Factors Influencing Support for Rural Land Use Control: A Case Study

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Agricultural land is being converted into rural residences at an unprecedented rate in the Inter-mountain West. Survey data have been collected for Sublette County, Wyoming concerning preferences for private land use and land use controls. Selected land use controls include zoning, purchase of development rights and cluster development. Local in-migration appears to be driven by the pursuit of open space and environmental amenities. Logit models are estimated for public and private choice co-variates. Private concerns about land use are the chief determinants of land use control approval.

The Rocky Mountain region of the United States is currently experiencing in-migration at historic levels. The most rapidly developing counties in the West are those containing national forests, national parks, mountains and lakes. Most of these sites are not located within commuting distance of any major urban area (Rudzitis 1993; Drabenstott and Smith 1996). People are relocating to the West for environmental amenities as much as for employment opportunities (Rudzitis 1993; Power 1996). Such amenities include clean air and water, outdoor life, access to mountain and desert wilderness, and freedom from the crowding of the cities (Stegner 1992). Rural counties with scenic or environmental amenities had population increases of 24%, six times that of the national average for non-metropolitan counties (Rudzitis 1993). In-migration has meant increased residential development and changes in land use.

Western Wyoming counties containing mountainous areas saw population increases between 7 to 18% from 1990 through 1995 (Woods and Pole 1996). Sublette County, Wyoming has grown by 11% in that period and is forecast to grow by another 10% by 2002 (Wyoming Department of Administration and Information Data Center, 1997). This is an important trend to consider in a county consisting of 85% public land.

Sublette County is updating its Master Land Use Plan to address the impending loss of agricultural land due to rural residential development. This study attempts to determine the types of land use controls that are likely to be supported in Sublette County, Wyoming. The primary focus is to determine respondent characteristics which contribute to the support of land use controls, including zoning, cluster development and purchase of development rights.

Economic Theory

The issue of whether an individual decision maker supports selected land use controls depends on two items. First, it depends on the policy itself as well as on individual tastes and preferences. The public goods characteristics of private lands and the negative externalities associated with rural development are relevant to policy formation. Second, the individual makes choices in order to improve his well being. Inherent in the individual choice is the ability of the decision maker to define and calculate the tradeoffs between different outcomes of policy. The individual also may make choices for the good of family, community or future generations. This involves individual choice both as consumer and as citizen. The discussion of theory provides the framework for the survey and the development of the model.

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The Need for Rural Land Use Policy

Private lands offer a variety of uses. Private uses such as agricultural production, residential or commercial development and their respective market outcomes are well defined. However, nonmarket goods and services, such as wildlife corridors, recreation access to public lands and visual resources may be under provided from private lands in that owners of these assets are unable to capture returns for these goods and services. Such goods and services offer little incentive for provision due to their nonrival and nonexclusive characteristics (Randall, 1987). The benefits derived from nonmarket goods associated with private lands are important in counties that have limited private lands. Consequently, pressure to develop the private open space can diminish the supply of such nonmarket goods and services.

The inappropriate location of activities can lead to negative externalities due to the nonexclusivity of some activities. An individual's basement may flood with water because a neighboring subirrigated meadow was developed. The septic system of a rural subdivision may contaminate a water supply for downstream users. Those benefiting from development may not bear the true cost of their choices. Private land markets may not recognize or internalize the negative development externalities associated with the conversion of agricultural lands to residential uses (Miranowski and Cochran, 1993). Policy referendums offer the opportunity for the individual expression of preference for the provision of public goods and the prevention of negative externalities.

A Choice Model for Land Use Control

A utilitarian approach to individual well being is based on several assumptions. It is assumed that an individual displays rational behavior, possesses valid and self regarding preferences and is locally nonsatiated (Varian, 1984). The individual's utility maximization problem in response to a regulation is given as follows:

$$\max_x U = U(X_j^i; X_a)$$

$$\text{(1)} \qquad \text{subject to } P_j^i X_j^i + P_a X_a = Y$$

The maximization of utility yields

$V(P_j^i, Y)$ for the constrained utility maximizing bundle of X's

where $U(\cdot)$ = the utility function;

X_j^i = the goods of interest indexed on state i and class of good j;

i = 0 as the initial state or pre regulation and; 1 as the new state or post regulation;

j = p as a composite of public goods attributes of private land; m as a composite of private goods attributes of private land;

X_a = all other goods whose provision is state invariant;

P_a = price of all other goods indexed to 1;

P_j^i = composite prices that are good (j) and state (i) dependent; and

$V(\cdot)$ = indirect utility as a function of prices and income.

The relevant choice is between two bundles consisting of both private and public goods. The goods are composites of private and public attributes of land, respectively. These composites are assumed to be mutually exclusive, as given in equation 2.

$$\text{(2)} \qquad X_p + X_m = X_t$$

where X_t is the total amount of attributes and is fixed.

