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## From Water Quality to Riparian Corridors: Assessing Willingness to Pay for Conservation Easements Using the Contingent Valuation Method

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## From Water Quality to Riparian Corridors: Assessing Willingness to Pay for Conservation Easements Using the Contingent Valuation Method

### Abstract

This article reports a survey to elicit public response to a proposal to fund a purchase of a conservation easements program to protect an environmentally sensitive riparian corridor. The results from two versions of the contingent valuation method (CVM)--a payment card and a referendum--reveal that mean household willingness to pay (WTP) is \$16.80 and \$29.16, respectively. Factors influencing WTP include proposed cost, age of respondent, and individual sense of local environmental priorities. This type of study represents an important opportunity for Extension educators to assist local officials as they struggle to make policy decisions regarding a variety of public projects.

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## Introduction

Streams and the lands adjacent to them are often referred to as "riparian corridors." Over the past decade, many people involved in improving water quality of streams and lakes have come to realize that preservation of the entire riparian corridor is often necessary to achieving environmental objectives, including preservation of wildlife habitat (Conway, Godwin, Cloughesy, & Nierenberg, 2003). This is a departure from previously held views that simply avoiding contamination of the water itself would be sufficient to meet these goals.

Over the past decade, numerous advocacy groups have emerged across the country to attempt to protect entire sections of streams (especially rivers), the corridors that contain them, and even entire watersheds. Many of these groups have aligned themselves with agencies that they believe share basic objectives concerning environmental quality.

One such group, Grand River Partners, joined with officials in the Trumbull County (Ohio) Health Department to request the assistance of Ohio State University Extension to conduct a survey of residents living in the upper portion of the Grand River watershed. The purpose of the survey was to determine residents' attitudes toward protecting water quality and preserving sensitive lands in the watershed, particularly those lands adjacent to the river itself or to tributaries that lead to the river.

The Grand River watershed offers an interesting setting for a study of this type because it features some unique characteristics. Because the landscape in the river's corridor is quite rugged, it offers numerous scenic views not typical in the region. But as a result of this terrain, lands adjacent to the river and some of its tributaries are quite sensitive. These lands also provide habitat for flora

and fauna that are well adapted to the local environment. Finally, as a major tributary to Lake Erie, the Grand River plays an important role in determining the water quality of the Lake.

## **Conservation Easements**

One of the tools that has emerged to preserve lands of all types is the conservation easement (Blaine, Lichtkoppler, & Stanbro, 2003; Schear & Blaine, 1998; Daniels & Bowers, 1997). A conservation easement amounts to a deed restriction on a land parcel, usually in perpetuity, that prevents or forbids most types of development from taking place on the parcel. These programs are typically voluntary on the part of the landowner, who maintains all other rights and responsibilities of ownership—including the obligation of payment of taxes and the right to occupy, lease, or sell the land.

Placing a conservation easement on a land parcel typically causes a significant reduction in the land's value, because its potential use becomes limited. Conservation easements are often donated by landowners who wish to have their land preserved. In this case, the landowner may achieve significant reduction or even elimination of federal and state income taxes for a number of years, because donation of the easement is regarded as a charitable contribution. In other cases, landowners may sell conservation easements on their property. Because land preservation has important benefits to society, (ranging from preservation of wildlife habitat to maintaining water quality and scenic beauty) often tax revenues are used to compensate the landowner through the purchase of the conservation easement.

Different communities use different means of generating tax revenues to fund purchase of conservation easement programs. Pennsylvania has a 2-cent per pack excise tax on cigarettes to assist in funding, while Maryland has a real estate transfer tax for this purpose. In November of 2000, Ohio voters passed a constitutional amendment authorizing the sale of \$400 million dollars in bonds for land use programs. This became known as the "Clean Ohio Fund." A total of \$200 million is allowed to go into financing brownfield rehabilitation (cleaning up old industrial sites), and \$200 million is targeted for green space preservation. A portion of the green space funding may be used to purchase conservation easements, the legality of which was passed into law in 1998.

Since the passage of the Clean Ohio Fund, members of communities throughout Ohio have been interested to know whether residents in their area would be willing to generate local funds to help secure matching funds from "Clean Ohio" to finance a variety of environmental programs. Several of these have included conservation easements.

