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Costs Incurred by Permittees in Grazing Livestock on Public Lands in Various Western States

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COSTS INCURRED BY PERMITTEES IN GRAZING LIVESTOCK ON PUBLIC LANDS IN VARIOUS WESTERN STATES

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Procedures followed and findings obtained through surveys of public land dependent ranchers in Oregon, Idaho, Nevada, Wyoming, North Dakota, South Dakota, and the Black Hills National Forest are presented in this publication which was developed as part of a special needs project financed by SEA-Extension, USDA, entitled *Improving Public Participation in Federal Range Management Programs*. This project was an outgrowth of needs identified in an earlier project, *Federal Land-Use Policy: Improving Citizen Participation*. Project leaders are Frederick W. Obermiller, Extension regional resource economist, and Thomas E. Bedell, Extension rangeland resource specialist, Oregon State University.

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by

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The purposes of this report are to describe the procedures followed and to present the findings obtained through forage utilization cost surveys of public land dependent ranchers in Oregon, Idaho, Nevada, Wyoming, North Dakota, South Dakota, and the Black Hills National Forest. The organization of the report is as follows. First, the reasons why the cost surveys were conducted are explained. Second, the sampling procedures used in conducting those surveys in each state and area are described. Third, the results obtained in each survey area are presented. Fourth, those results are analyzed to detect factors exerting a significant influence on forage utilization costs within each survey area. Fifth, conclusions and implications for the pricing of federal forage are drawn in the expectation that those observations are relevant to the resolution of the federal grazing fee controversy.

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* The authors are Professor and Extension Resource Economist, and Extension Public Lands Policy Assistant, respectively, in the Department of Agricultural and Resource Economics, Oregon State University. Seniority of authorship is shared by Lambert and Obermiller. Financial support for the work reported here was provided, in part, by the Office of the Administrator, Extension Service, United States Department of Agriculture through a special needs project entitled "Federal Rangeland Management: Improving Citizen Understanding." Other sources of financial support included cattlemen's associations and Extension Services in cooperating states; grazing associations and districts in North and South Dakota; the Governor's Office in the State of Wyoming; and the National Public Lands Council. The authors wish to acknowledge the assistance of all who participated in the various studies, both study team members and permittees, as well as the helpful cooperation of the Bureau of Land Management and the Forest Service. The results of their efforts, having been supported by tax dollars, therefore are public information and may be freely quoted and/or reprinted with customary crediting of the source.

In all of the surveys, a basic format for the interview questionnaire was adopted. Common elements included nine cost activities and procedures for estimating the values of nonmonetary cost components. These common cost activities and estimation procedures are defined and described in the appendix to the report.

Rationale for Evaluating Permittees' Costs

One of the more controversial recurring issues in the management of the federally-owned lands in the western United States has been the appropriate user fee to levy on livestock operators who graze their stock on public lands. This user fee, or federal grazing fee, has at various times been statutorally established or set by administrative prerogative. At present, the grazing fee is quite specifically established in a law passed by the 95th Congress on October 25, 1978: The Public Rangelands Improvement Act [43 USC 1901-1908]. The Public Rangelands Improvement Act (PRIA) establishes by statute a uniform federal grazing fee formula to be used by both the Forest Service and the Bureau of Land Management; however, the Act also contains a sunset clause.

> "No later than December 31, 1985, the Secretaries [of Agriculture and the Interior] shall report to the Congress the results of ... their evaluation of the fee established in Section 6 of this Act and other grazing fee options, and their recommendations to implement a grazing fee schedule for the 1986 and subsequent grazing years" [Section 12(b)].

The formula grazing fee established in Section 6 of the PRIA contains four basic components: (1) a "base fee" equalling $1.23, generally interpreted as the amount the government would

have had to collect (per animal unit month or AUM) for the costs of utilizing forage on public and on privately leased lands to have been identical in the year 1966; (2) a "forage value index" (FVI) the average current private grazing land lease rate in the 11 western states divided by the 1966 average private grazing land lease rate times 100; (3) a "beef prices index" (BPI) representing a weighted average selling price for beef cattle in the 11 western states, using the average price between 1964 and 1968 as its base; and (4) a "prices paid index" (PPI) constructed from nine major components of livestock production costs, also using 1966 as the base year. The BPI and PPI components are popularly known as "ability to pay" indicators; while both historical and prevailing private land lease rates influence the FVI component as well as the base fee. The PRIA formula is as follows:

$$Fee_{t+1} = \$1.23(FVI_t + BPI_t - PPI_t)/100$$

The Federal Grazing Fee Evaluation

The required evaluation of the PRIA formula and system is being conducted by the Forest Service and Bureau of Land Management. A draft report to Congress containing the results of that evaluation as well as recommendations for a future fee system is expected to be made public late in 1984. In conducting the evaluation, the agencies have used their appraisers to collect a substantial body of information on leasing arrangements and rental rates on privately-owned land. As noted above, that private land lease rate information directly bears on both the $1.23 base fee and the "forage value index."

Pursuant to the PRIA directive to evaluate other grazing fee options, the agencies contracted with Colorado State University for a study and evaluation of fee systems used by other agencies and by state and local governments. The agencies also contracted with the United States Department of Agriculture's Economic Research Service and Statistical Reporting Service for evaluations of the appropriateness of the "beef prices index" and "prices paid index" as presently constructed, and for an analysis of the possible financial and community impacts of changes in the federal grazing fee.

Early in their evaluation the Forest Service and Bureau of Land Management decided not to collect information from permittees on the costs they encounter in utilizing public land forage supplies. While this type of information clearly does influence the base fee (an estimate of the difference in costs of forage utilization on private and public lands) it was thought that indirect evidence on the cost differential could be obtained from the private land appraisal data.[1] The public land dependent livestock industry thought otherwise, however, and in November 1982 the Oregon Cattlemen's Association asked the Oregon State University Extension Service to collect information from permittees on costs of public land forage utilization in the State of Oregon.

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[1] This thought has been expressed in several documents distributed by the Bureau of Land Management and Forest Service to heighten public understanding of the ongoing federal grazing fee evaluation. See, for example, their "Information Paper Number 3: Fair Market Rental Appraisal of the Public Grazing Lands" (no date) and "Grazing Fee Review and Evaluation: Question-and-Answer Sheet," January 6, 1984.

Grazing Cost Surveys Supervised by Extension Service Personnel

The Oregon State University Extension Service responded to the industry request through an existing special needs project funded by the Office of the Administrator, Extension Service, United States Department of Agriculture: "Federal Rangeland Management: Improving Citizen Understanding."[2] The results of the Oregon public land forage utilization cost study initially were published in November 1983 [Lambert and Obermiller, reprinted March 1984].

As the Oregon study proceeded, interest began to be expressed in duplicating the study in southern Idaho and northern Nevada. Parallel surveys of permittees were initiated in those states with the assistance of special needs project personnel using modified versions of the questionnaire developed in Oregon. As the results of these studies became available, interest in similar efforts arose in Wyoming, northern California, and other western and Great Plains states.

In November 1983 the Grazing Fee Task Force of the Public Lands Council passed a resolution encouraging repetition of the "Oregon study" in as many western states as possible. In addition to the resolution, the Public Lands Council allocated a small amount of funds to help defray study costs. Representatives of both the Forest Service and the Bureau of Land Management endorsed the attempt to extend the public land forage

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[2] Project co-leaders for the Extension Service special needs project included Obermiller and Thomas E. Bedell of the Department of Rangeland Resources, Oregon State University. Project staff conducting the field interviews in Oregon included Lambert and Sherman Swanson of the Department of Rangeland Resources.

utilization cost study to as many additional western states as possible.[3]

Using the special needs project as a vehicle, the Oregon State University Extension Service agreed to provide assistance to other states, but only in response to formal requests for assistance. That assistance was to include providing other states with questionnaires consistent in structure and content with the original questionnaire used in the Oregon study; helping in the design of sampling procedures and the organization of local data collection activities; and analyzing the data collected by groups in other states. Responsibility for the actual conduct of interviews and acquisition of forage utilization cost data remained the sole responsibility of cooperating organizations, agencies, and individuals in other states.

By July 1984 the Nevada study had been expanded statewide, interviews had been completed, and results had been analyzed. The Idaho study also had been expanded, although not statewide, and completed. Elsewhere, following passage of the Public Lands Council resolution, forage utilization cost studies had been completed in the National Grasslands of North and South Dakota; in the Black Hills National Forest of western South Dakota and eastern Wyoming; and in all remaining Forest Service, Bureau of

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[3] See letter from Judy Nelson, Bureau of Land Management, to Frederick W. Obermiller, Oregon State University, dated September 8, 1983; letter from Edward R. Frandsen, Forest Service, to Frederick W. Obermiller, Oregon State University, dated August 3, 1983; and letter from Frederick W. Obermiller, Oregon State University to Edward R. Frandsen, Forest Service, dated August 18, 1983.

Land Management, and state-owned lands in Wyoming. A similar study was underway in California, although all necessary interviews had not yet been conducted. A forage utilization cost study was underway in Colorado, parallel in type but conducted independently of the Extension Service special needs project. A somewhat similar but independently conducted forage valuation study was in progress in New Mexico.

Summarized in the following three sections of this report are (1) the sampling procedures utilized in each of the states and areas receiving assistance through the Extension Service special needs project, (2) the empirical results for those states and areas for which data collection had been completed by July 1984, and (3) an analysis of factors exerting a significant influence on forage utilization costs. In the final section of the report, conclusions and implications for the current PRIA formula evaluation are drawn.

Sampling Procedures Used in the Grazing Cost Surveys

Sampling procedures differed among the states and areas in which the forage utilization cost survey was conducted. In Oregon and Idaho, a nonrandomly selected group of ranchers was interviewed. In Wyoming, both random and nonrandom samples of permittees were interviewed. Elsewhere, samples were randomly drawn from the entire population, or subset of that population, of Bureau of Land Management and Forest Service permittees. An area-by-area description of the sampling procedures employed in each state and area follows. The implications of the sampling procedures utilized in these states and areas are noted.

Emphasis is placed on the extent to which conclusions may or may not be drawn from the data.

Oregon

The Oregon forage utilization cost study was a pilot project, constituting the first large scale implementation of the survey process and questionnaire. The objectives of the Oregon study were both procedural and empirical. The procedural objective was to demonstrate the feasibility of obtaining forage utilization cost data through direct surveys of permittees. The second, empirical, objective was to obtain information on the cash and noncash costs experienced by Oregon permittees as a consequence of utilizing a public allotment. Of these two objectives, the first was of greater importance, since some believed that it would be prohibitively expensive and time consuming to collect cash and noncash forage utilization cost data directly from permittees.[4] Given the greater relative importance of the first objective, as well as time and budget constraints, a nonrandomly selected group of Oregon permittees was interviewed.

During the winter and spring of 1983, approximately 100 Eastern Oregon rangeland livestock operators who held either a

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[4] This view has been expressed in several public meetings and documents through which the federal land management agencies have informed the public of the purposes and progress of the federal grazing fee evaluation. See, for example, the memorandum with attachments from the Director, Bureau of Land Management and Chief, Forest Service, to State Directors and Regional Foresters "Current Status of the Grazing Fee Study," dated April 13, 1982.

Forest Service permit or a Bureau of Land Management license were interviewed by members of the special needs project team. The cooperating permittees had been identified on lists compiled by agricultural Extension agents in eight Eastern Oregon counties. Agents had been asked to identify operators who kept good cost records. Relevant sampling information is summarized in Table 1.

The sampling information as well as the results of the Oregon forage utilization cost study were published in November 1983. The nonrandom nature of the survey was stressed in that publication. The results could not and should not be generalized to the entire population of Eastern Oregon permittees; rather, they were representative only of the ranchers actually surveyed. Any hypotheses about the general representativeness of the cash and noncash forage utilization cost relationships could be neither proven nor disproven on the basis of available Oregon data.

