Land Use Policy 89 (2019) 104227

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Gaining voter support for watershed protection

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ARTICLE INFO

Keywords:
Watershed protection
Ballot referendums and referenda
Ecosystem services
Nudge
Voter behavior

ABSTRACT

Public officials and stakeholders who want to advance watershed protection may want to consider how ballot referendum design can serve as a nudge in voting behaviors. We extend the research literature on voter preferences by using behavioral economics theory to provide new insights into voter behaviors towards watershed conservation referendums. We drew upon observations from 76 separate watershed protection referendums, conducted in the eastern U.S. from 1991 to 2013, and evaluated the wording of the ballot statement to determine their potential influence on voter support and the psychology of voting. Data were fitted to weighted least squares regression models to allow for broader inferences about voting behaviors. We found shorter ballot referendums with broad or vague descriptions of expected benefits and fewer descriptions of funding mechanisms likely increased the perceived odds of a favorable outcome and subsequently increased likelihood of a yes vote.

1. Introduction

The protection of watersheds from increasing urban sprawl has emerged as one of the more important environmental issues in the United States (US; Bengston et al., 2004). Changes in the structure, management, and tenure of private lands often affect the provision of valued ecosystem services, such as clean water, carbon sequestration and biodiversity (Mercer et al., 2011; Cademus et al., 2014). In response to increased public demand for greater watershed protection—to protect both municipal drinking water supplies and water quality generally—government agencies and non-governmental conservation groups often rely on voter-approved ballot referendums and referenda to secure funding for public policies and programs (e.g., land acquisition, zoning laws) to advance proposed conservation goals and outcomes (Bengston et al., 2004; Merenlender et al., 2004; Newburn et al., 2005; Kline, 2006).

The voting outcomes of referendums and referenda can provide data that are useful for improving understanding of voter support for watershed and other open space protection policies and programs. Notable nationwide voter studies have consistently found factors such as population growth, increased development, and changes in income and employment, as well as the type of conservation funding mechanisms proposed, to be correlated with the rise and success of referendums to conserve open space and rural landscapes (Nelson et al., 2007; Kline, 2006; Kotchen and Powers, 2006). Due to the challenges of working with anonymous voter data, fewer studies have taken a normative approach, and examined strategies for encouraging the passage of conservation referendums (e.g., Maloney et al., 2013). Despite this, we feel that voter data can still provide us clues as to what types of referendums are well supported, more specifically, if the design of the ballot referendum statement may nudge voters to support the referendum. Strategic ballot statement design may be more preferred compared to controversial campaign efforts, which tend to focus on getting voter support through emotional appeals (e.g., Valdes, 2012). Moreover, our use of data where voters are making actual choices, as opposed to a hypothetical voting situation, which can help account for the many factors that influence voters' choices.

To date, ballot statement design research has mainly investigated the effects of information about the political candidates on voter behaviors, such as the candidate's gender or political party (e.g., Klein and Baum, 2001; Matson and Fine, 2006). There is a dearth of empirical research on how ballot statement design for land conservation may influence voting behavior, despite a need for this information among conservation practitioners (TPL, 2008). We address this gap in the literature by examining how the content of land conservation ballot referendums might influence voters' choices about watershed protection. Specifically, we draw from the field of behavioral economics and game theory to explore how strategies of decision-making, such as bounded

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https://doi.org/10.1016/j.landusepol.2019.104227
Received 14 September 2018; Received in revised form 2 August 2019; Accepted 14 September 2019

rationality, heuristics and cues, may explain voting decisions on watershed protection and help inform the design of nudges.

We use the methodological approach first developed by Deacon and Shapiro (1975)[1], to infer individual preferences from aggregate voting data. We examine the choice voting behavior from 76 different watershed protection referendums addressing the protection of forests and watersheds, conducted in the Eastern United States (US) between 1991 and 2013. We used weighted regression analyses to estimate the impact of different explanatory variables describing forest-water conservation benefits and costs (as described in the ballot statement) and other attributes of the ballot statement on the likelihood of a yes vote, and to make larger population inferences.

Our interpretation of the findings are based on the assumption that voters are primarily self-interested and will support ballot referendums they believe are most likely to give rise to preferred ecosystem services and economic benefits. This approach recognizes the complexities of decision-making about environmental goods, despite having well-informed preferences. If voting choices are less often a rational exercise and more of a gambling exercise that is influenced by unconscious psychological processes, one has to question the usefulness of voter data in describing public preferences for ecosystem conservation. Concerns such as these compelled us to look beyond the assumption that voters are always rational actors and examine voter data to search for new evidence of how voters may approach their decisions. To our knowledge, ours is the first study to address the potential influence of ballot referendum wording on voter support for watershed protection.

2. Evaluating conservation initiatives and referendums

States in the US began using ballot referendums to develop public policy about natural resource management as early as 1897, in response to public concerns that state legislators were too strongly influenced by corporations and monopolies (Williamson, 1998). Today, ballot referendums and referendums are often used to protect rural lands by authorizing necessary funding mechanisms (e.g., bonds, taxes) to support policies and actions such as land acquisition, purchasing conservation easements, and development of growth management plans (Bengston et al., 2004). A direct initiative is a process where citizens propose or initiate a statute or constitutional amendment, whereas the referendum process allows citizens to enact or repeal a measure that has been passed by the legislature, and it may carry the weight of being endorsed by public officials[2] . The Trust for Public Land found that between 1998 and 2017, over 75% (1973) of referenda held at different government levels were approved in the US, resulting in over $75 billion in land conservation funding (TPL, 2017). The frequency and passage of these referendums suggest that public support for the benefits provided by land conservation is ubiquitous in much of the US.

