

Public Support for Ecosystem Restoration in the Hudson River Valley, USA

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ABSTRACT / We applied the Theory of Planned Behavior to help understand the relationships between environmental beliefs, support for ecosystem restoration actions, and willingness to pay (WTP) for restoration and protection goals in the Hudson River estuary, New York State, USA. We conducted a mail survey with 3,000 randomly-chosen local residents of the Hudson River estuary in the fall of 1999. As hypothesized, the broad ecosystem restoration goals of the Hudson River Estu-

ary Action Plan were more strongly supported than the corresponding specific implementation actions. We found that beliefs and past behavior were better explanatory variables than sociodemographic characteristics for explaining people's support for ecosystem restoration actions and WTP for restoration and protection goals. Because ecosystem restoration goals appear to be more generally acceptable than specific restoration actions, proponents of restoration programs should not become complacent about the need for active public outreach and involvement even if initial restoration program discussions have been low in controversy. Efforts to assess and foster support for ecosystem restoration should be targeted toward audiences identified on the basis of beliefs and past behaviors rather than on sociodemographic characteristics.

Ecosystem restoration is an emerging resource management challenge across the United States (National Research Council 1992). Restoring ecosystems to a healthier level of functioning is a major undertaking that will require time, money, and commitment of a wide variety of stakeholder groups (Kent 1999). Understanding public support for ecosystem restoration is an important component of the process (Endter-Wada and others 1998). Explicitly including the human dimension in ecosystem management and restoration efforts is critical to their success because the sustainability of sound management is rooted in stakeholder support (Haney and Power 1996, Kauffman and others 1994, Lee 1995, Proctor 1998).

Information about local residents' attitudes toward ecosystem management and restoration often is anecdotal or based on interviews only with those actively involved in the issue (Solecki 1998). In this study, we sought to provide a conceptual basis to help better understand the relationships between restoration attitudes, beliefs, and behaviors and to help improve restoration program implementation. Our research focused on a random sample of residents in the Hudson River Estuary, New York State.

KEY WORDS: Ecosystem restoration; Restoration attitudes; Environmental beliefs; Contingent valuation; Hudson River

Concern among Americans about environmental issues has grown considerably in recent decades (Kempton and others 1995). Many previous studies, however, emphasized general questions about the environment, environmental quality, and broad environmental issues (e.g., Dunlap 1992, Dunlap and others 1993, Kempton and others 1995, Milon and others 1998). Few examined the relationship between beliefs and attitudes associated with statements about general environmental issues compared with beliefs and attitudes associated with proposals for implementing specific actions related to overall environmental goals (e.g., Barro and Bright 1998).

Solecki (1998) argued that more attention should be directed at assessing the public's environmental attitudes in relation to specific ecosystem management concerns familiar to the respondents. His study of New Jersey residents' attitudes toward regional ecosystem management demonstrated that individuals' familiarity with and direct interaction with specific management activities are important predictors of their support for regional ecosystem planning efforts.

Barro and Bright (1998) focused their research specifically on public beliefs and attitudes concerning ecosystem restoration and showed that, at least in one metropolitan area, residents were overwhelmingly in favor of overall ecosystem restoration goals but demonstrated varying support for specific practices that might be implemented to achieve these goals. They suggested

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this difference may reflect the lack of careful thought given by the public to the costs associated with ecosystem restoration goals until faced with the implications of specific, concrete, proposed activities.

Numerous studies have made connections between sociodemographic characteristics and concern for the environment (e.g., Jones and others 1999). Solecki (1998) summarized the most recent findings concerning age, gender, educational attainment, income, stated political orientation, membership in an environmental organization, and length of residence in the area. Other studies have drawn connections between value orientations and policy preferences (Steel and others 1994) or risk perceptions (Steel and others 1990). Scott and Willits (1994) found the New Environmental Paradigm scale (NEP), a measure of environmental attitudes originally developed by Dunlap and Van Liere (1978), was predictive of environmental behavior, but the relationships were not strong. A positive association between participation in outdoor recreation and pro-environmental behavior has been found (Theodori and others 1998). To our knowledge, none of these studies have attempted to evaluate the relative importance of beliefs, behaviors, and sociodemographic characteristics in understanding support for ecosystem restoration.