Idaho

Idaho was the second state to initiate a forage utilization cost study. Sampling procedures, as well as the survey questionnaire itself, were patterned after those used in Oregon. Agricultural extension agents in the four major public grazing land counties (Washington, Oneida, Custer, and Lemhi) provided names of five to ten permittees in their areas who could be expected to be cooperative and would have accurate cost records on their use of the grazing allotments. Twenty-six ranchers were subsequently interviewed in the spring and summer of 1983 by University of Idaho Extension Service personnel, providing usable

Table 1. Sample Information for the Nonrandom Survey of Oregon Permittees' Forage Utilization Costs.

County or Area	Number of Usable Rancher Inverviews	Number of Allotments by Type of Lease				
		Bureau of Land Management	Forest Service	Fish and Wild-life Service	Private	Total
Malheur	14	14	0	0	0	14
Baker	13	12	7	0	4	23
Grant	10	1	9	0	4	14
Harney	13	23	3	1	3	30
Lake	16	22	13	1	4	40
Northeast Oregon	10	0	12	0	5	17
Eastside Cascades	10	5	6	0	3	14
Crooked River N.G.	11	1	14	0	0	15
TOTAL	**97**	**78**	**64**	**2**	**23**	**167**
Total AUMs		133,495	57,659	3,607	20,318	215,079
Mean Permit Size		1,711	901	1,804	833	1,288
Standard Deviation[a]		NA	NA	NA	NA	NA

[a] When the Oregon survey results were analyzed, the standard deviations of these sample characteristics were not estimated.

information on 49 separate allotments.[5] Following passage of the Public Lands Council resolution in November 1983, another 22 ranchers were identified and interviewed, again nonrandomly, in order to provide a broader geographical representation of Idaho permittees. Sampling information for the Idaho grazing cost study is summarized in Table 2.

The conclusions drawn from the Idaho survey are subject to the same limitations affecting Oregon's study. Generalization of the results to all permittees and private lease holders in Idaho is inappropriate, and statements that the results are representative of all Idaho permittees can be neither proven nor disproven. It is only appropriate to state that the results accurately reflect the situation for the 48 ranchers and the 87 allotments included in the Idaho forage utilization cost survey.

Nevada

Nevada was the third western state to begin a public land forage utilization cost study, initiating the effort while the Oregon and Idaho surveys were still underway. As in Idaho, special needs project team members from Oregon provided assistance in development of the survey questionnaire. Unlike the sampling procedure followed in both Oregon and Idaho, however, a random sampling design was employed in Nevada by faculty members associated with the Department of Agricultural

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[5] Leadership for the Idaho forage utilization cost survey was provided by Neil R. Rimbey of the Southwest Idaho Research and Extension Center, University of Idaho.

Table 2. Sample Information for the Nonrandom Survey of Idaho Permittees' Forage Utilization Costs.

County	Number of Usable Rancher Interviews	Number of Allotments by Type of Lease				
		Bureau of Land Management	Forest Service	Mixed BLM/FS	Private	Total
Washington	9	8	5	0	5	18
Oneida	11	10	9	0	3	22
Lemhi	14	11	8	3	3	25
Custer	10	8	13	1	0	22
TOTAL	44[a]	**37**	**35**	4	11	**87**
Total AUMs		27,010	28,908	9,282	5,299	70,499
Mean Permit Size		730	826	2,320	482	810
Standard Deviation		1,363	703	1,925	393	NA

[a] Another four permittees (three Forest Service, one Bureau of Land Management) provided usable data for average total costs per AUM but not for individual cost components.

and Resource Economics and the Renewable Resources Center of the University of Nevada, Reno.[6]

In Nevada, 86 percent of the total land area is in public ownership. Consequently, virtually all rangeland livestock operations are public land dependent. Lists of the population of ranch operations larger than 50 brood cows in size were obtained from the tax rolls in each county assessor's office throughout the state. Ranches to be included in the sample then were drawn randomly from the population using a random number generating procedure. Interviews with the randomly selected sample of ranchers then were conducted -- a process that continued through the winter of 1984. Ultimately, over 50 ranchers provided forage utilization cost estimates for 84 federal allotments in Nevada. Sampling information for the Nevada grazing cost study is summarized in Table 3.

Since the Nevada permittee sample was randomly selected, survey results can be extrapolated to the population as a whole. The limitations and reservations regarding generalization inherent in both the Oregon and Idaho studies do not apply in the Nevada case. The nonresponse rate in Nevada, as elsewhere, was very low. Hence it is appropriate to conclude that the Nevada results do appropriately reflect the forage utilization cost relationships for all Nevada permittees with herds in excess of 50 brood cows.

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[6] These individuals included William O. Champney and John F. Yanagida of the Department of Agricultural and Resource Economics, and Sherman Swanson of the Renewable Resources Center, University of Nevada, Reno.

Table 3. Population and Sample Information for the Random Survey of Nevada Permittees' Forage Utilization Costs.

Activity	Permits			AUMs						
				Population			Sample			
	Number of Allotments in Population	Number of Allotments in Sample	Percent of Population Sampled	Total AUMs	Mean Permit Size	Standard Deviation	Total AUMs	Mean Permit Size	Standard Deviation	Percent of Population Sampled
Bureau of Land Management[a]	705	75	10.6	1,607,754	2,280	NA	369,691	4,929	6,533	23.0
Forest Service	195	9	4.6	365,142	1,873	NA	5,986	665	329	1.6
Private Lease[b]	NA	3	NA	NA	NA	NA	3,595	1,198	580	NA
Deeded Land[b]	NA	2	NA	NA	NA	NA	724	362	17	NA
TOTAL	NA	89	NA	NA	NA	NA	379,996	4,270	NA	NA

[a] Of these 705 Bureau of Land Management allotments, 333 were used by brood cow herds greater than 50 animals in size. Sampling was done only from these 333 allotments, from which 75 (22.5 percent) produced usable survey data.

[b] Two of the three private leases and both deeded land parcels were in intermingled Bureau of Land Management allotments.

Wyoming

Following passage of the Public Lands Council resolution, several areas that earlier had expressed interest in the public land forage utilization cost survey renewed their efforts to repeat the study in their areas. One of these areas was Wyoming, with leadership for the Wyoming grazing cost study vested in the Executive Department of the Office of the Governor.[7] Here, as in Idaho and Nevada, assistance was provided by members of the Oregon special needs project team. A modified version of the Oregon questionnaire was developed to accommodate additional Executive Department objectives. The Oregon team assisted in the training of field appraisers retained by the Governor's Office.

Two different sampling procedures were used in conducting the Wyoming study. One group of ranchers to be interviewed was chosen in a nonrandom manner similar to the procedure employed in Oregon and in Idaho. However, an additional group was selected randomly from population permittee lists for each National Forest and Bureau of Land Management district operating in the state. The random sample was stratified by both permit size and by geographical location. For example, approximately 33 percent of the Forest Service AUMs in Wyoming are licensed on the Medicine Bow National Forest. The sample therefore was drawn such that about 33 percent of the Wyoming Forest Service permittees to be surveyed held Medicine Bow National Forest permits.

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[7] Leadership for the Wyoming forage utilization cost surveys was provided by Rod Miller and Richard Loper through the Executive Department of the Office of the Governor of the State of Wyoming.

The results presented in a subsequent section of this report are pooled from both the random and the nonrandom samples. Part of the purpose in having the two (random and nonrandom) samples was to test the hypothesis that the two sets of sample characteristics would be indistinguishable, regardless of the sampling procedure employed. The results of that test revealed that the samples were, indeed, indistinguishable and hence could be combined. The two samples yielded information on forage utilization costs for 194 allotments and private pasture rental arrangements. Relevant sampling information is presented in Table 4.

National Grasslands of North and South Dakota

Another area expressing interest in replicating the Oregon grazing cost study was the National Grasslands. Although the Grasslands, administered through the Forest Service, are scattered through parts of several Great Plains and western states, they are concentrated in the western parts of the two Dakotas. Leadership was provided by the Association of National Grasslands, Inc., which also assumed responsibility for hiring field interviewers, most of whom had prior experience as Statistical Reporting Service field enumerators.[8] As in Wyoming, Oregon special needs project team members helped train the field

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[8] Officers of the Association of National Grasslands, Inc., provided leadership for the National Grasslands forage utilization cost surveys. They included Dale Greenwood of Cartwright, North Dakota, and Lynn C. Wolff of Haynes, North Dakota. Assistance also was provided by James R. Johnson of the West River Research and Extension Center, South Dakota State University.

Table 4. Population and Sample Information for the Combined Random and Nonrandom Surveys of Wyoming Permittees' Forage Utilization Costs.

Type of Lease	Permits			AUMs						
				Population			Sample			
	Number of Allotments in Population	Number of Allotments in Sample[a]	Percent of Population Sampled	Total AUMs	Mean Permit Size[b]	Standard Deviation	Total AUMs	Mean Permit Size	Standard Deviation	Percent of Population Sampled
Bureau of Land Management	2,759	128	4.6	1,073,370	389	NA	154,075	1,024	3,456	14.4
Forest Service[c]	582	71	12.2	753,256	1,294	NA	58,709	827	800	7.8
State Lease[d]	3,754	64	1.7	1,000,000	266	NA	17,887	279	373	1.8
Private Lease	NA	32	NA	NA	NA	NA	21,792	681	1,252	NA
Deeded Land	NA	66	NA	NA	NA	NA	93,720	1,420	3,062	NA
TOTAL	**NA**	**361**	**NA**	**NA**	**NA**	**NA**	**346,173**	**959**	**NA**	**NA**

SOURCES: The total number of Bureau of Land Management and Forest Service allotments in Wyoming was taken from a report by Edward Bradley, "Analysis of the Nonfee Costs of Grazing Livestock on Federal and Private Grazing Land in Wyoming: A Preliminary Research Proposal," Division of Agricultural Economics, University of Wyoming, November 1983. The Office of the Governor, State of Wyoming, supplied estimates of total state lease allotments and AUMs. Total Bureau of Land Management AUMs were obtained from the Bureau of Land Management's Public Land Statistics: 1980; while total Forest Service AUMs were estimated from permittee records from six Forest Supervisor Offices in Wyoming.

[a] As reported here, the number of sampled allotments differs from the figures reported in the results section. This discrepancy is due to the mixture of land ownerships found in many allotments. The numbers reported above can be interpreted as follows: Of the usable interviews completed, 128 were with permittees who had some Bureau of Land Management land in their allotment; 71 had some Forest Service land, etc.

[b] The mean permit size estimates can only be interpreted as approximations. They were obtained by dividing total AUM estimates by total number of allotments -- and the AUM and allotment population figures were obtained from several different sources.

[c] Excluding the Black Hills National Forest but including the Thunder Basin National Grassland.

[d] A separate sample was not drawn from state lease population lists. Rather, all state lease information was derived from interviews with permittees in either the Bureau of Land Management or Forest Service samples who happened also to hold state leases.

interviewers and prepared modified versions of the Oregon study questionnaire.

A random sampling technique was employed in the six National Grasslands grazing associations and districts surveyed in North and South Dakota. The decision to switch to a fully randomized sampling approach in these areas was based on three considerations: (1) After conducting the study in several other states, the final format for the questionnaire was complete and the analysis procedures were fully developed. More resources thus were available for drawing a random sample. (2) The names of the ranchers comprising the entire population as well as permit size data were readily available from the offices of the grazing associations and districts associated with each Grassland. (3) Criticism had been voiced about the nonrandom nature of the earlier surveys, particularly in Oregon and Idaho. It was decided that interviewing from a randomly drawn National Grasslands sample might provide indirect evidence on the representativeness, or lack of representativeness, of information obtained from the nonrandom surveys in those two western states.

Samples were drawn from the subpopulations of permittees in each of the six grazing associations and districts (Table 5). Hence, geographical stratification of the aggregate population of National Grasslands permittees was employed. The six subpopulations also were stratified on the basis of permit size. For example, in the Grand River Cooperative Grazing District 37 percent of the licensed AUMs were in permits of under 700 AUMs; another 37 percent were issued in permits ranging between 701 and 1,200 AUMs, while the remaining 26 percent of the licensed use

Table 5. Population and Sample Information for the Random Survey of National Grasslands Permittees' Forage Utilization Costs in Six Associations and Districts in North and South Dakota.

