Carbon Daggett Duchesne Salt Lake Uintah Weber	Colorado	Rio Blanco
		Nevada	White River
		Utah	Box Elder Carbon Daggett Duchesne Garfield Morgan Salt Lake Sevier Summit Utah Uintah Weber
Wyoming	Fremont Sweetwater Uinta	Wyoming	Fremont Lincoln Natrona Sublette Uinta

Boise National Forest

Idaho	Ada Blaine Boise Canyon Elmore Gem Gooding Owyhee Payette Valley Washington	Idaho	Ada Adams Blaine Boise Camas Canyon Elmore Gem Gooding Lincoln Minidoka Owyhee
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Boise National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Oregon	Grant	Idaho	Payette Twin Falls Valley Washington
		Nevada	Elko
		Oregon	Baker Grant Malheur

Bridger National Forest

Utah	Cache Davis	Idaho	Bear Lake Franklin Oneida
Wyoming	Laramie Lincoln Sublette Sweetwater	Nebraska	Kimball
		Utah	Box Elder Cache Davis Salt Lake Tooele
		Wyoming	Carbon Laramie Lincoln Platte Sublette Sweetwater

Cache National Forest

Idaho	Bannock Bear Lake Caribou Cassia Franklin Lemhi Oneida	California	Monterey
		Idaho	Bannock Bear Lake Bingham Caribou Cassia Franklin Lemhi Oneida
Nevada	Humboldt		Twin Falls
Utah	Box Elder Cache		

Cache National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Utah	Davis Rich Salt Lake Summit Utah Weber	Nevada	White Pine
Wyoming	Lincoln	Utah	Box Elder Cache Carbon Davis Duchesne Garfield Morgan Rich Salt Lake Sevier Summit Tooele Utah
		Wyoming	Lincoln Sublette

Caribou National Forest

Idaho	Ada Bannock Bear Lake Bonneville Butte Caribou Franklin Jefferson Minidoka Oneida Power	Idaho	Ada Bannock Bear Lake Bingham Blaine Bonneville Butte Canyon Caribou Cassia Elmore Franklin Fremont Jefferson Minidoka Oneida Owyhee Power Teton Valley Washington
Montana	Ravalli		
Oregon	Hood River Multnomah		
Utah	Box Elder Cache Davis Weber		
Wyoming	Lincoln	Montana	Gallatin Ravalli

Caribou National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
		Oregon	Harney Multnomah
		Utah	Morgan Salt Lake Sevier Tooele
		Wyoming	Lincoln Sublette

Challis National Forest

Idaho	Ada Bannock Bingham Blaine Bonneville Butte Canyon Custer Elmore Gooding Jefferson Jerome Lemhi Lincoln Nez Perce	Idaho	Ada Bannock Bear Lake Bingham Blaine Bonneville Butte Camas Canyon Clearwater Custer Elmore Franklin Fremont Gooding Jefferson Jerome Latah Lemhi Minidoka Nez Perce Oneida Owyhee Teton Twin Falls Valley Washington
Utah	Cache		
Wyoming	Sublette	Montana	Gallatin
		Nevada	Elko
		Utah	Cache

Challis National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
		Wyoming	Carbon Lincoln Sublette Sweetwater

Dixie National Forest

Utah	Cache Garfield Iron Kane Millard Piute Salt Lake Sevier Utah Washington Wayne	Arizona	Coconino Maricopa
		Idaho	Bear Lake Franklin Oneida
		Nevada	White Pine
		Utah	Cache Carbon Duchesne Emery Garfield Iron Juab Kane Millard Piute Salt Lake Sanpete Sevier Summit Utah Washington Wayne
		Wyoming	Lincoln

Fishlake National Forest

Colorado	Montrose	Colorado	Gunnison Montezuma Montrose Rio Blanco San Miguel
Nevada	Nye		
Utah	Beaver Carbon Davis Emery Garfield	Nevada	Nye White Pine

