



ANALYSIS

Social dilemmas and public range management in Nevada

G. Cornelis van Kooten^{*}, Roy Thomsen¹, Thomas G. Hobby¹, Alison J. Eagle¹

Department of Economics University of Victoria P.O. Box 1700, Stn CSC Victoria, B.C. Canada V8W 2Y2

Received 13 December 2004; received in revised form 13 April 2005; accepted 3 June 2005

Available online 1 August 2005

Abstract

Increasing tension in the Nevada ranch community may have had a negative impact on social capital. Social capital is important because it 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' relationships with the U.S. Forest Service and Bureau of Land Management. Results indicate that, contrary to expectations, economic factors such as income and ranch size have little or no effect on relationships in the Nevada ranch community — on ranchers' disagreements with public land managers and the deterioration in rancher-land agency relations. Rather, these relationships appear to be affected to a greater extent by our measures of social capital, personal characteristics and experience with wildfire. Indeed, disagreements with the public agencies were mainly affected by gender (males tended to have more disagreements), lack of trust, and disputes concerning responses to wildfire (which increased the chance of disagreement). Not surprisingly, disagreement resulted in a deterioration of relationships that could be offset by higher levels of social capital, particularly trust and positive attitudes towards the future of ranching and the community (as measured by responses to a variety of attitudinal questions). We conclude that, 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. This could potentially help in the resolution of social dilemmas related to range management.

© 2005 Elsevier B.V. All rights reserved.

Keywords: Social capital and institutions; Public land agencies; Range improvements; Factor analysis

JEL classification: O17; O52

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,

^{*} Corresponding author. Tel.: +1 250 721 8539; fax: +1 250 721 1642.

E-mail address: kooten@uvic.ca (G.C. van Kooten).

¹ Tel.: +1 250 721 8539; fax: +1 250 721 1642.

1994, 1990; Putnam, 2000, 1993; Woolcock). Institutions and social capital, the features of social organizations that facilitate action and cooperation for mutual benefit (Putnam, 1993, 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, 2000a).

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 (Rodríguez 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.

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., 2001, pp. 62–63). Bureau of Land Management and U.S. Forest Service 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 do not attempt to address all of these issues, but only shed light on some of them 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 ranchers' relations with the public agencies. We subsequently test these using responses 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. A discussion follows 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, proper economic institutions, a particular role for the state and social capital (Fukuyama, 2002).

2.1. *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 (BLM) and U.S. Forest Service (USFS). 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 (Connelly et al., 2000) or become an obstacle to resolving social dilemmas (Ostrom, 2000a). 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, as in the Ukraine, Iran and Ethiopia, for example. 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 bring about management activities that would otherwise be held up by bureaucracy and the hierarchy that inevitably accompanies it. If ranchers do not cooperate 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.

2.2. *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 (Connelly et al., 2000), 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 (Connelly et al., 2000). 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, 2002).

2.3. 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 an individual and an aggregate component (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 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).² 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).

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 (2000b) 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, 1993). In Nevada’s ranch community, relationships among ranchers, public agency representatives, 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

² It should not be forgotten that social capital can also have negative aspects related to crime and so on (Carol and Standfield, 2003).

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).

In this study, the effectiveness or ineffectiveness of the public land agencies in providing good policy and minimizing bureaucracy presents itself in ranchers’ perceptions of public land managers and in how disputes about land use and livestock grazing are resolved. Since lack of funding prevented us from surveying representatives of the public land agencies, we focus only on the ranchers’ perceived relations with the public land agencies and the role of social capital in that relationship. Is the relationship driven more by factors outside the control of the ranch community or by social capital factors that can be influenced, albeit with great difficulty, by concerted effort on the part of policy makers and the community? Outside factors include occurrence of wildfire, which is an uncertain but unavoidable event in the Great Basin, and certain operator and ranch characteristics that vary across ranchers but are essentially fixed for an individual.

We postulate that, rather than being random events, disagreements between ranchers and the agencies are a function of the personal characteristics of ranchers (e.g., gender, age), ranchers’ perceptions of the trustworthiness of the public land agencies, and exogenous shocks (here experience with wildfire), but that economic variables (e.g., income, farm size) are of lesser import in explaining relationships between ranchers and public land managers. We also hypothesize that negative experience with the land agency (in the form of disagreement) will, in turn, lead to deteriorating relationships between users and managers of public range that, in our view, can be detrimental to the resolution of social dilemmas related to the (real or perceived) externality costs of public grazing. Further, it is our measures of social capital (civic engagement, altruism, organizations, ranchers’ trust of the public land agencies, etc.), attitudes and personal characteristics, rather than economic factors, which are taken to affect changes in the perceived relationships between ranchers and the public agencies.

