

WESTERN RANGELANDS REFORM: AN ANALYSIS OF THE 1996 SENATE VOTE ON FEDERAL GRAZING FEES

GERALD A. FENNEMORE and JON P. NELSON*

Grazing of livestock on public lands is a controversial environmental issue, despite a long history of federal regulation of this activity. Environmentalists and economists have argued that grazing fees charged by the Bureau of Land Management subsidize livestock operators and that higher fees would help bring rangeland usage in line with environmental and economic goals. In 1996, the U.S. Senate voted to determine whether higher fees would be charged for use of federally owned land. Based on a theoretical model, probit regressions are used to analyze this vote with respect to the influences of the general electorate, special interests, party affiliation, senatorial preferences, and electoral security. We find that political competition among producers utilizing federal lands was a crucial factor in determining voting decisions. However, environmental interests had a smaller direct impact on the grazing fee vote. (JEL Q24, Q18)

I. INTRODUCTION

Grazing of livestock on public lands is an environmental issue that has been the topic of political and economic debate for several decades. In 1996, the U.S. Senate considered legislation that would establish higher grazing fees on federal lands, an issue that pitted ranching and environmental interests in the use and management of western rangelands. The League of Conservation Voters (LCV; (<http://www.lcv.org>)) singled out this issue as one of the Senate's major environmental votes of 1996. The objective of this article is to analyze the Senate's vote on grazing fees as a test of the economic theory of legislation as applied to environmental issues. There are several reasons why this issue is of interest for economic analysis. First, grazing issues are often cast in the context of the "jobs versus the environment" trade-off. This trade-off receives considerable attention in the popular press but has been largely

overlooked in the academic literature on voting. More generally, federal grazing fees use subsidies as a way of "creating" jobs (Hess and Holechek, 1995). Second, congressional votes on grazing fees and procedures are potentially affected by several special interest groups, including Western ranchers holding low-cost grazing permits; non-Western livestock interests; other users of federal lands (recreation, tourism, energy, mining, forestry, waste disposal); and environmental interests (wilderness, biodiversity, wild horses, endangered species, cultural preservation). One possible outcome is that Western ranchers are pitted against an uneasy coalition of conservation-preservation and special-use interests. Third, previous empirical voting studies tend to support the notion that legislators systematically find it in

ABBREVIATIONS

AUM: Animal Unit Month
BLM: Bureau of Land Management
GAO: General Accounting Office
LCV: League of Conservation Voters
PLLRC: Public Land Law Review Commission
PRIA: Public Rangelands Improvement Act
USDA: U.S. Department of Agriculture
USDI: U.S. Department of the Interior
USFS: U.S. Forest Service

*The authors thank Dave Abler, Robert Michaels, and two anonymous referees for comments on drafts.

Fennemore: Analyst, Capital One Financial Corp., 800 Jones Branch Drive, McLean, VA 22102. Phone 1-703-875-1404, Fax 1-703-875-1406, E-mail gerald.fennemore@yahoo.com

Nelson: Professor of Economics, 518 Kern Building, Pennsylvania State University, University Park, PA 16802. Phone 1-814-865-8871, Fax 1-814-863-4775, E-mail jpn@psu.edu

their self-interest to concentrate benefits and spread costs widely. Hence, Peltzman (1984, 184) argues that the larger and more defined the wealth stakes in a vote, the more important are constituent characteristics.

Although public land policies were important in national debates during the early part of the twentieth century, these policies received less attention after the 1930s (Calef, 1960; Culhane, 1981; USDI, 1977). The Taylor Grazing Act of 1934 established the Grazing Service (later Bureau of Land Management, BLM), and gave existing livestock ranchers formal recognition of previously informal privileges through a system of grazing districts, advisory boards, land allotments, permits, leases, and low-cost grazing fees (Libecap, 1981). The criteria for permits gave preference to ranchers who owned nearby land, held water rights, and who were using federal rangelands. Permits were authorized on a ten-year renewable basis, and grazing rights could be transferred to a new owner if the private land was sold. This gave ranchers limited, but relatively secure, property rights in grazing on public lands (Lambert, 1995). Hence, grazing rights are capitalized into the value of private lands, and permit values are recognized as an asset by lending institutions and the Internal Revenue Service (USDI, 1977, 3–8). Initially, grazing fees were based on administrative costs and changed infrequently. In 1958, following a decade of study and debate, the BLM adopted a new grazing fee formula based on the average price of livestock, paralleling the system used since 1933 by the U.S. Forest Service (USFS) for grazing on public forestlands.

Along with the rise of the environmental movement, the 1960s and 1970s ushered in a new era for the public-domain lands. Legislation enacted in 1960 and 1964 created uncertainty for ranchers, including creation of the Public Land Law Review Commission (PLLRC). The commission's final report called for "fair market value" grazing fees (PLLRC, 1970, 117). Further, the Federal Land Policy and Management Act of 1976 made clear the idea of permanent federal ownership of the Western public lands and gave the BLM new powers to control grazing, improve rangeland health, and manage

public lands for multiple uses.¹ Although the FLPMA left grazing fees unchanged, the Public Rangelands Improvement Act (PRIA) of 1978 established a new formula based on production costs, cattle prices, and private lease rates (USDI, 1977). Temporary suspension of the powerful advisory boards and a new emphasis on biological sustainability further signified a decline of tenure rights for livestock producers. Between 1978 and 1993, no changes were made in the grazing fee formula, but rangeland issues continued to be contentious as illustrated by the Sagebrush Rebellion of 1979–81 (Cawley, 1993) and the privatization debate (Clawson, 1983; Nelson, 1989). Finally, in 1993, the BLM issued a report entitled *Rangeland Reform '94* and notice of proposed rule making (58 *Fed. Reg.* 43208), that included a grazing fee increase of 130%. In response, Western legislators introduced bills that would block many of the proposed BLM reforms. The relative strengths of the several interest groups—consumptive, environmental, and bureaucratic—would be put to a political test.

