

Social Dilemmas and Public Range Management in Nevada

by

G. Cornelis van Kooten, Roy Thomsen, Thomas G. Hobby and Alison J. Eagle

Department of Economics
University of Victoria
P.O. Box 1700, Stn CSC
Victoria, B.C. V8W 2Y2
Canada
Phone: 250-721-8539
Fax: 250-721-1642
Email: kooten@uvic.ca

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Abstract

Increasing tension in the Nevada ranch community may have had a negative impact on social capital. Social capital facilitates cooperation in resolving social dilemmas related to public range management. In this paper, we use a survey of public grazing permit holders in Nevada to investigate factors that affect ranchers' trust in and relationships with the U.S. Forest Service and Bureau of Land Management, predictors of disagreements between ranchers and public land managers, and variables affecting relations between ranchers and the public agencies over time. Results indicate that low levels of trust between ranchers and public land managers were most significantly related to previous disagreements and belief that the future of ranching is bleak. Disagreements with public agencies were mainly the caused by disputes concerning responses to wildfire, and such disagreements led to a deterioration of relations over time. Relations between ranchers and the USFS deteriorated to a greater extent than relations with the BLM, partly because the former have cut back on allowable grazing to a greater extent. While there remain opportunities to build on existing social capital in the community (horizontal relations), ranchers and the public agencies need to work on building vertical relations, thereby increasing trust. We argue that, even if the latter fails, new institutions might evolve to utilize existing social capital and thereby help resolve social dilemmas.

Keywords: social capital, institutions, public land agencies; range improvements

JEL Category: O17, O52

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1. Introduction

Economists have long been interested in factors that contribute to economic development. The emphasis on pure economic explanations for development – namely monetary and fiscal policies, and trade policy – has recently shifted to focus on the role of cultural, historical, social and institutional factors (North 1994; North 1990; Putnam 2000; Putnam 1993a; Woolcock). Institutions and social capital, the features of social organizations that facilitate action and cooperation for mutual benefit (Putnam 1993b, pp. 35-36), are both important for economic development. In addition, they help resolve social dilemmas that arise when coordination of actions makes all parties better off compared to pursuit of activities that are only best from the perspective of an individual acting alone (Ostrom 2000b).¹

In public range management, social dilemmas arise because private activities on the range, principally livestock grazing, create externalities (environmental spillovers) that may be to the detriment of society. For example, domestic grazing might contribute to the demise of threatened or endangered plant and animal species, such as the sage grouse (van Kooten et al. 2004). It is possible that institutions and social capital can aid in finding solutions to these social dilemmas, thereby benefiting the range ecosystem (Rodriguez and Pascual 2004 p.245). Collier (2002) cites the benefits that higher levels of social capital have in reducing negative and enhancing positive externalities, lowering transaction costs, mitigating risks, and enabling the management of common resources.

¹ In contrast, Sen (1987, 1999) focuses on building individual capabilities and ensuring that people have the freedom to convert economic wealth into the outcomes they desire (Lehtonen 2004).

The Nevada ranch community has come under increasing pressure since the early 1980s because livestock grazing on public lands is increasingly perceived as a contributing factor to the environmental degradation of public lands. One view is that environmental laws enacted in the 1960s and 1970s combined with a shortage of funding left public land managers with too little time to make sound range management decisions and that the most common response to the federal environmental regulations was to reduce AUM allocations (Resource Concepts Inc., pp. 62-63). BLM and USFS data indicate that public grazing allocations have indeed been reduced, falling by 32.7% (or some 540,000 AUMs) between 1981 and 2002 and threatening the viability of some ranchers' operations. More than two-thirds of the AUM reductions were unexplained, resource-related (presumably to protect the range ecosystem, although this is not specified), or the result of permit violations (Resource Concepts Inc. 2001). This appears to have resulted in greater uncertainty, a decline in trust between ranchers and the land agencies, and too little investment in resolving social dilemmas through cooperative problem solving. That is, there may have been a general decline in efforts to maintain or enhance the ranch community's social capital.

