Contingent Valuation of an Urban Salt Marsh Restoration

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ABSTRACT
This paper discusses the validity of the contingent valuation method (CVM) and presents the results of a CVM survey we conducted to estimate the nonmarket value of restoring a salt marsh in New Haven, Connecticut. The literature suggests that CVM is valid, but results are often biased by poor survey design. Using a survey that was extensively pretested, we addressed potentially problematic issues such as payment vehicle bias, information bias, and hypothetical bias. We also combined techniques from conjoint analysis. Fifty-one households near the West River in New Haven were surveyed on Saturdays in March and April 1996. The households represented a wide range of socio-economic characteristics. Survey respondents were provided with background information including the current condition of the river and possible costs and benefits of restoration. Respondents were asked if they supported or opposed the restoration. Their maximum willingness to pay either for the restoration, or to keep the river in its current condition was solicited.

The contingent valuation survey performed well and was effective in educating participants about the current condition of the West River, the restoration measures proposed, and the possible impacts of the restoration; it was also effective in obtaining willingness to pay responses from people interviewed. Over three-quarters of people interviewed supported the proposed opening of the tidegates. Moreover, this support extended to a willingness to pay considerable amounts of money for the restoration. People clearly have high values for nonmarket and even nonuse environmental resources. Without a means to estimate their economic value, these significant amenities will be ignored and thus not protected. Contingent valuation can be an effective method of obtaining price estimates for non-market values that would be excluded from consideration in traditional economic decision-making because they have no associated price. Consequently, economic valuation has a crucial role to play in preserving and restoring priceless environmental resources. We conclude that a carefully designed contingent valuation survey is a promising method for bringing nonmarket economic values into the cost-benefit analysis of restoring the West River salt marsh.

The West River and its flood plains occupy approximately 35 square miles in New Haven and West Haven, Connecticut. Historically, 800 acres of this area were salt marsh (Casagrande, pp. 13-40, this volume). It was a highly productive estuarine ecosystem with an associated biological community.

In 1919 tidal gates were installed where Route 1 crosses the river in New Haven for the purpose of marsh reclamation. The gates stopped Long Island Sound's saltwater from traveling upstream, thus reducing upstream salinity and tidal inundation. As a result, *Phragmites australis* have aggressively colonized the area north of the tide gates. Such large, man-made stands of *Phragmites* provide poor wildlife habitat.

There is currently significant interest and some controversy with regard to restoring about 70 acres of the historic salt marsh located just upstream of the gates within West River Memorial Park. Both the interest and the controversy revolve around the effects of opening some of the 12 tide gates to increase tidal flushing. Other restoration projects in Connecticut have shown that restored tidal flushing reduces *Phragmites* and allows a salt-marsh community to return (Steinke 1986, Rozsa and Orson 1993). However, opening the tidal gates could also have negative impacts such as flooding.

For a policy decision regarding the restoration to be balanced and objective, it is helpful to aggregate economic benefits and costs. Economic valuation is complicated, however, by the fact that restoration benefits include salt-marsh resources that do not have a market price (e.g., scenic views and wildlife). In other words, *value* is not determined or set by the market. Although scenic views and wildlife have a significant value to the public, they risk being excluded from economic analysis because they appear to have no economic value. The historic eradication of salt marshes provides evidence that the exclusion of nonmarket values can result in environmentally destructive policies (Casagrande, pp. 13-40, this volume). For this reason, we have focused on the nonmarket benefits and costs of restoration.

For a policy decision regarding the restoration to be balanced and objective, it is helpful to aggregate economic benefits and costs. Although scenic views and wildlife have a significant value to the public, they risk being excluded from economic analysis because they appear to have no economic value.

The most widely recognized method for the valuation of nonmarket resources is the contingent valuation method (CVM). CVM involves presenting survey respondents with a hypothetical market for the resource and eliciting a willingness to pay for that resource.[1] Using CVM to value natural resources is not new. CVM has been used in several studies of endangered species.[2] Other studies have focused more generally on wildlife preservation (Stevens et al. 1994, Desvousges et al. 1993).

CVM has been the subject of debate among economists and others for the last decade. Even though a panel of experts convened by the National Oceanic and Atmospheric Administration (NOAA) in 1993 concluded that contingent valuation could produce reliable estimates of some types of values, critics have stated that CVM has failed to produce reliable and accurate measures of value (Diamond and Hausman 1994, McFadden and Leonard 1993, Diamond et al. 1993). Others emphasize that most (or even all) of CVM's perceived failures have been due to surveys that were inadequately planned or poorly structured, and that CVM works when properly executed (Portney 1994, Hanemann 1994). This study helps to alleviate some concern. We argue that a careful survey design can eliminate many of the biases that have caused the controversy.