In the context of voting theory, political pressures and the level of support offered by an interest group are manifested by the propensity of politicians to vote in favor of one interest over another. The winners receive a wealth transfer, representing the return on their rent-seeking investments. Objectively, an elected official votes for policies that maximize his or her net benefits and chances of reelection, but this requires careful balancing of conflicting interests. Hence, legislators must consider the perceived desires of the electorate, specific constituencies within the electorate, log-rolling agreements, pressures from party leaders, and their own beliefs and ideology. The balancing of marginal pressures results in a discrete vote for or against the legislation. Based on this rudimentary model of legislation, the theoretical and empirical literature on congressional voting is voluminous. Many empirical studies employ the Stigler-Peltzman theory of regulation, with a

1. In 1974, the court ruled in *National Resources Defense Council v. Morton* (388 F. Supp. 829, 1974) that the BLM had to prepare comprehensive land use plans and one or more site-specific environmental impact statements for each of 144 grazing districts (Nelson, 1995). The environmental impact statements planning process added to the uncertainty faced by Western livestock ranchers.

focus on the principal-agent issue of political "shirking" by self-interested officials. However, relatively few empirical studies address environmental issues, especially with regard to user charges. There is a tendency to believe that adoption of environmental laws is motivated by public interest concerns, despite widespread academic criticism of the manner in which such laws are enacted and administered (Lyons, 1999). Thus, Hahn (1990, 22) states that our understanding of what gets regulated is quite limited, and Congleton (1996, 19) argues that there is very little systematic evidence of how environmental interests affect the enactment of legislation.

This article provides an empirical study of how economic and environmental interests get mediated through the legislative process and which of these political interests played key rolls in the 1996 Senate vote on higher grazing fees. Section II provides additional background on rangeland and grazing fee issues during the 1980s and 1990s. The authors identify the key interest groups and the process by which rangeland legislation gets modified. Section III presents the theoretical model of legislative voting. Section IV describes the data and estimation methods, and section V presents the empirical results. Conclusions are presented in section VI.

II. LEGISLATIVE HISTORY

About 45% of the land in the 11 contiguous Western states is owned by the federal government, including 80% of Nevada, 64% of Utah, 62% of Idaho, 50% of Wyoming, and 45% of California. The BLM manages about 176 million acres in the Western states, including 137 million acres within grazing districts that provide 10 million AUMs to 17,000 operators.² The USFS manages about

156 million acres in the 11 states, providing 7 million AUMs to 10,000 operators (<http://www.fs.fed.us>). The public lands account for about 17% of all cattle forage in the West and 7% of the national total (Gardner, 1997, 16). Many ranchers use public lands in rotation with private lands, and use of public land usually requires additional private investments in roads, fences, wells, and maintenance. The BLM incurs direct and indirect public costs for grazing management and related planning. However, Nelson (1995, 264) estimated that grazing fees in 1981 were less than 20% of BLM's administrative and management costs, including overhead, suggesting that the BLM could reduce its costs by buying out some grazing rights. Further, the General Accounting Office (GAO, 1991) concluded that the fee formula suppressed increases over time relative to private lease rates. Between 1980 and 1990, the federal grazing fee fell by 15%, and private rates increased by 17%. Table 1 displays the fees charged in recent years for grazing on public and private lands. Though land qualities differ, federal fees are substantially below private lease rates.

Since the passage of the PRIA, the major issue in grazing policy has been the level of fees (GAO, 1991; USDA, and USDI, 1986). Indeed, the issues debated today are virtually the same as those debated in the 1930s (GAO, 1991, 9). The BLM-USFS fee increased from \$1.51 per AUM in 1978 to \$2.31 per AUM in 1981. With falling livestock prices, the fee was reduced to \$1.37 in 1985 compared to private fees of about \$6 per AUM (Klyza, 1996, 135). The PRIA formula was scheduled to expire in 1985. However, Congress was unable to agree on a new grazing law during 1985–86, and President Reagan issued an executive order that extended the PRIA formula indefinitely, subject to a floor of \$1.35 per AUM. This action was unsuccessfully challenged in court by a coalition of nine environmental groups, who argued that the order violated federal laws requiring "fair market value" fees for use of public lands (Klyza, 1996, 139). During 1990–93, several bills containing higher fees passed the House, but these bills either died in the Senate or were stripped away by conference committees (Bryner, 1998, 160; Davis, 1997, 83–85; Pendery, 1997, 558).

2. An animal unit month (AUM) is the amount of forage consumed by an adult cow or five sheep in one month. In the arid West, one AUM equals about 15 acres of rangeland of average productivity. Federal fees are uniform across grazing areas, and this constraint has been upheld in court. Proposals to vary grazing fees by location and productivity have failed to win support in Congress. One alternative to the current system is to use competitive bidding to create transferable forage permits. This proposal was first discussed in 1951; for recent discussions, see, among others, Gardner, 1997; Hess and Holechek, 1995; and Nelson, 1997.

TABLE 1
Private, State, and BLM Grazing Fees (\$ per AUM)

State	Private Lands			State Lands	
	1993	1994	1995	1993	1994
Arizona	\$5.72	\$5.72	\$5.75	\$ 1.43	\$ 1.53
California	10.40	11.00	10.50	1.86	1.98
Colorado	9.70	10.20	10.30	6.42	7.50
Idaho	9.25	9.70	10.10	4.99	4.53
Montana	11.40	11.80	11.90	4.03	4.09
Nevada	8.80	8.80	8.80	no fee	no fee
New Mexico	7.55	8.08	8.74	3.29	3.31
Oregon	9.75	9.00	10.20	2.50	3.01
Utah	8.90	9.00	9.50	2.21	2.33
Washington	7.80	8.30	8.50	6.34	7.15
Wyoming	10.50	10.50	11.30	2.50	3.50
Average	\$9.07	\$9.28	\$9.60	\$3.56	\$3.89
BLM fee	\$1.98	\$1.61	\$1.61	\$1.98	\$1.61

Sources: U.S. Congress (1995, 45) and USDA (<http://www.usda.gov>).

Lead by Interior Secretary Babbitt, the BLM held a series of local public meetings in 1993–94 in an attempt to build a consensus among affected parties on management goals and procedures (Davis, 1997, 84). Further, the BLM and USFS released a broad policy statement and agenda, *Rangeland Reform '94: A Proposal to Improve Management of Rangeland Ecosystems and Administration of Livestock Grazing on Public Lands* (USDI BLM, 1993). Among other objectives, the agenda required: (1) coordination of the policies of the BLM and the USFS; (2) creation of multi-use resource advisory boards that included representatives from science, amenity, and environmental groups as well as traditional producer groups; (3) new administrative standards and guidelines for livestock grazing, especially in riparian-wetlands areas; and (4) establishment of a new grazing fee formula based on fees for pasturing livestock on private lands, which would raise the federal fee by about 130%. In March 1994, the BLM published the proposed regulations (59 *Fed. Reg.* 14314), and final regulations were promulgated in February 1995 (60 *Fed. Reg.* 9894), effective on August 21, 1995. However, the final regulations did not include the fee increase, and Secretary Babbitt left it to Congress “to hold additional hearings and enact legislation addressing appropriate fees” (60 *Fed. Reg.* 9899).