The bundles are state dependent with respect to a public policy or regulation. The regulation is designed to increase the availability of public goods attributes of land. Due to the assumed tradeoff between public and private attributes, the regulation necessarily decreases the private attributes. This reduces the cost to the consumer of consuming the public goods (X_P) while increasing the cost to the consumer of consuming the private goods (X_m).

The following indicates the price and quantity relation:

$$\text{(3)} \qquad P^0 = (P_p^0, P_m^0) \text{ and } P^1 = (P_p^1, P_m^1)$$

$$\text{where } P_p^1 < P_p^0 \text{ since } X_p^1 > X_p^0; \text{ and}$$

$$P_m^1 > P_m^0 \text{ since } X_m^1 < X_m^0.$$

The above relationship presumes that land use regulation reduces the overall county supply of land available for development. This, in turn, drives up the prices for private attributes of land and rural residential development.

The preceding conceptual model can be operationalized using a random utility model (RUM). The RUM can be constructed using the indirect utility functions, following Hanemann (1984). The indirect utility relationships can be rewritten for purposes of estimation as:

$$(4) \qquad v(P^i, Y; s) + \varepsilon^i;$$

where

$v(\cdot)$ = the systematic components of utility;
ε^i = the nonsystematic, random or error components of utility; and
s = state variant co-variates that might affect preferences.

The choice becomes whether or not to approve the offered regulation. The probability of approval is based on the difference in state dependent utility. This will be estimated using a dichotomous choice model with the error having a logistic distribution. This research focuses on the importance of the s set of co-variates as the latter explains the regulation choice. The theoretical model presented above pertains primarily to the zoning and cluster development land use controls because they are predominantly regulatory. The purchase of development choice is broadly defined in the survey (and subsequently in this study) and implies the creation of a market for development rights. Market participation is voluntary. It may not lead to the above-mentioned shift in the prices of land attributes.

The Individual as Consumer and as Citizen

Public choice theory is a means to link the economic premise of self regarding utility to social decisions (Mueller, 1979; and Steven, 1993). Voters will choose initiatives which most successfully maximize their utility. Public choice theory does lend credibility to the idea of individuals displaying similar behavior in markets as well as political arenas (Reichelderfer and Kramer 1993). Hence voting can take on characteristics of consumer choice (Buchanan and Tullock 1974).

According to Margolis (1982) and Quiggin (1987) when voters react as citizens certain elements of an individual's objective function may override the private consumption market benefits which normally determine an individual's decisions. These elements may be a desire to express particular values, or judgments as to the desirability of the good for society (Blamey et al. 1995). Such motives typically play a minor role in market choice decisions.

Political referendums are often based on appeals to public responsibility or community interest. Gauthier (1986) views morality in a contractual nature whereby the action of maximizing utility is subject to a binding social constraint. Individuals are constrained by the goal of mutual benefit which supersedes pure self interest.

Sen (1987) distinguishes between the types of preferences people possess. One type of preference is based on activities for personal advantage: self regarding preferences. The other preference is an "agency aspect," where an individual seeks benefits on behalf of family, community or future generations. Sen argues that viewing preferences in this manner is more realistic than the utility approach. He reasons that desire as the basis of preference is an incomplete measure of value. Determining individual value for public goods may be akin to Sen's idea of agency preferences. Thus there may be two very different bases from which choices are made. People may have numerous incentives for choosing to vote. It is unclear what incentives people follow when voting for land use controls.

A more inclusive model of individual choice is formulated from the theoretical constructs set forth above by the following:

$$(5) \qquad \text{Vote} = f(\text{public choices, individual choices})$$

where:

Vote = decision on a public policy, yes or no;
public choices = choices representing societal interests; and
individual choices = choices representing self-interests.

Individuals support public policy measures which benefit society and their personal interests. It is assumed that when voting for a policy individuals understand the potential tradeoffs between different bundles of private and public goods. Opportunity costs occur between these different bundles. Equation (5) can readily be estimated using the two sets of co-variates and a logistic error distribution much as equation (4).

Studying an individual's choices is critical for determining what types of public policies the individual is likely to support. Choices regarding public interests (as opposed to self interests) may also be a basis for decisions regarding public goods (Mitchell and Carson 1989).

Other work has been conducted concerning preferences for land use controls. Kline and Wichelns (1995) have modeled individual choice as a function of agricultural land characteristics. Choices are ranked by preferred characteristics. Centenera and Mackenzie (1995) use conjoint analysis to determine desired attributes of agricultural lands. Contingent valuation estimates of willingness-to-

pay are determined for protecting farmland under a purchase of development program. Research presented here examines the characteristics of decision makers and their preferences for land use controls.

Data Collection

The following section provides the study location, the survey instrument and survey results pertinent to the preference models.

The Study Area

Sublette County has a population base of 4,843 and consists of 85% publicly owned land. Per capita income in 1993 was 18,942 dollars (1990 U.S. Census). Agriculture, mining extraction, and services have traditionally comprised the county's economic structure. Services, retail trade and construction have grown rapidly since 1988.