We chose the Hudson River Estuary as our study site because it is well-known and represents a mix of some of the most urbanized areas in the United States (i.e., New York City metropolitan area) as well as rural areas. The estuary has been affected by many human uses in the past, most notably shipping channel dredging, railroad right-of-way construction, and unrestricted dumping of chemicals and waste into the river (Hudson River Estuary Program 1999). Ecosystem restoration efforts via the Hudson River Estuary Action Plan are just beginning and information about public support for the broad goals as well as the specific restoration actions outlined in the Plan is needed.

We applied the Theory of Planned Behavior (Ajzen 1989) to help understand the relationships between environmental beliefs, support for restoration actions, and willingness to pay for restoration and protection goals. The Theory of Planned Behavior, a modification of the Theory of Reasoned Action developed earlier by Ajzen and Fishbein (1980), asserts that people systematically use the information available to them to shape their beliefs and attitudes about certain actions before deciding to take those actions. Relationships exist between external variables (e.g., sociodemographic characteristics, knowledge, past behavior), beliefs, attitudes, intended behavior, and actual behavior.

Willingness to pay (WTP) for ecosystem restoration

is one measure of the intensity of support for ecosystem protection and restoration goals. Measuring WTP for nonmarket goods in general, not to mention ecosystem restoration specifically, is often difficult and has been the subject of extensive previous research (Bjornstad and Kahn 1996). Currently, guidelines exist but debate continues regarding the best practices to use when undertaking some type of contingent valuation effort such as assessing WTP (Carson and others 1996). Past research also has tried to describe relationships between WTP and environmental attitudes and values (Stern and others 1993), with an underlying hypothesis that stronger pro-environmental attitudes would be associated with greater WTP for restoration. Champ (1994), for example, reported positive associations between WTP to protect the Grand Canyon and pro-environmental attitudes, along with other variables such as interest in the environment, a history of personal experience with the Grand Canyon, and demographic variables such as age, education, and income. Our study was not designed to produce a rigorous estimate of WTP to aid in overall economic valuation. Rather, we used a limited measure of WTP as an indicator of intended behavior.

This study had three objectives. First, we hypothesized that general ecosystem restoration goals will be supported more strongly and widely than will specific implementation strategies in the Hudson River Estuary. Second, using the Theory of Planned Behavior as a framework, we examined the extent to which beliefs taken from the NEP scale used by Scott and Willits (1994), beliefs about the connection between the economy and the environment (Kelly and Sushak 1996), degree of knowledge and involvement with the Hudson River, and sociodemographic characteristics (including age, gender, distance home is from the river, length of residence in the area, and stated political orientation) are associated with support for specific restoration actions. Understanding these relationships is important for community leaders and those advocating restoration efforts. They need to know who is likely to support which actions and where conflicts might arise. Third, based on the Theory of Planned Behavior, we examined whether an indicator of intended behavior (WTP for ecosystem restoration and protection) is explained by the beliefs, attitudes, and external variables discussed above.

Methods

We conducted a mail survey with 3,000 randomly-chosen local residents in the fall of 1999. We identified local residents from telephone directory listings in the

