Public land survey for agricultural education
by Rahelimihajandralambo Adele Gislaine

A thesis submitted in partial fulfillment of the requirements for the degree Master of Science in Agricultural Education
Montana State University

Abstract:
Controversies over public rangeland are contemporary issues not expected to be resolved in the near future. This study was designed to capture factors that bring conflict over the uses of public rangeland with a focus on agricultural education needs as part of the conflict resolution process. Factors included rangeland natural resource importance and condition, livestock grazing and public ranching, public land manager decision-making motives, multiple use philosophy, and actions to improve rangeland conservation and management. The study surveyed ranchers, Forest Service employees and Bureau of Land Management employees involved in federal public rangeland management in Montana. The . survey used a Likert-type attitudinal instrument. Chi square test compared the groups ' attitudes to determine uniformity or discrepancies of perceptions on selected parameters. Borich's method and open-ended questions were applied to capture educational needs. Data revealed that all groups agreed on potential uses of livestock grazing as a natural resource management tool, the importance of public ranching to the community, most factors that affect public land managers' decision-making motives, major sources of conflict over public rangeland uses, and actions needed to improve the management of public rangeland. Between groups statistically significant different perceptions were observed relative to rangeland condition, management behavior of ranchers on public rangeland, impacts of ranching on the cattle industry, and relationships between permittees and public land managers. All groups perceived needs to improve the natural resource inventory process by utilizing significant input from ranchers and to implement flexible grazing management methods. There was a perceived need to implement and/or strengthen coordinated/cooperative/participatory methods in management of natural resources. In conclusion, the study revealed a need to separate out the effects of livestock grazing and other uses on public rangeland. There was a perceived need for the use of scientifically and legally valid recording systems for the management of the natural resource and for educating environmental groups and the general public on the foundations of natural resource conservation and management. The College of Agriculture in cooperation with public land management agencies should deliver education to concerned groups about public land conservation and management.

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APPROVAL

of a thesis submitted by

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This thesis has been read by each member of the graduate committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Date 06/24/96.

In memory of

* my father who always told me that "education would be my greatest inheritance;
* my grandparents for their love and for teaching me the value of wisdom and righteousness;
* my father-in-law for accepting this project even though it was against his will.

I would like to dedicate this thesis to

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ABSTRACT

Controversies over public rangeland are contemporary issues not expected to be resolved in the near future. This study was designed to capture factors that bring conflict over the uses of public rangeland with a focus on agricultural education needs as part of the conflict resolution process. Factors included rangeland natural resource importance and condition, livestock grazing and public ranching, public land manager decision-making motives, multiple use philosophy, and actions to improve rangeland conservation and management. The study surveyed ranchers, Forest Service employees and Bureau of Land Management employees involved in federal public rangeland management in Montana. The survey used a Likert-type attitudinal instrument. Chi square test compared the groups' attitudes to determine uniformity or discrepancies of perceptions on selected parameters. Borich's method and open-ended questions were applied to capture educational needs. Data revealed that all groups agreed on potential uses of livestock grazing as a natural resource management tool, the importance of public ranching to the community, most factors that affect public land managers' decision-making motives, major sources of conflict over public rangeland uses, and actions needed to improve the management of public rangeland. Between groups statistically significant different perceptions were observed relative to rangeland condition, management behavior of ranchers on public rangeland, impacts of ranching on the cattle industry, and relationships between permittees and public land managers. All groups perceived needs to improve the natural resource inventory process by utilizing significant input from ranchers and to implement flexible grazing management methods. There was a perceived need to implement and/or strengthen coordinated/cooperative/participatory methods in management of natural resources. In conclusion, the study revealed a need to separate out the effects of livestock grazing and other uses on public rangeland. There was a perceived need for the use of scientifically and legally valid recording systems for the management of the natural resource and for educating environmental groups and the general public on the foundations of natural resource conservation and management. The College of Agriculture in cooperation with public land management agencies should deliver education to concerned groups about public land conservation and management.

INTRODUCTION

Managing and preserving the environment is a leitmotif worldwide, since the Stockholm Conference on the Human Environment in 1972 (MacNeil, 1989). More than ever the human community faces a number of problems: threats to human survival due to diseases, food, and social insecurity (Brown, 1994), threatened loss of biodiversity, pollution, global climatic changes, and soil degradation (Clark, 1989; MacNeil, 1989). All of those problems have increased awareness of the necessity of better conservation and management of all types of natural resources. The greatest concern that drives politicians, scientists, economists, environmentalists, ecologists, demographers, agronomists, developmental agencies, and the list goes on, is the dilemma between an exponential world population growth and high depletion rate of the non-elastic global natural resources (Johnston, 1988; MacNeil, 1989). Several media have brought the world to this point: (1) an increasing body of knowledge and more understanding of biological processes in different ecosystems, (2) an increasing efficacy, in terms of speed and volume, of information exchanges, and (3) consequently to the previous factors an increasing concern, at any level of our community, for preserving the environment (MacNeil, 1989).

All of these facts have led to different "environmentally sensitive policies," regulations, and management plans, supported by numerous publications based on scientific finding and facts (Johnston, 1988).

In spite of this dramatic increase in the knowledge base, biological processes and their complex interactions with human parameters are not understood well enough to solve the dilemma of natural resource preservation and population growth (Wilson & Macleod, 1991). It is now common to hear about scientists and experts working as much as possible with the new trend of "interdisciplinary team," "holistic approach," and "integrated approach" (Bentley, 1994; Donart, 1994). Still, debates persist among: (1) scientists from different but related fields and disciplines in ecology and all natural resource management, (2) policy makers within different regulatory agencies, and (3) different interest groups such as environmentalists and primary producers (Holloway & Guy, 1994). One would wonder if some parts of the population, having fulfilled their basic needs according to Maslow's hierarchy, blame the primary producers for all natural resource degradation without considering the importance of agricultural production, even though claims have arisen that the cost of natural resources conservation had negative impacts on overall production and economic development (Bartlett, 1994).

This situation focuses the attention on primary producers, especially "ranchers." Most of the time, livestock production practices in general are pointed out to be causes of one or another type of natural resource degradation

like soil erosion, non-point source water pollution, and loss of biological richness. This is true in developing as well as in developed countries like the United States of America. It is also true, on the other hand, that ranchers tend to reject environmentalists of any kind. Complaints are raised from individuals that regulations based upon sound scientific findings do not take into account the objectives of ranch production nor consider ranching as one productive component of the economy.

This controversial situation has produced a new wave of approaches like "ecosystem management," "landscape ecology," "integrated development," and "sustainable development" to integrate the "human parameter," whether as actors in the change processes or as partners in the processes of needs assessment, evaluation, and decision making. Another new approach, "integrated research-development," focuses mainly on associating the primary producers in field research with experimental activities. More wildly, advocates of "participatory approaches" and "indigenous" or local-based "knowledge systems" argue that the primary producers have to be the cornerstone to any decision making, actions, and issues that would affect their own environment.

This challenging idea of putting the primary producers as center of interest in any change processes merits more attention on the part of all entities, indeed scientists, change agents, and educators at all level, in formal as well as non-formal settings. This option does not have to dilute the focus that there is a need to balance the interests of food production and natural resource conservation.

Thus, all parts of our community have to be responsible in working out better solutions to resolve this critical dilemma of agricultural production and natural resource conservation. The focus of this study is to find a workable methodology that will include systematically the primary producers of interest, here the livestock producers, in the process of decision making that deals with rangeland natural resource conservation and livestock production.

Statement of the Problem

The purposes of this study were (1) to explore and describe factors that affect, positively or negatively, the behavior of Montana cattle ranchers toward natural resource conservation practices and, taking into account those factors, (2) to develop a decision-making process model that integrates systematically the interests of the primary producers with the concern of natural resource conservation.

Need for the Study

The increasing conflicts between primary producers and environmentalists, in general, and livestock producers and conservationists, in particular, are signs of social action process failure. Those conflicts indicate that there is a need for a change.

First, there is a need to (a) determine factors that bring conflict between farmers and conservationists and (b) define an approach that would resolve the

conflicts. Second, there is an educational need to change the view of environmentalists and conservationists that agricultural production is a "competitor for natural resources," and simultaneously there is a need to increase the awareness of the urban population of the importance of agriculture. Third, agricultural education needs to follow changes and dynamics of the environmentally concerned community. Consequently, there is a need to adjust agricultural education in its roles, methodology, and target groups to be responsive of our community's natural resource management and conservation needs. Fourth, there is a need to reinforce the social action process, that it will take systematically into account both agricultural production interests and objectives and natural resource conservation concerns.

Objectives

The objectives of this study were to:

(1) determine convergence and/or divergence of concerns about range management taking into account the ranchers and agency responsible for natural resources conservation objectives; and

(2) determine potential roles of agricultural educators in conflict resolution between land use practices management and conservation.

Assumptions

Three assumptions were made in this study:

(1) There are conflicting interests between livestock producers and natural resource conservationists.

(2) There are identifiable factors that are determinant to the relationships between the behavior of ranchers and federal public land managers.

(3) Agricultural education, whether in formal or non-formal settings, has a major role to convey accurate information to both ranchers and regulatory agencies and to bring the involved parties into the social action process to solve the dilemma of primary production and natural resource conservation and management.

Limitations

This study was limited to (1) cattle producers (whether or not they operated other types of production) that leased federal public lands for grazing in Montana during the summer 1995 and (2) employees of the United States Forest Service (USFS) and the United States Department of Interior--Bureau of Land Management (BLM) who dealt with public land grazing and related fields inside the state of Montana during 1995.

Definition of Terms

Natural resources: All non-manufactured resources that support life development.

Sustainability: A concept that any type of exploitation of natural resources or its management at least maintain the original rate of resource renewal and slow down the consumption of non-renewable resources by the use of alternative goods.

Environmentalist: An individual or group whose concerns and efforts are directed at preserving the environment at any cost.

Primary producers: Individuals or groups that produce raw goods. In economic concept, they are the first chain in the process of production.

Agricultural educators: Individuals, organizations, or institutions that are involved directly or indirectly in educating people in fields related to agriculture. The education process can be formal or informal.

Change agents: Individuals or political entities that bring about changes in defined areas of the community.

Social action process: A process that is installed in a democratic community to create debate between divergent entities or interests groups about issues that are crucial at that precise moment in time.

REVIEW OF RELATED LITERATURE

After the World Summit on Humans and Environment, in 1972, the world community realized that the world population has increased dramatically, more than three times its original level since the beginning of the century. Parallel to it, the consumption of world goods has increased more than 20 times. MacNeil (1989), Secretary General of the World Commission on Environment and Development, asked if "there is any way to meet the needs and aspirations of the five billion people now living on the earth without compromising tomorrow's eight to ten billion to meet theirs" and if the "growth on the scale projected over the next one to five decades can be managed on a basis that is sustainable both economically and ecologically" (p. 155). Those two "provocative questions and critical challenges" (Thrupp & Haynes, 1994, p. 3) underline a complex and multiple-factorial problem that the global community has to face and solve. The problem includes human population, its growth and values, natural resource conservation, management, economic policy, and socio-economic development of the human community, not only at the global or governmental level but also at the local level. Although there are profound concerns about the multiple-factorial characteristic of sustainability of natural resource uses and management, conflicts between different entities of agricultural production and conservationists are common at all levels of our community. Those facts require a focus and

understanding of "why do planet wide environmental problems arise and why do they persist?" (Johnston, 1988, p. 1).

Human Population Growth and Its Effect on Natural Resources

Brown (1994), in his article entitled "Facing the Food Insecurity," reported that world grain and fisheries production had increased respectively 2.6 and 4.6 folds from the middle of this century to the end of the '80s. However, the trend has reversed. From 1984 to 1993 the world grain production declined 11% per capita. This situation was brought about by an increasing population growth rate and depletion of natural resources due to over exploitation (pp. 177-195). Adding to that, Johnston (1988) emphasized that human population growth is not the only "source of global pressure on the natural resources" (p. 1). There is also the problem of increasing consumption per capita. Consequent to the human population growth and its effects on natural resources, Brown (1994) stated with a note of hopelessness that "the bottom line is that the world's farmers can no longer be counted on to feed the projected additions" to the world population and that "achieving a humane balance between food and people now depends more on family planners than on farmers" (p. 178). These statements show that the population and its growth do affect the natural resources.

Effects of Population Growth and Economic Development on Agriculture

Another consequence of human population growth is economic development and vice versa economic development favors human population growth. The dynamic pattern of this tandem results in expanding urbanization. The urbanization phenomenon, relative to agriculture and agricultural lands, has two effects. The first effect is the decline of agricultural lands due to urban development. The second effect is a relative shift in population distribution. Barrows (1988) observed that the rural population in industrialized countries is indeed becoming a minority.

In the case of the United States of America (USA) and particularly the state of Montana, statistics are revealing. Nationwide in the USA, Kellogg et al. (1994) reported the following ten year (1982-92) changes: cropland and rangeland decreased respectively by a net of 39 million (-9% of the total) and 10 million acres (-2.4%). Inversely, "developed land increased by 14 million acres" (+18% since 1982). In Montana, in 30 years (1963-93) all land in farms decreased by 7.3 million acres (-10.9%), and for the same period the number of farms lost was 5,000 (-17%). The number of farms in Montana has declined steadily since 1920 resulting in a 57.75% loss from 1920 to 1994 (Montana Agricultural Statistics Service). Relative to the population distribution effect, representatives of rural population and agricultural producers have become such a minority in the political arena that they need a strong coalition to be heard (Shelhamer, 1994, personal communication).

Population Distribution, Agricultural Production, and Natural Resources

As explained by Barrows (1988), the fixed characteristic of land necessitates that it be shared among all parts of the population. Without agreement about the way to share or manage the land, a fixed good, conflict arises. The actual patterns and dynamics of the natural resource concerns show more conflicts than agreements. Typically urban populations require more space not only for urban development but also for recreational uses. Another pressure that arises from the urban population is concern about natural resources conservation. Meyer (1993) remarked that agriculture is seen as a "competitor to natural resources" but not a part of it or a life supporting element (p. 881).

Rangeland Natural Resources Conservation and Management

The concern for rangeland, related to livestock production for human food, is well depicted by Schuster (1993):

> The contribution of rangelands to the earth life support system and economic welfare of its people is tremendous. As the demand on rangeland resources escalates with increasing population pressure, the need for sustainable, multiple use management will become stronger. Socio-economic and political pressure will continue to bring about changes in range resource uses. (p. 63)

In general livestock grazing is seen to be the worst pressure on rangeland. Non-agriculturists charge that livestock grazing causes natural resource degradation, loss of biological richness, soil erosion, riparian degradation, and non-point source water pollution, even though these facts are not always supported by scientific

findings (Wilson & Macleod, 1991, p. 175). Still, rangeland users and livestock producers have to face "several socio-economic-political issues impacting rangelands and rangeland resource management" (Schuster, 1991, p. 61).

Problems Relative to Rangeland and Rangeland Management

The problem relative to rangeland exploitation and management impacts on natural resources is the inability to show "concrete evidence . . . of the effects of overgrazing . . . as opposed to the resource base" (Wilson & Macleod, 1991, p. 61). Rangeland managers need to "recognize and integrate ecological relationships in order to achieve short and long term goals" and do so without affecting "the ability of the rangelands to produce the goods and services necessary to basic needs (Rowan & White, 1994, p. 338). However, Thomas remarked that if "grazing can be modified or eliminated if considered a pressure to the health of the ecosystem, who is to determine whether or not it is detrimental." He also claimed that the "USDI-Bureau of Land Management and USDA-Forest Service proposed rule changes for public land grazing" that were "disturbing to ranchers who depend on public land" (1994, p. 149).

In the case of Montana, the situation is controversial. Even though ranchers estimated losses from wildlife using private forage and grazing at $12 million for the overall livestock industry, ranchers nonetheless showed positive attitudes toward big game (Lacey, 1992). Ranchers did show little consideration toward environmentalists and conservation strategies. From range extension

specialists' point of view, some policies, like those relative to overgrazing or riparian conservation did not have foundation. Water quality policies were the exception (Surber, 1994, personal communication).

Rangeland Resource Management and Natural Resource Conservation Dilemma

These controversial facts call for alternatives dispute resolution in subject matters relative to natural resources preservation and management (Torell, 1993). Among ten recommendations given by Donart, president of the Society for Range Management, the following are significant:

> Development of consensus building to obtain agreement and avoid conflict; expansion of educational systems for managers, resources users, landowners, public officials . . . focus on pro-active programs to integrate more scientific data and information into policy process; revising the federal cost-benefit guidelines to reflect contemporary resources economics. (1994, p. 111)

METHODOLOGY

As this study was exploratory and descriptive, it used an attitudinal survey instrument. The survey included three groups that dealt concurrently with rangeland natural resource conservation and management and livestock production: livestock producers, Forest Service (FS) employees, and Bureau of Land Management (BLM) employees.

Population

Subjects were classified into two categories: livestock producers and federal public land managers from the Forest Service and Bureau of Land Management. The first category comprised ranchers that operated cattle enterprises on the federal public grazing allotment in Montana during the summer of 1995. The latest updated sampling frames, respectively from Montana FS and BLM, were used to select livestock producers. It was understood that cattle producers can use grazing allotment managed by both FS and BLM. Also, a rancher can operate under several permits inside one agency, and some permits are utilized by several ranchers. Since there was no means to merge the two sampling frames and eliminate subjects that run several permits (either inside one agency or both agencies) and the two clusters were of unequal sizes, the sampling procedure was based on one-stage cluster sampling of unequal size clusters with probability

proportional to the size of clusters based on the statistic of permit numbers given to the researcher by the agencies (Lee et al., 1989). Since the sampling frames did not distinguish the type of livestock operation run under the permit nor the region where the subjects operate, no further clustering nor stratification was done. However, the researcher estimated the total size of the population on the statistic given by the agencies with the assumption that all listed permittees were operating cattle enterprises. The elimination of selected permits that did not fit this population is explained in the survey instrument design. The final sampling design adopted in this study is then a one-stage cluster sampling of unequal clusters with probability proportional to the estimated size of the clusters (Lee et al., 1979).

