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VALUATION OF NON-PRICED AMENITIES PROVIDED BYTHE BIOLOGICAL RESOURCES WITHIN THE MONTEVERDE CLOUD FOREST PRESERVE, COSTA RICA

by

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ABSTRACT

To quantify the economic benefits of the Monteverde Cloud Forest Preserve and to test the contingent valuation method in a third world setting, a contingent valuation survey was designed with five experimental treatments. These determined an overall expected value per visitor; determined and compared two ways of eliciting value, single versus annual lump-sum payments; and compared average values of Costa Rican versus not-Costa Rican visitors.

Visitors were willing to pay to prevent Preserve conversion to agricultural uses. Monteverde's value as a preserve appears much higher than any value it might have in agricultural use. Despite lower incomes, Costa Rican visitors valued the Preserve more highly than not-Costa Rican visitors. Visitors did not appear to differentiate between greatly differing bid amounts. Expected values derived from the differing experimental treatments suggest that further methodological adaptation of the contingent valuation method may be required when it is applied in third world settings.

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Parks, biological reserves, and natural forests provide many services, including those with pure public and quasi-private goods aspects (Dixon et aI, 1992:2; Howarth and Norgaard, 1990:1; Mitchell and Carson, 1989:57). If of evident value, many such services are not traded in markets. The contingent valuation method (CVM) has been used often in the United States and other economically advanced regions to attach numeric values to non-marketed environmental amenities. The CVM itself has been the regular subject of theoretical, methodological, and applied research (Smith, 1993:1; Kahneman and Knetsch, 1992:57; Stevens et aI, 1991:390; Boyle and Bishop, 1988:20).

Contingent valuation has been less used in quantitative research in the third world and particularly in Latin America. Personal characteristics of taste, choice, income and other variables influencing willingness to pay (WTP) for non-market amenities may vary between developed and less developed settings. **In** view of the scarcity of contingent valuation research in Latin America, a general estimate of the non-market value of a Preserve such as Monteverde is of interest.

The Monteverde Cloud Forest Preserve comprises some 10,000 strategically located hectares lying along Costa Rica's continental divide and including both Pacific and Atlantic watersheds. It has an enormous biological diversity: It is home to several endemic species, some threatened with extinction such as the resplendent quetzal (Pharomacrus mocino), Baird's tapir (Tapirus bairdii) and the jaguar (Panthera onca). There are six different Holdrige life zones inhabited by more than 100 mammals, 400 species of birds and 120 species of reptilians and amphibians, some 2,500 species of plants and several thousands of insects.

In 1992 the Preserve received 32,213 paying visitors and that figure is expected to reach 40,000 in 1993. The great majority of these visitors had visited the Preserve only once, or at most twice, in a lifetime. This contrasts with respondents to recreational use value surveys in the United States, who often repeatedly visit sites.

The choice under study involves land use, the potential-conversion of the land in the biologically rich Preserve (the non-market environmental good) to an alternate land use, agriculture. The current use is natural forest of high biological diversity. The Forest provides a number of environmental services with public and quasi-private aspects, such as trapping and releasing water, the maintenance of endemism of potential and uncertain future use, wildlife habitat, and recreational and aesthetic services. The Forest also provides direct economic benefits from tourism to nearby communities. The alternate use involves forest removal (destruction) and conversion of the land area to pasture or other

agricultural use. These alternate uses would eliminate the public and quasi-private amenities as well as most of the direct economic benefits from tourist expenditures in the area. We hypothesize that individuals would be worse-off if the Monteverde Preserve were lost to agriculture and cattle ranching. Specifically, we hypothesize that an economic loss would occur in the form of a reduction in personal welfare (Pearce, 1986), that this loss would accrue to Preserve visitors, and that the visitors would be willing to pay a specified amount of money to prevent the forest from being converted to agricultural uses.

This study uses the CVM to estimate the economic benefits provided by the Monteverde Cloud Forest Preserve, Costa Rica. **It** is structured to allow hypothesis testing concerning both the CVM and the characteristics of Costa Rican versus non-Costa Rican visitors, and has three objectives:

1. To estimate the value of the non-market environmental amenities provided by the Preserve, in the aggregate, across two alternative ways of eliciting bids, and across all visitors;

2. To compare and contrast the contingent value placed by Costa Rican visitors, citizens of a Latin American "third world" country, with that of non-Costa Rican visitors (65% of whom were from the United States); and

3. To test whether the mean WTP estimated by asking about willingness to make a periodic payment of amount $ is the same as the mean WTP estimated by asking about willingness to pay $ once.