Grazing Association or District	Permits			AUMs						
				Population			Sample[a]			
	Number of Allotments in Population	Number of Allotments in Sample	Percent of Population Sampled	Total AUMs	Mean Permit Size	Standard Deviation	Total AUMs	Mean Permit Size	Standard Deviation	Percent of Population Sampled
McKenzie County Grazing Assoc.	200	78	39.0	NA	NA	NA	88,818 79,617*	1,139 1,021*	728 697*	NA
Medora Grazing Association	145	59	40.7	151,947	1,048	742	67,982 52,311*	1,152 887*	702 596*	44.7
Little Missouri Grazing Assoc.[b]	99	0	----	---	---	---	---	---	---	----
Grand River Co-operative Grazing District	80	39	48.8	48,374	604	447	30,201 27,294*	774 700*	573 544*	62.5
Central South Dakota Grazing District	47	24	51.1	65,867	1,041	489	34,565 33,863*	1,440 1,411*	611 595*	52.5
White River Co-operative Grazing District	44	23	52.3	28,087	638	367	17,597 16,204*	765 705*	361 360*	62.7
TOTAL GRASSLANDS	**615**	**223**	**43.2[c]**	**294,248[d]**	**931[d]**	**NA**	**239,163[c] 209,289***	**1,072[c] 939***	**NA**	**51.1[d]**

SOURCES: Grazing Association and Grazing District Offices as identified above.

[a] The numbers followed by an asterisk are for those federal (National Grasslands) AUMs included in association and district permits. Permits may also include lands owned by the associations or districts themselves, and/or private leased and deeded lands.

[b] Following completion of the Little Missouri Grazing Association survey it was found that that survey had been conducted in a nonrandom manner. Hence, its results were excluded from the analysis.

[c] Excluding Little Missouri Grazing Association.

[d] Excluding Little Missouri and McKenzie County Grazing Associations.

was in permits of over 1,200 AUMs. Three lists of randomly selected permittees corresponding to these three permit size groups were given to the interviewer with the instruction to proceed down the lists of names, interviewing at least 40 percent of the total population of Grand River permittees. Of those interviewed, approximately 37 percent were to come from the list of permittees with permits for under 700 AUMs; 37 percent to come from the middle group; and 26 percent to come from the group of permittees with the larger permits.

Due to the random sampling design employed in the National Grasslands survey, the results can be considered representative of the average forage utilization costs per AUM in each district or association. Since the stratified sampling procedure resulted in a larger proportion of large permit holders in the sample (i.e., 26 percent of the AUMs were in permits between 1,201 and 2,100 AUMs, but only nine percent of the operators held these permits), the costs reported for the National Grasslands are representative of the average per AUM costs rather than the average permittee costs per AUM. The distinction is of no significance unless there is found to be a statistically significant relationship between average total costs per AUM and the size of the permit.

Black Hills National Forest

Due to the perception that the permittee grazing livestock in the Black Hills National Forest may face costs that might be different than those facing permittees in other parts of South Dakota and Wyoming -- differences attributable to the topological

and climatological characteristics of the Black Hills -- a separate study was conducted in this National Forest area. As in all previous surveys, Oregon personnel assisted in questionnaire design and training of field interviewers. Leadership for the local data collection effort was provided by the South Dakota State University Extension Service.[9]

The Black Hills National Forest sample of permittees was drawn randomly from permittee lists provided by the local Forest Supervisor's office. As in Wyoming and the National Grasslands, the sample was again stratified on the basis of permit size. The Forest also was divided into three geographical strata -- south, central, and north -- with the samples drawn from within each geographical strata being proportional to the licensed AUMs within those areas. Sampling information for the Black Hills National Forest grazing cost study is summarized in Table 6. Because of the random sample design, the results of the Black Hills National Forest grazing cost survey can be construed as indicative of average forage utilization costs throughout that region.

Sampling Procedures in Other Grazing Cost Survey Areas

As noted earlier, forage utilization cost surveys similar in purpose and structure to the studies described above also were initiated in California and Colorado, while an independently designed effort was conducted in New Mexico. The Oregon group

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[9] Leadership for the Black Hills National Forest forage utilization cost survey was provided by James R. Johnson of the West River Research and Extension Center, South Dakota State University.

Table 6. Population and Sample Information for the Random Survey of Black Hills National Forest Permittees' Forage Utilization Costs.

Area and Ranger Districts (in parenthesis)	Permits			AUMs						
				Population			Sample			
	Number of Allotments in Population	Number of Allotments in Sample	Percent of Population Sampled	Total AUMs	Mean Permit Size	Standard Deviation	Total AUMs	Mean Permit Size	Standard Deviation	Percent of Population Sampled
North Stratum (Bearlodge, Nemo, Spearfish)	130	34	26.2	32,167	247	255	14,534	427	336	45.2
Central Stratum (Harney, Pactola)	47	22	46.8	22,493	479	530	11,740	534	432	52.2
South Stratum (Custer, Elk Mountain)	107	33	30.8	36,421	340	296	19,904	603	361	54.7
TOTAL FOREST	**284**	**89**	**31.3**	**91,081**	**321**	**NA**	**46,178**	**519**	**NA**	**50.7**

SOURCE: Forest Supervisor's Office, Black Hills National Forest.

provided the University of California Extension Service with assistance in questionnaire and sample design and in the training of Extension farm advisors who were to serve as field interviewers. Questionnaires were exchanged with personnel from the Department of Range Science, Colorado State University, who coordinated a random design forage cost utilization survey in that state. Information also was exchanged with faculty from the Department of Agricultural Economics and Agricultural Business, New Mexico State University.

It is expected that, upon their completion, the California and Colorado studies will yield forage utilization cost information similar to that described here. The New Mexico study will result in complementary, but not strictly comparable, findings and insights. None of these three studies had been completed by August 1984, however, and two were conducted independently of the Extension special needs project. Hence, they are considered no further in the present report.

Summary: Aggregate Sample Characteristics

The six forage utilization cost surveys completed by August 1984 were made possible, in part, through the financial support and cooperative effort of the federal and various states' Extension Services. In the course of that cooperative effort, several hundred permittees were interviewed, providing forage utilization cost information for 849 allotments. These permittees collectively utilized 1,267,214 AUMs of livestock forage, of which 684,271 AUMs (54 percent) were obtained from Bureau of Land Management rangelands and 406,729 AUMs (32

percent) were from the National Forests and National Grasslands. These aggregate grazing costs survey sample characteristics are summarized in Table 7.

Empirical Results

Following the completion of the Oregon grazing cost survey, and while the Idaho and Nevada surveys were still underway, the Oregon special needs project team received a request from the Forest Service to modify the format of the questionnaire.[10] The motive behind the request was to be able to collect and report forage utilization cost data in the same format as that used in the "1966 Western Livestock Grazing Survey" from which the $1.23 base fee in the PRIA formula is derived [Houseman, et al., 1968].

The questionnaire subsequently was modified to obtain specific information on herding versus other management costs, as well as information on improvement expenditures, or the value of investments by permittees on their allotments.[11] Further modifications were introduced such that noncash labor costs associated with alternative livestock management activities could be separated from other cash and noncash activity costs. These

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[10] See letter from Edward R. Frandsen, Forest Service, to Frederick W. Obermiller, Oregon State University, dated August 3, 1983, and letter from Frederick W. Obermiller, Oregon State University, to Edward R. Frandsen, Forest Service, dated August 18, 1983.

[11] Improvement expenditures (investment values) represent only the cash and noncash contributions by permittees to improvements on allotments. Examples of such improvements include fences, wells, pipelines, other water developments, and reseedings. Maintenance on improvements other than major structural renovation was included in maintenance costs rather than investment values.

Table 7. Aggregate Sample Information for All Random and Nonrandom Surveys of Permittees' Forage Utilization Costs in Six Western and Great Plains States.

State or Area	Number of Usable Rancher Interviews	Number of Allotments by Type of Lease				
		Bureau of Land Management	Forest Service	Private	Mixed or Other	Total
Oregon	97	78	64	23	2	167
Idaho	44	37	35	11	4	87
Nevada	50	75	9	5	0	89
Wyoming	190	93	62	26	13	194
National Grasslands	223	0	223	0	0	223
Black Hills N.F.	89	0	89	0	0	89
TOTAL	**693**	**283**	**482**	**65**	**13**	**849**
Total AUMs		**694,271**	**406,729**	**145,628**	**30,776**	**1,267,214**
Mean Permit Size		**2,418**	**844**	**2,240**	**2,367**	**1,493**

changes could not be made in time to alter the format of the Oregon and Idaho surveys. However, they were incorporated in the Nevada, Wyoming, National Grasslands, and Black Hills questionnaires. These differences are reflected in the following eight tables.

Presented below are the empirical results for those states and areas for which data collection had been completed by July 1984. As in the "1966 Western Livestock Grazing Survey," average forage utilization costs within each survey area were found to vary widely.[12] This means that the average costs reported in the following tables must be carefully interpreted. They represent only the averages derived from the survey data: They do not represent the average annual production costs of a "typical" permittee. Indeed, the survey results themselves suggest that there is no "typical" cost structure shared by all permittees, within or among regions in the western United States. The variation in forage utilization costs within survey areas, and the non-normality of the distributions of those costs, is graphically depicted in Figures 1a-1f below.

Oregon

In the initial Oregon study, as in all subsequent replications, a statistical technique known as analysis of variance was employed to determine if aggregation of the forage utilization cost data across geographical areas and/or land

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12 A summarized discussion of the variability in forage utilization costs within and among regions as reflected in the results of the "1966 Western Livestock Grazing Survey" is given in the October 21, 1977, report to Congress dealing with grazing fees on federal lands [Bergland and Andrus, 1977, Appendix C, Part 2].

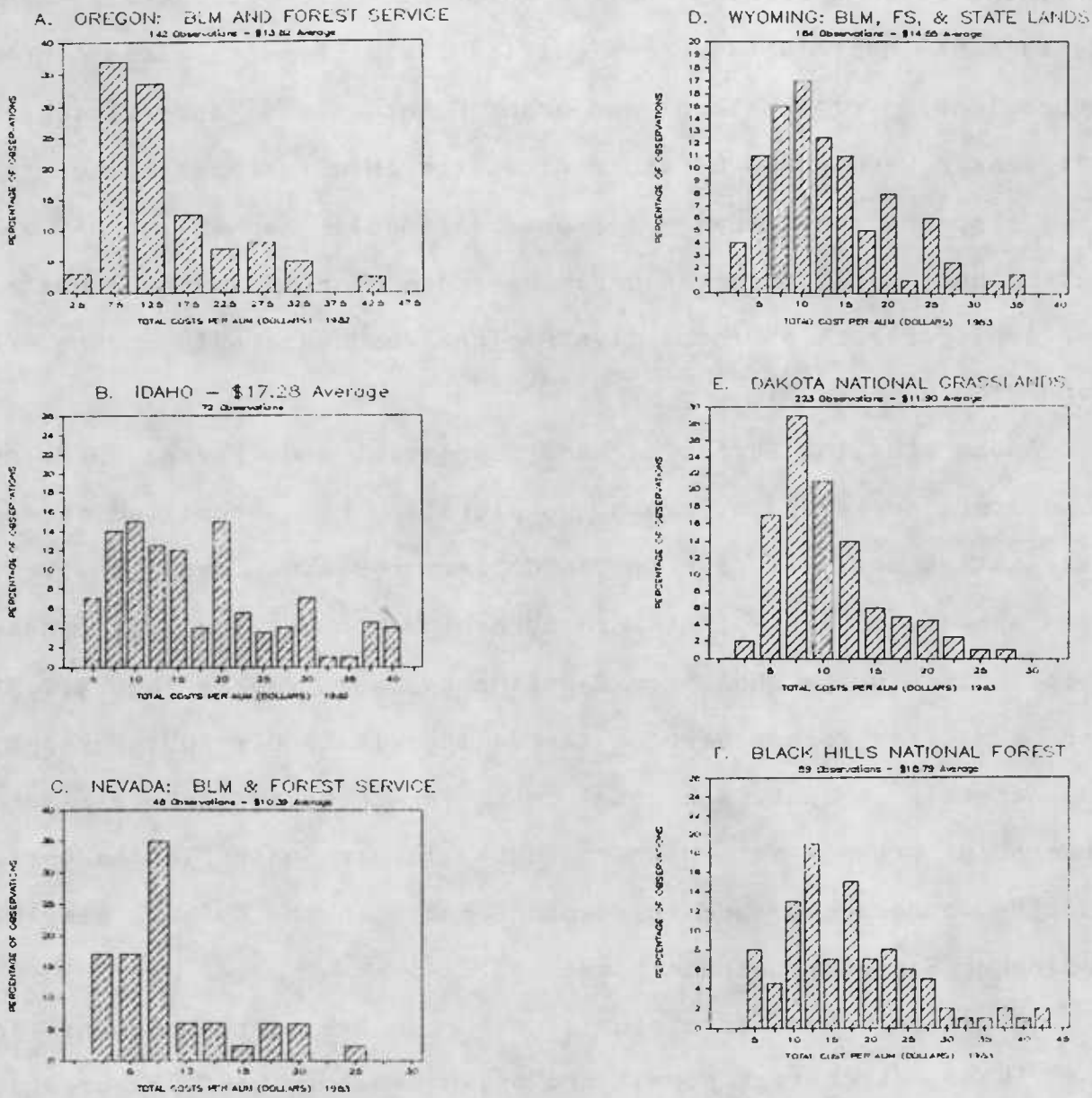

Figure 1A-1F. Observed Distributions of Total Forage Utilization Costs, Per AUM, Among Survey Areas in the Western and Great Plains States.

ownerships would be appropriate. The statistical results suggested that the cost observations on all Forest Service allotments (64 observations) could be combined as could the 23 private lease observations. However, the Bureau of Land Management cost data were significantly different among three subregions: (1) Malheur and Grant Counties (15 observations); (2) Baker County and a number of scattered allotments along the east slope of the Cascades (18 observations); and (3) Harney and Lake Counties (45 observations). Average cash and noncash costs, per AUM, for each of these five regional and ownership groups are reported in Table 8.

