

# GRAZING ON PUBLIC LANDS IN THE 21<sup>ST</sup> CENTURY

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## ABSTRACT

A panel of professionals from the ranching, environmental, agency, and university communities was assembled to examine trends relating to the future of grazing on federal lands. Five factors were identified that were thought to influence the use of grazed forages over the next 20 years. These factors were (1) multiple uses of public lands, (2) public sentiment towards grazing on public lands, (3) environmental and federal agency regulations, (4) permittee issues, and (5) use of science and technology for managing public land grazing. A list of issues associated with each of the five factors was concurrently developed. The panel of experts was surveyed to explore the future direction each issue would take and the influence each issue may exert on grazing on public lands. All four groups were fairly consistent on the way they viewed the future of grazing on public lands. The most likely scenario includes (1) a significant increase in the demand for multiple uses on public lands, (2) a continued public sentiment against grazing on public lands, (3) an increase in the regulations, and their enforcement, that will negatively impact livestock grazing on the majority of allotments, (4) a continued demand or slight decline in rancher demand for grazing on public lands, and (5) a significant increase in the use of science and technology for managing public land grazing.

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## INTRODUCTION

Federal lands include lands managed by the Bureau of Land Management (BLM) and U.S. Forest Service (USFS). These federal agencies manage a significant amount of rangelands in the West. As the dominant landowners in the 11 western states, BLM and USFS manage 42% of the land, ranging from 22% in Washington to 77% in Nevada.

About 85% of the federal lands are grazed by domestic livestock (Obermiller 1992, USDA 1990, USDI 1990). On these lands, there are about 21.6 million animal unit months (AUMs) of grazing authorized under about 29,000 grazing permits (CAST 1996). The level of federal land dependency for individual ranchers varies widely. Many public land ranchers depend on federal lands for a large part of seasonal grazing capacity, and, in some cases where yearlong grazing is common, federal lands provide nearly all AUMs of ranch grazing capacity. It has been estimated that over half the commercial beef-cattle in the 11 western states are on livestock operations holding grazing permits on BLM and USFS lands (CAST 1996, Torell et al. 1992).

The use of public lands for livestock grazing started at a time in American history when settlement of the western states was a primary national policy objective. Historically, there was little interest by the urban population in public land management, and livestock ranchers incorporated public land forage into their ranching operations. User fees were set low to encourage use and settlement of the vast public domain, and these past policies greatly accelerated the economic development of the western states. However, the state of public land management has now moved from a limited interest by most citizens to one of high public visibility. With this movement has come increased competition for the use of these lands. New federal policies have been proposed (USDI/USDA 1994), public land management is being carefully scrutinized, and various interest groups are positioning themselves to protect their perceived rights.

For individuals dependent upon public lands, taking a proactive approach to their changing environment requires futuristic views. In general, traditional forecasting methods center on the premise that future events are extrapolations of past trends and events (Zentner 1982). However, given the instability and uncertainty of future public land management, no single projection can be deduced from past trends or behaviors. This has been evidenced in the business world by the increase in forecasting errors in the general business climate since the 1970s (Wack 1985). Marcus and Mevorach (1988) state that "even the most sophisticated forecasting model—econometric modeling—has not made accurate predictions during periods of exceptional instability" (p. 50–51).

An alternative to forecasting that develops an understanding for the causal relationships and factors that contribute to change and instability is scenario analysis. Scenarios provide a framework for examining possible futures. By reducing uncertainties into a set of scenarios, decision-makers are provided with information that accounts for change and

unknowns. To make projections of future conditions, scenario analysis has been used by the energy industry (Wack 1985, Stokke et al. 1990, Kahane 1992), defense industry (Millet and Randles 1986), agriculture industry (Van Tassell et al. 1995) and many others (Klein and Linneman 1981).

According to Huss (1988), scenarios are best suited for long-term, macroeconomic, uncertain environments that are typified by a scarcity of data and a large number of non-quantifiable factors. The environment facing western rural communities, agricultural producers, and other public land users can be characterized as such. In this paper, we will use scenario analysis techniques to examine the future of grazing on public lands. Trends in issues most germane to public land use will be explored and scenarios characterizing potential environments that western ranchers dependent upon public lands may face will be determined.

## METHODOLOGY

A scenario is "a description of a possible future state of an organization's environment considering possible developments of relevant interdependent factors in that environment" (Brauers and Weber 1988). Scenarios have been developed using a myriad of different techniques centered on expert opinions of future events (Godet 1987, Ringland 1998, van der Heijden 1996). The techniques used in this study are an extension of those used by Brauers and Weber (1988) where expert opinion and clustering techniques are used to determine future states of nature.

Four expert panels (hereafter referred to as interest groups), each comprised of 15 individuals, from federal agencies (BLM and USFS), the ranching community, western universities, and environmental organizations, were enlisted. Representative environmental/conservation organizations included the Rocky Mountain Elk Foundation, The Nature Conservancy, Sierra Club, Greater Yellowstone Coalition, National Resources Defense Council, National Wildlife Federation, Forest Guardians, and the Center for Biological Diversity. Panel members were chosen based upon peer recommendation. These individuals were considered to be knowledgeable of public land trends and have been actively engaged in public land issues. The number of experts chosen was based upon Delphi studies where research has shown the error rate was small when eight or more qualified participants were used (Hodgetts 1979). Because the elicitation process is quite intense, we chose to start with 15 individuals on each panel to ensure that a minimum of eight would be able to participate through the entire study.