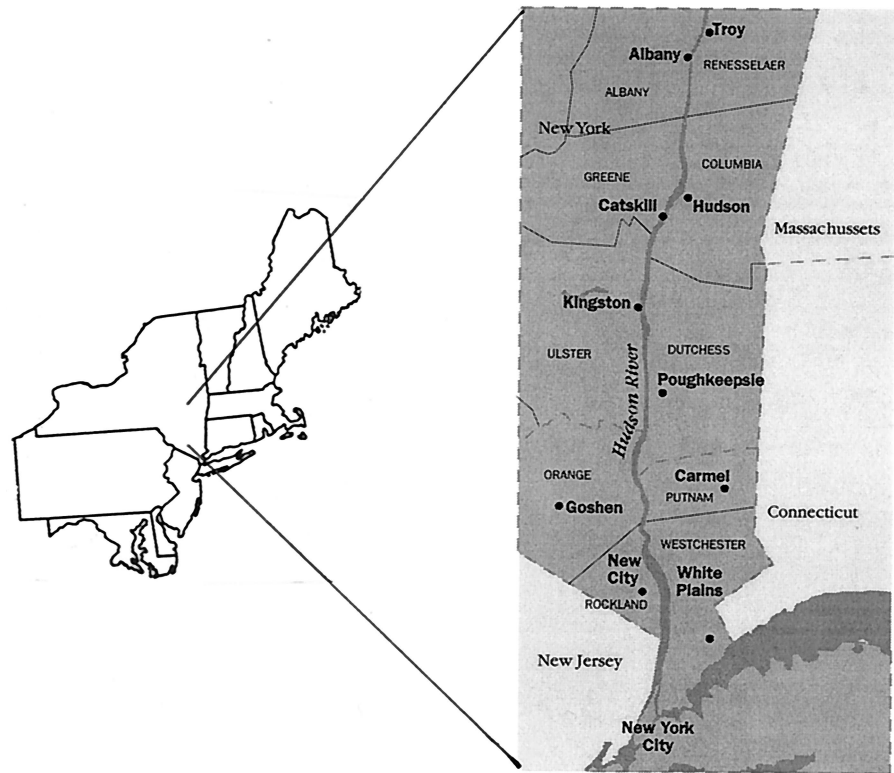


Figure 1. Map depicting study area.

counties bordering the Hudson River from Albany south to New York City (Figure 1). We defined the study area for residents as the Hudson River Valley, including the land on either side of the river and the river itself, from the Troy Dam south, past Albany, and down the river, past Manhattan and into New York Harbor as far as the Verrazano Narrows Bridge. This is the same area of the river defined in the Estuary Action Plan and referred to as the Hudson River Estuary. Because the views of residents in the upper part of the estuary might be different from those living in or near New York City, we divided the sample into two strata. "Upper" included all counties north of Rockland and Westchester and "Lower" included Rockland, Westchester, and New York City boroughs bordering the estuary.

We developed the questionnaire based on literature review and interviews with community leaders to identify pertinent issues associated with ecosystem restoration efforts in the Hudson River Estuary and terminology and definitions used by local residents. Questions in the survey covered the following topics: (1) the level of knowledge and involvement of residents with the Hudson River estuary, (2) beliefs about the relationship of humans and nature, (3) the degree of public support for ecosystem restoration efforts from the broad goals mentioned in the action plan to specific implementa-

tion strategies, (4) willingness to pay for four different types of ecosystem restoration, (5) measures of environmental activism, and (6) sociodemographic characteristics.

We mailed the survey in September 1999. We sent up to three follow-up mailings, using the general methodology laid out by Dillman (1978), to nonrespondents over the course of the following month to increase response rates. We conducted a telephone follow-up survey with 100 Upper Estuary nonrespondents and 100 Lower Estuary nonrespondents to determine if nonrespondents to the mail survey held different views than respondents in terms of support for broad goals and specific actions, involvement with the river, and selected sociodemographic characteristics.

For estuary-wide estimates, we weighted responses to account for the stratification of the original sample and a gender bias among respondents. Additionally, to more accurately represent the views of all local residents we weighted data to account for differences between respondents and nonrespondents for the questions common to both surveys.

We created a knowledge scale by summing the number of correct answers to four questions. Each question measured a different aspect of a respondent's knowledge about issues and functions of the estuary.

