



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

**Who Are Resource Nonusers and What Can They Tell Us About Nonuse Values?
An Application to Coastal Wetland Restoration**

by

Robert J. Johnston
Department of Agricultural and Resource Economics
University of Connecticut

James J. Opaluch
Department of Environmental and Natural Resource Economics
University of Rhode Island

Marisa J. Mazzotta
Environmental/Natural Resource Economist
Charlestown, RI

Gisele Magnusson
Center for Marine Resource Studies
School for Field Studies, Turks and Caicos Islands, British West Indies.

*Selected Paper prepared for the American Agricultural Economics Association Annual
Meetings, Denver, CO, August 1-4, 2004.*

Short Abstract

This paper assesses the potential for incomplete definitions of resource use to influence estimates of nonuser WTP, and whether uses underlying certain use values may escape measurement using standard mechanisms applied to distinguish resource users from nonusers. Empirical results are drawn from a stated preference analysis involving coastal wetland restoration.

Keywords: Willingness to Pay, Wetland Restoration, Stated Preference, Nonuse Value

Tracking Number: #115927

Robert J. Johnston is Assistant Professor, Department of Agricultural and Resource Economics, University of Connecticut; James J. Opaluch is Professor, Department of Environmental and Natural Resource Economics, University of Rhode Island; Marisa J. Mazzotta is an unaffiliated environmental and natural resource economist; and Gisele Magnusson is an Assistant Professor, Center for Marine Resource Studies, Turks and Caicos Islands, British West Indies. The research was funded by the National Science Foundation STAR Grant Program, the Connecticut Sea Grant College Program, and by the University of Rhode Island Agricultural Experiment Station.

Copyright 2004 by Robert J. Johnston. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes, provided that this copyright notice appears on all such copies.

Introduction

It is generally accepted that natural resource improvements, including improvements to water and wetland resources, may generate both use and nonuse values. The specific determinants of use and nonuse values, however, may differ. There is no necessary theoretical link between the magnitudes of use and nonuse values, and in most cases there are no behavioral trails from which one may validate nonuse value estimates. Although some attempts have been made to provide linkages between non-use values and behavior (e.g., Larson, 1993), revealed preference methods have not been demonstrated to be capable of estimating the full spectrum of non-used values. Nonetheless, nonuse values can represent a substantial component of total resource value; ignoring such values “could lead to serious errors and resource misallocations.” (Freeman 2003, p. 138).

Despite an increasing acceptance of nonuse values as a legitimate component of total resource value, there remains substantial controversy over the measurement of these values. One common means of distinguishing nonuse values is to estimate nonuse values as the total WTP for nonusers (Johnston et al. 2003). Examples of this approach are provided by Whitehead et al. (1995), Croke et al. (1986), Olsen et al. (1991), Cronin (1982), Whitehead and Groothuis (1992), and Mitchell and Carson (1981), among others. Within such analyses, respondents are generally characterized as nonusers if they do not report specified uses of a resource during some defined historical period, and do not expect to make similar use of the resource during some defined future period (Johnston et al. 2003). Limitations of such approaches include the potential for bias if systematic differences exist between nonuse values of users and non-users (Whitehead and Blomquist 1991).

Past studies define nonuse with differing degrees of stringency, using single or multiple indicators to identify nonusers. For example, Mitchell and Carson (1981) define a nonuser as a

respondent who had not engaged in boating, fishing, or swimming within the past two years. In contrast, Whitehead et al. (1995) apply a more stringent definition—identifying nonusers as those respondents who had not engaged in “fishing, swimming, boating, or some other activity” (p. 243) in specified water bodies, nor had “heard or read about the resources, uses, and problems” of the water bodies in question. Like Mitchell and Carson (1981), Cronin (1982) define nonusers based on a lack of participation in specific recreational activities (swimming, boating, fishing, hiking, camping, or picnicking), but expand the definition of users to encompass activities of other household members, and in water bodies other than the particular river in question.

Unlike alternative means of gaining insight into the magnitude of nonuse values, such methods do not require respondents to somehow apportion their WTP into use and nonuse components, nor do they require a combination of revealed and stated preference methods (Johnston et al. 2003). Nonetheless, aside from potential concerns discussed by Whitehead and Blomquist (1991) and Johnston et al. (2003)¹, there remain major unresolved issues in the literature regarding “how [one defines] the use behind use values,” (Freeman 2003, p. 141) or similarly how one defines the “nonuse” by which one might define nonusers. Simply put, stated preference analyses may apply incomplete definitions of resource use and nonuse, resulting in ambiguous definitions of resource nonusers. Where such ambiguities occur, reported nonuser values may in fact contain use value components, leading to the potential for misguided assessments of true nonuser welfare and nonuse willingness to pay (WTP).

While certain classes of natural resources may lend themselves to simple characterization of resource use, others may support myriad, often difficult-to-define or observe uses. For example, coastal wetlands may provide a wide range of use values, including values related to recreational

¹ For example, such methods of distinguishing use and nonuse values may underestimate nonuse values among resource users, as it implies that nonuse values are identical for users and nonusers.

activities (e.g., fishing, shell fishing, bird watching, hiking), values related to non-recreational aesthetic appreciation (e.g., viewing a wetland during a daily commute or from one's home), and values related to wetland services used off-site (e.g., nutrient processing, storm surge protection, erosion control)(Johnston et al. 2002). In such cases, the identification of nonusers based on an absence of past or planned recreational use will likely misspecify the set of true nonusers. Even in cases purportedly characterized by straightforward definitions of resource use, unexpected sources of use values may be present, such as values derived from indirect or otherwise off-site uses the resource in question (cf. Whitehead et al. 1995).² The result may be reported estimates of nonuser value that contain components derived from unsuspected resource uses. Such issues have led some researchers to suggest discarding common notions of use and nonuse values in favor of classifications based solely on relationships to observable or market behavior (e.g., Carson et al. 1999; Freeman 2003).