The hospitality industry has existed in the county since the turn of the century. Hunting, fishing, snowmobiling, horseback riding, hiking, and other recreational activities are prevalent in the county. Privately owned land is located along three rivers and their tributaries. Views of the Wyoming range to the west and the Wind River range to the east are ubiquitous from most of the county. The Wind River range has several wilderness areas containing the state's tallest peaks, glaciers and many lakes. Pinedale is located 78 highway miles from Jackson Hole and 140 miles from the south entrance of Yellowstone National Park. The private land is under pressure to be developed for amenity and other values.

Survey and Sample

A survey instrument was developed to query both county landowners, regardless of place of residence, as well as non landowning residents (renters) in Sublette County about land use issues. Landowners, regardless of place of residence comprise the majority of the survey population and the respondents. Renters were surveyed because they live in the county, may vote, contribute to property taxes indirectly and may be future landowners in the county. The nonresident landowners were surveyed because they pay property taxes and have investments to protect. It is assumed that nonresident landowners are likely future residents. The survey was designed to determine the population-wide characteristics of land use control approval. The intent was to provide policy makers with outcomes common across respondent types.

A survey population was constructed from comparing the Sublette County tax rolls with the Sublette County phone book for duplicate names. The survey was administered according to the Total Design Method (Salant and Dillman 1994). A total of 4493 surveys were mailed and undeliverable surveys totaled 282. Over 52% of the surveys were returned. Nonresponse bias was not thought to be a problem because the sample was a population and a majority response was obtained. This is further substantiated by comparing the proportion of respondents that reported particular income levels and the mean respondent age with 1990 U.S. Census data for Sublette County. No significant differences were detected.

Survey Results

Private Land Management Options: The respondent choices and response levels for the management of private lands are provided in table 1. The table offers evidence of support for land use planning in Sublette County.

Three land use controls are defined without invoking the actual name of the particular control. This was done so as to avoid any bias associated with the name. Respondents considered each definition separately. The zoning control was given as

> ". . . Local governments have authority over land use. Land is typically divided into areas which have specific and differing requirements to regulate the land use, as well as building placement, size and use. . . ."

This is a command and control approach to land use planning. Costs and development impacts are minimized by placement of similar land uses in the same place. Some uses are reduced or prohibited in certain areas. Such an approach effectively rations the available land across competing uses. This control is the most restrictive type of control depending on how it is implemented.

Table 1. Management of Private Lands

Management Option	% of Overall Respondents
Entirely a private matter	21.2%
Mostly a private and somewhat a public matter	52.4%
Equally a private and a public matter	24.0%
Mostly a public and somewhat a private matter	1.7%
Entirely a public matter	0.7%

Table 2. Land Use Control Policies

Land Use Control Policy	% of Overall Respondents Favoring the Option
Zoning	61.3%
Purchase of Development Rights	43.3%
Cluster Development	58.2%

> The purchase of development rights (PDR) control was given as ". . . Local governments allow land owners to separate their development rights from their other ownership rights. Those development rights can then be sold to any interested party (an individual or group). Thereafter, that land can not be developed. This strategy allows landowners to receive cash for their development rights, without actually developing their land . . ."

This is a market approach similar to a permit system. A market is established for development rights which allows their withdrawal from potential development. The landowner retains title to the land which can be sold or bequeathed; however, land use is restricted to agriculture and open space. The success of this approach depends on individuals agreeing on this redefined bundle of property rights and the ability of a market for development rights to function. Some may object to preventing their heirs from developing their land. This is a market approach whereby transactions are voluntary and may not occur.

This form of the PDR does not necessarily require government involvement nor the dedication of tax dollars to the program. However, enthusiasm for this program may be dampened by two local phenomena. As elsewhere in the Rocky Mountain region, large ranches have been purchased by wealthy absentee landowners. Also, the Nature Conservancy has purchased a working ranch in Fremont County which bounds Sublette on the east.

> The cluster development control was given as ". . . Homes are located close to one another in a development parcel. The remainder of the parcel is jointly owned by those homeowners, and is left undeveloped by mutual agreement . . ."

This concedes development in an area but provides guidelines that minimize development impacts. It is a command and control approach on a micro level. Explicit in the choice is the "joint ownership" and "mutual agreement." Respondents may object to being part of a collective.

Table 2 summarizes the approval rates by option. It appears that respondents have a higher preference for command and control forms of land-use planning.

Land Use Types: Photographs of an irrigated hay meadow and ranch, a sub-irrigated pasture, and a mountain pasture were used to solicit a preferred land use. The land use choices given were agriculture, residential, or wildlife/recreation. Respondents were asked to choose the land use best suited for the landscape if the parcel was located somewhere in Sublette County (table 3). Recreational/wildlife and agriculture uses are preferred. The residential option was not a preferred land use.