The problem in this type of research concerns causality: while we postulate that trust influences whether a rancher considers he/she has had a disagree-

ment with a land agency, for example, disagreement could just as well affect the rancher’s perception of the public agency’s trustworthiness. However, causality plagues all empirical studies of social capital, because social capital is difficult to define and measure, as already noted.³

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, and 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 pre-tested on a sample of ranchers and extension specialists at the University of Nevada and then mailed to all 514 BLM and Forest Service grazing permit holders in Nevada on March 29, 2002, with a follow-up mailing to non-respondents on May 21, 2002. Follow-up telephone calls were subsequently made to all ranchers who had not responded to either mailing. The design and mailing procedures were based on Dillman (2000). The response rate was 47.9%, or 246 returned surveys of which two were unusable because too few questions were completed (Thomsen, 2002).⁴

Included in the survey were questions dealing with the ranch operation, community activities, experience with fire, attitudes toward the public land agencies and the future of public land-based ranching, income,

³ Indeed, in an earlier version of this paper, we showed that trust is affected by whether a rancher indicates there has been disagreement.

⁴ Response rates for executives of small firms are notoriously low (Friedman and Singh, 1989). Ranches must be viewed as small firms, and not as individuals commonly surveyed using CVM (e.g., recreationists who tend to be avid users of a particular resource). For example, a telephone survey of farmers conducted for the Canadian government by the Environics Research Group (2000) reported a response rate of 12%, about the same as that reported by Bell et al. (1994) in their study of farmers’ participation in Tennessee’s Forest Stewardship Program. A ruling legal staff at the University of Nevada prevented the inclusion of any form of monetary payment for participating in the survey.

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

education, and so on. The context of the survey was the reduction in AUMs of public grazing to protect environmental amenities (noted above). 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.

As indicated in Table 2, on average respondents owned nearly 9000 acres of their own land and utilized 5037 AUMs of public grazing. Respondents were predominantly male (206 of 244), 53 years of age with nearly 38 years of ranching experience (not all as the operator), and with slightly more than one year post-secondary education. Annual income from all sources averaged about \$53,400, with some one-third reportedly coming from off the ranch.⁵ If one compares income, age and levels of education with 2000 Census Data for Elko, White Pine, Eureka and Humboldt Counties, those in which the majority of respondents are located, no statistical differences be-

⁵ Values are approximate because education, age, experience and income were elicited using categorical responses. The survey failed to elicit information on household size.

tween ranchers and other rural residents are discernable.⁶ Hence, we have no reason to suspect that the exclusion of non-respondents would lead to bias in the statistical analyses that follow.

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 subsequent regressions below that assess trust, relationship strength, and disagreements between ranchers and public land managers. The factor analysis results, factor descriptions and mean factor values are provided in the Appendix. Summary statistics are provided in Table 2.

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. Since the USFS reduced access to public forage to a greater extent than did the BLM, one expects that ranchers would have a more negative attitude towards the former than the latter. This is supported by the results in Table 3, which compare 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 3 is the extent of disagreement because this was elicited using a more general question that was not agency specific. Over 80% of ranchers indicated that they had had one or more disagreements with the public land agencies con-

⁶ See <http://www2.library.unr.edu/dataworks/NVdemog/index.htm#profiles> (viewed April 7, 2005). The Census Data do not differentiate between those living on farms and in towns.

Table 2
Descriptive statistics, 2000 Nevada ranch survey

Variable	# of obs	Mean	Std.Dev.	Min.	Max.
Relations with BLM (categorical) ^a	237	1.857	0.790	1	3
Relations with USFS (categorical) ^a	95	1.584	0.784	1	3
Disagreement with agency (=1)	243	0.807	0.396	0	1
Gender of Respondent (1=male)	244	0.844	0.363	0	1
Operator age (categorical) ^b	243	4.173	1.200	1	6
Ranching experience (categorical) ^c	241	4.726	1.326	1	6
Operator education (categorical) ^d	242	3.785	1.739	1	8
Income (categorical) ^e	221	3.887	1.921	1	6
Off farm income (% of total)	243	32.650	36.982	0	100
Owned acres ('000s)	244	8.955	28.938	0	270
AUMs of public grazing ('000s)	240	5.037	9.670	0	75
Trust public land agencies ^f	241	-1.071	1.040	-2	2
Experienced wildfire (1=yes)	242	0.678	0.468	0	1
<i>Factors from factor analysis^g</i>					
Poor future for ranching	227	0	1	-2.113	1.866
Social Capital	227	0	1	-1.772	2.516
Alternative ranch income	227	0	1	-1.237	3.122
Pro federal agencies	227	0	1	-1.924	3.603
Pro grazing	227	0	1	-5.400	1.307
Professionally active	227	0	1	-1.645	2.745
Service	227	0	1	-1.942	3.315
Survive	227	0	1	-3.723	2.192
Loner	227	0	1	-1.648	4.062