[1] See Portney 1994, Cummings et al. 1986, and Mitchell and Carson 1989 among others for details of methodology.

[2] See for example Samples et al. 1986, Boyle and Bishop 1987, and Stevens et al. 1991.

We used the CVM method to assess the nonmarket economic value of restoring the salt marsh in West River Memorial Park. Our goal was to produce a reliable estimate by adhering to survey methods that recent studies suggest can reduce bias.

SURVEY DESIGN

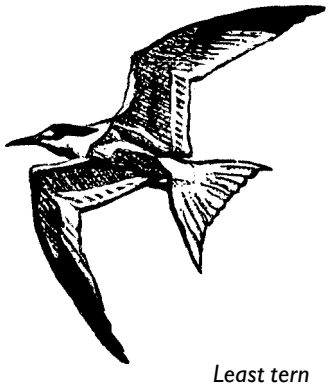
The survey instrument was carefully designed and pre-tested using focus groups and practice interviews. The survey is presented in the Appendix. The survey was conducted as personal interviews and consisted of four key components.

A DESCRIPTION OF THE CONTEXT AND THE COSTS AND BENEFITS TO BE VALUED

An important factor in the effectiveness of a contingent valuation survey is that the survey respondent must have a clear and accurate idea of the specific good that is being valued. In the case of natural resources, this is often a difficult concept to convey, because there are countless ways of viewing the resource. As a result, respondents could be considering their willingness to pay for a good that is different from the one being asked about in the survey. Careful survey design can help to avoid this information bias.

For example, the West River provides foraging habitat for the least tern, a threatened species in Connecticut that dives for fish (Lewis and Casagrande, this volume). The degraded condition of the marsh, however, reduces the habitat value for the tern. Least terns are common visitors to salt marshes in the northeast (Post 1970), and have been shown to benefit from salt-marsh restoration (Bontje 1987). Opening the tide gates and restoring the salt marsh may benefit the least tern by increasing fish abundance and improving water quality. Nevertheless, a survey question that asked for the value of the least tern only could have been ambiguous. Could the question be referring to the bird itself, reduced chance of extinction for the bird, probability of viewing a least tern during a visit to the West River, or the habitat it lives in?

Related to this is an issue known as "part-whole bias" or the "embedding effect," in which respondents produce equal values of willingness to pay for two goods, one of which is a subcomponent of the other (Brown et al., 1995). A good of interest, known as α, is valued by one set of subjects. Then, a larger good (Σ), which includes α, is valued by another set of subjects. Since studies of this type have obtained results that $\alpha \approx \Sigma$,[3] the conclusion is that either Σ is not valued at all (which is unlikely), or that respondents value α as a component of Σ. In our case, people may express a desire to preserve



Least tern

[3] The CV study of migratory waterfowl by Desvousges, et al. (1993) is commonly cited as an example of the severity of the embedding effect, because respondents failed to distinguish between 2,000, 20,000 and 200,000 birds. However, Hanemann (1994) has noted that when the data were trimmed to remove the extreme 10% of the values, the willingness to pay for each of the three quantities of birds was different.

the least tern because they value the habitat it lives in. In addition, respondents may be valuing other benefits of the restoration, such as enhanced aesthetics. Again, careful survey design can reduce the magnitude of this effect or eliminate it entirely.

This research addressed the embedding effect by phrasing the WTP question so that the good offered was a restored salt marsh that contained several benefits, including a specific number of acres (70) of habitat for the least tern, habitat for other wildlife, "naturalness" of salt marshes, and reduced fire hazard. Likewise, costs such as increased risk of flooding were included. Thus, respondents were considering an entire bundle of costs and benefits, all of which derive from the salt-marsh restoration. Pretesting of the survey had indicated that it would be beneficial to present respondents with all of the advantages and disadvantages of both conditions. They could then decide which "bundle" of benefits and drawbacks they preferred. This technique is called conjoint analysis and has been used extensively in marketing and transportation economics and more recently in natural resource valuation (Roe et al. 1996). Thus our survey not only incorporated CVM questions, but included conjoint analysis questions as well.

A panel of experts convened by the National Oceanic and Atmospheric Administration (NOAA) in 1993 concluded that contingent valuation could produce reliable estimates of values.

If information is comprehensive and properly presented, bias can be reduced. Therefore, we used visual aids extensively including photographs and maps to present a detailed description of current conditions and the effects of restoring tidal flushing.

Interviews began with questions about environmental attitudes and behavior. Respondents were asked how often they used the West River, where along the river they went, and what activities they did there, or why did they not use the river. Respondents were also asked about their perceptions of the West River's water quality, recreation potential, and habitat value. This allowed people to express their opinions and become comfortable with the survey.

