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Ecotourism as a Means of Conserving Wetlands

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The Nariva Swamp on the island of Trinidad in the Caribbean is being degraded due to increasing human activity. However, its conservation is desirable, as it is an internationally recognized wetland. The study examined an ecotourism project, with an emphasis on community participation, as a conservation approach to the Swamp, via benefit–cost analysis, where the benefits of conservation were measured by contingent valuation. Contingent valuation showed that the residents of Trinidad were willing to pay an average of $56 for conserving the Swamp. The analysis also showed that ecotourism represents an economically feasible use of ecologically fragile resources of this wetland.

Key Words: benefit–cost analysis, contingent valuation of wetlands, ecotourism

JEL Classifications: Q26, Q51, Q57, R14

The Nariva Swamp is the largest freshwater wetland in the eastern Caribbean. It is located on the east coast of Trinidad at 10°23′N latitude and 61°04′W longitude and covers a total of 6,234 hectares. It is situated approximately 50 km southeast of the city of Port of Spain and comprises state lands, including the Bush Bush Wildlife Sanctuary, the Manatee Observatory, and part of the Ortoire-Nariva Windbelt Forest Reserve (Aitken).

The Nariva Swamp was designated a Wetland of International Importance under the Ramsar Convention on December 21, 1992. Trinidad and Tobago remains the only island nation in the Caribbean that is signatory to the Convention, and Nariva Swamp remains the only wetland in the country's territory included in the Ramsar List (Ramsar Convention on Wetlands).

The Nariva Swamp, as a coastal wetland, has tremendous ecological significance because it supports a variety of rare and vulnerable species at crucial stages of their developmental cycles. Nariva Swamp is a complex of freshwater swamp forests, permanent herbaceous swamps, seasonally flooded marshes, and mangrove forests. It also provides the habitat of the anaconda (*Eunectes murinus*) and the endangered manatee (*Trichechus manatus*). The fauna of Nariva is extremely rich and includes many species of mammals and birds; and several species of reptiles (Wetlands International).

The human communities that surround Nariva engage in many activities that threaten the existence of the Swamp, ranging from agriculture to the clandestine cultivation of marijuana. In fact, many of the problems of ecological degradation of the Swamp may be attributable to the unsustainability of many of the activities that take place there. Such degradation of the Swamp may be leading to substantial coastal erosion and species loss.

Due to its tremendous biological diversity, the Nariva Swamp has the potential to be a prime destination for bird watchers and lovers

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of nature. Currently, natural and cultural visits take place in the Swamp.

Description of the Bush Bush Wildlife Sanctuary

The Bush Bush Sanctuary is situated within the Nariva Swamp and comprises 1,554 hectares, including Bush Bush Island and Bois Neuf Forest. The uniqueness of the area led to its declaration as a Wildlife Sanctuary on July 16, 1968, by the government of Trinidad and Tobago.

The Bush Bush Island is about 3 m above the surrounding Swamp at the height of the rainy season, and the soil is sandy and well drained. The island possesses a true hardwood forest, with the main canopy at about 21–25 m, with a few emergents reaching to 30.5 m (Bacon and Ffrench). Both species of monkey that are known to exist in Trinidad—the red howler (*Alouatta seniculus*) and the weeping capuchin (*Cebus albifrons*)—are present in this sanctuary, in addition to about 57 other species of mammals and a rich variety of avifauna and reptilian life forms (Bacon and Ffrench 1972).

The Bush Bush Island as part of the Bush Bush Wildlife Sanctuary provides an excellent opportunity for ecotourism because of its relatively pristine habitat and its manageability due to its small size.

The Manatee Observatory

The Manatee Observatory is owned by the Manatee Conservation Trust and lies on the Manzanilla beach front. It consists of a partially blocked, man-made channel, referred to as the Big Pond. The Big Pond is approximately 30 feet deep, and about 12–15 adult manatees are believed to inhabit this area.

Overlooking the Big Pond is an observation tower nestled in a large tree approximately 40–50 feet above the water. It is accessible by ladder only. Visitors usually sit in the observation tower and wait for the opportunity to see the manatees when they come to the surface of the water to breathe.

Neighboring Communities of Nariva Swamp

Two major communities exist on the extremities of the Nariva Swamp, Kernahan-Cascadoux and Plum Mitan. The close proximity of these communities and their dependence on the resources of the Swamp have resulted in legal and illegal uses of the Swamp that are both extractive and nonextractive in nature.