Based on this adopted sampling procedure the population size required an estimated sample size of 360 sample units (permit number) to be statistically sound at α =.05 (Krejcie & Morgan, 1970). However, given that the information relative to the subjects of interest was limited, the sensitivity of study, and the knowledge that spring is not the best time of the year to survey cattle producers, the researcher over-sampled by 40%. The over-sampling was based on results from the Montana Ranch and Farm Survey (L. Irby, November, 1995, personal communication) conducted at Montana State University. The subject selection was produced through simple random sampling within the clusters using random numbers generated by MSUSTAT (Lund, 1994).

The second category of the population was the federal public land manager employees from BLM and FS who had worked with the grazing allotments for at least one year in Montana. The small size and ready availability of the population list led the researcher to conduct a census for this category.

Survey Instrument Design

Since no survey instrument was available to survey either livestock producers or federal land management agency employees about the impacts of livestock production from public grazing allotment on rangeland management systems and conservation, the researcher developed a new survey instrument. The logic of the instrument development was based on different claims made by ranchers, environmentalists, and range conservationists as identified by a review of literature, conversations with livestock producers and extension agents during the researcher internship, discussions with professionals in range management science and related fields and individuals that worked on ranches using public grazing allotment.

The collected information was compiled and classified into the four generic domains: (1) natural resource base, (2) livestock grazing and public ranching, (3) federal land manager management approach and public relations, and (4) multiple use and its philosophical foundation. The survey instrument was designed to capture uniformity or differences of perception among livestock producers and federal land managers about these generic domains. It was

assumed that significant discrepancies in perception were a source for disagreements and conflicts over the use of public land resources. The survey was organized to assess agricultural education needs and at the same time reduce researcher bias.

Survey Instrument

The survey instrument was printed as a nine-page booklet (Appendix B). The front cover presented the title and year of the study, the institution name, and a thank you for all categories. The front cover of the instrument sent to livestock producers had additional information. A series of statements was presented to eliminate selected subjects that did not fit the population characteristics, using the procedure adopted by the Montana Ranch and Farm Survey (L. Irby, November, 1995, personal communication).

The back of the front cover explained (1) the purposes of the study, (2) the participants in the study, (3) directions for completing the instrument, and (4) contact number for additional information or comments. The core of the instrument had six sections. The first five sections used mostly attitudinal scales based on the principles of "methods of scale construction" (Shaw & Wright, 1967, p. 3). These first five sections were submitted to both livestock producers and federal agency employees without modification. The method was adopted to measure the perceptions of both groups on the same items so that measurement errors and bias would be limited.

The first section was designed to measure which natural resource base constructs were of perceived importance for both livestock producers and federal employees. At the same time, it measured how both groups assessed the perceived current health and condition of the rangeland natural resource base of interest such as vegetation status, soil components, water quality and supply, and riparian areas. These two distinctive constructs divided this first section into two parts.

The first part evaluated the groups' perception of importance of each natural resource of interest on a scale of seven units ranging from 1 to 7. One constituted the lowest negative answer "not important at all" and seven the highest positive response "very important." The neutral point was four which stated "uncertain."

The second part of the section evaluated the perceived current health and condition of the range, again with a continuum scale of 1 to 7. One constituted the lowest negative unit "extremely decreased" and seven the highest positive unit "greatly increased." The neutral point four ("stable") meant no decrease nor increase. An eighth column "na" meaning "not available" was added to the second part so as not to force the respondents to address items that may not exist in their allotment. Another row was also added at the end of the section to give the respondents an opportunity to address information on specific natural resources of importance but not addressed in the section.

The second section measured the perception of both livestock producers and federal land managers about livestock and ranchers using public grazing allotments. This section also had two parts with a seven unit scale. The scale was built to capture opposite opinions with one being the negative lowest rating of "strongly disagree" and seven being the positive and highest rating of "strongly agree." The continuum scale had a neutral point of four for "uncertain." Even though the researcher was aware of the possibilities of statistical difficulties of this neutral point, the choice was dictated for two reasons: (1) a logical flow of statements in the scale and (2) discussions with ranchers and a panel of experts revealed that some items may be out of the scope of experience of certain participants. This logic and background was also applied to the scale construction of sections two, three, and four. Given the underlying philosophy of the scale, the first part of this second section was designed to assess the perceived impacts of livestock grazing given the conditional statement "under proper management." The emphases were the impact of livestock on the natural resources base, on recreational value of the public land, and the potential of livestock grazing as a natural resource management tool.

The second part assessed the perception of each group about ranchers using federal public allotment for their livelihood with consideration to (1) livestock producers' contribution in developing the rangeland for different uses, (2) their influences and importance for the community, and (3) their

influence on the management of natural resource conservation policies and management.

The third section evaluated the underlying foundation of natural resource management. It was divided into four parts. The first two parts assessed motives that drive public land managers in their natural resource management decision making. The third part evaluated the perceived types of relationship between public land managers and permittees. These three parts used the same attitudinal scale as section two. The fourth and last part in this section was an open-ended question. It inquired the written reflection of the participants about the best approach to improve range management.

The fourth section of the instrument dealt with potential sources of conflicts relative to rangeland and actions that may be taken to resolve those conflicts. It had five parts. The first part addressed claimed sources of conflict relative to the uses of public rangeland. The second part evaluated the perceived best action toward the management of public rangeland. The third part addressed what should be the primary focus on public rangeland management based on the concept of multiple uses. These three parts used the adopted attitudinal scale. The fourth part was an open-ended question. It evaluated the participants' definition of the concept of multiple uses. The last part assessed the perceived importance of selected items pertaining to multiple uses by asking participants to rank items. The selected items were classified as commodity and amenity production oriented.

The fifth section was a compact approach to determine the agricultural educational needs for the management of the rangeland natural resources. Based on the review of literature 20 selected items were submitted to the participants. The competencies of interest were related to three areas: (1) basic sciences relative to the natural resource base, (2) management oriented competencies relative to natural resource conservation and livestock production, and (3) socio-economic competencies as they pertained to public relations as advocated by new trends such as ecosystem management and rural participatory approach. The section had three built-in parts. The first two parts used an attitudinal scale. These parts were designed following the Borich (1980) educational needs assessment method. The first part evaluated the perceived level of competencies of the participants. It used a seven unit scale range on a continuum from the lowest point "do not have knowledge at all" to the highest point "very knowledgeable" without a neutral point. The second section evaluated the perceived need for each selected competency. The scale was again a continuum of seven units ranging from a lowest point "no need" to the highest level "strongly needed" without a neutral point. The researcher recognized that the statement "uncertain" in the middle of the scale might lead one to interpret it as a neutral point; however, it was assumed that if the participants selected the lower levels of the scale, "no need" to "little need," they indicated a more precise perception of their needs. If participants were uncertain, their need for that item was assumed to be greater in the sense that they most likely did not have enough background

of that particular competency to make a firm decision. The third part of the section evaluated the major knowledge sources of the participants. Five sources: books, workshops, life experiences, course work, and Extension Service, were identified. The selection of the sources was based on discussions with livestock producers, extension professionals, and the researcher's graduate committee.

The sixth and last section, unlike the five first sections, had different contents for the two categories of population. It was designed to fit each type of participant activities due to the specific structure of the study (public land management nested within livestock production). The sixth section submitted to the ranchers was designed to collect information relative to the overall operation and demographics of the respondents. On the other hand, the sixth section administered to the public land managers collected information about overall allotments under the management of the respondent and his/her demographic profile and educational background. One common question submitted to both categories for this section was the perceived adequate and fair grazing price.

The six sections described above constituted the main core of the survey instrument. However, due to the extent of issues on livestock production from public land, a blank page was included for participants to address comments either on the study or the survey instrument and any issues relevant to the study.

Test for Validity of the Survey Instrument

A draft of the survey instrument was submitted to a selected panel of experts at Montana State University--Bozeman (MSU--Bozeman). Due to the time constraint of the researcher no pilot test was conducted. However, the survey instrument was submitted to senior students having the experiences of public ranching to ensure the content and vocabulary used reflected the day-to-day language of the livestock producers.

Test for Reliability of the Instrument

A reliability test was computed using a two-way Anova (Schuessler, 1971) for section one, parts one and two, and sections two, three and four including all items as a pool for each category of population. Separate reliability tests for each section were determined to show the internal consistency of each component of the survey for future uses. The separate reliability test computations for the two categories of population, on the other hand, were dictated by concerns for external validity of the survey instrument since the study in essence surveyed two distinct populations. The computation procedure itself was applied after cleaning the data (i.e., after eliminating incomplete responses) using a two-way analysis of variance without replication.

Data in Table 1 show that reliability test results ranged from 0.685 to 0.909 and 0.528 to 0.884 for the livestock producers and public land managers. Overall, the reliability yielded higher levels on the part of livestock producers than public land

Table 1. Reliability results from each section and part of the instrument.

Respondent category	Section/Part				
	One/One	One/Two	Two/All	Three/All	Four/All
Livestock producers	0.909	0.772	0.685	0.801	0.694
Public land managers	0.884	0.650	0.528	0.690	0.578

managers. This fact could be explained by two reasons. The survey instrument was designed from the livestock producer perspective due to the nested structure of the population. As a result, the researcher thought that the instrument reflected more accurately the environment of livestock production and public ranching than public land managers. Consequently, the reliability attained the acceptable to high recommended reliability levels (0.70) (Peterson, 1994). Reliability results for public land managers ranged from 0.884 to 0.528. Results were at acceptable levels for section one, parts one and two, and section three. These results indicated that public land managers have consistent perceptions toward the assessment of natural resource importance and conditions. They also seemed to have a consistent view of their decision-making motives. However, public land managers had split opinions toward livestock production using public land and public ranching and causes of conflicts on public rangeland and actions to take for the management of public rangeland. The analysis of frequency distribution for public land managers showed bimodal frequency distributions for several items in these sections. Thus, the reliability test results from these sections were lower.

Survey Calendar

The survey instrument was reviewed and accepted by the researcher's graduate committee at the end of December 1995. The first survey mailing was sent out on January 15, 1996, accompanied by a letter explaining the objectives and purposes of the survey. Two weeks later (recommended waiting time), the researcher sent the first postcard follow-up to the non-respondents. The postcard emphasized the importance of the participation of the potential respondents. After another two weeks of waiting time, the researcher sent the third follow-up containing another copy of the survey instrument and a letter stating the turn-in deadline as March 1, 1996. At that point, selected livestock producers with incorrect addresses (counted by the number of returned postcards) and forwarded addresses known to be unavailable were dropped from the sample without replacement. No further follow-up was done due to the relatively small gain (less than 5%) in additional responses from the livestock producers and recognition that they were in the middle of the calving period. The return rates from the public land managers (67.5 and 85.7%, respectively, for FS and BLM) was judged satisfactory.

Data Analysis

Data collected were classified into two categories: qualitative from open-ended questions and quantitative from the attitudinal survey. Qualitative data were processed on word processors distinguishing the group characteristics of the

respondents and the corresponding section in the survey. All quantitative data were coded and entered in spreadsheets, using Microsoft Excel 5.0 (1994). The codifications were made to keep track of the type of respondents such as livestock producers, FS, BLM, and sections of the survey instrument. To begin the analysis, the researcher computed a summary statistic (mean and standard deviation) and frequency and percent frequency distributions for each section and each item to determine the behavior of the collected data for each group. Then, depending on the nature and structure of the data, different statistical tests were applied.

Chi squares ($\chi 2$) were computed for each item for sections one, two, three and four using a two-way contingency table from MSUSTAT (Lund, 1994). The choice of this univariate analysis was determined by the non-parametric nature of the data, and comparative purpose of the study. The computations of χ^2; however, proceeded with two constraints. First, for χ^2 to be accurate, it required that at least 80% of E_{ij} (expected frequencies) be greater than five (>5) (Strohmeyer, E., EDCI 402, personal communication). Due to the relatively small size of the BLM population and the dimension of scale used, two to three scales were collapsed into one to permit the statistical computation. Second, due to the relatively high proportion of "undecided" responses among livestock producers, which brought statistical "noise" into the χ^2 computation, the researcher chose to drop the fourth scale in the χ^2 computation of sections two, three, and four, so that the comparison between groups was only about the

strength of agreement or disagreement. This approach may lead one to consider a loss of information; however, the researcher did not think so for two reasons: (1) χ^2 is a very flexible statistical test. Due to its non-parametric characteristic, "statistical significant results from χ^2 would also be significant for a more powerful test like Student-t test" (Popham & Sirotnik, 1992, p. 251), and (2) the interpretation of the result included all information from the summary statistic, frequency distribution, and χ^2.

Spearman-rank correlations were computed for the multiple use comparison (section four, part five) for all the groups. Data from respondents who ranked or chose only five uses were computed for the frequency distributions. Then, each count with precise rank was multiplied by an inverse score so that the highest rank "1" was given a highest score "5." Then a total score was computed for each item for each group. These total scores were ranked based on the score they yielded. For each group, the first rank was given to the item with the maximum score. Tied ranks were given the same rank as before the computation. The results of this ranking were then used to compute the Spearman-rank correlations.

A weighted discrepancy score from Borich's (1980) model was computed for section five, parts one and two. First, the mean for each item was calculated using the overall observations. Then, each observation from section five, part one was matched with and subtracted from its counterpart in section five, part two to get the discrepancy scores for each item and each respondent. Observations without a matched pair were dropped from the computation procedure. Next,

each discrepancy score was multiplied by the knowledge needs mean of that item to get the weighted discrepancy score. All the weighted discrepancy scores from each item and each respondent were used to compute the weighted discrepancy mean for that item for each group. Finally, the weighted discrepancy means were ranked, first being the means with the maximum value for each group.

RESULTS AND INTERPRETATION

To facilitate the presentation and interpretation of the results of the study, the researcher chose to describe the response rate for characteristics and demographics of the respondents and interpret the overall results for each section and then each item inside the section. The convergence and/or divergence between the three groups of interest will be described.

Response Rates

Response Rate from Ranchers

A total of 591 livestock producers were randomly selected from a population of 4863. After deduction for incorrect addresses and unavailable selected subjects, 570 participants were mailed a survey instrument. The researcher received 207 surveys back resulting in return rate of 36.3%. Among the returned surveys 151 (73.0%) were useable. The data in Table 2 reveal the reasons that the survey instruments were not useable.

The information in Table 2 shows that non-useable surveys constituted 27.0% of the returned surveys. Due to sampling frame error, the researcher expected that a certain proportion of the sample would not meet the population criteria.

Table 2. Frequency distributions and reasons for non-useable surveys.

Reasons	n	%*
Returned without any further information	10	17.8
Indicated operating cattle production but did not participate	4	7.1
Owner only	22	39.4
Selected subjects operating different production	12	21.4
Retired or sold cattle operation	5	8.9
Completed the survey but non-useable	3	5.4
Total	56	27.0**

*Percentage relative to the non-useable surveys.
**Proportion of non-useable relative to all surveys returned.

Of the non-useable returns 69.7% were due to owner only (22), operating different livestock operations (12), and retired people (5) that did not fit the population criteria. Comments worth being reported came from four different respondents saying that cattle operation was no longer "economically feasible" and "the economic return from cattle production using public grazing allotment was not worth the trouble from using public land" (not shown in table).

Ten non-useable returns came from respondents who did not indicate the reason why they were in the sampling frame or why they did not fill out the survey, even though they were given the opportunity. An explanation for why these people did not want to participate in the study could be summarized by the comments of this non-useable respondent, "Surveys of this type seem to assume that permittee will have some influence regarding the grazing on his/her leased federal land." In fact they perceived that the "final authority on any disagreement

would be resource manager" rather than the local ranger who would "listen to their idea or suggestions." The respondent concluded, "Since we have no effective influence in the above (issues regarding the management of the public grazing allotment), our opinions are useless; therefore, there is no reason to complete a survey of this type." The feeling of this respondent might indeed indicate the malaise regarding the issues on public land management.

The return rates of useable as well as non-useable were satisfactory given the quality of the sampling frames available and the length of the study.

Response Rate from Public Land Managers

The researcher sent the survey instrument to 115 public land managers, 35 for BLM and 80 for the FS. Thirty of the 35 BLM sampling units returned useable instruments resulting in an 85.7% response rate. Fifty-four FS respondents returned the survey resulting in an 67.5% response rate. Fifty-one (94.4%) of the FS surveys were useable. Among the three non-useable, one subject did not volunteer to participate in the study for two reasons. The subject perceived that (1) "misinformation and biased research from land grant universities have done much to inflame the controversy over the use and management of public land" and (2) the subject questioned the research institution's "ability to objectively review the issue of grazing on public land." Once again, the comment underlines a complex issue relative to the grazing on public land. The second non-useable survey came from a person who just took a position in Montana. Since, the researcher had limited the participants to those

who had at least one summer experience in Montana, this response was dropped from the study. The last response dropped was incomplete.

Demographic Analysis

Demographic Data of Livestock Producers

Due to the incompleteness of the respondents' surveys, the number of responses varies in each table. Among those (145) who gave their gender, 93.1% (135) were male and 6.9% (10) were female. The age distribution is presented as interval data in Table 3.

Table 3. Frequency distributions of age of livestock producers (N=120).

Age (years)	n	%
<=40	13	10.8
]40 - 50]	40	33.3
]50 - 60]	33	27.5
> 60	34	28.3

The majority (60.8%) of respondents were between the age brackets 40 to 60 years. Younger generations were under represented as 10.8% (n=13) were under 40 years of age. On the other hand, the generation of 60 and over constituted 28.3% of the respondents. The mean age was 54, with the youngest respondent being 25 and the oldest being 80. The distribution seemed to follow the age groups of agricultural operators in Montana.

This distribution was also reflected in the years of experiences in the business as shown by the data in Table 4.

Table 4. Frequency distributions of years experience in cattle production (N=142).

Experience (years)	n	%
<=10	3	2.1
] 10 - 20]	16	11.3
] 20 - 30]	45	31.7
] 30 - 40]	40	28.2
] 40 - 50]	25	17.6
> 50	13	9.1

As shown in Table 4, the majority (31.7% + 28.2% = 59.9%) of the respondents had been in an agricultural business for 20 to 40 years. Those who had been in the business over 40 years constituted 26.6% (17.6% + 9.1%) of the respondents and, as expected, 13.4% (11.3% + 2.1%) of respondents indicated being in the business less than 20 years.

Cattle Production Operation Profile

The five operation characteristics of interest in this study were (1) the size of the operation, (2) the size of grazing allotment used, (3) the number of AUM/AM run under the permit, (4) the estimated proportion of income generated by livestock production, and (5) the estimated proportion of livestock production possible because of the grazing permit.

