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Willingness to Pay Estimation When Protest Beliefs are not Separable from the Public Good Definition

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Abstract

Public good attributes that are correlated with protest beliefs but not separable from the good's value, would affect stated preference estimates of the WTP for the public good. Survey data collected to value a program to prevent ecosystem losses on Nevada rangelands, where the majority of land is publicly owned and managed, reveal more than half of the respondents exhibiting some protest belief. Of these, about 60% voted 'yes' to some nonzero bid amount. By treating protest beliefs and opposition to the proposed program as separate concepts, we systematically analyze their determinants and impacts on WTP. In this framework, people with protest beliefs may or may not vote 'no' to all bids and people may, without being protesters, answer 'no' to all dollar amounts. Multinomial logit regression results suggest that factors motivating people to protest and/or oppose the proposed program are so diverse that a single model does not provide a good fit. We estimate nested models and conclude that different underlying processes determine WTP for "protesters" ($34.02) and "non-protesters" ($69.56).

JEL Classification: Q51, Q24, Q57

Keywords: Stated preferences; Willingness to pay; Protest responses; Rangelands; Valuation of ecosystem services

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Introduction

Protest responses to stated preference questions have traditionally been treated as outliers to be identified and eliminated from data collected to estimate willingness to pay (WTP). The earliest literature identified a protest response as a 'no' to an extremely low dollar amount, or a 'yes' to an extremely high amount. However, in some circumstances a 'no' response to a very low bid, including $0, is not necessarily a protest response, but a genuine indication of a zero or negative WTP (or willingness to accept compensation). The use of sets of follow-up questions asking respondents why they voted 'no' has became standard practice to identify respondents who hold protest beliefs as opposed to genuine 'no' responses. These questions typically query the respondent about (a) their attitudes toward the payment vehicle (e.g. "I am opposed to new taxes"), (b) paying for a public good ("somebody else should pay" or "I don't believe in placing a dollar value on this good"), (c) trust in the agency or organization that would hypothetically provide the good ("I don't trust the government to use my contribution for the intended purpose"), and (d) other beliefs that affect the likelihood of a 'no' response but that are associated less with their preferences for the good itself than with the methods that are used to elicit preferences.

Standardization of a set of protest questions and protocol has not occurred, in part because the non-market goods and payment vehicles used in preference elicitation are highly variable. As an alternative to adopting a standard protocol, some authors advocate using open-ended questions identify protest responses (Bateman et al. 1999). Dziegielewska and Mendelsohn

(2007) propose a method that combines several approaches to identify protestors: they identify protesters as respondents who (a) vote 'no' to all dichotomous choice bid amounts, (b) indicate a $0 WTP on open-ended follow-up questions, and also (c) hold protest beliefs. The majority of the published literature in this area is similarly concerned with methods to identify protest responses in order to justify eliminating outliers from an analysis.

However, a number of authors point out that, in identifying protesters solely for the purpose of deleting outliers, we lose information that is important for non-market valuation as well as compromising our capacity to make inferences to the general population. Jorgensen and Syme (2000) illustrate that interdependence among the types of beliefs that people hold can lead to biased WTP estimates if observations from respondents with one type of belief are deleted from an analysis but those of the other type are not deleted. They show that some people who are willing to pay also hold protest beliefs, but would not be identified as protest respondents if the criteria included voting 'no' to all dollar amounts. They conclude that a more thorough analysis of protest beliefs and interdependencies among beliefs held by respondents is necessary for achieving a consistent method of identifying and treating protesters in an analysis.

Furthermore, we claim that in many circumstances public goods have attributes that are not easily separable from the flows and services provided such as program delivery and financing, but that are correlated with protest beliefs such as opposition to new taxes or distrust of government. In these cases, survey designs may be limited in their ability to control for attributes that trigger protest responses. If people with protest beliefs define the good in question differently from non-protesters, then the underlying preferences and the distributions for WTP may also be different, therefore making the WTP estimates difficult to interpret. In these circumstances, a large proportion of the population may exhibit protest beliefs. Eliminating

protest responses would result in loss of policy relevant information, while using both protesters' and non-protesters' WTP estimates would lead to better informed policy decisions.

In this paper, we use survey data collected to value a program to prevent further ecosystem losses from invasive species and wildfire on Great Basin rangelands in Nevada, where the vast majority of the land is publicly owned and managed. Historically there has been tension between the private citizens and the federal land management agencies. It is therefore not surprising that more than half of the respondents exhibited some protest belief. Given that the payment vehicle for the proposed program was taxation and that the most popular protest reasons were distrust of government and weariness of paying taxes, we hypothesize that many of those with protest beliefs likely evaluated, instead of a pure ecosystem, a composite good "ecosystem managed by a public agency." Appropriate definition of protest is especially important for this dataset because, of those with protest beliefs, about 60% voted 'yes' to some non-zero bid amount. As a result, if we were to apply the conventional protest definition, we would throw out more than a fifth of the survey responses from the analysis as outliers, while pooling those with protest beliefs and those without. If that is the case, WTP estimates for a pooled sample would be biased downward and would not be appropriate to use as society's valuation of the ecosystem.