This paper assesses two closely related issues regarding the estimation of user and nonuser values: 1] the potential for incomplete or ambiguous definitions of resource use to influence estimates of nonuser WTP, and 2] whether the use(s) underlying certain classes of use values may defy measurement using the standard mechanisms applied to distinguish resource users from nonusers. That is, given that resources may be subject to various definitions of resource nonuse, to what extent do researchers risk providing biased nonuser (or nonuse) WTP estimates by relying on definitions of nonuse that are potentially incomplete? A simple theoretical model is first presented in which general implications of incomplete nonuse definitions are derived. Based on this theoretical framework, an empirical model is estimated, with data drawn from *Rhode Island Salt Marsh Restoration: A 2001 Survey of Rhode Island Residents* (Johnston et al. 2002). The

² For example, recreational anglers may benefit from fish spawning “services” provided by coastal wetlands, because such services may improve fish populations elsewhere. Hence, an angler may realize indirect use values from coastal wetlands, even if he or she never visits or directly uses these wetlands.

combined theoretical and empirical models are designed such that hypothesis tests may reveal—at least in a single case study involving coastal wetlands—the potential for incomplete definitions of resource nonuse to generate potentially misleading welfare and policy guidance.

A Model of User and Nonuser Willingness to Pay

The model concerns nonuser values as related to estimation using stated preference survey instruments, and as related to the standard random utility models underpinning such analysis. Within this context, we define users as individuals who participate in at least one of a set of observable activities through which utility may be derived from a natural resource. We define nonusers as individuals who do not participate in such activities under any policy circumstance under consideration.

Although the literature provides various formulations of the utility theoretic basis for nonuse and nonuser values, no general model has emerged that is suitable for all applications (Carson et al. 1999; Freeman 2003). Here, the emphasis is not on use versus nonuse values, but rather on user versus nonuser values. To formalize the distinction between these values, we begin with a simple specification that models the utility derived from a vector ($\mathbf{Q} = x_1, x_2, \dots, x_J$) characterizing the quality (or quantity) of J valued wetland amenities or services. We specify $\mathbf{X} = [x_1, x_2, \dots, x_N]$ as a vector quantifying $\{1 \dots N\}$ observable activities related to \mathbf{Q} . For example, $x_1 > 0$ would indicate non-zero participation in activity $n=1$, such as a specified recreational use of wetland resources. Although some activities \mathbf{X} may include observable market behaviors, many may be behaviors with no observable price (e.g., viewing a wetland during a daily commute). We assume that for nonusers, $\mathbf{X}=0$. For users, at least some elements of \mathbf{X} are nonzero.

We begin with a simple utility function following standard random utility model conventions (McConnell 1990; Hanemann 1984), in which a respondent's utility depends on both

wetland resource-related behaviors \mathbf{X} and wetland resource quality \mathbf{Q} .³ For a representative individual with household income y ,

$$U(\mathbf{X}, \mathbf{Q}, y) = v(\mathbf{X}, \mathbf{Q}, y) + \varepsilon, \quad (1)$$

where $v(\cdot)$ represents the systematic or potentially observable component of utility, and ε represents the stochastic, or unobservable component.

We assume that each respondent considers two wetland management options (A, B) that each would alter the vector \mathbf{Q} and would involve an unavoidable household cost. For example, Plan A would result in $\mathbf{Q}=\mathbf{Q}_A$ and a cost of C_A . If one compares management plan A to plan B, the change in utility (dU) may be modeled as

$$\begin{aligned} dU &= U(\mathbf{X}, \mathbf{Q}_A, y-C_A) - U(\mathbf{X}, \mathbf{Q}_B, y-C_B) \\ &= [v(\mathbf{X}, \mathbf{Q}_A, y-C_A) - v(\mathbf{X}, \mathbf{Q}_B, y-C_B)] - [\varepsilon_B - \varepsilon_A] \\ &= dv - \theta \end{aligned} \quad (2)$$

The model assumes a respondent assesses the difference between utility under the two plans and indicates the sign of dU by either choosing Plan A ($dU > 0$) or Plan B ($dU < 0$). Assuming that θ has a logistic distribution, one may model the probability of selecting a given option using the familiar logit model, in which the probability of selecting a given option is a logistic function of the utility difference dv . If the respondent considers more than one hypothetical policy option (e.g., Plan A, Plan B, or neither plan), the conditional logit model applies (Maddala 1983).

User and Nonuser WTP When Definitions are Unambiguous

The standard model (1)-(2) may be easily customized to allow different utility specifications for different groups (cf. Carson et al. 1999). As above, we denote these groups users and nonusers. For a representative nonuser (subscript n),

³ As noted above, the price vector is assumed constant and suppressed.

$$v(\mathbf{X}, \mathbf{Q}, y) + \varepsilon = v_n(\mathbf{Q}, y) + \varepsilon_n. \quad (3)$$

The specification $v_n(\mathbf{Q}, y)$ in (3) indicates that the utility of a representative nonuser does not depend on the vector of observable activities \mathbf{X} , as by definition $\mathbf{X}=0$ for a nonuser.⁴ For ease of discussion, assume that management plan A is the status quo, or “no new action” plan, while plan B represents an unambiguous improvement in resource quality. Given the observable component of utility in (3), willingness to pay (WTP_n) for a change in \mathbf{Q} from \mathbf{Q}_A to \mathbf{Q}_B , comprising only nonuse values, may be specified as the solution to

$$v_n(\mathbf{Q}_B, y - WTP_n) = v_n(\mathbf{Q}_A, y) \quad (4)$$

where \mathbf{Q}_A is the initial level of resource quality and \mathbf{Q}_B is the subsequent level.