Among the 142 Bureau of Land Management and Forest Service allotments surveyed in Oregon, a plurality had associated forage utilization costs of five to ten dollars per AUM. Many, however, had associated costs that were much higher, particularly those allotments in the BLM Baker/Eastside Cascades (averaging $17.53 per AUM) and Forest Service (averaging $16.06 per AUM) groups. In general, the average total costs for these two federal land ownership groups were higher due to larger gathering/takeoff, routine management, and maintenance costs on the Forest Service and Baker/Eastside Cascade permits.

In general, the most significant relative cost component in the least expensive permit groups (Bureau of Land Management allotments in Malheur/Grant and Harney/Lake) was death loss, accounting for about one-quarter of total forage utilization costs. In the two more costly federal groups, other cost items were more significant, particularly routine management, gathering/takeoff, and maintenance costs.

Table 8. Average Total Costs, Per AUM, Experienced by Oregon Permittees in Grazing Livestock on Federal and Privately Leased Land: 1982.

	Type of Lease, Location, and Activity Cost ($/AUM)									
	Bureau of Land Management						Forest Service		Private Lease	
	Malheur/Grant		Baker/Eastside Cascades		Harney/Lake					
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.54	6.8	0.86	4.9	1.27	11.4	0.99	6.2	1.18	8.4
Gathering/Takeoff	0.81	10.3	2.92	16.7	1.66	14.9	3.24	20.2	1.29	9.2
Routine Management	1.15	14.6	4.29	24.5	1.72	15.4	4.24	26.4	1.16	8.3
Maintenance	0.49	6.2	1.76	10.0	0.75	6.7	1.82	11.3	0.64	4.6
Salting, Feeding, & Veterinary Services	0.29	3.7	0.40	2.3	0.42	3.8	0.32	2.0	0.35	2.5
Meetings	0.48	6.1	0.53	3.0	0.18	1.6	0.22	1.4	0.03	0.2
Death Loss	2.06	26.1	2.48	14.1	2.68	24.1	1.94	12.1	1.27	9.1
Fees & Rents	1.90	24.1	2.28	13.0	1.85	16.6	2.65	16.5	8.06	57.4
Other	0.18	2.3	2.01	11.5	0.61	5.5	0.64	3.9	0.05	0.4
TOTAL COSTS ($/AUM)	**7.90**	**100.0**	**17.53**	**100.0**	**11.14**	**100.0**	**16.06**	**100.0**	**14.03**	**100.0**

Of the 97 Oregon permittees with whom interviews were completed, a relatively small number also leased privately-owned pasture and range. The 23 private leases in the Oregon survey had associated cost structures that differed in several respects from the federal leases. As would be expected, fees and rents accounted for well over half (57.4 percent) of total private lease costs. In contrast, fees and rents were responsible for between 13.0 and 24.1 percent of federal lease costs. Turn-out costs were relatively larger in the private leases. However, these same private leases generally were much less expensive with respect to the values of death loss, routine management, and meetings and associated miscellaneous costs. The overall cost of the private leases ($14.03 per AUM) was quite similar to the average per AUM cost across all federal leases ($13.82 per AUM).

Idaho

In Idaho, unlike Oregon, differences in the average total costs of forage utilization on BLM and Forest Service allotments, as well as private leases, were not found to be statistically significant. Fully usable cost records were collected for 36 BLM allotments, 32 Forest Service allotments, and 11 private leases. One additional BLM and three additional Forest Service permittee interviews resulted in usable data for average total costs but not for individual cost components. The Idaho forage utilization cost estimates are presented in Table 9.

Idaho grazing costs were found to be somewhat more widely dispersed than Oregon costs, displaying only a weak central tendency averaging $17.06 on BLM allotments, $17.54 on Forest

Table 9. Average Total Costs, Per AUM, Experienced by Idaho Permittees in Grazing Livestock on Federal and Privately Leased Land: 1982.

	Type of Lease and Activity Cost ($/AUM)					
	Bureau of Land Management		Forest Service		Private Lease	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.99	5.8	1.07	6.1	0.69	4.5
Gathering/Takeoff	3.26	19.1	3.64	20.8	0.97	6.3
Routine Management	4.08	23.9	4.75	27.1	3.73	24.4
Maintenance	2.23	13.1	0.84	4.8	1.55	10.1
Salting, Feeding, & Veterinary Services	0.16	0.9	0.22	1.3	0.22	1.4
Meetings	0.80	4.7	0.27	1.5	0.01	0.1
Death Loss	3.13	18.3	3.44	19.6	0.37	2.4
Fees & Rents	2.24	13.1	3.18	18.1	7.77	50.8
Other	0.17	1.0	0.13	0.7	0.00	0.0
TOTAL COSTS ($/AUM)	**17.06**	**100.0**	**17.54**	**100.0**	**15.31**	**100.0**

Service allotments, and $15.31 on private leases. In general, BLM allotments had higher maintenance and meetings/other miscellaneous costs, but lower fees and rents costs, than Forest Service allotments.

As in Oregon, fees and rents accounted for over half (50.8 percent) of permittees' total private lease costs but were a much smaller component (13.1-18.1 percent) of total federal lease costs. In virtually all other respects, however, private lease cost components were less than corresponding federal lease cost components. These differences were most apparent in the respective costs of gathering/takeoff and death loss, although BLM and Forest Service allotments also had noticeably higher turnout, routine management, and meetings/other miscellaneous cost components.

Nevada

As in Idaho, average total costs of forage utilization were not found to differ significantly among regions or ownership categories in Nevada. These findings were based on an analysis of the 48 randomly selected allotments surveyed during the first phase of the Nevada study. As noted earlier, the Nevada survey did incorporate questionnaire changes designed to replicate the format of the "1966 Western Livestock Grazing Survey." Those changes are reflected in the structure of Table 10, wherein the results of the first phase of the random survey of Nevada permittees are reported.

As in Oregon, there was a relatively strong central tendency in the Nevada data, with a plurality of allotment forage

Table 10. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced by Nevada Permittees in Grazing Livestock on Federal Lands: 1983.

	Average Cost and Unpaid Labor Activity Cost ($/AUM)					
	Avg. Cost		Unpaid Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.39	4.8	0.19	8.6	0.58	5.6
Gathering/Takeoff	0.60	7.3	0.59	26.7	1.19	11.5
Routine Management[a]	1.90	23.2	0.72	32.6	2.62	25.2
Maintenance	0.57	7.0	0.35	15.8	0.92	8.9
Salting, Feeding, & Veterinary Services[b]	0.53	6.5	0.17	7.7	0.70	6.7
Meetings	0.06	0.7	0.07	3.2	0.13	1.3
Death Loss	2.36	28.9	0.00	0.0	2.36	22.7
Fees & Rents	1.64	20.0	0.00	0.0	1.64	15.8
Other	0.13	1.6	0.12	5.4	0.25	2.4
TOTAL COSTS ($/AUM)	**8.18**	**100.0**	**2.21**	**100.0**	**10.39**	**100.0**
IMPROVEMENT EXPENDITURES[c]	**0.42**		**0.03**		**0.45**	

[a] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $1.84 ($1.50 + $0.34) per AUM.

[b] Includes watering stock with average costs other than unpaid labor and noncash labor costs of $0.48 ($0.31 + $0.17) per AUM.

[c] As used here, improvement expenditures are the annualized value of permittees' capital and unpaid labor investments on the federal allotment over the time period 1963-1983 expressed in 1983 dollars.

utilization costs in the $7.50-$10.00 per AUM range. Cost observations were skewed to the right, however, resulting in an average total cost of $10.39 per AUM. Of this amount, roughly 79 percent ($8.18) was in the form of costs other than unpaid labor, while 21 percent ($2.21) was in the form of noncash labor costs.

In Nevada, the major contributors to overall forage utilization costs on federal lands were routine management, death loss, fees and rents, and gathering/takeoff activities. These are exactly the same leading cost activities as those observed among Oregon and Idaho permittees. In the Nevada case, however, it is possible to examine the extent to which noncash labor outlays affect each cost component. As would be expected, three activities (routine management, gathering/takeoff, and maintenance) accounted for over three-quarters of all noncash labor costs in Nevada. Were it not for noncash labor costs, gathering/takeoff activities would not be one of the major cost components facing Nevada permittees.

Improvement expenditures, calculated on a per AUM basis, also were estimated for all allotments in the Nevada survey. These expenditures approximated $0.45 per AUM on an annualized basis, of which over 90 percent ($0.42) was attributable to actual cash investments on the allotment paid for, over time, by the permittee. If capitalized at ten percent, the average value of each permittee's expenditures on his or her allotment would, in Nevada, be about $4.50 per licensed AUM.

Prior to the advent of the forage utilization cost survey in Nevada, an independent study was undertaken under the control of

the Department of Agricultural and Resource Economics at the University of Nevada, Reno. The primary purpose of this earlier study was to assess economies of scale in the Nevada range livestock industry, not to calculate public land forage utilization costs. However, awareness of the Oregon study led the study team leader (John F. Yanagida) to include questions that would allow comparable utilization cost data to be collected.

Since the principal purpose of the initial Nevada study concerned economies of scale, the randomly drawn sample was stratified such that eight ranches were surveyed in the small, medium, and large size categories. The results of the independent study were very similar to the results from the subsequent forage utilization cost survey. Total costs per AUM for the 37 BLM allotments analyzed in the earlier study were $9.86 per AUM, with a standard deviation of $7.02 per AUM. Comparable figures from the forage utilization cost survey were $10.39 and $6.80, respectively.

There was found to be no statistical difference between the two samples indicating they were drawn from the same parent population. This conclusion tends to impart a good deal of confidence to the Nevada results, and would seem to increase the confidence that can be placed in the procedures employed throughout the scope of the various forage utilization cost surveys. In Nevada it was found that two independently conducted

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[13] Due to the nonnormality of the cost distributions, a nonparametric Mann-Whitney U-test was conducted to compare the two sample results. The value of the Z-statistic obtained was $\pm$0.760 which is not statistically significant.

random surveys, with different interviewers involved in each, somewhat different survey instruments, and different analysts employing alternative analytical techniques, resulted in estimates of mean forage utilization costs that differed by slightly more than 50 cents. In addition, the distribution of the individual observations were similarly skewed to the right, and were found not to be different in the statistical sense.