Meyerhoff and Liebe (2006) focus on explaining the underlying motives for protest beliefs held by respondents to contingent valuation questionnaires. They use six questions for all respondents, not just people who voted 'no' for all dollar amounts, to identify protest respondents, distinguish among types of protest beliefs, and analyze how protest beliefs influence the decision to pay and the amount that protesters are willing to pay to support a public program. Respondents indicate agreement or disagreement on a 5-point Likert scale, from which a protest index is constructed. They use the protest index as the dependent variable in a

regression with demographic, attitudinal and economic variables as predictors to identify motivations for protest beliefs. They used the same independent variables in regressions to estimate WTP. While they show that people with protest beliefs behave differently in their WTP responses, they do not estimate separate models for protest and non-protest respondents. Instead, their constructed protest index variable is used to indicate strength of protest, and variables that indicate motivations for protesting are included in regressions. They find that most respondents who are willing to pay for the public good also hold protest beliefs, and that WTP is negatively correlated with the strength of protest belief. However, the overall fit for their WTP models is quite weak. If the underlying distributions for WTP are different for respondents with different protest reasons or strengths, then separate models, or allowing parameters to vary by protest belief, may have resulted in an improved fit, which is the approach used in this paper.

Many authors including Dziegielewska and Mendelsohn (2007) discuss the difficulty in coming up with a standard protocol for identifying protest responses. The problem may be that a protest response is not necessarily a discretely measured item. It may be that protest beliefs are held in some form by most people and have some effect on WTP responses. Therefore, we propose treating protesting (holding protest beliefs) and opposing ($WTP < 0$) a proposed public program as separate concepts, so as to systematically analyze their determinants and their impacts on WTP estimates. In this framework, people with protest beliefs may or may not vote 'no' to all bids and people may, without being protesters, answer 'no' to all dollar amounts because they believe the outcome would leave them worse off. We assume those who have no value for the proposed policy (i.e. indifferent respondents or $WTP = 0$) to be included in the "non-opposer" ($WTP \geq 0$) category.

The first set of analyses addresses on the factors that motivate people to protest and/or oppose the proposed program. Multinomial logit regression results suggest that the sample is so diverse that a single model does not provide a good fit. To generate more accurate predictions on the probabilities of protesting and opposing, a different model specification would be required for each subsample. Second, to test whether people with protest beliefs have different underlying processes that determine WTP than those without protest beliefs, we estimate nested models for "protesters" and "non-protesters" as group, rather than treating protesting as a continuous variable as in Meyerhoff and Liebe (2006). The statistical test suggests that the two groups of respondents have different WTP distributions. The result also suggests that the use of standard protest belief follow-up questions can successfully identify subsets of respondents whose strength of belief is different enough to affect WTP distribution.

Background, Survey Design, and Data

This paper provides valuation estimates for preventative and restorative land management programs in the Great Basin that would arrest the accelerated wildfire cycle due to invasion of annual weeds. The sagebrush steppe of the United States Great Basin occupies 100 million acres of western high desert, provides habitat for more than 300 species of wildlife, supports one of the nation's fastest growing human populations, and is the primary forage base for the western livestock industry (Knick et al. 2003). While these lands provide for less than 3 percent of the nation's cattle and sheep feed, grazing is a key component of local rural economies and the cultural identity of the region (Hess and Holechek 1995). This ecosystem is also severely ecologically stressed, with the Nature Conservancy recently ranking it as the third most endangered in the United States (Stein et al. 2000; Noss et al. 1995). Half has been lost to invasive annual grasses, primarily cheatgrass (*Bromus tectorum*), which have altered fire regimes

in the region, causing an escalating cycle of increasingly severe and frequent wildfire (Whisenant 1990; Miller and Tausch 2001). Scientific evidence suggests that unless steps are taken to intervene, the accelerating cheatgrass/wildfire cycle will result in irreversible shifts in ecosystem dynamics that would compromise the ability of the land to support native wildlife and plants and affect the biological and economic stability of the Great Basin (BLM 1999, 2000; Pellant, Abbey, and Karl 2004; Young et al. 1987; Devine 1993). This observation motivates our study on the valuation of Great Basin ecosystem protection.

Data were collected through a 2005 mail survey of Nevada residents, using survey methods based on Dillman (2000). Focus groups, questionnaire development and pretesting proceeded through spring and summer of 2005. Responses were analyzed during one-on-one interviews with pretest respondents, during group sessions, and afterward by the researchers. Question wording was reviewed for comprehension and interpretation. These results are based on the resulting pilot survey and are part of a larger body of related survey work in the Great Basin.

The questionnaire collected data necessary to estimate willingness to pay (WTP) for vegetation management programs to protect ecosystem-derived values. Questions were asked about respondents' demographic characteristics, how they benefit from Great Basin lands, their beliefs and attitudes regarding the effects of invasive annual grasses and wildfire on these lands, and value of land management practices that target invasive grasses and wildfire. A private firm supplied 2,125 addresses for the survey. One thousand addresses were generated to be representative of the state of Nevada overall, based on the 2000 census. Since a high proportion of the state population is in the Las Vegas and Reno metropolitan areas (Clark and Washoe Counties), an additional 1,125 addresses were drawn from rural counties to perform analysis comparing rural and urban populations. The first mailing was conducted during mid-October,

2005. Follow-up postcards were sent out to non-respondents. A second mailing to non-respondents was implemented during the first week of February, 2006, after the holiday season. Of 2,125 surveys sent out, 178 were undeliverable (no forwarding addresses available) and 576 completed surveys were returned for a statewide response rate of 30%. Response rates tended to be higher in rural counties, so the county-weighted average (37%) is higher than the statewide average. Eighteen surveys were eventually omitted from the valuation analysis because they included inconsistent responses (i.e. a 'no' to a bid amount that was lower than one with a 'yes' response from the same respondent).