A planning horizon of 10 to 20 years was chosen. This time frame represents a long-term outlook that should not make participants feel they have to predict events associated with a particular year. This horizon should afford enough time to allow several current trends to be realized and emerging issues to come to the forefront.

The first step in determining future scenarios was to identify major factors affecting grazing on public lands. The factors needed to be comprehensive enough to reflect all relevant concerns about the future, but had to be kept to a minimum because of the complexity of the survey process. Two to three possible future outcomes that were mutually exclusive and technically exhaustive (i.e., other outcomes were thought to have a probability of occurrence so low as to justify their exclusion) were designated for each factor. An initial listing of factors and possible future states were submitted to panel members for their input. Several panel members offered insightful suggestions. Several panel members again reviewed factors and states after revisions.

Three surveys were designed to obtain the required information for formation and interpretation of the scenarios. The first survey identified issues or topics associated with each factor that were hypothesized to impact livestock grazing on public lands. Panel members were asked to indicate the direction they believed each issue would take over the next 10 to 20 years using a 5-point scale. Three different 5-point scales were used depending upon the nature of the issue (significant decrease to significant increase; much less restrictive to much more restrictive; and highly unlikely to highly likely). After projecting the general trend, panel members were asked to rate the impact each issue would have on livestock grazing on public lands using a 5-point scale of significant decrease, decrease, no change, increase, or significant increase. Information from this survey was used to help interpret panel members' evaluations of the factor/state predictions they were subsequently asked to make.

The second survey was designed to elicit probabilities of occurrence for the three states of nature each factor could take. The sum of probabilities for each factor was required to equal one.

The third, and last, survey that panel members were asked to complete was, perhaps, the most important in developing scenarios. Given five factors and three states of nature for each factor, 243 ( $3^5$ ) different scenarios would be possible. The objective of scenario analysis is to group all scenarios into two or three most likely scenarios. To assure that scenarios within each group had a high likelihood of occurring together, a measure of compatibility was required. This measure was obtained by having panel members determine the likelihood that each alternative state of one factor would occur with each alternative state or level from each of the other four factors. Panel members were, thus, presented with each combination of two factor levels and were asked to rate their likelihood of occurring simultaneously as either (1) will not occur together, (2) low likelihood of occurring together, (3) neutral, (4) likely to occur together, or (5) very likely to occur together. This requires 60 comparisons of factor states given 5 factors and 3 states each. For analysis purposes, likelihood levels were assigned numbers 1 to 5 as listed above. A neutral rating was therefore listed as 3.

The first step in developing two or three most likely scenarios was to eliminate scenarios that had a low possibility of occurring. Two conditions were used to do this. First, if a compatibility rating of 1 (not likely to occur) existed between any two-factor outcomes in a scenario, the scenario was eliminated. Second, intra-scenario compatibility ratings were developed by averaging the individual compatibilities between factor outcomes in each scenario. If the intra-scenario compatibility of the scenario was less than 3.0, the scenario was eliminated. A lower limit of 3.0 was chosen to assure the remaining scenarios had at least a neutral compatibility.

As previously stated, the objective of scenario analysis is to develop a small number (2 or 3) of representative scenarios that can be used in strategic planning. Brauers and Weber (1988) recommend cluster analysis (Martino and Chen 1978) be used to organize scenarios into homogeneous groupings that are as heterogeneous from other scenarios as possible.

Representative scenarios were developed by using cluster analysis to group scenarios based on their compatibility. To accomplish this, inter-scenario compatibility ratings were determined by comparing the compatibility ratings between the factor outcomes in one scenario with each factor outcome in another scenario, summing all of these compatibility levels, and dividing by the number of factor levels compared. The resulting scenario compatibilities ranged from 1 to 5. Finalized input for the cluster analysis was a  $q \times q$  diagonal matrix (where  $q$  = number of acceptable scenarios) comprised of compatibility ratings between all scenarios. Diagonal values (the same scenarios) were assigned a rating of 5.

All scenarios were clustered into two or three groups so as to maximize the inter-scenario compatibility within a group and minimize the inter-scenario compatibility between groups. To determine whether two or three clusters were optimal, an average inter-compatibility rating for all scenarios within each cluster was developed, and used to determine which number of groupings obtained a maximum average compatibility rating.

To determine a representative scenario for each cluster, the mean, mode, and median of each factor outcome within a cluster were examined. Three representative scenarios were determined for each cluster based upon each statistic (mean, mode, and median). If the statistics disagreed on the representative scenario, scenario intra-compatibility ratings were used to decide between the three alternatives.

The probability of occurrence for each cluster (representative scenario) was determined by assuming an equal probability of occurrence for each of the scenarios within the two clusters, with the sum of all scenarios equaling one. Probabilities for each cluster were then obtained by summing the probability of the scenarios within the cluster.

Each panel member was contacted by telephone at the beginning of the project. The procedure was outlined and each respondent was told it would take approximately 1 to 2 hours of their time to complete the surveys. Each agreed to participate. Surveys were sent to all 60 panel members in

early summer of 2000. They were given one month to complete the surveys. They were given instructions and examples for filling each of the three surveys out. They also were given a phone number and email address of a contact person that could give them assistance, if needed. Follow-up phone calls encouraging participation were made to those not returning the survey after one month.

