Resolving Range Conflict in Nevada? The Potential for Compensation via Monetary Payouts and Grazing Alternatives

Thomas G. Hobby and G. Cornelis van Kooten

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ABSTRACT

In response to environmental pressure, public land agencies in Nevada have reduced animal unit months (AUMs) of grazing on public lands. This has resulted in economic losses to ranchers, increased conflict between ranchers and the public land agencies, and general unrest in the ranch community. One approach to resolving the problems might be to compensate ranchers for lost grazing privileges. In this study, we employ the results of the Nevada Ranch Survey to examine ranchers' willingness to accept a one-time payment to retire grazing rights, as well as three other means of "compensating" ranchers that enable them to earn a living from the public lands despite reduced access to public forage. The results suggest that ranchers are not keen on being compensated in any form, expressing a desire to continue ranching. However, those most amenable to compensation and a re-working of the social contract are those who have the best relationship with the public land manager and view the public agencies in a positive light.

Key words: range economics; environmental services from public land; compensation for

grazing rights; social capital and trust

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1. BACKGROUND

The Nevada ranch community has increasingly come under pressure from environmental groups and public land managers because livestock grazing on public lands is seen as a contributing factor to the environmental degradation of public lands. Public grazing allotments have fallen over time, threatening the viability of ranchers' operations and creating tension between ranchers and public land managers. Nevada public grazing allotments (measured in animal unit months or AUMs) decreased by 16% (473,553 AUMs) between 1980 and 1999. This resulted in an estimated direct loss of $11.6 million to the livestock industry and $24.8 million to the Nevada economy (Table 1). Reasons for decreased public grazing over this period vary, but the most important factors given by the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) are indicated in Table 2. More than two-thirds of the AUM reductions were unexplained, resource-related or the result of permit violations, but the explanation is only clear for the latter category.

Historically, ranchers and public land managers worked together to improve rangeland, but numerous environmental laws enacted in the 1970s and 1980s led public land managers to devote less time to building relationships with ranchers and more to complying with federal regulations. Further, the most common response of public land managers to demands to protect non-commercial values of the range was to reduce AUM allocations. Yet, land managers often made range management decisions based on inadequate information, resulting from too little staffing, funding or experience, leading to poor range decisions and

systematic AUM reductions. Insufficient time was spent seeking effective solutions to range problems (Resource Concepts Inc. 2001, pp.62-63). This led to a reduction in social capital (Putnam 2000, 2001) in the Nevada ranch community, particularly as trust between ranchers and the land agents declined. As a result, little has been done cooperatively to resolve grazing problems on public range, with little investment in activities that increase social capital and reduce the transaction costs of sustainable range management (van Kooten et al. 2003).

Table 1: Decline in AUMs of Grazing by Agency, Nevada, 1980-1999

	Δ 1980-1999		Economic impact ($'000s)	
Federal Agency	in AUMs	%	Nevada	Livestock sector
BLM.	-374,045	-14%	-$19,600	-$9,100
US Forest Service	-86,289	-23%	-$4,500	-$2,100
US Fish & Wildlife Service.	-25,176	-78%	-$1,300	-$600
Bureau of Reclamation	+10,218	*	$500	$250
National Park Service	-313	*	-$16	-$8
Totals	-473,553	-16%	-$24,800	-$11,600

* indicates not reported
Source: Resource Concepts Inc. (2001)

Table 2: Reductions in BLM and USFS Grazing Services, by Cause, 1980-1999

	BLM		U.S. Forest Service	
Item	Decrease in AUMs	% Δ	Decrease in AUMs[a]	% Δ
No reason given in the database	164,087	44	25,230	28
Resource related	89,619	24	19,719	23
Permit violation	35,210	9	13,672	16
Change in the class of livestock	34,179	9	(1,960)	(2)
Forest Service Enhancement Act	19,189	5	–	–
Transfer of Ownership	11,863	3	5,716	7
Final Multiple Use Decision	10,485	3		
Boundary Change	9,413	3	41,517	48
Forest Service Enhancement Act	–	–	(17,605)	(20)
Total Reduction	**374,045**	**100**	**86,289**	**100**

[a] Values in parentheses indicate an increase in grazing.