The factors that motivate citizens to register to vote, and their voting behavior, have been conceptualized from a variety of disciplinary perspectives, including sociology, psychology, economics, and political science (e.g., Gelman, 2009). Economic disciplines tend to assume that voters primarily cast their votes to advance or protect their self-interests, and that a yes vote is indicative of a voter's willingness to pay for conservation benefits (e.g., Kahn and Matsusaka, 1997). Conversely, researchers in other fields describe voting as a symbolic act (e.g., a patriotic duty) or as motivated by a desire to advance or protect the welfare of the community in which they live (Shabman and Stephenson, 1994). Regardless of whether the motivation to vote is out of self-interest, patriotism or altruism, voting on land conservation referendums for the voter is often a complex decision made in a low-information context—one that may require voters to be strategic in their decision-making.

One way voters attempt to rationally inform their choices is by gathering relevant information from sources such as media campaigns, editorial endorsements, voter information booklets and the opinions of trusted friends (Aidt, 2000; Lautenschlager and Bowyer, 1985). Despite these efforts, voters can still have significant uncertainty about the likely distribution of individual benefits associated with land conservation. In some contexts, important non-market watershed benefits may be excludable (e.g., within a gated community), or rivalrous (e.g., limited clean water supply). Moreover, the presence of conserved lands does not guarantee that preferred benefits will be provided or fairly distributed. Municipalities can affect public access to protected lands if affordable housing obligations are not enforced, for example (Schmidt and Paulsen, 2009). Even when forest lands are conserved, changes in forest structure or composition, through disturbance (e.g., wildfire) or forest management, can also influence important aesthetic benefits (Nielsen et al., 2007).

In addition to expected ecosystem service benefits, the distribution of economic costs and benefits associated with land conservation may not be well understood by voters. Residents in some communities may benefit from open space that increases their property values, due to protection of natural amenities, but this can also increase local property taxes (Knaap, 1987; Balsdon, 2012; Irwin, 2002). Conservation minded individuals in some communities may still want to exchange some of their current environmental quality for other forms of income, such as higher paying jobs (Nelson et al., 2007; Wu and Cutter, 2011; Hochschild, 2018). Voters may also have preferences for which funding rate or mechanism (i.e., a bond or tax) is used, based on perceptions of how costs will likely be allocated to taxpayers (Kotchen and Powers, 2006; Nelson et al., 2007).

A large body of literature reveals that voters will consistently rely on cues from trusted sources and heuristics to reach reasoned decisions under stiff information requirements. (Bowler et al., 1993; Leduc, 2002; Lupia, 1994; Popkin, 1994; McDermott, 2000). Low information contexts are not the only challenge. An increasing amount of information or number of options in the decision analysis (e.g., a large number of voting decisions) can also lead to voter fatigue and dependence on heuristic strategies to make choices (Stadelmann and Torgler, 2013). When complex decisions are made in a low information context, we think it is reasonable to consider how benign influences (e.g., the wording of the ballot statement) may have a significant effect (i.e., nudge) on how people approach the voting decision.

3. Methods

Conceptually, ecosystems comprised within watersheds offer bundles of services (e.g., scenic vistas, clean water, wildlife habitat) that make up "market baskets of goods" that a voter may consider (Brown et al., 2006). The reality of the choices about the environment is that voters are often uninformed, and decisions are made in low information contexts. We assert that in the context of land conservation referendums uninformed voters may rely on their intelligence and experience to help support their interests, but also on the ballot statement contract to help determine the likelihood desired benefits will be delivered and how costs will be distributed (Fig. 1). How costs and benefits are worded in the statement and the cognitive effort required to understand important elements of the contract will likely influence the perceived odds of a favorable outcome and the likelihood of a yes vote.

Our study focused on ballot referendums addressing primarily watershed protection in regions that are mostly forested, and subject to riparian based water laws (i.e., eastern US). In addition to water quality and supply being critical issues in many parts of the eastern US, we chose to focus on referendums that promote watershed protection because the likelihood of finding systematic variation in voter behavior may be improved by focusing on benefits (e.g., drinking water, wildlife habitat)

[1] Also used in subsequent studies (Kahn and Matsusaka, 1997; Kline and Wichelns, 1994; Kotchen and Powers, 2006).

[2] For the sake of brevity, the term referendum will be used more often in this paper.