In contrast, for a resource user utility is specified

$$v(\mathbf{X}, \mathbf{Q}, y) + \varepsilon = v_s(\mathbf{X}, \mathbf{Q}, y) + \varepsilon_s. \quad (5)$$

The presence of \mathbf{X} in $v_s(\mathbf{X}, \mathbf{Q}, y)$ indicates that utility may be influenced by participation in at least one of the component activities in this vector. For users, analogous willingness to pay (WTP_s) is given as the solution to

$$U_s(\mathbf{X}, \mathbf{Q}_B, y - WTP_s) = U_s(\mathbf{X}, \mathbf{Q}_A, y) \quad (6)$$

The literature provides various alternatives allowing a general utility specification such as (6) to generate distinguishable use and nonuse value components. For example, one may postulate weakly separable preferences, or, alternatively, weak complementarity (Carson et al. 1999, Freeman 2003, McConnell 1983). For purposes here, it is sufficient to posit that WTP_s in (6) may be comprised of both use (i.e., that related to observable behavior) and nonuse (i.e., that unrelated to observable behavior) components such that

⁴ The price vector for behaviors \mathbf{X} is suppressed for convenience, as all observable prices are assumed constant, and many activities in \mathbf{X} will have no observable price. While a changing price vector may have critical implications in a revealed preference context (e.g., when alluding to weak complementarity), it plays no active role in the derivations that follow.

$$WTP_s = WTP_s^{use} + WTP_s^{nonuse} \text{ (cf. Carson et al. 1999)} \quad (7)$$

However, even if one accepts (7) as a meaningful distinction, in practice distinguishing WTP_s^{use} and WTP_s^{nonuse} presents both theoretical and empirical challenges (e.g., Carson et al. 1999). Hence, in cases where stated preference analysis distinguishes among user and nonuser groups, researchers typically measure only WTP_s , or the total WTP of users.

In contrast, WTP_n (WTP of nonusers) is comprised—by definition—solely of nonuse values (Freeman 2003), so that

$$WTP_n = WTP_n^{nonuse}. \quad (8)$$

However, WTP_n^{nonuse} is not necessarily equivalent to WTP_s^{nonuse} (Whitehead and Blomquist 1991).

Hence, one cannot in general use WTP_n^{nonuse} as a measure of representative household nonuse willingness to pay among the general population (Freeman 2003, p. 142), or to implement the distinction between the use and nonuse values of resource users in (7).

As noted above, many stated preference assessments of use and nonuse values do not estimate use and nonuse values among the general population. Instead, surveys may include questions designed to distinguish resource users from nonusers. Responses to such questions are then used within a random utility framework to estimate *user* and *nonuser* values. As noted above, these values are not, in general, equivalent to use and nonuse values among the general population. However, assuming that the general population may be represented as a weighted sum of appropriately defined representative users and nonusers, under certain conditions well-defined estimates of user and nonuser values may provide insight into the ordinal magnitudes of use and nonuse values.

In the general case, where $WTP_n^{nonuse} \neq WTP_s^{nonuse}$, the ability to estimate nonuser WTP

provides little insight into the cardinal magnitude of general population nonuse WTP. However, if one is willing to accept the restrictive assumption that average nonuse WTP is identical among users and nonusers (i.e., $WTP_n^{nonuse} = WTP_s^{nonuse}$), then a representative estimate of WTP_n^{nonuse} is equivalent to marginal nonuse WTP among a representative member of the general population. Less restrictive assumptions may also allow one to bound nonuse WTP among the general populace, using information implicit in (3)-(8). For example, if one assumes that $WTP_s^{nonuse} \geq WTP_n^{nonuse}$, then WTP_n serves as a lower bound on nonuse WTP among the general population (cf., Whitehead and Blomquist 1991; Johnston et al. 2003), and $(WTP_s - WTP_n)$ serves as an upper bound on use WTP. If, in contrast, one has evidence to believe that $WTP_s^{nonuse} \leq WTP_n^{nonuse}$, then WTP_n serves as an upper bound on nonuse WTP among the general population, and $(WTP_s - WTP_n)$ will provide a lower bound on use WTP. Hence, assessments of nonuser WTP may provide some guidance as to the magnitude of general population nonuse WTP, if one is willing to accept assumptions regarding the ordinal magnitudes of nonuse WTP held by users and nonusers.

User and Nonuser WTP When Definitions are Incomplete

The ability of (3) - (8) to provide guidance regarding general population user and nonuser values depends on an unambiguous definition of resource nonusers. However, as noted above, researchers may generate incomplete definitions of resource nonuse based on $x_i=0$ for an incomplete $\bar{n} < N$ set of indicator activities. To simplify the presentation, we assume that a researcher improperly defines nonusers based on the criteria $x_1=0$, such that $\mathbf{X}_{qn} = [0, x_2, \dots, x_N]$. The subscript qn denotes *quasi-nonuser*, to reflect the fact that the incomplete definition of resource use may lead to the mischaracterization of some true users as nonusers.

Based on this definition, quasi-nonuser WTP for a change from \mathbf{Q}_A to \mathbf{Q}_B is given by the solution to

$$v_s(\mathbf{X}_{qn}, \mathbf{Q}_B, y - WTP_{qn}) = v_s(\mathbf{X}_{qn}, \mathbf{Q}_A, y) \quad (9)$$

where the presence of \mathbf{X}_{qn} in (9) indicates participation in a set of (unsuspected by the researcher) activities that contribute to utility. Although one might expect that $WTP_{qn} > WTP_n$, theory in fact provides no guidance regarding the magnitudes of these welfare measures, as WTP_{qn} may include both use and nonuse values, and nonuse values may differ between true nonusers and quasi-nonusers. Moreover, in some cases use values may be negative (Johnston et al. 2001). Hence, incomplete definitions of resource nonuse will likely yield estimates of quasi-nonuser WTP that reveal neither true nonuser nor nonuse WTP. (For example, even if one assumes that $WTP_n^{nonuse} = WTP_s^{nonuse}$ as above, WTP_{qn} provides no guidance as to the magnitude of general population nonuse values.) It may also be easily shown that the limited ability to bound general population nonuse WTP is lost when nonuser definitions are ambiguous.

The Empirical Model

Given the difficulty in identifying all potential avenues of resource use in some cases, equations (4)-(8) might seem to provide a discouraging message with regard to the ability to measure nonuse and nonuser WTP for particular resources. However, the empirical severity of the problem may depend on the ease of defining resource use and nonuse in specific cases, and on whether incomplete definitions of resource nonuse result in significant differences in estimated WTP. In some cases, WTP_{qn} may closely approximate WTP_n , thus providing researchers with a practical approximation to nonuser values even given incomplete definitions of nonuse. In other instances, however, incomplete definitions of nonuse may lead to significant changes in marginal

WTP, leading to the potential for notable biases if WTP_{qn} is used to approximate WTP_n . The principal question, then, is whether estimated nonuser WTP is sensitive to changes in definitions of nonuse and/or mechanisms used to define nonusers.