In this paper, we investigate how social capital in Nevada's ranch community might affect the political acceptability of several schemes to compensate ranchers for reduced

access to public lands. For this purpose, we employ responses to the Nevada Ranch Survey, using these to examine various economic and social aspects related to the acceptance of alternative grazing options that range from sale of all rights to future grazing to schemes that enables ranchers to maintain their incomes and lifestyles despite lost grazing opportunities. The Nevada Ranch Survey was mailed to the entire population of BLM and US Forest Service grazing permit holders in Nevada between March 29, 2002 and July 5, 2002. The design and mailing procedures were based on Dillman (2000). The survey was reviewed and pre-tested by various University of Nevada Reno faculty members, Nevada extension specialists and others at the university involved in ranching. The first mailing was sent on March 29, 2002 with a second mailing on May 21, 2002. The surveys included a postage paid return envelope and cover letter. Follow-up telephone calls were made to all ranchers who had not completed the survey. The response rate was 47.9 percent, or 246 completed surveys (Thomsen 2002).

The outline of this paper is as follows. We begin in the next section by employing the standard random utility maximization framework to examine ranchers' stated willingness to accept compensation for selling grazing rights. In section 3, we use an ordered-logit framework to examine responses to three alternative means of compensating ranchers. While the focus of the research is to investigate methods for compensating ranchers for loss of grazing privileges, we also investigate the impact on compensation of social capital and institutions in the Nevada ranch community (see van Kooten et al. 2003). Our conclusion is that institutions and social capital have an important impact on compensation levels and the design of compensation schemes. Some conclusions follow in section 4.

2. COMPENSATING RANCHERS FOR SALE OF GRAZING RIGHTS

Respondents to the Nevada Ranch Survey were asked whether they would be willing to accept (WTA) a certain level of compensation to retire permanently their grazing rights. Ranchers were given randomly generated WTA amounts ranging from $5 to $200 per AUM, with 8.13% of respondents indicating a willingness to accept the stated amount. To determine the average expected compensation required, we make use of the random utility maximization (RUM) framework.

Theoretical Model

Hanemann (1984) derives a theoretical random utility maximization framework for analyzing binary data that depicts an individual's decision whether or not to accept a particular offer to sell their grazing rights. The basic premise of RUM is that the individual's rational choice, which maximizes utility, is subject to researcher error due to unobservable characteristics. Assuming constant prices, individual i's utility function, $u_{i,a}(m, s)$, can be specified as consisting of a deterministic component, $v_{i,a}(m, s)$, and an additive stochastic component, $\varepsilon_{i,a}$:

$$(1) \quad u_{i,a}(m, s) = v_{i,a}(m, s) + \varepsilon_{i,a},$$

where a is the discrete decision to accept (a=1) or reject (a=0) the offer, m is income, s represents observable attributes that differentiate individuals, and $\varepsilon_{i,0}$ and $\varepsilon_{i,1}$ are identical independently distributed (iid) random variables with zero means and variance σ^2. RUM models the difference in the utilities of the 'yes' and 'no' alternatives as an underlying continuous index function (Greene 2000). The difference in indirect utilities of the two

alternatives is a function of the change in income caused by the compensation amount, which is fixed to the individual but random to the researcher.

Rancher i will sell her grazing rights ($a=1$) as long as $v_{i,1}(m+\Delta m, s)+\varepsilon_{i,1}>v_{i,0}(m, s)+\varepsilon_{i,0}$, where Δm is the compensation or "bid" (B) offered. Since utility is a random variable, the probability that a respondent's choice to accept the bid can be written as (upon suppressing subscript i):

(2) $\Pr(a=1)=\Pr\{v_1(m+\Delta m, s)+\varepsilon_1>v_0(m, s)+\varepsilon_0\} = \Pr\{(\varepsilon_1 - \varepsilon_0)>-[v_1(m+\Delta m, s) - v_0(m, s)]\}$.