Respondents were then asked whether they preferred the West River in its current state or as a restored salt marsh. This question was based on two photographs, one of each condition. Therefore, initial preference was based largely on aesthetics. A series of questions then gave successive information about the two river types. After each new fact was presented, respondents were asked which river they preferred. Finally, respondents were handed a list of all the advantages and disadvantages of each river type and asked to state a final preference based on all the information.

Interviewers next described the restoration proposal. The restored salt marsh would have both benefits (e.g., habitat for the least tern) and costs (e.g., increased flooding). Respondents were then asked if they supported or opposed the restoration.

THE WILLINGNESS TO PAY QUESTION

Economic value can be elicited with a CVM survey either using a question of willingness to pay (WTP) for a resource or willingness to accept (WTA) the loss of a resource. WTP is a measure of the maximum amount that a person would pay for a particular good or service, such as environmental quality or species existence, or for an incremental change in the amount of an environmental service provided. WTA refers to the minimum level of compensation that person would accept for losing those resources. Traditional economic theory suggests that the two should be equivalent. But studies have often found WTA to be larger than WTP (in some cases orders of magnitude larger). The NOAA panel (1993), among others, recommend using WTP since it elicits more conservative responses of value.

WTP is a measure of the maximum amount that a person would pay for a particular good or service, such as environmental quality or species existence, or for an incremental change in the amount of an environmental service provided.

Furthermore, a WTP response implies the respondent has no property right to the resource being valued. Alternatively, willingness to accept compensation for the loss of a resource would suggest that the respondent has a property right to the resource. We did not feel WTA applied to the West River situation and we elicited economic value using WTP.

The WTP question can be open-ended or presented as a dichotomous choice. In an open-ended question, respondents are asked for the maximum amount they would be willing to pay to obtain a particular environmental amenity. With dichotomous choice, respondents are presented with a price and asked to indicate whether or not they would be willing to pay the stated price. The NOAA panel recommended dichotomous choice in CVM surveys, because respondents are asked to make a familiar decision similar to voting or deciding whether or not to buy something. An open-ended question, the panel argued, places respondents in the unfamiliar situation of determining a value. However, recent comparative studies have revealed dichotomous choice WTP bids that are much higher than those from open-ended questions (see for example, McFadden and Leonard 1993). We used the open-ended format in order to obtain a more conservative estimate of New Haven's residents' values of salt-marsh restoration. We also chose open-ended questions in order to eliminate starting point bias, which is typically associated with dichotomous choice methods.

If respondents in our survey expressed support for the restoration, they were asked the maximum amount they would pay to ensure that it was implemented. If respondents opposed the restoration, the next question asked how much they would be willing to pay to ensure that the restoration was not implemented. Thus, the WTP

question measured the economic value both for and against the restoration. If a respondent gave a range of values, the lowest value was used for analysis.

WTP can be biased if respondents do not think in the framework of economic choices that they make with their own money. There may be an overestimation of price if they ignore what they will sacrifice by paying for the environmental amenity. When interviewing people, we kept the realism level high by making the scenario very specific: payment would only occur once; it would occur within the next year; and subjects were required to make their decision on the basis of their present income, not their expected future income. Respondents were also reminded that any amount they were willing to pay would reduce their ability to purchase other goods and services.

In order not to bias WTP estimates, protest bids must be identified and removed. A protest bid is a stated response of $0 to a willingness to pay question even though actual value might be greater than zero. Protest bids occur when respondents are protesting something other than the good in question. Since these responses are not valid "zeros," they must be eliminated from the sample. A common example of a protest bid is the objection to the type of payment mechanism, such as a tax. This type of protest bid creates what is called vehicle bias. To test for vehicle bias, half of our surveys were conducted with a one-time tax as the payment mechanism. The other half included a one-time private donation.

Protest bids can also result from a moral objection to placing a price on the environment. At the end of interviews, we asked respondents to give the reasons for their WTP value. This question was included to identify protest bids, though it also provided other useful information, such as confirmation that respondents understood the restoration scenario.

SOCIOECONOMIC QUESTIONS

Socioeconomic data were solicited confidentially. Respondents were asked to fill out a form about their age, education, income, and race. They folded the form and sealed it in an envelope, which was attached to the survey by the interviewer. This information was used to determine the range of socioeconomic characteristics within our sample, and to test for influence of income on WTP.

FOLLOW-UP QUESTIONS

We asked follow-up questions to ensure that respondents understood the scenario and the payment format and believed the information presented. Respondents were also asked to give reasons for answers of "$0" WTP, so that we could identify protest bids.