## RESULTS

Five general factors were theorized to have a major influence upon livestock grazing on public lands over the next 10 to 20 years. These factors were (1) multiple uses of public lands, (2) public sentiment against grazing on public lands, (3) environmental and federal agency regulations, (4) permit-tee issues, and (5) use of science and technology for managing public land grazing. Three alternative states of nature were hypothesized to occur under each factor (Table 1).

Panel members returned a total of 45 surveys. These included 9 from the environmental panel, 13 from university personnel, 11 from ranchers, and 12 from the agency panel.

## Probabilities of Occurrence

Average marginal probabilities for each interest group for the factor states are shown in Table 1. Ordinal rankings are fairly consistent among interest groups. All four groups felt the demand for multiple uses on public lands was likely to increase significantly. The environmental panel felt the strongest about this (82% probability) followed by the ranching, university, and agency panels. All groups assigned a fairly low probability that the demand for multiple uses would significantly decrease.

The agency and environmental panels felt somewhat more confident that public sentiment against grazing on public lands will significantly increase. The rancher and university panels felt that current public sentiment against grazing will continue to persist, with higher probabilities attached to this state of nature.

All panels felt that regulations, and their enforcement, affecting livestock grazing were quite likely to increase. The difference was where the regulations and their enforcement would occur. The agency, rancher, and university panels assigned a higher probability that the majority of grazing allotments would be impacted while the environmental panel

**Table 1. Marginal probabilities of each factor/state influencing grazing on public lands in the western U.S., by interest group<sup>1</sup>.**

Factor and states	Marginal probabilities (%)			
	Agency	Enviro	Rancher	University
1. The demand for multiple uses on public land:				
a. will increase significantly	55	82	72	64
b. will not change significantly	33	13	23	23
c. will decrease significantly	12	5	5	13
2. Public sentiment against grazing on public lands:				
a. will increase significantly	52	46	33	32
b. will not change significantly	34	39	48	48
c. will decrease significantly	14	15	19	20
3. Regulations, and their enforcement, affecting livestock grazing:				
a. will increase and negatively impact grazing on the majority grazing allotments	46	39	54	54
b. will increase, but only negatively impact areas where resource concerns have emerged	37	42	35	35
c. will not change significantly	17	19	11	11
4. Rancher demand for grazing on public lands:				
a. will increase significantly	21	5	23	9
b. will not change significantly	45	39	41	55
c. will decrease significantly	34	56	36	36
5. The use of science and technology for managing public land grazing:				
a. will increase significantly	55	52	47	33
b. will not change significantly	35	40	36	51
c. will decrease significantly	10	8	17	16

<sup>1</sup>Agency = Bureau of Land Management and U.S. Forest Service employees; Enviro = environmental constituents; Rancher = ranching constituents; University = selected professors from western universities.

assigned a slightly higher probability that the impact would be centered in areas where resource concerns have already emerged. When panel members reviewed the survey, several made the comment that more regulations wouldn't necessarily be devised, but that current regulations would be enforced more strongly. It appeared that the environmental panel felt that regulations should first be concentrated and enforced where problems already exist.

A fair amount of diversity and uncertainty existed regarding the rancher demand for grazing on public lands over the next 10 to 20 years. The environmental panel felt it was highly probable that rancher demand will decrease significantly. The other three panels assigned a higher probability to rancher demand remaining constant. The agency and rancher panels assigned a probability of over 20% that rancher demand will significantly increase.

The agency, environmental, and rancher panels felt the use of science and technology for managing public land grazing was more likely to increase significantly than to not change. The university panel, conversely, felt a higher probability existed that the use of science and technology for managing public land grazing would not change significantly. Perhaps these scientists felt somewhat frustrated that their research has not, or will not, be applied as readily as they felt it should be.

#### *Scenarios*

For each interest group, two and three groupings of scenarios were examined using cluster analysis. Based on the compatibility ratings within each cluster and the minimal variation in the resultant representative scenarios, two clusters were deemed optimal. Cluster 1 had a higher probability of occurrence than Cluster 2 by merit of the greater number of scenarios represented. A representative state of nature was obtained for each factor in the cluster by examining the mean, median, and mode of the scenario factor states within the cluster. The three measures of tendency were almost always in agreement. Two representative scenarios (Scenario 1 and Scenario 2) were, thus, developed for each interest group.

There was a fair amount of consistency among the representative scenarios developed for each interest group (Table 2). Overall, the demand for multiple uses will increase significantly; public sentiment will most likely not change significantly; regulations and their enforcement affecting livestock grazing will increase and negatively impact grazing on the majority of grazing allotments; rancher demand will decrease significantly; and the use of science and technology for managing public lands will increase significantly.

Several exceptions to this future are noteworthy. For Scenario 1, the agency and environmental panels called for public sentiment against grazing to increase significantly. The environmental panel projected regulations and their enforcement to only negatively impact grazing in areas where resource concerns have already emerged. Rancher demand was projected to not change significantly by the

agency panel, and the university panel felt there would not be a significant change in the use of science and technology for managing public land grazing.