Objectives two and three address the CVM itself. We would like to know whether the behavior of Costa Ricans is identical to that of not-Costa Ricans in responding to the CV question. If the two groups behave differently, what motivates the difference? We would also like to know whether respondents behave identically when a single lump-sum payment and a recuring annual payment of the same amount are offered. If behavior differs, what motivates the difference? What is implied about the precision of applied CV estimates?

PROCEDURE

The Preserve had 32,213 total visitors between June, 1991 and February, 1992. A closed-end, dichotomous choice CVM survey was administered to 575 of these visitors. The aim in conducting the survey follows Mitchell and Carson (p.17): "The ultimate aim of a contingent valuation survey is typically to obtain an accurate estimate of the benefits of a change in the level of provision of some public good...".

To be used for the CV estimation a survey response needed to contain data on all of the following: yes or no to a single bid ("take it or leave it"); annual household

income; age; sex; and level of education. Of the 575 responses obtained, 351 contained data on all of these variables. The large majority of the 224 incomplete surveys contained no response to the bid or income questions.

Prior survey research (Tobias, 1991; Boo, 1990) and records kept at the Preserve indicate that numbers of visitors per day, the proportionate representation of different nationalities, age, income, and other visitor traits vary through the year. The survey period encompassed sufficient time to incorporate this full range of variation. Furthermore, comparisons of visitor origins, ages, genders, and like variables showed that means on these variables did not differ significantly between the present and prior surveys.

The survey was administered by the authors and four Preserve employees to Preserve visitors selected randomly. All respondents had just finished visiting the preserve at the time they were invited to complete the survey. A protocol inviting visitors to respond was developed in writing and used. Also, strict guidelines were set forth for the surveyors regarding the way in which surveys would be administrated. A pre-test of the questionnaire was carried out to verify it was understandable, readable, and clear.

Identical English and Spanish language survey instruments were used. For both languages, contingent value bids were elicited for a single lump-sum payment (Type 1) and recurring annual payments of so much per year (Type 2). So, a total of four survey

forms were used, but any single respondent saw just one form, with a single randomly selected bid amount. This procedure is illustrated in the following table:

	English	Spanish
Type 1	Form 1	Form 2
Type 2	Form 3	Form 4

Potential truncation problems were addressed by including a wide range of bids, which began at $10.00 and proceeded in $10.00 increments to $200.00 (20 bid levels whether the lump-sum or the annual payment).

It is important to note that all respondents had just finished visiting the Preserve at the time they responded to the survey. Immediately following her or his visit, a given respondent filled out a survey form in one language, containing one version of the CV question, with a single bid amount.

In all, 185 questionnaires were obtained with single lump-sum payments; 166 with payments of so much per year. Forty two, or 12%, of the respondents were Costa Ricans and 309 were non-Costa Ricans. The distribution of bid amounts was approximately equal across the twenty bid intervals: About 17 complete survey responses were obtained for each of the 20 bid amounts.

We hypothesized that survey respondents would be worse off if the biological resources in the Preserve were lost via conversion to agricultural uses, and that they would be willing to pay a specified amount of money from their own incomes to avoid the loss.

Individuals surveyed were assumed to have, and know, a utility function described by Hanneman (1984) and used by Bowker and Stoll (1988). That function has as arguments income (M), a state of nature with or without the Monteverde Cloud Forest Preserve (S), and a set of conditioning factors (measured in this case by the level of education E):

$$V(S, M; E) \qquad (1)$$

The survey confronted individual respondents with the hypothetical situation described in the valuation question:

On your trip up to the Monteverde Cloud Forest Preserve, you may have noticed large deforested areas visible from the road that are now grass cattle pastures, are being used for agriculture or plain unused eroded hills. In earlier times, these areas were covered with tropical forests similar to the MV forest you have just visited. MV itself is regularly threatened by colonists and settlers, who seek to remove the forest and convert it to cattle pastures or other agricultural uses. Imagine no organization presently exists to prevent such conversion.

