Valuing forest conservation and water quality protection programs: A meta-analysis of willingness-to-pay scenarios

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INTRODUCTION

Florida's forested Ecosystems are highly effective in protecting water quality by reducing nutrient loading, however, information about the economic benefits and ecosystem services associated with preserving forested areas is frequently lacking.

Objectives:

1. **Use a meta-analysis approach to estimate the public's willingness-to-pay (WTP) for water resource protection and related forest conservation programs.**
2. **Conduct a benefit transfer of WTP values by applying the model to households within the lower Suwannee River watershed in Florida, USA.**

METHOD

Data Collection

Meta-analysis was comprised of 18 studies (43 observations) that met following criteria:

- Valued in-stream fresh water resources considered to be relatively unpolluted.
- Estimated WTP using contingent valuation methods

Selected Variable Categories

- ***Survey*** method (open ended, dichotomous choice, payment card, attribute based)
- ***Year*** study was conducted (1970-2010)
- Median household ***income*** *(county level)*
- Geographic ***region*** of the USA (South, West, Northeast, Midwest)
- Type of aquatic ***resource*** (river, lake, wetland, all resources combined)
- ***Scope*** of the program (single site, drainage basin, statewide)
- ***Program*** implementation (acquisition/easement, program not stated)

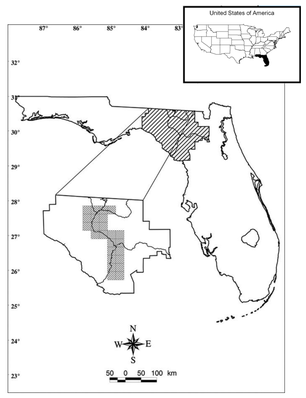
Econometric Model

Stepwise Multiple Regression model:

$$LnWTP = B_0 + B_1\ Survey \pm B_2\ Index \pm B_3\ Weighting \pm B_4\ Income \pm B_5\ Region \pm B_6\ Resource \pm B_7\ Scope \pm B_8\ Program + \cdots + \varepsilon$$

Equation 1.

Indicators within each variable category were hierarchically compared against a corresponding reference indicator to calculate a regression coefficient. A coefficient was not calculated for reference indicators.



Study Site

A benefit transfer of values was applied to households within the drainage basin of the lower Suwannee River by adjusting attributes of the model (Fig. 1.) .

Figure 1. The lower Suwannee River watershed located in North Florida, USA.

RESULTS

The two functional forms of our econometric model performed well and parameter estimates revealed several important drivers of WTP for water quality protection programs (Table 1.)

Table 1. Estimated multiple regression model of water protection valuation function (dependent variable is natural log of annual value per individual).

Variable Category	Indicator	Semi log [A] (SE)	Double log [B] (SE)
Study variables			
Intercept			-44.204* (6.277)
Survey Method (reference)	All other		
Survey Method	Open ended	-0.5922* (0.220)	
Year	Year index	0.0862* (0.012)	0.0943* (0.010)
Weighting	Response rate	0.7909 (0.406)	0.975* (0.421)
Site variables			
Median household income	Income	4.686-05* (0.000)	
Natural log of income	Ln income		4.151* (0.561)
Region (reference)	All other		
Region	South	-0.5077* (0.244)	
Resource (reference)	All other		1.125* (0.219)
Resource	Stream	-1.0512* (0.221)	
Scope (reference)	State wide		
Scope	Drainage basin	0.6910* (0.320)	0.800* (0.346)
Scope	Specific site	-1.3459* (0.426)	-1.370* (0.445)
Program (reference)	Not stated		
Program	Acquisition	-2.9562* (0.218)	-3.004* (0.216)
n		43	43
R^2 (adjusted)		0.98	0.85
F-statistic (degrees of freedom)		242.17* (9)	29.94 (7)

[A] Where the dependent variable is the natural log of WTP and independent variables are linear.

[B] Where WTP and Income are natural log and remaining independent variables are linear.

* Significantly different from zero at the 5% level.

Discussion

Respondents were willing-to-pay:

- more each year to protect water quality.
- slightly less to protect water quality in the Southeast compared to other regions.
- slightly more to protect lakes, wetlands and all water resources combined compared to just rivers and streams.

Discussion Continued…

Respondents were willing-to-pay:

- the most for programs that target resources within their own local drainage basin.
- less for programs that propose the use of land acquisition or conservation easements compared to programs that do not state how the program would be implemented.

BENEFIT TRANSFER

Attributes of the model were adjusted to transfer benefit values (Fig. 2.).

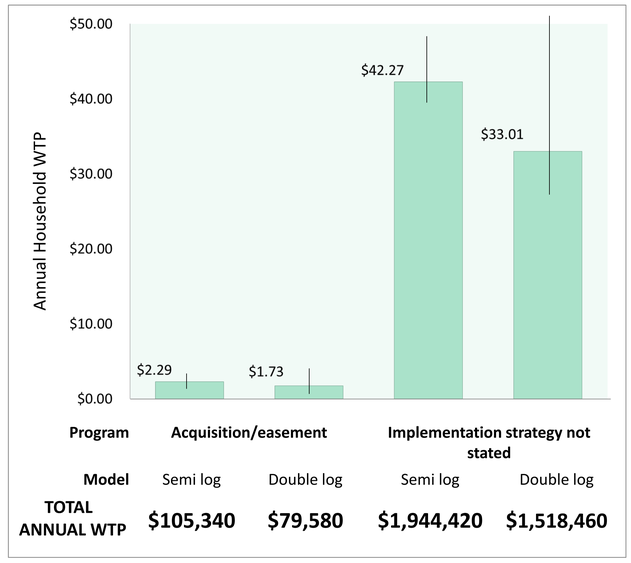


Figure 2. Columns represent annual household WTP values (2010 dollars) for programs that use land acquisition and conservation/easements compared to programs that do not state implementation strategies. Bars on columns represent 95% confidence intervals. Total WTP, based on population (46,000), is calculated at the bottom of each column. All values are estimates for the lower Suwannee River watershed located in the northwest region of Florida, USA (Median annual household income = $35,371).

CONCLUSIONS

WTP has increased over time suggesting a growing demand to protect relatively unpolluted water resources.

WTP decreases when the program proposes the use of land acquisition or conservation easements.

Researchers should consider the possibility that certain program implementation strategies may not be utility neutral and recognize the potential consequences of suppressing related preferences in welfare analysis.

Total WTP to protect the lower Suwannee River watershed illustrates the substantial value individuals place on forest conservation and protecting water quality.

Key References:
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