The purpose of the current study is to investigate the potential role that institutions and social capital can play in solving the social dilemmas of public range management. We might ask: Is there sufficient social capital in the ranch community to enable public managers to use this 'capital' to enhance range quality and protect the habitat of endangered species? Are extant institutions up to the task? Are existing policies of reducing livestock grazing and investing in range restoration (e.g., re-seeding programs) capable of achieving the objectives of management (reducing fire incidence, protecting wildlife habitat, forestalling and

mitigating range degradation)? Does the extant level of social capital facilitate dialogue between ranchers and public land agents, or is it inadequate for resolving range conflicts? We address these issues using the results of a 2002 survey of public grazing permit holders in Nevada.

We begin in the next section by defining what is meant by institutions and social capital in the context of Nevada's ranch community, providing several hypotheses related to the public agencies and the community that are then tested using results from the Nevada Ranch Survey, which is described in section 3. Survey responses are used in the empirical investigation of social capital, institutions and the public land agencies in section 4. Conclusions follow in section 5.

2. Institutions and Social Capital

The problems of economic development and social dilemmas are not that economic explanations are inappropriate, but rather that they are incomplete. For a democratic market economy to function properly, or for market-oriented economic policies to have effect, three criteria or factors other than markets and private property are required, namely, economic institutions, the role of the state and social capital (Fukuyama 2002).

Economic Institutions

A country or state must have a set of institutions within which policy change can occur. Institutions consist of formal rules (constitutions, laws and property rights) that constrain political, economic and social interactions, and include such things as commercial and criminal courts. They also include bureaucratic agencies like the Bureau of Land

Management and U.S. Forest Service. Unlike cultural constraints (see discussion on social capital), they are more amenable to change, although certain inertia may be required to overcome vested interests. Economists have often ignored institutions, even though existing institutions may not always be the ‘right ones’ (Bromley 1999). Recent research in economic development now stresses the need for good institutions, as some institutions retard rather than promote growth (La Porta et al. 1999) or become an obstacle to resolving social dilemmas (Ostrom 2000b). In order to remain effective, institutions need to evolve over time in response to changing circumstances, and the rate at which they evolve must not slow the progress of policy change.

In agriculture, the most important formal rules concern property rights over land and water. It is not possible, for example, to implement changes in livestock grazing on public land if it is not possible to enforce such changes and have the courts uphold them. Without the ‘right’ institutional environment, ranchers may not be concerned about how their activities affect the future quality of the public range. In order for ranchers to take future range quality into account, they most likely need to have a vested interest in the land, feel morally obliged to do ‘the right thing’, or somehow be ‘coerced’ to do what is socially desirable. Where the required institutions are lacking, it is not usually possible, for example, to use economic incentives to get ranchers to change grazing patterns and protect wildlife habitat. In the absence of appropriate property rights and their protection, ranchers tend to rely on personal networks rather than the rule of law, but this increases transaction costs relative to the situation where the pertinent institutions are in place.

In many jurisdictions, arid rangelands are largely publicly owned, and ranching may, in some cases, be performed by state-owned enterprises or quasi-public collectives (e.g., Ukraine, Iran, Ethiopia). In other jurisdictions, the state may own the land and allocate its use to private ranchers on the basis of historical ‘rights’, subject to oversight by a public land management agency, as in the United States and Canada. If public land agencies become too rigid, or fail to evolve sufficiently to address ‘modern’ needs, then ranchers will rely on their informal contacts with agency personnel – their personal network – to implement management activities that would otherwise be held up by bureaucracy and the hierarchy that inevitably accompanies it. However, if ranchers cannot work with the public agencies, range quality may deteriorate as may the habitat of threatened or endangered species. In such cases, other institutional arrangements may need to be considered, ones that yield better outcomes from a social viewpoint, and are also politically more acceptable.

Role of the State

Economic policies can only be carried out by the state, but the state must be limited in scope and yet able to enforce the rule of law. The state must be competent and sufficiently transparent in formulating policy, and have enough legitimacy to be able to make painful decisions. The role and performance of government is essential to economic development (La Porta et al. 1999), just as it is to the resolution of social dilemmas in the ranch community. Good governments protect property rights and individual freedom, keep regulations on businesses to a minimum, provide an adequate (efficient) level of public goods (e.g., infrastructure, schools, health care, police protection, court system), and are run by bureaucrats who are generally competent and not corrupt (La Porta et al. 1999).