Fishlake National ForestPublic Range

<u>State:</u>	<u>Counties:</u>
Utah	Juab Millard Piute Salt Lake San Juan Sanpete Sevier Tooele Uintah Utah Wayne

Private Leased Range

<u>State:</u>	<u>Counties:</u>
Utah	Beaver Box Elder Carbon Davis Duchesne Emery Garfield Juab Kane Millard Piute Utah San Juan Sanpete Sevier Summit Tooele Uintah Wayne
Wyoming	Lincoln

Humboldt National Forest

Arizona	Maricopa
California	Kern Los Angeles Sacramento Sutter
Idaho	Gooding Owyhee Twin Falls
Nevada	Churchill Clark Elko Humboldt Lander Lincoln Nye Pershing Washoe White Pine

Airzona	Coconino Maricopa
California	El Dorado Kern Los Angeles Modoc Mono Monterey Sacramento San Bernardino Sutter Trinity Ventura Yolo
Idaho	Blaine Boise Bonneville Camas Gooding Lincoln

Humboldt National ForestPublic Range

<u>State:</u>	<u>Counties:</u>
Oregon	Multnomah

Private Leased Range

<u>State:</u>	<u>Counties:</u>
Idaho	Owyhee Twin Falls
Nevada	Churchill Clark Elko Eureka Humboldt Lander Lincoln Nye Pershing Washoe White Pine
Oregon	Harney Multnomah
Utah	Juab Millard Sevier

Manti-Lasal National Forest

Colorado	Mesa Montezuma Montrose
Utah	Carbon Emery Grand Iron Salt Lake San Juan Sanpete Summit Utah

Colorado	Dolores Garfield Gunnison La Plata Mesa Moffat Montezuma Montrose Ouray San Miguel
Nevada	White Pine
Utah	Carbon Duchesne Emery Garfield Grand Iron Morgan Salt Lake

Manti-Lasal National ForestPublic RangeState: Counties:Private Leased RangeState: Counties:

Utah	San Juan Sanpete Summit Utah
Wyoming	Lincoln

Payette National Forest

Idaho	Ada Adams Fremont Idaho Washington
Oregon	Malheur
Washington	Franklin

Idaho	Ada Adams Bear Lake Bingham Canyon Caribou Elmore Fremont Idaho Minidoka Owyhee Valley Washington
Oregon	Malheur Wallowa
Washington	Franklin

Salmon National Forest

Idaho	Ada Butte Custer Idaho Lemhi Madison Oneida Twin Falls
Montana	Beaverhead

Idaho	Ada Blaine Bonneville Butte Canyon Clark Custer Elmore Idaho Jefferson Lemhi Madison Minidoka Oneida Owyhee Twin Falls
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Salmon National ForestPublic RangeState: Counties:Private Leased RangeState: Counties:

Idaho	Valley Washington
Montana	Beaverhead Madison
Nevada	Elko
Utah	Box Elder

Sawtooth National Forest

Idaho	Ada Adams Bannock Bear Lake Blaine Camas Cassia Custer Elmore Gooding Jerome Lincoln Minidoka Power Twin Falls
Nevada	Churchill
Utah	Box Elder

California	Modoc
Idaho	Ada Adams Bannock Bear Lake Bingham Blaine Bonneville Camas Canyon Caribou Cassia Custer Elmore Franklin Gooding Jerome Minidoka Oneida Owyhee Power Twin Falls Valley Washington

Targhee National Forest

Idaho	Bannock Bingham Blaine Boise Bonneville
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Idaho	Bannock Bingham Blaine Boise Bonneville
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Targhee National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Idaho	Butte Clark Fremont Jefferson Lemhi Madison Teton	Idaho	Butte Clark Fremont Jefferson Lemhi Madison Teton
Montana	Beaverhead	Montana	Beaverhead Gallatin Madison
Utah	Salt Lake	Nevada	White Pine
		Utah	Duchesne Garfield Salt Lake Summit Utah
		Wyoming	Lincoln