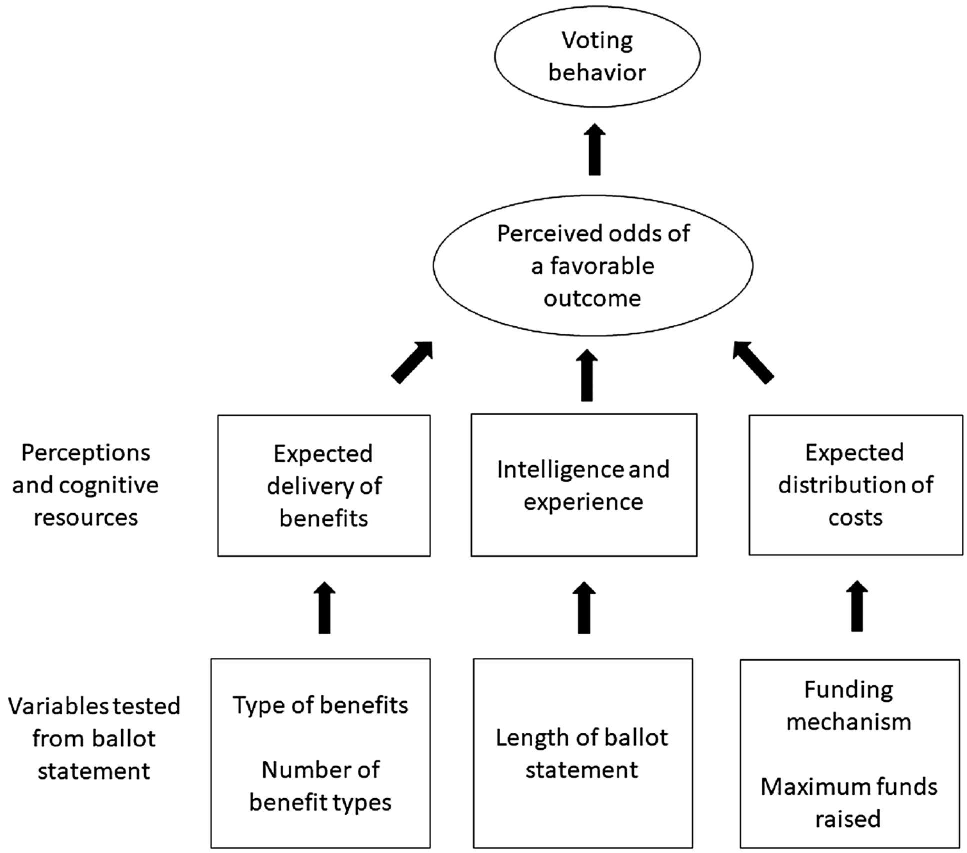

Fig. 1. Conceptual model of the relationship between characteristics of the ballot statement, relative cognitive processes, perceived odds of a favorable outcomes and voting behavior.

commonly associated with one category of conservation (i.e., watersheds). To understand spatial variation in voter behaviors, our analysis also focused on voting behavior in Florida, and compared it to voting behavior throughout the eastern US. Increased development and water supply are key environmental issues in Florida and have led to the advancement of numerous land conservation referendums in the state.

3.1. Econometric model

Following Deacon and Shapiro (1975), we assumed that voter support for watershed protection referendums can be described as,

$$Vote = ln\left[\frac{P(Yes_i)}{(1 - P(Yes_i))}\right]$$

where *ln* is the natural logarithm and $P(Yes_i)$ is the percent of voters who voted yes to the referendum in county or town *i* (e.g., Fischel, 1979; Kotchen and Powers, 2006). The dependent variable describes the ratio of the percent voters approving the referendum to the percent rejecting the referendum. This approach to analyzing voter data has a microeconomic foundation and implies that the aggregate voting results can be used to make inferences about voter preferences and the likelihood of a yes vote. The validity of making such inferences has some empirical support. A companion study found little difference between aggregate voting results and individual preferences for an environmental referendum in New Hampshire (Fischel, 1979). Still, a reliance on aggregate voting results make this approach vulnerable to the ecological fallacy[3] and caution should be used when interpreting the findings.

To identify and estimate the influence of key explanatory variables on voter support a stepwise weighted least squares linear regression model (e.g., Gujarati, 1995) was used. Similar studies have used ordinary least squares models to explain the data (Deacon and Shapiro, 1975; Kline and Wichelns, 1994), but a weighted least squares approach gives the researcher greater control over select observations and their impact on model outcomes and can improve the regression (Kahn and Matsusaka, 1997; Kotchen and Powers, 2006)[4] . An ordinary least square model takes the form:

$$Y_i = \beta_0 + \beta_1 x_{1i} \ldots \beta_n x_{ni} + \varepsilon_i$$

where Y_i is the value of the outcome variable for observation i, $\beta_1$through β_n are the fixed effect coefficients, x_{1i} through x_{ni} are the variables for observation i and ε_i is the error term. All observations are treated equally in an unweighted model, but a weighting variable can be inserted as described in the following equation:

$$S(\beta_0, \beta_1) = \sum_{i=1}^{n} w_i (y_i - \beta_0 - \beta_1 x_i)^2$$

where β_0, $\beta_1$addresses suspected bias impacts, such as site replication and fewer or non-representative voters.

[3] The ecological fallacy is a formal fallacy in the interpretation of statistical data that occurs when inferences about the nature of individuals are deduced from inferences about the group to which those individuals belong.

[4] A two-step model was also considered to help account for potential sample selection bias associated with voting districts, however, there were significant challenges with acquiring the appropriate data (e.g., non-referendum districts). Moreover, a previous voter preferences study found the two-step sample selection approach failed to significantly improve the model (Kotchen and Powers, 2006).

3.2. Data and analysis

Referendums were identified through the annual *LandVote* survey published by the Trust for Public Land (TPL 2014). Data included the year of the referendum, whether the referendum passed, proportion of yes votes, and jurisdiction level–whether municipal, county, or state (Kline and Wichelns, 1994; Kotchen and Powers, 2006). A description of the ballot statement used at the time of the referendum, and data describing percent of registered voters, ballots cast, and percent democrat were collected directly from the Office of Elections in each state. Of the 103 watershed open-space referendums, conducted in the eastern US between 1991 and 2013, a total of 76 observations were included in the final data set[5] . These referenda occurred in 14 states and 65 voting districts and most (84.2%) were conducted at the county or municipal level. The states that held the most referendums were Florida (26) and Ohio (14), and states with the fewest referendums were Wisconsin (1) and Louisiana (1). Florida and Ohio were the only states that allowed direct referendums, all states allowed for legislatively referred constitutional amendments (i.e., referendums). To understand spatial variation at state and watershed levels individual states and counties in Florida were classified by region of the US (1 = US south) and watershed region (1= southern watershed districts), respectively.

Iterative coding procedures were used to identify and categorize potential benefits and costs, as described in the ballot referendum statement. In some cases, referendum statements used explicit descriptions of important benefits (e.g., hiking trails or drinking water well protection). In other cases, referendum statements provided vague descriptions (i.e., "open space") or no details about expected ecosystem service benefits associated with land conservation. Descriptions of expected economic costs were associated with stated funding mechanisms, which described how much total funds would be raised and how costs would be distributed across households (e.g., via tax or bond). Variation in detail among the ballot statements required coding procedures that allowed researchers to capture as much detail as possible, but also allowed for a sufficient number of observations for the associated variable. As such, specific benefits descriptions, such as "hiking" or "camping", were coded more generally as "recreation" benefit, and words such as "water purification" and "water supply", were categorized as "drinking water" benefits. Similarly, specific cost descriptions, such as "sales tax", "property tax" and "ad valorem", were coded simply as "tax" for the funding mechanism. These actions resulted in five binary variables for conservation benefits and three binary variables for costs (i.e., funding mechanisms). These procedures resulted in a total of 20 binary and continuous variables (Table 1).