Based on concerns about the sweeping nature of the proposed reforms, several Western members of Congress held hearings and introduced legislation to ensure that livestock grazing would continue to be part of the economic base of the West. The existing BLM regulations and fees were frozen during this period. The Livestock Grazing Act (S. 852) was introduced in May of 1995 by Senator Domenici (R-NM), and a companion House bill (H.R. 1713) was introduced by Representative Cooley (R-OR). These efforts resulted in a new bill, the Public Rangelands Management Act of 1996 (S. 1459), authored by Senator Domenici. Among other objectives, this legislation would: (1) establish single-use grazing advisory councils, giving ranching interests special status compared to other users of public lands; (2) exempt all grazing permits and lease renewals from the National Environmental Policy Act; (3) create a formula for federal grazing fees that would reduce historical fees; and (4) allow a rancher who held a grazing permit to sublease it for a profit. Testimony at the congressional hearings tended to focus on the status of the family rancher, grazing fee determination, the scope for public involvement in rangeland management decisions, and the adverse environmental impacts of previous BLM policies. Government officials from the BLM and the USFS, as well as

numerous representatives from environmental groups, testified in opposition to the bill.³

S. 1459 contained a new formula for determining the fees based on the average price of beef cattle and the interest rate over the past ten years (U.S. Treasury six-month bill new issue rate). The opponents of S. 1459 argued that the new formula did not reflect market or environmental values of the rangelands, subsidized large corporate livestock producers, and imposed costly new requirements on the USDA to calculate the price of beef cattle. Furthermore, the critics predicted that grazing permittees would pay less in fees under this formula than they had in the past (U.S. Congress, House, 1996, 45). Supporters responded that the fee formula was easy to apply and reduced the scope for administrative judgement on fee levels. An amendment to S. 1459 by Senators Bumpers (D-AR) and Jeffords (R-VT) would have raised the federal fee by 25% or to the level of the state rate, whichever was higher, and eliminated Domenici's formula. This amendment failed by a 47–52 vote on March 21, 1996. A second and final attempt to change the formula was Senator Bumpers's amendment to the USDI's appropriation bill (H.R. 3662), which would have increased the fee for large ranchers who grazed more than 5,000 AUMs on federal lands. Hence, this amendment was designed to avoid touching grazing subsidies for smaller ranchers. Senator Domenici made a motion to kill the amendment, but his motion was rejected on September 17, 1996, by a 50-50 vote (41 Republicans and 9 Democrats voted to kill the amendment, and 12 Republican and 38 Democrats voted to support it). However, Bumpers's amendment was eventually removed from the appropriation bill due to concerns over a filibuster threat by Western senators (*CQ Weekly Report*, September 21, 1996, 2663). At least on the grazing fee issue, Western ranchers had won a political victory.⁴

3. See U.S. Congress, House (1995, 1996, 1998) and U.S. Congress, Senate (1995, 1996, 1998). Several environmental and taxpayer watchdog groups have engaged in campaigns against low grazing fees; see the Web site archives for Friends of the Earth, Taxpayers for Common Sense, and Center for Responsive Politics. The damage to the environment from livestock grazing has been detailed in numerous reports; see Belsky et al. (1999) and Hess and Holechek (1995).

4. Ultimately S. 1459 passed the Senate by a 51-46 vote. However, House sponsors attached the grazing bill

III. THEORETICAL MODEL

What economic and political factors impinged on the September 1996 vote on federal grazing fees? How important are the marginal effects of several influences on a senator's decision to vote for or against higher fees? In general, a legislator's vote is the result of a constrained optimization decision. To empirically examine the grazing fee vote, consider a legislator with a utility function given by $U(G; X)$, where G is a vector of consumption goods, including the satisfaction received from "public service," and X is a vector of legislator characteristics used as proxies for tastes (Coates and Munger, 1995, 864). An elected official maximizes this function subject to political and other constraints, including the provision that some elements of G can only be obtained if the legislator remains in office. Hence, the preferences of constituents and interest groups are important for reelection. The legislator's status and tenure also may depend on the extent to which party and institutional pressures get reflected in his voting record. Furthermore, Coates and Munger (1995, 864) point out that accounting for the effect of a constraint requires information on whether it is binding. They address this issue by including variables that measure the legislator's degree of electoral security. Security variables are interacted with constituency characteristics, so that the marginal effect of the latter variables depends on the degree of electoral security. Legislators with a high degree of security are subject to fewer monitoring/enforcement efforts by the electorate, and, in a principal-agent context, there is more room for "shirking" by secure legislators. Because the legislator desires reelection, then the more binding such constraints are, the less room there is for shirking to satisfy personal desires and ideology. Thus, if ideological shirking is important to a legislator, less is bought when the price is higher (Peltzman, 1984, 210).

Let the implicit constraint function be given by $F(C, P, S) = 0$, where C is a vector

to the omnibus parks bill, which President Clinton threatened to veto (Bryner, 1998, 163; Pendery, 1997, 607). The grazing bill was stripped away, and congressional hearings in 1997–98 failed to produce new grazing legislation. The federal grazing fee in 1999–2000 was \$1.35 per AUM, which was the minimum allowed under current law.

of constituency preferences, P is party pressures, and S is electoral security (Coates and Munger, 1995, 865). Maximizing utility subject to the constraint function yields an indirect utility function that depends on political "price and income" variables in the constraints and the vector of taste variables X . For a given bill, the legislator votes "yea or nay" so as to maximize expected utility. The level of utility is not observable, but the voting outcome is known and it takes the form of a binary dependent variable. The C vector is determined by the legislator's personal experience and knowledge, polling results, and demographic findings. Following Peltzman (1984), we also include explanatory variables that capture the distribution of the electorate. However, the special interests in the C vector are much easier for a legislator to determine, because these interests will make themselves known to politicians through lobbying efforts. The S vector reflects the legislator's tenure, past winning margin, and pending elections.