^a Relation with BLM and USFS categorized as: 1='worsened', 2='no change', 3='improved'.

^b Age categories: 30 or less, 31–40, 41–50, 51–60, 61–70 and over 70 years of age.

^c Ranching experience categories: 5 or less, 6–10, 11–20, 21–30, 31–40, >40 years experience.

^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 Ph.D.

^e Income categories: <\$30,000, \$30–\$45,000, \$45,000–\$60,000, \$60,000–\$75,000, \$75,000–\$90,000, >\$90,000.

^f Categories-2 ('complete lack of trust') to +2 ('complete trust').

^g Factors are described in the Appendix.

cerning their use of public range. From Table 3, 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 observation 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 ranchers' relations with these two agencies.

Given the importance of trust as a measure of social capital, 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 neutral, was employed. As indicated in Table 2, 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 indi-

Table 3

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		
<i>Change in relationship</i>	(<i>n</i> = 94)	(<i>n</i> = 237)	
No change in relations	21.3 (4.2)	35.9 (3.1)	**
Better relations	18.1 (4.0)	24.9 (2.8)	nss
Worse relations	60.6 (5.1)	39.2 (3.2)	*
<i>Resolution of disagreements</i>	(<i>n</i> = 96)	(<i>n</i> = 238)	
Informal resolution	35.4 (4.9)	51.3 (3.2)	*
District/State resolution	2.1 (1.5)	2.1 (0.9)	nss
Formal resolution (including courts)	11.5 (3.3)	2.1 (0.9)	**
Other or multiple methods	20.8 (4.1)	21.4 (2.7)	nss
No resolution specified	30.2 (4.7)	23.1 (2.7)	nss

^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 'nss' indicating not statistically significant.

cating a divergence of views about the trustworthiness of public agencies. Trust is an important regressor in the empirical analysis that follows.

4.1. Factors affecting ranchers' disagreements with the BLM and USFS

A logit model (Greene, 2000, p. 814) is used 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 (trust) translate into less conflict.⁷ 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. Both general and specific models are provided.⁸ All of the estimated coefficients

⁷ Perceptions are used because, supposedly, the level of aggregate social capital is the same throughout the ranch community. Summary statistics for the disagreement variable are provided in Table 2.

⁸ In this and subsequent regressions, a more parsimonious version of the general model is obtained by removing from the general model statistically insignificant regressors. In each iteration, the least significant regressor is removed, until the Wald χ^2 statistic falls below a critical 0.10 level of significance, in which case the restricted model is preferred to the general model.

in the specific model are statistically significant at the 5% level or better, except the coefficient on education, which is significant at the 6.5% level.

Respondent characteristics (gender, age and education) are important factors in the regression. Not surprisingly perhaps, male respondents were more inclined to have had a disagreement with a public land agency over their use of the public range. Likewise, more educated ranchers were more inclined to have had a disagreement over range use. Somewhat surprisingly, older ranchers were less likely to have indicated that they had a disagreement over their use of public range than younger ones. One possible explanation is that young and more educated ranchers are more aggressive in asserting that their view of how the range is to be used is just as valid as that held by the public manager.

The only ranch characteristic important in explaining disagreement is the extent of public forage that the respondent utilized. As expected, the more public forage that the rancher utilizes, the greater is the likelihood that a respondent ran afoul of the public land agency.

The results in Table 4 also indicate that disagreements with the public agency about how the range is used are inversely correlated with trust in the agency. However, as noted in the earlier discussion, the direction of causality cannot be unambiguously determined.