An experimental design included five survey versions, assigned randomly to participants, to measure effects of providing respondents with additional information, preemptive versus restoration treatment scenarios, and multiple contingent valuation bid formats (Table 1). The contingent valuation question is presented in the context of one of two treatment scenarios. The prevent loss (*PL*) scenario states that the numbers of wildfires in Nevada are expected to double over the next five years due to the continued spread of cheatgrass, increasing the risk of irreversibly losing lands that could support native vegetation. In this case, the proposed vegetation management program would prevent a negative change from the status quo. The obtain gain (*OG*) scenario states that the proposed vegetation management program would be restorative and thereby reduce the number of wildfires throughout Nevada by half (a positive change). Thus the *OG* scenario measures willingness to pay to improve the status quo (obtain a positive change relative to the status quo). The two versions of the program proposal are provided in an Appendix. Both scenarios state that the program would be funded through a dedicated tax. Respondents were asked how they would vote in a referendum to implement the

vegetation management program, if passage would cost each household a specific amount every year for the foreseeable future.

Table 1. Questionnaire Versions

Version	Information	Treatment scenario	Bid format	Responses
PLSi	with	Prevent loss (PL)	$0, $1, and 1 other (S)	109
PLDi	with	Prevent loss (PL)	$0, $1, and 2 others (D)	84
PLMi	with	Prevent loss (PL)	$0, $1, and 7 others (M)	75
OGMi	with	Obtain gain (OG)	$0, $1, and 7 others (M)	104
OGM	without	Obtain gain (OG)	$0, $1, and 7 others (M)	186
(Total)				558

Respondents were presented with three to nine bid amounts. Three discrete choice CVM formats were employed. All versions included the bid amounts $0 and $1. A "single-bid" (*S*) version included one additional randomly assigned bid amount from the bid set $12, $31, $52, $83, $114, $157, and $282. The "double-bid" (*D*) version included two additional randomly assigned bid amounts from the same bid set. The "multiple-bid" (*M*) version included all bid amounts, listed in ascending order. The "no cost" ($0 bid) and the $1 bid amounts are included to separate those who are opposed to the proposed program and would vote against it even if it cost them nothing, from those who are in favor of the proposal but are unwilling or unable to pay for it. Following Alberini et al (2003) and Welch and Poe (1998) all versions used polychotomous choice response options including 'definitely no,' 'probably no,' 'probably yes,' 'definitely yes,' and 'not sure,' allowing respondents to indicate qualitative levels of uncertainty.[1]

We included with the survey a 2-page information sheet about cheatgrass, increasing wildfire suppression costs, the accelerating fire cycle and resulting irreversible ecosystem losses. This information sheet was omitted from a sub-sample of the multiple-bid Obtain Gain versions

(*OGM*) in order to investigate the influence of information provision on WTP for fuel management programs.

Table 2 summarizes demographic, and survey design variables generated from the data that are used in all models, as well as variables that indicate respondents' perceptions of 1) the importance of specific resources and services provided by Nevada's rangelands, 2) what threatens them, 3) what they believe management priorities should be, and 4) attitudes toward management methods. Descriptions and measurement units listed in Table 2 are self-explanatory.

Identifying Protesters

A battery of questions asking why respondents voted the way that they did to valuation proposals was included in the questionnaire to identify protest responses. A protest response is defined as one motivated at least in part by attitudes that are not directly related to the good in question. Respondents are coded as "protesters" if they checked any of the following four reasons for voting 'no' at least once to any dollar bid amount: "I don't trust the government to use my taxes wisely," "I already pay too much in taxes," "I object to the way the question was asked," or "I feel that I don't have enough information." Opposition to the program is defined as not having answered 'definitely yes' to the $0 bid. Because of the design of the polychotomous multiple question format, most respondents answered 'no' to at least one of the higher bid amounts, even if they had answered 'yes' to lower bid amounts. This design resulted in a possibility of respondents who are "protester•non-opposers" who express protest beliefs but are willing to pay a non-negative amount.