Scenario 2 was consistent among the environmental, rancher, and university panels. The outlook for grazing on public lands under Scenario 2 called for the demand for multiple uses on public lands to not change significantly; public sentiment against grazing to not change significantly; regulations and their enforcement affecting livestock grazing to increase, but only negatively impact grazing in areas where resource concerns have already emerged; rancher demand for grazing on public lands to not change significantly; and for no significant change in the use of science and technology for managing public land grazing. Scenarios 1 and 2 for the agency panel were identical except that the use of science and technology was projected to increase significantly under Scenario 1 and not change under Scenario 2.

Several events, or factor states, appear to be contingent upon others occurring. For example, there is interdependency between the demand for multiple uses not changing significantly, public sentiment not changing significantly, regulations only impacting existing concerns, and rancher demand not changing significantly.

### **General Trends and Their Impacts on Grazing**

#### *Multiple uses*

Increases in recreational demands on public lands are projected to be strong and impact livestock grazing negatively (Table 3). The environmental panel felt the strongest regarding the increase in recreational demand, while the agency panel, though anticipating an increase, projected it to not be as strong as the other three panels. Agency and rancher panels expect the increased recreational demands to be slightly more detrimental to livestock grazing than the other two panels.

While most panel members did not feel wildlife numbers will significantly increase, there was a strong sentiment that more public land will be set aside for wildlife habitat. The consumptive demand for wildlife should decline somewhat, while the non-consumptive demand for wildlife will heighten.

Increased designation of wilderness areas, monuments, and national parks, along with efforts to protect biodiversity and preserve native species are expected. The rancher panel projected the designation/expansion of wilderness areas, national parks, and monuments to negatively impact livestock grazing, while the agency panel gave more consideration to future efforts to protect biodiversity and preserve native species.

Development near public lands is expected to increase over the next 10 to 20 years. While this is projected to have a somewhat negative impact on the number of AUMs grazed, it is not expected to exert as great of an influence as many of the other issues previously discussed.

**Table 2. Two most likely future scenarios for grazing on western public lands considering a 20-year planning horizon, by interest group.<sup>1</sup>**

Factor and states	Agency		Environmental		Rancher		University	
	Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2
1. The demand for multiple uses:								
a. will increase significantly	a	a	a		a		a	
b. will not change significantly				b		b		b
c. will decrease significantly								
2. Public sentiment against grazing:								
a. will increase significantly	a	a	a					
b. will not change significantly				b	b	b	b	b
c. will decrease significantly								
3. Regulations affecting grazing:								
a. on the majority of allotments	a	a			a		a	
b. where have already emerged			b	b		b		b
c. will not change significantly								
4. Rancher demand for grazing:								
a. will increase significantly								
b. will not change significantly	b	b		b		b		b
c. will decrease significantly			c		c		c	
5. Use of science and technology:								
a. will increase significantly	a		a		a			a
b. will not change significantly		b		b		b	b	
c. will decrease significantly								
Probability of occurrence	82%	18%	59%	41%	67%	33%	66%	34%

<sup>1</sup>Agency = Bureau of Land Management and U.S. Forest Service employees; Environmental = environmental constituents; Rancher = ranching constituents; University = selected professors from western universities.

**Table 3. Projected trend in alternative uses that may compete with grazing on public lands and their impacts on the number of animal unit months (AUMs) grazed by livestock.**

Use	Trend in use <sup>1</sup>				Impact on AUMs grazed <sup>2</sup>			
	Univ	Ranch	Enviro	Agency	Univ	Ranch	Enviro	Agency
Demands for recreation on public lands	4.23	4.36	4.89	4.00	2.00	1.91	2.33	1.92
Wildlife numbers on public lands	3.38	3.09	3.44	3.25	2.46	2.27	2.22	2.25
Public land set aside for wildlife forage or habitat	4.00	4.18	3.89	3.67	2.00	2.00	2.00	2.08
Consumptive demand for wildlife	2.46	2.45	2.89	3.08	3.00	2.82	2.89	2.67
Non-consumptive demand for wildlife	4.15	4.10	4.44	4.17	2.23	2.40	2.44	2.50
Wild horse and burro numbers on public lands	3.00	3.10	2.89	2.83	2.85	2.50	2.78	3.00
Designation/expansion of wilderness areas	4.00	3.82	4.13	3.75	2.38	2.09	2.88	2.58
Designation/expansion of national parks and monuments	4.00	4.09	3.89	4.00	2.31	2.00	2.56	2.33
Efforts to improve/protect biodiversity	3.85	4.36	4.22	4.17	2.23	2.36	2.33	2.00
Native species preservation efforts	3.77	4.18	4.22	4.17	2.38	2.18	2.44	2.00
Development near public lands	4.38	4.45	4.44	4.08	2.38	2.36	2.44	2.25
Increase in acreage of public lands through purchases or exchanges	3.23	3.82	3.44	3.33	2.62	2.73	2.89	2.83
Privatization of public lands	2.69	3.00	2.89	3.08	2.85	3.09	3.00	2.92

<sup>1</sup>Trend in use was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase. <sup>2</sup>Impact this trend will have on AUMs grazed by livestock on public lands was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase.

### Public sentiment

The two sentiments identified by the environmental and agency panels to exert the greatest influence on livestock grazing were the perception that grazing is destroying public lands and the opinion that the value of public lands is in open space and environmental uses, and not extractive uses (Table 4). The university and rancher panels felt the perception that grazing is destroying public lands would not change or somewhat decline. While these two panels felt the opinion that the value of public land is in open space and environmental uses would increase, they did not feel as strongly as the environmental and agency panels regarding the negative impact this would exert on public land grazing.