Teton National Forest

Nebraska	Jefferson	Idaho	Fremont
Wyoming	Fremont Lincoln Sublette Sweetwater Teton	Wyoming	Carbon Fremont Lincoln Natrona Sublette Sweetwater Teton

Toiyabe National Forest

Arizona	Navajo	Arizona	Navajo
California	Alpine Amador El Dorado Inyo Los Angeles Mono Placer Yuba	California	Alpine Amador El Dorado Inyo Kern Los Angeles Modoc Mono Nevada

Toiyabe National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Nevada	Churchill Clark Douglas Eureka Lander Lyon Nye Ormsby Washoe	California	Placer Sacramento Ventura
		Nevada	Churchill Clark Douglas Eureka Lander Lyon Nye Ormsby Washoe

Uinta National Forest

Utah	Box Elder Carbon Duchesne Juab Morgan Salt Lake Sanpete Summit Tooele Utah Wasatch	Idaho	Caribou Cassia Franklin Oneida
		Utah	Box Elder Carbon Duchesne Emery Garfield Juab Morgan Salt Lake Sanpete Summit Tooele Utah Wasatch Weber
		Nevada	White Pine
		Wyoming	Lincoln

Wasatch National Forest

Utah	Daggett Davis Juab Millard Morgan	Idaho	Caribou Cassia Franklin Oneida
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Wasatch National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Utah	Salt Lake Sevier Summit Tooele Uintah Utah	Utah	Box Elder Carbon Duchesne Emery Garfield Juab Morgan Salt Lake Sanpete Summit Tooele Utah Wasatch Weber
Wyoming	Sweetwater Uinta	Nevada	White Pine
		Wyoming	Lincoln

FOREST REGION 5

Angeles National Forest

California	Los Angeles	California	Kern Los Angeles Mono Ventura
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Cleveland National Forest

California	Imperial Los Angeles Orange San Diego	California	Imperial Inyo Kern Los Angeles Mono Orange San Bernardino San Diego
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Eldorado National Forest

California	Amador Calaveras Colusa El Dorado	California	Alpine Amador Calaveras Colusa
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Eldorado National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
California	Placer Sacramento San Joaquin Yolo	California	El Dorado Lassen Mono Nevada Placer Sacramento San Joaquin Stanislaus Yolo
Nevada	Douglas	Nevada	Douglas

Inyo National Forest

California	Inyo Kern Los Angeles Marin Mono Orange San Bernardino San Diego Ventura	Arizona	Mohave
Nevada	Esmeralda Lyon Nye	California	Alpine Inyo Kern Kings Los Angeles Marin Mono Orange Riverside San Bernardino San Diego Sonoma Ventura
		Nevada	Lyon Hye

Klamath National Forest

California	Los Angeles Santa Clara Siskiyou Yolo	California	Kern Los Angeles Modoc Mono Santa Clara Siskiyou Ventura Yolo
Oregon	Josephine	Oregon	Josephine Wallowa

Lassen National ForestPublic Range

<u>State:</u>	<u>Counties:</u>
California	Butte Colusa Lassen Modoc Plumas Shasta

Private Leased Range

<u>State:</u>	<u>Counties:</u>
California	Butte Colusa Glenn Lassen Modoc Plumas Shasta Siskiyou Tehama
Nevada	Pershing

Los Padres National Forest

California	Alameda Kern Los Angeles Monterey San Francisco San Luis Obispo Santa Barbara Ventura
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California	Alameda Kern Kings Los Angeles Mono Monterey San Benito San Bernardino San Luis Obispo Santa Barbara Santa Clara Ventura
Nevada	Lander

Mendocino National Forest

California	Colusa El Dorado Glenn Lake Marin Mendocino San Francisco Tehama
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California	Butte Colusa El Dorado Glenn Lake Marin Sacramento San Luis Obispo Shasta Sonoma Tehama
Nevada	Lander