Unfortunately, regulatory agencies often prevent entry, courts resolve disputes arbitrarily and sometimes dishonestly, and politicians use government property to benefit their supporters rather than the population at large. In the ranch community, such characteristics take a more subtle form: ranchers are denied access to historical grazing lands, decisions appear to be arbitrary as transparency disappears, and agency representatives hide information, often acting in their own self interest with guile (Williamson 1996; Williamson 2002).

In this study, the effectiveness or ineffectiveness of public agencies in providing good policy and minimizing bureaucracy presents itself in ranchers' perceptions of public land agency staff and in how disputes about land use and livestock grazing are resolved.² We postulate that, rather than being random events, disagreements between ranchers and the public land agencies are a function of the personal characteristics of ranchers and of social capital. We then test this hypothesis using the results of the Nevada Ranch Survey.

Social Capital

The third factor needed to resolve social dilemmas is social capital, or “the proper cultural predispositions on the part of economic and political actors” (Fukuyama 2002, p. 24). The ‘cultural factor’ constitutes informal constraints (sanctions, taboos, customs, traditions, and norms or codes of conduct) that structure political, economic and social interactions.

Social capital has both individual and aggregate components (Gelauff 2003). Individual social capital consists of intrinsic aspects (charisma, values) and aspects in which one can invest (trustworthiness, personal networks), although these two aspects are difficult

² Lack of funding prevented us from surveying representatives of the public land agencies.

to separate. Aggregate social capital, on the other hand, constitutes the total of the social capital of the individuals in society, varying by form (trust in people, trust in government, level of participation in society), place (firm, region in a city or country, neighborhood), and group (ethnic and religious groups, service organizations, sport associations, gangs).³ It is difficult for society to invest in aggregate social capital because the manner in which the social capital of individuals is aggregated is not clear. A society can only invest in culture by somehow affecting individuals who do the investing. For example, society can encourage couples to stay together longer by making divorce more difficult, or encourage church attendance by providing tax incentives for charitable giving, but both actions fail to address culture directly.

Trust is perhaps the most important component of social capital: “Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time” (Dasgupta 2000). Trust is not social capital, but a manifestation of it (Woolcock 2001); trust is related to institutions and affects the costs of transacting. If confidence in an enforcement agency falters, one may not trust others to fulfill their agreements and thus enter into fewer agreements. There is an element of trust in any transaction where one has to decide (make a choice) before being able to observe the action of the other party to the transaction. One has to assume that the other person is not acting with guile, keeping information hidden that could be used to their advantage at the expense of the other party to the transaction. Like other components of social capital, trust makes an economy function more efficiently (Fukuyama 1999).

³ It should not be forgotten that social capital can also have negative aspects related to crime and so on (Carol and Standfield 2003).

In addition to trust, other elements of social capital include social norms, or behavioral strategies (e.g., always do p if q occurs) subscribed to by all in society, and networks of civic engagement (membership in swim clubs, church organizations, etc.) that enhance cooperation. Ostrom (2000a) shows how social norms of reciprocity and trust, combined with local enforcement and graduated sanctions result in effective resource management regimes. For example, irrigation systems in India, where rules were made by the local farmers, required less maintenance and experienced lower deadweight loss from rule violations than where government agencies determined water allocation and distribution.

In the ranch community, trust, social norms (shared beliefs) and social networks – social capital – are vitally important to community health and that of the range ecosystem. Ranchers function as stewards over the public range, performing such tasks as monitoring and policing trespassing and legitimate use by recreationists. As a group, ranchers are often better able to monitor range condition than the public land managers. They also are likely to have good ideas about the outcomes of various range management investments in terms of their impact on forage availability and the range ecosystem more broadly. Such knowledge can impact how public range is managed sustainably. Good relationships between ranchers and recreational users and the public land managers ensure that all parties benefit from the use of the public land.

Social capital involves both horizontal and vertical associations among people, and these affect the productivity of the community (Lehtonen 2004; Putnam 1993a). In Nevada's ranch community, relationships among ranchers, public agency representative, and environmentalists are important to the ability of the community to implement range

management improvements in an effective and efficient manner – to its ability to resolve social dilemmas related to the management of a common resource. Linking social capital to range/ecological improvements is based on social capital’s “capacity to leverage resources, ideas and information from formal institutions [to] beyond the community” (Woolcock 2001). The reliance on accumulated social capital among ranchers, land managers and environmental groups is key to the attainment of sustainable range management (Brunner et al. 2002; Hadley 2001). We postulate that the ability to rely on accumulated social capital for ecosystem management has been somewhat compromised in Nevada.