SAMPLING DESIGN

Three neighborhoods were selected to represent the greatest range of socio-economic characteristics adjacent to the West River. The Hill is located in southern New Haven and borders the lowest stretch of the West River downstream from the tide gates. Households in the Hill are mostly Hispanic or African American and represented the lowest income. Edgewood is located to the north of the Hill, and is upstream from the tide gates. Edgewood is racially mixed, and incomes are higher than the Hill. Westville is in the north of New Haven; residents are mostly White and have high incomes.

Land use adjacent to the river differs for the three neighborhoods. Land use along the river in the Hill is mostly commercial, landfill, or junkyards. Adjacent to the Edgewood neighborhood, the West River flows through Edgewood Park. Westville is bisected by the river, and some homes are located close to the river. Westville suffers major flooding about every 30 years. The most recent flood in 1982 caused substantial loss of property.

Interviews were conducted with teams of two. This was initially done for safety, but it was also found that one interviewer could ask questions while the other handled the numerous visual aids. As soon as the interview was completed, interviewers filled out a short evaluation form to record time, date, address, payment mechanism, and their impression of the interview.

Interviewers went door-to-door to survey people in their homes during four Saturday afternoons in March and April. Each interview team was assigned a block and called at every house. People who were home and willing to participate were interviewed. In order to reduce voluntary response bias, subjects were offered $5 in cash to be interviewed. A total of 51 households were surveyed.

Interviewers who were native speakers of Spanish conducted impromptu translations of the survey for Spanish-speaking respondents. This enabled a wider cross-section of the population to be interviewed.

Table 1. Number of respondents in income groups by neighborhood.

Income	Hill	Edgewood	Westville	Total	% Total
$10,000-$19,999	4	2	0	6	14
$20,000-$29,999	4	3	1	8	19
$30,000-$39,999	2	2	1	5	12
$40,000-$49,999	1	2	2	5	12
$50,000-$59,999	0	2	0	2	5
> $60,000	0	6	7	13	30
not indicated	2	0	2	4	9

RESULTS

Of the 51 surveys, 19 were conducted in the Hill, 19 in Edgewood, and 13 in Westville. Household income of respondents was diverse, with an increasing gradient from the Hill (lowest), to Edgewood and Westville (highest, Table 1). Respondents were also racially diverse – 53% were Hispanic or African American (Table 2).

We removed protest bids in order to compute willingness to pay (WTP). A protest bid was considered a bid of $0 that was due to a protest against the payment mechanism (tax or donation) or moral objection to placing a dollar value on an environmental amenity. Protest bids were identified using follow-up questions. Nine protests to the tax mechanism were identified and removed. We did not detect any moral protests.

There were three respondents who were unable to determine their WTP. These were not protest bids, but were removed in order to calculate mean WTP. Respondents who wanted to pay, but were not able to pay anything were considered to have given valid bids of $0, and were included in mean WTP.

Of the seven responses that opposed opening the tide gates (Table 3), five were protest bids. This left two responses: a $20 tax bid and a $50 donation bid. The two bids against opening the tide gates were included in mean WTP for salt-marsh restoration as negative values. Of the 39 responses that favored opening the tide gates (Table 3), 4 of the tax responses were protest bids. There were no protest bids by respondents who favored opening the gates who took the donation survey. Three others were unable to determine WTP. Thus, there were 32 responses with valid WTP bids for opening the tide gates; 17 by donation and 15 by tax.

Table 2. Race of respondents.

	Number	Percent
Hispanic	14	25
Black	13	28
White	22	43
Asian	1	2
not indicated	1	2

Table 3. Responses to the proposal to open tide gates.

For the TAX survey, with 26 people surveyed:		
	3 people were against opening the tidegates	(11%)
	22 people were for opening the tidegates	(85%)
	1 person had no opinion	(4%)
For the DONATION survey, with 25 people surveyed:		
	4 people were against opening the tidegates	(16%)
	17 people were for opening the tidegates	(68%)
	4 people had no opinion	(16%)
For the TOTAL:		
	7 people were against opening the tidegates	(14%)
	39 people were for opening the tidegates	(76%)
	5 people had no opinion	(10%)

Table 4. The contingency table for the χ^2 test for the relationship between income and WTP.

	WTP		
Income	≤ Med	> Med	Total
Low	14	5	19
High	5	8	13
Total	19	13	32

The expected values are:

	WTP	
Income	≤ Med	> Med
Low	11.28	7.72
High	7.72	5.28

There were many $100 bids (and a few $200 bids) and many bids of $25 or less. Only one value occurred between $25 and $100. As a result, there is a wide difference between mean WTP ($61.41) and the median value ($25.00), and the standard deviation is large ($100.22). We used chi-square (χ^2) tests of two-way contingency tables to determine if WTP was influenced by income or payment mechanism (tax vs. donation). A χ^2 test was used because the WTP values had a discrete probability distribution rather than continuous (people tended to bid $25 or $100, but not values in between). Tests were conducted at the 5% significance level.