Other sentiments that are expected to increase, but not have a major impact on the AUMs grazed, are the opinion that livestock do not belong on public lands regardless of other circumstances (environmental and agency panels), the perception that permittees are receiving a subsidy for grazing on public lands (agency panel), the perception that public interest is more influential than science in the management of public lands (university and agency panels), and the opinion that economics of communities should not be a factor in determining grazing decisions (agency panel). While all panels felt the use of litigation to control public land decisions would increase, the agency panel felt the increase in this trend would be strongest and the impact on grazing would be the greatest. The environmental panel expected litigation to be used the least and, thus, have a minor negative impact on livestock grazing.

### Federal and agency regulations and activities

Regulations regarding clean water and wetland/riparian area conservation are expected to become more restrictive and negatively impact the number of AUMs grazed on public lands (Table 5). The university panel did not feel quite as strongly as the other panels regarding this trend. The rancher panel felt slightly more concerned about riparian area conservation than other panels. While regulations regarding clean air and global warming are expected by many of the panels to become more restrictive, their impact on public land grazing is thought to be minimal.

All panels anticipate that regulations regarding endangered species will become more restrictive and negatively impact livestock grazing over the next 10 to 20 years. The agency panel felt the strongest regarding this trend, while the university panel felt these regulations would not be quite as restrictive as the other panels did. Most panels felt there would be an increase in the reintroduction of species and an increase in the number of endangered species listed. While all panels felt there would be an increased trend in the delisting of endangered species, the rancher panel felt the strongest regarding this trend.

Grazing requirements, standards, and guidelines, and their enforcement, are expected to become more restrictive. Rangeland monitoring requirements are specifically expected to become more restrictive. While the rancher and agency panels felt stronger regarding these trends than the other two panels, the agency panel felt more strongly than the rancher panel that these trends will negatively impact the number of AUMs grazed.

**Table 4. Projected trend in public sentiment towards grazing on public lands and their impact on the number of animal unit months (AUMs) grazed by livestock.**

Sentiment	Trend in sentiment <sup>1</sup>				Impact on AUMs grazed <sup>2</sup>			
	Univ	Ranch	Enviro	Agency	Univ	Ranch	Enviro	Agency
Perception that grazing is destroying public lands	3.00	2.64	3.56	3.92	2.54	2.73	2.11	2.08
Perception that permittees are receiving a subsidy for grazing on public lands	3.00	3.36	3.44	3.75	2.85	2.45	2.44	2.50
Perception that public interest is more influential than science in the management of public lands	3.69	3.36	3.38	3.58	2.54	2.55	2.38	2.42
Public opinion that livestock do not belong on public lands regardless of other circumstances	3.15	2.80	3.67	3.67	2.77	2.80	2.44	2.50
Opinion that economics of communities should not be a factor in determining grazing decisions	2.77	3.09	3.00	3.50	2.83	2.91	2.67	2.67
Opinion that social and historic values should not be factors in determining grazing on public lands	2.77	2.82	3.44	3.42	2.85	2.73	2.44	2.75
Use of litigation to control public land decisions	3.69	3.91	3.44	4.08	2.31	2.55	2.67	2.17
Opinion that the value of public lands is in open space and environmental uses, and not extractive uses	4.00	3.91	4.22	4.25	2.54	2.55	1.89	2.08

<sup>1</sup>Trend in sentiment was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase. <sup>2</sup>Impact this trend will have on AUMs grazed by livestock on public lands was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase.

**Table 5. Projected change in environmental and federal agency (BLM and USFS) regulations or activities and their impact on the number of animal unit months (AUMs) grazed by livestock.**