Analyses of voting behavior typically includes various demographic and socioeconomic variables pertaining to the characteristics of the population. Unfortunately, sources of data describing voter demographics over two decades was often limited. Some voter studies have successfully used US Census data as a proxy for voter demographics, but this occurred under favorable conditions (Fischel, 1979; Kahn and Matsusaka, 1997). What was of concern to us is that in many counties a slim majority register to vote, and in the referendums that we examined only 65% of those registered actually voted. Related research has found that voters are often wealthier and more educated compared to the larger population, suggesting census data may be a poor proxy for demographic data of voters (Matson and Fine, 2006). Confirming this, preliminary runs of the model failed to find systematic variation in county level demographic characteristics and the yes vote, with the exception of household income. Following Kotchen and Powers (2006), only significant demographic and explanatory variables are included in our models.

[5] The referendums removed from the final data set were from rural counties and small municipal jurisdictions that did not keep extended records on elections statistics or the language used in the original ballot statement.

Preliminary investigation of the data also revealed that voting district levels (i.e, statewide, county, municipality) where the referendums occurred often differed in population size, median annual household income, and number of repeat referendums (Table 2). These findings suggest that the referendums used in this study occurred more frequently in smaller communities with wealthier voting populations. Related studies have consistently found environmental referendums are more likely to occur and pass in smaller, wealthier communities, however, voter preferences in these communities may not represent the preferences of the broader public (e.g., Nelson et al., 2007; Kotchen and Powers, 2006). In order to make population inferences about voter behaviors, we used a weighting procedure that reduced the influence of observations from smaller voting populations and districts that had repeat referendums. As such, the following weight was used,

$$w_i = (site)(pop\_vote)/1000$$

where *pop_vote* is the number of individuals that voted within that district (i.e., size of the voting population) and *site* is 1 divided by the total number of referendums conducted within a given voting district.

Tests for normality were performed using Shapiro-Wilk's test ($p < 0.10$), and tests for multicollinearity using eigenvalues and variance inflation factor (VIF) criteria. Variables coded to describe the type and number of benefits and funding mechanisms were often found to be collinear. As such, the variables describing number of benefits and funding mechanisms were removed from the regression analysis and used in a separate Pearson's Correlation analysis to test for potential linear relationships with the yes vote ($p < 0.05$). Data from the eastern US and the Florida referendums were fitted to weighted and unweighted models with variable retention parameters were set at $p < 0.10$.

Separate regressions were run for the Eastern data set and the Florida data set due to differences in how the region variable was characterized. The region variable in the Eastern model described spatial variation in voter behavior across states. The watershed region variable assessed in the Florida model described spatial variation within a single state. The subsequent regression outputs had the following general form:

$$\begin{aligned} Vote = {} & \beta_0 + \beta_{1\,YEAR} + \beta_{2\,REG} + \beta_{3\,DEM} + \beta_{4\,WORDS} + \beta_{5\,SCALE} \\ & + \beta_{6\,FUND} + \beta_{7\,REGION} + \beta_{8\,MAX} + \beta_{9\,REC} + \beta_{10\,DRINK} \\ & + \beta_{11\,OPEN} + \beta_{12\,WILD} + \beta_{13\,FLOOD} + \beta_{14\,INC} + \varepsilon_i \end{aligned}$$

where β_0 is the intercept, coefficients $\beta_{1\dots6}$ are continuous variables describing characteristics of the referendums and the voter including year, percent registered, percent democrat, number of words used, the amount of funds raised using a bond or tax. Coefficients $\beta_{7\dots8}$ are dummy variables describing the geographic region where observations were collected and the type of funding mechanism. Coefficients $\beta_{9\dots13}$are dummy variables describing the benefits associated with watershed protection and include recreation, drinking water, open space, wildlife habitat, and flood protection. Coefficient $\beta_{14}$is a continuous variable describing the median household income of the county or counties within that voting region.

4. Results

Descriptive counts revealed that the proportion of mean yes votes to be slightly higher in Florida (0.45) compared to the eastern US (0.38) and this increased for observations located in southern states (Table 3). The percent of registered voters was also slightly higher in Florida (64%) compared to the eastern US (51%) and the percent of the total population casting a ballot in the voting district (52% and 41% respectively). Conversely, the percent who voted for a democratic president in the last general election—a proxy for registered democrat (e.g., Kahn and Matsusaka, 1997)—was higher in the eastern US (45%) compared to Florida (41%). At both sites, the total funds to be raised via

Table 1
Variable descriptions and sources.

Name	Description	Variable	Data Source
Vote	The proportion of yes votes out of the total number of votes cast in a referendum (see Equation 4-1)	Continuous	Trust For Public Land
Year	Year of the election over a 23 year period (1990 to 2013).	Continuous	Trust For Public Land
% Registered	Percent registered voters.	Continuous	Office of Elections
% Population Voted	Percent of total population in region that case a ballot.	Continuous	Office of Elections
% Democrat	Percent of voters who voted for a democratic president in the last general election.	Continuous	Office of Elections
Funds	Max amount of dollar funds to be raised or were raised using a bond or tax (2013 dollars).	Continuous	Trust For Public Land
Tax/household	Max amount of dollar funds to be raised using a tax increase divided by the estimated number of households (containing 2.5 individuals) within the voting jurisdiction.	Continuous	Office of Elections
Bond/household	Max amount of dollar funds to be raised using a bond divided by the estimated number of households (containing 2.5 individuals) within the voting jurisdiction.	Continuous	Office of Elections
Number words	Number words in the referendum.	Continuous	Office of Elections
Number of processes	Number of processes from 0 to 4 including if a time limit, maximum funds, type of purchase and implementer were stated.	Continuous	Office of Elections
Number of benefits	Number of benefits from 0 to 5 including recreation, wildlife habitat, drinking water resources, flood protection, other benefits.	Continuous	Office of Elections
Region eastern[1]	Geographic location of voting jurisdictions in the Eastern US. 1 = south region, 0 = north region	Binary	
Watershed Region[2]	Geographic location of voting jurisdictions within water management districts within the state of Florida. 1 = south region, 0 = north region	Binary	
Funding mechanisim[3]	Proposed payment vehicle stated in the referendum (1 = tax, 0 = bond).	Binary	Office of Elections
Max stated	If the maximum funds to be raised is stated in the referendum (1 = yes, 0 = no).	Binary	Office of Elections
Recreation	If the referendum stated that the program would provide recreational benefits (1 = yes, 0 = no).	Binary	Office of Elections
Drinking water	If the referendum stated that the program would provide/protect drinking water resources (1 = yes, 0 = no).	Binary	Office of Elections
Open space	If the referendum stated that the program would provide open space benefits (1 = yes, 0 = no).	Binary	Office of Elections
Wildlife habitat	If the referendum stated that the program would provide wildlife/fisheries habitat (1 = yes, 0 = no).	Binary	Office of Elections
Flood protection	If the referendum stated that the program would provide flood protection benefits (1 = yes, 0 = no).	Binary	Office of Elections
Income	Median annual household income at the county level.	Continuous	U.S. Census