Let Y_{ik} represent the vote cast by senator i on legislation k . Let $Y_{ik} = 1$ if the vote is labeled "correct" according to some congressional watchdog organization, and let $Y_{ik} = 0$ if the vote is "incorrect." For this purpose, we use the 1996 scorecard of the LCV (1996). A simple linear regression is not appropriate because, among other things, the fitted values of Y_{ik} would not be restricted to lie between zero and one. Assuming that the disturbances are normally distributed, we estimate the probit model by maximum likelihood. Dropping the subscript k , let the probit of Y_i be given by $Pr(Y_i)$. The probit estimating equation takes the following general form:

$$(1) \quad Pr(Y_i) = C_i\pi + P_i\delta + S_i\gamma \\ + (C \cdot S)_i\lambda + X_i\beta + \varepsilon_i,$$

where $(C \cdot S)$ are interaction terms between C and S ; the Greek symbols represent the parameter vectors on each of the explanatory variables; and ε_i is the error term. In the next section, the C vector will be subdivided into variables for the general electorate and interest groups within the electorate that have a special stake in specific legislation. The interaction terms modify the marginal impact of the constituency variables, so that "secure" legislators can be less attentive to

these interests compared to "insecure" legislators. This relationship suggests opposite coefficient signs for C and $(C \cdot S)$, and the marginal impact of a given constituency variable is closer to zero for secure legislators (Coates and Munger, 1995, 866). In this manner, the model allows for shirking based on the importance of monitoring rather than on notions of legislator ideology. The main role of legislator variables, X , is to capture tastes and ideology, although these characteristics also may act as low-cost signals for constituents about the likely behavior of the candidate once he or she is in office.

The Coates-Munger model includes X and S as regressors, that is, the indirect utility function is given by $H(C, P, S, X)$. In addition, several alternative specifications are nested within their model, including the median voter model, $H(C)$; Stigler-Peltzman model, $H(C, P, S)$; and Wittman's (1983) trade-off specification, $H(C, P, X)$. In the interest of space, results for the last model are not reported (see Fennemore [1997] for these results). Further, monetary political contributions are excluded, such as the contributions obtained from soft money sources and political action committees. There are several reasons for this exclusion. First, contributions may be correlated with the error term in the voting equation, creating simultaneous equation bias (Coates, 1996). Second, current year contributions by political action committees include many zero values, which leads to a complicated econometric specification involving, say, a probit voting equation and a tobit equation for contributions. Nonlinear impacts of contributions also may occur (Coates, 1996). Third, there are measurement issues about what time periods to consider for contributions, such as the current year, current election cycle or lifetime, and what organizations to include. Given these complications, only interest group variables that are clearly exogenous are considered, although some variables are highly correlated with contributions (e.g., the Center for Responsive Politics notes that soft money and livestock political action committees contributed \$429,348 during the 1996 election cycle, with 87% going to Republican legislators.)

IV. VARIABLES AND DATA

The explanatory variables are divided into four categories: (1) *party affiliation*, which represents all political party and party leadership constraints on an elected official; (2) *general constituency* characteristics, which capture the influence of the electorate, broadly defined; (3) *special interest* characteristics, representing more narrowly defined economic and noneconomic groups with important stakes in grazing fee reform; and (4) *legislator characteristics*, including electoral security *S*. Table 2 summarizes the variables and data sources.

For party affiliation, *DemParty* is a dummy variable equal to one for Democrat senators and zero for Republican senators. The average LCV rating for Democrat legislators has been higher than the average for Republicans in every year since the LCV scorecard was first calculated in 1970. This implies that there is something about the Democrat party that leads to more pro-environmental voting behaviors. Further, political party affiliation captures the role of "reputation" as an influence on voting decisions. The expected coefficient sign is positive. The general constituency variables are *AdvDegree*, *Income*, *Energy*, *PopDensity*, and *PctPoverty*. *AdvDegree* is the percent of a state's population that holds a postbachelor degree. An advanced degree implies a higher potential income, so this variable measures the upper end of the income distribution of the constituency. Environmental public goods are normal goods at most income levels. Hence, *AdvDegree* is expected to have a positive coefficient. This variable also allows a test of the effect of education attainment on the demand for environmental public goods. *Income* is median household income, which should have a positive sign for the same reasons as *AdvDegree*. *Energy* is per-capita expenditures on energy for each state. Constituents who spend more on energy are expected to be less pro-environmental, because they bear a greater proportion of the costs of environmental public goods, such as clean air and wilderness preservation. The coefficient on *Energy* is predicted to be negative. *PopDensity* is the state's population density, which captures differences between urban and rural states. A decline in the livestock industry might lead to contraction of affiliated jobs in urban

areas, so it is possible that urbanization creates a pro-jobs sentiment. However, people in urban areas also are removed from many of the public goods provided by the environment and may favor grazing reforms for greater recreation use or "option-value" reasons (Coates, 1996, 80). Hence, the sign on *PopDensity* is uncertain. Last, *PctPoverty* is the percentage of a state's population that earns less than the federally determined poverty level, which measures the lower end of the income distribution for each state. Some aspects of the "jobs versus the environment" trade-offs also are captured by this variable, and *PctPoverty* should have a negative coefficient.

The special interest variables are *StateExp*, *HR-LCV*, *PctFed*, and *PctCattle*. *StateExp* is state government expenditure per capita for natural resource and environmental projects in 1994. Legislators from states with higher expenditures are likely to be more receptive to pressures from environmental groups. However, due to the wilderness nature of many of the Western states, this effect is expected to be nonlinear. The square of *StateExp* also is included as an explanatory variable. *HR-LCV* measures pro-environmental voting behavior of House members from a senator's state, which captures pro-environmental sentiments of a majority of the state's voters. The coefficient signs for *StateExp* and *HR-LCV* are expected to be positive, whereas the square of *StateExp* should have a negative sign. *StateExp* and *HR-LCV* are fairly broad measure of special interests, but they should be correlated with support from narrowly defined environmental interests. *PctFed* measures intra-industry competition among producers. Senators from states with large amounts of federally owned land can be expected to support special interests who prefer to use the land for the production of private goods, such as cattle grazing and mineral mining. Senators from states with little federally owned land are more likely to support their state's livestock producers and constituents who would prefer to see the public lands used for environmental public goods. *PctCattle* is a second measure of intra-industry competition among cattle producers and focuses more on the specific issue of federal grazing fees. The coefficients of *PctFed* and *PctCattle* are expected to be negative.