Wyoming

As in Idaho and Nevada, analysis of variance revealed no statistically significant differences among federal or state land forage utilization costs in Wyoming. However, utilization costs for those surveyed allotments in which deeded lands accounted for over half of the available forage were found to be significantly lower than comparable public land costs at the 95 percent confidence level. Average costs, differentiating noncash labor costs, per AUM for two public land ownership groups in Wyoming are reported in Table 11, while forage utilization costs for deeded land allotments in the Wyoming survey are presented in Table 12.

The combined random and nonrandom Wyoming surveys yielded usable cost records for 18 allotments wherein 50 percent or more of the available forage was supplied by the Thunder Basin National Grassland; 146 allotments deriving half or more of the available forage from other federal or state-owned lands; and 19 allotments primarily dependent on deeded land forage supplies. Many of the surveyed allotments contained a mix of Forest Service, Bureau of Land Management, State of Wyoming, and deeded

Table 11. Average Total Labor Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced by Wyoming Permittees in Grazing Livestock on Federal and State Lands: 1983.

	Type of Lease, Average Cost, and Unpaid Labor Activity Cost ($/AUM)[a]											
	Thunder Basin National Grassland						Other Government Leases					
	Avg. Cost		Labor Cost		Total Cost		Avg. Cost		Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.33	3.9	0.54	10.5	0.87	6.4	0.61	6.0	0.67	15.1	1.28	8.7
Gathering/Takeoff	0.35	4.2	0.57	11.1	0.92	6.8	1.02	10.0	1.28	28.8	2.30	15.7
Routine Management[b]	1.18	14.0	2.95	57.5	4.13	30.5	2.01	19.6	1.40	31.5	3.41	23.2
Maintenance	1.38	16.4	0.75	14.6	2.13	15.7	1.29	12.6	0.57	12.8	1.86	12.7
Salting, Feeding, & Veterinary Services	0.26	3.1	----	----	0.26	1.9	0.35	3.4	----	----	0.35	2.4
Meetings	0.07	0.8	0.09	1.8	0.16	1.2	0.18	1.8	0.25	5.6	0.43	2.9
Death Loss	1.85	22.0	0.00	0.0	1.85	13.7	3.00	29.3	0.00	0.0	3.00	20.4
Fees & Rents	2.63	31.2	0.00	0.0	2.63	19.4	1.41	13.8	0.00	0.0	1.41	9.6
Other	0.37	4.4	0.23	4.5	0.60	4.4	0.36	3.5	0.27	6.1	0.63	4.3
TOTAL COSTS ($/AUM)	**8.42**	**100.0**	**5.13**	**100.0**	**13.55**	**100.0**	**10.23**	**100.0**	**4.44**	**100.0**	**14.67**	**100.0**
IMPROVEMENT EXPENDITURES[c]	**0.37**		**0.00**		**0.37**		**0.93**		**0.00**		**0.93**	
LEGAL COSTS[d]	**0.08**		**0.00**		**0.08**		**0.02**		**0.00**		**0.02**	

[a] Lease classifications are based on that source of federal forage which supplies 50 percent or more of the total forage in the allotment. Other government leases include those administered by the Bureau of Land Management, Forest Service, and state leases.

[b] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $0.45 ($0.21 + $0.24) per AUM on Thunder Basin National Grassland and $1.68 ($1.19 + $0.49) on other government leases; grazing season management with costs of $2.96 ($0.78 + $2.18) per AUM on the National Grassland and $1.55 ($0.74 + $0.81) on other government leases; and wintering period management with costs of $0.72 ($0.19 + $0.53) per AUM on the National Grassland and $0.18 ($0.08 + $0.10) on other government leases.

[c] In the Wyoming analysis, improvement expenditures refer only to the annualized value of permittees' capital investments on public allotments over the time period 1963-1983 expressed in 1983 dollars. Reported labor use figures were erratic and hence were not considered.

[d] Legal costs refer to legal and consulting fees paid over the 1963-1983 time period, and are expressed on an annualized basis in 1983 dollars.

Table 12. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced by Wyoming Nonpermittees in Grazing Livestock on Deeded Lands: 1983.

	Average Cost and Unpaid Labor Activity Cost ($/AUM)					
	Avg. Cost		Unpaid Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.20	4.2	0.22	8.0	0.42	5.6
Gathering/Takeoff	0.48	10.0	0.39	14.1	0.87	11.5
Routine Management[a]	0.92	19.2	1.52	55.1	2.44	32.4
Maintenance	0.87	18.2	0.38	13.8	1.25	16.6
Salting, Feeding, & Veterinary Services	0.60	12.6	----	-----	0.60	8.0
Meetings	0.03	0.6	0.04	1.4	0.07	0.9
Death Loss	0.95	19.9	0.00	0.0	0.95	12.6
Fees & Rents	0.65	13.6	0.00	0.0	0.65	8.6
Other	0.08	1.7	0.21	7.6	0.29	3.8
TOTAL COSTS ($/AUM)	**4.78**	**100.0**	**2.76**	**100.0**	**7.54**	**100.0**
IMPROVEMENT EXPENDITURES[b]	**0.36**		**0.00**		**0.36**	
LEGAL COSTS[c]	**0.09**		**0.00**		**0.09**	

[a] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $0.57 ($0.28 + $0.29) per AUM; grazing season management with costs of $1.78 ($0.62 + $1.16) per AUM; and wintering period management with costs of $0.09 ($0.02 + $0.07) per AUM.

[b] In the Wyoming analysis, improvement expenditures refer only to the annualized value of nonpermittees' capital investments on deeded lands over the time period 1963-1983 expressed in 1983 dollars. Reported labor use figures were erratic and hence were not considered.

[c] Legal costs refer to legal and consulting fees paid over the 1963-1983 time period, and are expressed on an annualized basis in 1983 dollars.

land forage supplies. The extent of these mixed ownership allotments is reflected in the difference between the 361 land ownership types among the sampled allotments as reported in Table 4, and the 194 allotments assigned to one or another of the three ownership groups identified in Tables 11 and 12.

The Wyoming public land allotments had a central tendency with a modal response in the $10.00-$12.50 per AUM range. As elsewhere, dispersion was fairly pronounced, and many of the public land allotments had associated forage utilization costs in excess of $20.00 per AUM. This skewed distribution of grazing costs resulted in an average public land forage utilization cost of $14.55 per AUM in Wyoming. In contrast, the average predominantly deeded land allotment's forage utilization cost was substantially lower at $7.54 per AUM. Costs other than unpaid family labor accounted for roughly two-thirds of total forage utilization costs on both public and deeded lands in the State of Wyoming.

As in Oregon, Idaho, and Nevada, the primary contributors to average total forage utilization costs on public lands in Wyoming as a whole were routine management, death loss, and fees and rents. A difference was noted between the relative importance of gathering/takeoff costs on Thunder Basin National Grassland versus other public allotments, however, with gathering/takeoff activities being substantially more costly on the latter. The Wyoming National Grassland generally enjoyed cost advantages with respect to turn-out and death loss costs as well, but had higher fee and rent costs than other federal and state-owned allotments.

The bulk of the noncash labor costs experienced on Thunder Basin National Grassland allotments were for routine management activities. On other public allotments, gathering/takeoff activities were an equally important noncash labor component. On all public allotments, the presence of noncash labor costs led to a substantial increase in the relative importance of the average total costs of turn-out and gathering/takeoff activities in Wyoming.

Those allotments assigned to the deeded land group in Wyoming usually contained small public land parcels, which accounted for the existence of minor fee and rent costs on surveyed deeded land allotments. With the exception of salting, feeding, and veterinary services costs, all other forage utilization costs on deeded lands were lower than comparable public land grazing costs. These differences were most substantial for death loss, routine management, and fees and rents costs.

As in Nevada, per AUM improvement expenditures also were calculated in the Wyoming study, although annualized expenditures for noncash labor activities were not estimated because of the erratic character of responses. The annualized value of permittees' capital and labor expenditures on Thunder Basin National Grassland allotments averaged $0.37 per AUM versus $0.93 per AUM on other public land allotments and $0.36 per AUM on deeded land parcels.

At the request of the Office of the Governor, data were collected on legal and consulting costs associated with allotment livestock grazing as well. The annualized value of these legal and consulting expenses averaged $0.08 per AUM on the Thunder

Basin National Grassland, $0.02 on other public lands, and $0.09 on the predominantly deeded land allotments in the Wyoming surveys.

In Wyoming, as previously noted, both random and nonrandom surveys were conducted.[14] Due to the statistically significant differences between average total costs per AUM on predominantly public versus predominantly private allotments, these land ownership categories were separated in testing the significance of differences between the random and nonrandom samples. Neither test revealed the random and nonrandom sample characteristics to be statistically different.[15] These results indicate that there was no apparent difference in average total costs per AUM for those ranchers randomly surveyed versus those interviewed from a selective list. Hence, the samples may be combined and resulting sample characteristics can be considered to be representative of the underlying population.

National Grasslands of North and South Dakota

Statistical tests revealed that the costs of forage utilization on McKenzie County Grazing Association lands were substantially higher than grazing costs on other National Grasslands in North and South Dakota. Average forage utilization

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[14] In the nonrandom survey, allotment cost records were acquired for 42 predominantly public land and 8 predominantly deeded land allotments. Cost records for each ownership category in the random sample numbered 134 and 24, respectively.

[15] As in the Nevada case, the nonparametric Mann-Whitney U-test was used to investigate the degree of similarity between the random and nonrandom Wyoming samples. The values of the Z statistics obtained were ± 1.15 for the predominantly public land allotments and ± 0.305 for the predominantly private land allotments. Neither of these values are statistically significant.

costs ranged from $14.76 in that area to $7.60 per AUM on the Grand River Cooperative Grazing District in South Dakota. The North Dakota National Grasslands grazing association costs are reported in Table 13, and the South Dakota grazing district costs are given in Table 14.

For all grazing associations and districts in North and South Dakota, there was an observed central tendency in forage utilization costs in the $7.50-$10.00 per AUM range. As in all other survey areas, the cost distribution was skewed to the right resulting in an average forage utilization cost for all 223 sampled allotments of $11.90 per AUM. This average is made less meaningful due to the fairly wide dispersion in noncash labor costs, other costs, and total forage utilization costs per AUM among grazing associations and districts, however. The McKenzie County Grazing Association had not only the highest total cost per AUM ($14.78), but also the highest costs other than unpaid labor ($9.19), highest noncash labor cost ($5.59) and highest improvement expenditures ($0.51) of all surveyed National Grassland areas. In contrast, per AUM costs other than unpaid labor were lowest for Medora Grazing Association permittees ($6.58), while both noncash labor costs ($2.19 per AUM) and improvement expenditures ($0.06) were least significant for Grand River Cooperative Grazing District operators.

Fairly striking differences were observed in the relative importance of cost components between North versus South Dakota National Grassland permittees. In both of the North Dakota grazing associations (McKenzie and Medora), the primary contributors to total grazing costs were routine management

Table 13. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced by North Dakota Permittees in Grazing Livestock on the National Grasslands: 1983.

	Grazing Association, Average Cost, and Unpaid Labor Activity Cost ($/AUM)											
	McKenzie County Grazing Association						Medora Grazing Association					
	Avg. Cost		Labor Cost		Total Cost		Avg. Cost		Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.18	2.0	0.64	11.4	0.82	5.5	0.12	1.8	0.27	6.3	0.39	3.6
Gathering/Takeoff	0.38	4.1	1.16	20.8	1.54	10.4	0.17	2.6	0.92	21.3	1.09	10.0
Routine Management[a]	1.05	11.4	2.69	48.1	3.74	25.3	0.65	9.9	2.21	51.3	2.86	26.3
Maintenance	1.15	12.5	0.92	16.5	2.07	14.0	1.09	16.6	0.75	17.4	1.84	16.9
Salting, Feeding, & Veterinary Services	0.46	5.0	----	-----	0.46	3.1	0.57	8.7	----	-----	0.57	5.2
Meetings	0.10	1.1	0.08	1.4	0.18	1.2	0.08	1.2	0.05	1.1	0.13	1.2
Death Loss	2.05	22.3	0.00	0.0	2.05	13.9	1.46	22.2	0.00	0.0	1.46	13.4
Fees & Rents	3.72	40.5	0.00	0.0	3.72	25.2	2.34	35.5	0.00	0.0	2.34	21.5
Other	0.10	1.1	0.10	1.8	0.20	1.4	0.10	1.5	0.11	2.6	0.21	1.9
TOTAL COSTS ($/AUM)	**9.19**	**100.0**	**5.59**	**100.0**	**14.78**	**100.0**	**6.58**	**100.0**	**4.31**	**100.0**	**10.89**	**100.0**
IMPROVEMENT EXPENDITURES[b]	**0.46**		**0.05**		**0.51**		**0.40**		**0.06**		**0.46**	

[a] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $1.54 ($0.42 + $1.12) per AUM on McKenzie County Grazing Association and $1.02 ($0.26 + $0.76) on Medora Grazing Association; grazing season management with costs of $2.16 ($0.62 + $1.54) per AUM on McKenzie and $1.81 ($0.39 + $1.42) on Medora; and wintering period management with costs of $0.04 ($0.01 + $0.03) per AUM on McKenzie and $0.03 ($0.00 + $0.03) on Medora.