[1] States in the south include Florida (26), Georgia (2), Louisiana (1), North Carolina (3), South Carolina (3) and Texas (5). States in the north Include: Illinois (3), Maine (4), Michigan (3) Minnesota (2), New Jersey (5), Ohio (14), Pennsylvania (4), and Wisconsin (1).
[2] Jurisdictions in Florida are based on counties located in water management district (WMD) boundaries. WMD's in the north include: Northwest, Suwannee River and St John's River. WMD's in the south include southwest and south.
[3] Payment vehicles include sales and property taxes and general obligation bonds.

a bond was greater than that to be raised via a tax, and total funds raised per household was greater in Florida compared to the eastern US.

The average number of words used in ballot referendum statements was 100.0 (SD = 89.73) in the eastern US, compared to 71.6 (SD = 10.39) in Florida. Each ballot referendum in the eastern US described an average of 1.5 (SD = 1.06) types of benefits and 2.8 (1.13) types of funding mechanisms. In Florida, each ballot referendum described an average of 1.6 (SD = 1.09) types of benefits and 2.6 (SD = 1.23) types of funding mechanisms. Fifteen percent of referenda stated no specific benefits associated with protecting watershed resources.

Most of the watershed protection referendums included in our analysis were conducted at county levels, followed by municipal and state levels (Table 4). Almost all referendums included information about the type of funding mechanisms that would be used (i.e., tax or bond). About half of the ballot referendum statements included a description of the maximum amount of funds to be raised. Watershed benefits most frequently described in the ballot referendum statements included recreation and wildlife habitat. The rather general term "open space" was also frequently used in ballot referendum statements, instead of a more explicit or descriptive characterization of the benefits associated with watershed protection. Few ballot referendum statements described flood protection benefits, and these referendums passed less frequently compared to other referendums.

Our examination of residuals indicated that the weighting procedure improved the regression analysis (i.e., controlled for heteroscedasticity; Gujarati, 1995). The following tables report models containing only coefficients significant at $p < 0.10$. The unweighted and weighted regression models describing voter behavior in the eastern US produced R-squared values of 0.42 and 0.45, respectively (Table 5). The variable accounting for region was statistically significant in both models ($p < 0.1$ and $p < 0.05$). The magnitude of this variable, compared to other coefficients in the model, indicates the importance of spatial variability in voter preferences for ballot statement design. In the eastern model the likelihood of a yes vote was greater in the southern states. In the Florida model the likelihood of a yes vote was greater in the south and southwest water management districts.

In the unweighted model, variable year had a statistically significant ($p < 0.05$) positive effect, indicating that the likelihood of a yes vote increased for referendums held in more recent years. The percent of registered voters also had a statistically significant ($p < 0.01$) positive effect, indicating that the likelihood of a yes vote was higher in districts having greater numbers of registered voters. In the unweighted model, the number of words used in the ballot statement had a significant ($p < 0.05$) and positive effect, indicating that the likelihood of a yes vote increased for referendums containing longer statements. Conversely, in the weighted model, in which observations from smaller districts were controlled, the number of words had a statistically significant ($p < 0.01$) negative effect, indicating that the likelihood of a yes vote increased with shorter ballot referendum statements. The explanatory variables describing funding mechanisms were not statistically significant ($p < 0.10$) in either model. The estimated coefficients for recreation and flood protection were statistically significant, greater in magnitude compared to other coefficients, and negative, indicating that the likelihood of a yes vote was greatly reduced when these specific benefits were described. Income was significant and negative indicating that the likelihood of a yes vote increased as the median household income in counties decreased.

Unweighted and weighted models describing voter behavior in Florida also performed well with R-squared values of 0.59 and 0.69 respectively (Table 6). Similar to the models for the eastern US, the magnitude of the region variable coefficients, compared to other

Table 2
Descriptive statistics of annual household income, population size and number of repeat referendums per 100,000 people within each voting district.