TABLE 2
Description of Explanatory Variables and Data Sources

Variables (Category)	Description (Data Sources)	Mean (SD.) [min, max]
Party (<i>P</i>)— <i>DemParty</i>	Dummy equals one if Democrat party affiliation (a, b)	0.47 (0.50)
General constituency (<i>C</i>):		
<i>AdvDegree</i>	Percent of state population with postbachelor degree (e)	6.79 (1.66) [4.5, 11.0]
<i>Income</i>	State median household income, 1994, in thousands of dollars (e)	32.52 (4.90) [23.6, 45.4]
<i>Energy</i>	State per capita energy expenditure in dollars, 1992 (e)	1,951 (359) [1,510, 3,334]
<i>PopDensity</i>	State population per square mile (d)	168.96 (235) [1, 1,042]
<i>PctPoverty</i>	Percent of state households below poverty line, 1994 (e)	13.07 (3.94) [7.6, 25.7]
Special interests (<i>C</i>):		
<i>State Exp</i>	State expenditure per capita on natural resources and the environment, 1994 (d)	50.1 (32.9) [18.7, 189.69]
<i>HR-LCV</i>	Mean House LCV score for state delegation, 1995 (a)	41.94 (26.26) [39,100]
<i>PctFed</i>	Percent of state land owned by the federal government (e)	15.05 (21.05) [0.2, 82.9]
<i>PctCattle</i>	State beef cattle herd as percent of national total (f)	1.97 (2.51) [0.01, 14.9]
Senator characteristics (<i>X</i> , <i>S</i>):		
<i>Tenure</i>	Number of years in Senate (c)	13.30 (9.41) [2, 42]
<i>Margin</i>	Percent of two-party vote in last election minus 50 (c)	11.24 (9.97) [0, 50]
<i>Reelect</i>	Dummy equals one if up for reelection, 1996 (c)	0.21 (0.41)
<i>Retire</i>	Dummy equals one of retiring in 1996 (c)	0.12 (0.33)
<i>Lawyer</i>	Dummy equals one if lawyer (c)	0.57 (0.50)
<i>Religion</i>	Dummy equals one if Protestant (c)	0.64 (0.48)

Sources: (a) League of Conservation Voters (<http://www.lcv.org>); (b) *CQ Weekly Report* (various issues); (c) Project Vote Smart (<http://www.vote-smart.org>); (d) Council of State Governments (1996); (e) *Statistical Abstract*; (f) USDA, National Agricultural Statistical Service (<http://www.usda.gov/nass>). Sample size is 98. Senators Dole (R-KS) and Wyden (D-OR) were deleted due to missing data.

The proxies for senators' tastes and security are *Lawyer*, *Religion*, *Tenure*, *Reelect*, *Margin*, and *Retire*. These variables are entered in the regressions in a linear form, and *Reelect* also is used to obtain interaction terms. *Lawyer* is a binary variable for the unique perspective of those legislators who hold law degrees (Coates and Munger, 1995). *Religion* is a binary variable for senators who adhere to a Protestant denomination. Economic theory does not provide any prior expectations for the signs of the coefficients for *Lawyer* or

Religion. *Tenure* is a measure of an incumbent senator's seniority. Other things equal, senators with longer tenure have more latitude to vote against the interests of the general electorate (Lloyd and McGarrity, 1995). On the other hand, senators with a long tenure (or larger winning margin) may be more faithful servants of their constituents' interests. Hence, it is possible that the coefficient for *Tenure* (as well as *Margin* and *Retire*) is zero because the net benefits of shirking are small. Because this variable captures several

possible influences, including effects of ideology, the coefficient sign is uncertain. *Reelect* is a dummy variable for those senators who faced reelection in 1996. Two opposing forces also may be operating here. First, a senator may desire campaign contributions from industry groups. Second, a senator also must attempt to vote in a manner that reflects the desires of the general electorate, who may favor environmental improvements. *Reelect* is a measure of senatorial insecurity, but its expected sign is uncertain. *Margin* is one-half of a senator's winning margin of the two-party vote in the most recent election. Senators with a high value of *Margin* are likely to have greater discretion, but the coefficient sign is uncertain. *Retire* is a dummy variable for senators who planned to retire in 1996. Shirking is more likely in the case of retiring senators, but the expected sign is uncertain.

V. EMPIRICAL RESULTS

The estimation strategy is as follows: First, a reference model is estimated that includes only political party (*DemParty*) and three regional dummies as explanatory variables. The dummies capture all constituency influences that are constant across each geographic region, such as general economic conditions. Second, constituency variables are added to the model, which is the median voter specification. Third, the regional dummies are excluded, and the special interest and senator security variables are included. This is the authors' specification of the Stigler-Peltzman model. For possible collinearity reasons, several of the least significant explanatory variables are excluded. Fourth, the senator-specific taste variables are included. Fifth, interactions between *Reelect* and various constituency variables are examined, which is the Coates-Munger model. Qualitative results for probit regressions are reported in Tables 3 and 4, including the coefficient estimates and robust estimates of the z-statistic (the coefficient divided by its standard error). Sixth, a parsimonious specification is selected and used to calculate the marginal effects of selected variables at the means. These results indicate magnitude or quantitative importance, that is, the change in the probability of voting in a pro-environmental manner given a one-unit (or one-standard-deviation) change

in an explanatory variable. Several graphs of selected nonlinear probability response curves complete the empirical investigation.

A. Qualitative Effects

Table 3 displays the results of four probit regressions, including the expected sign on each regressor. Regression (1) is the reference model. *DemParty* has the expected positive sign and the regional dummies all have negative signs. The expected signs for the *Midwest* and *Southern* state dummies are uncertain. Legislators from these areas might desire to protect their livestock producers by voting for higher federal grazing fees or their constituents might be more pro-environment. On the other hand, these legislators could be more conservative or pro-business compared to Eastern legislators (Coates, 1996, 79). Regression (2) adds the general constituency variables, which is the median voter model. The *Midwest* and *Southern* dummies are no longer statistically significant at the 95% confidence level, but the *Western states* dummy is significantly negative. *PopDensity* has a positive sign, indicating that urban constituents desire more environmental protection, and *PctPoverty* has the expected negative sign.

AdvDegree and *Energy* are jointly insignificant as explanatory variables. Regression (3) excludes these variables and includes the special interest and senator-specific security variables, which is the Stigler-Peltzman model of legislative voting. All of the special interest variables are statistically significant. However, *HR-LCV* has the wrong sign, suggesting that senators may be less responsive to the general constituency compared to House members. One reason for this outcome is that senators do not have to face reelection every two years. Among the security variables, only *Reelect* is close to being significant. The insignificant results for these variables provide support for the hypothesis that shirking is unimportant. *Income* is significantly positive (one-tailed test), which supports the hypothesis that environmental protection is a normal good. *PopDensity* and *StateExp* are both significantly positive, and the square of *StateExp* is significantly negative, as expected.