The intervals presented here were chosen to show the degree of professionalism of the respondents. Data in Table 5 show that 5.9% (n=8) of the respondents operated less than 1000 acres and 29.4% (n=40) operated more than 1000 acres but less than 5000 acres. Over 50% (n=69) of the ranchers operated between 5000 to 20,000 acres. Fourteen percent (n=19) of the respondents operated more than 20,000 acres. The data reveal that the sample and participants operate different sizes of business with a minimum of 360 acres, maximum of 106,000 acres, and with a mean of 15,100 acres.

Table 5. Frequency distributions of operation size based on acreage (N=136).

Acreage (acres)	n	%
< = 1000	8	5.9
] 1000 - 5000]	40	29.4
] 5000 - 10000]	31	22.8
] 10000 - 20000]	38	27.9
> 20000	19	14.0

Data in Table 6 show that the majority of the respondents operated on less than 10,000 acres of grazing allotment (cumulative frequencies of n=94 or 79.9%) with a mean of 6858 acres. One fifth of the respondents (20.2%) operated more than 10,000 acres of grazing allotment.

Table 6. Frequency distributions of grazing allotment size operated (N=119).

Acreage (acres)	n	%
< 1000	41	34.5
] 1000 - 5000]	31	26.0
] 5000 - 10000]	23	19.4
] 10000 - 20000]	14	11.8
> 20000	10	8.4

Data in Table 7 reveal that 76.6% (27.0 + 49.6) (n=88) of the respondents operated less than 1000 AUM. Twenty-five (21.7%) of the respondents operated more than 1000 AUM but less than 5000 AUM. Less than 2% of the respondents reported operating more than 5000 AUM. The mean was 836 AUM (not shown in Table 7) with a minimum of 5 AUM and maximum of 14,000 AUM. Ranchers reported, however, that this figure is not definite in a sense that the AUM operated is a function of the weather in each year (forage availability in a drought year), duration and season of use as recommended by the agency.

Table 7. Frequency distributions of AUM operated (N=115).

AUM/AM operated	n	%
< 100	31	27.0
] 100 - 1000]	57	49.6
] 1000 - 2000]	14	12.2
] 2000 - 5000]	11	9.5
> 5000	2	1.7

Data in Table 8 reveal that 69.7% (n=99) of the respondents reported that over 75% of their income comes from livestock production with a mean of 77.2%. Less than one fourth (23.3%, n=22+11) of the respondents said that 25% to 75% of their income was supported by livestock production. Ten ranchers (7.0%) reported that 25% or less of their income came from livestock production, with a minimum estimate of 5%.

Table 8. Estimated income in percentage from livestock production (N=142).

Estimated income (%)	n	%
< = 15	5	3.5
] 15 - 25]	5	3.5
] 25 - 50]	22	15.5
] 50 - 75]	11	7.8
> 75	99	69.7

Data in Table 9 show that a majority of respondents (n=66, 17.0+12.6+19.2 = 48.8%) estimated that 25% or less of their livestock production is due to their grazing allotment. Sixty-three (17.0+12.6+19.2%) of the ranchers said that 25% to 75% of livestock production is due to their grazing allotment and 4.4% (n=6) of the respondents reported that over 75% of their production is due to public grazing allotment (with a maximum of 90%). On the average, 28.3% of livestock production was estimated due to grazing allotment.

Table 9. Estimated livestock production in percentage due to grazing allotment (N=135).

Estimated livestock production (%)	n	%
< = 5	23	17.0
] 5 - 15]	17	12.6
] 15 - 25]	26	19.2
] 25 - 50]	38	28.1
] 50 - 75]	25	18.5
> 75	6	4.4

Demographic Data of Public Land Managers

Data in Table 10 show that a majority of respondents from public land managers were between the age brackets of 35 to 45 years (n=24, 50%, n=10, 43.5%, respectively, for FS and BLM). Those under 35 years old constituted 16.6% (n=8) and 21.7% (n=5), respectively, for FS and BLM. One third of the respondents were over 45 years old (n=16, 33.6% for FS and n=8, 32.8% for BLM). On average, the age of public land managers respondents was 41 years with the youngest being 25 years old and the oldest 58.

Table 10. Age frequency distributions of public land managers (N=71).

Age (years)	FS (n=48)		BLM (n=23)	
	n	%	n	%
<= 35	8	16.6	5	21.7
] 35 - 45]	24	50.0	10	43.5
] 45 - 55]	9	19.0	6	26.1
> 55	7	14.6	2	8.7

Data in Table 11 reveal that a majority of FS respondents have worked for the agency for less than 10 years (n=23, 48.9%). Fourteen FS respondents reported having worked for the agency over 10 years but less than 20 years (36.2%). Seven (14.9%) FS respondents indicated being in the agency for more than 20 years. For BLM respondents, eight (27.6%) have worked inside the agency for less than 10 years. Fifteen (51.7%) have been with the agency for more than 10 years but less than 20 years. Six respondents reported over 20 years of job experience. On the average, public land manager respondents had 13 years of job experience with a maximum of 29 years and a minimum of 1.

Table 11. Frequency distributions of job experience of public land managers (N=76).

Job experiences (years)	FS (n=47)		BLM (n=29	
	n	%	n	%
< = 10	23	48.9	8	27.6
] 10 - 15]	6	13.1	6	20.7
] 15 - 20]	11	23.1	9	31.0
> 20	7	14.9	6	20.7

Data in Table 12 indicate that a majority of public land managers had at least a bachelor's degree (n=37, 78.7% for FS and n=20, 69.0% for BLM). Eight BLM and six FS respondents reported having a master's degree (12.8% for FS and 27.6% for BLM). Four respondents from FS had only a high school diploma. One BLM respondent indicated having an associate degree. Three FS

respondents were graduate candidates. It should be mentioned that among those who had a college degree several respondents indicated holding more than one degree. Consequently, the numbers of respondents in Table 13 do not add up to the total respondents.

Table 12. Educational background frequency distributions of public land managers (N=76).

Degrees	FS (n=47)		BLM (n=29)	
	n	%	n	%
High School Diploma	4	8.5	0	0.0
Associate Degree	0	0.0	1	3.4
Bachelor's Degree	37	78.7	20	69.0
Master's Degree	6	12.8	8	27.6

Data in Table 13 show that the majority of the public land manager respondents had degrees in range science and related disciplines with frequencies ranging from 50.0% (MS for BLM) to 100% (BS for BLM).

Table 13. Degrees held frequency distributions.

Disciplines	FS		BLM	
	BS (n=37)	MS (n=6)	BS (n=20)	MS (n=8)
Range science & related	29 (78.4%)	4 (66.6%)	20 (100%)	4 (50.0%)
Forestry	9 (24.3%)	1 (16.6%)		
Wildlife & related	5 (13.5%)			
Soil science	4 (10.8%)			1 (12.5%)
Animal science	2 (5.4%)		1 (5%)	
Biology and related			1 (5%)	2 (25.0%)
Others and no specification	2 (5.4%)	1 (16.6%)	1 (5%)	1 (12.%)

BS = Bachelor of Science, MS = Master of Science

Data in Table 14 show that 8 (20.0%) FS respondents supervised less than or equal to 150,000 acres with a minimum being 14,000 acres. Twenty-four (60.0%) FS managed more than 150,000 acres but less than or equal to 500,000 acres and 8 (20.0%) supervised more than 500,000 acres with maximum of 10,500,000 acres. Among BLM respondents, 5 (20.0%) reported supervising less than or equal to 150,000 acres with a minimum being 14,000 acres. Ten respondents (40.0%) managed more than 150,000 acres but less than or equal to 500,000 acres, and 10 (40.0%) supervised more than 500,000 acres with a maximum being 3,000,000 acres.

Table 14. Frequency distributions of public land extent supervised by public land managers (N=65).

Acres (000)	FS (n=40)		BLM (n=25)	
	n	%	n	%
< = 150	8	20.0	5	20.0
] 150 - 500]	24	60.0	10	40.0
> 500	8	20.0	10	40.0

Data in Table 15 indicate that 27 (64.2%) FS respondents supervised less than or equal to 50,000 AUM, 12 (28.6%) supervised more than 50,000 AUM but less than or equal to 200,000. Three respondents reported supervising more than 200,000 AUM. Among BLM respondents, 9 (36.0%) reported being responsible for less than or equal to 50,000 AUM and 13 (52.0%) reported supervising more

Table 15. Frequency distributions of AUM/AM supervised by public land managers (N=67).

AUM / AM	FS (n=42)		BLM (n=25)	
	n	%	n	%
< = 50,000	27	64.2	9	36.0
] 50,000 - 200,000]	12	28.6	13	52.0
> 200,000	3	7.2	3	12.0

than 50,000 but less than 200,000 AUM. Three respondents supervised more than 200,000 AUM.

Among those who did not respond to the question, three respondents said that they do not have direct responsibility regarding the management of grazing allotments. Another three respondents reported the number of permits under their supervision instead of the acreage of grazing allotments.

Perceived Importance of Natural Resources

The data in Table 16 show that overall respondents agreed that all selected natural resources were important. All means were greater than 5.0. Seventeen of the 18 items had means around 6.0 or greater. Over-rest had means ranging from 4.5 to 5.4. Ranchers and BLM presented similar frequency distributions for over-rest with means of 5.4. Forest Service respondents ranked significantly lower than other groups on over-rest with a mean of 4.5. The reason most likely was the essence of the agency itself. Being foresters, respondents

Table 16. Perceived importance of selected natural resources.

Natural resource of concern	Group	n	Relative frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Forage production	R	14	0.7	0.0	0.7	0.0	2.8	8.3	87.6	6.8	0.7	41.7**
	FS	5	0.0	0.0	2.0	0.0	24.0	28.0	46.0	6.2	0.9	
	BLM	3	0.0	0.0	0.0	0.0	20.0	26.7	53.3	6.3	0.8	
Plant diversity	R	14	1.4	0.7	4.8	9.0	27.6	29.0	27.6	5.6	1.3	47.27**
	FS	5	0.0	0.0	0.0	0.0	4.0	26.0	70.0	6.7	0.6	
	BLM	3	0.0	0.0	0.0	0.0	10.0	20.0	70.0	6.6	0.7	
Native species	R	14	0.0	0.7	0.7	0.7	18.6	25.5	53.8	6.3	0.9	7.7[a]
	FS	4	0.0	0.0	0.0	0.0	4.1	30.6	65.3	6.6	0.6	
	BLM	3	0.0	0.0	0.0	0.0	13.3	26.7	60.0	6.5	0.7	
Over-grazing	R	14	2.8	2.1	2.1	1.4	4.9	19.0	67.6	6.3	1.4	8.2[a]
	FS	4	0.0	0.0	4.1	0.0	12.2	16.3	67.3	6.4	1.0	
	BLM	3	0.0	0.0	3.3	6.7	0.0	23.3	66.7	6.4	1.0	
Over-rest	R	14	3.6	2.1	6.4	5.7	29.3	28.6	24.3	5.4	1.5	18.3*
	FS	4	4.2	6.3	16.7	6.3	45.8	18.8	2.1	4.5	1.4	
	BLM	3	0.0	6.7	6.7	6.7	23.3	33.3	23.3	5.4	1.5	
Natural soil erosion	R	14	1.4	2.8	6.9	2.1	16.7	23.6	46.5	5.9	1.5	12.2[a]
	FS	4	0.0	0.0	18.4	2.0	28.6	22.4	28.6	5.4	1.4	
	BLM	3	3.3	0.0	0.0	6.7	10.0	40.0	40.0	6.0	1.3	
Soil loss due to grazing	R	14	2.8	2.1	3.5	2.8	12.5	21.5	54.9	6.0	1.5	7.5[a]
	FS	4	0.0	0.0	6.1	2.0	8.2	20.4	63.3	6.3	1.1	
	BLM	3	0.0	0.0	0.0	6.7	0.0	36.7	56.7	6.4	0.8	
Soil compacting	R	14	2.8	6.3	11.2	4.9	18.2	32.9	23.8	5.2	1.7	21.9**
	FS	4	0.0	0.0	2.0	2.0	18.4	30.6	46.9	6.2	1.0	
	BLM	3	0.0	0.0	6.7	0.0	6.7	46.7	40.0	6.1	1.0	
Loss of soil fertility	R	14	0.0	2.8	4.2	7.7	11.2	23.8	49.7	6.0	1.3	7.6[a]
	FS	4	0.0	0.0	0.0	2.1	16.7	22.9	58.3	6.4	0.8	
	BLM	3	0.0	0.0	3.3	6.7	6.7	23.3	60.0	6.3	1.1	
Water supply (quantity)	R	14	1.4	0.7	0.7	0.7	0.0	6.4	90.0	6.8	0.9	18.1**
	FS	4	0.0	0.0	0.0	0.0	4.1	24.5	71.4	6.7	0.6	
	BLM	2	0.0	0.0	3.4	0.0	10.3	17.2	69.0	6.5	0.9	
Human use water quality	R	13	2.9	2.2	5.8	7.2	12.2	14.4	55.4	5.9	1.6	10.3[a]
	FS	4	0.0	0.0	0.0	0.0	14.3	18.4	67.3	6.5	0.7	
	BLM	2	0.0	0.0	0.0	0.0	3.4	24.1	72.4	6.7	0.5	
Fish/wildlife water quality	R	13	2.3	1.5	6.0	5.3	18.8	27.8	38.3	5.7	1.4	27.2**
	FS	4	0.0	0.0	0.0	0.0	12.2	18.4	69.4	6.6	0.7	
	BLM	2	0.0	0.0	6.9	0.0	6.9	24.1	62.1	6.3	1.1	
Sediment loads run off	R	13	2.3	3.8	4.5	3.8	19.7	25.0	40.9	5.7	1.5	15.5*
	FS	4	0.0	0.0	0.0	0.0	14.3	32.7	53.1	6.4	0.7	
	BLM	2	0.0	3.4	0.0	0.0	3.4	34.5	58.6	6.4	1.0	
Ground water pollution	R	13	3.8	3.0	1.5	4.5	9.8	20.3	57.1	6.0	1.6	4.0[a]
	FS	4	0.0	0.0	4.1	2.0	10.2	20.4	63.3	6.4	1.0	
	BLM	2	0.0	0.0	0.0	3.4	10.3	17.2	69.0	6.5	0.8	
Stream bank trampling	R	13	5.3	2.3	8.4	5.3	24.4	29.0	25.2	5.3	1.6	46.6**
	FS	4	0.0	0.0	0.0	0.0	2.0	28.6	69.4	6.7	0.5	
	BLM	3	0.0	0.0	0.0	0.0	16.7	23.3	60.0	6.4	0.8	
Stream sedimentation	R	13	4.6	2.3	10.8	4.6	21.5	33.1	23.1	5.3	1.6	33.1**
	FS	4	0.0	0.0	0.0	0.0	12.2	36.7	51.0	6.4	0.7	
	BLM	3	0.0	0.0	0.0	3.3	10.0	26.7	60.0	6.4	0.8	
Riparian vegetation	R	13	3.1	0.8	4.6	4.6	19.1	37.4	30.5	5.7	1.4	50.6**
	FS	4	0.0	0.0	0.0	0.0	0.0	28.6	71.4	6.7	0.5	
	BLM	3	0.0	0.0	0.0	0.0	6.7	13.3	80.0	6.7	0.6	
Flooding	R	13	3.8	3.8	8.5	10.0	25.4	29.2	19.2	5.1	1.6	36.7**
	FS	4	0.0	0.0	0.0	2.0	12.2	36.7	49.0	6.3	0.8	
	BLM	3	0.0	0.0	0.0	0.0	23.3	26.7	50.0	6.3	0.8	

[a]Non-significant, *significant at α=.05, **significant at α=.01 and beyond

[b]1-not important at all; 4-uncertain; 7-very important

might favor late succession. Consequently, they may not place great importance on over-rest.

The analysis of remaining items in the table show that FS and BLM presented similar means and frequency distributions. Ranchers responses yielded lower means than FS and BLM except on forage production and water supply. Seven items (native species, over-grazing, soil erosion due to natural process, loss of soil fertility, water quality for human uses, and ground water pollution) did not reveal any statistically significant differences between groups. On ten items that showed statistically significant differences, the discrepancies resulted from the magnitude of importance assigned to the item.

All three groups presented means greater than 6.0 for forage production and water supply. Ranchers, as indicated by a significant $\chi 2$, perceived those two items as being statistically more important than FS and BLM. The frequencies showed that 87.6% to 90.0% of the ranchers rated these items on scale 7 whereas FS and BLM gave them less importance magnitude with cumulative frequencies ranging from 80.0% to 95.9% on scale 6 to 7. These results can be explained by the point that in order for ranchers to make a living, they need adequate quantities of forage and water.

In every case, discrepancies were influenced by ranchers' perception of the items. On the other 8 statistically different items (plant diversity, soil compacting, stream bank trampling, stream sedimentation, fish and wildlife water quality, riparian vegetation, and flooding) the inverse scheme was observed. Ranchers

consistently rated them less important than public land managers. Data reveal that the means yielded by ranchers varied from 5.1 to 5.9 while means from public managers ranged from 6.2 to 6.7 for FS and from 6.1 to 6.7 for BLM.

Perceived Health and Condition of the Range Natural Resource

The data in Table 17 reveal that ranchers and public land managers had different assessments of the health and condition of the rangeland natural resources. Only five items did not show statistically significant differences. These items were over-grazing, soil erosion due to natural process, loss of soil fertility, water supply, and flooding. Over-grazing was perceived as stable to much decreased with cumulative frequencies of 71.0% to 85.7% on scale 2 to 4 (means of 3.3 to 3.0). Soil erosion due to natural process (means of 3.5 to 3.8) and loss of soil fertility (means of 3.6 to 3.8) were perceived as stable to slightly decreased with cumulative frequencies ranging from 68.8% to 81.6% on scale 3 to 4. Water supply (means of 4.0 to 4.3) and flooding (means of 3.9 to 4.1) were perceived by all groups as varying between slightly decreased to slightly increased with cumulative frequencies of 72.8 to 93.6% on scale 3 to 5. All groups perceived these natural resources to be stable or moving in a positive direction.

On the 13 natural resources that showed statistically significant differences, the analysis of each item and each group perception was of interest. Explanation will be given whenever respondents added extra information relative to that item.