Voting district	n	Annual household income*	SD	Mean population size*	SD	Mean number voted	SD	Mean number of referendums	SD	Mean number of referendums per 100,000 people	SD
State	15	56,460	9,530	6,059,169	4,287,412	2,063,898	1,828,690	2.500	1.167	0.143	0.179
County	49	62,732	15,148	341,566	472,645	174,479	343,331	1.489	0.767	1.070	0.962
Municipality	12	59,318	9,480	796,820	710,839	160,076	183,190	1.860	1.245	0.599	0.579

* Annual household income is the mean of the median values reported for each county associated with each voting district. Data for annual household income and population size were collected from the US Census, 2011.

coefficients in the model, indicates that the factors endogenous to different regions had an important influence on the likelihood of a yes vote. Variables accounting for year ($p < 0.05$), and percent of registered voters($p < 0.05$) had a lesser influence, but were positive indicating that the likelihood of a yes vote increased for referendums held in more recent years, and when more people were registered to vote. Funding scale—or the amount of funds raised per capita ($p < 0.01$)—was also positive indicating that the likelihood of a yes vote increased for more expensive programs. The variable for funding mechanism ($p < 0.10$) was negative indicating a reduced likelihood of a yes vote for referendums that proposed taxes with which to fund watershed protection. The coefficients for variable max stated ($p < 0.05$ and $p < 0.01$) was greater in the unweighted model indicating that the likelihood of a yes vote increased when the maximum level of funds to be raised was stated in the ballot referendum statement. Coefficients for variables describing open space and drinking water, followed by wildlife habitat, were greater in magnitude compared to other coefficients in the model, except max stated, indicating that the likelihood of a yes vote was greatly reduced when these benefits were described. Conversely, open space ($p < 0.01$) had a large positive effect indicating that when this benefit was stated, the likelihood of a yes vote greatly increased.

The Pearson's correlation analysis revealed that the description of the good (i.e., the number of stated benefits and funding mechanisms) had a real effect on choices (Table 7). Using the eastern dataset, we found a small negative correlation between number of funding mechanisms stated and the yes vote, $r(74) = -0.332$, $p < 0.002$, with number of funding mechanisms explaining 11.0% of the variation in the yes vote. For the Florida dataset we found a moderate negative correlation between number of benefits stated and the yes vote, $r(24) = -0.431$, $p < 0.024$, with number of benefits explaining 18.5% of the variation in the yes vote.

5. Discussion

Our results indicate that the quantity and type of information presented in the ballot referendum statement is indeed correlated with voting behaviors, which could help inform the design of the ballot statement. Voter support for watershed protection programs was also found to be increasing throughout the Eastern US, but voter support can vary at the local and regional levels suggesting opportunity for using nudge strategies (Press, 2003). Importantly, the ballot referendums included in our analysis took place in communities where support for conservation was already substantial enough to give rise to, and allow for the frequent passage of, watershed protection ballot referendums. As such, our findings arguably provide greater understanding of communities in which such referendums have taken place, rather than non-referendum communities.

The numbers of words, or lengths of ballot referendum statements were expected to have an important impact on voter behavior, because of the opportunity for voters to experience cognitive fatigue and use heuristic strategies when considering longer statements. The number of words did in fact have a differing effect on voter behavior in the weighted and unweighted models. In the weighted model, we found that voters generally preferred shorter ballot statements. However, in the unweighted model voters preferred a longer ballot statement. The opposite signs between models suggests that the potential for decision fatigue, associated with ballot statement length, may be less in some voting populations. Related research has found wealthier voters tend to have more time and resources to consider their decision outside the ballot box (Aidt, 2000; Lassen 2005; Leduc, 2002). In this case, a lengthy ballot statement could be less of a deterrent to the yes vote. Comparatively, the average uninformed voter may become fatigued when reading a long ballot statement and considering complicated decisions. This fatigue and lack of knowledge could make a voter more risk-averse and more likely to reject the referendum (Bowler and Donovan, 1994).

Table 3
Descriptive statistics of data for continuous variables from the eastern US and Florida.

	Eastern US	Florida								
	N	Mean	Max	Min	Std. dev.	N	Mean	Max	Min	Std. dev.
Vote	76	0.38	1.55	−0.70	0.42	26	0.45	−0.62	1.55	0.42
Referendum Characteristics										
Region	76	0.53	1.00	0.00	0.50	26	0.62	1	0	0.49
Year	76	13.28	24.0	0.00	5.26	26	11.07	17.00	1.00	4.55
% Registered	76	50.88	91.00	11.71	24.65	26	63.69	90.93	13.20	20.60
% Population voted	76	42.21	92.04	2.34	22.59	26	51.64	88.38	13.18	20.74
% Democrat	76	44.72	64.00	18.00	11.28	26	41.39	64.00	18.00	12.96
Total funds (millions)	70	$166	$6010	$0.66	$708	26	$108	$900	$7.59	201
Bonds/household	33	$951.40	$7195	$2.53	$1,733	11	$1920	$7195	$192.35	$2,635
Tax/household	40	$170.12	$1743	$1.05	$483.97	11	$588.94	$1546	$52.11	$557.47
Number words	76	100.09	558	19	89.73	26	71.65	94.00	48.00	10.39
Number benefits	76	1.53	4	0	1.06	26	1.61	4	0	1.09
Number mechanisms	76	2.78	5	0	1.13	26	2.61	5	0	1.23
Income	76	61,068	99,071	44,275	13,519	26	54,970	72,921	44,275	7,679

Table 4
Descriptive statistics for referendum attributes as they relate to the proportion of passing referenda for rural lands to protect water quality in the eastern US and Florida.

	Eastern US	Florida						
			Proportion yes votes			Proportion yes votes		
	N	Proportion passing	Mean	Std. dev.	N	Proportion passing	Mean	Std. dev.
Voting results by level of government								
State	12	91.67	59.64	3.76	2	50.00	62.30	0.00
County	49	81.63	58.27	11.61	19	89.47	60.95	11.21
Municipality	15	100.00	61.85	6.32	5	100.00	58.90	3.83
Total	76	86.84	59.19	9.89	26	88.46	60.66	9.68
Voting results by funding procedure characteristics								
Bond	39	85.45	62.55	8.07	12	100.00	64.10	6.86
Tax	36	90.48	55.52	10.60	13	76.92	57.47	11.37
Max stated	56	88.89	59.54	9.65	15	100.00	63.17	6.70
Voting results by benefit characteristics								
Recreation	44	86.27	58.51	10.12	15	88.24	58.83	9.58
Wildlife habitat	29	80.56	58.81	11.08	12	85.71	58.24	10.40
Open space	28	87.50	61.14	11.49	10	90.91	60.94	10.88
Drinking water	17	85.00	58.20	10.79	7	87.50	58.60	8.90
Flood protection	8	81.00	52.29	11.20	2	66.67	49.63	13.08