Table 4
Logit model of disagreement between ranchers and public land agencies

Variable	General model		Specific model		Marginal effect ^b
	Est. Coef	Prob. ^a	Est. Coef	Prob. ^a	
Constant	−1.5317	0.250	−0.2055	0.845	
Gender of operator	1.1401	0.030	0.9604	0.048	0.107
Operator age	−0.3703	0.060	−0.3601	0.033	−0.030*
Ranching experience	0.1435	0.408			
Operator education	0.3841	0.008	0.2278	0.065	0.019*
Income	0.0250	0.821			
Off farm income (% of total)	−0.0047	0.432			
Owned acres ('000s)	0.0021	0.937			
AUMs of public land agencies	0.1952	0.068	0.2000	0.034	0.017***
Trust public land agencies	−0.6335	0.001	−0.5768	0.001	−0.049***
Experienced wildfire on ranch	0.8604	0.048	0.9322	0.019	0.092*
Number of observations	213		231		
Log likelihood=	−75.754		−84.3524		
Pseudo R ²	0.2836		0.2595		
LRχ ²	59.99	0.000	59.11	0.000	
(degrees of freedom)	(10)		(6)		

^a Probability refers to the estimated confidence level of the estimate based on a z-test.

^b Estimated marginal effect (dy/dx) or discrete change for a dummy variable; see [Greene \(2000, pp. 815\)](#) for discussion of how the marginal effects are calculated: *** indicates statistical significance at the 0.01 level or better, ** at the 0.05 level or better and * at the 0.10 level or better.

Finally, along with gender, whether or not a rancher's grazing allotment had been affected by wildfire is an 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 it does 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 ha 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=3411 ac) of private land and 5385 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 1222 AUMs (sd=5482 AUMs) per rancher.

4.2. Factors affecting changes in relations between ranchers and the BLM and USFS

An ordered logit model is used to investigate factors that have resulted in a change in the relationship between ranchers and the two public land agencies over time. 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. Responses were coded so that 1 indicates a change for the worse, 2 no change, and 3 a change for the better (see [Table 3](#)). The ordered logit regression results are provided in [Tables 5 and 6](#) for the BLM and USFS, respectively. Unlike the disagreement model in [Table 4](#), which excluded the variables from the factor analysis, all of the possible regressors found in [Table 2](#) (including the disagreement variable but not experience with wildfire) were

Table 5
Ordered logit model explaining ranchers' change in relationship with the BLM

Variable	General model		Specific model		Marginal effects/ relational Δ /proportion ^b		
					Worse	No Δ	Better
	Est. coef.	Prob. ^a	Est. coef.	Prob. ^a	0.3853	0.4185	0.1962
Gender (1 = male)	0.5406	0.218					
Operator age	-0.0792	0.595					
Ranching experience	-0.2099	0.108	-0.2583	0.013	0.061***	-0.020**	-0.041***
Operator education	-0.0344	0.724					
Income	0.0878	0.265					
Off farm income (% of total)	-0.0019	0.639					
Owned acres	0.0042	0.453					
AUMs of public grazing	0.0032	0.846					
Trust public land agencies	0.3562	0.025	0.3923	0.007	-0.093***	0.013**	0.062***
Disagreement with agency (=1)	-0.9181	0.021	-0.7420	0.032	0.163***	-0.029*	-0.134*
<i>Factors from factor analysis</i>							
Poor future for ranching	-0.7098	0.000	-0.6506	0.000	0.154***	-0.051***	-0.103***
Social capital	0.0527	0.728					
Alternative ranch income	0.1726	0.223	0.1389	0.301	-0.033	0.011	0.023
Pro federal agencies	0.2457	0.104	0.2898	0.037	-0.069**	0.023*	0.046**
Pro grazing	0.3297	0.056	0.3244	0.043	-0.079**	0.026*	0.051**
Professionally active	0.1853	0.236	0.2274	0.111	-0.054	0.018	0.036
Service	0.0949	0.524					
Survive	0.0723	0.615					
Loner	0.1413	0.325					
cut1 ^c	-2.2119	0.992	-2.6847	0.626			
cut2 ^c	-0.2391	0.978	-0.8073	0.600			
Number of observations	199		216				
Log likelihood=	-184.904		-203.415				
Pseudo R ²	0.1397		0.1286				
LR χ^2	60.04	0.000	60.06	0.000			
(degrees of freedom)	(19)		(8)				

^a Probability refers to the estimated confidence level of the estimate based on a z-test.

^b Estimated marginal effect (dy/dx) or discrete change for a dummy variable; see Greene (2000, pp. 876–877) for discussion of how the marginal effects are calculated: *** indicates statistical significance at the 0.01 level or better, ** at the 0.05 level or better and * at the 0.10 level or better.