Regulation or activity	----- Change in regulation/activity -----				----- Impact on AUMs grazed <sup>1</sup> -----			
	Univ	Ranch	Enviro	Agency	Univ	Ranch	Enviro	Agency
Regulations, and their enforcement, concerning wetland and riparian area conservation and protection <sup>2</sup>	3.62	4.18	4.00	4.08	2.35	2.09	1.89	2.21
Regulations, and their enforcement, concerning endangered species <sup>2</sup>	3.46	3.91	3.78	4.08	2.27	2.27	2.11	1.91
Regulations, and their enforcement, concerning clean water <sup>2</sup>	3.69	4.00	4.00	4.08	2.46	2.09	2.00	2.00
Regulations, and their enforcement concerning clean air <sup>2</sup>	3.62	3.73	3.67	3.83	2.92	2.73	3.00	2.58
Regulations, and their enforcement, due to global warming concerns <sup>2</sup>	3.46	3.73	3.44	3.42	3.00	2.64	3.00	2.67
Limitations on the use of natural or controlled fires as a land management tool <sup>2</sup>	3.35	2.91	2.89	3.25	3.00	3.09	2.89	2.75
Limitations on removing tree cover on public lands for management purposes <sup>3</sup>	3.00	3.64	3.22	3.00	2.77	2.82	3.11	2.92
Limitations on the control of weeds and insects <sup>3</sup>	2.77	3.00	2.56	3.25	2.92	3.00	3.00	2.92
Limitations on the control of livestock predators <sup>3</sup>	3.38	3.55	3.33	3.58	2.54	2.64	3.00	2.50
Mandated reintroduction of species <sup>3</sup>	3.62	4.00	3.78	4.00	2.38	2.18	2.44	2.33
Number of endangered species listed <sup>3</sup>	3.92	4.00	4.11	4.08	2.35	2.27	2.11	2.08
Delisting of endangered species <sup>3</sup>	3.23	3.55	3.22	3.33	2.92	3.18	3.00	2.92
Grazing requirements, standards, and guidelines and their enforcement <sup>2</sup>	3.69	4.00	3.75	4.00	2.54	2.36	2.13	2.17
Rangeland monitoring requirements and enforcement <sup>2</sup>	3.50	3.91	3.78	4.00	2.75	2.55	2.33	2.25
Ability to re-issue grazing permits in a timely manner <sup>3</sup>	2.69	2.36	2.89	2.83	2.54	2.45	2.78	2.75
Likelihood that gra-zing permits will be re-issued <sup>4</sup>	3.69	3.73	3.22	4.00	2.54	2.73	2.75	2.67
Ability of non-agricultural interests to obtain grazing permits for conservation use <sup>3</sup>	3.38	3.64	4.00	3.83	2.38	2.36	2.11	2.17
Grazing fee level <sup>3</sup>	3.69	3.91	4.00	3.75	2.62	2.73	2.67	2.75
Likelihood that the grazing fee will be determined more by some type of competitive bidding process than by a fee formula <sup>4</sup>	2.31	2.55	2.89	2.75	2.77	3.00	3.00	2.75
Use of sheep as a land management tool (e.g., control of vegetation) <sup>3</sup>	3.73	3.45	3.11	3.50	3.23	3.27	2.89	3.25
Use of cattle as a land management tool (e.g., control of vegetation) <sup>3</sup>	3.23	3.09	3.11	3.17	3.08	2.82	2.89	3.00
Flexibility of allotment on/off dates <sup>3</sup>	2.92	3.09	3.44	3.42	2.69	3.00	2.89	2.75
Agency personnel time for on-the-ground allotment management <sup>3</sup>	2.23	2.73	2.56	2.25	2.62	2.45	2.56	2.58
NEPA <sup>5</sup> requirements and paperwork <sup>3</sup>	3.77	4.00	3.11	3.92	2.50	2.55	3.00	2.67
Number of agency personnel employed <sup>3</sup>	2.92	3.27	3.00	2.83	2.77	2.64	2.89	2.75
Agency cost of managing public lands <sup>3</sup>	4.00	4.18	3.78	4.00	2.77	2.50	2.78	2.75
Likelihood that agencies will pay permittees for their loss when AUMs are reduced <sup>6,4</sup>	1.46	1.91	2.11	1.67	2.54	2.60	2.78	2.67

<sup>1</sup>Impact the change in regulation or activity will have on AUMs grazed by livestock on public lands was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase. <sup>2</sup> Change in regulation or activity was ranked as 1 = much less restrictive, 2 = less restrictive, 3 = no change, 4 = more restrictive, 5 = much more restrictive. <sup>3</sup> Change in regulation or activity was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase. <sup>4</sup> Change in regulation or activity was ranked as 1 = highly unlikely, 2 = unlikely, 3 = not sure, 4 = likely, 5 = highly likely. <sup>5</sup> National Environmental Policy Act. <sup>6</sup> Assuming permittee is not out of compliance.



The number of agency personnel employed is expected to be maintained at current levels, but personnel time for on-the-ground allotment management is expected to decrease, perhaps partly because the requirements and paperwork associated with the National Environmental Policy Act (NEPA) compliance also are projected to increase. The rancher panel seemed somewhat concerned that the lack of agency personnel time for on-the-ground allotment management would have a detrimental effect on the number of AUMs grazed. The rancher panel also was concerned about the agencies' abilities to re-issue grazing permits in a timely manner. Overall, all panels expect the agency cost of managing public lands to increase.

All panels felt there was a better-than-average chance that grazing permits will be re-issued when their current tenure expires. The agency panel felt the most confident in this trend, while the environmental panel felt the least confidence. All panels felt there would be some increase in the ability of non-agricultural interests to obtain grazing permits for conservation use with the result that the number of AUMs grazed would decrease. This sentiment was shared more universally among the environmental panel and less so among the university panel. A low likelihood was attached to the possibility that, in the future, agencies will financially compensate permittees for their loss of AUMs.

All panels were fairly confident that an increase in the grazing fee level is likely. The environmental and rancher panels were somewhat more confident this would occur than the other two panels. All panels, particularly the university panel, felt it was more likely that some type of a fee formula will be used rather than a competitive bidding process. None of these grazing fee issues are expected to have much of an impact on the number of AUMs grazed.

Few trends in on-the-ground management activities (e.g., flexibility in allotment on/off dates; control of tree cover, weeds, and insects) are projected, with little to no impact from these on actual livestock grazing. The rancher and agency panels expect an increase in the limitations on the control of livestock predators, but a strong decline in AUMs grazed should not result. The university and agency panels also anticipate an increase in the use of sheep as a land management tool.

#### *Permittee issues*

Rancher demand for grazing on public lands is a function of several issues (Table 6). One is the profitability of the livestock industry. Panel members projected the profitability of the range livestock industry, especially sheep, to somewhat decrease. A more drastic decrease was projected for both the cattle and sheep industries by the environmental panel. The environmental panel also anticipates that decreased profitability will have a more drastic impact on AUMs grazed than the other panels projected. The rancher panel was more optimistic regarding the lack of profitability

and its impacts on public land grazing than were the other panels.