Future Expectations about Sublette County and about the Activities of the Respondent: Table 4 indicates that within the next 10 years a significant number of people plan to live in Sublette County, but many do not plan to be employed. This may be attributable to respondent's mean age of 53 years. The number of individuals reporting that they plan to live in the county in 10 years is composed of 88% of residents and 65% of non-resident landowners. Numerous people who do not presently live in Sublette County plan to be living there within the next decade.

Determining people's attitudes toward increased population levels and the impact on their perspective on quality of life was measured in several ways. Respondents were asked to judge the increased level of population that would cause them to move from the county (table 5). Participants were then asked to indicate what they anticipated the population of the county to be in 10 years. The final question was a function of the population level respondents projected in 10 years. Respondents were asked to match their projected popula-

Table 3. Preferred Land Use for Land Scenarios: If It Were Someone Else's Land

	% of Overall Respondents Selecting the Type		
Land Use Type	Irrigated Hay Meadow	Sub-irrigated Meadow	Mountain Meadow
Agriculture	72.7%	23.8%	39.9%
Residential	4.4%	6.5%	4.9%
Recreational/Wildlife	21.0%	67.5%	52.0%
Other	1.9%	2.1%	3.1%

Table 4. Expectations of Living and Working in Sublette County in 10 Years

Type of Respondent	% of Total Respondents
Will live in Sublette County	76.1%
Will be employed in Sublette County	34.9%

tion level to how their quality of life might change (table 6). It appears that population has little effect on place of residence or quality of life.

Respondents were given 11 indicators of their preference for residing or desiring to reside in Sublette County. They were asked to select any statement consistent with why they might reside in the county. Table 7 summarizes the importance of 11 indicators. Respondents tended to choose options reflecting amenity type qualities such as scenery, recreation, rural lifestyle and low population.

Model Specification

The statistical model is in referendum format and hypothesized to be driven by two categories of choice determinants: public and private regarding preferences. The following indicates the variables used to operationalize the two preference categories. Three models are estimated corresponding to the three land use controls. The three models are structured as follows:

$$RV_i = \beta_0 + \beta_1 PRVLND + \beta_2 DIRR2 + \beta_3 DIRR3 + \beta_4 DSUB2 + \beta_5 DSUB3 + \beta_6 DMTN2 + \beta_7 DMTN3 + \beta_8 LIVE + \beta_9 WORK + \beta_{10} QLIFE + \beta_{11} LENGTH + \beta 12 RESIDE + \beta_{13} EDUC + \beta_{14} AGE + \beta_{15} INC + \varepsilon$$

where the specific response variables $RV_i = 1$ if the respondent favors the response variable, 0 otherwise for the land use models which include zoning, purchase of development rights and cluster development. Explanatory variables, as per theory,

Table 5. Percent of Individuals Leaving Due to Increased Population Levels

Population Level 6,000 Current Level	% of Total Respondents Who Would Move
8,000 total people	3.5%
10,000 total people	11.3%
12,000 total people	16.6%
14,000 total people	16.0%
Stay at any level	52.6%

Table 6. Changes in Quality of Life With Increased Population

Quality of Life Change	% of Total Respondents
Improved dramatically	2.8%
Improved	9.3%
Improved somewhat	20.5%
Stayed the same	20.1%
Decreased somewhat	24.1%
Decreased	14.8%
Decreased dramatically	8.4%

are grouped into public preference and private preference categories.

Public Preference Variables:

PRVLND = attitude toward private land management, range 1 to 5 (See table 1);
DIRR2 = dummy variable, 1 if the respondent preferred residential land use for an irrigated hay meadow, 0 otherwise, relative to agricultural use;
DIRR3 = dummy variable, 1 if the respondent preferred recreation/wildlife land use for an irrigated hay meadow, 0 otherwise, relative to agricultural use;
DSUB2 = dummy variable, 1 if the respondent preferred residential land use for a sub-irrigated hay meadow, 0 otherwise, relative to agricultural use;
DSUB3 = dummy variable, 1 if the respondent preferred recreation/wildlife land use for a sub-irrigated hay meadow, 0 otherwise, relative to agricultural use;
DMTN2 = dummy variable, 1 if the respondent preferred residential land use for a mountain meadow, 0 otherwise, relative to agricultural use; and
DMTN3 = dummy variable, 1 if the respondent

Table 7. Indicators of Why People Reside in Sublette County

Reason	% of Total Who Responded
Low population	53.3%
Job/Business opportunity	18.4%
Rural lifestyle	56.9%
Scenery	61.5%
Family safety	39.0%
Recreational opportunities	58.5%
Air/Water quality	48.9%
Low taxes	22.9%
Climate	16.3%
Quality of K-12 education	14.2%
Other	11.1%

preferred recreation/wildlife land use for a mountain meadow, 0 otherwise, relative to agricultural use.