^c The estimated boundaries between 'relationship worsened' and 'no change' (cut1) and 'no change' and 'relationship got better' (cut2). Since the statistical test is not relative to the hypothesis that the estimated coefficient equals zero, standard errors are reported rather than probability.

included in the general model. Experience with wildfire was excluded because it is assumed to operate through the disagreement variable (see Table 4).

As hypothesized, economic variables related to ranchers' income and ranch size turned out to be statistically insignificant explanatory variables. With the exception of experience as a rancher in the BLM regression, personal characteristics played no role in explaining the dynamics of the relationship between ranchers and the public agencies. Along with trust,

however, whether a rancher had a disagreement with a public land agency plays a statistically significant and important role in explaining the change in respondents' relationships with both the BLM and USFS, as evidenced by the estimated coefficients and marginal effects. Given that personal characteristics (especially gender) explain disagreement, personal characteristics may enter through the disagreement variable. The same is true of experience with wildfire. Trust, on the other hand, has both a direct effect and an indirect effect (through disagreement) on the ran-

Table 6
Ordered logit model explaining rancher' change in relationship with the USFS

Variable	General model		Specific model		Marginal effects/relational Δ /proportion ^b		
	Est. coef.	Prob. ^a	Est. coef.	Prob. ^a	Worse	No Δ	Better
Gender (1 = male)	0.4577	0.606					
Operator Age	0.4342	0.197					
Ranching experience	-0.1772	0.578					
Operator education	0.0865	0.702					
Income	0.0211	0.903					
Off farm income (% of total)	0.0085	0.276					
Owned cares	0.0039	0.798					
AUMs of public grazing	0.0069	0.831					
Trust public land agencies	1.0853	0.001	1.1428	0.000	-0.272***	0.164***	0.109***
Disagreement with agency (=1)	-0.8582	0.311	-1.0243	0.088	0.250*	-0.124*	0.126
<i>Factors from factor analysis</i>							
Poor future for ranching	-0.0934	0.766					
Social capital	0.5834	0.118	0.3115	0.239	-0.074	0.045	0.030
Alternative ranch income	0.4114	0.169	0.3116	0.221	-0.074	0.045	0.030
Pro federal agencies	0.5955	0.064	0.4778	0.066	0.114*	0.068*	0.045*
Pro grazing	0.4103	0.322					
Professionally active	-0.2211	0.553					
Service	-0.5463	0.135	-0.3279	0.236	0.078	-0.047	-0.031
Survive	-0.1533	0.630					
Loner	0.4420	0.154	0.3442	0.151	-0.082	0.050	0.033
cut1 ^c	0.9090	2.533	-1.7307	0.619			
cut2 ^c	2.6560	2.538	-0.0422	0.571			
number of observations	81		89				
Log likelihood=	-55.214		-64.386				
Pseudo R ²	0.2636		0.2508				
LR χ^2	39.53	0.004	43.12	0.000			
(degrees of freedom)	(19)		(7)				

^a Notes: See Table 5 for footnotes.

chers' relationships with the BLM and USFS. Trust was included in all of the regressions in Tables 4–6 because it is considered the most important measure of social capital.

The regressions results in Tables 5 and 6 are quite robust. In both models, disagreement has soured the relationship between the rancher and agency, and this factor has perhaps the greatest impact on the relationship (as indicated by the estimated coefficients and marginal effects). As expected, the absolute value of the estimated coefficients on the disagreement variable is larger in the USFS equation than the BLM equation, because relations between ranchers and the USFS have deteriorated to a greater extent than those with the BLM.

Trust in the public agency has an effect opposite that of past disagreements – higher levels of trust are correlated with improved relations with both agencies – 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. As in the case of disagreement, the empirical results on the trust variable support the notion that relations deteriorated more in dealings with the USFS than the BLM, as the marginal effect of trust in the USFS regression is strongly negative for the group indicating relations are worse (compare marginal values for trust in Table 6 with those of Table 5).

In the BLM regression model, experienced ranchers and those who do not think there is a future in ranching

as it is currently practiced (factor ‘poor future’) are more likely to have indicated a negative impact on the relationship they have with the public land agency. In contrast, respondents who view grazing of domestic animals as socially and ecologically beneficial (‘pro grazing’), have a favorable attitude towards the public agencies (‘pro federal agencies’) and the ability of the range resource to provide them alternative income sources in the future (‘alternative ranch income’), and are active in professional organization are more likely to indicate that relations with the BLM have improved. However, the marginal impact of these factors tends to be small compared to the effect of previous disagreements and the trust variable.