All panels felt the relative cost of grazing on public versus private leases would increase, but few felt it would impact the number of AUMs grazed. Few alternatives to grazing on public lands are expected, with the availability of private grazing leases projected to decline, as well as rancher's ability to purchase additional private lands.

Permittee's desire to maintain public grazing permits for non-livestock profit motives, such as establishing a guide/hunting enterprise or guest ranch, is expected to increase, with the environmental and rancher panels giving this a slightly higher rating than the other two panels. Likewise, a slight increase in the permittee's desire to maintain public grazing permits for scenic, recreation, and other personal nonprofit motives is anticipated. The environmental panel was somewhat more optimistic regarding this trend than were the other panels. The environmental panel also was more likely to project an accompanying decline in AUMs grazed as a result of the impact of these non-livestock motives.

Permittee's ownership of water rights on public lands is projected to remain secure and the opportunities to sell those water rights are expected to increase. As water rights are sold, all panels anticipate AUMs will decline.

All panels, especially the environmental panel, felt strongly that residential encroachment and the opportunities for permittees to sell deeded land for development will increase. These events are projected to decrease the AUMs grazed on public lands. A lesser trend is expected, by all groups, in the value of livestock ranching as a means to deter residential development, although the availability and use of purchased and donated conservation easements is expected to increase. The stress of dealing with public land issues is expected to increase with an ensuing decline in AUMs grazed. The rancher panel appears to be the first to admit this aspect of public land management.

#### *Use of science and technology*

The use of science and technology for managing public land grazing is projected to increase in several areas over the next 10 to 20 years, but it will have little impact on the number of AUMs grazed (Table 7). The rancher and university panels felt that science will find that livestock grazing is generally beneficial to the management of public lands, while the environmental panel projected science will find it is somewhat damaging. The agency panel felt neither would be found.

Technologies expected to be implemented are the use of biological control methods for control of undesirable plants, use of Geographic Information Systems and Global Position Systems (GIS/GSP) for rangeland monitoring, and a slight increase in the development and use of grazing management methods for public lands. Permittee participation in the monitoring of public land grazing also is expected to increase. Much of the science will be aimed at managing public lands as an ecosystem, with new ecological concepts being

**Table 6. Projected trend in permittee issues and their impact on the number of animal unit months (AUMs) grazed by livestock.**

Issue	Trend in use <sup>1</sup>				Impact on AUMs grazed <sup>2</sup>			
	Univ	Ranch	Enviro	Agency	Univ	Ranch	Enviro	Agency
Availability of private grazing leases	3.15	2.00	2.78	2.83	2.54	2.73	2.89	2.67
Relative cost of grazing on public vs private leases	4.00	3.60	3.56	3.25	2.77	2.90	2.44	2.58
Rancher's ability to purchase additional private lands	2.42	2.09	2.44	2.00	2.69	2.82	2.89	2.58
Permittee desire to maintain public grazing permits for scenic, recreation, and other personal nonprofit motives	3.38	3.36	3.78	3.33	2.54	2.82	2.44	2.67
Permittee desire to maintain public grazing permits for non-livestock profit motives <sup>3</sup>	3.46	3.73	4.00	3.67	2.54	2.45	2.22	2.75
Monetary value of grazing permits (permit value)	2.77	2.82	3.22	2.92	2.85	2.45	2.56	2.75
Length (term) of grazing permit tenure	2.92	2.64	2.89	2.75	2.92	2.45	2.78	2.83
Permittee control over management activities on public allotments	3.00	2.64	3.00	2.50	2.85	2.64	2.89	2.67
Range improvement on public lands	2.85	2.45	2.89	3.08	2.62	2.91	2.89	2.50
Profitability of the cattle industry	3.08	2.82	2.00	2.58	2.54	2.64	2.00	2.42
Profitability of the sheep industry	2.69	2.36	2.00	2.33	2.46	2.82	2.11	2.33
Demand for red meat	3.54	3.82	3.22	2.75	3.00	3.18	2.89	2.58
Permittee's ownership of water rights on public lands	3.62	3.73	3.22	3.83	2.69	2.64	3.00	2.83
Opportunities for permittee to sell deeded land for development	4.08	4.00	4.22	4.08	2.17	2.09	1.78	2.17
Opportunities for permittee to sell water rights	3.92	3.82	4.22	3.58	2.31	2.45	1.89	2.50
Permittee stress from dealing with public land issues	4.23	4.45	3.67	4.08	2.00	2.27	2.33	2.25
Encroachment of residential development	4.08	4.09	4.33	4.08	2.15	2.18	1.75	2.08
Value of livestock ranching as a means to deter residential development	3.38	3.45	3.11	3.00	3.00	2.91	2.89	2.83
Availability of purchased conservation easements on deeded lands	3.92	4.00	3.78	3.83	2.92	3.27	2.89	2.50
Use of donated conservation easements on deeded lands	3.85	3.64	3.78	3.83	3.08	3.09	2.89	2.42

<sup>1</sup>Change in trend of permittee issue was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase, *except* for permittee's ownership of water rights on public lands, where 1 = much less restrictive, 2 = less restrictive, 3 = no change, 4 = more restrictive, 5 = much more restrictive. <sup>2</sup>Impact the trend in permittee issue will have on AUMs grazed by livestock on public lands was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase. <sup>3</sup>Could include using access to public lands for establishing a guide/hunting enterprise or guest ranch.

developed and used. There will be little encouragement to develop and seed new forage species and varieties on public lands.