Modoc National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
California	Kern Lassen Los Angeles Madera Modoc Napa Santa Clara Siskiyou Tehama Yolo	California	Butte Glenn Kern Lassen Los Angeles Madera Mariposa Modoc Mono Monterey Napa Plumas San Bernardino Santa Clara Shasta Siskiyou Tehama Ventura Yolo
Nevada	Humboldt	Nevada	Elko Humboldt Pershing
Oregon	Douglas Klamath Lake Tillamook	Oregon	Douglas Klamath Lake Tillamook Wallowa

Six Rivers National Forest

California	Humboldt Mendocino Trinity	California	Humboldt Mendocino Shasta Trinity
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Plumas National Forest

California	Butte Colusa Lassen Placer Plumas Sacramento San Francisco	California	Butte Colusa El Dorado Glenn Lassen Modoc Nevada
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Plumas National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
California	Santa Clara Sierra Sutter Tehama Yuba	California	Placer Plumas Sacramento San Luis Obispo Santa Clara Shasta Sierra Sutter Tehama Trinity Yolo Yuba
Nevada	Ormsby Washoe	Nevada	Lander Ormsby Washoe

San Bernardino National Forest

California	Los Angeles Riverside San Bernardino	Arizona	Mohave
		California	Alpine Kern Los Angeles Mono Riverside San Bernardino San Diego Ventura

Sequoia National Forest

California	Fresno Kern Los Angeles San Bernardino San Luis Obispo Tulare	Arizona	Mohave
		California	Alpine Fresno Kern Lassen Los Angeles Madera Mono Riverside San Bernardino San Diego San Luis Obispo Tulare Ventura

Shasta-Trinity National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
California	Glenn Siskiyou Shasta Tehama Trinity	California	Butte Glenn Lassen Mendocino Modoc Shasta Siskiyou Tehama Trinity

Sierra National Forest

California	Fresno Madera Mariposa	California	Butte Fresno Madera Mariposa Merced San Joaquin
		Oregon	Klamath

Stanislaus National Forest

California	Calaveras Mariposa Merced San Joaquin Stanislaus Tuolumne	California	Alpine Butte Calaveras Fresno Mariposa Merced Modoc Mono Sacramento San Joaquin Stanislaus Tuolumne
Nevada	Douglas	Nevada	Douglas

Tahoe National Forest

California	El Dorado Nevada Placer Sacramento Sierra Sutter Yuba	California	Butte El Dorado Nevada Placer Sacramento Sierra Sutter
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Tahoe National ForestPublic RangeState: Counties:

FOREST REGION 6

Private Leased RangeState: Counties:California Trinity
 Yolo
 YubaDeschutes National Forest

California San Joaquin

Oregon Crook
 Deschutes
 Lake
 Lane
 Linn
 Multnomah
 Tillamook
 Wasco
 Wheeler

California San Joaquin

Oregon Crook
 Deschutes
 Gilliam
 Harney
 Jefferson
 Lake
 Lane
 Linn
 Multnomah
 Sherman
 Tillamook
 Umatilla
 Wallowa
 Wasco
 WheelerFremont National ForestCalifornia Modoc
 Shasta
 Siskiyou
 TehamaOregon Klamath
 LakeCalifornia Butte
 Glenn
 Lassen
 Modoc
 Shasta
 Siskiyou
 Tehama

Nevada Pershing

Oregon Klamath
 LakeGifford Pinchot National Forest

Oregon Wheeler

Oregon Crook
 Gilliam

Gifford Pinchot National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Washington	Clark Klickitat Lewis Yakima	Oregon	Umatilla Wallowa Wheeler
		Washington	Clark Klickitat Lewis Yakima

Malheur National Forest

Idaho	Ada	Idaho	Ada Canyon
Oregon	Deschutes Grant Harney Jefferson Malheur Morrow Multnomah Wheeler	Oregon	Elmore Minidoka Owyhee Valley Washington Baker Crook Deschutes Gilliam Grant Harney Jefferson Malheur Morrow Multnomah Umatilla Wallowa Wheeler