The same is true in the USFS regression. While the factors ‘social capital’ (altruism and community service), ‘alternative ranch income’, ‘pro federal agencies’, ‘service’ (involvement in community service clubs) and ‘loner’ (not social) enter into the more-parsimonious regression model, their impact on the relationship that ranchers have with the USFS is small relative to that of the trust and disagreement variables (see Table 6). A favorable attitude towards the public agencies (‘pro federal agencies’) constitutes an exception, but even its impact is much smaller than those of trust and disagreement. That is, the marginal impacts of the ‘factor variables’ are small, or statistically insignificant.

Given that disagreement is such an important factor, which itself is impacted greatly by the occurrence of wildfire (Table 4), one could conclude 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).

5. Discussion

Nevada ranchers have suffered financially from reduced access to public grazing over the past several decades. Disagreements over how public range is used have affected 80% of the ranchers surveyed in this study, and relations with the public land agencies have generally worsened. While disagreements over ranchers’ use of public range are likely more pro-

nounced among male, younger and more educated ranchers, the issues over which ranchers disagree most with the public agencies appears to be related to wildfire and its aftermath. Only where ranchers have a higher level of trust in the public agency are disagreements less evident. Whether or not ranchers have disagreed with public managers about land use has, in turn, had a negative impact on the relationship between ranchers and the public land agencies. While attitudes and experience have had some effect on the rancher-agency relationship, trust is the only factor offsetting the negative impact of disagreement. Disagreements and rancher-agency relationships are not affected by economic variables, such as income and farm size. Thus, it would seem that trust is the only variable that public policy can impact.

Our results appear to provide support for our theory, which indicates that an increase in social capital can benefit the ranch community by reducing transaction costs and increasing opportunities to resolve range management conflicts. This can be accomplished primarily by restoring trust between ranchers and public land managers (vertical relations) (see Table 3) and building upon extant relations that exist because of high levels of participation in community service and professional organizations (horizontal relations) (Table 1).

Given that wildfire appears to play an important role as a catalyst for rancher–public agency conflicts about the management or use of public range, we might want to speculate further on fire in the context of our economic theory. 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.⁹ 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

⁹ 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.

increase the effectiveness of public investments in rangeland improvements.

We might therefore want 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 extant 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).

Acknowledgements

The authors want to thank Hope Lewis and Mark Eiswerth for their contributions to the development and administration of the Nevada Ranch Survey, and Hudson Glimp and Eiswerth for helpful comments and suggestions.

Appendix A. Factor analysis

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	Loner	Uniqueness
Donate blood	0.0519	0.5671	-0.1413	0.1180	0.0615	0.0259	0.2886	0.0373	0.0288	0.5518
Volunterism	-0.0563	0.5878	0.1021	-0.0785	0.1112	0.1023	0.0629	0.0192	-0.2825	0.5278
Donate to charity	-0.0730	0.1394	0.0944	0.0043	-0.1426	0.0218	0.0080	0.0059	-0.7665	0.3578
Active with friends	-0.0297	-0.0063	0.1145	0.1896	0.5595	0.0217	0.0464	-0.0747	-0.5977	0.2716
Active in professional organizations	-0.1289	-0.0566	0.0477	0.0678	-0.0324	0.6627	0.3377	0.1857	-0.2173	0.3373
Active in service organizations	-0.0335	0.0755	0.0265	0.0512	-0.0043	0.0731	0.7843	-0.0036	-0.0174	0.3691
Spectator at local events	0.0993	0.4530	0.2730	0.3125	0.2718	0.2146	-0.1528	-0.0524	0.0757	0.4611
Participant in non-ranch activities	-0.0647	0.5915	0.1021	0.0457	0.1007	-0.0759	0.4317	-0.0694	0.1006	0.4163
Politically involved	0.1223	0.3704	-0.0554	0.0223	0.1162	-0.1198	0.3403	0.1161	-0.2101	0.6431
Attend church	-0.1590	0.5894	0.0873	-0.2540	-0.1329	-0.0487	-0.2155	0.1739	-0.3133	0.3603
Involved on grazing board(s)	0.0162	0.0458	-0.0651	-0.1266	0.0910	0.7926	-0.1007	-0.0874	0.0802	0.3168
Indicates they are under financial stress	0.2155	0.2631	0.0416	0.1218	0.0561	-0.0559	-0.1178	0.6927	0.1593	0.3424
Livestock considered threat to environment	-0.0287	-0.0479	-0.1640	-0.0220	0.7105	-0.0387	0.0827	0.1134	0.1886	0.4080
Public agencies are going good job	-0.4587	0.1577	-0.275	0.3276	-0.2075	0.2390	-0.3092	-0.0947	0.0368	0.4505