Table 17. Perceived condition and health of natural resources.

Natural resource of concern	Group	n	Relative frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Forage production	R	143	1.4	0.7	5.6	28.7	28.0	27.3	8.4	5.0	1.2	
	FS	47	0.0	6.4	25.5	38.3	21.3	8.5	0.0	4.0	1.0	29.2**
	BLM	30	0.0	3.3	13.3	43.3	16.7	20.0	3.3	4.5	1.2	
Plant diversity	R	143	0.7	2.1	8.4	49.0	23.8	14.0	2.1	4.4	1.0	
	FS	49	0.0	18.4	36.7	22.4	20.4	2.0	0.0	3.5	1.1	46.5**
	BLM	30	0.0	10.0	26.7	36.7	23.3	3.3	0.0	3.8	1.0	
Native species	R	144	1.4	0.7	8.3	54.2	20.8	9.7	4.9	4.4	1.1	
	FS	48	2.1	12.5	50.0	22.9	8.3	4.2	0.0	3.4	1.0	67.9**
	BLM	30	3.3	6.7	46.7	33.3	10.0	0.0	0.0	3.4	0.9	
Over-grazing	R	138	15.2	27.5	19.6	23.9	7.2	5.1	1.4	3.0	1.5	
	FS	49	2.0	24.5	34.7	26.5	8.2	4.1	0.0	3.3	1.1	14.7[a]
	BLM	30	6.7	20.0	33.3	20.0	16.7	3.3	0.0	3.3	1.3	
Over-rest	R	135	3.0	6.7	15.6	43.7	18.5	7.4	5.2	4.1	1.3	
	FS	40	5.0	15.0	7.5	52.5	17.5	2.5	0.0	3.7	1.2	18.6*
	BLM	26	0.0	3.8	26.9	34.6	34.6	0.0	0.0	4.0	0.9	
Natural soil erosion	R	141	5.7	12.1	19.9	53.9	5.7	2.1	0.7	3.5	1.1	
	FS	49	6.1	6.1	16.3	65.3	6.1	0.0	0.0	3.6	0.9	4.0[a]
	BLM	28	3.6	7.1	14.3	60.7	14.3	0.0	0.0	3.8	0.9	
Soil loss due to grazing	R	139	15.1	21.6	12.2	44.6	3.6	1.4	1.4	3.1	1.3	
	FS	50	4.0	16.0	38.0	26.0	12.0	4.0	0.0	3.4	1.1	25.3**
	BLM	30	3.3	20.0	33.3	33.3	6.7	3.3	0.0	3.3	1.1	
Soil trampling/compacting	R	140	10.7	17.1	15.0	50.7	5.0	0.7	0.7	3.3	1.2	
	FS	49	2.0	6.1	49.0	20.4	12.2	8.2	2.0	3.7	1.2	44.1**
	BLM	30	0.0	6.7	33.3	46.7	6.7	6.7	0.0	3.7	0.9	
Loss of soil fertility	R	137	6.6	5.8	8.0	67.9	5.8	3.6	2.2	3.8	1.1	
	FS	48	4.2	8.3	16.7	52.1	14.6	4.2	0.0	3.8	1.1	9.8[a]
	BLM	30	0.0	13.3	23.3	56.7	6.7	0.0	0.0	3.6	0.8	
Water supply (quantity)	R	136	2.2	3.7	16.9	41.9	14.0	11.8	9.6	4.4	1.4	
	FS	48	0.0	8.3	18.8	47.9	16.7	6.3	2.1	4.0	1.1	7.5[a]
	BLM	29	3.4	3.4	13.8	37.9	27.6	6.9	6.9	4.3	1.3	
Human use water quality	R	120	3.3	3.3	7.5	70.8	8.3	5.0	1.7	4.0	1.0	
	FS	49	0.0	2.0	28.6	46.9	14.3	8.2	0.0	4.0	0.9	25.4*
	BLM	28	3.6	10.7	32.1	42.9	7.1	0.0	3.6	3.5	1.1	
Fish/wildlife water quality	R	114	1.8	3.5	6.1	62.3	14.9	7.9	3.5	4.2	1.0	
	FS	49	0.0	4.1	24.5	34.7	26.5	6.1	4.1	4.2	1.1	34.6**
	BLM	29	6.9	10.3	31.0	27.6	24.1	0.0	0.0	3.5	1.2	
Sediment load run off	R	123	4.9	13.0	16.3	55.3	7.3	0.8	2.4	3.6	1.1	
	FS	49	0.0	10.2	32.7	38.8	14.3	4.1	0.0	3.7	1.0	14.7[a]
	BLM	28	3.6	14.3	32.1	28.6	10.7	10.7	0.0	3.6	1.3	
Ground water pollution	R	122	6.6	9.8	7.4	64.8	8.2	0.8	2.5	3.7	1.1	
	FS	45	0.0	8.9	24.4	33.3	26.7	4.4	2.2	4.0	1.1	35.1**
	BLM	27	0.0	0.0	14.8	44.4	25.9	14.8	0.0	4.4	0.9	
Stream bank trampling	R	126	4.8	15.9	19.0	51.6	8.7	0.0	0.0	3.4	1.0	
	FS	49	0.0	14.3	49.0	18.4	8.2	6.1	4.1	3.6	1.3	41.7**
	BLM	30	0.0	16.7	46.7	16.7	10.0	6.7	3.3	3.5	1.3	
Stream sedimentation	R	124	7.3	8.9	23.4	54.8	4.8	0.8	0.0	3.4	1.0	
	FS	48	0.0	10.4	37.5	31.3	14.6	2.1	4.2	3.7	1.2	40.8**
	BLM	30	0.0	10.0	16.7	26.7	30.0	13.3	3.3	4.3	1.3	
Riparian vegetation	R	128	3.1	3.9	3.9	50.8	25.0	9.4	3.9	4.3	1.2	
	FS	49	4.1	4.1	24.5	12.2	44.9	10.2	0.0	4.2	1.3	49.3**
	BLM	30	6.7	10.0	26.7	6.7	36.7	3.3	10.0	4.1	1.7	
Flooding	R	124	1.6	4.8	8.9	67.7	15.3	0.8	0.8	4.0	0.8	
	FS	47	0.0	2.1	17.0	59.6	17.0	2.1	2.1	4.1	0.8	12.7[a]
	BLM	29	6.9	6.9	13.8	48.3	13.8	10.3	0.0	3.9	1.3	

[a]Non-significant; *significant at α=.05; **significant at α=.01 and beyond

[b]1-extremely decreased; 4-stable; 7-greatly increased

Forage production (means of 4.0 to 5.0) was perceived to be stable to much increased by ranchers and BLM, with respective cumulative frequencies of 84.0% and 80.0% on scale 4 to 6. Significant difference was caused by FS perception. FS managers perceived this item as slightly decreased to slightly increased (means of 4.0) with a cumulative frequency of 85.1% on scale 3 to 5. Reasons given by five FS respondents, in their written comments, were conifer encroachment, trees and weed invasions. These comments were further supported by the written comments from 12 ranchers who complained about the trees and weed invasions.

Information in Table 17 shows that plant diversity (mean of 4.4) and native species (mean of 4.4) were perceived by ranchers to be stable to much increased with respective cumulative frequencies of 86.8 and 84.7% on scale 4 to 6. On the other hand, public land managers perceived plant diversity to be much decreased to slightly increased (means of 3.5 to 3.8) with cumulative frequencies of 97.9 and 96.7% on scale 2 to 5, respectively, for FS and BLM. Native species was perceived by public land managers as much decreased to stable (mean of 3.4) with cumulative frequencies of 85.5 and 86.7% on scale 2 to 4, respectively, for FS and BLM.

Relative to over-rest, all groups perceived this item as varying from slightly decreased to slightly increased (means of 3.7 to 4.1). Statistical significant differences resulted from the discrepancies of relative frequency distributions on scale 2 to 3 for each group. However, ranchers and BLM seemed to perceive the

item as increasing (means of 4.1 and 4.0), whereas FS viewed it as in a decreasing phase (mean of 3.7).

Soil loss due to grazing (means of 3.1 to 3.4) and soil trampling and compacting (means of 3.3 to 3.7) were agreed by all groups to be in the direction of improving. Statistical significant differences resulted from the magnitude of agreement on scale 3 and 4. Ranchers perceived these two parameters to be extremely decreased to stable, whereas public land managers perceived soil loss due to cattle grazing as much decreased to stable (respective cumulative frequencies of 80.0 and 86.6% on scale 2 to 4) and soil trampling and compacting as only slightly decreased to stable (respective cumulative frequencies of 69.4 and 80.0% on scale 3 to 4).

Concerning water quality for human uses, statistical differences resulted from variation within and between groups. Ranchers perceived that item as stable with a frequency of 70.8% on scale 4. FS managers viewed it as slightly decreased to much increased with a cumulative frequency of 89.8% on scale 3 to 5 (mean of 4.0). BLM, on the other hand, perceived this item only as much decreased to stable with a cumulative frequency of 85.7% on scale 2 to 4 (mean of 3.5).

Relative to water quality for fish and wildlife, ranchers perceived the resource as stable to slightly increased (mean of 4.2, cumulative frequency of 77.2% on scale 4 to 5). Public land managers perceived the item to oscillate between slightly decreased to slightly increased (cumulative frequencies of 85.7

and 82.7% on scale 3 to 5, respectively, for FS and BLM). However, FS seemed to view this item as on a slightly positive trend (mean of 4.2) while BLM tended to view it in a slightly negative direction (mean of 3.5).

Statistical differences on runoff sediment load resulted from between and within groups differences. Ranchers perceived it as much decreased to stable with a cumulative frequency of 84.6% on a scale from 2 to 4 (mean of 3.5). Public land managers showed statistical differences within the group (means of 3.6 and 3.7). While a majority of the respondents agreed with ranchers and perceived the state of this natural resource as much decreased to stable (cumulative frequencies of 81.7 and 75.0% on scale 2 to 4, respectively, for FS and BLM), a non-negligible proportion of respondents (cumulative frequencies of 18.4 and 21.4% on scale 5 to 6, respectively, for FS and BLM) perceived the item to be slightly to much increased.

A similar scheme was observed relative to ground water pollution. Ranchers rated it as stable (mode of 64.8% on scale 4, mean of 3.7) while public land managers perceived it as slightly decreased to slightly increased with cumulative frequencies of 84.4 and 85.1% on scale 3 to 5, respectively, for FS and BLM (means of 4.0 and 4.4).

All groups perceived stream bank trampling as decreased to stable with cumulative frequencies of 86.5, 81.7 and 80.1% on scale 2 to 4, respectively, for ranchers, FS, and BLM. Statistical significant differences resulted from strength of agreement. Public land managers rated more positively than ranchers. Half of

the ranchers perceived this natural resource problem as stable (mode of 51.6% on scale 4), whereas a majority of public land managers saw it as slightly decreased (modes of 49.0 and 46.7% on scale 3, respectively, for FS and BLM).

Data on stream sedimentation revealed that ranchers and FS perceived this natural resource as much decreased to stable with respective cumulative frequencies of 87.1 and 79.2% on scale 2 to 4 (mean of 3.4). BLM, on the other hand, showed a split opinion. While a majority of BLM perceived this factor to be much decreased to stable like the ranchers and FS (cumulative frequency of 53.4% on scale 2 to 4), a non-negligible proportion of respondents (cumulative frequency of 43.3% on scale 5 to 6) rated it as slightly to much increased.

Riparian vegetation was the last item that presented a statistical significant difference. Ranchers consistently perceived it in a positive trend, stable to much increased with a cumulative frequency of 85.2% on scale 4 to 6 (mean of 4.3). The data revealed significant differences among public land managers. Of the FS respondents, 67.3% perceived that item as stable to much increased (mean of 4.2); however, 32.7% of them rated the item to be extremely to slightly decreased. There were almost equal numbers of BLM respondents on the two sides of the scale. Data showed that 50.0% of BLM perceived the item to be slightly to extremely increased (cumulative frequency on scale 5 to 7) while 43.4% of the respondents saw the item as extremely to slightly decreased (cumulative frequency on scale 1 to 3, mean 4.1).

In summary, separate analysis of each item revealed that there were significant differences among the three groups on the assessment of rangeland natural resource. To cross reference these results, an analysis of allotment condition ranking given by public land managers and ranchers and ranchers' comments was of great interest. To do so, ranchers were asked to give their allotment condition as stated by their allotment management plan (AMP). Public land managers were asked to estimate the proportions of grazing allotments in their areas in each of the three categories of the allotment management plan. All estimates were equal to 100%. The three categories of grazing allotment conditions were (1) to be maintained (M--allotments in good condition and have no significant conflicts), (2) in custodial (C--allotments in stable condition which have no major resource conflicts and productive potential is economically limited), and (3) to be improved (I--allotments in less than satisfactory condition, possibly with existing resource conflict and not producing at their productive potential). The researcher computed the frequency distributions of each condition category that falls in the chosen ranges of proportion as shown in Tables 18 and 19. Due to the nested structure of the data, i.e., together FS and BLM covered all the ranchers respondents, FS and BLM's answers were combined. This approach was necessary to proceed with a meaningful comparison of the grazing allotment conditions.

The data in Table 18 reveal that on the average public land managers estimated that 44.5% of the grazing allotments under their supervised areas were

Table 18. Frequency distribution of estimated proportion of grazing allotment condition ranking as reported by public land managers (N=73).

Condition	Range of estimates (%)								Mean %
	<=25		] 25 - 50]		] 50 - 75]		> 75		
	n	%	n	%	n	%	n	%	
To be improved	40	54.8	29	39.7	2	2.7	2	2.7	27.0
Custodial	36	49.3	26	35.6	10	13.7	1	1.4	28.5
To be maintained	18	24.7	30	41.1	17	23.3	8	11.0	44.5

to be maintained, 28.5% in custodial condition, and 27.0% to be improved. The collective analysis of the frequency distributions show that the majority of respondents (54.8%, n=40) estimated that 25% or less of the grazing allotments under their supervision were to be improved. A non-negligible proportion (n=29, 39.7%) of respondents estimated that 25 to 50% of their areas needed to be improved. These proportions, when balanced with the ones on grazing allotments in "custodial" and "to be maintained" conditions over 25% which cumulate respectively at 50.7 and 75.4%, may explain the slightly decreased condition reported by public land managers.

The data in Table 19 present the grazing allotment conditions as reported by ranchers who had an AMP and those who did not. The researcher computed a T-test matched pair for statistical difference between the two groups of respondents. T-test results (p-val = 0.23) indicated that there was not enough

evidence to say that the two groups reported differently. Consequently, the researcher will interpret the results for both groups.

Table 19. Frequency distribution of grazing allotment condition as reported by ranchers (N=124).

Condition	Frequency distribution of allotment ranks						T-test
	Responses from AMP (n=94)		Responses without AMP (n=30)		Total (N=124)		
	n	%	n	%	n	%	p-val
To be improved	10	10.6	2	6.7	12	9.6	
Custodial	13	13.8	4	13.3	17	13.7	0.23
To be maintained	71	75.5	24	80.0	95	76.6	

The information in Table 19 shows that the majority of the respondents (n=95, 76.6%) have their allotment ranked to be maintained. Twelve respondents (9.6%) reported having their allotment ranked to be improved. The researcher noted that besides these 30 respondents who self-reported their allotment, 20 other ranchers said they never had or did not know when they had an AMP. They did not rank their allotment. There were also 8 respondents who said that they had ongoing AMPs at the time of the surveys.

A χ^2 analysis between the proportion estimated by public land managers and proportion reported by ranchers yielded a result of $\chi^2 = 23.3$ and P-value = 0.000. The χ^2 result indicated that public land managers and ranchers have a statistical significant different assessment of rangeland condition and health. The

result revealed the concern that "the current condition or quality of U.S. rangeland has been described by some as the best condition in this century, and by others, using the same data, as extremely abused and degraded" (Busby, 1994, p. vii). Two reasons may explain this result: (1) ranchers and public land managers have different biological and ecological assessments of the grazing allotments and (2) ranchers who participated in the study may be those who have a positive attitude toward the public land management system. In a sense, they perceived that their allotments were in "good stable," "optimum," "pristine," "excellent," and "improved" conditions. As a respondent commented, "Public land has improved over the last 75 years, making a stable economy, improved wildlife and habitat, increased grazing capacity, and improved water resources for every kind of use." Some conditions were due to natural phenomena like terrain, drought, grasshoppers, and weeds and brush encroachment. However, they also perceived that there was still "room for improvement." Improvements were requested in water developments, weed control, fire control, or other agricultural practices (Appendix C).

Perceived Potential Utilization and Effects of Livestock on the Range Natural Resource

The researcher underlined the word "potential" because all items in section two, part one were based on the conditional statement "under proper grazing management." The analysis of this section was divided into two parts: (1)

potential utilization of livestock for the management of rangeland and (2) their effects on the rangeland.

Four statements were included to capture the perceptions of all groups regarding the potential utilization of livestock: livestock under proper management can (1) improve the soil fertility, (2) enhance wildlife food supply, (3) be a tool for natural resources management, and (4) be a means to enhance the economic value of the natural resources. The data in Table 20 indicated that all groups agreed to those potential utilizations of livestock, with means about or greater than 5.0 for all groups and all items. Statistical significant differences were mostly due to the difference in the magnitude of agreement.

Table 20. Perceived potential utilization of livestock on the rangeland natural resource.