Would you be willing to make a payment of $ A per year from your own income to support a non-profit private organization which will protect the Preserve and guarantee its continued existence[1]?

YES NO

Respondents faced two options: 1) to answer NO and face the loss of the resource being valued (S=O) and keep all of their income (M); or 2) to answer yes and have their income reduced by A but the resource available in the future (S = 1). The individual will respond positively only if V(l,M-A;E) is greater than or equal to V(O,M;E), that is, only if her or his utility level under option 2 is greater than or equal to that under option 1. It is assumed that if the individual makes the payment the resource will be preserved for sure and if he or she does not make it the resource will be lost for sure[2].

The probability that an individual will say YES to the valuation question is:

$$Pr = G(dV) \quad (2)$$

where G is a probability function for the random component of utility and dV is the expected utility difference mentioned above:

$$dV = V(1,M-A;E) - V(O,M;E) \quad (3)$$

Following Stevens *et al* (1991) an approximation of the probability that a respondent would pay the specified amount A is G(dV(A». An individual would be willing to pay an amount A if her or his true equivalent consumer surplus (ES) is greater than or equal to A so that G(dV(A» approximates the probability of ES $\geq$ A. What is important here is that the value of the resource can be approximated by the expected value of the true equivalent surplus, E(ES). The empirical analysis approximates dV as:

$$dV = B_1 + B_2 \log A + B_3 \log M + B_4 E \quad (4)$$

where A is the take-it-or-Ieave-it bid amount in dollars, M is annual income in dollars, and E the education level in years. Then:

$$E(ES) = \int G(dV(A»dA \quad (5)$$

An estimate of the true Hicksian equivalent surplus is obtained from the expected value of the equivalent surplus (Just et. aI., 1982:85 and 139). This E(ES) is the value of a Reimann sum (equation 5) computed by *multiplying* the probability of a yes response (to the CV question) for any given bid amount *times* the value of dV (equation 4) for that same bid amount *and summing* across all bid amounts[3]. This expected equivalent surplus is defined as "the consumer's willingness to pay to avoid the loss of a commodity which, if paid, would place the consumer at the post-change welfare leve1." (Hanneman, 1984; Sellar, Chavas, and Stoll, 1986:386; Randall and Stoll, 1980:449).

A logit dichotomous choice model was used for the econometric estimation. The logistic distribution function,

$$(1 + \exp(-X_i B))^{-1} \qquad (6)$$

was used for G.

We aggregate across the 351 useable survey respondents to show that a system of preferences exists at societal level whereby aggregate WTP to avoid a quality deterioration in the land area currently preserved as natural forest by its conversion to agricultural use, is positive.

RESULTS

The logit model was used to estimate the parameters shown in Table 1. In all cases, the amount of the bid, (A), was the most significant factor in determining the probability of a YES response. The coefficients have the expected signs: Increases in both education and income levels increase the probability of a YES response; and increases in the bid decrease the probability of a YES response.

Regarding the significance of the estimates, the bid parameter is significant or highly significant in all cases. The income parameter is significant only among not-Costa Ricans. The education parameter is significant for the 351 pooled respondents and also among not-Costa Ricans. All five models have a better than average predictive capacity ranging from 62 to 76 percent of right predictions. The likelihood ratio test, A_{LR}, distributed as Chi-Square, is significant below 1% in four of the five models, and below 3% in the fifth model. This indicates that, in all five models, not all of the logit regression parameters are equal to zero.

Mean and Aggregate Hicksian Equivalent Surplus for the Monteverde Cloud Forest Preserve

As shown on Table 2, the estimated mean individual Hicksian equivalent surplus across all 351 survey respondents is \$121.05[4]. Aggregating across the 32,213 persons who

visited the Preserve during the period when surveys were collected, and taking a conservative equivalent surplus value of zero for the 224 respondents who incompletely answered the survey (575-351=224), the aggregate annual economic benefits derived by visitors are $2,380,263 (or, $121.05 x 32,213 visitors x (351/575». If visitors derive those benefits only *once*[5], the net present value of a flow of benefits from 32,213 annual visitors using a 6% real discount rate and a 50-year term equals $37,517,374 and is the aggregate willingness to pay among Preserve visitors to avoid the loss of the Preserve via its conversion to a non-Preserve use. This value is a function of the discount rate, the number of visitors, the proportion of complete survey responses, and the term of analysis. It includes the use, existence, and option values perceived by visitors, but excludes any value among Preserve non-visitors.