To assess these questions we estimate a model of user and nonuser stated preferences for multiattribute coastal wetland restoration plans. We estimate a random utility model allowing calculation of user and nonuser marginal WTP for a variety of different coastal wetland attributes; WTP is estimated based on stated preference choice experiment data. User and nonuser WTP are assessed under differing definitions of resource nonuse, determined by a set of nonuse indicators. The model allows a systematic assessment of the impacts of increasingly stringent (or simply different) indicators of resource nonuse on estimated nonuser WTP.

The Data

The data are drawn from *Rhode Island Salt Marsh Restoration: A 2001 Survey of Rhode Island Residents*. The survey was designed to assess the relationship between salt marsh functions provided by coastal wetland restoration and public values. Survey development required over sixteen months and involved extensive background research, interviews with experts in marsh ecology and restoration, and 16 focus groups. A large number of pretests, including verbal protocol analysis (Schkade and Payne 1994), were conducted to ensure that the survey language and format could be easily understood by respondents, and that respondents shared interpretations of survey scenarios (Johnston et al. 2002).

Focus groups and pre-tests led to a self administered, in-person survey approach that combined a printed survey booklet with an eight-minute introductory computer-based video presentation. This presentation introduced respondents to information regarding salt marshes and restoration; reminded respondents of tradeoffs involved in salt marsh restoration; reminded

respondents of their budget constraint and the implications of choosing to direct funds to restoration programs; emphasized the importance of respondents' choices; and provided survey instructions. The script and graphics of the presentation were pre-tested extensively, and iteratively revised along with the survey booklet.

Stated preference questions were designed as choice experiments (Adamowicz et al. 1998). Each survey booklet presented the respondent with four sets of discrete choices, each involving two alternative, hypothetical multiattribute restoration plans that would take place in Narragansett Bay. Respondents were explicitly instructed—in both video and text—to consider each pair independent of previous choices. Fractional factorial design was used to construct a range of survey questions with an orthogonal array of attribute levels, resulting in 80 contingent choice questions divided among 20 unique booklets. Attributes distinguishing plans were selected based on background research, expert interviews, and focus groups, and characterized such features as bird, fish, and shellfish habitat; wetland size; mosquito control, public access facilities, and annual household cost (table 1). Based on these attributes, respondents chose one of the two plans, or chose “neither plan.”

Aside from the core stated preference questions, the survey elicited a variety of information regarding respondents' use of and proximity to Rhode Island salt marshes. For example, respondents were asked 1] whether they ever used salt marshes for canoeing/kayaking, hiking/walking, bird watching, shell fishing/crabbing, fishing, swimming, hunting, or other outdoor activities, 2] the frequency with which they drove by or otherwise viewed Rhode Island salt marshes, and 3] whether they lived within sight of a salt marsh. Responses to these questions are used to derive a variety of definitions for a resource nonuser. For example, one may distinguish between recreational nonusers and those who in addition neither (regularly) drive by

nor live within sight of Rhode Island salt marshes—a more complete definition of nonuse. Model variables derived from these questions are summarized in table 1.

The survey was conducted from September through December, 2001. Respondents were intercepted in-person at survey locations including Rhode Island Department of Motor Vehicle offices, public libraries, and other sites. In total, interviewers collected 661 surveys, providing responses to 2,341 individual contingent choice questions (89% of the potential 2644).

Econometric Analysis

To allow for a variety of potential definitions of nonuse within a single empirical model, we introduce two binary variables characterizing the absence of different dimensions of resource use. The first, *nonrec*, identifies individuals who not participate in a comprehensive list of recreational uses of salt water wetlands (*nonrec*=1 indicates a recreational nonuser). The second, *nonproximate*, identifies individuals who do not drive by, otherwise view, or live within sight of a salt water wetland (table 1). Combinations of these two variables allow for various definitions of nonusers. For example, one might defines a nonuser based solely on non-participation in recreational uses of wetland resources (*nonrec*=1), following similar definitions applied elsewhere (e.g., Mitchell and Carson 1981, Cronin 1982). In contrast, one might apply a more restrictive definition, characterizing a nonuser as a respondent for whom both *nonrec*=1 and *nonproximate*=1.

As each respondent considers three potential choice options (i.e., Plan A, Plan B, Neither), the model is estimated as a conditional logit model (cf. Johnston et al. 2002), allowing systematically varying slopes according to the two definitions of a resource nonuser. That is,

$$dv = \beta(\Delta\mathbf{Q}) + \lambda_1(\Delta\mathbf{Q})(nonrec) + \lambda_2(\Delta\mathbf{Q})(nonproximate) + \gamma(\Delta fee) + \psi_1(\Delta fee)(nonrec) + \psi_2(\Delta fee)(nonproximate) \quad (10)$$

where $\Delta\mathbf{Q}$ represents the change in the vector of wetland attributes provided by a restoration plan,

Δfee represents the change in unavoidable household taxes, and conforming parameter estimates are given by β , λ_1 , λ_2 , γ , ψ_1 , and ψ_2 . Given (10), marginal utilities of those for whom $nonrec=1$ and $nonproximate=0$ are given by $(\beta+\lambda_1)$; marginal utilities for those for whom $nonrec=1$ and $nonproximate=1$ are given by $(\beta+ \lambda_1+\lambda_2)$. That is, the model allows marginal utility and WTP to vary systematically according to values of the nonuse indicators $nonrec$ and $nonproximate$.

As the final data is comprised of four responses per survey (i.e., panel data), there is a possibility of correlated errors across responses. That is, responses provided by individual respondents may be correlated even though responses across different respondents are considered *iid*. There are a variety of approaches to such potential correlation, including random effects and random parameters (mixed) discrete choice models (Greene 2003; McFadden and Train 2000). Although the most flexible model specifications would allow for a random distribution of the entire parameter vector across respondents, in practice one may experience difficulties in model convergence when large numbers of random parameters are incorporated (e.g., Layton 2000; Johnston et al. 2003). Here, we estimate (10) assuming that the coefficient vector β is randomly distributed across respondents, while the remaining parameters λ_1 , λ_2 , γ , ψ_1 , and ψ_2 are assumed to be nonrandom (fixed) coefficients. The model is estimated using maximum likelihood for mixed conditional logit—or random parameters logit (RPL)—with Halton draws applied in the log likelihood simulation. Elements of coefficient vector β are assumed normally distributed across respondents, with free correlation allowed among parameters (Greene 2002).