Mt. Baker National Forest

Washington	Skagit	Washington	Skagit
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Mt. Hood National Forest

Oregon	Wasco	Oregon	Jefferson Sherman Wasco
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Ochoco National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
California	Alameda San Francisco	California	Alameda Monterey San Luis Obispo Santa Clara
Idaho	Bonner	Idaho	Bonner
Oregon	Crook Deschutes Grant Harney Jefferson Multnomah Wasco Wheeler	Nevada	Lander
		Oregon	Baker Crook Deschutes Gilliam Grant Harney Jefferson Multnomah Sherman Umatilla Wallowa Wasco Wheeler

Okanogan National Forest

Washington	Adams Asotin Benton Chelan Grant King Okanogan	Idaho	Benewah Clearwater Kootenai Latsh Shoshone
		Oregon	Wallowa Wasco
		Washington	Asotin Benton Chelan Ferry Grant King Okanogan

Olympic National Forest

Washington	Okanogan	Washington	Grant Okanogan
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Rogue River National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Oregon	Douglas Jackson Josephine Klamath	Oregon	Douglas Jackson Josephine Klamath

Siskiyou National Forest

Oregon	Coos Curry Josephine	Oregon	Coos Curry Josephine Lake
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Siuslaw National Forest

Oregon	Benton Lane Lincoln Tillamook	Oregon	Benton Lake Lane Lincoln Tillamook
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Snoqualmie National Forest

Washington	Lewis Yakima	Washington	Lewis Yakima
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Umatilla National Forest

Oregon	Baker Benton Curry Gilliam Grant Lane Morrow Umatilla Wallowa Wheeler	Idaho	Benewah Clearwater Latsh Shoshone
Washington	Asotin Columbia Garfield Spokane Walla Walla	Oregon	Baker Benton Crook Curry Gilliam Grant Lake Lane Lincoln Malheur Morrow Umatilla Wallowa Wasco

Umatilla National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
		Washington	Asotin Columbia Garfield Pend Orille Spokane Walla Walla Whitman

Umpqua National Forest

Oregon	Douglas Jackson	Oregon	Douglas Jackson
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Wallowa-Whitman National Forest

California	Santa Clara	Claifornia	Santa Clara
Idaho	Adams Nez Perce	Idaho	Adams Bear Lake Benewah Clearwater Latah Nez Perce Owyhee Shoshone
Oregon	Baker Crook Grant Malheur Multnomah Umatilla Union Wallowa	Oregon	Baker Crook Deschutes Grant Harney Malheur Multnomah Umatilla Union Wallowa Wasco
Washington	Asotin	Washington	Asotin

Wenatchee National Forest

Washington	Asotin Chelan Grant King	Idaho	Benewah Clearwater Kootensi Latah
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Wenatchee National Forest

<u>Public Range</u>		<u>Private Leased Range</u>	
<u>State:</u>	<u>Counties:</u>	<u>State:</u>	<u>Counties:</u>
Washington	Kittitas Okanogan Yakima	Idaho	Shoshone
		Oregon	Wallowa Wasco
		Washington	Asotin Chelan Ferry Grant King Klickitat Kittitas Okanogan Yakima

Willamette National Forest

Oregon	Clatsop Lane Linn	Oregon	Clatsop Lane Linn
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Winema National Forest

California	Siskiyou Tehama	California	Butte Glenn Modoc Shasta Siskiyou Tehama
Oregon	Jackson Klamath Lake	Oregon	Jackson Klamath Lake

VITA

Robert Gus Williams

Candidate for the Degree of

Master of Science

Thesis: Determining Market Areas for Livestock Grazing

Major Field: Agriculture Economics

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Education: Attended Teasdale elementary school in Teasdale, Utah; graduated from Wayne High School in 1958; received the Bachelor of Science degree from Utah State University, with a major in Agriculture Economics in 1962; completed requirements for the Master of Science degree in Agriculture Economics at Utah State University in 1969.

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