Replace $[v_1(m+\Delta m, s) - v_0(m, s)]/\sigma$ with Δv and $(\varepsilon_1 - \varepsilon_0)/\sigma$ with ε, which is distributed as a logistics function and is iid because ε_1 and ε_0 are iid. The (cumulative) logistic distribution function is then given by (Greene 2000, p.814):

(3) $\qquad \Pr(Y = 1) = E(y = 1|x) = \dfrac{e^{\beta x}}{1 + e^{\beta x}}$,

where x is a vector of exogenous variables and β a vector of parameters to be estimated. The conditional expected probability of a, $E[a|x]$, is then equal to:

(4) $\qquad E[a|x] = \Pr(a=1) = F_\varepsilon(\Delta v) = \int\limits_{-\infty}^{+\infty} \dfrac{e^{\beta x}}{1 + e^{\beta x}} dx$,

where F_ε is the cumulative logistics distribution function.

Hanemann's approach to deriving ranchers' minimum WTA compensation, denoted by B^* is determined as the amount of money needed to keep the rancher indifferent between

accepting the bid and retaining cattle on public land. Analogously, one can express this indifference by setting the probability of accepting a bid to 0.5 and solving for B^*,

(5) $\Pr(a=1) = \Pr\{\, v_1(m+B^*,\, s) + \varepsilon_1 > v_0(m,\, s) + \varepsilon_0\} = 0.5.$

From (5), the probability of accepting the bid, B^*, is the same as the probability of rejecting it. Thus,

(6) $\Delta v = \alpha + \beta\, B^* + \delta s = 0 \Rightarrow B^* = -\left(\dfrac{\alpha}{\beta} + \dfrac{\delta}{\beta}\, s\right).$

These results facilitate the interpretation of the median willingness to accept compensation as a basic welfare measure. The median is the value of B that corresponds to $\Pr(a=1) = 0.5$ and is equivalent to B^*.

The marginal effect of each independent variable on the expected likelihood of accepting the stated WTA amount can be calculated as follows (Greene 2000, pp.815-816):

(7) $\dfrac{\partial \mathrm{E}[y|x]}{\partial x} = \Lambda(\mathrm{B}'x)[1 - \Lambda(\mathrm{B}'x)]\mathrm{B}$

Finally, a log-likelihood ratio test is used to determine whether the variables included in the final or restricted regression model are statistically preferred to those included in the general model, which includes all the variables available for explaining acceptance of the WTA amount. In each iteration, the variable with the least statistical significance was removed from the model. This continued until the Wald χ^2 statistic fell below a critical significance level, in which case the restricted model is preferred to the general one. Only the final restricted model results are presented.

Empirical Results

Factor analysis was used to reduce the number of opinion variables in the models. Factor analytic methods are useful for extracting, from a large number of variables, a smaller number of underlying dimensions that characterize the data. The choice of variables for factor analysis is made in the context of a theoretical formulation about the phenomena under consideration (Pedhazur and Schmelkin 1991). Factor analysis determines whether there are linear combinations of variables that help identify underlying relationships in the data (Hair et al 2000, p.590). Factor loadings of 0.40 or better were considered to be significant variables in the new factors that were used in the logit models. The factor analyses for the logit models are provided in the Appendix.

The empirical estimates of WTA compensation for retiring grazing rights are provided in Table 3. The WTA variable has a positive coefficient as anticipated, indicating that as the WTA payment offer increases the likelihood of a 'yes' response also increases. The average median WTA determined from the results in Table 3, where a median WTA compensation was predicted for each respondent, is $255.95, with a standard deviation of $57.66 and respective minimum and maximum values of $147.44 and $465.27. This is the compensation demanded that would make each rancher indifferent between the bid and staying in ranching (i.e. 50/50 probability of a yes/no response). Although the compensation bids in the Nevada Ranch Survey ranged from $5 to $200, the predicted median WTA is roughly three times the $90.83 average WTA of the 8.13 percent of respondents who would take the offered amount. It would appear, therefore, that ranchers wanted to hold on to their grazing rights. This is further supported by the relatively low marginal effect of WTA on the likelihood of accepting the bid amount.