Private Preference Variables:

LIVE = 1 if the respondent plans to live in Sublette County in 10 years, 0 otherwise;
WORK = 1 if the respondent plans to be employed in Sublette County in 10 years, 0 otherwise;
QLIFE = anticipated quality of life given the respondent's projected population, range 1 to 7 (see table 6);
LENGTH = length of residence in Sublette County;
RESIDE = 1 if respondent's primary residence is Sublette County, 0 otherwise;
EDUC = 1 if respondent has a four-year college degree, 0 otherwise;
AGE = respondent's age;
INC = 1995 gross household annual income, range 1 to 14 (in $10,000 increments);
β = estimated coefficients; and
ε = an error term.

Table 8 summarizes the hypothesized coefficient signs. These *a priori* relationships are based on a literature review about preferences for environmental regulation. The preference for land use controls is assumed to be consistent with that for environmental regulation. The preference for land use controls can be viewed as a preference derived from the preference for environmental regulation. There may, in fact, be important differences between the two. The hypothesized signs could be in question due to the paucity of research concerning the preferences for rural land use control.

Public Preference Variables

Determining if private land management is a public or private matter (*PRVLND*) can be viewed as an attitude toward land management. Research by Blamey et al. (1995) found that citizens base decisions on political attitudes. All dummy variables on preferred land use (*DIRR2, DIRR3, DSUB2, DSUB3, DMTN2, DMTN3*) are proxy measures to compare agricultural use to recreation/wildlife use or residential use. As a citizen, an individual may be expressing preferences for nonrival, nonexclusive land uses such as those providing visual or wildlife habitat resources.

Private Preference Variables

Determining the location of future residence (*LIVE*) and future employment (*WORK*) can be regarded as an indicator of future preferences for an individual. Assessing quality of life (*QLIFE*) is a variable which falls under agency preferences as defined by Sen (1987). This is tantamount to preferences for a state of the world, or community, akin to Sen's agency preferences. It also could be reflective of individual pursuit of well being.

Environmental concern, as a preference type that encompasses demand for open space, is related to education and age (Honnold 1981). Age, education, and to a lesser extent residence consistently predict environmental concern, but explain only modest levels of the respective variance (Buttel and Flinn 1974). Socio-demographic factors including gender, age, education, location of primary residence, length of residence and income influence attitudes toward the environment and residential development (Buttel 1987; Van Liere and Dunlap 1980; Reading et al. 1994; Green et al. 1996; Wilkin and Iams 1988). Demographic characteristics are viewed to reflect personal rather than community interests.

Estimation Results

Dichotomous choice logit model are used for the analysis. Properties of this model and its associated

Table 8. Hypothesized Parameter Coefficient Signs for Growth Management Strategies

RV_i's	PRVLND	DIRR2	DIRR3	DSUB2	DSUB3	DMTN2	DMTN3	LIVE	WORK	QLIFE	LENGTH	RESIDE	EDUC	AGE	INC
Zoning	−	−	?	−	?	−	?	+	−	?	+	−	+	−	+
Purchase of Development Rights	−	−	+	−	+	−	+	+	−	?	−	−	+	−	+
Cluster Development	−	−	+	−	+	−	+	+	−	?	−	−	+	−	+

statistical distribution are well known (Wrigley, 1985; Amemiya, 1981; Maddala, 1983).

Zoning

Table 9 reports results of the estimates for the logit analysis on zoning.

Consistent with *a priori* expectations, the attitudes concerning the management of private lands (*PRVLND*) have an inverse relationship with zoning. Desirability of the growth management strategy had a reduced probability of −0.1886, *ceteris paribus.*

Unexpectedly, respondents who preferred that the irrigated hay meadow be used for residential development (*DIRR2*), relative to agriculture, were more inclined to favor zoning. The associated probability of such a situation is 0.1338. No other dummy variables for preferred land use were significant in choosing zoning.

People planning to live in Sublette County in 10 years (*LIVE*) were anticipated to support a zoning program implemented in the present. The latter is based on personal quality of life (demand for open space) considerations. Model results are inconsistent with *a priori* expectations. The probability of zoning being approved by respondents decreased when people planned to live in Sublette County (*LIVE*). This outcome may be consistent with individuals attempting to protect their property investment which may be diminished depending on the type and location of zoning. Holding all other effects constant, the probability decreased −0.0613 from future residence plans (*RESIDE*).

It was hypothesized that education (*EDUC*) and age (*AGE*) would both have direct relationships with the likelihood of zoning being accepted. The hypothesized outcomes would be consistent with quality of life considerations outweighing property investment interests. However, both variables had negative parameter estimate signs, thus lowering the associated probability. Each variable may connote an understanding by the respondents of the implications of zoning. If this is the case, then respondents may have been wary of the potential windfalls, gain in property values, for those located outside of a particular zoned area as well as the wipeouts, loss of property values, for those within a zoned area. Specifically, the probability was lowered −0.1114 by education (*EDUC*) and −0.0046 by age (*AGE*). Income (*INC*) was assumed to have a direct relationship with zoning. The opposite sign was exhibited in the model estimation. This result reflects the possibility that property investment concerns outweigh fears of open space development. Income (*INC*) further reduced the probability of a respondent choosing zoning by −0.0078, *ceteris paribus.*