3. The Nevada Ranch Survey: Background to Social Capital

We investigate some of the aforementioned postulates and the broader role of social capital in Nevada’s ranch community by examining civic engagement and altruism, ranchers’ trust of the public land agencies, factors that affect disagreements between ranchers and the public agencies, how disagreements are resolved, and how ranchers’ relationships with the BLM and USFS have changed over time. For this purpose, we employ responses to the Nevada Ranch Survey.

The Nevada Ranch Survey was initially mailed to the entire population of BLM and US Forest Service grazing permit holders in Nevada on 29 March 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. A second mailing was sent to non-respondents on May 21, 2002. During June, follow-up telephone calls were made to all ranchers who had

not returned the survey. The response rate was 47.9 percent, or 246 completed surveys (Thomsen 2002)⁴

Since civic engagement gives rise to social capital (Harriss and De Renzio, p. 920), it appears that there is a relatively high level of social capital in the Nevada ranch community as ranchers are keenly involved in community and professional activities (Table 1). Ranchers were most active interacting with friends, donating to charity, volunteering and being involved in professional organizations.

Since the survey included a large number of opinion variables, factor analysis was employed. 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). The new factors are used in the logit and ordered logit models below that assess trust, relationship strength, disagreements and disagreement resolution between ranchers and public land managers. The factor analysis results are provided in the Appendix.

⁴ Response rates for executives of small firms are notoriously low (Friedman and Singh 1989). Ranches must be viewed as small firms, and ranchers cannot be considered the same as respondents to a contingent valuation survey. For example, in their study of farmers' participation in Tennessee's Forest Stewardship Program, Bell et al. (1994) reported a response rate of only 12%, much lower than that reported here. The survey is available from the authors upon request.

4. Results: Factors Affecting Ranchers' Relationships with the BLM and USFS

The Nevada ranch survey asked how ranchers' relationships with the public land agencies had changed over time. It is hypothesized that relations would have declined more for the USFS than BLM since public grazing was reduced to a greater relative degree by the former. This is supported by the results in Table 2, which compares ranchers' perceptions of how their relationships with the two agencies have changed over time, and how disagreements have been resolved. More respondents reported a decline in relations with the USFS (60%) than indicated a decline in relations with the BLM (39%).

Not shown in Table 2 is the extent of disagreement because this was elicited using a more general question that was not agency specific. Over 80 percent of ranchers indicated that they had had one or more disagreements with the public land agencies concerning their use of the public range. From Table 2, more disagreements between ranchers and the BLM are resolved informally than is the case with the USFS, likely because relationships with the BLM have not declined to the same extent as those with the USFS. That ranchers had poorer relations with the USFS than BLM is also reflected, at least partly, by the fact that more disagreements were resolved formally (with lawyers getting involved) in the case of the USFS than the BLM. It appears that ranchers prefer to resolve disagreements with the local land manager, but, if unsuccessful, they may trust more in the potential for District/State level resolution in dealing with the BLM than with the USFS. Overall, relations with the BLM seem better than those with the USFS. In the following subsections, we further investigate the factors contributing to trust and conflict resolution with respect to these two agencies.

Statistical Model

A logit model is generally used when the dependent variable is binary, taking on a value of 1 (often indicating a ‘yes’ response) or 0 (‘no’ response). An ordered logit model is appropriate if the dependent variable is qualitative and takes the form of an ordered ranking, such as 1=better, 2=no change and 3=worse. In this study, we use a logit model to examine factors that might explain why ranchers may have had a disagreement with a public land agency. In particular, we want to determine whether ranchers’ perceptions of the level of social capital in the ranch community translate into less conflict.⁵ We employ an ordered logit model to determine factors affecting trust (a key component of social capital), and to investigate factors that have resulted in a change in the relationship between ranchers and the two public land agencies over time.