Table 3: Logit Regression of Ranchers' Willingness to Accept a Lump Sum Payment to Sell Permanent Grazing Rights, Nevada, 2002 (n=192)

Explanatory Variable	Estimated Coefficient [a]	Marginal Effect	Mean
WTA ($ per AUM)	0.0182	0.0008	90.83
	(0.0000)		
Income (categories 1–6)[b]	-0.1007	-0.0046	4.0208
	(0.5050)		
Trust (categories 1–5)[c]	-0.6714	-0.0304	1.9427
	(0.0830)		
Education (categories 1 through 8)[d]	0.3494	0.0158	3.9063
	(0.0380)		
"Social Capital" Factor	-0.3665	-0.0166	0.0060
	(0.1900)		
"Service" Factor	-0.4804	-0.0218	0.0056
	(0.2060)		
Log Likelihood	-47.513		
Pseudo R^2	0.2046		
Wald $\chi^2(9)$	4.09		
Median WTA	$ 255.95		

[a] Statistical level of significance of the coefficient is provided in parentheses.
[b] Categories from <$30,000, $30,000-$45,000, $45,000-$60,000, $60,000-$75,000, $75,000-$90,000, > $90,000
[c] Categories 1 ("lack" of trust) to 5 ("total") trust
[d] Education categories: grade school, high school, some college or technical school, technical training in the armed forces, completed college, completed some graduate classes, completed Masters degrees, and completed PhD.

Historically grazing fees have been in the range of $2 per AUM. The capitalized value of those grazing fees – the value of the grazing rights – amounts to some $40 per AUM if a discount rate of 5% is employed. Based on the estimated compensation demanded, ranchers would appear to be using a much lower discount rate than 5%; a crude calculation suggests it is below 1%. This is surprising because one would expect the value of grazing rights to be discounted at a much higher rate than even 5%, perhaps in the range of 20%, which would imply a value of $10, because of the uncertainty about ranchers' future rights to graze livestock on public land. Two factors might explain the difference: The grazing fee of about $2 constitutes a rather large subsidy to ranchers, implying that the true value of one

AUM of grazing is closer to $50 (assuming a high discount rate of 20%) or about $12.50 (given a discount rate of about 5%). Alternatively, ranchers value grazing rights highly because it not only gives them the ability to graze cattle, but it enables them to pursue a particular lifestyle. The fact that income was <u>not</u> significant in the WTA model provides some support for the idea that the decision to sell grazing rights is clearly more than just an economic one. While both of these explanations are valid, further research would be needed to determine the contribution of each. What is clear in either case is that access to public lands constitutes a subsidy to ranchers in the form of income or income in kind.

Now consider the other explanatory variables in Table 3. The significant variables are trust and education. As trust between ranchers and land managers increases, the likelihood that a rancher is willing to accept a lump sum offer to retire grazing rights decreases. Ranchers with a higher level of trust of the public land manager are likely more positive about the future of ranching in Nevada and are thus less willing to sell their grazing rights. Conversely, ranchers with lower levels of trust may be more willing to sell as they are less hopeful of being able to work out range management problems in the future.

As a respondent's level of education increased, she was more likely to accept the bid amount. This may indicate that ranchers with higher education may be more hopeful of alternative grazing ideas working if they were to retire some of the grazing rights, or conversely they see little future for ranching and see the offer as a good economic decision.

The 'social capital' factor (see Appendix), though significant at the 20 percent level, harmonizes with the trust variable in that respondents who view the ranch community as having a high degree of social capital, which makes it less costly to resolve range

management conflicts, have a positive view about the versatility of the ranch system and are thus less likely to accept the offer to sell grazing rights.

3. ALTERNATIVE OPTIONS FOR COMPENSATING NEVADA RANCHERS

To address the environmental concerns associated with livestock grazing, public managers reduced AUMs of forage available from the land (see Tables 1 and 2). However, decisions as to how much and where grazing reductions are to take place have often been based on inadequate information about the range ecology and, importantly, about the socioeconomics of the ranch community. Increased grazing fees are one option, but other options have been suggested at various times and places. To investigate some of the options for addressing changes in the management objectives of public lands, the Nevada Ranch Survey asked respondents to consider potential means by which they might be "compensated" for a one-quarter reduction in livestock grazing on public lands. Respondents were asked to value each of the following options on a likert scale of 1 (bad idea) to 5 (good idea):

1. "Differentiated grazing fees will be used to reward or penalize ranchers for their efforts to improve range quality and/or make available environmental amenities (e.g., better sagebrush habitat) on public land."

2. Ranchers would "be allowed to collect fees for use of public lands by hunters and recreationists, and for providing guiding services."