Table 2. Variables Describing Bid Responses, Demographics, and Survey Versions

Variable	Definition	Mean	St. Dev.
Bid	Dollar amount presented to respondent	65.612	27.153
Vs	1 = single bid questionnaire version; 0 otherwise	0.195	0.397
Vd	1 = double bid questionnaire version; 0 otherwise	0.151	0.358
Vm	1 = multiple bid questionnaire version; 0 otherwise	0.654	0.476
OG	Scenario: 1 = restoration (obtain gain); 0 = prevent loss	0.520	0.500
Info	1 = information sheet provided; 0 = no information sheet	0.667	0.472
Income	Household annual income in $1000's	71.085	51.950
Age	Age of respondent	52.135	14.356
Educ	Number of years of schooling completed	14.254	2.469
Yrs_NV	Number of years lived in Nevada	20.971	12.001
Job_ag	1 = ranching or agriculture; else = 0	0.075	0.264
Job_lndscp	1 = landscaping; else = 0	0.020	0.139
Job_mine	1 = mining; else = 0	0.152	0.360
Job_constr/mfn	1 = construction or manufacturing; else = 0	0.097	0.296
Job_trade	1 = wholesale or retail trade; else = 0	0.075	0.264
Job_wtrmgnt	1 = water resources management; else = 0	0.023	0.151
Job_othutil	1 = utilities (other than water); else = 0	0.034	0.182
Job_health	1 = healthcare; else = 0	0.088	0.283
Job_nrsci	1 = natural resource / environmental sciences; else = 0	0.036	0.186
Job_ed	1 = education/academia; else = 0	0.100	0.301
Job_ent	1 = arts, entertainment, hotel, food services; else = 0	0.048	0.215
Job_recr	1 = outdoor recreation & tourism; else = 0	0.043	0.203
Job_publnds	1 = public land management; else = 0	0.027	0.162
Job_admin	1 = public admin (not land & water resources); else = 0	0.016	0.126
Job_fire	1 = firefighting; else = 0	0.020	0.139
Srt	1= lives in small rural town; else = 0	0.373	0.484
Lrt	1= lives in large rural town; else = 0	0.140	0.347
Activity	Number times engaged in activities on rangelands per year	1.744	1.320
Import_airwat	Mean response to importance of air & water quality (1 to 4)	3.555	0.680
Threat_policy	1 = land use policies threaten rangelands; else = 0	0.610	0.488
Threat_wldhrse	1 = wild horses threaten Nevada's rangelands; else = 0	0.410	0.492
Threat_nonnat	1 = seeding w/ non-natives threaten rangelands; else = 0	0.554	0.498
Pri_frpvt	Importance of wildfire prevention as a mgmnt priority (1-4)	3.049	0.960
dmeth_herb	1 = Using herbicides not appropriate; else = 0	0.249	0.433
dmthd_nogrz	1 = Excluding grazing animals not appropriate; else = 0	0.405	0.491
dmthd_prsfir	1 = Prescribed fire not appropriate; else = 0	0.063	0.243
dmthd_prsgrz	1 = Prescribed grazing not appropriate; else = 0	0.061	0.240
dgrzveg	1 = Agree that livestock grazing should be managed for vegetation priorities; else = 0	0.762	0.426
dfiresupp	1 = Agree that rangeland fires should be stopped only when	0.448	0.498

	they threaten human life; 0 = otherwise

Because only those who answered 'no' to any bid were asked to answer follow-up questions, protest attitudes of those who answered 'yes' to all bids could not be determined. There were 35 responses with 'definitely yes' to all bids, of which one answered the follow-up question and was coded as a protester. The other 34 respondents were assigned a missing value for the protest dummy variable. Of the 524 respondents with a value for the protest variable, 286 (55%) exhibited some protest beliefs (Table 3). Distrust of government was the most popular reason for protest, followed by already paying too much in taxes and then by insufficient information. Proportionately more protesters are found among opposers than among non-opposers, but a substantial 51% of non-opposers are also protesters. No clear pattern is observed for differences in protest reasons between opposers and non-opposers.

Table 3. Protesting and Opposing

	Opposer (WTP < 0)		**Non-opposer (WTP ≥ 0)**		**Total**	
Protester ('yes' to at least one question) of which:	117	(60%)	169	(51%)	286	(55%)
I don't trust the government	77	(66%)	116	(69%)	193	(67%)
I already pay too much in taxes	64	(55%)	93	(55%)	157	(55%)
I object to the way the question was asked	21	(18%)	21	(12%)	42	(15%)
I don't have enough information	57	(49%)	53	(31%)	110	(38%)
Non-protester	77	(40%)	161	(49%)	238	(45%)
Total	194	(100%)	330	(100%)	524	(100%)

We assume that protest attitudes are a characteristic of the individual that originates from his or her beliefs. If any of the questionnaire design variables influenced a respondent's propensity to be a protester, we would need to proceed with caution. Of particular concern is whether demonstration of protest attitude was affected by whether respondents were given *PL* (prevent

losses) or *OG* (obtain gain) version of questionnaire. Whether or not the additional 2-page information was offered also potentially affect propensity to express protest attitudes.

To test for potential selection bias introduced by survey designs, probit regressions were run to estimate protest probabilities using questionnaire design variables as explanatory variables for appropriate subsamples. The estimation results (not shown in table) indicate that whether a respondent received a *PL* or *OG* version or whether a respondent received additional information did not affect protest probability. On the other hand, we found that the bid structure may have affected protest answers: a higher protest probability was observed among respondents with questionnaire that contained higher dollar bid amounts on average. However, the effect was insignificant when the same model was run only for *PL* version recipients (the OG version contains no variation in bid structure). Thus, it is likely that bid structure did not affect protest answers but, when *PL* and *OG* version respondents are pooled, the data tend to show some spurious relation. This result will be accounted for in the subsequent analyses.

Probabilities of Protesting and Opposing

The next model predicts the probability a respondent will be one of the four types: 1) protester•opposer, 2) non-protester•opposer, 3) protester•non-opposer, and 4) non-protester•non-opposer. The model explores which individual characteristics are associated with protest beliefs and what motivates people to oppose or support programs to protect rangeland ecosystems. A multinomial logit regression was applied to the dataset using the "non-protester•non-opposer" type as the base outcome. In this model, observations with missing protest information were dropped.

Non-opposers are defined as those individuals who answered 'definitely yes' to $0; that is, they are certain that they would support or be indifferent to the program if it would cost their

household nothing. If we define indifferent respondents as those who answered 'definitely yes' to $0 but not to $1 bid, there were 42 such respondents. Non-opposers are assumed to be "in the market" for the proposed efforts to protect rangeland ecosystems in principle, but they may still hold protest beliefs.