WTP bids were divided into two categories: bids less than the median, and bids greater than the median. Respondents were grouped as those having household income below the median for the survey, and those above (Table 4). The null hypothesis (H_o) was that income and WTP are independent. There was one degree of freedom because we used two-by-two contingency tables. Values for χ^2 were obtained from a reference table. WTP was dependent on income ($\chi^2 = 3.97$).

Respondents' bids were also grouped by payment mechanism (Table 5). WTP bids were grouped as above. The null hypothesis (H_o) was that payment mechanism and WTP were independent. Final WTP values appeared to be independent of whether the purchase mechanism was by tax or donation ($\chi^2 = 0.43$).

Table 5. The contingency table for the χ^2 test for the relationship between payment mechanism and WTP.

Payment	WTP		
mechanism	≤ Med	> Med	Total
Tax	8	7	15
Donation	11	6	17
Total	19	13	32

The expected values are:

Payment	WTP	
mechanism	≤ Med	> Med
Tax	8.91	6.09
Donation	10.09	6.91

DISCUSSION

Given that our sample size was relatively small, we view this as a "pilot project" for what will ultimately be a survey of a larger number of households. Testing our survey design for a small sample allows us to determine whether or not to proceed with a larger group.

The survey's overall performance was satisfactory. People generally understood the content, purpose, and logic, and respondents tended to make WTP bids in terms of real economic decisions. One respondent mentioned goods he would sacrifice in his determination of WTP by deciding to "give up a couple of twelve-packs." Other comments included: "I know my budget for April, and this is the amount I have free." "I'm bringing up three children; this is all I can spare." "I can't pay anything because I'm not working right now."

Respondents often anticipated questions. For example, when asked, "Do you think the restoration project is a good idea?" respondents often asked how much it would cost. Respondents were also curious as to why the initial photo with *Phragmites* was unnatural, when it looked natural. They appeared satisfied to learn a few questions later how the landscape had been altered by humans. Such synchronization within the survey provides evidence that its structure was cognitively sound; it made sense; it flowed well. Nevertheless, some considerations need to be discussed.

PAYMENT MECHANISM

The χ^2 test indicated that the amount respondents were willing to pay for the restoration was independent of payment mechanism. Protest bids, however, appeared to be more prevalent among tax payment mechanism surveys (almost one-fifth of all tax surveys). One respondent who was willing to make a donation of $500-$1000 told interviewers that had the question been in the form of a tax increase, his bid would have changed to $0. The statement, "I'm sorry, but if its dealing with taxes, then I can't support it," occurred several times.

Nevertheless, the proportion of people who were willing to pay a positive amount for the restoration with taxes (73%) was similar to those willing to pay with donations (71%). Therefore, it does not appear as though the subset of people who were willing to pay for the restoration was biased by payment mechanism, and our mean WTP value was not biased in this way.

GENDER BIAS

More males (53%) than females (37%) were interviewed. (Some respondents left this portion of the follow-up written questionnaire blank, explaining the discrepancy from 100%). More males than females answered the door. Also, men tended to participate when both men and women were present in the house. But the decision whether or not to make a donation or support a new tax is often a household decision, and our data analysis focused on households. Often, surveys with individuals were quickly transformed into household discussions. For example, a couple debated how to rate the current condition of the river for wildlife habitat. In another home, a wife convinced her husband to change his preference to the salt-marsh photo because she was concerned about the least tern. These decision-making processes are common, and thus represent appropriate responses to this survey.

UNCERTAINTY

Most economic surveys, CVM and otherwise, focus on demand for goods that are certain with regard to quantity, quality, and timing of availability. For environmental goods such as wildlife, however, these are not always certain. Threat of extinction may decrease for a rare bird, but the extent of decrease may not be defined. Respondents in a contingent valuation survey must determine willingness to pay even though they may not know if the species will survive long enough for them to experience a benefit.

Whitehead (1993) studied the effects of uncertainty on existence values of marine and coastal wildlife in North Carolina. His two main findings were that (1) there is evidence that "total economic values under uncertainty are theoretically valid", and (2) omitting consideration of uncertainty from CVM studies will produce a distorted value for willingness to pay. The first conclusion lends support for the use of CVM as a tool to elicit nonuse values for wildlife; the second implies that inclusion of uncertainty is necessary for a valid CVM survey.

Uncertainty became a factor in the West River survey. For example, even if the salt marsh was restored, respondents did not know the probability of seeing a least tern during a visit to the river. Thus, there was a risk involved in making a payment for that resource. Respondents were also told that the restoration would increase risk of flooding. But interviewers, as part of the survey design, would not give specific details regarding where flooding would occur, or how much more likely it would be. Respondents thus had to weigh uncertain harms against uncertain environmental benefits.