Under proper management livestock grazing can:	Group	n	Relative frequency distribution[b]							Mean	SD	X^2
			1	2	3	4	5	6	7			
improve soil fertility	R	146	0.7	1.4	0.0	4.8	21.9	45.9	25.3	5.8	1.0	
	FS	51	0.0	7.8	11.8	13.7	37.3	23.5	5.9	4.7	1.3	40.6**
	BLM	30	0.0	0.0	3.3	6.7	16.7	43.3	30.0	5.9	1.0	
enhance wildlife food supply	R	145	3.4	0.0	4.8	6.9	20.0	42.1	22.8	5.6	1.4	
	FS	50	0.0	4.0	8.0	6.0	34.0	36.0	12.0	5.2	1.3	10.3[a]
	BLM	30	0.0	3.3	10.0	6.7	23.3	50.0	6.7	5.3	1.2	
be a natural resource management tool	R	145	0.0	0.0	0.0	0.7	4.1	36.6	58.6	6.6	0.6	
	FS	50	0.0	4.0	0.0	4.0	18.0	40.0	34.0	5.9	1.2	19.1**
	BLM	30	3.3	0.0	3.3	0.0	3.3	46.7	43.3	6.1	1.3	
enhance the economic value of the natural resource	R	145	0.0	0.0	0.7	1.4	3.4	43.4	51.0	6.4	0.7	
	FS	50	4.0	2.0	4.0	4.0	24.0	42.0	20.0	5.5	1.4	48.4**
	BLM	30	3.3	0.0	6.7	3.3	6.7	53.3	26.7	5.8	1.4	

[a]Non-significant; *significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

Ranchers and BLM (means of 5.8 and 5.9) agreed that livestock can improve soil fertility with cumulative frequency, respectively, of 93.1 and 90.0% on a scale from 5 to 7. Statistical significant differences resulted from internal discrepancies among FS (mean of 4.7). If the majority of the respondents (cumulative frequency of 66.7% on scale 5 to 7) agreed with the statement, a non-negligible proportion of respondents (19.6%) disagreed on scale 2 to 3.

Statistical significant differences about livestock as a natural resource management tool and a means to enhance economic value of natural resources resulted from the fact that ranchers had consistent and strong agreement (means of 6.6 and 6.4), whereas public land managers rated less strongly the items (means ranging from 5.5 to 6.1).

Data in Table 21 show the statistical analysis results of negative impacts of livestock on natural resources. The information indicates that ranchers had consistent and greater magnitude of agreement (means of 1.7 to 2.5) than public land managers, who had within group differences (means ranging from 3.4 to 4.4) except on "livestock can reduce public land social value" (means of 2.6 and 2.4). Relative to that item, all groups disagreed with the statement (means ranging from 1.7 to 2.6). Statistical significant differences resulted from the fact that ranchers had a mode of 55.9% on scale 1 while public land managers had modes of 46.0% for FS and 43.3% for BLM on scale 2.

Table 21. Perceived effects of livestock on the rangeland natural resource.

Under proper management livestock grazing can:	Group	n	Relative frequency distribution[b]							Mean	SD	X^2
			1	2	3	4	5	6	7			
contribute to water pollution	R	137	33.6	28.5	12.4	6.6	18.2	5.1	0.7	2.6	1.7	
	FS	51	3.9	27.5	11.8	2.0	49.0	5.9	0.0	3.8	1.5	37.8**
	BLM	30	13.3	23.3	23.3	10.0	16.7	6.7	6.7	3.4	1.8	
damage riparian areas	R	145	31.7	30.3	14.5	5.5	12.4	4.1	1.4	2.5	1.6	
	FS	51	9.8	27.5	21.6	5.9	25.5	5.9	3.9	3.4	1.7	17.3*
	BLM	29	13.8	37.9	20.7	6.9	10.3	3.4	6.9	3.0	1.7	
compete with wildlife food supply	R	145	30.3	23.4	13.1	4.8	13.1	12.4	2.8	2.9	1.9	
	FS	51	9.8	21.6	15.7	2.0	35.3	13.7	2.0	3.8	1.7	28.7**
	BLM	29	3.4	34.5	3.4	13.8	17.2	13.8	13.8	4.0	2.0	
damage recreation site and area's quality	R	145	33.8	28.3	17.2	5.5	11.0	2.8	1.4	2.5	1.6	
	FS	50	6.0	24.0	16.0	8.0	34.0	10.0	2.0	3.8	1.6	37.1**
	BLM	29	3.4	27.6	13.8	10.3	31.0	13.8	0.0	3.8	1.6	
reduce the aesthetic quality of the wilderness	R	145	34.5	31.0	15.9	4.8	9.0	3.4	1.4	2.4	1.5	
	FS	50	6.0	12.0	18.0	4.0	26.0	30.0	4.0	4.4	1.7	55.4**
	BLM	30	6.7	26.7	10.0	16.7	20.0	16.7	3.3	3.8	1.7	
reduce the social value of the public land	R	145	55.9	27.6	7.6	5.5	0.7	1.4	1.4	1.7	1.2	
	FS	50	18.0	46.0	12.0	10.0	8.0	6.0	0.0	2.6	1.4	35.2**
	BLM	30	20.0	43.3	23.3	10.0	0.0	3.3	0.0	2.4	1.1	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

There are between and within group differences relative to the question of the impacts of livestock grazing on water pollution (means of 2.6 to 3.8). Ranchers strongly disagreed with the statement (mean of 2.6 and cumulative frequency of 74.5% on scale 1 to 3). The majority of BLM disagreed to slightly disagreed (mean of 3.4 and cumulative frequency of 59.9% on scale 1 to 3) and had the same view as ranchers. However, a non-negligible proportion of BLM respondents (30.1% cumulative frequency on scale 5 to 7) agreed. FS were divided on the two sides of the scale. Over 43% (cumulative frequency on scale 1

to 3) of them disagreed with the statement while 54.9% (cumulative frequency on scale 5 to 6) agreed with it and disagreed with ranchers and BLM.

All groups disagreed with the statement about damage to riparian areas by livestock grazing. However, ranchers show stronger magnitude of disagreement (a mean of 2.5, mode of 31.7% on scale 1, cumulative frequency of 76.5% on scale 1 to 3) than public land managers (mean of 3.4 and 3.0, modes of 27.5% for FS and 34.5% for BLM on scale 2, cumulative frequencies of 58.9 and 72.4% on scale 1 to 3, respectively, for FS and BLM). Data also show that there was a non-negligible proportion of FS who agreed with the statement (cumulative frequency of 35.3% on scale 5 to 7).

Statistical significant differences on livestock grazing compete with wildlife's food supply resulted from between and within groups differences (means ranging from 2.9 to 4.0). While two-thirds (cumulative frequency of 66.8% on scale 1 to 3) of ranchers disagreed with the statement, a majority of public land managers agreed with it (cumulative frequencies of 51.0 and 41.8% on scale 5 to 7, respectively, for FS and BLM). However, a non-negligible proportion of public land managers disagreed with the statement as ranchers (cumulative frequency of 47.1 and 41.3% on scale 1 to 3, respectively, for FS and BLM).

Relative to damages on recreational site quality, statistical significant differences resulted from the internal differences among public land managers (means of 3.8). Ranchers consistently disagreed with the statement (mean of 2.5). There were as many public land manager respondents that disagreed as agreed

with the statement (same cumulative frequencies on scale 1 to 3 and scale 5 to 7 of 46.0 and 48.8%, respectively, from FS and BLM).

For the last statement, "Livestock reduce aesthetic quality of the wilderness," the statistical significant difference resulted from variations of perception within and between groups. Ranchers consistently disagreed with the statement (mean of 2.5, cumulative frequency of 81.4% on scale 1 to 3). Even though FS respondents showed a tendency to agree with the statement (mean of 4.4) they presented within group differences. There were 60.0% (cumulative frequency on scale 5 to 7) of respondents that agreed with the statement against a non-negligible proportion (36.0% cumulative frequency on scale 1 to 3) who disagreed with it and had the same view as ranchers. The BLM respondents also showed an internal difference with a mean of 3.8. If the majority of respondents (43.4% cumulative frequency on scale 1 to 3) disagreed with the statement and had the same view as ranchers, a non-negligible proportion of respondents agreed (40.0% cumulative frequency on scale 5 to 7).

In summary, all groups agreed to the potential utilization of livestock for the management of rangeland natural resources, with respect to the magnitude given to each item. There were statistical significant differences of perception between groups relative to the potential effects of livestock grazing on public land.

Perceived Impacts and Importance of Ranchers Using Public Grazing Allotments

Four areas were of interest relative to ranchers using public grazing allotments: (1) importance relative to cattle industry, (2) significance to the community, (3) contributions to the public grazing allotment, and (4) behavior relative to the management of public land.

Perceived Importance of Ranchers to Cattle Industry

Data in Table 22 show that ranchers disagreed that public ranching is not significant in number and size to cattle industry. Public land managers presented conflicting opinions. Even though there were more respondents who agreed that public ranching is significant to the cattle industry (cumulative frequencies of 49.1 and 53.3% on scale 1 to 3, respectively, for FS and BLM), those who disagreed were nonetheless significant (cumulative frequencies of 43.3 and 40.0% on scale 5 to 7, respectively, for FS and BLM). This resulted in somewhat of a controversy

Table 22. Public ranchers' importance relative to the cattle industry.

Criteria of interest	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Non-significance in number and size relative to the livestock industry	R	145	26.2	33.1	6.9	11.0	9.0	11.0	2.8	2.9	1.8	
	FS	51	9.8	27.5	11.8	7.8	11.8	27.5	3.9	3.8	1.9	15.7*
	BLM	30	20.0	23.3	10.0	6.7	20.0	20.0	0.0	3.4	1.9	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

on the part of public land managers because when estimating the proportion of livestock production from public allotment, they showed the following results (Table 23).

Table 23. Estimated proportion of livestock production from public grazing allotments by public land managers (N=60).

Estimated proportion (%)	Frequency distributions	
	n	%
<=15	17	28.3
]15 - 35]	27	45.0
]35 - 55]	6	10.0
>55	10	16.7

The results in Table 23 show that 28.3% of public land managers estimated that livestock production from public grazing allotments in their areas was less than 15%. Twenty-seven (45.0%) of the respondents estimated that livestock due to public grazing allotment varied from 15 to 35%. The estimated mean proportion of livestock production from public land was 31.1%. Sixteen respondents (cumulative frequency of 26.7%) estimated that over 35% of livestock production was due to public grazing allotments.

Cross reference analysis of the estimated proportion of livestock production from public land by ranchers matched the estimation of public land managers as shown by the Table 24.

Table 24. Estimated proportion of livestock production from public grazing allotment by ranchers (N=135).

Estimated proportion (%)	Frequency distributions	
	n	%
<=15	40	29.6
] 15 - 35]	54	40.0
] 35 - 55]	25	18.5
>55	16	11.9

Data in Table 24 show that 29.6% (n=40) of ranchers estimated that 15% or less of their livestock production was due to public grazing allotments (minimum of 1%). Fifty-four respondents (40.0%) estimated that 15 to 35% of their livestock production was from public lands with a mean of 28.3%. Thirty-one respondents (cumulative frequency of 30.4%) indicated that over 35% of their livestock production was from public lands (with a maximum of 90%). A χ^2 comparison between the two estimates from public land managers and ranchers did not show a statistical difference with $\chi^2 = 4.01$ and a p-value $= 0.26$. These results seemed to indicate, from the researcher point of view, that there was a contradictory perception on the part of public land managers who did not perceive the importance of public ranching to the cattle industry.

Data in Table 25 reveal that ranchers and public land managers had significant statistical differences in perception between groups relative to the economic competitive advantages of ranchers using public grazing allotments (means of 2.7, 4.7, and 5.0, respectively, for ranchers, FS, and BLM). If 72.9% of

ranchers disagreed with the statement (cumulative frequency on scale 1 to 3), the same proportion of public land managers agreed with it (cumulative frequencies of 68.0 and 63.3% on scale 5 to 7, respectively, for FS and BLM). The analysis of "fair and adequate grazing price" and comments of respondents relative to the subject were of interest to describe the observations.

Table 25. Public rancher competitive advantages relative to the cattle industry.

Criteria of interest	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Competitive advantage due to low grazing fees	R	144	34.7	27.1	11.1	5.6	9.0	8.3	4.2	2.7	1.8	
	FS	50	4.0	14.0	8.0	6.0	26.0	30.0	12.0	4.7	1.7	67.3**
	BLM	30	3.3	16.7	3.3	13.3	3.3	40.0	20.0	5.0	1.9	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

Data in Table 26 indicate that 16 (15.8%) ranchers estimated that adequate and fair grazing fee should be less than or equal to $1.50 with a minimum of $0.00. The reasons given by those respondents were (1) "the present system is working," (2) "remain as currently because the government invests nothing," (3) "$1.35 per AUM is [what public grazing is] worth under the present management system" and (4) "PRIA system was fair and adequate." Eight respondents estimated the fair and adequate grazing price as $1.35, the currently adopted price (February 1996). This fact may indicate that the study was subjected to "history" phenomenon. The majority of ranchers respondents (n=49, 48.9%) estimated that the fair and adequate grazing price should be between

$1.50 and $3.00. The average estimated price was $3.30. Twenty-six (25.7%) respondents estimated that the grazing price should be more than $3.00 but less than or equal to $5.00. Ten respondents estimated that fair and adequate grazing price should be more than $5.00, the maximum being $10.00.

Table 26. Frequency distributions of estimated fair and adequate grazing price by ranchers (N=101).

Estimated price ($ / AUM)	Ranchers	
	n	%
< = 1.50	16	15.8
] 1.50 - 3.00]	49	48.5
] 3.00 - 4.00]	14	13.8
] 4.00 - 5.00]	12	11.9
] 5.00 - 6.00]	2	2.0
] 6.00 - 8.00]	5	4.9
> 8.00	3	3.0

Among those who estimated the fair and adequate grazing price to be above $5.00 the comments of one respondent are worth reporting, "The current fee schedule is unrealistically low and causing much harm to permittees in public opinion."

Among comments given by ranchers the following were of interest:

* Fair grazing price should be less than the price of private but slightly higher than it is currently.

* Fair price would vary from ranch to ranch - community to community.

* Price should be local but not national.

* One price does not fit all.

Fourteen ranchers (not shown in table) who gave a range of prices commented that the grazing fee should be locally based and consider parameters such as land conditions, forage productivity, and weather, especially drought conditions. Price should account for management costs like fencing, transportation and accessibility, water development and maintenance, salting, as supported by the comments of this non-participant respondent, "There are so many unaccounted expenses with a public permit that my actual costs per AUM have varied from $14-22/AUM instead of the phoney $2/AUM that is talked about." Furthermore, explained this respondent, "With regard to the price per AUM of grazing, some allotments that are inaccessible and have high management costs should cost less than ones that are easily managed with little cost." Finally, ranchers perceived that grazing price should fluctuate with cattle and forage market values.

Public land managers' estimates of fair and adequate grazing price are shown in Table 27. A χ^2 analysis was computed to test if the FS and BLM presented statistical significant differences in their estimates of fair and adequate grazing price. The χ^2 results show a $\chi^2 = 1.407$ and p-value = 0.9235 indicate that there is not enough evidence to state that public land managers estimated the grazing price differently. Consequently, the researcher interpreted the results including all public land managers.

Table 27. Frequency distributions of estimated fair and adequate grazing price by public land managers (N=67).

Estimated price ($ / AUM)	FS (n=40)		BLM (n=27)		Public land managers	
	n	%	n	%	n	%
<=3.00	6	15.0	3	11.1	9	13.4
] 3.00 - 4.00]	6	15.0	5	18.5	11	16.4
] 4.00 - 5.00]	15	37.5	9	33.3	24	35.8
] 5.00 - 6.00]	5	12.5	2	7.4	7	10.5
] 6.00 - 8.00]	6	15.0	6	22.2	12	17.9
>8.00	2	5.0	2	7.4	4	6.0

$\chi^2_{(FS,BLM)} = 1.407$, p-value = 0.9235

Data in Table 27 show that 9 (13.4%) respondents estimated that the grazing price should be less than or equal to $3.00 with a minimum being $2.00/AUM for FS and $2.50/AUM for BLM (not shown in table). The majority (35.8%, n=24) estimated that a fair and adequate grazing price should be more than $4.00/AUM but less than or equal to $5.00/AUM. Seven respondents estimated the price to be more than $5.00/AUM but less than or equal to $6.00/AUM. Almost 24% (n=16) estimated the grazing price should be more that $6.00/AUM. On the average, public land managers estimated that a fair and adequate grazing price should be $5.34/AUM with a maximum of $10.00/AUM for FS and $12.00/AUM for BLM (not shown in table).

Besides these participants who gave precise estimates, five other public land manager respondents said similarly to ranchers that a fair and adequate grazing price should be based on (1) land productivity, (2) forage market value,

(3) cattle price, and (4) less or equal to put rate. One respondent indicated that a fair and adequate grazing price should be half of the private lease.

Among public land managers there were those who had similar views as ranchers, like the respondent who commented, "Grazing fees should vary depending on value for livestock production and difficulty managing livestock." However, there was a faction that thought otherwise, like this participant: "Public land permittees justify the low grazing fee by saying that public lands are poorer lands than private and that is all the grazing is worth."

A χ^2 comparison between the estimate distributions on ranchers and public land managers yielded a $\chi^2 = 48.87$ and a p-value = .0000. The results of χ^2 reveal that public land managers and ranchers have statistical significant differences in estimates of fair and adequate grazing price.

Perceived Impacts of Public Ranching to the Community

Data in Table 28 reveal that all groups agreed that public ranching has a positive effect on the socio-economic development of the community with means ranging from 5.7 to 6.3. Parameters of interest included (1) economic significance to local agriculture, (2) contribution to local agriculture production, (3) contribution to the health and development of the community, and (4) maintenance of the rural community. Only the statement "public ranching contributes to community health and economic development" yielded a statistical significant difference. Statistical significant difference on this parameter was due

to the magnitude of agreement. Ranchers strongly agreed to the statement with a mode of 51.7% on scale 7, whereas public land manager agreed with modes of 43.1 and 46.7% on scale 6, respectively, for FS and BLM.

Table 28. Perceived importance of public ranching to the community.