Table 9. Preference for Zoning Estimates

Variable	Mean	Parameter Estimate	Standard Error	Range	PR>Chi-Square	X*B	Change in Probability
Intercept		2.8739	0.4427		0.0001*	2.8739	
PRVLND	2.1109	−0.8358	0.0932	1 to 5	0.0001*	−1.7643	−0.1886
DIRR2	0.0483	0.5930	0.2845	0 to 1[a]	0.0372*	0.0286	0.1338
DIRR3	0.2054	−0.1854	0.1595	0 to 1[a]	0.2451	−0.0381	−0.0418
DSUB2	0.0739	0.3002	0.2652	0 to 1[a]	0.2577	0.0222	0.0677
DSUB3	0.6844	−0.0293	0.1625	0 to 1[a]	0.8568	−0.0201	−0.0066
DMTN2	0.0583	−0.1602	0.2775	0 to 1[a]	0.5636	−0.0093	−0.0361
DMTN3	0.5537	−0.1369	0.1454	0 to 1[a]	0.3463	−0.0758	−0.0309
LIVE	0.7868	−0.2719	0.1568	0 to 1	0.0829*	−0.2139	−0.0613
WORK	0.3760	−0.2401	0.1582	0 to 1	0.1290	−0.0903	−0.0542
QLIFE	3.6660	0.0115	0.0400	1 to 7	0.7736	0.0422	0.0026
LENGTH	15.4302	0.00721	0.00546	Continuous	0.1863	0.1113	0.0016
RESIDE	0.4954	−0.0378	0.1398	0 to 1	0.7867	−0.0187	−0.0085
EDUC	0.4748	−0.4938	0.1260	0 to 1	0.0001*	−0.2345	−0.1114
AGE	51.1741	−0.0202	0.00586	Continuous	0.0006*	−1.0337	−0.0046
INC	6.5153	−0.0347	0.0189	1 to 14	0.0661*	−0.2261	−0.0078

[a]denotes dummy variable
*denotes significance level of 0.10
At sample means, the density function value = 0.2256
N = 1407
Number of "YES" responses = 510; "NO" responses = 897
−2 LOG L score = 167.461 with 15 degrees of freedom
Percentage concordant responses predicted by model = 69.9%

Purchase of Development Rights

The purchase of development rights (*PDR*) logit analysis is found in table 10.

The management of private land (*PRVLND*) has no statistically significant link to support for purchase of development rights. Residential use of the sub-irrigated hay meadow, relative to agriculture (*DSUB2*) was a significant variable in explaining the probability of a respondent choosing PDR. Preferred residential use, relative to agriculture (*DSUB2*) increased the probability by 0.1571. The estimated positive association between preferred recreation/wildlife use of the mountain meadow, relative to agriculture (*DMTN3*) and *PDR* is as hypothesized. The probability of a respondent selecting purchase of development rights, holding other effects constant, was increased by 0.0654 when the mountain meadow was used for recreation/wildlife purposes, relative to agriculture. No other dummy variables for land use were statistically significant.

Quality of life (*QLIFE*) and approval of *PDR* displayed a direct relationship. *A priori* effects on the dependent variable *PDR* caused by quality of life (*QLIFE*) were not known. Survey results indicated as the population of Sublette County increases, quality of life (*QLIFE*) either stayed the same or slightly decreased. A raised quality of life (*QLIFE*) positively increases the probability of the response variable by 0.0191.

Selected demographic variables were hypothesized to influence how a respondent would support *PDR* rights as a land use control. Contrary to *a priori* expectations, respondents with higher education (*EDUC*) levels were not more likely to select *PDR*. If individuals are interested in land use control, then they would want to know the exact payment mechanism to be implemented. As mentioned previously, this voluntary market approach does not indicate where, when or for how much. Land speculators could benefit from this approach as much as ranchers. The associated probability was lowered by −0.1586, *ceteris paribus*. There was a positive relationship between older individuals (*AGE*) and the probability of a respondent endorsing purchase of development rights. As one's age rises, the probability increases by 0.0024. This may indicate that older respondents are willing to accept payment in exchange for not developing their land while still holding the title to the land. The impact of income (*INC*) was contrary to *a priori* expectations. It may be that those respondents with higher incomes are uninterested in the program. Specifically, the wealthier an individual is (*INC*), the probability of them supporting *PDR* decreases by −0.0077.

Cluster Development

The logit analysis for cluster development is reported in table 11.