WARM GLOW AND FAIR SHARE EFFECTS

Stevens et al. (1994) studied the change of existence values for wildlife over time and found that they were stable. The reason for this stability, they found, was not due to the respondents' economic valuation of wildlife. Instead, the WTP was for something other than the wildlife. One such value is the satisfaction of contributing to a "worthy cause." Since giving to "good causes" and charities tends to be stable for individuals and households over time, this would be reflected in the stated willingness to pay for wildlife.

Kahneman and Knetsch (1992) have termed this the "warm glow effect," in which people derive value from knowing they have contributed to a good cause. Such respondents are purchasing the price of moral satisfaction, and one cause may be just as worthy as another.

Some of the responses to the West River survey suggest that the warm glow effect might have influenced respondents. When asked to state why they were willing to pay money to restore the West River, many people gave responses such as "to help the bird" or "to improve the community". These statements could imply the subjects viewed their WTP as a "charitable" donation to a "worthy cause."

Another factor that may influence WTP for environmental amenities is the tendency to calculate WTP based on the perceived total cost of the project divided by the assumed population of people who would have to contribute. Instead of constructing an individual existence value, respondents figure what their "fair share" would be. The rationale is, if everyone had to pay, it would only cost me a minimal amount. Survey respondents calculate this in two ways: out of a sense of duty to do their fair share (Stevens et al. 1994), or from belief that a certain amount is the maximum they should have to pay (Schkade and Payne 1993) because total cost is spread out over numerous individuals.

A few respondents in our survey gave WTP responses as the maximum cost of the project divided by the population they figured would be taxed. "If everyone in New Haven and West Haven was charged for this, it couldn't be more than $10 per person," one respondent concluded. The "fair share effect" has been offered as evidence that WTP bids are invalid because they do not represent a person's true value for an environmental good. However, an alternate interpretation could be that individuals motivated by their perception of fairness would not be willing to pay more for an amenity, because they would then bear an unjust proportion of the costs.

Rather than concluding that warm glow and fair share effects render CVM unable to obtain the monetary amount of nonuse values, it should be noted that individuals create their own valuation priorities. Hanemann (1994) argues that people have a wide variety of motives that help them determine their values for both market and nonmarket goods. Why a person would be willing to pay a certain price to restore the West River is perhaps less important than the fact that they would be willing to pay. Such values still would indicate a level of support for the restoration, and could be incorporated into a cost-benefit analysis.

COSTS AND BENEFITS

Respondents placed an economic value on the nonmarket environmental benefits of the West River salt-marsh restoration. Mean WTP could be aggregated over the population of households that would benefit from the restoration to approximate the value of the restoration. How would that value compare to the costs of the restoration? The major potential costs of the project would be associated with mitigating potential flooding. Fortunately, no residential areas are likely to be affected by the minimal water elevation increase needed to eradicate the *Phragmites* (Barten and Kenny, this volume). Most land use adjacent to the restoration zone is nonresidential (Page, this volume), and the few residential areas are much higher than the marsh. Of greater concern would be potential impacts to recreation facilities in the immediate flood plain, such as playgrounds, sport fields, and the Connecticut Tennis Center.

One option to eliminate potential damage to recreational areas as a result of opening tide gates at Route 1 would be to install an additional tidal control structure at Route 34. Thus, salt marsh could be established between Route 1 and Route 34, while recreational facilities north of Route 34 would be protected. Another option would be to build dikes around areas of concern. (Dikes for a similar project in Fairfield Connecticut cost $250,000, Steinke 1986.) Finally, self regulating tide gates that allow tidal flushing – but close during very high tides – could be installed to replace the existing tide gates at Route 1 (Barten and Kenny, this volume). Self regulating tide gates cost around $30,000 (Steinke 1986).

Other costs associated with the project would include a design study and, possibly, removal of earth to lower the marsh surface so that restoration could occur with less increase in water elevation. These tasks would be performed under the Connecticut Department of Environmental Protection's (CT DEP) Wetland Restoration Program.

CONCLUSION

The contingent valuation survey performed well and was effective in obtaining willingness to pay (WTP) and thus *value* estimates. There was strong public support for the restoration project: over three-quarters of people interviewed supported the proposed opening of the tide gates. These results suggest a large nonmarket value associated with restoration benefits.

Yet this nonmarket value would be excluded from consideration in traditional economic decision-making, because there is no associated price. Without a means to estimate their value, significant amenities would be excluded from policy decisions. Contingent valuation is an effective method for obtaining price estimates for nonmarket values, thus balancing the decision-making process. Consequently, contingent valuation has a crucial role to play in preserving and restoring environmental resources.