Criteria of interest	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Economic significance relative to local agricultural production	R	145	0.7	1.4	2.1	3.4	11.0	44.1	37.2	6.0	1.1	
	FS	50	0.0	2.0	4.0	10.0	10.0	46.0	28.0	5.8	1.2	1.7[a]
	BLM	30	0.0	3.3	0.0	3.3	13.3	46.7	33.3	6.0	1.1	
Significance to economic development of the community	R	145	0.7	0.7	0.7	3.4	7.6	35.2	51.7	6.3	1.0	
	FS	51	0.0	5.9	5.9	2.0	15.7	43.1	27.5	5.7	1.4	19.3**
	BLM	30	0.0	3.3	0.0	3.3	16.7	46.7	30.0	5.9	1.1	
Contribution to community health and social development	R	145	0.7	0.7	0.7	6.9	6.9	41.4	42.8	6.1	1.1	
	FS	51	0.0	0.0	3.9	2.0	21.6	45.1	27.5	5.9	1.0	12.1[a]
	BLM	30	0.0	3.3	0.0	6.7	10.0	53.3	26.7	5.9	1.1	
Maintenance of the existence of the rural community	R	144	0.0	1.4	1.4	2.8	10.4	39.6	44.4	6.2	1.0	
	FS	51	2.0	2.0	7.8	5.9	13.7	35.3	33.3	5.7	1.5	10.6[a]
	BLM	30	0.0	3.3	3.3	6.7	20.0	40.0	26.7	5.7	1.2	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

Perceived Uses and Effects of Ranching on Public Grazing Allotments

Data in Table 29 show that all four parameters designed to capture ranchers' uses of and effects on public grazing allotments yielded statistical significant differences. Discrepancies resulted from differences within and between groups. The only parameter that all groups agreed upon was the positive contribution of ranchers to wildlife benefits (means of 4.5 to 5.8). Statistical significant difference resulted from the strength of agreement. Ranchers tended to strongly agree to agree with the statement (cumulative frequency of 71.0% on

scale 6 and 7), whereas public land managers slightly agreed to agreed (cumulative frequencies of 62.8 and 60.0% on scale 5 to 6, respectively, for FS and BLM).

Table 29. Ranchers' uses of and effects on public grazing allotments.

Criteria of interest	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Preference privilege on use of public land	R	145	9.7	15.2	9.0	13.8	14.5	29.0	9.0	4.3	1.9	
	FS	51	25.5	35.3	7.8	2.0	9.8	15.7	3.9	3.0	2.0	19.2*
	BLM	29	13.8	24.1	13.8	6.9	17.2	17.2	6.9	3.7	2.0	
Contribution to recreational benefits	R	146	2.1	3.4	4.8	14.4	22.6	34.9	17.8	5.3	1.4	
	FS	51	9.8	25.5	21.6	13.7	15.7	11.8	2.0	3.4	1.6	55.9**
	BLM	29	3.4	17.2	20.7	17.2	13.8	17.2	10.3	4.1	1.7	
Contribution to wildlife benefits	R	145	1.4	2.8	0.7	9.0	15.2	40.0	31.0	5.8	1.3	
	FS	51	2.0	15.7	9.8	5.9	37.3	25.5	3.9	4.5	1.6	55.9**
	BLM	30	0.0	3.3	20.0	3.3	33.3	26.7	13.3	5.0	1.4	
Primary responsibility on public land	R	145	1.4	2.8	2.8	4.1	10.3	48.3	30.3	5.9	1.3	
	FS	51	9.8	29.4	17.6	2.0	13.7	19.6	7.8	3.7	2.0	75.8**
	BLM	29	17.2	20.7	6.9	6.9	13.8	31.0	3.4	3.9	2.1	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

Differences within and between groups were observed relative to the assumption that ranchers have the first preference privilege in use of public land (means ranging from 3.0 to 4.3). Among ranchers, 33.9% (cumulative frequency on scale 1 to 3) disagreed with the statement, whereas the majority (44.3%) agreed (cumulative frequency on scale 5 to 7). Contrarily, the majority of FS strongly disagreed to disagreed (cumulative frequency of 60.6% on scale 1 to 2) with the statement, whereas a non-negligible proportion of respondents

with the statement, whereas a non-negligible proportion of respondents (cumulative frequency of 29.4% on scale 5 to 7) agreed. BLM showed internal differences; while the majority 51.7% (cumulative frequency on scale 1 to 3) of the respondents disagreed with the statement, a non-negligible proportion 41.3% agreed (cumulative frequency on scale 5 to 7).

Similar patterns were observed relative to ranchers' contribution to recreational benefits and primary responsibility on public land under their management. The majority of ranchers agreed with these statements (cumulative frequency of 75.3 and 88.9% on scale 5 to 7, means of 5.3 and 5.9, respectively, for the first and second statements). FS seemed to disagree with these statements and with ranchers (means of 3.4 and 3.7). Cumulative frequencies in Table 29 reveal that if the majority of FS respondents disagreed with the statements regarding ranchers' contribution to recreational benefits and primary responsibility on public land under their management (cumulative frequency of 56.9 and 56.8% on scale 1 to 3), a non-negligible proportion of respondents agreed with them (cumulative frequency of 29.5 and 41.1% on scale 5 to 7). BLM internal differences were more pronounced for these two statements (means of 4.1 and 3.9). There were as many respondents who agreed to the positive contribution of ranchers to recreational benefits as respondents who disagreed (cumulative frequencies of 41.3% on both sides of the scale). Relative to the primary responsibility of ranchers on the grazing allotment under their management, 48.2% of BLM respondents (cumulative frequency on scale 5 to 7)

agreed with the statement and ranchers, whereas a non-negligible proportion of respondents disagreed (44.8% cumulative frequency on scale 1 to 3).

Perceived Behavior of Ranchers Toward Public Land Management

Data in Table 30 reveal that all 13 items designed to capture perception about ranchers' behavior toward the management of grazing allotment yielded statistical significant differences. However, statistical significant differences on three parameters: (1) compliance to laws and policies applicable to rangeland, (2) allotment management as mandated by FS/BLM, and (3) ranchers seek to have their input in the allotment management, were due to the difference in strength of agreement (means ranging from 4.5 to 5.9 for all items and all groups) rather than between groups differences. Between ranchers and public land managers groups, statistical significant differences were observed on 6 items: (1) ranchers consultation in management planning of the range natural resource, (2) ranchers participation in the planning of the rangeland management, (3) ranchers active participation in policy creation and decision making, (4) rancher willingness to cooperate with the range district manager, (5) rancher willingness to cooperate with user representatives, and (6) rancher reactive position toward grazing allotment management.

Public land managers and ranchers had opposite perceptions regarding the consultation of ranchers in the management planning of the rangeland natural resources (means of 3.1, 5.6, and 4.8, respectively, for ranchers, FS, and BLM).

Table 30. Perceived behavior of ranchers toward the public grazing allotment management.

Criteria of interest	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Compliance to laws and policies applicable to rangeland	R	145	0.7	1.4	3.4	5.5	9.7	49.7	29.7	5.9	1.1	
	FS	50	0.0	14.0	10.0	0.0	22.0	34.0	20.0	5.1	1.7	25.5**
	BLM	30	0.0	10.0	10.0	6.7	23.3	36.7	13.3	5.1	1.5	
Latitude to implement management program	R	145	13.1	20.7	19.3	6.2	17.9	20.7	2.1	3.7	1.8	
	FS	51	5.9	31.4	11.8	3.9	33.3	9.8	3.9	3.7	1.7	18.0*
	BLM	30	0.0	16.7	10.0	10.0	30.0	30.0	3.3	4.6	1.5	
Consultation in inventory process of the rangeland natural resource	R	146	16.4	32.2	21.2	11.6	8.2	8.2	2.1	3.0	1.6	
	FS	51	0.0	11.8	17.6	3.9	25.5	35.3	5.9	4.7	1.5	42.1**
	BLM	30	3.3	26.7	26.7	6.7	10.0	23.3	3.3	3.8	1.7	
Consultation in management planning of the range natural resource	R	145	14.5	33.8	19.3	9.7	11.0	9.7	2.1	3.1	1.6	
	FS	51	0.0	0.0	13.7	2.0	13.7	51.0	19.6	5.6	1.2	79.0**
	BLM	30	0.0	13.3	20.0	3.3	10.0	40.0	13.3	4.8	1.7	
Participation in planning of the rangeland management	R	144	9.0	23.6	13.9	8.3	25.0	17.4	2.8	3.8	1.8	
	FS	51	2.0	3.9	11.8	0.0	29.4	41.2	11.8	5.2	1.4	27.9**
	BLM	30	0.0	13.3	13.3	3.3	30.0	30.0	10.0	4.8	1.6	
Participation in policy creation and decision making	R	144	20.8	25.0	17.4	8.3	17.4	9.0	2.1	3.1	1.7	
	FS	50	2.0	10.0	18.0	10.0	42.0	16.0	2.0	4.4	1.4	26.5**
	BLM	30	3.3	13.3	16.7	16.7	30.0	16.7	3.3	4.2	1.5	
Cooperation with the range district manager	R	145	2.1	11.0	15.9	13.8	24.8	24.8	7.6	4.5	1.6	
	FS	51	2.0	33.3	21.6	3.9	25.5	11.8	2.0	3.6	1.6	21.6**
	BLM	30	6.7	23.3	33.3	0.0	26.7	6.7	3.3	3.5	1.6	
Willingness to cooperate with user representatives	R	145	0.7	9.7	14.5	17.9	27.6	23.4	6.2	4.6	1.4	
	FS	51	3.9	27.5	21.6	19.6	15.7	11.8	0.0	3.5	1.4	23.4**
	BLM	30	3.3	20.0	26.7	13.3	26.7	10.0	0.0	3.7	1.4	
Reactive position toward rangeland management	R	142	2.1	11.3	11.3	33.1	19.0	15.5	7.7	4.3	1.5	
	FS	51	2.0	23.5	19.6	15.7	27.5	11.8	0.0	3.8	1.4	13.2*
	BLM	30	3.3	30.0	13.3	16.7	30.0	6.7	0.0	3.6	1.5	
Allotment management as mandated by USFS/BLM	R	145	2.1	3.4	4.1	4.1	14.5	53.1	18.6	5.6	1.3	
	FS	50	0.0	4.0	16.0	2.0	24.0	38.0	16.0	5.2	1.4	25.2**
	BLM	30	3.3	13.3	16.7	3.3	30.0	23.3	10.0	4.5	1.7	
Recognition and reward for good stewardship	R	146	21.2	23.3	13.7	12.3	13.7	12.3	3.4	3.2	1.8	
	FS	51	0.0	15.7	13.7	9.8	37.3	23.5	0.0	4.4	1.4	28.9**
	BLM	30	6.7	20.0	23.3	3.3	33.3	13.3	0.0	3.8	1.6	
Knowledge level to manage the allotment	R	146	0.0	1.4	2.7	6.2	15.8	51.4	22.6	5.8	1.0	
	FS	51	3.9	11.8	19.6	11.8	31.4	17.6	3.9	4.2	1.5	80.4**
	BLM	30	3.3	20.0	30.0	6.7	23.3	16.7	0.0	3.8	1.5	
Input in the allotment management guidelines	R	145	1.4	2.8	2.8	10.3	14.5	47.6	20.7	5.6	1.3	
	FS	51	0.0	2.0	5.9	9.8	21.6	51.0	9.8	5.4	1.1	27.8**
	BLM	30	0.0	0.0	16.7	0.0	46.7	26.7	10.0	5.1	1.2	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond

[b]1-strongly disagree; 4-undecided; 7-strongly agree

The majority of ranchers disagreed with the statement with a cumulative frequency of 67.6% on scale 1 to 3, whereas public land managers agreed with the item with cumulative relative frequencies of 84.3 and 63.3% on scale 5 to 7, respectively, for FS and BLM. The same scheme was observed relative to the active participation of ranchers in policy creation and decision making regarding the rangeland (means of 3.8 and 3.1 for ranchers, means of 5.2 and 4.4 for FS, and means of 4.8 and 4.2 for BLM). However, there were within group significant differences relative to these parameters. If a majority of ranchers (46.5% cumulative frequency on scale 1 to 3) disagreed with the statement "ranchers are always consulted in the range natural resource management," a non-negligible proportion of the respondents (45.2% cumulative frequency on scale 5 to 7) agreed with the item and public land managers. On the other hand, if the majority of public land managers agreed with the statement that "ranchers are active participants in policy creation and decision making of the rangeland management" (cumulative frequency of 60.0 and 50.0% on scale 5 to 7, respectively, for FS and BLM), a non-negligible proportion of respondents disagreed with the statement (cumulative frequencies of 30.0 and 33.3% on scale 1 to 3, respectively, for FS and BLM) and indicated having the same view as ranchers.

On the contrary, ranchers seemed to agree with the three statements: (1) rancher willingness to cooperate with the range district managers, (2) rancher willingness to cooperate with user representatives, and (3) ranchers reactive

position regarding the management of grazing allotment (means of 4.5, 4.6, and 4.3), whereas public land managers seemed to disagree with them (means of 3.6, 3.5, and 3.8 for FS and means of 3.5, 3.7, and 3.6 for BLM). However, data in Table 30 reveal that there are significant within group differences on these three items. Relative to the first statement, if the majority of public land managers disagreed with it (cumulative frequencies of 56.9 and 63.3% on scale 1 to 3, respectively, for FS and BLM), a non-negligible proportion of respondents agreed with the statement (cumulative frequencies of 39.3 and 36.7% on scale 5 to 7, respectively, for FS and BLM) and agreed with the majority of ranchers. On the other hand, there was a non-negligible proportion of ranchers (cumulative frequency of 29.0% on scale 1 to 3) who showed similar views as public land managers. These distribution patterns were also observed on the other two statements. Data in Table 30 also indicate that there were non-negligible proportions of respondents who were undecided about these two statements (frequencies ranging from 13.3 to 33.1%).

Ranchers and FS showed a similar view concerning the knowledge level of ranchers to manage the grazing allotment. However, if ranchers revealed a strong agreement (mean of 5.8), FS showed a weak agreement (mean of 4.2). There were non-negligible proportions of FS respondents (cumulative frequency of 35.3% on scale 1 to 3) who disagreed with the item. On the contrary, BLM seemed to disagree with the statement and ranchers' perception (mean of 3.8). Data show that the majority of BLM (cumulative frequency of 53.3% on scale 1

to 3) disagreed with the item, whereas a non-negligible proportion of respondents (cumulative frequency of 40.0% on scale 5 to 6) agreed.

Ranchers and FS also seemed to have the same perception relative to ranchers latitude to implement grazing management program (means of 3.7). Both groups seemed to disagree with the statement. However, if the majority of respondents disagreed with the statement (cumulative frequencies of 53.1 and 49.1% on scale 1 to 3, respectively, for ranchers and FS), a non-negligible proportion of respondents agreed (cumulative frequencies of 40.7 and 47.0% on scale 5 to 7). On the contrary, BLM seemed to agree with the statement and disagree with ranchers and FS (mean of 4.6). However, if the majority of BLM agreed with the item (cumulative frequency of 66.3% on scale 5 to 7), a non-negligible proportion of BLM respondents disagreed with it (cumulative frequency of 26.7% on scale 2 to 3) and showed similar views as ranchers and FS.

Concerning the statement "ranchers are always consulted in the inventory process of rangeland natural resource," the result revealed within and between group differences. Ranchers disagreed with the statement (mean of 3.0). Forest Service respondents seemed to agree with the statement and at the same time disagreed with ranchers (mean of 4.7). However, if the majority of FS agreed (cumulative frequency of 66.7%), the proportion of respondents who disagreed with the statement and showed similar views as ranchers (cumulative frequency of 29.4% on scale 2 to 3) was non-negligible. Data indicated that BLM presented within group differences (mean of 3.8). If the majority of the respondents

(cumulative frequency of 56.7%) disagreed with the statement and presented the same perception as ranchers, a non-negligible proportion of respondents (cumulative frequency of 36.3% on scale 5 to 7) agreed with the item.

Similar frequency distribution patterns were observed relative to ranchers recognition and reward for good stewardship. Ranchers and BLM seemed to disagree with the statement (means of 3.2 and 3.8); however, a non-negligible proportion of the respondents agreed so (cumulative frequency of 29.4% on scale 5 to 7 for ranchers and cumulative frequency of 49.6% on scale 5 to 6 for BLM). On the contrary, FS seemed to agree with the statement (mean of 4.4); however, a non-negligible proportion of them (cumulative frequency of 29.4% on scale 2 to 3) disagreed.

In summary, all groups agreed that ranchers have to comply to laws and policies applicable to rangeland in order to manage the grazing allotment as prescribed or mandated by USFS and BLM, they showed significant statistical differences about the behavior of ranchers toward the management of public land, even though they all agreed that ranchers always seek to have their input considered in the allotment management guidelines. It was noted that ranchers felt they had sufficient managerial styles, whereas public land managers presented mixed opinions.

Perceived Motives of Public Land Managers Relative to Public Land Management

Two areas were of interest relative to the motives and foundation of public land managers' decision making about grazing allotments. The first area covers factors that influence the decision making of public land managers. The second area captures parameters that drive public land managers in the application of grazing allotment management.

Data in Table 31 reveal that all groups agreed on 5 of 7 parameters designed to capture public land managers decision-making motives with means ranging from 5.1 to 6.2. No statistical significant difference was observed relative to decision-making based on application of natural resource laws and policies (means of 5.6 to 6.2) and natural resource health (means of 5.1 to 5.5). The information in Table 31 shows that there were statistical significant differences on decision making based on (1) public opinion about natural resource (means of 5.5 to 5.8), (2) opinion of recreationists (means of 5.5 to 5.9), and (3) environmentalist opinion (means of 5.3 to 5.9). However, these statistical significant differences resulted from strength of agreement rather than between group differences.

Statistical significant differences relative to decision making based on (1) livestock producer opinion and (2) economic return from natural resource uses resulted from within and between group differences. Public land managers agreed (means of 5.8 and 5.5, respectively, for FS and BLM) that they consider

Table 31. Perceived factors that influence public land managers' decision making about grazing allotment management.