Table 10. Preference for Purchase of Development Rights Estimates

Variable	Mean	Parameter Estimate	Standard Error	Range	PR>Chi-Square	X*B	Change in Probability
Intercept		−0.1603	0.4018		0.6900	−0.1603	−0.0395
PRVLND	2.1084	−0.0751	0.0792	1 to 5	0.3432	−0.1583	−0.0185
DIRR2	0.0484	0.1169	0.2845	0 to 1[a]	0.6810	0.0057	0.0288
DIRR3	0.2059	−0.00648	0.1459	0 to 1[a]	0.9646	−0.0013	−0.0016
DSUB2	0.0744	0.6375	0.2637	0 to 1[a]	0.0156*	0.0474	0.1571
DSUB3	0.6842	0.1205	0.1546	0 to 1[a]	0.4360	0.0824	0.0297
DMTN2	0.0599	0.3948	0.2704	0 to 1[a]	0.1442	0.0236	0.0973
DMTN3	0.5520	0.2654	0.1374	0 to 1[a]	0.0535*	0.1465	0.0654
LIVE	0.8747	0.0814	0.1502	0 to 1	0.5879	0.0639	0.0201
WORK	0.3786	−0.0118	0.1472	0 to 1	0.9359	−0.0045	−0.0029
QLIFE	3.6488	0.0774	0.0378	1 to 7	0.0404*	0.2824	0.0191
LENGTH	15.5681	−0.0005	0.00511	Continuous	0.9227	−0.0078	−0.0001
RESIDE	0.4986	−0.1597	0.1313	0 to 1	0.2240	−0.0796	−0.0394
EDUC	0.4740	−0.6433	0.1177	0 to 1	0.0001*	−0.3049	−0.1586
AGE	51.1098	0.00983	0.00547	Continuous	0.0725*	0.5024	0.0024
INC	6.4516	−0.0312	0.0176	1 to 14	0.0761*	−0.2013	−0.0077

[a]denotes dummy variable
*denotes significance level of 0.10
At sample means, the density function value = 0.2465
N = 1384
Number of "YES" responses = 769; "NO" responses = 615
−2 LOG L score = 72.995 with 15 degrees of freedom
Percentage concordant responses predicted by model = 63.2%

The odds of a respondent selecting cluster development (*CLSTR*) improve with believing that private lands are a private matter. When all other effects are held constant, the probability increased by 0.0336.

Future employment plans (*WORK*) in Sublette County increases the probability of a respondent supporting *CLSTR*. The associated probability was significantly greater by 0.0765, *ceteris paribus*. Despite having no *a priori* expectations, quality of life (*QLIFE*) has an indirect relationship with *CLSTR*. As quality of life increases (*QLIFE*) relative to a population increase, the likelihood of a respondent selecting *CLSTR* actually decreases. The probability decreased by –0.0213.

The longer an individual has lived in Sublette County (*LENGTH*) decreased the probability of endorsing *CLSTR* by –0.0027. In accordance with expectations, higher levels of education (*EDUC*) increase the probability of a respondent preferring *CLSTR*. Holding all other variables constant, the probability increased by 0.0582. As anticipated, older individuals (*AGE*) have a greater likelihood of supporting *CLSTR*. The probability increased by 0.0022. Income (*INC*) was statistically significant, and related to *CLSTR* according to *a priori* expectations. Higher income levels (*INC*) cause a 0.0084 increase in the possibility of *CLSTR* receiving approval, *ceteris paribus*.

Further Discussion of Results

Summary statistics indicate zoning was favorable with 61.3% of survey respondents. If respondents thought the irrigated hay meadow should be residentially developed, relative to agriculture, then, based on the model estimation, zoning was approved as a land use control. This is important as hay meadows are adjacent to the county seat. Several other variables had a negative impact on zoning's approval rating. Specifically, the negative variables are: private land management, planning to live in the county, and increased education, age, and income.

Purchase of development rights was the least favorable form of controlling growth from the given survey options. Less than half of all respondents (43.3%) would support purchase of development rights. However, the logit analysis revealed a more optimistic outlook than was provided for zoning. Relative to agriculture, residential use of the sub-irrigated hay meadow and recreation/wildlife use of the mountain meadow are situations in which purchase of development rights is preferred. The latter land type is generally located near public land and would provide access to recreational areas. If a respondent felt that quality of life had improved because of a population increase then they tended to approve of purchase of devel-

Table 11. Preference for Cluster Development Estimates

Variable	Mean	Parameter Estimate	Standard Error	Range	PR>Chi-Square	X*B	Change in Probability
Intercept		–0.1967	0.4039		0.6262	–0.1967	
PRVLND	2.1140	0.1398	0.0788	1 to 5	0.0762*	0.2955	0.0336
DIRR2	0.0484	–0.0806	0.2709	0 to 1[a]	0.7661	–0.0039	–0.0194
DIRR3	0.2044	0.00178	0.1448	0 to 1[a]	0.9902	0.0004	0.0004
DSUB2	0.0741	–0.3002	0.2498	0 to 1[a]	0.2295	–0.0222	–0.0721
DSUB3	0.6830	–0.1081	0.1543	0 to 1[a]	0.4836	–0.0738	–0.0260
DMTN2	0.0598	–0.00221	0.2576	0 to 1[a]	0.9932	–0.0001	–0.0005
DMTN3	0.5513	0.0135	0.1358	0 to 1[a]	0.9206	0.0074	0.0032
LIVE	0.7856	–0.1850	0.1478	0 to 1	0.2109	–0.1453	–0.0445
WORK	0.3754	0.3183	0.1469	0 to 1	0.0303*	0.1195	0.0765
QLIFE	3.6603	–0.0886	0.0375	1 to 7	0.0182*	–0.3243	–0.0213
LENGTH	15.5113	–0.0111	0.00507	Continuous	0.0285*	–0.1722	–0.0027
RESIDE	0.4907	0.1932	0.1302	0 to 1	0.1380	0.0948	0.0464
EDUC	0.4779	0.2421	0.1174	0 to 1	0.0392*	0.1157	0.0582
AGE	51.2536	0.00931	0.00540	Continuous	0.0848*	0.4772	0.0022
INC	6.4879	0.0350	0.0177	1 to 14	0.0479*	0.2271	0.0084