The end of the road with regard to the West River restoration has not yet been reached. Further public discussion and debate lie ahead, and there are opportunities for further research. This study, which comprised a small-scale contingent valuation survey, could be expanded in scope to increase its accuracy. This type of survey should also be periodically repeated over the long term, so that nonmarket environmental values are updated. In the case of the West River, it would be useful to determine if economic values of nonmarket benefits that accrue from restoration change as the restoration proceeds.

ACKNOWLEDGMENTS

The Connecticut Sea Grant College Program and the Yale Center for Coastal and Watershed Systems provided financial assistance for this research. Dr. Robert Mendelsohn and David Casagrande provided advice on survey structure. Dr. Mendelsohn and Christina Page provided comments on the manuscript. Thanks are also due to Katie Bannon, Deron Chang, Jonathan Kohl, Duncan Schmitt, and Nick Slosser for their participation in the focus group and pretest, and to Sue Ask, Iliana Ayala, Todd Campbell, David Casagrande, Celia Hartmann, and Rob Naeser for conducting door-to-door interviews.

APPENDIX. WEST RIVER SURVEY - TAX PAYMENT VEHICLE[1]

This is a survey that will be asking for your opinions and ideas about the West River, in New Haven, Connecticut. I appreciate your taking the time to assist me and help complete it.

1. Do you ever visit the West River or walk along roads that cross it?

   Yes (*go to question 2*) No (*go to question 6*)

2. Where along the river do you go to when you visit it? If you walk along roads that cross it, which roads do you see the river from?

3. What do you do when you visit the West River?

4. Where along the river do you do these things, and how often?

5. Do you ever see birds or other wildlife when you are at the West River?

   Yes No

   (*After completing question 5, please skip to question 7)*

6. Why don't you visit the West River?

7. On a scale of one to ten, how clean do you think the water in the West River is? A one means you think the water is so dirty you wouldn't even feel safe boating in it. A three means you think it is clean enough to boat on it. A five means you would feel safe eating a fish caught in the West River. A seven means you would feel the water in the river is clean enough to swim in. A ten means you think the water is clean enough to drink straight out of the river.

   Nothing Boat Fish Swim Drink

   1 2 3 4 5 6 7 8 9 10 don't know

8. On a scale of one to ten, how good do you think the West River is as a recreational site? A one means you think it has no value at all for recreation. A ten means you feel it is the best recreational site in Connecticut.

   1 2 3 4 5 6 7 8 9 10 don't know

9. On a scale of one to ten, how good do you think the West River is as a place for wildlife and birds to live? A one means you think no birds or animals can live there. A ten means you think the West River is better than any other place in Connecticut for birds and animals.

   1 2 3 4 5 6 7 8 9 10 don't know

[1] Only the survey format that used a one time tax as the willingness to pay vehicle is included here. The donation vehicle survey differed only in the wording of questions 17, 18, 20, 21, 22, and 24, in which language regarding a one-time donation was substituted for the one-time tax. Also, the sentence that stated, "Everyone would pay their fair share, and the tax would be no greater than the costs of the project." was not included in questions 17 and 21 of the donation survey.

Here are pictures of the lower stretches of two Connecticut rivers.

(*Show Picture A, which shows a river with a* Phragmites *monoculture*)

(*Show Picture B, which shows a* Spartina *salt marsh*)

Most rivers in coastal Connecticut resemble either Picture A or Picture B.

10. Based on what you see in the pictures, do you prefer a river that looks like the one shown in Picture A or Picture B?

Picture A Picture B no preference

The two rivers in the picture provide different types of habitat for wildlife and birds. Here is a photo of a bird called the least tern. It is an endangered bird species.

(*Show photo of least tern*)

11. Have you ever seen a least tern before?

Yes No

If yes, where and when?

The least tern can make its home in River B, but not in River A.

12. Now that you know that River B supports the least tern, which river do you now prefer?

River A River B no preference

River B can sometimes cause flooding problems for houses and buildings that are located along the river.

River A does not cause flooding problems.

13. Now that you know that River B can cause flooding problems and River A does not, which river do you prefer?

River A River B no preference

Historically, the lower part of most rivers in Coastal Connecticut looked like Picture B. In other words, Picture B shows the natural state of these rivers. People have altered the natural state of these rivers in several ways. As a result of these human actions, many rivers in Connecticut now look like the river shown in Picture A.

14. Now that you know that River A has been altered by humans and River B is in its natural state, which river do you prefer?

River A River B no preference

Here is some more information about River A and River B. (*Hand list to interviewee.*) Each of the rivers has both advantages and disadvantages, which are listed on your sheet. (*Read list out loud.*)

River A	River B
Is protected from flooding.	Can cause flooding to adjacent properties.
Has playgrounds and soccer fields by it.	Is a productive and diverse salt marsh.
Has been altered by humans.	Is in its natural historic state.
An aggressive grass called *Phragmites* has taken over the river. It grows 12-15 feet high and crowds out other plants and animals.	Is not dominated by Phragmites.
The *Phragmites* breeds more insects, like ticks and mosquitoes.	Provides habitat for many types of animals and birds, including endangered species like the least tern.
The *Phragmites* burns frequently in the summer in intense fires.	Has very little fire danger.