Results and Discussion

Model results are presented in table 2. The model is significant at $p<0.0001$ ($\chi^2=1560.66$, $df=68$). A likelihood ratio test of the random parameters model versus a conditional logit model in which all parameters are fixed rejects the null hypothesis of a fixed β vector at $p<0.01$ ($\chi^2=390.78$,

df=36). A likelihood ratio test of the unrestricted model (shown in table 2) compared to a restricted model in which $\lambda_1=\lambda_2=\psi_1=\psi_2=0$ rejects the null hypothesis of zero joint influence at $p<0.03$ ($\chi^2=31.69$, df=18), indicating that the resource use indicators *nonrec* and *nonproximate* are jointly associated with statistically significant changes in *dv*. That is, indicators of resource nonuse are jointly associated with changes in the marginal utility of wetland restoration programs. All parameter estimates associated with non-interacted resource quality attributes (β) are statistically significant. Signs of parameter estimates correspond with prior expectations derived from focus groups, where prior expectations exist. For example, respondents favor plans that restore larger salt marshes; improve bird, fish, and shellfish habitat; provide improved mosquito control; provide public access; and result in lower household cost.

User and Nonuser Willingness to Pay for Coastal Wetland Attributes

Parameter estimates in table 2 allow one to assess the statistical significance of changes in marginal utilities associated with the nonuse indicators *nonrec* and *nonproximate*. However, the presence of statistically significant changes in marginal utilities does not necessarily imply changes (statistically significant or otherwise) in associated marginal WTP. To assess differences in nonuser WTP associated with different indicators of nonuse, we assess and compare marginal WTP for the cases in which 1] *nonrec*=0 and *nonproximate*=0; 2] *nonrec*=1 and *nonproximate*=0; and 3] *nonrec*=1 and *nonproximate*=1. To simplify discussion, we denote those for whom *nonrec*=0 and *nonproximate*=0 as “users”. Those for whom *nonrec*=1 and *nonproximate*=0 are denoted “recreational nonusers”, and those for whom *nonrec*=1 and *nonproximate*=1 are denoted “comprehensive nonusers”.

Marginal WTP is calculated following Hanemann (1984), as the quotient of the marginal utility associated with a particular wetland attribute (e.g., *bird*, *fish*, *acres*) and the marginal utility

of the money cost of the program (*tax_cost*). These marginal utilities are revealed by parameter estimates β , λ_1 , λ_2 , γ , ψ_1 , and ψ_2 , as noted above. For example, the vector of mean marginal WTP values for a representative respondent for whom *nonrec*=0 and *nonproximate*=0 would be given by β/γ .⁵ The vector of marginal WTP values for a representative respondent for whom *nonrec*=1 and *nonproximate*=1 would be given by $(\beta+\lambda_1+\lambda_2)/(\gamma+\psi_1+\psi_2)$. Table 3 illustrates estimated marginal WTP for each of the three cases noted above. Table 4 illustrates differences in marginal WTP values across the three cases, together with p-values for the null hypothesis of zero difference in WTP values. Hypotheses tests are conducted using nonlinear Wald tests (Greene 2003).

For five of seven wetland attributes considered, WTP point estimates for coastal wetland users (*nonrec*=0; *nonproximate*=0) exceed those of both nonuser groups (table 3). Moreover, for the majority of attributes, WTP of recreational nonusers exceed those of comprehensive nonusers—suggesting that a greater scope of use is associated with an increase in marginal values. For example, point estimates of marginal WTP for increases in fish habitat (*fish*), shellfish habitat (*shellfish*) and wetland access facilities (*platform*, *plat_trail*) decline as one successively reduces the scope of use (table 3).

Such intuitive changes in WTP point estimates notwithstanding, table 4 illustrates that not all differences in WTP point estimates are statistically significant. For three of seven attributes (*shellfish*, *mosquito*, *platform*) we fail to reject the null hypothesis of zero difference in WTP across groups in all cases (at a critical value of $p=0.10$). Two of seven attributes (*bird*, *acres*) are characterized by a statistically significant and positive difference ($p<0.10$) in WTP between users and recreational nonusers, but a non-significant difference in WTP between users and comprehensive nonusers. The remaining two attributes (*fish*, *plat_trail*) reveal statistically

⁵ While the RPL model estimates a distribution for each parameter estimate in β , WTP is calculated only for the mean of this distribution, given by the estimated β vector.

significant and positive differences in WTP between users and comprehensive nonusers, but fail to identify a statistically significant difference between users and recreational users. In sum, for four of seven attributes (*bird, fish, plat_trail, acres*), conclusions regarding the statistical significance of differences between user and nonuser WTP change as a function of the specific indicators used to define nonuse (table 4).

Combined findings presented in tables 2-4 suggest that differences between user and nonuser WTP for wetland attributes may vary both by attribute and according to the applied definition of a nonuser. Although the expected general pattern of user values exceeding nonuser values applies to many wetland attributes (table 3), the set of attributes for which statistically significant WTP differences (between users and nonusers) may be established depends on the set of indicators used to define nonusers (e.g., *nonrec, nonproximate*). These results suggest that conclusions regarding nonuser values for wetland attributes may depend critically on the mechanisms used to distinguish users from nonusers. However, for a small number of attributes (e.g., *platform, mosquito*), conclusions regarding user and nonuser values may be more robust to nonuser definitions. Hence, while model results highlight the risk of providing potentially misleading welfare guidance based on incomplete or ambiguous definitions of resource users and nonusers, they also indicate that WTP may be in some cases robust to varying nonuser definitions.

Potential Impacts of Negative Use Values on Estimated User and Nonuser WTP

While most attributes reveal generally expected patterns in which a greater scope of use is associated with larger WTP point estimates (table 3), such findings are not universal. For example, marginal WTP for increases in the size of restored wetlands (*acres*) is similar for users (*nonrec=0; nonproximate=0*) and comprehensive nonusers (*nonrec=1; nonproximate=1*).