Based on a joint test of significance, *Tenure* and *Retire* were dropped. Regression (4) includes two senator-specific taste variables. Six variables in this model are significant

TABLE 3
Binary Probit Coefficients (z-Statistics)

Regressor (Expected Sign)	(1)	(2)	(3)	(4)
Constant (?)	0.274 (0.888)	2.235 (1.093)	-5.092 (1.308)	-6.593 (1.342)
<i>DemParty</i> (+)	1.545 (4.297)*	1.920 (4.477)*	3.134 (5.229)*	3.456 (3.902)*
<i>Midwest states</i> (?)	-1.096 (2.508)*	-0.752 (1.708)	—	—
<i>Southern states</i> (?)	-1.116 (2.622)*	-0.296 (0.595)	—	—
<i>Western states</i> (-)	-9.748 (23.35)*	-9.717 (16.67)*	—	—
<i>AdvDegree</i> (+)	—	0.142 (0.573)	—	—
<i>Income</i> (+)	—	-0.095 (1.252)	0.170 (1.928)*	0.208 (1.804)*
<i>Energy</i> (-)	—	0.001 (0.952)	—	—
<i>PopDensity</i> (?)	—	0.007 (2.523)*	0.009 (2.356)*	0.007 (1.466)
<i>PctPoverty</i> (-)	—	-0.202 (2.311)*	-0.123 (1.315)	-0.147 (1.487)*
<i>StateExp</i> (+)	—	—	0.097 (2.887)*	0.105 (2.648)*
<i>StateExp Squared</i> (-)	—	—	-0.0005 (2.58)*	-0.0005 (2.57)*
<i>HR-LCV</i> (+)	—	—	-0.045 (3.479)*	-0.047 (3.360)*
<i>PctFed</i> (-)	—	—	-0.098 (5.127)*	-0.105 (3.924)*
<i>PctCattle</i> (-)	—	—	-0.595 (4.050)*	-0.513 (3.040)*
<i>Tenure</i> (?)	—	—	-0.021 (0.841)	—
<i>Margin</i> (?)	—	—	-0.007 (0.330)	-0.014 (0.641)
<i>Reelect</i> (?)	—	—	1.178 (1.887)	1.237 (2.086)*
<i>Retire</i> (?)	—	—	0.301 (0.362)	—
<i>Lawyer</i> (?)	—	—	—	1.257 (2.339)*
<i>Religion</i> (?)	—	—	—	-0.445 (0.962)
% correct predictions	84.69	87.76	88.78	93.88
-2* Log-likelihood	71.38	57.50	42.07	37.40
McFadden R ²	0.475	0.577	0.690	0.725

Notes: Asterisks indicate significance at the 95% confidence level for one- and two-tailed tests. Robust standard errors computed using the Huber-White procedure. Correct predictions based on an error cutoff of ± 0.5 .

(one-tailed test) and have the expected sign. Two variables with uncertain signs, *Reelect* and *Lawyer*, also are significant (two-tailed test). Examination of the residuals from this model indicates normality if the two senators with the largest residuals were deleted. Using an error cutoff with a value of ± 0.5 , then 93.88% of the votes (92 of 98 senators) are correctly predicted by (4).

The last step is to include interaction terms as a test of the Coates-Munger model. Two insignificant variables, *Margin* and *Religion*, were deleted. These results are shown in regression (1) in Table 4. *Reelect* is marginally significant, but all of the other variables are statistically significant at the 95% level. Regression (2) shows the effect of the interaction terms between *Reelect* and the constituency variables. The interaction variables are not jointly significant, and only the interaction with *PctPoverty* is individually

significant. All of the linear variables are significant, and there are no major changes in magnitudes or signs. Overall, there is weak support for a voting model in which legislator security affects voting decisions through interactions with constituency variables. There is strong support for a model where key roles are played by political party and by concentration of benefits accruing to narrowly defined producer groups, which is the Stigler-Peltzman model. Estimation of more complex models, including additional interaction terms and bivariate probits, failed to improve on these results (see Fennemore [1997]).

B. Quantitative Effects

The probit model is nonlinear, and the marginal effect of an explanatory variable depends on the coefficient magnitude and

TABLE 4
Binary Probit Coefficients for Interaction Model (z-Statistics)

Regressor (Expected Sign)	(1)	(2)	
	Linear	Linear	Interaction
Constant (?)	-7.547 (1.673)	-7.457 (1.619)	—
<i>DemParty</i> (+)	3.248 (4.541)*	3.888 (4.037)*	—
<i>Income</i> (+)	0.208 (2.052)*	0.230 (1.960)*	-0.024 (0.263)
<i>PopDensity</i> (?)	0.009 (1.996)*	0.013 (2.040)*	-0.007 (0.417)
<i>PctPoverty</i> (-)	-0.144 (1.581)*	-0.234 (2.248)*	0.267 (2.203)*
<i>StateExp</i> (+)	0.114 (2.938)*	0.125 (2.598)*	-0.059 (1.234)
<i>StateExp</i> squared(-)	-0.0006 (2.85)*	-0.0005 (2.40)*	—
<i>HR-LCV</i> (+)	-0.047 (3.678)*	-0.060 (3.112)*	0.014 (0.515)
<i>PctFed</i> (-)	-0.103 (4.382)*	-0.117 (3.877)*	0.068 (1.319)
<i>PctCattle</i> (-)	-0.472 (3.125)*	-0.564 (2.826)*	0.135 (0.346)
<i>Lawyer</i> (?)	1.135 (2.295)*	1.178 (2.248)*	—
<i>Reelect</i> (?)	1.062 (1.915)	—	—
% correct predictions	92.86	93.88	—
-2* Log-likelihood	38.06	35.67	—
McFadden R^2	0.720	0.737	—

Notes: Asterisks indicate significance at the 95% confidence level for one- and two-tailed tests. Robust standard errors computed using the Huber-White procedure. Correct predictions based on an error cutoff of ± 0.5 . Interaction terms obtained using *Reelect* variable.

the level of the variable. Using regression (1) in Table 4, we first computed the marginal effect for a one-unit change at the mean of each variable. *Reelect* has an initial value set equal to zero. Second, the marginal effects are computed at the means for $Y = 0$ and $Y = 1$. Third, four variables (*PctFed*, *PctPoverty*, *Reelect*, *StateExp*) are used to obtain probability response curves, which show how the predicted probability of voting for higher grazing fees varies over the range of each variable. These curves also are evaluated for both values of *DemParty* (with all other variables held constant at their mean values, except *Reelect*).

In Table 5, column four shows that the marginal effects of continuous variables are modest, except for *Income*, *PctCattle*, *DemParty*, *Reelect*, and *Lawyer*. These results indicate that basic economic and political variables are important in determining the voting decisions of senators. The dummy variables are more difficult to evaluate in this framework, because their observed values are either one or zero. Clearly, extreme values of these variables have major impacts on voting decisions. When the model is evaluated at the means for $Y = 0$ (i.e., a vote against higher fees), all of the marginal

effects are very small. A complementary view of these impacts is shown in Figure 1, which illustrate how the voting probability varies with *PctFed*, *PctPoverty*, *Reelect*, and *StateExp*, respectively. The differences between Republicans and Democrats are substantial, but both parties are predicted to respond to variations in the percent of land held by the federal government and to increased poverty. The situation for reelection status is somewhat different. Democrats are predicted to vote in favor of higher fees regardless of their reelection status, ceteris paribus. Republicans, however, have a probability of only 0.4 if they face reelection and zero otherwise. Last, the nonlinear effect of state environmental expenditure illustrates that, up to a point, Republicans are responsive to environmental interests.