A downward trend in road development is projected and the development of water facilities will be mainly for wildlife use. A prominent trend was not apparent regarding the use of chemicals for control of undesirable plants or pests.

A slight increase is expected in the use of coordinated management/decision-making groups and Resource Advisory Councils in managing activities on public lands. Educational programs for permittees, agency personnel, and the general public regarding management of public lands also should increase slightly.

## CONCLUSIONS

The trend in livestock grazing on public lands over the next 10 to 20 years is projected to generally decrease. Multiple uses, particularly recreation, will increase and public lands will be managed more for ecological purposes than for extractive uses. Public sentiment towards grazing on public lands will not improve and the use of litigation to control public land decisions should continue. Environmental and federal agency regulations and activities will generally increase, especially regulations regarding riparian and wetland areas. Endangered species will continue to take center stage in the decision-making process and NEPA requirements and paperwork will continue to increase for agency personnel. Though conservation easements will play a role in slowing the encroachment of residential development, development

**Table 7. Projected use of science and technology for managing public land grazing and their impact on the number of animal unit months (AUMs) grazed by livestock.**

Use	Trend in use <sup>1</sup>				Impact on AUMs grazed <sup>2</sup>			
	Univ	Ranch	Enviro	Agency	Univ	Ranch	Enviro	Agency
Use of currently approved chemicals for control of undesirable plants on public lands	2.92	2.82	3.22	3.17	2.92	2.82	3.11	2.92
Development and use of new chemicals for control of undesirable plants on public lands	2.92	3.27	3.44	3.50	3.00	2.91	3.00	3.17
Use of biological control methods for control of undesirable plants on public lands	3.77	4.00	3.89	3.83	3.08	2.91	3.00	3.17
Use of chemicals for pest (e.g., grasshopper) control on public lands	2.62	2.73	2.89	2.75	2.77	2.82	3.00	3.00
Development and seeding of new forage species and varieties on public lands	2.38	2.82	2.78	2.67	2.62	2.91	2.89	3.00
Development and use of grazing management methods on public lands	3.31	3.82	3.56	3.75	3.23	3.45	3.22	3.17
Development and use of new ecological concepts	3.54	3.73	3.89	4.00	3.08	2.82	3.13	2.92
Water development for livestock use on public lands	2.67	3.00	2.89	3.00	2.75	2.80	2.89	2.92
Water development for wildlife use on public lands	3.46	3.60	3.33	3.42	3.00	3.00	3.11	2.92
Road development on public lands	2.31	1.82	2.25	2.17	2.85	3.27	3.00	2.92
Fence development on public lands	2.54	2.91	3.00	2.67	2.77	3.00	2.89	2.75
Use of GIS/GSP on rangeland monitoring <sup>3</sup>	4.08	4.00	4.22	4.00	3.08	3.09	3.00	2.92
Permittee participation in rangeland/livestock use monitoring	4.15	4.00	4.00	3.83	3.17	3.36	3.22	3.00
Use of coordinated management/decision-making groups in managing allotments <sup>4</sup>	3.85	3.64	3.67	3.75	2.92	3.09	3.38	2.83
Use of Resource Advisory Councils (RACs) in managing activities on public lands	3.46	3.45	3.67	3.58	3.00	2.82	3.13	2.83
Education programs regarding management of public lands for permittees	3.62	3.82	3.44	3.75	3.15	3.36	3.11	3.00
Education programs regarding management of public lands for agency personnel	3.54	3.45	3.44	3.67	2.92	2.91	3.00	2.92
Education programs regarding management of public lands for the public	3.54	3.82	3.67	3.83	3.00	3.36	2.78	2.83
Public funding for rangeland research	2.69	3.00	3.11	3.00	2.69	2.91	3.00	2.83
Science will find that livestock grazing is generally damaging or beneficial <sup>5</sup>	3.69	3.70	2.50	2.92	3.15	3.40	2.38	2.58
Management of public lands as an ecosystem	3.54	3.91	4.11	3.92	2.77	2.82	2.22	2.58
Management of public lands for multiple uses	2.62	3.18	3.44	2.75	2.38	2.64	2.33	2.33

<sup>1</sup>Change in use of science and technology for managing public land grazing was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase. <sup>2</sup>Impact use of science and technology will have on AUMs grazed by livestock on public lands was ranked as 1 = significant decrease, 2 = decrease, 3 = no change, 4 = increase, 5 = significant increase. <sup>3</sup>Geographic Information Systems and Global Positioning Systems. <sup>4</sup>An example would be the Coordinated Resource Management (CRM) program. <sup>5</sup>Trend was ranked as 1 = very damaging, 2 = damaging, 3 = no findings, 4 = beneficial, 5 = very beneficial.

is projected to increase with ample opportunities for permittees to sell their deeded land and water rights. New technologies will be implemented, especially the use of biological control methods for undesirable plants and pests, along with GIS/GPS monitoring technology. While the use of science and technology will increase in the management of public land grazing, it will have little impact on the number of AUMs grazed on public lands.

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