However, WTP is markedly reduced for recreational nonusers (those who do not use coastal wetlands for recreation, but do view coastal wetlands while driving and/or from their homes). These differences are statistically significant (table 4).

Such findings may indicate the presence of *negative* use value components (cf. Johnston et al. 2001)—an occurrence not often considered when contrasting WTP of users and nonusers. For example, additional acres of restored wetlands may be associated with certain perceived elements (e.g., flooding, wildlife nuisance, development restrictions) that reduce utility for households in close proximity to coastal wetlands (i.e., those for whom *nonproximate*=0). In such cases, one would expect a positive increment to utility associated with *nonproximate*=1, as shown in table 2 for *acres* × *nonproximate* ($p < 0.02$). The combination of a *positive* increment to utility associated with *nonproximate*=1, and a *negative* increment to utility associated with *nonrec*=1 (i.e., due to the loss of marginal utility that one might otherwise gain from recreational pursuits) leads to the pattern of WTP revealed for the wetland attribute *acres* (tables 3, 4). The veracity of this intuition notwithstanding, patterns of WTP for *acres* suggest that relationships among use behaviors and marginal restoration values may be more complex than are typically assumed, and that certain wetland attributes may be associated with negative increments to use values. These findings again suggest that common assumptions regarding user and nonuser values (e.g., that user WTP typically exceeds nonuser WTP) may not hold for the full range of resource attributes under consideration in certain policy contexts.

Are Distinctions Among User and Nonuser Values Empirically Meaningful?

Finally, aside from providing insight into the potential impact of nonuser definitions on distinctions between user and nonuser WTP, model results also provide insight into potential

difficulties associated with the isolation of different components of wetland value. Specifically, the “use” underlying some types of use or user values may be difficult to observe or assess, leading to questions regarding the empirical meaning of distinctions between user and nonuser values.

The potential difficulty in identifying the use underlying use values is exemplified here by results associated with mosquito control in wetland restoration. While intuition suggests that WTP for mosquito control comprises an element of use value (i.e., a desire to avoid mosquito bites and associated diseases), marginal values for mosquito control (*mosquito*) appear independent of wetland use as measured here (tables 3, 4). WTP for mosquito control is nearly identical across users, recreational nonusers, and comprehensive nonusers—the indicators *nonrec* and *nonproximate* are associated with no (non-trivial) variance in WTP. This indicates that the use behaviors that might influence WTP for mosquito control are—at the very least—uncorrelated with our nonuse indicators (*nonrec* and *nonproximate*). More broadly, there may be few observable use behaviors that one might associate with WTP for large-scale coastal wetland mosquito control.

Such results highlight the difficulty in assigning traditional distinctions (e.g., use versus nonuse, user versus nonuser) to WTP for attributes such as mosquito control, with which few observable behaviors may be associated. For such goods, traditional distinctions (e.g., user versus nonuser WTP), while perhaps appealing from certain perspectives, may not be empirically practical. In such cases, researchers may find distinctions such as that proposed by Carson et al. (1999) and Freeman (2003) to be more appropriate. These and other authors have proposed discarding the traditional—but perhaps less empirically meaningful—distinction between use and nonuse (or user and nonuser) values in favor of distinctions based purely on relationships to observable market behavior (Carson et al. 1999, p. 100). Hence, WTP for goods such as mosquito

control might be characterized simply as “unrelated to observable behavior.” As above, these findings suggest that policy relevant distinctions between user and nonuser values may be subject to a high degree of variance in reliability and interpretation, depending on the specific characteristics of the resource changes in question and the specific mechanisms used to distinguish users from nonusers.

Conclusion

Model results suggest a considerable likelihood that the particular mechanism used to distinguish resource users and nonusers will influence estimates of user and nonuser WTP for marginal resource changes—in this case changes related to coastal wetland restoration programs. For four of seven coastal wetland attributes considered here, conclusions regarding the statistical significance of WTP differences between users and nonusers are sensitive to the applied definition of a resource nonuser. We also find evidence that for some attributes (e.g., mosquito control) the use underlying presumed user WTP may defy simple observation or measurement—leading to cases where the distinction between user and nonuser WTP may have little empirical justification. Finally, conclusions regarding user and nonuser WTP may be further convoluted by the presence of negative components of use WTP associated with some resource changes.

While model results are based on a single case study, they suggest that distinctions between user and nonuser WTP may be sensitive to various aspects of study and model design, as well as to characteristics of the resource in question. Hence, such distinctions may be fundamentally non-comparable across different study contexts. Such issues may be particularly germane for cases in which benefit transfer is applied to approximate or distinguish user and nonuser (or use and nonuse) values based on research conducted elsewhere (Desvousges et al. 1998), or in which policymakers desire estimates of values realized by users and nonusers.

We emphasize that results shown here do not suggest that researchers abandon measurement of user and nonuser values. In some contexts, estimates of user and nonuser values may be of substantial interest to policymakers. Nonetheless, results do suggest caution in the interpretation of such results, and in comparing distinctions between user and nonuser values across study contexts—particularly where researchers apply unlike methods to define nonusers. Results also suggest that researchers consider the possibility that certain types of WTP typically classified as use values (e.g., values for mosquito control) may lack a discernable correlation to observable behaviors. In such cases, reported nonuser WTP may contain components that researchers and policymakers might consider to be use values.