[b] As used here, improvement expenditures are the annualized value of permittees' capital and unpaid labor investments on the National Grasslands permits over the time period 1963-1983 expressed in 1983 dollars. In addition, each permittee in the McKenzie County Grazing Association maintains a capital credit account with the Association. As of the end of 1983, the capital accounts were valued at ten percent of their opportunity costs, and these annualized capital account figures were included in the McKenzie County Grazing Association investment value estimates. The average capital credit account was valued at $1.58 per AUM in 1983. Ten percent of that amount, or $0.16, was added to the per AUM improvement expenditure in the McKenzie County Grazing Association.

Table 14. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced by South Dakota Permittees in Grazing Livestock on the National Grasslands: 1983.

	Grazing District, Average Cost, and Unpaid Labor Activity Cost ($/AUM)											
	Grand River Cooperative Grazing District						Central South Dakota Grazing District					
	Avg. Cost		Labor Cost		Total Cost		Avg. Cost		Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.11	1.5	0.17	7.6	0.28	2.9	0.18	2.3	0.14	5.3	0.32	3.1
Gathering/Takeoff	0.23	3.1	0.57	25.7	0.80	8.2	0.18	2.3	0.20	7.7	0.38	3.6
Routine Management[a]	0.49	6.9	1.26	57.2	1.75	18.0	1.08	13.9	1.88	72.6	2.96	28.6
Maintenance	0.06	0.8	0.05	2.0	0.11	1.1	0.43	5.5	0.19	7.3	0.62	6.0
Salting, Feeding, & Veterinary Services	0.04	0.5	----	----	0.04	0.4	1.18	15.2	----	-----	1.18	11.4
Meetings	0.17	2.2	0.14	6.3	0.31	3.1	0.13	1.8	0.14	5.5	0.27	2.6
Death Loss	1.12	14.8	0.00	0.0	1.12	11.4	1.36	17.5	0.00	0.0	1.36	13.1
Fees & Rents	5.31	70.3	0.00	0.0	5.31	54.5	3.14	40.5	0.00	0.0	3.14	30.4
Other	0.02	0.3	0.03	1.2	0.05	0.5	0.08	1.0	0.04	1.6	0.12	1.1
TOTAL COSTS ($/AUM)	**7.56**	**100.0**	**2.19**	**100.0**	**9.75**	**100.0**	**7.76**	**100.0**	**2.58**	**100.0**	**10.34**	**100.0**
IMPROVEMENT EXPENDITURES[b]	**0.04**		**0.02**		**0.06**		**0.40**		**0.04**		**0.44**	

Table 14. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced by South Dakota Permittees in Grazing Livestock on the National Grasslands: 1983. (continued).

Grazing District, Average Cost, and Unpaid Labor Activity Cost ($/AUM)

	White River Cooperative Grazing District					
	Avg. Cost		Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.09	1.3	0.23	8.3	0.32	3.2
Gathering/Takeoff	0.08	1.1	0.31	11.1	0.39	3.8
Routine Management[a]	0.55	7.2	1.45	51.5	2.00	19.1
Maintenance	0.95	12.5	0.58	20.8	1.53	14.8
Salting, Feeding & Veterinary Services	0.79	10.5	----	-----	0.79	7.6
Meetings	0.11	1.4	0.12	4.3	0.23	2.2
Death Loss	1.93	25.5	0.00	0.0	1.93	18.6
Fees & Rents	2.80	36.9	0.00	0.0	2.80	26.9
Other	0.28	3.7	0.12	4.1	0.40	3.8
TOTAL COSTS ($/AUM)	**7.58**	**100.0**	**2.80**	**100.0**	**10.38**	**100.0**
IMPROVEMENT EXPENDITURES[b]	**0.43**		**0.02**		**0.45**	

[a] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $0.16 ($0.04 + $0.12) per AUM on Grand River Cooperative Grazing District, $0.47 ($0.20 + $0.27) on Central South Dakota Grazing District, and $0.39 ($0.10 + $0.29) on White River Cooperative Grazing District; grazing season management with costs of $1.59 ($0.46 + $1.13) per AUM on Grand River, $2.41 ($0.88 + $1.53) on Central South Dakota, and $1.49 ($0.40 + $1.09) on White River; and wintering period management with no costs on Grand River, $0.08 ($0.00 + $0.08) per AUM on Central South Dakota, and $0.10 ($0.04 + $0.06) on White River.

[b] As used here, improvement expenditures are the annualized value of permittees' capital and unpaid labor investments on the National Grasslands permits over the time period 1963-1983 expressed in 1983 dollars.

followed by fees and rents, maintenance, and death loss. Management, gathering/takeoff activities, and maintenance were significant noncash labor cost components in both areas. Both management and maintenance were significant other cost components among both associations' permittees as well. In these respects the North Dakota National Grassland permittees were more similar to Bureau of Land Management and National Forest permittees in other western states than to their National Grassland counterparts in South Dakota.

In contrast, the primary cost component in the South Dakota grazing districts were fees and rents, followed by routine management and death loss. In two of these districts it is association policy to assess members for capital improvements and their maintenance. Thus, fee and rent costs would be expected to be a more significant component of total forage utilization costs.

In neither of the two capital improvement assessment districts (Grand River and Central South Dakota) was maintenance a significant noncash labor or other cost activity. In all three areas routine management was the dominant noncash activity; while fees and rents tended to be an equally dominant cash cost component. Of all survey areas in the western and Great Plains states, only in the Central South Dakota Grazing District was salting, feeding, or veterinary services a fairly significant contributor to the total costs of forage utilization by domestic livestock.

Improvement expenditures among National Grassland grazing associations and districts varied, with values tending to be

higher in the North Dakota association areas and lower in the South Dakota grazing districts. The highest of these values ($0.51 per AUM for the McKenzie County Grazing Association) is explained in part by the existence, only in that Association, of a capital credit account maintained by each of the Association's permittees.

Black Hills National Forest

As indicated earlier, the 89 allotment cost records obtained through interviews with Black Hills National Forest permittees were divided, along ranger district lines, into three geographical strata: north (34 observations), central (22 observations), and south (33 observations). Analysis of variance revealed that costs in the northern strata (Bearlodge, Nemo, Spearfish) were significantly higher than forage utilization costs in the central (Harney, Pactola) and southern (Custer, Elk Mountain) strata. Total forage utilization costs per AUM averaged $20.94, $17.40, and $17.50 in these three Black Hills regions, respectively. Forest-wide, total forage utilization costs averaged $18.79 per AUM. The modal cost was in the $12.50 to $15.00 range, and as in all other survey areas the cost distribution was skewed to the right with a substantial number of observations in excess of $22.50 per AUM.

Routine management, followed by gathering/takeoff and death loss were leading total grazing cost components. Indeed, management costs on Black Hills National Forest allotments were the highest among all survey areas in the western and Great Plains states. Death loss, routine management, gathering/takeoff

Table 15. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced in Grazing Livestock on Black Hills National Forest Allotments: 1983.

	Area, Average Cost, and Unpaid Labor Activity Cost ($/AUM)					
	North Stratum (Bearlodge, Nemo, Spearfish)					
	Avg. Cost		Unpaid Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.97	7.7	1.20	14.3	2.17	10.4
Gathering/Takeoff	2.28	18.2	2.21	26.2	4.48	21.4
Routine Management[a]	1.82	14.6	2.71	32.2	4.53	21.7
Maintenance	2.11	16.9	1.43	17.0	3.54	16.9
Salting, Feeding, & Veterinary Services	0.36	2.8	----	-----	0.36	1.7
Meetings	0.18	1.5	0.24	2.8	0.42	2.0
Death Loss	2.91	23.2	----	----	2.91	13.9
Fees & Rents	1.51	12.0	----	----	1.51	7.2
Other	0.39	3.1	0.63	7.5	1.02	4.9
TOTAL COSTS ($/AUM)	**12.52**	**100.0**	**8.42**	**100.0**	**20.94**	**100.0**
IMPROVEMENT EXPENDITURES[b]	**0.64**		**0.17**		**0.81**	

[a] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $0.91 ($0.34 + $0.57) per AUM and grazing season management with costs of $3.62 ($1.48 + $2.14) per AUM.

[b] As used here, improvement expenditures are the annualized value of permittees' capital and unpaid labor investments on Black Hills National Forest allotments over the time period 1963-1983. The annualized value is expressed in 1983 dollars.

Table 15. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced in Grazing Livestock on Black Hills National Forest Allotments: 1983. (continued)

	Area, Average Cost, and Unpaid Labor Activity Cost ($/AUM)					
	Central Stratum (Harney, Pactola)					
	Avg. Cost		Unpaid Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.86	8.6	0.51	6.8	1.37	7.8
Gathering/Takeoff	1.18	11.9	1.15	15.4	2.33	13.4
Routine Management[a]	2.16	21.7	3.95	52.9	6.11	35.1
Maintenance	0.55	5.6	0.89	11.9	1.44	8.3
Salting, Feeding, & Veterinary Services	0.43	4.4	----	-----	0.43	2.5
Meetings	0.06	0.6	0.18	2.4	0.24	1.4
Death Loss	2.70	27.2	----	----	2.70	15.5
Fees & Rents	1.44	14.5	----	----	1.44	8.3
Other	0.55	5.5	0.80	10.7	1.35	7.7
TOTAL COSTS ($/AUM)	**9.94**	**100.0**	**7.47**	**100.0**	**17.40**	**100.0**
IMPROVEMENT EXPENDITURES[b]	**0.80**		**0.22**		1.02	

[a] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $1.71 ($0.63 + $1.08) per AUM and grazing season management with costs of $4.96 ($1.84 + $3.12) per AUM.

[b] As used here, improvement expenditures are the annualized value of permittees' capital and unpaid labor investments on Black Hills National Forest allotments over the time period 1963-1983. The annualized value is expressed in 1983 dollars.

Table 15. Average Total Costs Per AUM, Differentiating Unpaid Labor Costs, Experienced in Grazing Livestock on Black Hills National Forest Allotments: 1983. (continued)

	Area, Average Cost, and Unpaid Labor Activity Cost ($/AUM)					
	South Stratum (Custer, Elk Mountain)					
	Avg. Cost		Unpaid Labor Cost		Total Cost	
Activity	Cost	% of Total	Cost	% of Total	Cost	% of Total
Turn-Out	0.46	4.6	0.58	7.6	1.04	5.9
Gathering/Takeoff	0.87	8.8	1.49	19.5	2.36	13.5
Routine Management[a]	2.30	23.3	4.05	52.9	6.35	36.2
Maintenance	0.85	8.6	0.73	9.6	1.58	9.0
Salting, Feeding, & Veterinary Services	0.51	5.2	----	-----	0.51	2.9
Meetings	0.21	2.1	0.11	1.4	0.32	1.8
Death Loss	2.28	23.1	----	----	2.28	13.0
Fees & Rents	1.44	14.6	----	----	1.44	8.2
Other	0.95	9.6	0.69	9.0	1.64	9.4
TOTAL COSTS ($/AUM)	**9.86**	**100.0**	**7.65**	**100.0**	**17.50**	**100.0**
IMPROVEMENT EXPENDITURES[b]	**0.49**		**0.11**		**0.60**	

[a] Includes herding stock with average costs other than unpaid labor and noncash labor costs of $1.39 ($0.46 + $0.93) per AUM and grazing season management with costs of $4.40 ($1.53 + $2.87) per AUM.