3. Ranchers would "be allowed to access AUMs of grazing as before, but when grazing allotments are transferred use will be reduced."

Because of the likert scale, ordered logit models are used to analyze responses.

The Ordered Logit Model

Ordered logit models are used when the dependent variable is categorical but it takes on more than two values, as in binary choice models (0 or 1), and the values are ordered. Ranchers were asked to express their opinions using the above likert scale, which is amenable to analysis using an ordered logit model. Such a model can assist in determining those variables that increase our prediction that ranchers would see a given alternative as a good idea (positive estimated coefficient) or a bad one (negative coefficient).

For a model with three categorical variables (or three outcomes), ordered logit probabilities are calculated as follows (Greene 2000, p.876):

$$
\begin{aligned}
\Pr(y = 0) &= 1 - \Lambda(\beta x)) \\
(8) \qquad \Pr(y = 1) &= \Lambda(\mu - \beta x) - \Lambda(\beta x) \\
\Pr(y = 2) &= 1 - \Lambda(\mu - \beta x)
\end{aligned}
$$

where $\Lambda(.) = \dfrac{e^{(.)}}{1 + e^{(.)}}$ represents the logistic cumulative distribution function, x is a vector of explanatory variables, and β is a vector of parameters to be estimated.

The marginal effect of each independent variable on the probability of selecting a particular category, for the case of three categories, is given by (Greene 2000, pp.876-877):

$$
\begin{aligned}
\frac{\partial \Pr[y = 0]}{\partial x} &= -\Lambda(B'x)[1 - \Lambda(B'x)]B \\
(9) \qquad \frac{\partial \Pr[y = 1]}{\partial x} &= [\Lambda(-B'x)[1 - \Lambda(B'x)] - \Lambda(\mu - B'x)[1 - \Lambda(\mu - B'x)]]B \\
\frac{\partial \Pr[y = 2]}{\partial x} &= \Lambda(\mu - B'x)[1 - \Lambda(\mu - B'x)]B
\end{aligned}
$$

Again, as in section 2, a log-likelihood ratio test is used to determine whether the restricted

(final) regression model is statistically preferred to the general model that includes all of the available explanatory variables that might affect the dependent variable.

Differentiated Grazing Fees to Reward Environmental Improvements

The mean response to this survey question was a likert score of 1.27 with a standard deviation of 0.78. This suggests that respondents are not really keen on this idea. The likert scores were regressed on the available explanatory variables, with estimation results for the restricted model reported in Table 4.

Table 4: Order-Logit Differentiated Grazing Fees Model, Nevada, 2002 (n=192)

		Marginal Effects					
		Bad Idea				Good Idea	
Proportion responding:		0.8908	0.0707	0.0178	0.0127	0.0080	
Explanatory Variable	Est. Coeff[a].	1	2	3	4	5	Mean
Had disagreement with agency	-0.9230 (0.077)	0.1125	-0.0670	-0.0202	-0.0153	-0.0100	0.8125
Trust of public land managers	0.6535 (0.002)	-0.0636	0.0394	0.0110	0.0080	0.0052	1.9427
Education	0.2481 (0.034)	-0.0241	0.0149	0.0042	0.0031	0.0020	3.9063
Age	-0.3349 (0.103)	0.0326	-0.0202	-0.0056	-0.0041	-0.0027	4.0833
"Service" Factor[a]	0.3165 (0.103)	-0.0308	0.0191	0.0053	0.0039	0.0025	0.0056
"Survival" Factor[b]	-0.3644 (0.106)	0.0354	-0.0220	-0.0061	-0.0045	-0.0029	0.0692
Log likelihood	-100.863						
Pseudo R^2	0.1161						
Wald $\chi^2(7)$	7.84						

[a] Statistical level of significance of the coefficient is provided in parentheses.

Consider first variables that increased the probability that differentiated grazing fees would be viewed as a good idea. When trust between ranchers and pubic land managers increases, differentiated grazing fees have a higher chance of being considered a good idea. Differentiated grazing was also viewed positively by those with higher levels of education.

This may be reflective of the fact that more educated ranchers are better able to manage the range and willing to be paid for their expertise if they could improve the ecosystem. The service variable was also positive, indicating that ranchers involved in community organizations are more likely to see differentiated fees as a good idea. This may indicate that there is a positive benefit to working with local community organizations to help spread the benefits of alternative grazing plans.