Perceived factors	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Application of the natural resource laws and policies	R	144	1.4	2.1	3.5	9.0	13.9	50.0	20.1	5.6	1.3	
	FS	51	0.0	0.0	2.0	0.0	9.8	56.9	31.4	6.2	0.8	7.8[a]
	BLM	30	0.0	0.0	0.0	0.0	20.0	46.7	33.3	6.1	0.7	
Natural resources	R	144	2.8	4.9	9.7	11.1	19.4	39.6	12.5	5.1	1.5	
	FS	51	0.0	5.9	5.9	2.0	23.5	39.2	23.5	5.5	1.4	4.4[a]
	BLM	29	0.0	3.4	10.3	13.8	13.8	44.8	13.8	5.3	1.4	
Public opinion about natural resource conservation	R	143	2.8	2.1	4.2	4.2	12.6	42.0	32.2	5.8	1.4	
	FS	51	0.0	0.0	3.9	0.0	17.6	72.5	5.9	5.8	0.7	35.6**
	BLM	30	0.0	0.0	3.3	3.3	43.3	36.7	13.3	5.5	0.9	
Opinion of recreationists	R	144	2.1	0.0	2.1	7.6	13.9	38.2	36.1	5.9	1.2	
	FS	51	0.0	2.0	3.9	0.0	27.5	62.7	3.9	5.6	0.9	35.9**
	BLM	30	0.0	0.0	3.3	3.3	43.3	40.0	10.0	5.5	0.9	
Opinion of environmentalists	R	144	3.5	0.0	2.8	4.9	10.4	42.4	36.1	5.9	1.3	
	FS	51	0.0	2.0	11.8	2.0	21.6	58.8	3.9	5.4	1.1	34.5**
	BLM	30	0.0	0.0	10.0	6.7	33.3	43.3	6.7	5.3	1.1	
Opinion of livestock producers	R	144	6.3	15.3	15.3	11.1	29.9	18.1	4.2	4.1	1.6	
	FS	51	0.0	0.0	3.9	0.0	13.7	78.4	3.9	5.8	0.7	63.5[a]
	BLM	30	0.0	0.0	6.7	6.7	30.0	46.7	10.0	5.5	1.0	
Economic return from the natural resource uses	R	143	14.7	21.0	16.8	11.9	15.4	13.3	7.0	3.6	1.9	
	FS	51	5.9	7.8	9.8	9.8	35.3	29.4	2.0	4.6	1.5	22.0**
	BLM	30	3.3	30.0	16.7	6.7	30.0	13.3	0.0	3.7	1.6	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

livestock producers' opinion in their decision making. The data reveal that ranchers presented a within group difference (mean of 4.1). If the majority of ranchers (cumulative frequency of 51.2% on scale 5 to 7) agreed with the statement, a non-negligible proportion (cumulative frequency of 36.9% on scale 1 to 3) disagreed. Relative to decision making based on economic return from

natural resource uses, FS seemed to agree with the statement (means of 4.6 and cumulative frequency of 68.7% on scale 5 to 7), whereas ranchers and BLM seemed to disagree with respective means of 3.7 and 3.6. However, ranchers and BLM reveal within group differences. If the majority of the respondents disagreed with the statement (cumulative frequencies of 52.5 and 50.0% on scale 1 to 3, respectively, for ranchers and BLM), a non-negligible proportion of them agreed with the item and the majority of FS (cumulative frequencies of 28.7 and 43.3% on scale 5 to 6).

Data in Table 32 show that public land managers agreed that they are prone to apply grazing allotment management based on (1) field observations (means of 6.1 and 5.4), (2) CRM agreement (means of 5.3 and 5.4), (3) sound scientific facts (means of 5.6 and 5.4), and (4) stipulation of multiple uses (means of 5.5 and 5.3). Ranchers seemed to agree with public land managers and the statements that grazing allotment management decision making are based on (1) CRM agreement, (2) field observations of the rangeland, and (3) stipulation of multiple uses (means of 4.7, 4.5, and 4.5, and cumulative frequencies of 57.8, 59.9, and 58.1% on scale 5 to 7). However, information in Table 32 also indicates that there were non-negligible proportions of ranchers who were undecided (frequency on scale 4 ranging from 14.7 to 26.5%). Besides those undecided respondents, there were also non-negligible proportions of ranchers who did not view grazing allotment management as based on field observations (cumulative

Table 32. Perceived bases for application of grazing allotments.

Perceived basis	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Field observations of rangeland	R	142	4.9	11.3	9.2	14.8	28.9	27.5	3.5	4.5	1.6	
	FS	51	0.0	0.0	0.0	0.0	11.8	66.7	21.6	6.1	0.6	49.4**
	BLM	30	0.0	0.0	10.0	0.0	43.3	30.0	16.7	5.4	1.1	
C.R.M. agreements	R	142	2.1	5.6	7.7	26.8	26.1	28.2	3.5	4.7	1.3	
	FS	51	2.0	5.9	0.0	5.9	31.4	49.0	5.9	5.3	1.3	12.2[a]
	BLM	30	0.0	3.3	6.7	10.0	20.0	43.3	16.7	5.4	1.3	
Sound scientific facts	R	143	10.5	21.0	21.0	14.7	15.4	14.7	2.8	3.6	1.7	
	FS	51	0.0	2.0	5.9	2.0	23.5	52.9	13.7	5.6	1.1	65.4**
	BLM	30	0.0	6.7	3.3	0.0	43.3	30.0	16.7	5.4	1.3	
Multiple uses stipulation	R	143	4.9	4.9	15.4	16.8	31.5	22.4	4.2	4.5	1.5	
	FS	51	0.0	0.0	9.8	3.9	23.5	54.9	7.8	5.5	1.0	65.4**
	BLM	29	0.0	0.0	10.3	3.4	44.8	27.6	13.8	5.3	1.1	
Agreement of stakeholders	R	140	7.1	17.9	17.1	29.3	17.9	9.3	1.4	3.7	1.5	
	FS	49	2.0	2.0	26.5	12.2	34.7	20.4	2.0	4.4	1.3	29.0**
	BLM	30	0.0	3.3	16.7	10.0	30.0	33.3	6.7	4.9	1.3	
Balance between public/private rights	R	142	9.9	11.3	21.1	19.0	15.5	21.1	2.1	3.9	1.7	
	FS	51	11.8	11.8	5.9	17.6	29.4	23.5	0.0	4.1	1.7	14.2*
	BLM	29	0.0	6.9	20.7	17.2	34.5	17.2	3.4	4.4	1.3	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

frequency of 25.4% on scale 1 to 3) nor on multiple uses stipulation (cumulative frequency of 25.2% on scale 1 to 3).

Although the majority of ranchers disagreed with public land managers and the statement grazing allotment management based on sound scientific facts (mean of 3.6 and cumulative frequency of 52.5% on scale 1 to 3), a non-negligible proportion of respondents agreed with the item (cumulative frequency of 32.9% on scale 5 to 7).

Within and between group differences were observed relative to the statements grazing allotment management based on (1) agreement of all stakeholders and (2) balance between public and private right. Public land managers seemed to agree with these two statements (means ranging from 4.1 to 4.9), whereas ranchers seemed to disagree with them (means of 3.7 and 3.9). There was also a significant proportion of respondents who were undecided relative to those two items (frequencies ranging from 10.0% to 29.3%).

Perceived Relationship Between Public Land Managers and Permittees

Data in Table 33 collectively and separately revealed that public land managers and ranchers have statistical significant differences in assessments of their relationships. All χ^2 results were statistically significant beyond the α=.01 level. Collectively, from the top to the bottom, the table presented an increasing gradient of relationships between public land manager and permittees. The top was the lowest level of relationship with the statement "limited to business correspondences" and bottom the highest "deciding together about grazing practices." Analysis of the data in Table 33, collectively from top to bottom, revealed between groups significant statistical differences. Whereas public land managers yielded increasing means, from 2.4 to 5.4 for FS (with maximum of 5.6 on statement working together on grazing guidelines and planning) and from 3.4 to 5.3 for BLM, ranchers presented decreasing means from 4.5 to 3.9.

Table 33. Perceived relationship between public land managers and permittees.

Perceived relationship	Group	n	Percent frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Limited to business correspondences	R	131	4.6	15.3	15.3	4.6	18.3	34.4	7.6	4.5	1.8	
	FS	49	24.5	34.7	28.6	4.1	4.1	4.1	0.0	2.4	1.3	54.1**
	BLM	28	3.6	35.7	28.6	0.0	17.9	10.7	3.6	3.4	1.6	
Limited to two-way exchanges of information	R	130	4.6	13.8	14.6	6.9	27.7	26.9	5.4	4.4	1.7	
	FS	49	12.2	34.7	34.7	4.1	10.2	4.1	0.0	2.8	1.3	41.6**
	BLM	28	3.6	35.7	28.6	0.0	25.0	3.6	3.6	3.3	1.5	
Execution of guidelines as prescribed or mandated	R	129	3.1	3.9	9.3	12.4	27.9	34.9	8.5	5.0	1.4	
	FS	49	8.2	16.3	10.2	8.2	32.7	22.4	2.0	4.2	1.7	23.7**
	BLM	28	3.6	28.6	21.4	0.0	28.6	14.3	3.6	3.8	1.7	
Participating together to any prescribed action	R	130	7.7	12.3	16.2	10.8	26.2	20.0	6.9	4.2	1.7	
	FS	48	0.0	0.0	12.5	4.2	33.3	39.6	10.4	5.3	1.1	22.4**
	BLM	28	0.0	7.1	10.7	7.1	50.0	25.0	0.0	4.8	1.2	
Working together on grazing management guidelines and planning	R	131	9.2	14.5	12.2	10.7	22.9	24.4	6.1	4.2	1.8	
	FS	48	0.0	0.0	8.3	0.0	29.2	47.9	14.6	5.6	1.0	25.9**
	BLM	28	0.0	10.7	7.1	10.7	35.7	35.7	0.0	4.8	1.3	
Deciding together about grazing practices	R	130	10.0	16.9	21.5	12.3	13.1	20.8	5.4	3.9	1.8	
	FS	47	2.1	0.0	6.4	0.0	42.6	36.2	12.8	5.4	1.2	42.1**
	BLM	28	0.0	3.6	10.7	0.0	32.1	42.9	10.7	5.3	1.2	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

Separately, item by item, data in Table 33 show within group differences. Public land managers disagreed that their relationship with permittees is limited to business correspondences (means 2.4 and 3.4, respectively, for FS and BLM) or limited to two-way exchanges of information (means 2.8 and 3.3, respectively, for FS and BLM). Ranchers seemed to agree with these statements (means of 4.5 and 4.4). However, the data indicated that there were within group differences among ranchers and BLM. A non-negligible proportion of ranchers agreed with the majority of public land managers and disagreed with the statements

(cumulative frequencies of 35.2 and 33.0% on scale 1 to 3). Also, a non-negligible proportion of BLM agreed with these statements (cumulative frequencies of 32.2% on scale 5 to 7) and had the same perception as ranchers.

Ranchers agreed (mean of 5.0) that their relationship with public land managers is executing guidelines as prescribed or mandated. Public land managers presented a within group differences relative to that item (means of 4.2 and 3.8). If the majority of FS agreed with the statement (cumulative frequency of 57.1% on scale 5 to 7), a non-negligible proportion of respondents disagreed (cumulative frequency of 34.7% on scale 1 to 3). Contrarily, a majority of BLM disagreed with the statement (cumulative frequency of 53.6% on scale 1 to 3), whereas a non-negligible proportion agreed (cumulative frequency of 46.7% on scale 5 to 7). Public land managers agreed with the three remaining items: (1) participating together on any prescribed action, (2) working on grazing management and planning, and (3) deciding together about grazing practices (means of 5.3, 5.6, 5.4 for FS and 4.8, 4.8, and 5.3 for BLM). Data indicated that there were internal differences among ranchers relative to those three items (means of 4.2, 4.2, and 3.9). If the majority of ranchers agreed, like public land managers, with the statements participating together to any prescribed action and working together on grazing management guidelines and planning (cumulative frequencies of 53.1 and 53.4% on scale 5 to 7), a non-negligible proportion of respondents disagreed (cumulative frequencies of 36.2 and 35.9% on scale 1 to 3). On the last item, public land manager-permittee relationships as to deciding

together what should be applied in grazing practices, the majority of ranchers disagreed with the statement and public land managers (means of 3.9 and cumulative frequency of 58.4% on scale 1 to 3). However, a non-negligible proportion of rancher respondents agreed with the statement (cumulative frequency of 39.3%). Public land managers agreed with the statement with means of 5.4 and 5.3, respectively, for BLM and FS.

In summary, the analysis of the data in Table 33 revealed that ranchers perceived their relationship with public land managers as executing guidelines as prescribed or mandated. FS indicated that their relationship with permittees is working together on grazing management and planning, whereas BLM viewed their relationship as deciding together about grazing practices. However, results seemed to indicate that public land managers and ranchers have a particular relationship which is mostly dependent on individual personalities.

Perceived Best Approach to Improve Range Management

To facilitate the interpretation of comments on the best approach to improve range management, the researcher focused mostly on common thoughts from public land managers and ranchers and educational needs of the study. To ease the analysis, the researcher aggregated the parameters into four factors underlying specific needs. The four factors pertain to (1) natural resources, (2) permittees, (3) public land managers, and (4) overall management. The

results are summarized in Tables 34 and 35. The comments are presented in their entirety for each group in Appendix C.

Perceived Best Approach to Improve Range Management by Ranchers

Overall, 104 ranchers commented on the question. The frequencies in Table 34 do not add up to the total number of respondents because several ideas were reported in one response and each idea was counted as a unit. For this reason the researcher did not compute the percent frequency.

Data in Table 34 reveal that 11 ranchers perceived that there was a need to develop and/or improve water sources for the improvement of the range natural resource. As two respondents commented, "Plenty of water must be developed for all the animals," and "Water should be developed in as many places as possible for wildlife and livestock." Supporting that need another rancher commented, "Take into consideration that there is a wide variation in wet year and dry year and the rancher has to survive in an adverse year."

Supporting the results in section one, part two, related to range health and condition, seven ranchers commented that there is a need to control the weeds and tree encroachment. One respondent commented, "Weeds like leafy spurge are getting out of control, so the BLM should be doing all they can on this problem." Another said, "The shrub trees are enclosing the range." Furthermore, this rancher noted that "noxious weed control should be maintained." Proposing

Table 34. Best approach to range management as perceived by ranchers (N=104).

Factors	n
Actions required about natural improvement	
* water development and/or improvement	11
* weed and tree encroachment control	7
* application of different grazing rotation	11
* limitation of overgrazing	3
* balanced uses between livestock and wildlife	3
Actions needed on the part of permittees	
* active, comfortable and collaborative work with public land managers.	3
* active livestock management	3
* education of poor manager	3
Actions required from public land managers	
* consideration of ranchers' input to give more leeway to ranchers	22
* more on the field work	3
* limitation of bureaucracy.	3
* limitation distance and text book management	4
* education about ranch /range	7
Actions needed for overall range management	
* collaboration between public land managers and permittees.	14
* flexible grazing methods	9
* management based on scientific data	4
* consideration of on-site environmental condition differences	7
* consideration of cost sharing	4
* consideration of economic outcomes	5
* empowerment of local authority	4
* reconsideration of land tenure	6
* establishment of measurable and attainable long term goals	4
* limitation of political and radical groups interventions	4
* improvement of communication	4
* use of trust and common sense	2
* use of incentive measures	6

solutions, these respondents said, "The BLM should be more flexible in allowing the producer to improve the land without allowing the producer to abuse it, for example, allowing the producer to control sagebrush with pesticides or other means." "Permittees need to be able to spend their own money on improvement to BLM land if BLM so approves." Two ranchers were concerned about overgrazing impacts on the improvement of the range physical environment. Referring to other ranchers relative to the overgrazing problem, a respondent said, "Don't overgraze it and take care of it as if it is your own." Advancing solutions, another rancher commented, "If someone is consistently overgrazing on public land for an extended period, then cancel their right to the allotment."

Still, on the improvement of the range physical environment, ranchers perceived that there was a need for the adoption of different grazing management and active livestock management. This respondent pinpointed a need for "spreading the cattle more with riders and salt, not using specific dates for on/off but condition of grass depending on type of growing season."

Ranchers also perceived a need "to educate poor managers." As commented by this respondent, "more education and concerted effort" are needed "to get permittees with a problem to view areas that are OK and visit with other permittees to see what they are doing." There was also a perceived need to educate ranchers to work comfortably and collaboratively with public land managers. Supporting this need, a respondent commented, "Many ranchers are so

concerned about loss of grazing permits or property rights that they are unable to work comfortably with any government agency."

One possible source of this problem may be related to the method of doing the AMP. When asked when participants of the study had their "AMP negotiated" (question 4 - section VI) one rancher pointed out that the "AMP is not negotiable." Another rancher remarked that "negotiated is not a proper term for this."

Among actions required from public land managers there were significant requests (n=22) that the public land managers give more leeway to ranchers and consideration to their input. As an illustration, some comments by ranchers follow:

* Agency should listen more to on-the-ground users.

* Producer should have more say as they are on the land 365 days a year.

* USFS/BLM should let the operator of the allotment have more say than they sometimes get, because they are closer to the land than the guy that sits in an office and tries to run the allotments from a desk.

* [Public land managers should] "listen to users" ideas about improving range management rather than executing mandates or guidelines.

* USFS/BLM should talk to permittees as they would to another educated person, then use some of their ideas or discuss the reasons why they do not wish to.

One rancher, however, put a condition to the request and commented, "Let the permittee have more input if he is managing his private land well."

Ranchers also perceived a need to have more leeway in the management of the allotment. As this respondent said, "Leave the management to individual permittees." This respondent gave a solution to the problem and commented: "The majority of producers are the best managers of public land. The permittee should be the person who determines the AUM each year depending on range conditions as well as turn in and out dates." The second request from ranchers to public land managers was to understand the environment of livestock production (n=7). As depicted by this rancher, "Public land managers need to have an understanding of the economics as well as the practicability of management techniques they would like the permittees to use." Two ranchers commented: "It would help if you have someone who just knew a little bit about the management of cattle." "The forest managers need to be more familiar with livestock handling on open forest and more of a stock person." More specifically to public land managers' educational needs, a respondent said in his/her final comment,

> Range specialists should be required to work on ranch or grazing operation with BLM or FS allotments for at least 2 years as a prerequisite to a degree in range management. Qualified range specialists (from government agencies) should work with permittees toward better management, not just being out there on a policing action looking for minor violations.

Along the same thought, ranchers perceived that "federal land managers need more field work." It was perceived to be "the biggest complaint." This respondent requested, "Give the land manager more time to work with the permittees on the ground to address management problems." He/she said they "never see the person." Supporting this remark, another respondent said, "We . . .

have very little interaction with the managers." These comments noticeably support the results of rancher perceptions about public land manager/permittee relationships in Table 34.

Comments from ranchers seemed to indicate that the source of the problem was the structure of bureaucracy. "The field range conservationists have too much to cover to do their job. The organization is top heavy," commented one respondent. Another perceived that there was a need to "allow some common sense employees to act/consult with users without their work being reviewed by layers and layers of bureaucracy."