VI. SUMMARY AND CONCLUSIONS

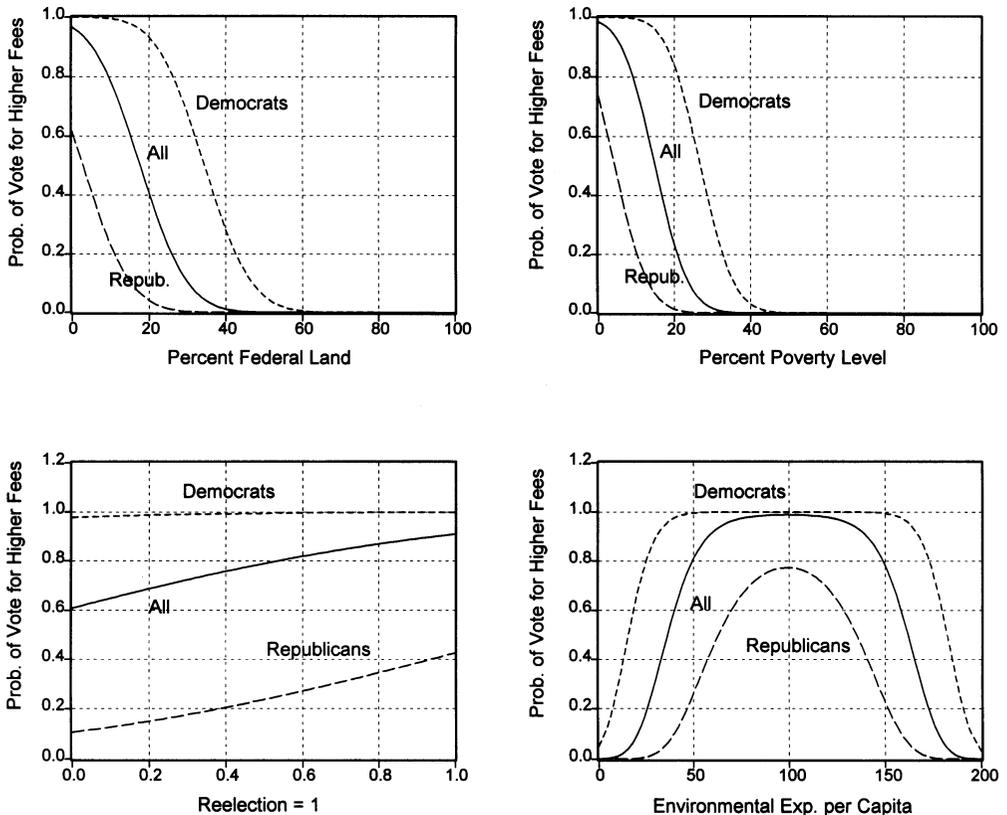
The authors first comment on the general findings and then turn to the issue of environmental interest groups and grazing legislation. First, the results show that income levels are important, including the effect of poverty-level households. Second, political party is clearly an important factor, a result that is

TABLE 5
Marginal Effects of Standardized Changes

Variable	Mean (SD) (All Votes)	Probit Coefficient	Marginal Effect (Means, All Votes)	Marginal Effect (Means, Y = 0)	Marginal Effect (Means, Y = 1)
<i>DemParty</i>	0.469388 (0.5)	3.247698	0.987877	0.002520	1.623482
<i>Income</i>	32.51912 (4.9)	0.207812	0.126424	0.000322	0.207765
<i>PopDensity</i>	168.9592 (235)	0.009271	0.005640	0.000014	0.009269
<i>PctPoverty</i>	13.06837 (3.9)	-0.144049	-0.087633	-0.000224	-0.144016
<i>StateExp</i>	50.0700 (32.9)	0.114198	0.069473	0.000177	0.114172
<i>StateExp-sq</i>	3577.1 (6434)	-0.000576	-0.000350	-0.000001	-0.000576
<i>HR-LCV</i>	41.93878 (26)	-0.047007	-0.028597	-0.000073	-0.046996
<i>PctFed</i>	15.05102 (21)	-0.102759	-0.062514	-0.000160	-0.102736
<i>PctCattle</i>	1.971633 (2.5)	-0.472460	-0.287423	-0.000733	-0.472353
<i>Reelect</i>	0.214286 (0.4)	1.061717	1.061717	0.001648	1.061477
<i>Lawyer</i>	0.571429 (0.5)	1.135141	0.345284	0.000881	0.567442

Notes: Table values show the effect of a one-unit change of a variable on the probability of voting in a pro-environmental manner (i.e., voting for higher grazing fees), except for *Lawyer*, which uses a one-standard-deviation change. The fitted values of the probit index are 0.608355 for all votes; 0.001552 for $Y = 0$, and 0.999774 for $Y = 1$ (*Reelect* = 0 initially, and = 1 for marginal effect).

FIGURE 1
Probability Response Curves



consistent with the role of reputation in voting decision. Third, livestock interests are important in determining the probability that a senator will vote against higher fees. The percent of land held by the federal government and the importance of the cattle industry are both significant factors leading to votes against higher fees.

Fourth, the empirical results suggest a modest role for the environmental interest groups relative to producer interests. *HR-LCV* has a negative sign, and *StateExp* has an important nonlinear effect. A simple interpretation of the Stigler-Peltzman model suggests that producer interests always prevail, but Peltzman (1976) emphasized that the legislators and regulators must balance support and opposition at the margin. The relative unimportance of the environmental variables seems to contradict Peltzman. However, a different interpretation of this result is suggested by a careful reading of the legislative history, which shows that two issues were being debated—federal grazing fees and ecosystem management of the rangelands. Davis (1997, 84) argues that Interior Secretary Babbitt was a strong believer in the “New West,” but astutely recognized that he could not win on both issues without a political backlash, and Pendley (1995, 72) provides evidence that Babbitt was prepared to concede the grazing fee issue to obtain support for broader rangeland reforms. Thus, both producer and environmental groups obtained some concessions, but livestock operators only won the grazing fee battle and lost the larger quarrel over administration and management of the public rangeland’s ecosystem.