Table 2. Individual and Aggregate Willingness to Pay

WTP - All Useable Surveys	
Individual	Aggregate
$121.05	$37,517,374

Costa Ricans and Non-Costa Ricans

A comparison of the contingent values placed by the Costa Rican vs. not-Costa Rican survey respondents is shown on Table 3.

Table 3. Costa Ricans or not-Costa Ricans.

Finding	Costa Ricans	not-Costa Ricans
Mean WTP	$137.41	$118.76
Whole Regression, λ_{LR}	λ_{LR} = 9.16**, 3 df	λ_{LR} = 23.78***, 3 df
Costa Rica vs. not CR, λ_{LR}	λ_{LR} = 8.546***, 1 df	
Ho: $B_{CR} - B_{ootcR} = 0$	t = 2.022*, 346 df	

key: * A larger value of t might occur by chance about six times in 100 trials.

** A larger value of λ_{LR} might occur by chance only about three times in 100 trials.

*** A larger value of λ_{LR} might occur by chance about once or fewer times in 100 trials.

The estimated mean individual Hicksian equivalent surplus across the 42 Costa Rican respondents is $137.41 and across the not-Costa Rican respondents $118.76, a difference of $18.65 or 13.6%. Simulation procedures described by Cameron (1991) and Park et. al. (1991) might be used to construct confidence intervals on the mean WTP's, but this has not been done here. Our procedures did not simulate a distribution about the mean estimates, and so we do not know the width of the interval about either mean nor whether their intervals may overlap.

Otherwise, the Costa Rican and not-Costa Rican regressions are both significant below the 97% level as measured by their whole-regression likelihood ratio tests. Both test results indicate that there is less than a 3% chance that all regression parameters are equal to zero.

Two procedures are available to test whether costa Ricans responded in the same way as not-Costa Ricans. The likelihood ratio test, $_{ALR\ 6}$, described by Judge et. aI. (1985, p.182-184) yields the chi-square test shown on Table 3. The null hypothesis is that a "restricted" model with a single bid parameter not differentiated by nationality results in the same explanatory power as a "full" model where there are separate bid terms for Costa Ricans and not-Costa Ricans. In effect, this procedure tests the null hypothesis that the two bid parameters in the full model are equal, Ho: $_{B_{CR}\ -\ BnotCR}\ =\ 0$. The null hpothesis is rejected for large values of A_{LR}, and the observed value of 8.546 is significant below 99%. The likelihood ratio test indicates that the Costa Ricans are not responding to the bid question identically to the not-Costa Ricans.

A direct test of the hypothesis that the two regression parameters are equal is available via a paired t-test from the full model. The null hypothesis is the same as that for the likelihood ratio test, and values for t larger than the one shown on Table 3 would be expected to result by chance only about six times in 100. The t-test also suggests that the Costa Ricans may not be responding to the bid question identically to the not-Costa Ricans.

It is important to note the small size of the Costa Rican sample, and to point out that only the bid parameter is significant in the all-Costa Rican regression and in particular that the income parameters was not significant in either regression. Still, our hypothesis tests concerning the equality of responses between the two groups suggest that Costa Rican behavior in answering the contingent value question may not be the same as the behavior of not-Costa Ricans. One indication of this behavioral difference is provided by comparing the bid and income parameters of the two groups. Mean annual income for Costa Ricans was $19,086, just 30% of the mean not-Costa Rican income of $63,823. Costa Ricans valued the resource 13% higher than not-Costa Ricans, yet had only 30% as much income. As a proportion of their incomes, Costa Ricans are willing to pay 3.9 times more than not-Costa Ricans to preserve the environmental good.

These apparent differences may be motivated by other apparent differences between the two groups. For example, Costa Ricans may have a higher stake in a local or national amenity: as a part of their national patrimony, they may value it more and may be willing to give up proportionately (much) more of their incomes to preserve it. It is also reasonable to suppose that the not-Costa Ricans may respond to CV questioning differently in the context of a big-ticket foreign vacation, or that our respondents represent social groups not altogether representative of their own national norms. The latter may be indicated because the mean incomes of, for example, the U. S. citizen respondents appear to be well above the U. S. annual family average income of about $40,000.