## **Contingent Valuation Method (CVM)**

Economists have long been aware that there are a number of items which, although not typically bought and sold in markets, have value to people nonetheless. These non-market goods (or public goods) range from national defense to environmental quality. They include items like police and fire protection, scenic beauty, and many kinds of research and development. But providing these items to the public requires some kind of commitment of resources (e.g., money). How much should government spend on these items? How much are they worth? These are the questions that non-market valuation methods have been designed to address (King & Mazzotta, 2005).

One of the key non-market methods economists have used to measure public attitudes about the value of environmental goods/amenities is the contingent valuation method (CVM) (Blaine, Lichtkoppler, & Stanbro, 2003; Carson, Wright, Carson, Alberini, & Flores, 1994). In recent decades, CVM has achieved a substantial amount of credibility not only among economists, but also in the eyes of public officials who are eager to learn about their constituents' opinions regarding various initiatives.

CVM is especially appropriate for use in evaluating funding options for conservation easement programs because, although these programs have become very popular and widely discussed, the question as to "who pays" for them has yet to be answered in any consistent way. This is all the more important in an era of tight government budgets when local governments are being required to provide larger portions of funding for all types of programs than in previous years.

The study described here involves the application of CVM to determining residents' attitudes toward the Grand River watershed in general and their willingness to support and fund the creation of a purchase of conservation easement program in particular.

## **Survey Design and Method**

In following methods outlined by Dillman (1978), we obtained a mail list of 1,000 residents of the upper Grand River Watershed, an area that includes portions of Geauga, Ashtabula, Portage, and Trumbull Counties in northeast Ohio. Initially we sent a post card to each respondent stating that a survey concerning the Grand River would be arriving soon and requesting his or her participation. We received 82 returns stating the cards were undeliverable, and we replaced these with an additional 82. The final number of deliverable mailings was 988. This constituted our sample.

The mail survey we sent included a cover letter, again asking for participation. We received a total

of 188 usable surveys by the end of the time period we had detailed in the letter. We then sent out reminder cards to non-respondents, and in the following 3 weeks received another 42 completed surveys, bringing our total number to 230. This constituted a response rate of 24%.

One of the key questions that emerges in survey research is whether the people who never responded differ in their views from those who did. This problem is referred to as "non-response bias," and it may be especially suspected in a survey like this, where the response rate is relatively low. This topic has a long history of receiving considerable attention in this journal (Wiseman, 2003). Researchers have developed two primary methods for determining whether or not non-response bias is present in a given survey.

One approach involves statistical tests between "early" respondents and those who responded only after repeated follow-ups (referred to as "late" respondents). Research has shown that late respondents are more like non-respondents than early respondents are (Miller & Smith, 1983). So if non-response rate in a survey is a problem, it is quite likely that statistical differences between early and late responses will be observed. In order to test for this, we conducted a series of statistical tests comparing early and late respondents. Since we found no statistical difference between these groups (at  $p < .05$ ), we concluded that non-response bias is not likely to be a problem in this study, despite the relatively low response rate.

A second approach is to compare key demographic variables (gender, age, and income) from the sample with those of the population as a whole (Ohio Department of Development, 2003). The distributions of these variables for both groups are presented in Appendix A. A series of F tests reveal that the distributions do not differ statistically ( $p < .05$ ) for any of the three variables, serving as another indicator that non-response bias is likely absent from the results.

## Results

Respondents were presented with a series of 13 environmental objectives and asked to rate each on a partially anchored Likert scale, ranging from 1 (lowest priority) to 5 (highest priority). The results, including means, are presented in Table 1 in descending order of respondents' priorities. They show that, in general, respondents believe that all of these objectives are relatively important. However, it is obvious that a few stand out. These include: improving water quality by protecting local streams and rivers as well as Lake Erie, restoring and protecting streamside wildlife habitat, increasing monitoring and enforcement of existing environmental laws, preserving green space, and providing environmental education for youth. Wetland protection and erosion reduction received the lowest priority scores.

**Table 1.**  
Environmental Priorities as Ranked by Survey Respondents (Percentages may not sum to 100 due to rounding.)