The variables that decreased the likelihood of viewing differentiated grazing fees as a good idea were whether the rancher had disagreements with the public land agent, respondent's age and the factor "survive". It seems logical that, as disagreements with the public agencies rises, ranchers consider differentiated grazing fees a poor idea, because they likely view differentiated fees as simply another potential source of conflict. As age increases, ranchers see no need to change the existing fee system, which has worked well so long. Lastly, the survive factor relates to the perception ranchers have about their future survival (see Appendix). The more worrisome that survival is to a rancher, the more likely they will perceive differentiated fees as something that is going to increase their operating costs.

Ranchers Attain the Right to Sell Non-grazing Services

Should ranchers be allowed to collect fees for use of public lands by hunters and recreationists, and for providing guiding services? While this is an idea that may be beyond the realm of political feasibility, it is nonetheless one means by which ranchers can be given greater property rights to certain environmental products of the range, thereby encouraging them to be better public land stewards. The mean response to this idea was 2.66 with a standard deviation of 1.41, suggesting that, while still a bad idea, it was at least an

improvement over the idea of differentiated grazing fees. The results of the ordered logit regression are provided in Table 5.

Table 5: Order-logit Ranchers Collecting Fees Model, Nevada, 2002 (n=192)

		Marginal Effects					
		Bad Idea			**Good Idea**		
Proportion responding:		0.2796	0.1400	0.3504	0.1136	0.1165	
Explanatory Variable	Est. Coeff[a]	1	2	3	4	5	Mean
Education	0.1786	-0.0360	-0.0075	0.0119	0.0133	0.0184	3.9063
	(0.022)						
Age	0.3756	-0.0757	-0.0158	0.0249	0.0279	0.0387	4.0833
	(0.001)						
"Pro federal agencies" factor	0.4004	-0.0807	-0.0169	0.0266	0.0297	0.0412	0.0000
	(0.003)						
"Pro grazing" factor	-0.3238	0.0652	0.0136	-0.0215	-0.0240	-0.0333	-0.0167
	(0.023)						
Log likelihood	−276.401						
Pseudo R^2	0.466						
Wald $\chi^2(8)$	2.49						

[a] Level of statistical significance of the coefficient is provided in parentheses.

More educated and older ranchers are more likely to consider providing ranchers the right to sell the non-grazing services of the public range a good idea. So do those with a generally favorable view of the federal land management agencies. Not unexpectedly, those who view grazing as a solution to the environmental problems of the public range rather than a contributing factor are least likely to view provision of alternative rights as a good idea. These ranchers believe that domestic grazing on public lands is beneficial to the ecosystem and not a threat to endangered species. They may also perceive this suggestion as an attempt to turn their operation into "dude" ranch – into a tourist attraction – thus destroying their way of life.

Reducing Grazing upon Permit Transfer

The final suggestion is one that allows rancher's to maintain their current AUM use, but to lose grazing allotments when ranches are transferred. This effectively reduces the rancher's wealth while maintaining current levels of use. Again, ranchers were not keen to see their wealth reduced and considered this option to be a rather bad idea, as indicated by a mean response on a likert scale of 2.77 with a standard deviation of 1.40. Nonetheless, this option was considered more favorably than the other two, if only slightly so. To determine which factors affect responses, an ordered logt model was estimated, with estimation results provided in Table 6.

Table 6: Ordered-logit AUM Reductions Model, Nevada 2002, (n=192)

		Marginal Effects					
		Bad Idea			**Good Idea**		
Proportion responding:		0.2386	0.1697	0.2850	0.1866	0.1201	
Explanatory		1	2	3	4	5	Mean
Variable	Est. Coeff[a]						
Trust	0.3255	-0.0591	-0.0195	0.0094	0.0348	0.0344	0.7031
	(0.016)						
Fire	0.4458	-0.0847	-0.0242	0.0177	0.0471	0.0441	3.9063
	(0.127)						
Education	0.1997	-0.0363	-0.0120	0.0058	0.0214	0.0211	0.0000
	(0.011)						
"Service" factor	-0.2976	0.0541	0.0178	-0.0086	-0.0318	-0.0315	0.0000
	(0.025)						
"Survive" factor	0.4261	-0.0774	-0.0255	0.0123	0.0456	0.0450	
	(0.001)						
Log likelihood	-289.192						
Pseudo R^2	.0459						
Wald $\chi^2(8)$	3.53						

[a] Level of statistical significance of the coefficients is provided in parentheses.