The (cumulative) logistic distribution function is given by Greene (2000, p. 814) as:

$$\Pr(Y = 1) = E(y = 1|X) = \frac{e^{\beta x}}{1 + e^{\beta x}}, \quad (1)$$

where x is a vector of explanatory variables and β is a vector of parameters to be estimated. This equation calculates the likelihood that a respondent will have a disagreement with one of the public land agencies. For a three-outcome model, the ordered logit model probabilities are given by Greene (2000, p. 876):

$$\begin{aligned} \Pr(y = 0) &= 1 - \Lambda(Bx) \\ \Pr(y = 1) &= \Lambda(\mu - Bx) - \Lambda(Bx) \\ \Pr(y = 2) &= 1 - \Lambda(\mu - Bx) \end{aligned} \quad (2)$$

⁵ Perceptions are used because, supposedly, the level of aggregate social capital is the same throughout the ranch community.

where $\Lambda(.) = \frac{e^{(.)}}{1 + e^{(.)}}$ represents the logistic cumulative function and μ and B are vectors of parameters to be estimated, with μ representing critical cutoffs that separate categories. The estimated functions provide the likelihood that a respondent with the characteristics given by x will take a particular stance.

A log-likelihood ratio test was used to determine whether variables included in the model are statistically necessary in the final regressions. In each iteration, the variable with the least statistical significance was removed from the model. This continued until the Wald statistic fell below a critical value of one percent significance level, in which case the restricted model is preferred to the general model. Only the final restricted model results are presented.

Finally, for each model the marginal effects (dy/dx) of the explanatory variables are determined. The marginal effects enable us to identify the variables that have the greatest influence on the dependent variable at the margin. These are given, respectively, for the binary logit model and ordered logit model as by Greene (2000, pp. 815, 876-877):

$$\frac{\partial E[y|x]}{\partial x} = \Lambda(B'x)[1 - \Lambda(B'x)]B \quad (3)$$

$$\begin{aligned} \frac{\partial \Pr[y = 0]}{\partial x} &= -\Lambda(B'x)[1 - \Lambda(B'x)]B \\ \frac{\partial \Pr[y = 1]}{\partial x} &= [\Lambda(-B'x)[1 - \Lambda(B'x)] - \Lambda(\mu - B'x)[1 - \Lambda(\mu - B'x)]]B \\ \frac{\partial \Pr[y = 2]}{\partial x} &= \Lambda(\mu - B'x)[1 - \Lambda(\mu - B'x)]B \end{aligned} \quad (4)$$

Trust between Ranchers and the Public Land Managers

We use an ordered logit model to identify factors affecting trust. The survey asked respondents about the extent to which they trusted the public land managers. Specifically, respondents were asked to evaluate the statement: “In general I trust the public land managers and don’t have to be too careful in dealing with them”. A Likert scale ranging from +2 (strongly agree with statement) to -2 (strongly disagree), with 0 being neutral, was employed. For the 241 respondents who answered this question, the mean opinion was -1.071 (indicating lack of trust), with a standard deviation of 1.040 (indicating relative agreement among respondents), although the maximum and minimum responses were +2 and -2. The regression results are provided in Table 3. All of the estimated coefficients in the final regression model are statistically significant at the 10% level, with most significant at the 1% level.

The level of trust in public land agencies is inversely related to two factors – the extent to which ranchers had disagreements with public land managers about how the range is utilized and the extent to which respondents were negative about the future of ranching. Respondents who viewed grazing as a solution to problems of a deteriorating range ecosystem, were more highly educated and/or were professionally active also exhibited greater trust in the public land agencies. Nonetheless, as indicted earlier, overall trust in the public agencies was not very high. This is supported by the marginal effects, which indicate that the negative influences of past disagreement and the view that ranching has a ‘poor future’ in Nevada are greater than the positive impacts of the remaining variables.

Factors Affecting Ranchers' Disagreements with the BLM and USFS

We use a logit model to examine factors that result in disagreements with the public agencies. The survey asked if the respondent ever had a disagreement with a public land agency, but did not distinguish between the BLM and the USFS. A 'yes' response was coded with a one and a 'no' response with zero. The logit regression results are provided in Table 4. All of the estimated coefficients are statistically significant at the 5% level or better, except the coefficient on education, which is significant at the 10% level. Surprisingly, younger ranchers were more inclined to indicate that they have had a disagreement with a public land agency over their use of the public range. Less surprisingly, disagreement is inversely correlated with trust in the agency, although the direction of causality cannot be determined.