	Lowest Priority				High Priority
	1	2	3	4	5
Improve water quality in our local streams and river (mean = 4.28)	2	3	16	22	57
Improve Lake Erie water quality (mean = 4.25)	3	4	14	26	54
Local stream protection (mean = 4.06)	3	3	19	34	41
Restore and protect streamside wildlife habitat (mean = 4.03)	6	4	17	26	47
Increase monitoring and enforcement of existing laws to prevent damage to natural resources. (mean = 4.00)	5	5	21	23	46
Preserve green space/natural areas					

(mean = 4.00)	3	7	20	26	44
Provide environmental education for youth (mean = 4.00)	3	6	19	31	40
Reduce the impact of residential development on local water quality (mean = 3.97)	4	6	18	33	39
Help elected officials understand the significance of water quality issues (mean = 3.92)	7	5	20	25	43
Provide environmental education for adults (mean = 3.85)	4	8	24	27	37
Improve storm water management (mean = 3.83)	3	6	28	31	32
Reduce local stream bank erosion (mean = 3.74)	5	8	27	28	32
Local wetland protection (mean = 3.53)	9	12	26	25	29

## Contingent Valuation Results

Respondents were given a description of a conservation easement (see Appendix B) and then asked how they felt about the use of this tool to help preserve lands within the Grand River watershed. The results are presented in Table 2.

**Table 2.**  
Support for Conservation Easements Program

Strongly Support	21%
Support	46%
Indifferent	19%
Oppose	10%
Strongly Oppose	4%

These results are quite similar to those found throughout Ohio--roughly two-thirds of residents support the creation of the purchase of conservation easements program. Approximately one in five have no opinion, and opposition is around 14%.

Next, we divided the sample in order to elicit measures of willingness to pay (WTP) to fund the purchase of conservation easements program. In the contingent valuation method (CVM) the two simplest, most straightforward ways of obtaining these measures are called "payment card" and "referendum." In the payment card technique, each respondent is presented with the full range of

potential payment amounts and asked to circle his or her maximum willingness to pay for the program. In the referendum technique, each respondent is only presented with one amount from the overall range and asked to vote "yes" or "no."

Each method has its own advantages and disadvantages. Because neither has been shown to be unambiguously superior to the other, we decided to use each one in this study. Half of the sample received payment cards, while the other half received the referendum. The offer amounts ranged from \$1 to \$5 per household per month in \$1 increments. A place was also included on the payment card version for a payment of zero. Respondents who received a referendum were randomly assigned one of the values from \$1 to \$5. In all other respects there were no differences between the design of the payment card survey and the referendum. Tables 3 and 4 reveal the results.

**Table 3.**  
Payment Card Results on Willingness to Pay (WTP)

<b>Offer Amount</b>	<b>Cumulative Percentage of Respondents Willing to Pay</b>
\$1.00	59%
\$2.00	41%
\$3.00	21%
\$4.00	11%
\$5.00	8%

These results show that a total of 59% of respondents were willing to pay at least \$1 per household per month to fund the purchase of conservation easements program in the Grand River watershed. Roughly one in five would pay at least \$3 per month, and 10% would pay between \$4 and \$5. Based on these statistics, the mean (average) household willingness to pay obtained from the payment card is \$1.40 per month, or \$16.80 per year.

**Table 4.**  
Referendum Results on Willingness to Pay

<b>Offer Amount</b>	<b>Percent Voting "Yes"</b>
\$1.00	68%
\$2.00	80%
\$3.00	18%
\$4.00	36%
\$5.00	41%

Note that while the payment card had shown that the amount offered needed to decline to \$1.00 per month in order to gain majority support, the referendum shows that a majority supports up to \$2.00. Support falls below majority beyond that point. Based on these statistics, we get an average (mean) household willingness to pay of \$2.43 per month, or \$29.16 per year.

## A Profile of Willingness to Pay

We wished to utilize a statistical procedure to determine what if any factors that we could identify might explain or predict respondents' willingness to pay more (or less) for the conservation easements program. This kind of investigation is critical to understanding residents' views and is a mainstay of contingent valuation method (CVM). For example, why do only 18% of respondents vote yes on a referendum at \$3.00, but over 40% vote yes at \$5.00? We expect willingness to vote yes to decline as the cost goes up, and in general it does, but it is likely that other factors besides the offer amount are influencing respondents' answers. Identifying and measuring the impacts of these influences is an important component of CVM.

We used a multiple regression procedure to estimate these influences. Regression generates an equation to measure the extent to which a variable, called the "dependent variable," is influenced by a set of other variables, called "independent variables."