Any other response to $0 is assumed to indicate either a perceived utility loss from adoption of the proposed program or a protest response. Some respondents may oppose because they expect to be negatively affected by certain features of a vegetation management program. The description of the treatments include all of the methods currently being used in the Great Basin today for vegetation management, including herbicides that target invasive annuals, prescribed burning, grazing prohibitions, and planting non-native grasses that can out-compete invasive annuals more effectively than native species. While all of these methods are used because they have been proven effective in a variety of circumstances, there are potential costs and risks associated with them as well. We expect that respondents who believe that the expected net effect of a program to them personally would leave them worse off would indicate opposition to the program even if it cost them $0. If these respondents did not indicate a protest reason for their answer, then we consider these as legitimate indications of negative WTP for the programs.

Many of the demographic and attitudinal variables are collinear. Thus, model selection focused on removing insignificant and collinear variables from the regression while keeping the variables we believe affect probabilities of protesting and opposing. Regression results are summarized in Table 4, and their interpretations are the following. Since the base outcome is non-protester•non-opposer, column (1) reveals variables that affect the probability of protesting and opposing simultaneously. Column (2) represents how the explanatory variables affect non-protester•opposer probability relative to non-protester•non-opposer probability, that is, they show

what makes an individual more likely to oppose when he or she is a non-protester. Similarly, column (3) represents the effect of the variables on probability of protesting when an individual is a non-opposer. Upon inspection of coefficients and standard errors, it appears that the underlying behavioral motivations for protesting and opposing are very different among the three groups (indicated by columns 1 through 3).

Nevada's population is such that residents who live in metropolitan areas tend to be less conservative than their rural counterparts. Nevadans who live in rural towns and isolated rural areas tend to be much more conservative and less likely to trust government and support new government programs. For these reasons, we might expect that the probability of being a protester would be higher for rural residents relative to the rest of the population. On the other hand, we can surmise that respondents from large rural towns are more likely to live in communities most affected by exotic weed invasions and accelerating fire cycles. For this reason, they may be more likely to understand the proposed vegetation management programs, how they work and how they may affect residents' quality of life. We can surmise that these respondents are more likely to respond to the specific features of the good in question (programs to affect accelerating fire cycles) rather than to their held beliefs about trust in government or tax rates. As for opposition to the proposed programs, for the reasons outlined above, residents of large rural communities may be less likely to oppose such a program.

Model results indicate that, relative to the base case, the probabilities of being a non-protester•opposer (column 2) and protester•non-opposer (column 3) individually are lower for residents in large rural towns. These results are consistent with our discussion above. However, the coefficient for large rural town residence (*Lrt*) is not significant for the probability of being both an opposer and a protester (column 1). The result suggests that the underlying motivations

[**Table 4. Estimation Results for Probability of Protesting and Opposing (Multinomial Logit)**

	(1) Protester Opposer		(2) Non-protester Opposer		(3) Protester Non-opposer	
	Coeff	s.e.	Coeff	s.e.	Coeff	s.e.
Educ	-0.164***	0.059	-0.173**	0.073	-0.119**	0.051
Age	0.003	0.010	0.000	0.012	-0.016*	0.009
Job_ag	1.148**	0.499	0.684	0.584	-0.208	0.546
Job_trade	0.522	0.507	1.015*	0.536	-0.028	0.519
Job_ed	-0.387	0.524	-1.165	0.811	0.516	0.372
Job_recr	-1.261*	0.723	-0.605	0.676	-1.117*	0.623
Srt	0.348	0.312	0.299	0.346	0.361	0.263
Lrt	0.542	0.364	-1.032*	0.608	-0.661*	0.375
Activity	-0.259**	0.114	0.099	0.120	0.072	0.093
Import_airwat	-0.270	0.216	-0.035	0.273	-0.296	0.201
Threat_policy	-0.268	0.281	-0.351	0.342	0.289	0.254
Threat_wldhrse	0.262	0.282	0.737**	0.332	0.017	0.246
Threat_non-nat	0.071	0.280	-0.138	0.333	0.307	0.246
Pri_frpvt	-0.319**	0.144	0.056	0.181	-0.097	0.132
dmthd_nogrz	0.253	0.276	-0.507	0.341	0.045	0.245
dmthd_prsgrz	0.248	0.701	1.069	0.657	0.813	0.565
dmthd_prsfir	1.021	0.622	0.337	0.769	0.639	0.598
dmeth_herb	-0.070	0.329	0.333	0.367	-0.289	0.292
dgrzveg	-0.901***	0.332	-1.339***	0.385	-0.762**	0.310
dfiresupp	0.241	0.273	0.576*	0.325	0.129	0.241
Vs	-0.766	0.480	-1.080**	0.552	-1.058**	0.426
Vd	-0.835*	0.500	-1.486**	0.615	-0.917**	0.440
OG	-0.478	0.487	-0.455	0.537	-0.283	0.414
Info	-0.619	0.392	-0.136	0.444	-0.370	0.330
cons	5.124***	1.440	2.628	1.768	4.527***	1.304
Log likelihood	-600.257					
Observations	515					
Pseudo R^2	0.116					

Notes: Significance levels of 0.01, 0.05, and 0.1 are denoted by three, two, and one asterisks (***, **, *), respectively.
Base outcome is non-protester•non-opposer.
Observations with missing protest information are dropped.

by large rural town residents for protest and opposition voting may be very different, so that the multinomial logit picks these up through the coefficients that isolate the individual effects but not when they are combined.