Whether or not a rancher's grazing allotment had been affected by wildfire is the most important source of disagreement between ranchers and public land managers, as indicated by the estimated marginal effects. What to do about wildfire and how to respond to it remains a contentious issue in the ranch community, as elsewhere (Pyne 1997). Probably the greatest source of disagreement in the Nevada ranch community concerns when cattle can return to a site that has burned. Public land managers generally wait two seasons before permitting domestic livestock on the range (Miller 1996), whereas ranchers feel that earlier grazing might be beneficial both financially and for the range itself.

Not surprisingly, wildfire is ubiquitous, with 164 out of 242 respondents indicating that they had been affected by fire in the past twenty years. Ranchers reported that 100,000 hectares of private land had burned in the most recent fires experienced by 157 respondents, while some 850,000 ha of public land had burned (155 responses); thus, an average of 905 ha

(standard deviation = 3,411 ac) of private land and 5,385 ha (sd=10,083 ha) of public land was burned in the most recent fires experienced by ranchers. A total of 171,041 AUMs of grazing was reportedly lost (n=140 responses), or an average of 1,222 AUMs (sd=5,482 AUMs) per rancher. Fifty-eight percent of land was reseeded following wildfire.

Factors Affecting Changes in Relations between Ranchers and the BLM and USFS

For each of the BLM and USFS, survey respondents were asked whether their relationship with the agency had improved, remained unchanged or changed for the worse over time. Responses were coded so that 1 indicates a change for the worse, 2 no change, and 3 a change for the better. The ordered logit regression results are provided in Tables 5 and 6 for the BLM and USFS, respectively. All of the estimated coefficients in the BLM regression model are statistically significant at the 10% level of significance or better, while only the trust and disagreement variables are statistically significant in the USFS regression model. In both models, disagreement has soured the relationship between the rancher and agency, and this factor has the greatest impact on the relationship (as indicated by the marginal effect).

Trust in the public agency has an effect opposite that of past disagreements – higher levels of trust are correlated with improved relations – although the direction of causality is unclear. In this regard, it should be recognized, however, that trust is a more general variable, referring to expressed trust in the public agencies generally as opposed to a specific agency.

In the BLM regression model, the factors ‘poor future’ and ‘pro-grazing’ appear to have a negative impact on the relationship between ranchers and public land agents. That is, ranchers who do not think there is a future in ranching as it is currently practiced, and ones who view grazing of domestic animals as socially and ecologically beneficial, are more likely

to view their relationship with the BLM to have deteriorated over time. As the number of years the individual has been engaged in ranching increases, so too does her view that the relationship with the public land agency has declined. Only those who are active in community service appear to view the BLM relationship in a positive light and those with greater service in the community had more positive views of their relation with the BLM. Perhaps this is because those who are active in service are more likely to engage with representatives of public land agencies outside of professional confines, thus (inadvertently) improving the professional relationship. However, none of these factors is as important as disagreement in shaping the relationship between rancher and public land agency.

The ‘social capital’ and ‘survive’ factors could not be eliminated from the USFS regression reported in Table 6 (according to the χ^2 tests), but neither variable is a statistically significant factor explaining the changing relationship between ranchers and the USFS over time. In addition, their marginal impacts are small. Again, disagreement is the most important factor affecting relations between Nevada ranchers and the USFS, followed by trust in public agencies more generally.

Given that disagreement is such an important factor, which itself is impacted greatly by the occurrence of wildfire (Table 4), one obvious conclusion is that wildfire is an important driver in the Nevada ranch community. It follows that ranchers and public land managers (or the agencies), as well as environmental groups, need to determine how to manage fire. This is a difficult if not impossible task (Pyne 1997, pp. 235-237).

Fire and ecological management pose a social dilemma because an individual rancher has no incentive to manage the public range in ways that minimize ‘catastrophic’ or ‘hot’

fires or enhance the range ecology.⁶ One thing that may be required to solve social dilemmas related to public lands is new institutional arrangements that change the way public range is managed. New institutional arrangements may be able to improve response to wildfire, enhance habitat for threatened species such as sage grouse, and/or increase the effectiveness of public investments in rangeland improvements. Social capital plays a role in helping new institutions develop, but it can also be relied upon to a greater extent to make existing arrangements more successful. Our research suggests that disputes over range management may have led to a reduction in social capital, but that there remains an adequate ‘stock’ for policy makers to help resolve social dilemmas in the management of public lands.