For the payment card, the regression of choice is ordinary least squares (OLS). We specified willingness to pay as the dependent variable and regressed it against a set of attitudinal and socio-demographic variables obtained from the survey. In order to measure attitudes, we took a mean score (average) of the 13 variables that respondents evaluated in Table 1. We took this as a measure of how important local environmental topics were to the respondent. We added gender and age of respondent along with household income as independent variables as well. Table 5 shows the initial multiple regression results for willingness to pay (WTP) obtained from the payment card.

**Table 5.**  
Payment Card Regression Results (First Run)  
Dependent Variable - Willingness to Pay

Independent Variable	Parameter Estimate	t statistic
Age	-.148	-1.54
Gender	-.332	-1.15
Income	-.086	0.74
Environment	.601	3.98**
** denotes statistically significant at 99% level of confidence		

These results show that only one of the four independent variables listed has a significant influence on WTP. That variable is the mean score on the 13 attitudinal variables presented in Table 1. For every one-unit increase, a respondent scores on the 1-5 scale he or she is willing to pay an additional 60 cents per month on the program.

The only other parameter that is close to significance is the one on age. Because age is often related to income, a confounding influence among these variables can influence regression results. So in a second step we discarded the income variable, along with gender, and re-ran the procedure. Table 6 features the results of that equation.

**Table 6.**  
Payment Card Regression Results (Second Run)  
Dependent Variable - Willingness to Pay

Independent Variable	Parameter Estimate	t statistic
Age	-.20	-2.12*
Environment	.59	4.14**
** denotes statistically significant at the 99% level of confidence		

\* 95% level

This new equation shows that indeed age is a significant factor in influencing the WTP of residents. Specifically every one-unit increase in age (10 years) causes WTP to fall by 20 cents per month. So older respondents are less willing to fund the conservation easements program. This result, along with the one on attitudes, is highly typical of CVM studies.

Often, however, we are able to identify other factors influencing willingness to pay, including income and gender. In the first run, the parameter estimate on gender indicated that women were willing to pay 33 cents more per month than male respondents. This is typical; however, in this case the result was not statistically significant. This means that there was sufficient variation among female respondents (and among males) that we cannot conclude that there is difference between the two when holding other factors constant in this particular study.

The same can be said for income. As expected, we have an association between income and age. We tried a number of techniques in combining the influence of these variables to identify specific interactions between the two in determining WTP, but none produced an improvement over the results in the second run of the regression. So we conclude that in this sample, among the socio-demographic variables, it is age and not income or gender that is driving individual WTP.

For the referendum portion of the sample, because of the limited nature of the dependent variable (yes/no) we used a logistic regression procedure to measure the extent to which variables influenced respondents' decisions. In addition to age, income, gender, and the environmental attitude variable, this regression included the offer amount (\$1 to \$5) as an independent variable. Table 7 reveals the results.

**Table 7.**  
Referendum Regression Results (First Run)  
Dependent Variable (Yes/No)

<b>Independent Variable</b>	<b>Parameter Estimate</b>	<b>W Statistic</b>
Dollar Amount	-.724	8.38**
Age	-.332	1.96
Income	.210	0.718
Gender	.669	0.831
Environment	2.90	14.71**
** denotes statistically significant at the 99% level of confidence		

As in the case of the payment card, attitudes toward local environmental protection play a major role in determining WTP. Also as expected, this regression reveals that respondents' willingness to support the referendum is highly sensitive to the proposed cost. Gender and income appear to fail to play a role, and again age is negative, but is not quite statistically significant. We dropped income and gender and re-ran the regression. The results are in Table 8.

**Table 8.**  
Referendum Regression Results (Second Run)  
Dependent Variable (Yes/No)

<b>Independent Variable</b>	<b>Parameter Estimate</b>	<b>W Statistic</b>
Dollar Amount	-.417	5.44*
Age	-.273	2.01



Environment	2.32	19.30**
** denotes statistically significant at the 99% level of confidence		
* 95% level		

One of the unfortunate properties of a logistic regression procedure is that, beyond the *signs* of the parameter estimates, there is no straightforward way to interpret parameters. But a key advantage of the procedure is that we get a table showing how well our equation predicts or explains whether an individual voted for or against the referendum. Table 9 shows the results.