REFERENCES

- Belsky, A. J., A. Matzke, and S. Uselman. “Survey of Livestock Influences on Stream and Riparian Ecosystems in the Western United States.” *Journal of Soil and Water Conservation*, 54, 1999, 419–31.
- Bryner, G. C. *U.S. Land and Natural Resources Policy*. Westport, CT: Greenwood Press, 1998.
- Calef, W. *Private Grazing and Public Lands: Studies of the Local Management of the Taylor Grazing Act*. Chicago: University of Chicago Press, 1960.
- Cawley, R. M. *Federal Land, Western Anger: The Sagebrush Rebellion and Environmental Politics*. Lawrence: University Press of Kansas, 1993.
- Clawson, M. *The Federal Lands Revisited*. Washington, DC: Resources for the Future, 1983.
- Coates, D. “Jobs versus Wilderness Areas: The Role of Campaign Contributions,” in *The Political Economy of Environmental Protection: Analysis and Evidence*, edited by R. D. Congleton. Ann Arbor: University of Michigan Press, 1996, 69–96.
- Coates, D., and M. Munger. “Legislative Voting and the Economic Theory of Politics.” *Southern Economic Journal*, 61, 1995, 861–72.
- Congleton, R. D. “Introduction and Overview of the Political Economy of Environmental Protection,” in *The Political Economy of Environmental Protection: Analysis and Evidence*, edited by R. D. Congleton. Ann Arbor: University of Michigan Press, 1996, 3–28.
- Council of State Governments. *Resource Guide to State Environmental Management*, 4th ed. Lexington, KY: Council of State Governments, 1996.
- Culhane, P. J. *Public Lands Politics: Interest Group Influence on the Forest Service and the Bureau of Land Management*. Baltimore, MD: Johns Hopkins University Press, 1981.
- Davis, C. “Politics and Public Rangeland Policy,” in *Western Public Lands and Environmental Politics*, edited by C. Davis. Boulder, CO: Westview Press, 1997, 74–94.
- Fennemore, G. A. *Environmental Voting Behavior: An Empirical Study of the Political Markets for Public Goods*. Ph.D. diss., Pennsylvania State University, 1997.
- GAO (General Accounting Office). *Rangeland Management: Current Formula Keeps Grazing Fees Low*. GAO/RCED-91-185BR. Washington, DC: GAO, June 1991.
- Gardner, B. D. “The Political Economy of Public Land Use.” *Journal of Agricultural and Resource Economics*, 22, 1997, 12–29.
- Hahn, R. W. “The Political Economy of Environmental Regulation: Towards a Unifying Framework.” *Public Choice*, 65, 1990, 21–47.
- Hess, K., and J. L. Holechek. “Beyond the Grazing Fee: An Agenda for Rangeland Reform.” *Policy Analysis*, No. 234, Cato Institute, July 1995.
- Klyza, C. M. *Who Controls Public Lands? Mining, Forestry, and Grazing Policies, 1870–1990*. Chapel Hill: University of North Carolina Press, 1996.
- Lambert, D. K. “Grazing on Public Rangelands: An Evolving Problem of Property Rights.” *Contemporary Economic Policy*, 13, 1995, 119–28.
- LCV (League of Conservation Voters). *National Environmental Scorecard*. Washington, DC: LCV, 1996.
- Libecap, G. D. *Locking up the Range: Federal Land Controls and Grazing*. Cambridge, MA: Ballinger, 1981.
- Lloyd, R., and J. McGarrity. “A Probit Analysis of the Senate Vote on Gramm-Rudman.” *Public Choice*, 85, 1995, 81–90.
- Lyons, M. “Political Self-Interest and U.S. Environmental Policy.” *Natural Resources Journal*, 39, 1999, 271–94.
- Nelson, R. H. “Privatization of Federal Lands,” in *Regulation and the Reagan Era*, edited by R. E. Meiners and B. Yandle. New York: Holmes & Meier, 1989, 132–65.
- . *Public Lands and Private Rights: The Failure of Scientific Management*. Lanham, MD: Rowan & Littlefield, 1995.

- . “How to Reform Grazing Policy: Creating Forage Rights on Federal Rangelands.” *Fordam Environmental Law Journal*, 3, 1997, 645–90.
- Peltzman, S. “Toward a General Theory of Regulation.” *Journal of Law and Economics*, 19, 1976, 211–40.
- . “Constituent Interest and Congressional Voting.” *Journal of Law and Economics*, 27, 1984, 181–210.
- Pendery, B. M. “Reforming Livestock Grazing on the Public Domain.” *Environmental Law*, 27, 1997, 513–609.
- Pendley, W. P. *War on the West: Government Tyranny on America's Great Frontier*. Washington, DC: Regnery, 1995.
- PLLRC (Public Land Law Review Commission). *One Third of the Nation's Land: A Report to the President and to the Congress by the Public Land Law Review Commission*. Washington, DC: Government Printing Office, 1970.
- U.S. Bureau of the Census. *Statistical Abstract of the United States*. Washington, DC: Government Printing Office, 1996.
- U.S. Congress, House. *Hearing on Livestock Grazing on Federal Land*. Report no. 104–38, 104th Congress, 1st Session. Washington, DC: Government Printing Office, 1995.
- . *Report Together with Dissenting Views on Public Rangelands Management Act of 1996* (S. 1459). Serial no. 104-674, Part 1, 104th Congress, 2nd Session. Washington, DC: Government Printing Office, 1996.
- . *Hearing on Grazing Reduction and Other Issues on BLM Lands*. Serial no. 105–32, 105th Congress, 1st Session. Washington, DC: Government Printing Office, 1998.
- U.S. Congress, Senate. *Report on Public Rangelands Management Act of 1995*. Report 104-123, 104th Congress, 1st Session. Washington, DC: Government Printing Office, 1995.
- . *Hearing on S. 852, Livestock Grazing Act*. Serial no. 104–389, 104th Congress, 2nd Session. Washington, DC: Government Printing Office, 1996.
- . *Hearings on Public Lands Management Improvement Act of 1997*. S. Hrg. 105-390, 105th Congress, 1st Session. Washington, DC: Government Printing Office, 1998.
- USDA and USDI. *Grazing Fee Review and Evaluation*. Washington, DC: USDA/USDI, 1986.
- USDI. *Study of Fees for Grazing Livestock on Federal Lands*. Washington, DC: USDI and USDA, 1977.
- USDI, Bureau of Land Management. *Rangeland Reform '94: A Proposal to Improve Management of Rangeland Ecosystems and the Administration of Livestock Grazing on Public Lands*. Washington, DC: USDI/USDA, 1993.
- Wittman, D. “Candidate Motivation: A Synthesis of Alternative Theories.” *American Political Science Review*, 77, 1983, 142–57.