We created two beliefs scales using questions that

asked respondents to agree or disagree with a series of belief statements. The statements were patterned after the work of Scott and Willits (1994) who used the NEP scale, Kelly and Sushak (1996) who compared the economy and the environment, and Barro and Bright (1998) who asked about beliefs associated with restrictions on land use. One scale measured concern for the environment; the other, the importance of valuing human needs over nature. The scale value was the mean of the items in the scale.

We created two eight-point involvement scales using personal and household involvement with activities associated with the Hudson River. The scales ranged from no involvement with the river in the past year to working for a company who uses the resources of the river. Intermediate values represented varying levels of recreational involvement such as picnicking near the river, boating, fishing, and eating fish from the river. A person or household was categorized at the highest level of involvement.

We created an environmental activism scale by summing the number of environmentally-related activities a respondent had participated in during the past 12 months. The items included voting for political candidates, joining organizations, writing letters, and volunteering for a shoreline clean up along the Hudson River.

We divided the sample into four subsamples. Each subsample was asked to provide a WTP estimate for a different environmental restoration or protection proposal. The proposals were: (1) replace and restore damaged wetlands, (2) clean up PCBs (polychlorinated biphenyls) and other industrial chemicals that pollute the river, (3) buy wetlands to provide protected areas for habitat and water quality, and (4) buy land to set aside as undeveloped open space. Because no significant difference was found between the four WTP estimates, we grouped them together for analysis.

We examined the difference between a respondent's support for broad restoration goals and his/her support for specific actions. The mean difference for all respondents was compared with zero to test for statistically significant differences using a one-sample *t*-test.

We used stepwise multiple regression to examine the relative importance of beliefs, behaviors, knowledge, and sociodemographic characteristics in explaining support for specific restoration actions. We considered these same variables in explaining WTP. We used the natural log of WTP in the regression analysis because it provided a better fit under linear regression. Only variables significant at $p \leq 0.05$ were used in the explanatory models. We analyzed data using SPSS (SPSS Inc. 1994) and STATA (StataCorp. 1999).

Results

Response Rate

Of the 3,000 questionnaires mailed, 444 were undeliverable and 730 completed questionnaires were returned. This resulted in an adjusted response rate of 29%. The response rate was higher in the Upper Estuary (35%) and lower in the Lower Estuary (22%). Very few differences were found between upper and lower estuary respondents, thus all further analysis was done on an estuary-wide basis. Compared to respondents, we found that nonrespondents were less supportive of most ecosystem restoration goals and actions. They were also less likely to have participated in half of the activities along the Hudson River about which we inquired.

Support for Broad Goals Versus Specific Actions

Local residents on average felt the broad restoration goals were very important to them personally (Table 1). They assigned equal importance to cleaning up pollution and protecting living resources. They felt less strongly about the broad goal of promoting public use and enjoyment of the river, but still assigned it an average rating of moderately to very important.

The perceived importance of possible specific restoration actions varied from very/extremely important to slightly important (Table 1). The top three actions local residents perceived as very to extremely important were all related to contaminants in the environment: (1) reduce danger to humans from chemical contaminants, like PCBs, in the river, (2) monitor levels of contaminants in fish in the river, and (3) clean up contaminated urban waterfront sites, called brownfields. Actions at the lower importance end of the scale were issues associated with providing access to the river and economic development to improve the quality of peoples' interactions with the river. Providing more access for motorized boats was lowest, with an average rating of "slightly important."

Respondents perceived broad restoration goals as, on average, significantly more important than specific restoration actions (Table 2). This trend held for comparison of all restoration goals versus all restoration actions as well as for comparisons within two subsets: goals and actions for protecting, conserving, and cleaning up the environment; and goals and actions for public use and enjoyment. However, the difference in perceived importance was greatest between the goal of public use and the associated use-oriented actions of increasing access, economic development, and education programs.