The mechanisms used to raise funds were important to voters, particularly in Florida where bonds were a preferred funding mechanism. Throughout the US, bonds are generally preferred as a funding mechanism for securing rural lands (e.g., farm lands, historic sites, watersheds; Kotchen and Powers, 2006). Conceivably, bonds[6] are more often preferred because they generate necessary funding more immediately compared to taxes, and bonds can be associated with a specific program, whereas a tax revenue could take years to accrue in a fund with unspecific future benefits (Kotchen and Powers, 2006). Another reason bonds could be attractive to voters is because the cost of conservation is put on future tax payers and is therefore obscured. When the mechanisms used to raise funds obscures who pays, or the possibility of a free ride, this may in fact enhance the voter's perception that the passage of the referendum will leave them better off. In other studies, free riding or avoiding costs has even been found to occur in cases where people are not strategic or selfish, (Fischbacher and Gachter, 2010). Comparatively, taxes are more often perceived as a direct cost, and at times are less socially preferred (Lowery and Sigelman, 1981; Welch, 1985).

Unlike the broader eastern US, voters in Florida preferred referendums that stated the maximum amount of funds to be raised, and they were willing to support more expensive programs (cost per capita). It is unclear if the ability for Florida to have direct referendums contributed to this preference in the ballot statement, but this behavior does appear consistent with widespread concerns in Florida about rapid changes in land use and loss of ecosystem services. A recent survey of Florida residents ranked the protection of water resources as extremely important, behind the economy and healthcare (Odera and Lamm, 2015). In addition to widespread concern, statements about funding levels could have also prompted Florida voters to make assumptions about how much land will be brought into conservation, or the level of watershed protection (e.g., Kotchen and Powers, 2006). This suggests that in some contexts (e.g., rapid loss of ecosystem services) voters may want confirmation that the amount of funds raised will provide adequate levels of protection or will ensure that expected benefits will be provided.

How watershed protection benefits were described in ballot referendum statements also had an important influence on voting behavior. Voters responded to whether or not benefits and finding mechanisms were stated (see regression analysis) and the total number stated (see Pearson's correlation analysis). Overall, voters' preferred ballot referendums that were less specific or offered fewer descriptions of benefits and processes. Specific benefits such as wildlife habitat and drinking water had an overall strong negative impact on voting outcomes, whereas the absence of this information and the vague description "open space" had a positive impact on voting behaviors. From a psychological perspective, one may assume that voters would be averse to voting yes when the selection is limited. However, this aversion may not be manifested in cases where there are no other program options from which to select from (Heath and Tversky, 1991). Experimental

[6] Buyers of bonds are typically large institutional investors, which can allow conservation costs to be delayed to future taxpayers.

Table 5
Stepwise least squares regression of voting behavior in the eastern United States.

	Unweighted Coef.	Weighted t-stat	(95% CI)	Coef.	t-stat	(95% CI)		
Region eastern	0.404***	4.00	0.202	0.606	0.161**	2.35	0.024	0.299
Year	0.019**	2.25	0.002	0.037	–	–	–	–
% Registered	0.004***	2.65	0.001	0.008	–	–	–	–
% Democrat	–	–	–	–	–	–	–	–
Number words	0.001**	2.38	0.000	0.002	−0.000***	−3.83	−0.000	−0.000
Funding Scale	–	–	–	–	–	–	–	–
Funding Characteristics								
Funding mechanism	–	–	–	–	–	–	–	–
Max stated	–	–	–	–	–	–	–	–
Benefit Characteristics								
Recreation	−0.300***	−3.30	−0.482	−0.118	–	–	–	–
Wildlife habitat	–	–	–	–	–	–	–	–
Open space	–	–	–	–	–	–	–	–
Drinking water	−0.175*	−1.81	−0.370	0.018	−0.082*	−1.64	−0.182	0.017
Flood protection	–	–	–	–	−0.284*	−3.33	−0.454	−0.114
Income	–	–	–	–	−0.000**	−2.09	0.000	0.000
Constant	0.0738	0.24	−0.532	0.680	0.181	0.46	−0.598	0.960
Observations	76				76			
F –stat (df)	4.77 (6)				13.67 (5)			
R-squared	0.42				0.45			

Notes: The dependent variable in all models is vote. One, two, and three asterisks indicate at the level $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.

studies have also shown that choice patterns sometimes conflict with current theoretical and common-sense ideas about the positive effect of added alternatives (Huber and Puto, 1983). The amorphous nature of environmental goods and the utility associated with them (e.g., existence value and other non-use values) likely made a reasoned tradeoff assessment challenging for many voters. Voter's preference for less information suggests that voters prefer to use inductive (i.e., not rational) reasoning strategies to assess outcomes (Arthur, 1994). In low information contexts a simple statement may also appear less constrained and voters may assume they would likely be better off if the referendum passed.

Support for watershed protection was also found to have increased in more recent years. This is in agreement with numerous environmental valuation studies (e.g., contingent valuation) which provides an alternative source of data to assess trends in demand for conservation. A meta-analysis study of willingness-to-pay (WTP) estimates found respondents in the southern US are willing to pay more in more recent years to improve the condition of impaired water bodies (Johnston et al., 2003). Likewise, another meta-analysis study of WTP estimates found that, over a 34 year time period, respondents throughout the US were willing to pay increasingly more to protect clean water benefits

Table 7
Pearson's correlation of the yes vote with variables describing the number of benefits and funding mechanisms stated in referendums for protecting rural lands.

	Eastern US			Florida		
Variable	r	P-value	%	r	P-value	%
Number of benefits	−0.189	0.092	3.5	−0.431	0.024	18.5
Number of funding mechanisms	−0.332	0.002	11.0	−0.194	0.330	3.7
df	*74*			*24*		

Table 6
Stepwise least squares regression of voting behavior in Florida.