(continued on next page)

Table A1 (continued)

Item	Poor future	Social capital	Alt. ranch income	Pro-federal agencies	Pro-grazing	Prof active	Service	Survive	Loner	Uniqueness
Too much public land	0.0037	0.0041	0.0607	– 0.7858	0.0242	0.0885	–0.0923	–0.0623	0.0062	0.3580
Federal gov't ought to control public lands	0.2106	0.0772	–0.0202	– 0.6001	0.2138	–0.0133	0.416	0.2459	0.1753	0.4503
Ranchers given more rights to public land	–0.0185	–0.1170	0.1449	–0.1307	0.0074	0.0423	0.1098	0.7709	–0.0896	0.3317
Grazing enhances the ecosystem	0.0016	0.1398	0.0662	–0.1548	0.7665	0.0786	–0.0085	–0.0390	–0.0339	0.3557
Too many livestock are on public land	–0.2446	0.0363	–0.0928	0.4076	–0.2421	–0.2460	0.0362	–0.1720	–0.0438	0.6121
Ranching won't survive the next 50 years	0.8025	–0.0046	–0.0060	–0.0242	–0.0081	–0.1070	–0.0436	0.0568	0.2058	0.2963
Ranchers are solution to range problems	0.0693	0.0635	–0.1530	–0.2371	0.4976	0.1176	–0.1232	0.3920	–0.0368	0.4799
Ranchers see no future on public lands	0.7459	–0.1514	–0.2086	0.0576	–0.0544	0.0469	0.0839	0.0460	–0.0240	0.3589
Ranching will continue as is on public land	– 0.8623	–0.0727	–0.0127	0.0857	–0.0063	–0.0230	0.0650	–0.0304	0.0492	0.2355
Ranching will become a hobby	0.3861	–0.0832	0.5121	–0.0882	0.1762	0.1003	–0.1305	–0.0682	0.0338	0.5101
Ranching will include tourism	–0.1239	0.0440	0.8138	–0.0649	–0.0336	–0.0839	0.1528	0.1169	–0.0174	0.2708
Ranching will include recreation uses	–0.0506	0.0650	0.8143	0.0311	–0.0494	0.0266	–0.0808	0.0411	–0.1382	0.2988

The bold numbers represent factor loadings.

Factor Descriptions

Poor Future Ranchers feel that ranching has no future and won't survive in its current form

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 involved in cattlemen's associations and grazing boards

Service Ranchers 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

Loner Ranchers do not contribute financially to community organizations and do not have friends over, and are generally not socially involved

References

- Bell, D.C., Roberts, K.R., English, C.B., Park, M.W., 1994. A logit analysis of participation in Tennessee's Forest Stewardship Program. *Journal of Agricultural and Applied Economics* 26, 463–472.
- Bromley, D.W., 1999. *Sustaining Development: Environmental Resources in Developing Countries*. Edward Elgar, Cheltenham, UK.
- Brunner, R.D., Colburn, C.H., Cromley, C.M., Klein, R.A., Olson, E.A. (Eds.), 2002. *Finding Common Ground: Governance and Natural Resources in the American West*. Yale University Press, Princeton, NJ.