[b] As used here, improvement expenditures are the annualized value of permittees' capital and unpaid labor investments on Black Hills National Forest allotments over the time period 1963-1983. The annualized value is expressed in 1983 dollars.

activities, and fees and rents were the leading other cost components. Routine management and gathering/takeoff activities were the dominant noncash labor cost components. These results were generally consistent with those observed for Forest Service permittees in Oregon and Idaho as well as National Grassland permittees in the McKenzie County Grazing Association.

As in Nevada, Wyoming, and the Dakotas, improvement expenditures were calculated for Black Hills National Forest allotments. These values averaged $0.78 per AUM in the Black Hills, second only in magnitude among all survey areas to the "other public land" improvement expenditures in Wyoming.

Factors Influencing Forage Utilization Costs Within Areas

In all of the survey areas, an explanation was sought for the wide variation in costs observed in the empirical results. Among those factors thought to influence grazing costs were size of the permit or lease, number of animals in the allotment, length of the grazing season, distance of the allotment from the headquarters ranch, distance from the last pasture or allotment in which the livestock grazed, existence of mining or geological survey work in the allotment, and class of livestock grazed on the allotment. The statistical technique used to evaluate the significance of each of those explanatory factors was regression analysis. The results of that analysis are summarized below.

Oregon

In Oregon, those factors found to exert a statistically significant influence on per AUM forage utilization costs

included number of animal units in the allotment or pasture (AUs), length of the lease or allowable grazing season (WEEKS), and the distance from the headquarters ranch (DISTHQ). The regression results are presented in Table 16.

The signs on the coefficients for these three explanatory variables were logically consistent. The size of the permit (AUs) and the length of the grazing season (WEEKS) both had negative impacts on per AUM forage utilization costs. Each additional animal unit reduced per AUM grazing costs by about 0.3 cents. Each additional week in the grazing season reduced costs by about 18.6 cents per AUM. The distance between the allotment and the headquarters ranch (DISTHQ) had a positive influence on costs. Each additional mile, holding the other factors constant, added about 7.4 cents to the cost of utilizing the allotment.

Problems with heteroskedasticity in the Forest Service data required a more complex analysis to be done on these observations. The results of this weighted least squares regression also are reported in Table 16.

Since the data were transformed by this procedure, direct comparisons of the Forest Service coefficients with those obtained for the remaining four groups were not possible. However, it was seen that the same general relationships hold. Costs per AUM declined with increases in the number of animal units, and increased with the distance from the home ranch. Although not significant, there did appear to be a slight negative relationship between the length of the grazing season and the average total costs of forage utilization.

Table 16. Regression Results for Average Total Forage Utilization Costs, Per AUM, Incurred by Permittees in Grazing Livestock on Bureau of Land Management, Forest Service, and Privately Leased Lands in Eastern Oregon and Eastern Oregon Subregions: 1982.

Type of Lease	Variable (T-Values in Parentheses)				Number of Observations
	Constant	AUs	WEEKS	DISTHQ	
	Ordinary Least Squares Parameter Estimates				
Bureau of Land Management					
Malheur/Grant	12.4707 (+4.665)	-.0034 (-2.054)	-.1861 (-2.359)	.0742 (+3.015)	15
Harney/Lake	14.0879 (+7.774)	-.0034	-.1861	.0742	45
Baker/Eastside Cascades	19.9420 (+8.961)	-.0034	-.1861	.0742	18
Private Leases	15.7526 (+7.548)	-.0034	-.1861	.0742	23
Forest Service	18.6093 (+11.195)	-.0034	-.1861	.0742	64
	Weighted Least Squares Parameter Estimates				
Forest Service	16.0890 (+5.33)	-.0060 (-1.659)	-.1792 (-1.379)	.1495 (+3.409)	64

The Oregon results may be summarized as follows. Total costs per AUM for the 165 pastures and allotments in the Oregon study were influenced by three factors: (1) Costs tended to decline with increases in the number of animals in the allotment and/or (2) with increases in the length of the grazing season; and (3) increasing distance from the home ranch increased the costs associated with using these allotments and pastures.

Idaho

Since no statistically significant differences were found among the average total costs of utilizing BLM, Forest Service, or private leases in Idaho, regression analyses were run on the entire set of observations. Those factors found to significantly affect per AUM forage utilization costs included number of AUMs in the pasture or allotment (AUM) and the distance of the allotment or pasture from the headquarters ranch (DISTHQ). Both had the same influence on per AUM forage utilization costs as in Oregon. The Idaho regression results are summarized in Table 17.

Table 17. Ordinary Least Squares Regression Results for Average Total Forage Utilization Costs, Per AUM, Incurred by Permittees in Grazing Livestock on Bureau of Land Management, Forest Service, and Privately Leased Lands in Idaho: 1982.

R^2 ($\bar{R}^2$)	Variable (T-Values in Parentheses)			Number of Observations
	Constant	AUM	DISTHQ	
0.165 (0.145)	+16.1643 (+12.93)	-0.0028 (-3.53)	+0.0862 (+2.05)	87

For the 87 allotments and leases analyzed, each additional AUM reduced the cost of using the permit by about 0.3 cents per AUM. The distance from the headquarters ranch to the allotment or pasture had a positive influence on costs, with each mile adding approximately 8.6 cents to total forage utilization costs per AUM.

Nevada

Regression results for the randomly drawn Nevada sample are presented in Table 18. Factors hypothesized to exert a statistically significant influence on per AUM forage utilization costs in Nevada included number of AUMs in the pasture or allotment (AUM), distance of the allotment or pasture from the headquarters ranch (DISTHQ), whether the allotment was held by an individual or in common (IND), and class of livestock (SHEEP).[16] Unlike the results in Oregon or Idaho, class of livestock dominated all other variables tested in explaining observed variation in average forage utilization costs per AUM.

Table 18. Ordinary Least Squares Regression Results for Average Total Forage Utilization Costs, Per AUM, Incurred by Permittees in Grazing Livestock on Federal Lands in Nevada: 1983.

R^2 ($\bar{R}^2$)	Variable (T-Values in Parentheses)					Number of Observations
	Constant	AUM	DISTHQ	IND	SHEEP	
0.357 (0.298)	+9.5925 (+8.00)	-0.0040 (-1.13)	+0.0071 (+0.29)	-0.8184 (-0.46)	+11.8237 (+3.68)	48

[16] In performing the regression analyses, the conversion rate for sheep versus cattle AUMs was 5:1.

The 42 cattle permits in the Nevada sample had total forage utilization costs, per AUM, of $8.78, while the six sheep permits had equivalent average costs of $19.80 per AUM. While sheep permits clearly were more expensive to operate than cattle permits, it does not necessarily follow that rangeland sheep operations are less profitable. Additional revenue data for sheep versus cattle permit operations would be required before such conclusions would be warranted.

Wyoming

No statistically significant difference was found between the averages of the total forage utilization costs per AUM for the Thunder Basin National Grassland and the other federal and state managed grazing lands in Wyoming. However, costs were significantly lower at the 95 percent level of confidence for those allotments included in the survey in which deeded land accounted for more than half of the available forage. Since virtually all of the deeded land observations contained some federal or state forage supplies, regression analyses were run on the pooled set of public and predominantly deeded land allotment data. The regression results are presented in Table 19.

Table 19. Ordinary Least Squares Regression Results for Average Total Forage Utilization Costs, Per AUM, Incurred by Permittees and Nonpermittees in Grazing Livestock on Federal, State, and Deeded Lands in Wyoming: 1983.

R^2 / ($\bar{R}^2$)	Variable (T-Values in Parentheses)				Number of Observations
	Constant	AUM	ACRES	SHEEP	
0.033 (0.028)	+14.4508 (+22.66)	-0.0032 (-2.52)			194
0.027 (0.022)	+13.9210 (+19.88)		-0.00003 (-2.19)		194
0.044 (0.039)	+13.4040 (+21.44)			+6.469 (+2.92)	194

Factors thought to influence per AUM forage utilization costs in Wyoming included number of AUMs in the pasture or allotment (AUM), distance of the allotment or pasture from the headquarters ranch (DISTHQ), whether the allotment was held by an individual or in common (IND), the presence of mining, geological, and/or active timber harvesting operations in the allotment (ACTIVITY), class of livestock (SHEEP), and number of acres in the allotment or pasture (ACRES). As in the Nevada analysis, class of livestock was found to significantly influence grazing costs, with sheep permits being substantially more costly than cattle permits. However, two other variables -- number of AUMs and number of acres in the pasture of allotment -- were found to significantly influence forage utilization costs as well.

The results suggest that, on average, sheep permits cost about $6.47 more per AUM than cattle permits in Wyoming. For either type of permit, each additional AUM in the allotment or pasture reduced per AUM utilization costs by about 0.3 cents. As the number of acres in the allotment or pasture increased, per AUM costs also declined although by very little. A 1,000 acre increase in the size of the allotment or pasture would, on average, reduce the per AUM costs associated with its use by about three cents. The results relative to size of the allotment may be relatively meaningless, however, since AUMs would be expected to increase as number of acres increase. Regressions were run separately with acres and AUMs as explanatory variables due to multicollinearity problems (high correlation) between acres and AUMs.

National Grasslands of North and South Dakota

No significant difference could be found among the total cash and noncash forage utilization costs for the different National Grasslands with the exception of the northern-most area, the McKenzie County Grazing Association. Costs in the McKenzie area were found to be between $3.89 and $5.03 per AUM higher than in the other four surveyed areas.

Results from the various regression analyses in which statistically significant relationships were found between the explanatory variables and per AUM grazing costs are reported in Table 20. As in most of the other survey areas, the larger was the permitted use or AUMs in the allotment (AUM), the smaller were the utilization costs.

Table 20. Ordinary Least Squares Regression Results for Average Total Forage Utilization Costs, Per AUM, Incurred by North and South Dakota National Grasslands Permittees: 1983.

R^2 ($\bar{R}^2$)	Variable (T-Values in Parentheses)					Number of Observations
	Constant	McKenzie	AUM	DISTHQ	ACTIVITY	
0.177 (0.162)	+12.2272 (+15.534)	+4.3669 (+4.820)	-0.0021 (-3.77)	+0.0728 (+1.084)	+0.7142 (+0.768)	223

Statistical tests revealed a significant positive correlation between the incidence of mining and geological activity in allotments and location. These disturbances were most frequent in the McKenzie County and Medora Grazing Association areas. When dummy variables representing McKenzie and Medora were included in the equations, no significant relationship was found between costs per AUM and whether any significant (i.e., occurring for more than 20 days during the grazing season) mining or geological survey work was occurring in the allotment. However, in those equations from which the McKenzie and Medora dummy variables were omitted, such activity was found to lead to a significant increase in grazing costs. This suggests that the presence, in the McKenzie County Grazing Association area, of mining and geological survey activity may be associated with the higher per AUM grazing costs observed in that region.

Distance to the headquarters ranch and whether or not the allotment was held by an individual or in common had no significant impact on average total forage utilization costs.

Distances to headquarters tended to be less, and number of permitted AUMs in the allotment tended to be more, in the two northern-most grazing association areas.

There was reported to be little or no privately leased land available in at least some of the surveyed National Grasslands areas. Therefore, no direct comparison between the average costs of using the federal permits versus private leases can be made. An attempt was made to assess the influence that increasing percentages of federal AUMs (as opposed to deeded land) might have on the cost of using the permit. However, results were inconclusive. Comparison of National Grasslands utilization costs with private lease costs will not be possible until lease information collected by the Bureau of Land Management and Forest Service as part of the evaluation of the PRIA fee formula becomes available.

Black Hills National Forest

Although statistically significant differences were observed between average total forage utilization costs in different geographical regions on the Black Hills National Forest, the relatively small number of observations precluded separate regression analyses for these different regions. Factors thought to influence differences in observed costs among Black Hills National Forest permittees included number of AUMs in the allotment (AUM), distance of the allotment from the headquarters ranch (DISTHQ), whether the allotment was held by an individual or in common (IND), and the presence of mining, geological, and/or active timber harvesting operations in the allotment

(ACTIVITY). Of these four possible explanatory variables, only two -- number of AUMs in the allotment and distance from the headquarters ranch -- were found to significantly affect forage utilization costs. The regression results are presented in Table 21.