Trust, education level, and the factors "service" (rancher involvement in community service) and "survive" are the only statistically significant variables in the regression, although it was not possible to reject experience with fire as an explanatory variable in the

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model. As trust increases, it seems reasonable that retirement of grazing rights would be more acceptable to ranchers as they would trust land managers to develop new programs to resolve range utilizations conflicts. Also, as education increases, ranchers are more likely to see this as a good idea. Again, better educated ranchers may see the benefits of changing the current grazing system and may be more open to new ideas for the survival of ranching in the future. Not surprisingly, ranchers concerned about survival are open to the idea of protecting access to the public range in the short term.

The leading explanation as to why this alternative is considered a poor idea is the factor "service". As service included ranchers involved in community organizations and local boards, these ranchers may see this alternative as another way that government is attempting to take away their rights, leading them to view this idea negatively.

Lastly, fire should be mentioned although this variable was only statistically significant at about the 12% level. Ranchers' experience with fire made them more amenable to the thought of retiring grazing rights over time. This suggests that they do see grazing as associated with fire, either that grazing enhances fire or that fire has a negative effect on the availability of public forage.

4. DISCUSSION

Access to public forage has had a negative financial impact on the livestock sector and economy of the State of Nevada. And it has reduced social capital in the State's ranch community (van Kooten et al. 2003; Thomsen 2002). While it is not clear that AUM reductions are an effective method of improving range ecosystems, lower levels of social capital not only make it more difficult to find politically feasible means of resolving range

conflicts – making it more difficult to find acceptable means of compensating ranchers for lost access to public lands – but also make it more difficult to rely on knowledge existing in the ranch community to solve environmental problems related to multiple demands for the services public lands provide. In particular, it makes it more expensive to implement range improvements as lower levels of social capital are correlated with higher transaction costs.

Results from the Nevada Ranch Survey indicate that the most significant variables predicting the probability of acceptance of compensation to stop grazing on public lands, or to consider other means of "compensating" that enable ranchers to earn a living from the public lands despite reduced public forage, relate to social capital, primarily trust. Although most ranchers expressed opposition to any change in current arrangements, our research suggests that opposition to alternatives is inversely correlated with trust in the public agencies. As a means of building social capital in the ranch community, including therein trust between ranchers and public land managers, other institutional arrangements, such as Community Based Initiatives, may offer an alternative approach to willy-nilly reductions in grazing access. Whatever is done, it is clear that eroding levels of social capital will make it harder to accomplish social objectives related to Nevada's rangelands.