In view of the small sample size, the robustness of our results is open to question. That consideration and our findings warrant further experimentation upon the behavior of residents of different countries in answering contingent value questions.

Are the Two Ways of Asking the Contingent Value Question the Same?

A comparison of the contingent values placed by the respondents to the Type I and Type II bid questions is shown on Table 4.

Table 4. Single Lump Sum or Recurring Annual Payment.

Findin~	Type I or Lump Sum	Type II or Recurring
Mean WTP	$130.43	$110.64
Whole Regression, A_{LR}	A_{LR} = 14.26**, 3 df	A_{LR} = 11.63**, 3 df
Type I vs. Type II, A_{LR}	A_{LR} = 7.249**, 1 df	
Ho: $B_{Type\ I} - B_{Type\ II} = 0$	t = 1.899*, 346 df	

key: * A larger value of t might occur by chance about six times in 100 trials.

** A larger value might occur by chance about once or fewer times in 100 trials.

The Type I and Type II regressions are significant below the 99% level as measured by their whole-regression likelihood ratio tests. Both test results indicate that there is less than a 1% chance that all regression parameters are equal to zero.

It is reasonable to suppose that an individual asked for a recurring annual payment would be willing to pay a smaller annual amount than when asked for a one-time payment because the absolute value of a periodic stream of recurring payments would be many times greater than the absolute value of just one of the periodic payments. Here, the estimated mean individual Hicksian equivalent surplus across the 185 Type I respondents is $130.43 and across the Type II respondents $110.64, a difference of $19.79 or 15.2%. Again, our procedures did not simulate a distribution about the mean estimates, and so we again lack a means to test for the significance of the difference.

The same two procedures used to test for equality of response between Costa Ricans and not-Costa Ricans may be used to test equality of response to the Type I and Type II CV questions. The likelihood ratio test yields the chi-square test shown on Table 4. The null hypothesis is that a "restricted" model with a single bid parameter not differentiated by question type results in the same explanatory power as a "full" model where there are separate bid terms for the Type I and Type II respondents. In effect, this procedure tests the null hypothesis that the two bid parameters in the full model are equal, Ho: $B_{Typ\,I} - B_{Typ\,II} = 0$. The null hpothesis is rejected for the observed value of 7.249, significant below 99%. The likelihood ratio test indicates that the Type I and Type II respondents

are not answering the bid question identically.

A direct test of the hypothesis that the two regression parameters are equal is available via a paired t-test. The null hypothesis is the same as that for the likelihood ratio test, and values for t larger than the one shown on Table 4 would be expected to result by chance only about six times in 100. The t-test indicates that the Type I and Type II respondents may not be answering the bid question identically.

If Type I and Type II sample sizes are larger, the bids are the only significant parameters estimated. Still, our hypothesis tests concerning the equality of response between the two ways of asking the CV question suggest that Type I and Type II respondents did not respond identically, but also that the two groups may have perceived only a weak difference between what they wer~ offering to pay when, in fact, a large difference existed. In the present case, the Type I and Type II mean WTP's were not directly compared, but the t-test result suggests that respondents in the present experiment marginally differentiated between their mean willingness to make a single lump sum or recurring annual payment of the same amount. The likelihood ratio test permits a clear conclusion that respondents did differentiate between the two payment types. We would like our test results to be clearer: There is clearly a large difference between paying $130 once or $110 annually (no plausible discount rate equates a recurring annual annuity of $110.64 to a single lump sum net present value of $130.43).

The robustness of our results can again improve and the stability of our tests should be further investigated. The applied valuation of environmental goods via CV is becoming more and more common and we would like as much precision as possible in CV estimates. Further experimentation seems warranted upon the perceptions of consumers about how much they would really have to pay to avoid the loss of environmental amenities.

ADDITIONAL DISCUSSION

This study reinforces preservation since it shows that the resource *per se* is very important to many people. While this importance was recognized prior to establishing the Preserve, the present research provides new reasons for maintaining the current land use. Costa Rican and not-Costa Rican visitors are willing to pay for preservation of the biological resources and other amenities provided by the Monteverde Cloud Forest Preserve. Our results show that the Preserve had economic value for the people who visited it. Sixty percene of those surveyed were willing to contribute some amount from their own incomes for preservation, and preferred having Monteverde preserved and less personal income than the opposite situation: their income intact but the resource destroyed. On a per hectare basis, the per hectare net present value of the preserve land use appears considerably larger than the net present value of a stream of future net earnings from common land use alternatives in the area, ego dairy farming.