We can surmise that Nevada residents involved in agriculture are likely to be aware that vegetation management treatments associated with rangeland restoration and prevention of exotic weed invasion typically involve livestock grazing prohibitions that can have negative effects on ranching income. They are thus more likely to be opposers. If it can be assumed that ranchers follow similar demographic patterns to others living in rural Nevada, we would expect these respondents to be more conservative and more likely to hold protestor beliefs regarding government distrust and taxation. As expected, column (1) indicates that individuals involved in agriculture (*Job_ag*) are more likely to protest and oppose. However, its individual effects on protesting or opposing alone are not significant (columns 2 and 3).

Not surprisingly, the probability of falling into any of the three groups, relative to the base case, is negatively associated with education level (*Educ*) and agreement with the statement that grazing should be managed for vegetation management priorities (*dgrzveg*). These variables are statistically significant across all groups. Other variables seem to have differential effects on protest and opposition probabilities. Those who engage more in outdoor activities (*Activity*) and those who consider fire prevention as a priority (*Pri_firpvt*) are less likely to protest or oppose the proposed land management programs (column 1). Employment in retail or wholesale trade (*Job_trade*), the degree to which individuals believe wildhorses are a serious threat to rangelands (*Threat_wldhrse*), and agreement with the statement that rangeland fires should be stopped only when they threaten human life (*dfiresupp*) are positively and significantly associated with non-

protester's probability of opposing (column 2). These variables likely reflect underlying conflicts of respondents' personal interests with the proposed program so that, while not revealing protest beliefs, they are unwilling to pay for the program. In column (3) the negative coefficient on *Age* suggests that a non-opposer's probability of protesting decreases with age. Employment in outdoor recreation and tourism (*Job_recr*) is negatively associated with the probability of protesting for both opposers and non-opposers (columns 1 and 3).

Finally, in general, survey design variables (*Vs*, *Vd*, *OG*, and *Info*) all have a negative effect on the probabilities of being in any of the three categories in Table 4. Relative to the multiple-bounded versions (with 9 bid amounts presented), respondents with single or double bid versions are less likely to oppose and protest. The effects from information provision (*Info*) and the restoration version of the program (*OG*) are not significant, but the signs are persistently negative on these coefficients. However, the coefficients on *Vs* and *Vd* likely reflect the spurious relation between bid design and protest probability discussed in the previous section.

Overall, the multinomial logit results indicate that there are likely complex behavioral motivations underlying the probabilities of being a protestor•opposer, a non-protestor•opposer, a protester•non-opposer, and a non-protester•non-opposer. Different behavioral motivations may carry through to different underlying distributions for WTP so that estimation of WTP without testing for these differences would result in the wrong model. Moreover, the low pseudo R^2 value (0.116) for the multinomial logit suggests that this model does not possess the predictive power on protest/oppose probabilities that policy decision makers would like. For more accurate probability predictions, it is desirable to fit different conditional models for protesters, non-protesters, opposers, and non-opposers. For the purpose of the present paper, however, we point out that conventional treatment of protester responses in willingness to pay estimation –

dropping groups (1) and (2) and pooling the rest – may be overly simplistic, and lead to loss of information. We accommodate for these differences in estimation of WTP for the programs.

Willingness to Pay Estimation

Respondents who voted 'definitely yes' to support the program at zero cost were retained to use in the valuation models to estimate WTP for the proposed programs to protect rangeland ecosystems. In doing so, we measure conditional WTP (WTP|WTP $\geq$ 0). A random effects probit was used to determine the probability of a 'yes' response, as described in Rollins et al. (2008) and Boxall et al. (2003). An unbalanced panel was created with one observation per bid amount for each individual. Thus, each respondent is represented by three to nine observations.

The overall model selection strategy was to include as many variables that are observable and easily identifiable to policy makers as possible. This called for inclusion of more demographic than attitudinal variables. Preliminary models (not presented here) showed that most attitudinal variables had minimal effect on WTP estimates; the estimated WTP levels were extremely robust to the choice of attitudinal variables to include in the model. Thus, we focus on demographic and survey design variables that were included to test for robustness of WTP estimation. First, a pooled model was used to perform a Chi-square test to determine whether protest and non-protest models are statistically different.[2] The regression coefficients of our predictor variables are constrained to be the same for protestors and non-protestors against unconstrained models. The likelihood ratio chi-square test shows that the unconstrained models provide a significantly better fit to the data (Table 5). The important implication is that the processes generating WTP are different for protestors and non-protestors, so generalization to the population as a whole cannot take place unless both group processes have been modeled.

Table 5. Results of Likelihood-Ratio Test

Sample	Log likelihood
Pooled[a]	-712.253
Protesters	-287.697
Non-protesters[a]	-349.351
LR Chi^2 (26)	144.26
Prob > Chi^2	0.000

[a] Observations with missing protest information are included.

The model was then estimated for the pooled sample, protester subsample, and non-protester subsample (Table 6). In models (4) and (6), the observations with missing protest information were included as non-protesters. Because these observations were the only ones with 'yes' votes to the highest bid ($282), omitting them from WTP estimation would result in a downward bias in the estimates. Thus, we consider that model (6) gives the most reliable estimates of WTP for the proposed rangeland protection programs. Note that model (4) would arise as the only WTP model if the conventional protest definition was applied (a 'no' response to all bid levels and a protest response indicated).