	Unweighted				Weighted			
	Coef.	t-stat	(95% CI)		Coef.	t-stat	(95% CI)	
Watershed Region	–	–	–	–	0.245**	2.13	−0.003	0.494
Year	0.079***	3.77	0.034	0.124	0.047**	2.58	0.007	0.087
% Registered[1]	–	–	–	–	0.003	1.64	−0.001	0.008
% Democrat	–	–	–	–	–	–	–	–
Number words	–	–	–	–	–	–	–	–
Funding scale	–	–	–	–	0.000**	2.39	0.000	0.000
Funding Characteristics								
Funding mechanism	−0.254*	−1.82	−0.554	0.045	–	–	–	–
Max stated	0.421**	2.38	0.042	0.800	0.003***	2.89	0.085	0.587
Benefit Characteristics								
Recreation	–	–	–	–	–	–	–	–
Wildlife habitat	−0.389**	−2.39	−0.738	−0.039	−0.261**	−2.53	−0.484	−0.038
Open space	0.567***	3.16	0.182	0.952	0.488***	4.24	0.239	0.737
Drinking water	−0.560***	−2.62	−1.019	−0.101	−0.419**	−2.38	−0.800	−0.038
Flood protection	–	–	–	–	–	–	–	–
Income	–	–	–	–	–	–	–	–
Constant	−0.344	−1.22	−0.949	0.259	−0.611	−2.04	−1.25	0.036
Observations	26				26			
F –stat (df)	2.89 (7)				9.60 (8)			
R-squared	0.59				0.69			

Notes: The dependent variable in all models is vote. One, two, and three asterisks indicate at the level $p < 0.10$, $p < 0.05$, $p < 0.01$, respectively.

(Kreye et al., 2014). Spatial differences in voter behavior (i.e., greater support in the southern states and southern water management districts in Florida) is indicative of variation in voter preferences for conservation. As such, practitioners may benefit from customizing the design of ballot referendum statements to better reflect the concerns or expectations of the voting population (e.g., level of funding).

Finally, the descriptive statistics in Table 2 suggests that referendums occurred more often in small, wealthy populations (Freudenberg and Steinsapir, 1991; Heintzelman et al., 2013; Leighley and Nagler, 2013). Unfortunately, the voting actions of select communities can be a concern for larger conservation efforts, because they can further entrench a municipality-based institutional structure for conserving rural lands and limit possibilities for supporting conservation reform at the regional or state level (Howell-Moroney, 2004). We expect demand for conservation does likely exist in poorer communities, and there is a need to protect environmental quality in these districts as well. For example, the weighted model found voter support was higher in the few poorer counties sampled in Florida, which may be due to factors such as public resistance towards rapid changes in environmental quality. Poorer counties likely want to use land conservation (e.g., easements) to stop the rapid conversion of natural areas into more developed landscapes (i.e., Florida districts; Banzhaf et al., 2010; Kroetz et al., 2014). Further research into environmental context, and the role of voter attitudes and subjective norms in voting behaviors may offer new ways of encouraging voter support in less wealthy communities (Maloney et al., 2013).

6. Conclusions

Our examination of the voting outcomes from 76 watershed protection referendums held in the eastern US and Florida expands existing literature by examining the role of the ballot referendum statement in influencing voter behaviors. Our findings are conceivably of interest to conservation advocates interested in understanding voting behavior to help promote conservation efforts. We found evidence that voting on rural land referendums may at times be more like a gambling exercise that is influenced by unconscious psychological processes. This is based on our findings that voters responded more positively to short and less specific (or more vaguely worded) ballot statements, along with funding mechanisms that potentially obscures who pays. This approach is not unreasonable as the direct costs and benefits of watershed protection may not be well understood by voters. Voters may instead prefer, or are nudged by ballot statements that require less cognitive effort and support simpler inductive reasoning strategies.

We found that overall voter demand for watershed protection occurs more often in smaller, wealthy populations. However, the weighted model found evidence that some poorer communities in Florida were also interested in rural land conservation. This is in agreement with contingent valuation studies that have found public demand for watershed protection is generally widespread. If so, there is reason to consider the importance of designing ballot statements that nudge voters to support the more equitable provision of watershed protection, or at least that ballot statement design doesn't impair voters with limited cognitive resources. Spatial variation in voting behaviors also suggests ballot statement design may affect voters differently in different areas. We advise practitioners to be aware of this potential variation at the local and state level when seeking to inform ballot design.

The limitations of this study include a lack of data about voter demographics and other voting decisions that voters may have made at the time of the watershed referendum (i.e., contextual effects). Voters who have to make a lot of decisions or have a limited tolerance for items such as referendums (which can increase taxpayer costs) may have responded differently to the same choice if it was offered on a different day. Another limitation of this study was the use of linear modeling, commonly used in social science and voter studies, which may obscure important interactions between causal factors (e.g., between benefits and funding mechanisms) by assessing only the joint impact of specified independent variables (Achen, 1992). Also, not well understood in this study are the importance of the ballot referendum statements relative to factors outside of the voting booth that also influence voting behaviors (e.g., social psychology, Maloney et al., 2013). Future research using laboratory experiments may help advance our understanding of ballot design and voter behavior. Because of the high number of referendums occurring in Florida and Ohio, future research should also examine the role of the direct initiative process on the frequency and passage of rural land conservation referendums.

The implications of this research on assessing public choice through voter behavior are significant. Our findings suggest that voter data is well suited for describing broad demand for conserved lands within wealthier communities, but frequently fails to identify demand in less wealthy communities or provide direction on how conserved land should be managed to provide expected benefits. Notable, the strategies that uninformed voters tend to use, as a way of securing the most favorable outcome, may also obscure the evidence of what preferences may be driving voting behaviors. Stated preference methods have the potential to gather more targeted information about how conservation benefits produce changes in social welfare, however, this strategy is often criticized because the data collected is not based on actual spending or voting behaviors. Improvements in stated preference methods, such as validation procedures, non-linear choice modeling and psychometrics, continue to be needed.

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