Table 1. Importance local residents placed on broad restoration goals and specific restoration actions, weighted for sampling stratification, gender bias, and nonresponse bias

	Mean Importance, Adjusted for Nonresponse ^a
Broad Restoration Goals	
<i>Protect, Conserve, Clean Up Subset</i>	
Cleaning up pollution and other problems in the river	4.3
Protecting the health of the environment in the Hudson River Valley	4.2
Protecting and conserving living resources such as fish, shellfish, and wildlife in the Hudson River Valley	4.1
<i>Public Use Subset</i>	
Promoting public use and enjoyment of the river	3.6
Specific Restoration Actions	
<i>Protect, Conserve, Clean Up Subset</i>	
Reduce danger to humans from chemical contaminants, like PCBs, in the river	4.5
Monitor levels of contaminants in fish in the river	4.5
Clean up contaminated urban waterfront sites called brownfields	4.4
Monitor, protect, and improve fish populations	4.1
Protect wetlands along the river	4.0
Acquire more open land to set aside as natural areas in the valley	3.9
Restore wetland habitat along the river and its tributaries	3.8
<i>Public Use Subset</i>	
Develop and expand education programs, where people can learn about the river	3.7
Provide more access for nonmotorized boats (canoes, kayaks) to the river	3.1
Provide safe access across the railroad tracks for shore fishing	3.1
Increase economic development at urban waterfront sites	3.0
Provide more access for motorized boats to the river	2.0

^aImportance was measured on a 5-point scale where 1 = not at all important, 2 = slightly important, 3 = moderately important, 4 = very important, and 5 = extremely important.

Table 2. Means for broad goals and specific actions overall and by restoration goals/actions subset, and the average difference between goals and actions, weighted for sampling stratification and gender bias

	Broad Restoration Goals		Specific Restoration Actions		Difference (Broad Goals - Specific Actions) Mean
	Mean Importance	SE	Mean Importance	SE	
Overall	4.42	0.04	3.80	0.04	0.64*
<i>Goal/action subset</i>					
Protect, conserve, clean up	4.56	0.05	4.35	0.05	0.24*
Public use	3.94	0.07	3.02	0.05	0.96*

*Statistically significant difference from zero using one-tailed t-test at $p = 0.05$.

Explaining Support for Specific Actions Using Beliefs, Behaviors, and Sociodemographic Characteristics

Correlations between independent variables and the two dependent variables (perceived importance of protect, conserve, clean up actions, and perceived importance of public-use actions) were generally weak, but significant correlations were consistent with expected

direction (Table 3). Correlations between beliefs and the two dependent variables were strongest. Correlations with sociodemographic characteristics were weakest, but in the direction expected for significant comparisons.

Three variables encompassing beliefs about the Hudson River environment and participation in environmentally-supportive activities best explained the im-

Table 3. Knowledge, belief, and behavior scales and sociodemographic characteristics potentially associated with support for ecosystem restoration actions focused on either public use, or protection, conservation, and clean up, weighted for sampling stratification and gender bias