As expected, the mean WTP estimate for protesters ($34.02) indicated in model (5) is substantially lower than that of model (6) for the non-protesters ($69.56). The explanatory power of the independent variables on WTP for protestors is low; other than the bid amount and income, none are statistically significant. We conjecture that those who expressed protest beliefs likely evaluated, rather than a pure valuation of the ecosystem goods and services protected by the proposed programs, a composite good that included program delivery by government, funding via taxation, and other additional elements with negative connotations. The poor fit of model (5) may indicate the necessity of alternative specifications that address these factors. The

Table 6. Estimation Results for WTP model (Random Effects Probit)

	(4) Pooled[a]		(5) Protester		(6) Non-protester[a]	
	Coeff	s.e.	Coeff	s.e.	Coeff	s.e.
Bid	-0.104***	0.016	-0.108***	0.019	-0.102***	0.013
Income	0.030***	0.008	0.012*	0.006	0.051***	0.013
Age	0.181	0.132	-0.064	0.112	0.465**	0.201
Age^2	-0.002	0.001	0.001	0.001	-0.005**	0.002
Yrs_NV	0.034	0.028	0.012	0.024	-0.049	0.041
Job_ag	1.007	1.496	-2.450	1.565	2.137	2.093
Job_lndscp	-4.665*	2.599	-3.441	2.698	-4.113	3.871
Job_mine	-0.956	0.865	-0.207	0.766	-1.494	1.294
Job_constr/mfn	-0.059	1.161	0.372	0.916	1.671	1.530
Job_trade	2.722*	1.443	-0.422	1.399	6.768***	2.403
Job_wtrmgnt	0.622	2.391	1.872	2.428	3.793	3.936
Job_othutil	-2.839*	1.665	-0.157	1.122	-9.512***	3.387
Job_health	-0.131	1.181	0.948	0.942	-1.557	2.223
Job_nrsci	-1.993	1.972	2.559	1.791	-6.799***	2.388
Job_ed	-0.165	0.930	0.984	0.827	-1.303	1.321
Job_ent	1.013	1.468	1.119	1.244	0.558	1.968
Job_recr	3.171*	1.844	1.014	1.875	3.393	2.197
Job_publnds	2.325	2.521			2.244	3.352
Job_admin	0.130	1.857	3.363	2.136	-5.428**	2.470
Job_fire	-0.331	1.910	-0.364	1.707	1.675	3.896
Lrt	-1.229	0.938	-1.091	0.957	-2.588*	1.383
dmthd_prsgrz	1.387	1.508	0.217	1.002	6.676**	2.757
Vs	-0.601	1.144	-0.677	1.075	-2.398	1.821
Vd	-1.016	1.317	-0.321	1.040	-3.814**	1.905
OG	-0.995	1.167	-0.061	0.888	-4.859**	2.084
Info	0.024	0.926	0.087	0.723	-1.478	1.521
cons	-1.074	3.378	2.695	2.870	-0.594	5.306
WTP mean (s.e.)	54.828	(1.253)	34.020	(1.020)	75.704	(3.167)
WTP median	52.782		33.751		69.561	
95% CI	(52.363, 57.293)		(32.005, 36.035)		(69.451, 81.956)	
K&R 95% CI[b]	(48.76, 61.60)		(29.12, 39.29)		(67.00, 84.16)	
Log likelihood	-711.885		-287.697		-349.148	
Observations	2281		1157		1124	
Respondents	325		153		172	
Rho	0.968	0.010	0.894	0.038	0.975	0.007

[a] Observations with missing protest information are included.
[b] Krinsky and Robb Confidence Intervals estimated using a Stata routine developed by Jeanty (2007).
Notes: Significance levels of 0.01, 0.05, and 0.1 are denoted by three, two, and one asterisks (***, **, *), respectively. *Job_publnds* is dropped in model (5) due to collinearity.

model under the conventional protest definition, model (4), also understates ($54.82) the pure valuation of the ecosystem services to be protected.

Model (6), WTP for non-protesters, indicates that the probability of a 'yes' response is decreasing in the bid amount and increasing in income, as expected. WTP is increasing with age until age 49, after which it is decreasing. People who received the version of the questionnaire with the restoration policy (*OG*) were less likely to vote 'yes' than those with the preservation policy (*PL*). This is consistent with previous research that suggests people tend to be willing to pay more to protect the status quo than they are to obtain a gain to the status quo. This result may be important to consider more carefully in further work, since it would imply that the longer policy-makers wait to implement policies to protect ecosystem services, there will be lower public support for restoring additional degradation that might occur.

People who believe that prescribed grazing is *not* an appropriate tool for rangeland management (*dmthd_prsgrz*) were more likely to vote 'yes.' Prescribed grazing was listed as one of the ten means by which the proposed programs would reduce the spread of invasive species and reduce wildfire frequency. However, prescribed grazing is controversial among those who are generally skeptical of private ranching on public lands in the Great Basin. Thus, the positive coefficients on *dmthd_prsgrz* may imply that those who are opposed to prescribed grazing as a management method are willing to pay *more* to prevent ecosystem losses through the *other* methods. This result also has direct policy relevance, as the choice of rangeland management methods is a significant concern for the public land management authority.

While Table 4 results indicate that a respondent from a large rural town (*Lrt*) is less likely to be a protester or an opposer, a non-protester•non-opposer from a large rural town tends to have a lower WTP than the rest of the population (Table 6, model 6). The result confirms that the four

groups used in the multinomial logit are indeed very different and that separate models are warranted. Variable *Lrt* does not significantly affect protestors' WTP.