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APPENDIX: FACTOR ANALYSES

Table A1: Factor Analysis for Civic Engagement and Altruism Opinion Questions

Item	Poor Future	Social Capital	Alt. Ranch Income	Pro-federal Agencies	Pro-grazing	Prof Active	Service	Survive	Anti-SK	Unique-ness
Donate blood	0.05194	**0.56714**	-0.14126	0.11803	0.06148	0.02586	0.28863	0.03728	0.02877	0.55179
Volunterism	-0.05631	**0.58779**	0.10205	-0.07848	0.11124	0.10231	0.06285	0.01921	-0.28246	0.52781
Donate to Charity	-0.07295	0.13944	0.09441	0.00434	-0.14255	0.02182	0.00801	0.00593	**-0.76654**	0.35783
Active with friends	-0.02965	-0.00625	0.11451	0.18962	**0.55952**	0.0217	0.04639	-0.07473	**-0.59765**	0.27156
Active in prof. Orgs.	-0.12885	-0.05657	0.04771	0.06784	-0.03235	**0.66273**	0.33766	0.18571	-0.21731	0.33733
Active in service org.	-0.03352	0.07554	0.02651	0.0512	-0.00429	0.07308	**0.78429**	-0.00361	-0.01738	0.36906
Spectator at local events	0.09926	**0.45296**	0.27296	0.31254	0.27177	0.21462	-0.15279	-0.05242	0.07565	0.46105
Non-ranch activities	-0.06471	**0.59147**	0.10207	0.04565	0.10065	-0.07586	**0.43173**	-0.06941	0.10057	0.41626
Politically involved	0.12231	0.37042	-0.05539	0.02233	0.11615	-0.11975	0.34025	0.11607	-0.21007	0.64306
Attend Church	-0.15896	**0.58943**	0.08726	-0.25404	-0.13292	-0.04868	-0.21549	0.17393	-0.31333	0.36025
Grazing Board Invovement	0.01621	0.04579	-0.06514	-0.12656	0.09099	**0.79255**	-0.1007	-0.08739	0.08023	0.31675
Ranchers are under financial stress	0.21551	0.2631	0.04155	0.12179	0.05613	-0.05589	-0.1178	**0.69274**	0.15928	0.34236
Livestock are a threat to Environment	-0.02865	-0.04787	-0.16402	-0.02197	0.71046	-0.03868	0.08272	0.11335	0.18858	0.408
Public Agen. Are doing good job	**-0.4587**	0.15771	-0.02749	0.32757	-0.20753	0.239	-0.30921	-0.0947	0.03676	0.45054
Too much public land	0.00367	0.0041	0.06068	**-0.78578**	0.02415	0.08848	-0.09226	-0.06228	0.00624	0.35799
Fed gov. ought to control pub. Land	0.2106	0.07722	-0.02023	**-0.60014**	0.21384	-0.01329	0.04158	0.24594	0.1753	0.45026
Ranchers given more rights-hunting	-0.0185	-0.11698	0.14493	-0.13071	0.00736	0.04229	0.1098	**0.77087**	-0.08957	0.33173
Grazing enhances the ecosystem	0.00159	0.13976	0.06617	-0.15482	**0.76647**	0.0786	-0.00854	-0.03901	-0.03387	0.35572
To many livestock are on public land	-0.24462	0.03625	-0.09276	**0.40764**	-0.24213	-0.24597	0.03615	-0.17202	-0.04379	0.61213
Ranching won't survive the next 50 yrs	**0.8025**	-0.00462	-0.00596	-0.02424	-0.00812	-0.10697	-0.04357	0.05675	0.20584	0.29634
Ranchers are the soln. to range problems	0.06928	0.06353	-0.15298	-0.2371	**0.49762**	0.11763	-0.12318	0.39195	-0.03678	0.47994
Ranchers see no future on public lands	**0.74594**	-0.15142	-0.20862	0.05757	-0.0544	0.04692	0.08391	0.04602	-0.02403	0.35891
Ranching will cont. as is on public land	**-0.86234**	-0.0727	-0.01265	0.0857	-0.00633	-0.02302	0.06497	-0.03039	0.04916	0.23545
Ranching will become hobby ranches	0.38606	-0.08324	**0.51207**	-0.08819	0.17618	0.10025	-0.13049	-0.06817	0.03379	0.51013
Ranching will include tourism	-0.12387	0.044	**0.81375**	-0.06494	-0.03362	-0.08394	0.1528	0.11687	-0.01736	0.27083
Ranching will include recreation uses	-0.0506	0.065	**0.81425**	0.03108	-0.04935	0.02664	-0.08079	0.04109	-0.13818	0.2988

Factor Descriptions:

Poor Future– Ranchers feel that ranching has no future and won't survive "as is"

Social Capital – Ranchers who are involved in civic activities and are altruistic

Alternative ranch income – Ranchers will survive by developing income from tourism, recreational use, and become more of a hobby than a viable ranching operation

Pro-federal agencies – Ranchers feel that the Federal government should have more power in controlling and managing lands

Pro-grazing – Ranchers feel that grazing enhances the ecosystem, grazing doesn't negatively impact endangered species, and that ranchers are the solution, not the problem to range degradation

Professionally Active – Ranchers are involved in cattlemen's associations and are on grazing boards

Service – Ranchers are involved in community service organizations like Elks/Lion's clubs, and are involved in community activities like sports, municipal boards etc.

Survive – Ranchers generally feel they are under financial stress and they believe they should be given greater rights to generate income from tourism and hunting

Anti–SK (Social Capital) – Ranchers who are not financial contributors to community organizations and do not have friends over or are very socially involved.