- Carol, M.C., Standfield, J.R., 2003. Social capital, Karl Polanyi, and American social and institutional economics. *Economic Issues* 37 (2), 397–404.
- Collier, P., 2002. Social capital and poverty: a microeconomic perspective. In: Grootaert, C., van Bastelaer, T. (Eds.), *The Role of Social Capital in Development: An Empirical Assessment*. Cambridge University Press, Cambridge, UK.
- Connelly, J.W., Schroeder, M.A., Sands, A.R., Braun, C.E., 2000. Guidelines to manage sage grouse populations and their habitats. *Wildlife Society Bulletin* 28 (4), 967–985.
- Dasgupta, P., 2000. Economic progress and the idea of social capital. In: Dasgupta, P., Serageldin, I. (Eds.), *Social Capital. A Multifaceted Perspective*. The World Bank, Washington.
- Dillman, D.A., 2000. *Mail and Internet Surveys: The Tailored Design Method*, 2nd ed. John Wiley & Sons, New York, NY.
- Environics Research Group, 2000. Survey of farmers, ranchers and rural landowners attitudes and behaviours regarding land stewardship. Wildlife Habitat Canada, Ottawa (<http://www.whc.org/whc/WHCDocuments.nsf/Documents?OpenFrameSet>).
- Friedman, S.D., Singh, H., 1989. CEO succession and stockholder reaction. The influence of organizational context and event content. *Academy of Management Journal* 32, 718–744.
- Fukuyama, F., 1999. *The Great Disruption. Human Nature and the Reconstitution of Social Order*. The Free Press, New York.
- Fukuyama, F., 2002. Social capital and development: the coming agenda. *SAIS Review* XXII (1), 23–37 (Winter-Spring).
- Gelauff, G.M.M., 2003. Sociaal Kapitaal in De Economie. *Economisch Statistische Berichten* 88 (4398), 3–5.
- Greene, W.H., 2000. *Econometric Analysis*, 4th ed. Prentice Hall, Upper Saddle River, NJ.
- Hadley, D., 2001. Grazing the southwest borderlands. In: Huggard, C.J., Gomez, A.R. (Eds.), *Forest Under Fire. A Century of Ecosystem Mismanagement in the Southwest*. University of Arizona Press, Tucson, AZ.
- Hair, J., Brush, R., Ortinau, D., 2000. *Marketing Research: A Practical Approach for the New Millennium*. McGraw-Hill, Columbus, OH.
- Lehtonen, M., 2004. The environmental-social interface of sustainable development: capabilities, social capital, institutions. *Ecological Economics* 49 (2), 199–214.
- Miller, S., 1996. Sagebrush Rebellion II: A Fires in Ruby Valley Electric Nevada, Tahoe NV, As viewed November 26 2003 at: <http://www.ziahet.com/wblase/endtimes/gardners.htm>.
- North, D.C., 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge University Press, Cambridge.
- North, D.C., 1994. Economic performance through time. *American Economic Review* 84, 359–368.
- Ostrom, E., 2000a. Collective action and the evolution of social norms. *Journal of Economic Perspectives* 14, 137–158.
- Ostrom, E., 2000b. Social capital: a fad or a fundamental concept? In: Dasgupta, P., Serageldin, I. (Eds.), *Social Capital. A Multifaceted Perspective*. The World Bank, Washington, DC.
- Pedhazur, E.J., Schmelkin, L.P., 1991. *Measurement, Design, and Analysis: An Integrated Approach*. Lawrence Erlbaum Associates, Hillsdale, NJ.
- Putnam, R.D., 1993. *Making Democracy Work: Civil Traditions in Modern Italy*. Princeton University Press, Princeton, NJ.
- Putnam, R.D., 2000. *Bowling Alone: The Collapse and Revival of American Community*. Simon and Schuster, New York.
- Pyne, S.J., 1997. *World Fire: The Culture of Fire on Earth*. University of Washington Press, Seattle, WA.
- Resource Concepts Inc., 2001. *Nevada Grazing Statistics Report and Economic Analysis for Federal Lands in Nevada*. Resource Concepts Inc., Carson City, NV. (26 March 2001, pp.).
- Rodríguez, L.C., Pascual, U., 2004. Land clearance and social capital in mountain Agro-Ecosystems: The case of *Opuntia* Scrubland in Ayacucho, Peru. *Ecological Economics* 49 (2), 243–252.
- Thomsen, R., 2002. *The Role of Social Capital in the Ranch-Public Range Community of Nevada*. MS Thesis, University of Nevada, Reno, NV.
- van Kooten, G.C., Eagle, A.J., Eiswerth, M.E., 2004. *Anthropogenic and Natural Determinants of the Population of a Sensitive Species: Sage Grouse in Nevada*. Victoria: REPA Working Paper, Department of Economics, University of Victoria.
- Williamson, O.E., 1996. *The Mechanism of Governance*. Oxford University Press, New York.
- Williamson, O.E., 2002. *The theory of the firm as governance structure: from choice to contract*. Working Paper. UC Berkeley, Berkeley, CA.
- Woolcock, M., 2001. *The Place of Social Capital in Understanding Social and Economic Outcomes*. Paper read at The Contribution of Human and Social Capital to Sustained Economic Growth and Well Being. Report of an International Symposium, Ottawa.