The probability of voting 'yes' is positively associated with employment in wholesale or retail trade (*Job_trade*) but negatively associated with employment in utilities other than water (*Job_othutil*), natural resource and environmental sciences (*Job_nrsci*), and public administration (*Job_admin*). These results may be associated with potential impacts of the proposed policy on the regional economy through linkage effects across sectors.

Of the design variables other than *OG*, the additional information supplied (*Info*) did not appear to affect the probability of a 'yes' response, nor was the effect of a single-bid amount (*Vs*) relative to the multiple-bid amount (*Vm*) versions. However, relative to the respondents who received the multiple-bid versions (*Vm*), the double version (*Vd*) appears to have a negative influence on WTP. However, upon further investigation, these latter effects are spurious and were inadvertently generated as a result of the experimental design described in Table 1[3].

Conclusions

The willingness to pay estimation for protest respondents revealed that they do value ecosystem services that would be protected under the proposed programs in this study. However, the estimated WTP levels were substantially lower for protesters than for non-protesters. In the case of programs to protect flows of ecological goods and services from Nevada's rangelands, the fact that over 86% of these lands are in public ownership makes it difficult to suggest a credible stated-preference payment vehicle and policy-delivery mechanism that does not include public sector involvement. The policies would necessarily be implemented by public agencies and methods would comply with federal government regulatory requirements. We expect that the general population from which the sample is drawn is well aware of this. For

protester respondents, the good being valued may include features that are inseparable from the policy implementation and the payment vehicle, both in the stated preference questionnaire as well as in their understanding of the good as it exists in reality.

When the reality of the proposed policy is reflected in the stated preference payment vehicle and policy implementation mechanism, we find it less compelling to treat traditional protest beliefs as indicative of an outlier. Instead, we consider the possibility that in these cases a protest belief is a legitimate part of individuals' preferences and influences their understanding of the definition of the good at hand. However, under these conditions, the data may represent different definitions of the good being valued, and therefore different distributions for WTP.

To generalize beyond the current study, under what circumstances are the protest beliefs a genuine reflection of the definition of the good as that portion of the population understand it? If the components of a proposed policy that trigger protest beliefs are integral to the good as it enters an individual's utility function, then it is difficult to separate what part of WTP for protesters is their valuation of ecosystem goods, and what part is due to how these ecosystems are managed in order to provide flows of benefits. In cases like these, we suggest that both sets of estimates, those for protestors and non-protestors, are informative for policy makers.

For many environmental goods, policy contexts are integral to people's values for these goods. Other circumstances in which environmental goods and the existing policy mechanisms to deliver them are not separable include the impacts of global environmental goods for which collective action is required to produce a desired public good benefit. Further work might investigate whether it is possible to develop stated preference models in which structural interactions between the environmental good and the mechanisms for its delivery and payment

can be explicitly modeled, where these mechanisms are likely to be highly correlated with pervasive protest beliefs.

Appendix: Two Versions of Proposal

A. Proposal *PL* (Prevent Loss)

PROPOSAL

Suppose that experts predict the numbers of wildfires in Nevada to **double** over the next five years due to the continued spread of cheatgrass. This will lead to the loss of native grasses, wildflowers, and shrubs.

A new, intensive Rangeland Vegetation Management Program has been proposed. This program will reduce fire risk by reducing cheatgrass through the use of prescribed fires, machinery, herbicides, prescribed grazing, and seeding with native plants and non-native grasses such as crested wheatgrass.

Under this new program, fire risk would **not double**, but stay the same as it is now.

Now **suppose** that the Rangeland Vegetation Management Program would be funded through a new tax.

If a majority voted **YES** (for the proposal), a special tax would be collected from everyone and used only for the Rangeland Vegetation Management Program.

If a majority voted **NO** (against the proposal), the tax would not be charged and the management program would not be funded.

Please imagine that if the proposal passes, you would be charged the special tax every year for the foreseeable future.

As you think about your answer, please remember that if this proposal passes, you would have less money for other expenses.

B. Proposal *OG* (Obtain Gain)

PROPOSAL

Suppose that a new, intensive Rangeland Vegetation Management Program has been proposed. This program will reduce fire risk by reducing cheatgrass through the use of prescribed fires, machinery, herbicides, prescribed grazing, and seeding with native plants and non-native grasses such as crested wheatgrass.

The new program could **reduce** the number of wildfires throughout the state **by half**.

Now **suppose** that the Rangeland Vegetation Management Program would be funded through a new tax.

If a majority voted **YES** (for the proposal), a special tax would be collected from everyone and used only for the Rangeland Vegetation Management Program.

If a majority voted **NO** (against the proposal), the tax would not be charged and the management program would not be funded.

Please imagine that if the proposal passes, you would be charged the special tax every year for the foreseeable future.

As you think about your answer, please remember that if this proposal passes, you would have less money for other expenses.

Notes

[1] An analysis of respondents' uncertainty about answers is forthcoming.

[2] Those observations with missing protest information were included as non-protesters. Note that these are the respondents who answered 'definitely yes' to all bid amounts.

[3] Running the same models with only prevent loss (*PL*) policy versions indicated extremely high *P*-values for the *V*s and *Vd* coefficients. There is no bid structure variation for obtain gain (*OG*) version. Running the model for both policy versions but without the *V*s and *Vd* variables indicates that the coefficient on *OG* remains significant and negative. Therefore, we attribute the significance of *Vd* to the spurious correlation coming through the survey design, for which we have been unable to control.

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