While the mean annual incomes of Costa Ricans surveyed is just 30% of the not-

Costa Ricans, the mean willingness to pay of the Costa Ricans is higher and the proportion of their incomes they are willing to pay for preservation is much higher. One explanation is that the Costa Rican visitors truly value the Preserve more highly than the not-Costa Ricans, perhaps from a sense of national pride or patrimony. But, our results indicate that the Costa Ricans were not responding to the CV question the same as the not-Costa Ricans. This possibility permits us to raise CVM validity questions when comparing citizens of differing regions or trying to generalize from results obtained from groups with socio-economic attributes that represent population subsectors (in this case, persons with well above average incomes who are also experiencing an exotic vacation experience). It is difficult to accept the idea that income level is not related to the preference systems of Costa Ricans as these preferences apply to environmental goods, or to see why Costa Ricans appear willing to pay a proportion of thier incomes almost four times greater than not-Costa Ricans. Yet, our results. imply both.

Our respondents appear to have differentiated between bid amounts of very different sizes, but may have only weakly perceived the difference. This may have happened because respondents read the valuation question lightly not paying much attention to the wording. Alternatively, respondents may have placed great value on immediate preservation but exhibited a very high rate of discount, implying the present value of any future benefits was close to zero for them. It is also possible that this result may signal validityquestions: Our CVM survey respondents may have been influenced by the immediacyof their visits to the Preserve, and most were making a one-time visit to what

they.can only have regarded as an exotic and foreign natural area. The results suggest the need for additional experimentation designed to clarify the accuracy of consumer perceptions concerning the real value to them of environmental goods.

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Liklihood Ratio Tests

It is possible to test whether the use of two bid terms in equation 4 -- one term for annual bids add one term for lump-sum bids, or a "full" model -- generates statistically significant additional information over a "reduced" model with a single bid term. One such test is done by first fitting all 351 observations in an equation with one bid term, A, then fitting the 351 observations with a separate term for each type of bid (that is, 185 non-zero observations on a lump-sum bid variable, AL' and 166 non-zero observations on a recurring annual bid variable, A J:

(This is equation 4)

versus

(7)

For normal distributions, this test procedure is described by Neter et. al. (1983, p.289-293). Judge et. aI. describe a test procedure applicable to the logit distribution (1985, p. 182-84). The logit procedure is a likelihood ratio test that yields the test statistic }..LR :

$$X_{LR} = 2[\ L_{X.} - 4\ ] \qquad (8)$$

where It. is the value of the log-likelihood function from the full model (equation 7) and 4 is the value of the log-likelihood function from the reduced model (equation 4).

The null hypothesis is that the two regression parameters B_2 and B3 in equation (7) are equal, B_2 - B3 = 0. The result of this likelihood ratio test falls between the 90% and 95% levels of statistical significance:

A_{LR} = -3.64 - Chi-square, with (N - 4) - (N - 3), or 1 degree of freedom.

We cannot reject the null hypothesis at the 95% level, but can reject it at the 90% level of comidence.

1.. This is the type 2 contingent value question. The type 1 question substituted the following phrase: "Would you be willing to make a one-time payment of $ Δ from your own..."

2.. This approach to the valuation of non-market environmental amenities is described by Seller, Stoll, and Chavas (1985:156) and has been used in a number of applied studies. See for example Bergstrom et al (1990:129); Stevens et al (1991:390); Whittington et al (1992).

3. Our procedure used $10 and $200 as ends, so the area under equation 5 is restricted to E(ES) ~ 0.

4.. This value results from evaluating equation 5, where the lower and upper limits of integration are $0.00 and $200.00; equation 6 is used for G; and equation 4 is used for dV.

5.. i.e., each year different people will accrue the benefits and after a year will not derive continued benefits from the existence of the Preserve; or, alternatively, if the discounted net present value of the lifetime benefits enjoyed by a one-time visitor are $121.05).

.6. Construction of a likelihood ratio test is shown following references.

7.. 59.83% of all 351 respondents answered yes to the WTP survey question.