	Perceived importance of protect, conserve, clean-up actions	Perceived importance of public-use actions
	Pearson's correlation	
Knowledge		
<i>Knowledge scale</i> (number of correct answers: 0–4)	0.1476*	–0.2100*
There is a tide in the Hudson River below the Troy Dam		
It is safe to eat as many fish and crabs as you want from the river		
PCB is the abbreviation for a chemical in the Hudson River		
The term estuary refers to tidal rivers where salt water and fresh water mix		
Beliefs		
<i>Concern for environment scale</i> (mean of items)	0.4928*	0.2982*
A healthy economy in the valley depends on a healthy environment		
The balance of nature in the Hudson River Valley is very delicate and easily upset by human activities		
Effects on wildlife, plants, and humans should be considered equally in decisions affecting the Hudson River environment		
<i>Concern for humans over nature scale</i> (mean of items)	–0.1900*	0.2805*
Sometimes it is OK to degrade the environment in the Hudson River Valley to promote economic development		
Plants and animals in the Hudson River Valley exist primarily for human use		
Restoring natural areas along the river would place too many restrictions on how land could be used		
Cost should be an important factor in decisions about how much to clean up and restore the environment in the Hudson River Valley		
<i>How clean is the river today?</i> (1 = extremely dirty, 7 = extremely clean)	0.1269	0.0985
Behaviors		
<i>Personal involvement scale</i>	0.0911	0.1506
(0 = none, 1 = know river exists [stopped to enjoy view], 2 = used land near river [picnicked, walked, biked, or jogged], 3 = river important to activity [watched birds], 4 = river necessary for activity [boating, swimming], 5 = taking something from the river [fished, hunted], 6 = ate fish from river, 7 = worked for company using river resources)		
<i>Household involvement scale</i>	0.1063	0.1453
(same coding as personal scale)		
<i>Boating participation</i> (0 = no, 1 = yes)	0.0500	0.1889*
<i>Fishing or hunting participation</i> (0 = no, 1 = yes)	0.0300	0.0755
<i>Environmental activism scale</i> (sum of activities)	0.1889*	0.0458
Voted for political candidates because of their environmentally-conscious policies		
Joined (or renewed membership in) an environmental organization		
Written a letter to a government representative expressing your opinion about an environmental program or policy		
Volunteered for a Hudson River shoreline clean-up day		

Table 3. (Continued)

	Perceived importance of protect, conserve, clean-up actions	Perceived importance of public-use actions
	Pearson's correlation	
Sociodemographic Characteristics		
<i>Stated political orientation on domestic policy issues</i> (1 = very conservative, 7 = very liberal)	0.1257	0.0400
<i>Gender</i> (1 = male, 2 = female)	0.0400	0.0173
<i>Years lived in area</i>	−0.0592	0.0500
<i>Household income</i>	−0.0566	−0.1245
<i>Educational attainment</i>	−0.0954	−0.1985*
<i>Graduate from college</i> (0 = no, 1 = yes)	−0.0100	−0.1836*
<i>Age</i>	0.0447	0.1068
<i>Distance residence is from the river</i>	−0.0685	−0.0100

*Statistically significant correlation at $p = 0.05$.

portance respondents placed on actions associated with protecting, conserving, and cleaning up the Hudson River environment. The adjusted R^2 for the regression model was 0.270. Examination of the model, shown in Figure 2 (top left), indicated that two sets of beliefs contributed to explaining support. Concern for the environment had a positive effect; concern for humans over nature had a negative effect. Respondents' degree of environmental activism had a positive effect on support for protection, conservation, and clean up actions.

In explaining support for restoration actions focused on public use and enjoyment of the river, beliefs and past behaviors were again significant variables along with knowledge of the river. However, in this model (bottom left of Figure 2), the concern for humans over nature scale was positively related to support for restoration actions focused on public use. Behaviors associated with support (boating) were those directly related to the specific river uses comprising part of the public use subset of restoration actions. The adjusted R^2 for this model was lower than the first model at 0.189.

Intended Behavior: Willingness to Pay for Ecosystem Restoration

Support for actions protecting, conserving, and cleaning up the Hudson River environment were positively associated with WTP for ecosystem restoration and protection (Figure 2, right side). Support for actions providing public use and enjoyment of the River were negatively associated with WTP. Other significant variables in the model were income, education, and knowledge. All were positively associated with WTP. The adjusted R^2 for this model was 0.309.

Discussion

Concern About Response Rate

Previous surveys of the general public have experienced lower response rates than surveys of selected audiences for whom the topic of the survey was potentially more salient (Brown and others 1989). Based on past research we expected the response rate for this study to be particularly low in the New York City metropolitan area (Connelly and Brown 1994, Kay 1998). The results of the nonrespondent phone follow-up became more important for calculating estuary-wide response estimates. However, estuary-wide estimates adjusted for nonresponse bias constitute a limited portion of the data presented here and were not used in the regression models. Nonresponse concerns are lessened because the data are used for model development rather than population-level response estimates.