References

- Adamowicz, W., P. Boxall, M. Williams, and J. Louviere. 1998. "Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation." *American Journal of Agricultural Economics* 80(1): 64-75.
- Carson, R.T., N.E. Flores, and R.C. Mitchell. 1999. The Theory and Measurement of Passive-Use Value. Chapter 4 in in Bateman, I.J. and K.G. Willis, eds. *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the US, EU, and Developing Countries*. Oxford, UK: Oxford University Press.
- Croke, K., R.G. Fabian, and G. Brennan, Estimating the Value of Improved Water Quality in an Urban River System, *Journal of Environmental Systems* 16(1): 13-24, 1986.
- Cronin, F.J., Valuing Nonmarket Goods Through Contingent Markets, Pacific Northwest Laboratory, PNL 4255, Richland, WA, 1982.
- Freeman, A.M. III, *The Measurement of Environmental and Resource Values: Theory and Methods*, Resources for the Future, Washington, D.C., 2003.
- Greene, W.H., *Econometric Analysis*, 5th ed., Prentice Hall, Upper Saddle River, NJ, 2003.
- Greene, W.H., *NLOGIT Version 3.0 Reference Guide*. Plainview, NY: Econometric Software, Inc.
- Hanemann, W.M. 1984. Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses. *American Journal of Agricultural Economics* 66(3): 332-341.
- Johnston, R.J., E.Y. Besedin and R.F. Wardwell. 2003. Modeling Relationships Between Use and Nonuse Values for Surface Water Quality: A Meta-Analysis. *Water Resources Research* 39(12), p. 1363.
- Johnston, R.J., G. Magnusson, M. Mazzotta and J.J. Opaluch. 2002. Combining Economic and Ecological Indicators to Prioritize Salt Marsh Restoration Actions. *American Journal of Agricultural Economics* 84(5): 1362-1370.
- Johnston, R.J., J.J. Opaluch, T.A. Grigalunas, and M.J. Mazzotta. 2001. Estimating Amenity Benefits of Coastal Farmland. *Growth and Change* 32(summer): 305-325.
- Larson, Douglas M. 1993. On Measuring Existence Value. *Land Economics* 69(4): 377-388.
- Layton, D.F. 2000. Random coefficient models for stated preference surveys. *Journal of Environmental Economics and Management* 40(1): 21-36.
- McConnell, K.E. 1990. "Models for Referendum Data: The Structure of Discrete Choice Models for Contingent Valuation." *Journal of Environmental Economics and Management* 19(1): 19-34.
- McFadden, D. and K. Train. 2000. Mixed Multinomial Logit Models for Discrete Responses. *Journal of Applied Econometrics* 15: 447-470.
- Mitchell, R. C., and R. T. Carson, An experiment in determining willingness to pay for national water quality improvements, Draft report to the U.S. Environmental Protection Agency. Resources for the Future, Washington, D.C., 1981.
- Olsen, D., J. Richards, , and R.D. Scott, Existence and Sport Values for Doubling the Size of

- Columbia River Basin Salmon and Steelhead Runs, *Rivers* 2(1), 44-56, 1991.
- Schkade, D.A. and J.W. Payne. 1994. "How People Respond to Contingent Valuation Questions: A Verbal Protocol Analysis of Willingness to Pay for an Environmental Regulation." *Journal of Environmental Economics and Management* 26(1): 88-109.
- Whitehead, J.C. and G.C. Blomquist, A Link Between Behavior, Information, and Existence Value, *Leisure Sciences* 13, 97-109, 1991.
- Whitehead, J.C., G.C. Blomquist, T.J.Hoban, and W.B. Clifford, Assessing the Validity and Reliability of Contingent Values: A Comparison of On Site Users, Off Site Users, and Non users. *Journal of Environmental Economics and Management* 29(2), 238-251, 1995.
- Whitehead, J.C., and P.A. Groothuis, Economic Benefits of Improved Water Quality: a case study of North Carolina's Tar Pamlico River, *Rivers* 3, 170-178, 1992.

Table 1. Model Variables: Definitions and Summary Statistics

Variable Name	Description	Mean (Std. Dev.)
<i>neither</i>	<i>Neither=1</i> identifies “Neither Plan” selected (alternative specific constant)	0.3333 (0.4714)
<i>environ</i>	Binary variable (0,1) indicating membership of respondent in environmental organizations.	0.1890 (0.3916)
<i>taxgroup</i>	Binary variable (0,1) indicating membership of respondent in taxpayers associations.	0.0233 (0.1510)
<i>lo_income</i>	Binary variable (0,1) identifying respondents with a household income less than \$35,000/yr.	0.2428 (0.4288)
<i>hi_educate</i>	Binary variable (0,1) identifying respondents with greater than a four-year college degree.	0.1830 (0.3867)
<i>age</i>	Age of respondent, in years.	39.1244 (15.0496)
<i>bird</i>	Ecological improvement to bird populations (0-10 scale). ^a	2.7664 (2.6048)
<i>fish</i>	Ecological improvement to fish populations (0-10 scale). ^a	2.9063 (2.6519)
<i>shellfish</i>	Ecological improvement to shellfish populations (0-10 scale). ^a	2.9151 (2.6543)
<i>mosquito</i>	Improved potential to control mosquito nuisance (0-10 scale). ^b	2.9098 (2.6512)
<i>acres</i>	Size of restored salt marsh, in acres.	4.8961 (4.3995)
<i>platform</i>	Binary (0,1) variable indicating that restoration provides “viewing platforms”	0.2267 (0.4187)
<i>plat_trail</i>	Binary (0,1) variable indicating that restoration provides both “viewing platforms” and “trails”.	0.2219 (0.4155)
<i>tax_cost</i>	Annual cost of plan to the household (increase in state taxes)	62.9691 (70.6690)
<i>nonrec</i>	Binary (0,1) variable identifying respondents who do <i>not</i> engage regularly (at least 3-4 times per year) in any of the following activities in or around salt marshes: canoeing/kayaking, hiking/walking, birdwatching, shellfishing/crabbing, recreational fishing, swimming, hunting, or other outdoor activities.	0.3187 (0.4660)
<i>nonproximate</i>	Binary (0,1) variable identifying respondents who “drive by or otherwise view ... salt marshes” less than once per month, and who do not “live within sight of a salt marsh.”	0.4363 (0.4959)

^a All ecological improvement variables (*bird*, *fish*, *shellfish*) were described on a (0-10) scale. This scale was described to respondents as the “ecological improvement” to statewide populations “as judged by wetland experts, compared to all other potential salt marsh restoration projects in Rhode Island.”

^b The potential to control mosquito nuisance (*mosquito*) was described on a (0-10) scale. This scale was described to respondents as the “potential to control mosquito nuisance...as judged by wetland experts, compared to all other potential salt marsh restoration projects in Rhode Island.”