15. Now that you know these things about the two rivers, which river do you prefer?

River A River B no preference

This next question will be about the West River. Historically, the lower part of the West River looked like the river in Picture B. Here is a map of the area that used to look like Picture B.

(S*how map of historic salt marsh.*)

In 1919, tide gates were installed at the point where Route 1 crosses the West River

(*Point to this on the map.*)

These tide gates changed the West River and caused it to look like Picture A.

Suppose there was a proposal to restore the West River to its historic condition so that it would look like the river in Picture B. The restoration would affect about 70 acres along the lower part of the river.

(*Show map again.*)

The restoration would restore the river to its natural, historic state, and it would also provide habitat for the least tern, an endangered bird species. This restoration would be done by opening the tide gates. When this was tried in other rivers along the Connecticut coast, the rivers were successfully restored to where they looked like Picture B.

16. Do you think this project is a good idea?

Yes No no opinion

Why or why not?

(*Note, if they answered Yes to question 16, go to question 17. If they answered No to question 16, go to question 21. If they answered no preference, go to question 25.*)

17. You had answered that you think this restoration project is a good idea. Suppose that in order to pay for this project, there would be a one-time tax next year. Everyone would pay their fair share, and the tax would be no greater than the costs of the project. However, I am interested in finding out how much restoring the West River to its natural state is worth to you. Would you be willing to pay additional taxes next year to restore the West River? Keep in mind that any money you pay in additional taxes will not be available for you to spend on other things. Also keep in mind that this tax would occur only once, during next year.

    Would you be willing to pay additional taxes to restore the West River?

    Yes (*go to question 18*) No (*go to question 20*)

18. What is the maximum amount that you would be willing to pay in additional taxes?

19. Why did you choose this amount?

    (*After completing question 19, go on to question 25.*)

20. Why did you say you would not be willing to pay additional taxes to restore the West River?

    (*After completing question 20, go on to question 25.*)

21. You had answered that you do not think the restoration project is a good idea. Suppose that the only way to avoid doing the restoration project was to do additional construction and repair of the tide gates where the West River crosses Route 1.

    In order to pay for this repair, there would be a one-time tax next year. Everyone would pay their fair share, and the tax would be no greater than the costs of the project. However, I am interested in finding out how much keeping the West River in its current condition is worth to you. Would you be willing to pay additional taxes next year to repair the tide gates? Keep in mind that any money you pay in additional taxes will not be available for you to spend on other things. Also keep in mind that this tax would occur only once, during next year.

    Would you be willing to pay additional taxes to repair the tide gates?

    Yes (go *to question 22*) No (*go to question 24*)

22. What is the maximum amount that you would be willing to pay in additional taxes?

23. Why did you choose this amount?

    (*After completing question 23, please go to question 25.*)

24. Why did you say you would not be willing to pay additional taxes to restore the West River?

25. *At this point, reconfirm that the respondent either*

    1) expressed support for the restoration project.

    2) expressed opposition to the restoration project.

    3) were indifferent about the restoration project.

    If they have changed their minds, ask why, and note response.

Also reconfirm their willingness to pay, either 0, or if greater than 0, the amount they stated. Again, allow changes if they change their mind.

26. You are almost at the end of the survey. Please tell me in your own words why you think we are doing this survey.

27. Is there anything else you would like to say about the West River?

The last few questions are for demographic purposes. The answers are private and confidential. I am now giving you this page to fill out yourself. When you are done, please fold it and I will seal it. (*Hand the next page to them.*)

28. Age (please circle one)

A Under 20
B 20-29
C 30-39
D 40-49
E 50-59
F 60-69
G Over 70

29. Gender

M F

30. Household income (please circle one)

A Under $10,000
B $10,000-$19,999
C $20,000-$29,999
D $30,000-$39,999
E $40,000-$49,999
F $50,000-$59,999
G $60,000 and over

31. Number of years of education (please circle one)

A Less than 12 years
B Completed high school
C Attended college
D Completed college
E Attended graduate school
F Completed graduate school

32. How would you describe your ethnicity?

A Hispanic
B Black and Hispanic
C Black, non-Hispanic
D White and Hispanic
E White, non-Hispanic
F Asian
G Native American/American Indian/ First Nations
H Other (please specify)

Now, please fold this paper and the interviewer will seal it.

Those are all the questions. Thank you very much for your time in completing this survey!

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