Among necessary actions to improve the overall management of the range natural resource, ranchers perceived that there were needs for collaborative or cooperative action between public land managers and permittees (n=13). As pointed out by this rancher, "The public land manager and lessee should work together in coming up with a management plan that will improve the range." This rancher perceived a need "for the permittees and management to work together year by year as range conditions change due to weather changes, etc." From the ranchers' perspectives this collaboration or cooperation should be based on scientific facts, include economic and physical environment concerns, and consider long term goals.

As an illustration, these were the comments from ranchers to improve the overall management of range:

* Active face-to-face consultation to develop goals and implementation practices with consideration given to economic and ecological factors.

* On site mutual visits to evaluate what is there and ideas on how to best utilize it.

* Work cooperatively to develop management that will support grazing as well as protect and enhance other resources.

* By ranchers and public land managers using scientific facts to together decide how to reach realistic economic and environmental goals.

* [That public land managers] work with the permittees when a problem arises and try to come up with solutions together.

Along with collaborative or cooperative management, ranchers also perceived the needs to instate incentive measures (n=3), empower local authority (n=4), and limit the intervention of environmentalists and politics (n=4). As this rancher commented, "The best approach to improve range management is to provide incentives such as cost sharing projects and educational directives." Cost sharing alternative was proposed with the present condition of "assurance that the lease will be continued" or, as another rancher commented, "assurance that they will get paid for their investment should be the allotment grazing be cancelled." This condition was perceived to be "key to encouraging ranchers to make important improvements." Other incentive measures proposed by ranchers were, as perceived by this respondent, a need for "more hands-on site cooperative effort" with "less edict from Washington," "less input from environmentalists" and "less control by people not on site." Given his/her reason, this rancher pointed out that "putting authority at the local level for most part will improve range

conditions faster than any other practice." Another supporting comment said that "USFS and BLM should . . . accept the suggestions of responsible permittees instead of using textbook approach management. Many permittees are intelligent and educated individuals with years of practical experience that could be an advantage to government agencies."

Among other prospects to improve the management of the range, there were perceived needs to improve communication between public land managers and permittees (n=4) and use common sense (n=2) as well as reconsidering the land tenure (n=6). One rancher commented that better communication should "try to avoid confrontation and use common sense" and "remain open to ideas both on the federal employee's behalf as well as the permittee." Adding to that, another rancher commented that "less adversarial relationship between ranchers and professionals would help."

Relative to land tenure, one rancher perceived the need of "blocking [consolidating] of the federal land." To do so, another rancher commented that "the sale of BLM' small tracts would aid in the BLM being able to enlarge other grazing districts and improve access and public uses." Another rancher perceived the need to enforce the consolidation of the management of public land "as proposed in the Public Rangelands Act."

There were two propositions of interest mentioned by ranchers but not reported in Table 35. The first proposition asked "to put the allotment on use

basis rather than a set unit of turn out number." The second proposition concerned the need of willingness to "monitor the condition of the range."

Perceived Best Approach to Improve Range Management by Public Land Managers

The data analysis for the perceived best approach to improve range management included both FS and BLM for the sake of meaningful interpretation. However, the comments from FS and BLM are presented separately in their entirety in Appendix C for reader reference. Also the source of comments are distinguished as from FS or BLM. The analysis focused on the same four factors adopted in the analysis of data from ranchers.

Forty-four FS and 29 BLM responded to the question. The data in Table 35 show that, like ranchers, public land managers perceived the need to improve water source (n=3), control weeds and undesirable trees species (n=2), and apply different grazing management (n=6). As this FS respondent pointed out, "On the ground actions would include more prescribed burning, biological control of weed and alien plants, more flexibility in livestock grazing and grazing as a tool." The use of fire was tied to a need for "education of its use as a tool to improve ecosystem condition." Public land managers perceived a significant need for a physical environment assessment (n=9) as a foundation to improve the management of range natural resource. There were noticeable needs for stressing the geographical scale of environmental assessment and the outcomes of management on the natural resource. As a FS respondent reported, there was

Table 35. Best approach to range management as perceived by public land managers (N=73).

Factors	n
Actions required about natural improvement	
* water development and/or improvement	3
* weed and tree encroachment control	2
* application of different grazing management	6
* environmental assessment or inventory	9
Actions needed on permittees' part	
* active livestock management	3
* education of poor manager	3
Actions required from public land managers	
* consideration of ranchers' input to give more leeway to ranchers	2
* more on the field work	4
* limitation of bureaucracy	3
Actions needed for the overall range management	
* collaboration between public land managers and permittees	18
* flexible grazing methods	5
* management based on scientific data	6
* consideration of on site environmental outcomes	10
* consideration of cost sharing and economic outcomes	6
* empowerment of local authority	3
* reconsideration of land tenure	3
* establishment of measurable and attainable long term goals	3
* limitation of political and radical groups interventions	7
* improvement of communication and trust	9
* use of incentive measures	3

a need to do the environmental assessment with "site specific analysis with vegetation, hydrologic and soil objectives." Two BLM respondents noted the need to place the "emphasis on whole system processes" and use a "holistic approach assessing ecosystems rather than components of the range." There was a perceived need that the outcomes of management be "sustainable." As a BLM respondent commented, there was a perceived need to "design management that will meet the needs of the resource so that it will be sustainable." One FS respondent suggested that the best approach to improve range management is to "maintain rangeland uses at levels that will protect soil, water, and vegetation." A BLM respondent remarked, "Don't manage for things that will never be on the range." Furthermore, another BLM respondent remarked that "management practices should not manage the land according to land ownership-- fence lines should not be the management boundary lines."

Like ranchers, public land managers perceived a need for active livestock management by permittees. One FS respondent pointed out that there was a need for more "active management on the part of the permittees, more time spent riding and assessing cattle management." Another FS respondent perceived the need to "teach folks how to be cowboys again." Even stronger, another FS respondent commented that "permittees have to be active effective participants." Educational needs were perceived by two FS respondents (1) to "improve the ranchers' knowledge of the other influences on land manager's decision" and (2) to educate the permittee to the benefits of intensive grazing systems." More

specifically, another FS respondent perceived the need for "field tours to good and bad examples, particularly of riparian grazing, winter pasture management, [and] sustainable concept."

There was an expressed need from public land managers, as from ranchers, to give leeway to permittees. A FS respondent commented that there was a need for "having the permittees become more directly responsible for the management of the allotment they are permitted for, including monitoring and compliance with management standards." Another FS expressed the need to "provide as much flexibility to the livestock operator in meeting his/her objectives while meeting the sustained resource objectives and laws of the public land."

Like ranchers, public land managers also perceived the need of "more field work" and use of flexible grazing management. As commented by this FS respondent there was a need for public land managers to "spend more time in the field to develop solid approaches to solving real problems or improving on-the-ground conditions." Another FS respondent expressed the need to educate public land managers to be "willing to try different methods of grazing practices and compare those against standard practices." Furthermore, another FS respondent perceived the need "to use all management opportunities available to promote livestock grazing as beneficial use" and not to "be boxed in by fixed management systems and dates."

Among actions required for the overall management, there was a significant expressed need (n=17) for coordinated/collaborative/cooperative

approaches. Unlike ranchers, coordinated/collaborative/cooperative methods were perceived by public land managers to include (mostly but not limited to) permittees and "other special interest groups." The "other groups" were perceived to be as "environmentalists" or non-specifically defined as "user groups." As expressed by this BLM respondent, this approach "in many cases would be working with the permittee and getting his/her understanding of what is to be accomplished." More specifically there was a noticeable preference for "coordinated resource management" (comments from 2 FS and 1 BLM respondents) and "collaborative process" (comments from 2 FS and 2 BLM respondents). The coordinated/ collaborative/cooperative methods were perceived to be applied to "design grazing system" (comment from 1 FS respondent), "insure that the best management principles are being used and adhered to" (comment from 1 FS respondent), define "what the objectives are in the land use plans" (comment from 1 BLM respondent), and "foster good management practices" (comment from 1 BLM respondent).

To realize this approach, public land managers, like ranchers, perceived the need to input "the best scientific data available" (comment from one FS respondent) "into the formula for success" (comment from one FS respondent). Like ranchers, public land managers also perceived the need to limit the intervention of radicals and politics. As this FS pointed out, there was a need to not "let a few radicals on both ends of the scale, environmentalists and ranchers, hold up the process." One BLM respondent remarked that the overall

management of the rangeland should not be "politically dictated or court bound." One FS respondent commented that there was a need for "less input from environmental groups." Another FS respondent demanded, "Remove politics at all levels of land resource management."

Like ranchers, public land managers perceived the need to improve communication and trust. The trust and communication needs were perceived to carry the objectives of management and create positive cooperative working environment. As one respondent pointed out, "Trust, respect, good communication and flexibility on both sides is a must." One FS respondent perceived the need for trust for, if not, "the resource will suffer." One BLM respondent perceived the need for "building trust among all groups so they can work together to achieve their common objective of improved conditions along with economic development." To fulfill that need, one FS respondent perceived the need to "improve the communication/relationship to improve trust on both sides." More specifically one BLM respondent perceived a need for "communication and education of ranchers' needs to the public land manager and education and communication of the public land manager's needs and objectives to the ranchers."

It was, however, noted that there was a policy constraint to attaining improved communication. As requested by this FS respondent, public land managers should "be given more flexibility to try different range management approaches and techniques, while working with permittees and other special

interest groups." The respondent perceived the need for "having public laws allowing [him/her] to consult with permittees on ideas they may have and implement these ideas." One BLM respondent, when completing the perceived relationship between permittees and public land manager, section 3, part 3, remarked that "deciding together what should be applied in grazing practices . . . is illegal."

Other parameters that concerned public land managers relative to improving range management was the need for educating the public. As commented by this BLM respondent, there was a need for "educating all users about ecological process and management actions that address and maintain ecological process." More specifically, one BLM indicated that there was a need to "educate ranch and environmental sides to proper, reasonable and logical management." Supporting this request, another BLM respondent commented that "the most limiting factor is education of permittees and environmentalist about how the land should look when it is healthy." It was perceived that until that "is accomplished, we can't have a common vision to work toward."

Perceived Sources of Conflict on Public Rangeland

Data in Table 36 show that all groups agreed that conflicts over public rangeland are due to (1) lack of knowledge base (means of 5.2 to 6.0), (2) lack of understanding between users (means of 5.8 to 6.2), (3) different personality views (means of 5.5 to 5.6), (4) lack of communication (means of 5.5 to 5.9), and

Table 36. Perceived causes of conflicts on public rangeland.

Perceived cause	Group	n	Relative frequency distribution[b]							Mean	SD	χ^2
			1	2	3	4	5	6	7			
Lack of knowledge base	R	144	1.4	2.1	4.2	2.1	13.2	36.8	40.3	6.0	1.3	
	FS	51	2.0	5.9	9.8	0.0	35.3	33.3	13.7	5.2	1.5	26.1**
	BLM	30	0.0	3.3	0.0	3.3	30.0	43.3	20.0	5.7	1.1	
Lack of understanding between different users	R	146	0.7	1.4	4.1	0.7	11.6	45.9	35.6	6.0	1.1	
	FS	51	0.0	2.0	0.0	0.0	29.4	47.1	21.6	5.8	0.9	15.6*
	BLM	30	0.0	0.0	0.0	0.0	10.0	63.3	26.7	6.2	0.6	
Different personality views	R	146	0.0	2.1	6.8	10.3	24.7	35.6	20.5	5.5	1.2	
	FS	50	0.0	6.0	4.0	6.0	22.0	30.0	32.0	5.6	1.4	7.1[a]
	BLM	30	0.0	6.7	3.3	0.0	30.0	43.3	16.7	5.5	1.3	
Lack of communication	R	146	0.7	2.1	2.1	8.9	25.3	38.4	22.6	5.6	1.2	
	FS	51	2.0	5.9	2.0	2.0	23.5	47.1	17.6	5.5	1.4	2.3[a]
	BLM	30	0.0	0.0	3.3	0.0	23.3	46.7	26.7	5.9	0.9	
Conflicting interest between users	R	146	1.4	4.1	6.2	8.2	15.1	44.5	20.5	5.5	1.4	
	FS	51	0.0	2.0	2.0	0.0	11.8	47.1	37.3	6.1	1.0	9.3[a]
	BLM	30	0.0	10.0	3.3	0.0	23.3	40.0	23.3	5.5	1.5	
Enforcement of policies	R	146	4.1	5.5	14.4	17.8	26.7	22.6	8.9	4.6	1.5	
	FS	51	2.0	11.8	19.6	9.8	31.4	25.5	0.0	4.3	1.5	11.2[a]
	BLM	30	0.0	10.0	10.0	16.7	43.3	20.0	0.0	4.5	1.2	
Inaccuracy of policies relative to grazing allotment	R	146	0.7	2.7	11.6	21.2	18.5	32.2	13.0	5.0	1.4	
	FS	51	2.0	27.5	31.4	17.6	15.7	3.9	2.0	3.4	1.3	57.9**
	BLM	30	3.3	30.0	16.7	16.7	13.3	16.7	3.3	3.7	1.7	
Non-applicability of grazing allotment management guidelines	R	144	0.7	10.4	16.7	20.1	22.2	19.4	10.4	4.5	1.5	
	FS	50	4.0	36.0	28.0	8.0	18.0	6.0	0.0	3.2	1.4	33.7**
	BLM	30	6.7	23.3	16.7	23.3	26.7	3.3	0.0	3.5	1.4	
Mismanagement of the allotment by the permittees	R	145	18.6	30.3	19.3	4.1	15.2	10.3	2.1	3.1	1.7	
	FS	51	2.0	15.7	15.7	9.8	41.2	9.8	5.9	4.3	1.5	25.5**
	BLM	30	10.0	20.0	6.7	3.3	43.3	13.3	3.3	4.0	1.8	
Limited potential of the range to support various uses	R	146	8.2	19.2	12.3	8.2	15.8	28.1	8.2	4.2	1.9	
	FS	51	7.8	19.6	17.6	5.9	35.3	9.8	3.9	3.9	1.7	22.4**
	BLM	30	13.3	16.7	20.0	3.3	33.3	10.0	3.3	3.7	1.8	

[a]Non-significant; * significant at α=.05; ** significant at α=.01 and beyond
[b]1-strongly disagree; 4-undecided; 7-strongly agree

(5) conflicting interests between users (means of 5.5 to 6.1). Statistical significant differences on these items were simply due to the strength of agreement.

Although all groups seemed to agree with the statement that conflicts on public rangeland are due to enforcement of policies (means of 4.6, 4.3, and 4.5 and cumulative frequencies of 58.2, 56.9, and 63.3% on scale 5 to 7, respectively, for ranchers, FS, and BLM), statistics show within group differences. A non-negligible proportion of respondents within each group disagreed with the statement (cumulative frequencies of 24.0, 33.4, and 20% on scale 1 to 3, respectively, for ranchers, FS, and BLM). There was also a non-negligible proportion of undecided respondents (ranging from 9.8 to 17.8%).

Data in Table 36 show that there are between and within group differences about (1) inaccuracy of policies relative to grazing allotment and (2) non-applicability of grazing allotment guidelines as sources of conflict over the public rangeland (means ranging from 3.2 to 5.0). The majority of ranchers agreed with the statements (means of 5.0 and 4.5, cumulative frequencies of 63.7 and 52.0% on scale 5 to 7). However, a non-negligible proportion of respondents were undecided (frequency of 21.2 and 20.1% on scale 4) and disagreed with these items (cumulative frequencies of 15.0 and 27.8%). Public land managers seemed to disagree with these two statements and with the majority of ranchers (means of 3.2 and 3.7, respectively, for FS and BLM). However, like ranchers, public land managers show internal differences. The majority of respondents disagreed that "inaccuracy of policies relative to grazing allotment" causes conflict on public

rangeland (cumulative frequencies of 60.9 and 50.0% on scale 1 to 3, respectively, for FS and BLM). However, a non-negligible proportion of the respondents agreed with the item (cumulative frequencies of 21.6 and 33.3% on scale 5 to 7, respectively, for FS and BLM). Data also show that there was a non-negligible proportion of public land managers who were undecided (frequencies of 17.6 and 16.7% on scale 4).

A similar distribution pattern was observed relative to the statement non-applicability of grazing allotment guidelines. Public land managers disagreed with the statement as did a majority of ranchers (means of 3.2 and 3.5, cumulative frequencies of 68.0 and 46.7% on scale 1 to 3, respectively, for FS and BLM). However, a non-negligible proportion of respondents slightly agreed to agreed (cumulative frequencies of 24.0 and 30.0% on scale 5 to 6). Data also indicated that there was a non-negligible proportion of BLM who were undecided (frequency of 23.3% on scale 4).

Data revealed that all groups show internal differences relative to the statements that conflicts on public land are due to (1) mismanagement of the allotment by the permittees (means of 3.1 to 4.3) and (2) limited potential of the range to support various uses (means of 3.7 and 4.2). A majority of public land managers agreed with the statement that conflicts on public land are due to mismanagement of the allotment by the permittees (cumulative frequencies of 56.9 and 59.9% on scale 5 to 7, respectively, for FS and BLM). It was noted, however, that among those who agreed the majority slightly agreed with the

statement (modes of 41.2 and 43.3%). Among the respondents who disagreed, a number of respondents from FS disagreed to slightly disagreed (cumulative frequency of 31.1% on scale 2 to 3), whereas those from BLM strongly disagreed to disagreed (cumulative frequency of 30.0% on scale 1 to 2). Ranchers disagreed with the statement (mean of 3.1 and cumulative frequency of 68.0% on scale 1 to 3). However, those who slightly agreed to agreed (cumulative frequency of 25.5% on scale 5 to 6) constituted a non-negligible proportion.

In summary, all groups clearly agreed that the following five factors are sources of conflict on public rangeland: (1) lack of knowledge base, (2) lack of understanding between users, (3) lack of communication, (4) different personality view, and (5) conflicting interest between users. Data also indicated that there were discrepancies relative to the perception of accuracy of policies, applicability of grazing allotment guidelines, and mismanagement of the allotment by the ranchers.

Perceived Best Action Toward Public Rangeland Management

Data in Table 37 indicate that all groups strongly disagreed (means of 1.2 to 1.3) with the statement that the best action toward public rangeland management is to revert it to total wilderness. Public land managers also strongly disagreed about the privatization of public rangeland (means of 1.2 and 1.7). The majority of ranchers (cumulative frequency of 45.9% on scale 5 to 7), however, agreed with