Table 2. Random Parameters Logit (RPL) Results^a

Variable	Parameter Vector	Estimate	Std. Error	Prob. Z >z
<i>neither</i> ^b	β	1.6621	0.7271	0.0223
<i>neither</i> \times <i>taxgroup</i>	β	1.0946	1.1739	0.3511
<i>neither</i> \times <i>lo_income</i>	β	0.1439	0.4358	0.7412
<i>neither</i> \times <i>hi_educate</i>	β	0.3699	0.5738	0.5192
<i>neither</i> \times <i>age</i>	β	-0.0235	0.0144	0.1025
<i>neither</i> \times <i>environ</i>	β	-1.3860	0.6179	0.0249
<i>bird</i> ^b	β	0.2136	0.0418	0.0001
<i>fish</i> ^b	β	0.2283	0.0394	0.0001
<i>shellfish</i> ^b	β	0.2637	0.0434	0.0001
<i>mosquito</i> ^b	β	0.2122	0.0371	0.0001
<i>platform</i> ^b	β	0.4497	0.1869	0.0161
<i>plat_trail</i> ^b	β	0.8180	0.1917	0.0001
<i>acres</i> ^b	β	0.0670	0.0236	0.0045
<i>tax_cost</i>	γ	-0.0098	0.0009	0.0001
<i>neither</i> \times <i>norec</i>	λ_1	0.2588	0.7672	0.7358
<i>bird</i> \times <i>norec</i>	λ_1	-0.0662	0.0651	0.3088
<i>fish</i> \times <i>norec</i>	λ_1	0.0259	0.0589	0.6593
<i>shellfish</i> \times <i>norec</i>	λ_1	0.0781	0.0671	0.2438
<i>mosquito</i> \times <i>norec</i>	λ_1	0.0804	0.0638	0.2081
<i>platform</i> \times <i>norec</i>	λ_1	-0.2400	0.2973	0.4195
<i>plat_trail</i> \times <i>norec</i>	λ_1	-0.0752	0.3289	0.8193
<i>acres</i> \times <i>norec</i>	λ_1	-0.0512	0.0383	0.1806
<i>tax_cost</i> \times <i>norec</i>	ψ_1	-0.0033	0.0017	0.0536
<i>neither</i> \times <i>noview</i>	λ_2	-0.4307	0.7153	0.5470
<i>bird</i> \times <i>noview</i>	λ_2	0.8491	0.0627	0.1759
<i>fish</i> \times <i>noview</i>	λ_2	-0.1072	0.0568	0.0590
<i>shellfish</i> \times <i>noview</i>	λ_2	-0.0733	0.0631	0.2451
<i>mosquito</i> \times <i>noview</i>	λ_2	0.0139	0.0585	0.8120
<i>platform</i> \times <i>noview</i>	λ_2	-0.0641	0.2640	0.8083
<i>plat_trail</i> \times <i>noview</i>	λ_2	-0.2773	0.2931	0.3442
<i>acres</i> \times <i>noview</i>	λ_2	0.0882	0.0373	0.0182
<i>tax_cost</i> \times <i>noview</i>	ψ_2	-0.0009	0.0016	0.5692
<i>Log Likelihood</i>		-1745.38		
<i>-2 LnL χ^2</i>		1560.66	df = 68 ^a	0.0001
<i>χ^2 for RPL vs. fixed parameters logit</i>		390.78	df = 36	0.0001
<i>χ^2 for $H_0: \lambda_1=\lambda_2=\psi_1=\psi_2=0$</i>		31.69	df = 18	0.0230
<i>N</i>		2306 ^c		

^a Additional parameters estimated as part of the RPL model are suppressed for brevity. These include the diagonal and off-diagonal elements of the Cholesky Matrix for random parameters, and the associated standard deviations of random parameter distributions. In total, 68 parameters are estimated; 32 are illustrated.

^b Random parameter (all others are considered fixed).

^c Thirty-five observations of the original 2341 were deleted due to missing values for model variables.

Table 3. Marginal Willingness to Pay (WTP) for Wetland Attributes

Variable	WTP: <i>norec</i> =0, <i>noview</i> =0 (std. error) ^a	WTP: <i>norec</i> =1, <i>noview</i> =0 (std. error)	WTP: <i>norec</i> =1, <i>noview</i> =1 (std. error)
<i>bird</i>	21.91 (4.34)	11.29 (5.14)	16.66 (4.20)
<i>fish</i>	23.41 (4.43)	19.48 (5.04)	10.54 (3.80)
<i>shellfish</i>	27.04 (4.92)	26.20 (6.18)	19.25 (4.53)
<i>mosquito</i>	21.76 (3.98)	22.42 (5.15)	21.97 (3.99)
<i>platform</i>	46.12 (19.33)	16.07 (22.96)	10.44 (18.95)
<i>plat_trail</i>	83.90 (20.94)	56.94 (26.01)	33.38 (19.63)
<i>acres</i>	6.87 (2.45)	1.21 (2.79)	7.45 (2.47)

^a Standard errors calculated following Greene (2003, p. 487).

Table 4. WTP Differences Associated with Nonuse Indicators

Variable	WTP ^a (1) – (2) (std. error)	WTP (1) – (3) (std. error)	WTP (2) – (3) (std. error)
<i>bird</i>	10.61* (5.61)	5.26 (6.41)	-5.36 (4.82)
<i>fish</i>	3.93 (5.55)	12.87** (6.26)	8.94* (4.64)
<i>shellfish</i>	0.84 (6.50)	7.79 (7.21)	6.95 (5.50)
<i>mosquito</i>	-0.656 (5.33)	-0.21 (5.96)	0.45 (4.69)
<i>platform</i>	30.05 (24.62)	35.68 (29.04)	5.63 (19.61)
<i>plat_trail</i>	26.97 (27.36)	50.53* (30.01)	23.56 (22.28)
<i>acres</i>	5.66* (3.23)	-0.58 (3.79)	-6.25** (2.83)

^a (1) WTP: *norec*=0, *noview*=0; (2) WTP: *norec*=1, *noview*=0; (3) WTP: *norec*=1, *noview*=1.
* p<0.10; ** p < 0.05 (p-values based on an asymptotic Wald test (Greene 2003)).