**Table 9.**  
Actual Versus Predicted Willingness to Vote for Conservation Easement Funding

		Predicted		Percent Correct
		No	Yes	
Observed	No	36	10	78%
	Yes	12	34	74%
			Overall	76%

Of the 46 voters who voted against the referendum, the regression predicts that 36 would in fact vote no, for a prediction success rate of 78%. Of the 46 respondents who voted yes, the model predicts that 34 would vote yes, for a prediction success rate of 74%. Overall, the predictive success rate is 76%, which is fairly strong for this type of equation.

## Conclusions

The results of this survey are very relevant because of what they reveal about the attitudes of residents in an important watershed concerning local environmental priorities, programs, and funding. A clear majority of the respondents to this survey believe that preserving and maintaining environmental quality in the Grand River watershed is an important socioeconomic goal. Moreover, most are able to prioritize objectives on issues facing the watershed, as well as make decisions on their willingness to fund a conservation easements program designed to protect it.

Most respondents to this survey support the establishment of a conservation easements program to obtain the goal of protecting resources in the watershed. Most are willing to pay at least a modest amount of household income to fund the conservation easements program. Key factors associated with willingness to pay (WTP) include program cost, age of respondent, and individual attitudes regarding environmental priorities. The statistical models used in the survey indicate that these factors present a reasonably accurate profile of WTP.

The study implies that establishing a Grand River Watershed Conservation Easements Program would receive little opposition from the public. Conservation easements have been legally recognized in Ohio since 1998. Funding has been available from the state since the Clean Ohio fund was passed by Ohio voters in 2000. But if local officials are going to attempt to raise tax revenues to obtain a local match for state funding, they should consider two important factors. One is that reducing opposition among older residents (particularly those above the age of 60) is critical. Another is that residents of local taxing jurisdictions that lie outside the watershed may not have the same support for funding that the respondents living in the watershed do. In that case, proponents of the program will need to show how benefits of the program extend beyond the boundaries of the watershed by achieving objectives that are more regional in nature, such as improving Lake Erie water quality and providing habitat for migratory species.

This presents an enormous opportunity to those involved in environmental education. Because more and more federal and state programs designed to obtain environmental improvement are requiring local jurisdictions to fund portions of these initiatives, local officials are increasingly going to need to have information about their constituents' views on these programs in general--and on

funding them in particular. It seems reasonable that Extension educators working at the local level should be able to take the lead in conducting applied survey research to try to answer these questions for officials.

On the basis of the work done in this study, Extension educators were able to conduct a number of outreach programs designed to educate residents of the watershed about how their peers viewed environmental issues facing the area. Residents in general, and local officials in particular, did not seem to be disturbed that the two CVM techniques yielded different estimates of WTP. In contrast to the stereotypical policy maker who preferred to get his or her answers from a "one-handed economist," members of the Grand River watershed actually seemed to appreciate the fact that we utilized two different CVM approaches, and given that the divergence in these results was not excessive, they expressed a view that they could think of willingness to pay as lying in this somewhat narrow range.

Use of various forms of the contingent valuation method (CVM) will likely play a key role in providing input like this to communities if Extension educators are willing to embrace it. This study is meant to be a useful guide to those interested in applying CVM to obtaining estimates of residents' willingness to pay for conservation easements programs. But its use in assessing public opinion on a host of other proposed initiatives is something Extension educators should consider as well.

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### **Appendix A. Socio-Demographic Profile of Respondents and General Public (18 and over)**

	<b>Survey Respondents</b>	<b>Adult Population</b>
<b>1) Gender</b>		
Male	53%	49%
Female	47%	51%
<b>2) Age</b>		

<30	9%	11%
30-39	16%	25%
40-49	20%	21%
50-59	25%	19%
60-69	16%	1%
70+	14%	13%
<b>3) Annual Household Income</b>		
< \$20K	19%	23%
\$20-\$40	25%	28%
\$40-\$60	28%	26%
\$60-\$80	16%	13%
\$80K+	12%	10%

### ***Appendix B. Conservation Easements as Described in the Survey***

Conservation easements are one way for private property owners to protect their land from development. Under Ohio law, certain private and government organizations--for example the Grand River Partners and Soil and Water Conservation Districts (SWCD)--are permitted to hold conservation easements. This means that a landowner can still own the land while voluntarily selling or donating the right to develop on that land to an easement holder. The easement is recorded on the deed of the property and stays with the deed. The landowner keeps ownership and the land stays in a natural state.

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