[a]denotes dummy variable
*denotes significance level of 0.10
At sample means, the density function value = 0.2403
N = 1404
Number of "YES" responses = 837; "NO" responses = 567
–2 LOG L score = 33.611 with 15 degrees of freedom
Percentage concordant responses predicted by model = 58.5%

opment rights. Increased education, age, and income were all critical determinants of a respondent's choice. Older individuals tended to be more supportive of the land use control. Diminished approval of purchase of development rights is best explained by higher levels of education and income.

The survey revealed a 58% respondent approval level for cluster development. The model estimation yielded estimated determinants both for and against the option. Cluster development is not acceptable for controlling growth with people who believe an increased population decreased their quality of life. Individuals who have resided in Sublette County for longer periods of time are also not supportive of the strategy. Cluster development is favorable if private lands are managed in a private manner. Additional support occurs when people are more likely to work in the county and have increased education, age, and income.

Conclusions

Citizens of Sublette County are concerned about the changes taking place. Four criteria should be used to evaluate the effectiveness of policy changes before they are implemented. Namely, a policy needs to be technically feasible, economic/financially possible, politically viable, and administratively operable (Patton and Sawicki 1993). Before actions can be taken by the Planning and Zoning Commission, the office must recognize that in-migration will occur.

Individuals are moving in, but not necessarily for employment reasons. Survey results indicate that most people neither plan to be working in the county in 10 years nor are locally employed. Study participants consistently preferred agricultural or recreation/wildlife land uses for undeveloped landscapes. Converting land to residential developments was not widely supported. Yet, in-migration is a precursor to the development of rural lands.

Greater value is placed on retaining agricultural lands when these landscapes provide open space and public goods. Agricultural lands and rural communities possess attributes that people cited as reasons for living in Sublette County. People live in Sublette County because of amenity characteristics. When agricultural lands are converted from production, public goods and attractive community attributes will decline. Agricultural lands possessing fewer scenic amenities are a possible consideration for development. Initially, lands on the rural-urban fringe could be utilized in order to prevent rural residential development.

The desire to live in or near rural open space leads to a contradiction. Rural in-migrants diminish the scenery, agricultural lands, presence of wildlife, and recreational opportunities that initiated their arrival. Survey results indicate a preference for zoning which is a traditional form of land use planning. People favor traditional practices in that they are familiar. Purchase of development rights is not a familiar practice. This may have resulted in minority approval of this land use control (Stokes and Watson 1989).

The logit analysis offers a possible scenario in which purchase of development rights might be acceptable. Supporters of land use controls tend to prefer residential use of hay meadows possibly to protect property investments. Development rights could be purchased from the sub-irrigated hay meadow and mountain meadow to preserve open space and recreation/wildlife without wiping out the property investment.

Logit analyses demonstrate decisions regarding support for land use controls are based primarily on an individual's demographic characteristics. Education, age, and income characteristics appear to be the factors driving individual preference. Demographic characteristics had a positive effect on decisions regarding cluster development. Approval for zoning and purchase of development rights was negatively impacted by demographic factors. Attitudes toward private land management and quality of life assessments also exert influence on decisions, to a lesser extent. Information about factors that affect preferences can be beneficial for land use planning. It provides determinants of land control approval for a policy-relevant population. Planning officials could assess future support for land use controls from comparing characteristics of in-migrants with those of survey respondents. Note that Sublette county survey responses by respondent place of residence are available elsewhere (McLeod, et al. 1998). They could also use these outcomes for purposes of public education concerning what land use means and how it may be implemented.

The land use control models do not coincide well with the expectations derived from the environmental regulation literature. Several possibilities exist. Individual attitudes toward land use may be different than that toward environmental regulation. Environmental regulation is typically portrayed as mitigation of environmental degradation due to production practices. It may not be synonymous with the impact of rural residential development. Previous land use preference research is scant (Sullivan 1994) and perhaps incompatible with this work due to site specific results.

This research generally found a lack of statistical significance with respect to public preference variables except for private land management attitudes. Private concerns may outweigh public concerns when private land use issues are under consideration. However, the proxies used here for public preferences may be either inadequate or poorly measured. Recognizing these limitations, this research provides information relevant to Sublette County planning efforts.

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