Broad Goals Supported More Strongly Than Specific Actions

As hypothesized, the broad ecosystem restoration goals of the Hudson River Estuary Action Plan were more strongly supported than the corresponding specific implementation actions. This finding supports Barro and Bright's (1998) results from a survey of Chicago-area residents. In the Hudson River case, the area and issues were more diverse than in Chicago. Broad support exists for environmental goals, but as Barro and Bright (1998) speculated, when residents think through the specific costs and actions needed, they become less supportive. Promoters of other ecosystem restoration efforts should consider

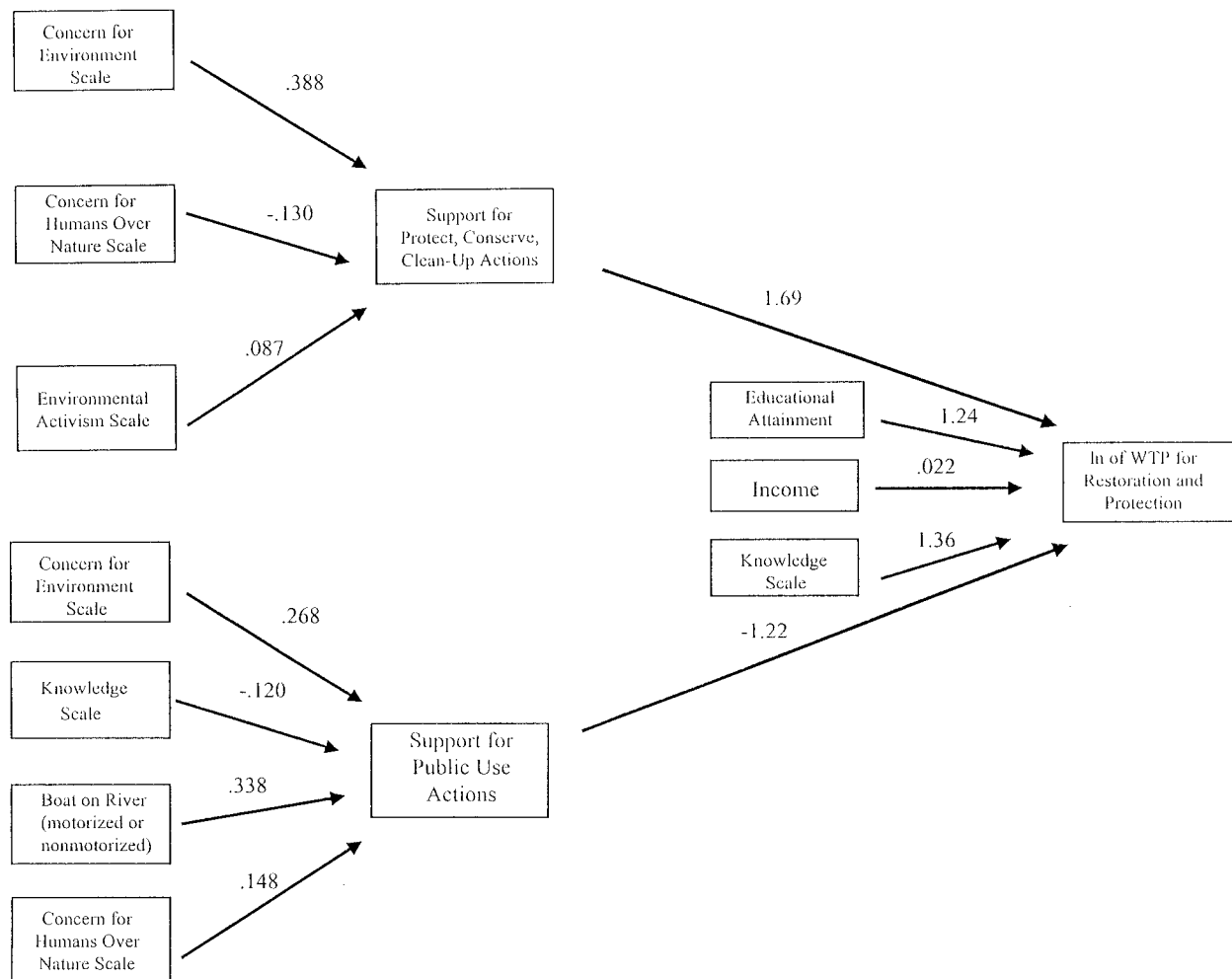


Figure 2. Models developed to explain support for two types of ecosystem restoration actions and WTP for restoration and protection. Data weighted for sampling stratification and gender bias.

this difference in level of support and develop means to actively translate support for goals into continuing support for implementation actions.

Beliefs and Past Behaviors Explain Support For Specific Restoration Actions

We found that beliefs and past behavior are better explanatory variables than sociodemographic characteristics for explaining people's support for ecosystem restoration actions, which mirrors the findings of Smith and others (1997). Although we found weak correlations between sociodemographic characteristics and support for restoration actions, similar to past researchers (e.g., Jones and others 1999, Solecki 1998), the sociodemographic characteristics did not enter the regression models as significant variables.

The model explaining people's support for actions that would protect, conserve, or clean up the Hudson River environment had the higher explanatory power. Support for these actions was best explained by beliefs expressing concern for the environment, the importance of considering the value of nature, and the environmental activism of respondents. Resource managers and other organizations attempting to identify and implement ecosystem restoration actions should try to anticipate and understand potential public reactions to such initiatives. Understanding that beliefs and past involvement may influence support for restoration activities may stimulate managers to learn more about the thoughts and past experiences of key stakeholders before developing proposals for restoration activities, or programs to evaluate such proposals.

Attitudes Linked to Intended Behavior

