Analysis of Voter Preferences and Willingness to Pay for Clean Water Resources in the Eastern US

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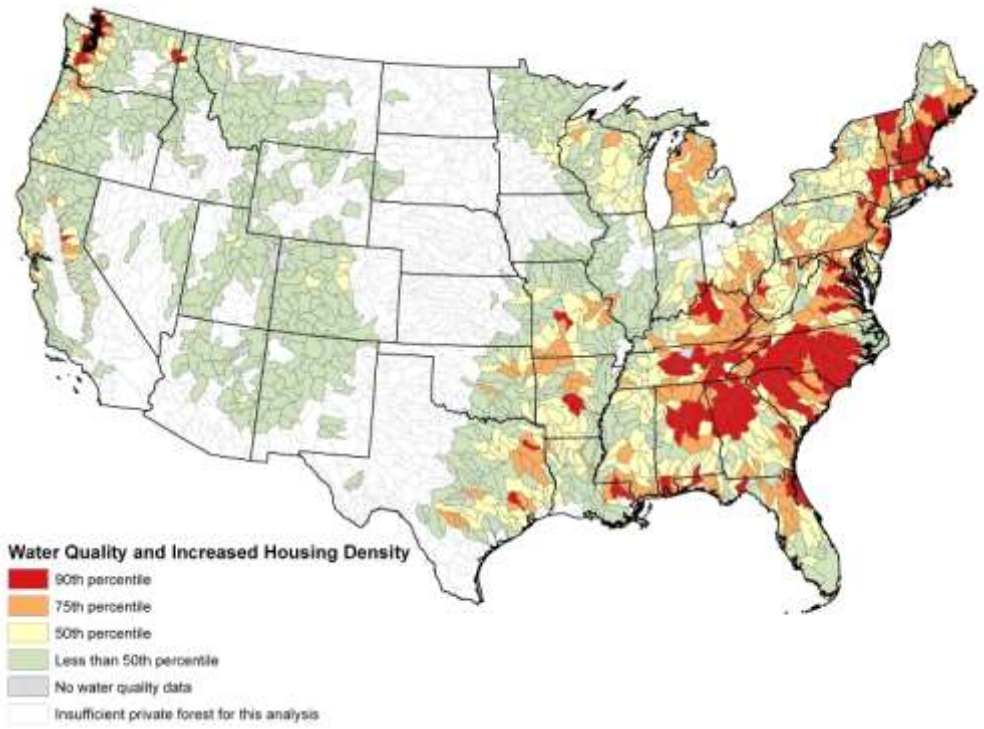
SFRC School of FOREST RESOURCES & CONSERVATION

UF UNIVERSITY of FLORIDA IFAS

CFEOR Conserved Forest Ecosystems Outreach and Research

Reduced forestland threatens water resources



Watersheds by potential for changes in water quality as a result of projected increases in housing density on private forest lands

Source: www.fs.fed.us

Forest ecosystems provide up to 80% of freshwater water resources

Ecosystem Services

<u>Supporting Service</u>
Uptake and filtration of nutrients

<u>Provisioning Service</u>
Water yield

<u>Regulating Service</u>
Clean water

<u>Cultural Services</u>
Spiritual
Aesthetics

Benefits to Humans

Water supply
Recreation
Transportation
Fisheries
Flood control
Option value
Existence value
Bequest Value
Education

Adapted from: Millennium Ecosystem Assessment., 2005. Ecosystems and human well-being. A framework for assessment. Washington DC: Island Press.

Government efforts to protect rural lands

- Zoning regulations
- Taxes on development (i.e., stamp tax)
- Conservation easements
- Public acquisition of undeveloped land

Often authorized through ballot initiatives

Over 2,400 initiatives since 1998

Trust for Public Land https://tpl.quickbase.com

Why examine voting behaviors?

- Advantages
  - Public preferences may be inferred from examining actual voting behaviors
  - May help inform decision-making under the ES framework
- Challenges
  - Individual preferences cannot be linked with voting behavior.

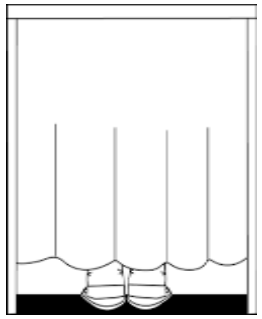
Factors that Impact Voting Behavior

Outside the voting booth

- Voter/population characteristics
- Changes in environmental conditions
- Dominate industry
- Type/level of activism

Inside the voting booth

- Information in ballot summary
  - Proposed benefits
  - Implementation processes
  - Payment vehicle
  - Scale of conservation effort
- Presentation
  - Word order
  - Length



Psychology of Voting Behavior

Rational Choice Theory

- People are more likely to choose options that provide a high level of utility or satisfaction.

Heuristic Strategies

- People often rely on previously established attitudes and beliefs to inform choice behaviors rather than consider new information.
  - Decision-making short cut

Decision and Game theory

- People are generally adverse to accepting ambiguous options except:
  - When prospects are examined in isolation
  - When they think they know the odds of a favorable outcome

Study Objective

To understand public preferences for a forest-water protection program identify factors that impact voter behaviors.

H1: Voting behaviors vary across time and geographic location.

H2: The type of information presented in a ballot summary impacts voting behaviors.