5. Discussion and Conclusions

Nevada ranchers have suffered financially from reduced access to public grazing over the past several decades. Relations with the public land agencies have also worsened, while disagreements over range use have affected 80 percent of the ranchers surveyed in this study. Disagreements appear to have come about mainly as a result of issues related to wildfire and its aftermath, while they in turn have had a negative impact on the relationship between ranchers and the public land agencies, making it increasingly difficult to solve social dilemmas concerning range management. Economic theory indicates that an increase in social capital can benefit the ranch community by reducing transaction costs and increasing

⁶ Range fires are a fact of life in Nevada, but land management (e.g., deciding when to let a fire burn) can minimize the damage to the range ecology. Some fires help reduce unwanted invasions of brush and stimulate native forbs. Catastrophic or hot fires usually occur after years of fire suppression with the result that the root biomass of perennial native plants is destroyed and invasive annuals can become established. Burning of sage brush can enhance sage grouse habitat, or damage it depending on the type of wildfire.

opportunities to resolve range management conflicts. This can be accomplished primarily by restoring trust between ranchers and public land managers (vertical relations) (see Table 2) and building upon extant relations that exist because of high levels of participation in community service and professional organizations (horizontal relations) (Table 1).

We might consider a very pertinent question for public land policy in the western United States: Are public land managers (the BLM and USFS) capable of mobilizing the existing social capital in the ranch community to resolve social dilemmas related to range management? Or are there alternative institutional arrangements that can more effectively utilize the community's social capital than is possible by relying on the public agencies? While the research reported here provides insights into the potential role of social capital in resolving range conflicts, more research is required. We lacked the resources to take the second step in this research and conduct a structured interview of BLM and USFS field agents and representatives located in the District and State offices, and the final step of interviewing environmental groups. Insights from such interviews would be helpful in determining why grazing permits have declined and how such decisions were made, the importance and role of wildfire in range conflicts, and the potential to bring local knowledge to bear in managing public range. Likewise, it is necessary to go back and interview ranchers for additional insights into the exact nature of range conflicts, why there are disagreements, and what local solutions are possible. Only by bringing together the 'demand' and 'supply' sides of this relationship using a sound socioeconomic framework will it be possible to make progress in resolving range conflicts. Yet, the history of range conflicts suggests that this research is of great importance (Brunner et al. 2002; Hadley 2001).

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Table 1: Perceptions of social capital: civic engagement and altruism (n=243)

Activity	% of respondents indicating involvement in activity
Gave blood within last year	14.4
Did volunteer work within last year	52.3
Donated to a charity within last year	78.1
Regularly interact with friends	93.0
Member of a professional organization	55.1
Member of a service organization	14.0
Spectator at community sporting and other events	44.4
Engage in non-ranch activities	37.0
Politically active	23.0
Regular church attendee	34.2
Member of Grazing Board	16.5
Other community/professional involvement	15.2

Table 2: Respondents' perceptions of how their relationships with the US Forest Service and BLM changed over time and how disagreements have been resolved^a

Item	USFS	BLM	Significance ^b
	% of respondents indicating		
	(n=94)	(n=237)	
<i>Change in Relationship</i>			
No change in relations	21.3 (4.2)	35.9 (3.1)	**
Better relations	18.1 (4.0)	24.9 (2.8)	n.s.
Worse relations	60.6 (5.1)	39.2 (3.2)	*
<i>Resolution of Disagreements</i>	(n=96)	(n=238)	
Informal resolution	35.4 (4.9)	51.3 (3.2)	*
District/State resolution	2.1 (1.5)	2.1 (0.9)	n.s.
Formal resolution (including courts)	11.5 (3.3)	2.1 (0.9)	**
Other or multiple methods	20.8 (4.1)	21.4 (2.7)	n.s.
No resolution specified	30.2 (4.7)	23.1 (2.7)	n.s.

^a Of respondents, 146 reported a relationship with only the BLM, 3 with only the USFS, and 91 with both the BLM and the USFS. The latter were separated into independent responses for each agency, resulting in more total responses than total respondents. Responses of BLM permit holders with and without USFS permits were compared and found not to be significantly different, justifying the combination of these responses.

^b Test of statistical difference in response between USFS and BLM, with ** indicating statistical significant at the $p < 0.05$ level and * at the $p < 0.10$ level, and n.s. indicating not statistically significant.