The best regression model we found to describe WTP included attitudinal measures of support for ecosystem restoration actions and obvious demographic variables. Higher income and education were positively associated with higher WTP, as is typical and consistent with theoretical construct validity (Mitchell and Carson 1989, Whitehead and Hoban 1999), and our similar findings lend support to the validity of our model. The positive association of knowledge and WTP could reflect the combination of income and education and/or interest in the estuary. The strong positive relationship between support for actions that would protect, conserve, or clean up the Hudson River environment and WTP for restoration and protection confirms the Theory of Planned Behavior's assertion that attitudes influence intended behavior (Ajzen 1989, Mitchell and Carson 1989). The negative association between support for public-use restoration actions and WTP might at first seem illogical. However, we offer three explanations for the negative relationship. First, support for public-use actions includes economic development, which some may see as antithetical to restoration and protection. Second, the river is currently used (e.g., boating, fishing) by only a small percentage of local residents. Support for restoration actions to increase public access for these activities was weak among the majority of local residents. Third, the amenities respondents were asked to value fell into the "protect, conserve, clean up" subset, not the "public use" subset. Individuals who most strongly supported public use of the river were willing to pay less than others for environmentally-oriented protection and restoration policies.

Conclusions

Because ecosystem restoration goals appear to be more generally acceptable than specific restoration actions, proponents of restoration programs should not become complacent about the need for active public outreach and involvement even if initial restoration program discussions have been low in controversy. Efforts to assess and foster support for ecosystem restoration should be targeted toward audiences identified on the basis of beliefs and past behaviors rather than on sociodemographic characteristics. Audience-specific outreach might therefore be targeted toward behavior-based groups such as boating associations, beach clean-up participants, sportsman's associations, etc. Our intended behavior measure (WTP) appears adequate for researchers seeking to apply the Theory of

Planned Behavior to understand factors driving support for ecosystem restoration. This measure also helped to illuminate the different ways respondents conceive of restoration activities focused on ecological criteria (protection, conservation) versus public-use criteria (e.g., access). These results should help those involved in ecosystem restoration efforts better anticipate the types of support and opposition they may encounter, as well as the underlying reasons.

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