H3: The quantity of information presented in a ballot summary impacts voting behaviors.

Data Collection

- Data Sources
  - Trust for Public Land Database
  - Local elections offices
  - US Census (2011)
- 103 referendums 1991-2013
  - Watershed protection
- 76 included in final dataset
  - 65 jurisdictions
  - 28% between 2010-2013

Data Collection

- Voter Characteristics
  - Percent registered
  - Percent democrat
  - Percent ballots cast
- County Characteristics
  - Average age
  - Median household income
  - Race
  - Education
  - Population density

- Referendum Characteristics
  - Year of referendum
  - State/county/local
  - Proportion of yes votes
  - Number of words
  - Implementation processes
    - Purchase land/conservation easement
    - Implementing organization
    - Funding mechanism (bond/tax)
    - Maximum funds raised
  - Proposed benefits
    - Open space
    - Recreation
    - Drinking water
    - Wildlife habitat
    - Flood protection

Data Collection

Table 1. Descriptive statistics of continuous data variables from the Eastern US and Florida.

	Eastern US					Florida				
	N	Mean	Max	Min	Std. dev.	N	Mean	Max	Min	Std. dev.
States	14					1				
Yes vote	**76**	**0.38**	1.55	-0.70	0.42	**26**	**0.45**	-0.62	1.55	0.42
Referendum Characteristics										
South 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
% Democrat	76	44.72	64.00	18.00	11.28	26	41.39	64.00	18.00	12.96
Funds (millions)	70	$166	6010	0.66	708	26	$108	900	7.59	201
Funds/household	70	**$231.93**	2,878	0.42	404.20	26	**$374.37**	2,878	20.85	595.19
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 processes	76	**2.78**	5	0	1.13	26	**2.61**	5	0	1.23

Data Collection

Table 2. 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	**15**	100.00	61.85	6.32	2	50.00	62.30	0.00
County	**49**	81.63	58.27	11.61	19	89.47	60.95	11.21
Local	**12**	91.67	59.64	3.75	1	100.00	58.90	3.83
Total	**76**	86.84	59.19	9.89	26	88.46	60.66	9.68
Voting results by referendum process 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
Purchase	47	85.45	57.62	9.93	19	89.47	59.29	9.99
Implementer	29	85.29	57.28	9.83	7	85.71	56.98	8.70

Data Analysis

- Least squares regression (weighted and unweighted)
  - Identify factors that impact the likelihood of a yes vote

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

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

Y_i value of the outcome variable for observation i
β_0 constant term
β_1 fixed effect coefficient
x_i dependent variable

Ordinary least squares regression

$$Y_i = \beta_0 + \beta_1 x_i \ldots . \beta_n x_{ni} + \varepsilon_i$$

Weighted least squares regression

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

Regression Analysis Results

Eastern US

- Likelihood of yes vote increased:
  - In the south*
  - In more recent years**
  - With more registered voters*
  - As median household income decreases**
- Likelihood of yes vote decreased:
  - Drinking water***
  - Recreation*
  - Flood protection ***

(n= 72, R^2= 0.42, 0.45)

Florida

- Likelihood of yes vote increased:
  - In the south**
  - In more recent years*
  - For bond issues***
  - When max funds is stated**
  - As max funds increased**
  - For open space*
- Likelihood of yes vote decreased:
  - Drinking water*
  - Wildlife habitat**

(n= 26, R^2= 0.59, 0.69)

* P<0.01, ** p<0.05,
***p<0.10

Data Analysis

- Pairwise correlation
  - Examine correlations between sets of continuous variables
  - Measure impact of number of coded items on likelihood of a yes vote

$$r_{xy} = \frac{\operatorname{cov}(x, y)}{\sqrt{\operatorname{var}(x)} \cdot \sqrt{\operatorname{var}(y)}}$$

$r_{x,y}$ sample correlation coefficient between x and y
cov (x,y) is the sample covariance of x and y
var (x) is the sample variance of x
var (y) is the sample variance of y

Pairwise Correlation Analysis Results

Eastern US (n=72)

- Likelihood of yes vote increases:
  - As number of benefits decreases***
  - As number of processes decreases*

Florida (n=25)

- Likelihood of yes vote increases:
  - As number of benefits decreases**

* P<0.01, ** p<0.05, ***p<0.10

Results/Discussion

ACCEPT- H1: Voting behaviors vary across time and space.

- Voter demand for clean water benefits is continually increasing, especially in the south and in poorer counties.
- Voters in Florida are willing to pay the most for clean water benefits

ACCEPT- H2: Information impacts voting behaviors.

- Prefer ballots that are vague or less descriptive
  - Assume benefits may only apply in certain areas
  - Assume benefits may have substitutes available

Results/Discussion

ACCEPT-H3: Quantity of information impacts voting behaviors.

- People tend to vote for ballot summaries that are shorter
  - Cognitive fatigue
  - Positive assumptions (e.g., less risk averse)

Conclusions

- There is large voter support for forest-water protection programs, especially in Florida.
- It is difficult to determine important tradeoffs for specific benefits.
  - Preference for shorter referendums
  - Free rider effect
  - Self selected voters

Thank you

- Florida Forest Service
- U.S. Forest Service
- Conserved Forest Ecosystems: Outreach and Research
- University of Florida/School of Forest Resources and Conservation