Table 3: Trust between ranchers and public land managers (n=205)

Explanatory Variable	Estimated Coeff ^a	Marginal Effects					Mean
		1	2	3	4	5	
Proportion responding:		0.3874	0.4189	0.1111	0.0770	0.0056	
Education	0.1586 (0.0570)	-0.0376	0.0129	0.0128	0.0111	0.0009	3.8732
Disagreement w agency	-1.3222 (0.0000)	0.2716	-0.0183	-0.1120	-0.1296	-0.0117	0.8000
Factor ‘poor future’ ^c	-0.5580 (0.0000)	0.1324	-0.0452	-0.0449	-0.0392	-0.0031	0.0000
Factor ‘pro-grazing’ ^c	0.2357 (0.0900)	-0.0559	0.0191	0.0190	0.0165	0.0013	0.0000
Factor ‘professionally active’ ^c	0.4259 (0.0040)	-0.1011	0.0345	0.0342	0.0299	0.0024	0.0000
Factor ‘anti-social capital’ ^c	0.3727 (0.0060)	-0.0884	0.0302	0.0300	0.0262	0.0021	0.0000
Pseudo R2	0.1093						
Log-likelihood	-233.7158						
Wald $\chi^2(5)$	0.072						

^a Level of statistical significance of the estimated coefficient is provided in parentheses.

^b 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 Ph.D.

^c Factors are described in the Appendix

Table 4: Logit model of disagreement between ranchers and agencies (n=205)

Explanatory Variable	Estimated Coefficient ^a	Marginal Effects	Mean
Age	-0.4669 (0.0110)	-0.0551	4.1220
Education ^b	0.2314 (0.0760)	0.0273	3.8732
Occurrence of wildfire	0.9419 (0.0200)	0.1269	0.6878
Trust of public land managers ^c	-0.6905 (0.0000)	-0.0815	1.966
Factor ‘service’	0.5331 (0.0180)	0.0630	0.0056
Constant	3.5799 (0.0020)		
Proportion of ‘yes’ responses	0.807		
Pseudo R ²	0.2246		
Log-likelihood	-79.5434		
Wald $\chi^2(8)$	4.89		

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

^b See Table 3 for definition.

^c Categories 1 (“lack” of trust) to 5 (“total” trust) (see Table 3)

Table 5: Change in relationship with the BLM over time (n=200)

Explanatory Variable	Relations got:→ Estimated Coeff ^a	Marginal Effects			Mean
		Worse 1	No Δ 2	Better 3	
Proportion responding		.3778	0.4214	.2008	
Trust of public land managers	0.3578 (0.0160)	0.0574	0.0267	-0.0841	1.9450
Disagreement with agency	-0.8327 (0.0190)	-0.1540	-0.0251	0.1791	0.8150
Factor 'poor future' ^b	-0.6711 (0.0000)	-0.1077	-0.0500	.1578	-0.0054
Factor 'pro-grazing' ^b	-0.3259 (0.0470)	-0.0523	-0.0243	.0766	-0.0167
Factor 'service' ^b	0.2560 (0.0840)	0.0411	0.0191	-0.602	0.0056
Number of years ranching	-0.2529 (0.0150)	-0.0406	-0.0189	.0594	4.6250
Pseudo R ²	0.1160				
Log likelihood	-191.2275				
Wald $\chi^2(8)$	2.43				

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

^b Factors are described in the Appendix

Table 6: Change in relationship with the USFS over time

Explanatory Variable	Relations got:→ Estimated Coeff ^a	Marginal Effects			Mean
		Worse 1	No Δ 2	Better 3	
Proportion responding:		0.678	0.2542	0.0979	
Trust of public land managers	1.1528 (0.0000)	-0.2630	0.1612	0.1018	1.8272
Disagreement with agency	-1.1973 (0.0500)	0.2875	-0.1425	-0.1450	0.8272
Factor 'social capital' ^b	0.3377 (0.2090)	-0.0770	0.0472	0.0298	0.0060
Factor 'survive' ^b	0.3747 (0.1310)	-0.0855	0.0524	0.0331	0.0692
Pseudo R ²	0.1978				
Log likelihood	-60.1478				
Wald $\chi^2(10)$	4.89				

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

^b Factors are described in the Appendix

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	Uniqueness
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 Invoement	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

Professional Activity – 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.