Table 21. Ordinary Least Squares Regression Results for Average Total Forage Utilization Costs, Per AUM, Incurred by Permittees in Grazing Livestock on Black Hills National Forest Allotments: 1983.

R^2 ($\bar{R}^2$)	Variable (T-Values in Parentheses)			Number of Observations
	Constant	AUM	DISTHQ	
0.340 (0.324)	+20.9111 (+12.23)	-0.0117 (-5.13)	+0.2433 (+4.88)	89

For the 89 allotments in the Black Hills National Forest sample, each additional AUM in the permit reduced per AUM costs, on average, by about 1.2 cents. Each additional mile from the headquarters ranch to the allotment increased per AUM forage utilization costs by about 24 cents. Distances to the headquarters ranch tended to be greater, and number of permitted AUMs in the allotment tended to be less, in the northern ranger district area. These results were generally consistent with those obtained in the Oregon and Idaho surveys.

Conclusions and Implications

It is possible to draw some general conclusions from the results of the permittee grazing cost surveys in the western and

Great Plains states. Two of the most apparent are (1) forage utilization cost structures vary widely among permittees, and (2) for many permittees the federal grazing fee is a small component of the total cost of grazing livestock on public lands. In contrast, private lease rates tend to be a much larger component of the total costs of grazing livestock on privately-owned lands. The results reported here suggest that the cost structures facing surveyed permittees on public lands differ from the cost structures facing the same permittees if they also lease privately-owned lands, but the average total costs of forage utilization in both instances are about the same.

While the sampling procedures used in Oregon and Nevada were nonrandom, and the results obtained from those two surveys cannot be assumed to be representative of all permittees in either state, neither are they necessarily nonrepresentative. The results obtained through tests of random versus nonrandom samples in Wyoming, and of separate random samples in Nevada, indicate that sample characteristics were indistinguishable on statistical grounds. This implies that in both cases the alternative samples, regardless of sampling procedures employed, were drawn from the same population, and therefore are representative of that population. This suggests that the Oregon and Idaho results may indeed be representative of all permittees in the two states.

In those areas which were surveyed, sheep permits tended to be more costly than cattle permits on a per AUM basis. Also more costly were smaller permits and permits for allotments farther removed from base operations. However, these three generally significant explanatory variables failed, in all cases, to

explain more than 40 percent of the observed variation in total forage utilization costs.

These results imply that the use of averages in determining a "typical" permittee's production costs, and/or in establishing the level of federal grazing fees, may be inappropriate on economic efficiency or statistical grounds. Average total costs are quite variable and cost distributions are asymmetrical. The grazing cost surveys were not designed to obtain information on differences in physical productivity, and hence net returns to livestock operations, among allotments. Notwithstanding these differences, the cost structures associated with public and private land livestock grazing are different. If public land forage values, or federal grazing fees, are to be inferred from private forage rental rates, these differences must be recognized. A complex cost adjustment process will be needed if accurate estimates of public forage values are to be calculated from prevailing private lease rates in the same region. Simple comparisons between the federal grazing fee and private lease rates can be misleading since the fee, and conceivably the private rental rate as well, fail to account for additional, and quite variable, costs incurred by the users.

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APPENDIX

Description of Cost Activities and Procedures Used in Estimating Nonmonetary Forage Utilization Costs

Description of Cost Activities and Procedures Used in Estimating Nonmonetary Forage Utilization Costs

The various forage utilization cost surveys resulted in estimates of the total (cash plus noncash) costs, by type of cost or cost activity, incurred by ranchers who graze livestock on public lands. In the following two sections of this appendix the individual cost components are described, and the assumptions and procedures used in estimating the associated values of their noncash components are presented.

Description of Cost Activities

In Tables 8-15, nine cost activities are specified. Each of these nine activities is described in more detail below.

1. **Turn-Out:** Transporting livestock to an allotment or pasture either by trailing or by trucking.

2. **Gathering/Takeoff:** Rounding up livestock and moving them off the allotment or pasture; full costs assigned to the allotment if their subsequent pasturage was deeded land; costs prorated between the present and subsequent allotment if moved to other public land.

3. **Routine Management:** Routine trips to the allotment during the grazing season including movement of stock within allotments or pastures, routine range rider expenses, and sheep herding costs.

4. **Maintenance:** Cash costs of parts, generator and pump fuel and lubricants, contract labor and equipment, and associated ranch labor costs and vehicle expenses.

5. **Salting, Feeding, and Veterinary Services:** Includes only the cash cost of these items; their application and/or distribution is included as a routine management expense.

6. **Meetings:** Meetings held with federal or state agencies or private land owners; necessary paperwork; associated office costs such as supplies and telephone bills.

7. **Death Loss:** Based on average number of animals lost in the pasture or allotment during the grazing season.

8. **Fees and Rents:** Lease cost on privately owned lands, generally charged on a head-month but occasionally on a weight-gain basis; grazing fee on federal or state-owned lands based on actual fees charged in either 1982 (Oregon and Idaho) or 1983 (all other survey areas); association fees if the permittee belonged to a grazing association.

9. **Other:** Flying costs, chasing stock due to gates being left open, monitoring rangeland condition, etc.

Assumptions Used in Estimating Monetary Values for Noncash Costs

There were five major noncash costs associated with forage utilization. These included unpaid family labor, horse costs,

death loss, vehicle mileage costs, and investment expenditures. Estimation procedures used in each instance are described below.

Unpaid Family Labor

There are at least two approaches for calculating the cash value of unpaid family labor. One is to determine its marginal contribution to ranch net revenues through mathematical programming models. The second approach is to use the average cost of hired labor as a conservative (i.e., low) estimate of the value of unpaid family labor.

Development of a mathematical programming model was felt to be beyond the scope and needs of the study. Therefore, in the original Oregon survey, average hired labor costs were calculated from 102 allotment observations for which hired labor data were available. This figure, which included wages, unemployment insurance, and, where applicable, fringe benefits, averaged $49.52 per ten-hour day. By applying the same per day value to a day of work provided by an unpaid family member, the implicit assumption was made that the value of family labor was at least as great as that of hired labor. In this respect, the $49.52 figure probably underestimated unpaid family labor costs.

Scanty data on hired labor costs were collected in most of the other survey areas. In some instances, extremely low daily wages were reported, thus suggesting that fringe benefits, such as room and board, must have been provided the hired labor, although these costs often were not reported. In addition, some interviewers assigned an arbitrary wage rate to unpaid family and neighbor (exchange) labor reflective of the interviewer's own

valuation of the labor provided. Due to the frequencies of these sorts of errors, $50.00 per ten-hour day was used in all areas except Oregon and Idaho (where $49.52 was used) as an estimate of the value of both hired and unpaid family labor. This value, while arbitrary, was considered sufficiently close to the actual figures calculated for Oregon and Idaho to permit its use.

Horse Costs

In the early stages of assessing the economic impacts resulting from the creation of wilderness areas on public lands, a Bureau of Land Management staff economist in the Oregon State Office calculated the costs of maintaining horses. Data used in the derivation of these costs were gathered through interviews with a professor in the Oregon State University Animal Science Department, with three Eastern Oregon county extension agents, and with one professional packer in northeastern Oregon. Based on a $1,000 purchase price, a $450 salvage value, a ten year useful life, and $750 a year in operating costs, the annual expense was determined to be $805. A conservative cost estimate was obtained by dividing this figure by 365 to get a cost of $2.20 per day.

A liberal estimate of the number of horses required during the grazing seasons was used to offset this conservative cost per horse-day figure. It was usually observed during the interviews that three or four animals were required per person for most management activities. Therefore, information on the total number of horses involved in the activity was collected, with each horse-day valued at the $2.20 figure. The same value was

used in all remaining areas surveyed in the western and Great Plains states.

Death Loss

In Oregon and Idaho, animals lost through death or disappearance were valued using 1982 cattle prices. The specific assumptions were as follows:

(1) Calves were valued at the price received per weaned animal. A simple average was used of the value of a steer calf (weighing 425 pounds and worth $65/cwt) and of a heifer calf (400 pounds at $55/cwt), yielding an average value of $247.50 for lost calves.

(2) Brood cows were valued at the sales revenue foregone from holding a replacement heifer to take her place, or $300 per lost brood cow.

(3) Bulls were assumed to cost $1,000, provide four years of service, and bring $500 as a cull animal. Loss was assumed to occur at the midpoint of their productive lives (or after two years). The loss to the rancher, thus, was assumed to be $602.20, which is the value of the final two years of discounted benefits to the rancher from the bull's use and the foregone revenue from selling the bull for slaughter. A 14 percent interest rate was assumed.

The values for lost animals used in the remaining areas were based on 1983 cattle prices. Thus the specific value estimates

were as follows: cows and calves - $261.50; yearlings - $413.00; bulls - crippled - $241.75, lost - $687.49; sheep - $38.00.

Vehicle Mileage Costs

In Oregon and Idaho, vehicle mileage costs were assumed to be 37 cents/mile for pickups, 55 cents/mile for pickups with a gooseneck trailer, $1.00/mile for two ton or bigger stock trucks, and $1.90 per loaded mile for a semi-trailer rigs. The last figure was based on commercial hauling rates. The assumptions outlined in Table A-1 were used to derive the other three cost estimates.

The values for vehicle use in the other survey areas were updated to reflect 1983 prices. These values used in the remaining areas were:

Pickups	$ .46/mile
Pickup & Trailer	$ .66/mile
Stock Truck	$1.05/mile
Semi-Trailer	$1.90/mile

Additional cost data were collected for vehicles used in the other areas that were not commonly encountered in the Oregon and Idaho surveys. The vehicle cost estimation procedure used to develop the costs reported in Table A-1 was used for dirt bikes and All Terrain Vehicles (ATC) yielding the following cost estimates:

Dirt Bike	$.20/mile
ATC	$.26/mile

Table A-1. Assumptions Used in Estimating Vehicle Mileage Costs for the Calculation of Per AUM Cash and Noncash Forage Utilization Costs in Eastern Oregon and Idaho.

Item	Vehicle Type: Pickup	Pickup with trailer	Stock truck
New price	$10,000	$13,500	$20,000
Salvage	$ 2,500	$ 3,300	$ 3,000
Miles/year	10,000	10,000	5,000
Years of use	6	6	10
Fuel consumption (mpg)	10	6	6
Fuel cost ($/gallon)	$ 1.20	$ 1.20	$ 1.18
Annual interest rate	14%	14%	14%
Annual tax/license	$ 10	$ 15	$ 50
Annual insurance cost	$ 80	$ 90	$ 140
Tire Cost	$ 320	$ 680	$ 1,500
Miles on set of tires	25,000	20,000	25,500
Annual maintenance	$ 150	$ 176	$ 350
Total annual cost	**$ 3,693**	**$ 5,496**	**$ 5,133**
Cost/mile	**$ .37**	**$ .55**	**$ 1.03**
Fixed cost/mile	**$ .22**	**$ .30**	**$ .70**
Variable cost/mile	**$ .15**	**$ .25**	**$ .33**

Additional use of farm machinery also was reported in some of the other survey areas. Using estimates forwarded by James R. Johnson, Range Management Specialist, South Dakota State University, after consultation with Herbert R. Allen of the Economics Department of South Dakota State University, the following two hourly costs were used for small (e.g., 45 horsepower tractor) equipment and large (e.g., 80 horsepower caterpillar tractor) equipment:

Small Equipment	$ 8.49/hour
Large Equipment	$15.76/hour

Improvement Expenditures

Cash and noncash contributions by permittees to improvements on their allotments were estimated in the year or years during which the expenditures were made. Each year's reported improvement costs then were inflated by the appropriate annual consumer price index (CPI) figure, with $CPI_{1983} = 100.0$. The total investment costs for the period 1963-1983, expressed in 1983 dollars, were then divided by 21 years to approximate an annualized average improvement expenditure as reported in Tables 10-15.

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