The Nariva Swamp has been allocated for the following legal land use: 85% Swamp, 10% forest, and 5% agriculture. However, there has been illegal conversion of Swamp lands for large-scale rice cultivation since 1987. In the Kernahan area, the residents also engage in rice and vegetable farming, though on a small scale. There is also the harvesting of fish, conches, oyster, crabs, and other crustaceans. At least half of the Swamp has therefore been altered in some form or another (Ramsar Convention on Wetlands).

Conceptual Framework

Wetland Conservation

Over time, there has been increasing global recognition of the need to preserve wetlands. Ramachandra states that wetland systems directly and indirectly support millions of people through the provision of goods and services and by contributing to important processes. These processes include the movement of water through the wetland into streams or the ocean; decay of organic matter; release of nitrogen, sulfur, and carbon into the atmosphere; removal of nutrients, sediment, and organic matter from water moving into the wetland; and the provisional habitat for a wide range of flora and fauna.

Integrated management of wetlands provides a range of natural products that can add revenue and create employment in local economies while providing opportunities for outdoor recreation and the perpetuation, through education, of the movement toward environmentalism. Once it can be illustrated that wetlands provide positive net benefits to a community, it is much easier to convince com-

munity residents that the wetlands are worth preserving, thus helping to perpetuate a paradigm that wetlands are indeed vital to all forms of life (Schiller and Flanagan).

Ecotourism

According to Shores, nature-based tourism or ecotourism is one of the fastest-growing subsectors of the tourism industry. He suggests that ecotourism be defined as ecologically sound or ecologically sensitive tourism where the emphasis is placed on preserving the environment.

Given that tourism generates a large and increasing proportion of national income in developing countries, ecotourism presents a substantial opportunity to realize benefits in terms of the conservation of biological diversity and sustainable resource use. This opportunity occurs particularly when the benefits of ecotourism accrue directly to local communities because their valuation of the resources around them increases, resulting in a higher degree of protection of natural resources, in recognition that they are indeed a major source of income (Convention on Biological Diversity). Such community conservation is particularly important in developing countries, where governments lack sufficient funds to manage and protect natural resources, which have come under substantial pressure due to hunting, agriculture, logging, and fishing (Center for Development Information and Evaluation).

Objectives of the Study

The major objective of this study was to determine whether conservation of the Nariva Swamp through its use for ecotourism represents an economically beneficial use of its resources. Therefore. the study conducted a cost–benefit analysis (Hanley and Spash) of an ecotourism project in the Swamp.

Empirical Approach

Definition of the Ecotourism Project

The project allows for nonextractive, regulated use of the resources at the Nariva Swamp. This is achieved by the provision of guided tours for purposes of bird watching and the observation of the manatee and other fauna and flora in their natural habitats.

The criteria used in the selection of the site for the ecotourism project was manageability, in terms of physical boundaries and the scope of activities available. Bush Bush Island and the Manatee Observatory lend themselves well to these criteria because of their small sizes and partial isolation from the rest of the Swamp and the wide range of flora and fauna they possess.

The intent of the project is to adopt a community participatory approach, as well as to employ, where possible, any existing infrastructural resources and amenities in the immediate area. Ecotourism at the site (Bush Bush Island and the Manatee Observatory) will be conducted within the following framework:

I. Protection of the site from aggressive and abusive recreational activities.
II. Provision of opportunities for tourists to observe the fauna and flora.
III. The creation of a consciousness for the conservation of the environment through education.
IV. Initiating and promoting employment opportunities for neighboring communities.

Monetary Valuation of Relevant Impacts—Costs

Conducting cost–benefit exercise necessitates the quantification and valuation of both the costs and benefits of the project. The costs considered are the costs of implementation of the project and will include construction costs, purchase of boats and other materials and labor, and maintenance costs. These costs include

a. the upgrade of the Manzanilla Beach Facility to include the following:
   - rest/change area,
   - food and beverage facilities,
   - a small museum,

- craft shop,
- bathroom/toilet facilities, and
- parking facilities

b. construction of jetties and a shelter at the Bush Bush Island entrance
c. clearing of channels to Bush Bush Island and Big Pond
d. training of guides and the orientation of residents
e. purchase of boats and maintenance of boats and engines
f. marketing and advertising, including the establishment and maintenance of an e-commerce website

The table in Appendix 1 presents the undiscounted costs associated with the implementation of the project.

Monetary Valuation of Relevant Impacts—Benefits

The benefits of the project are to be realized by way of

(a) entrance fees charged at current rates for similar types of activities, and
(b) the value to the population of Trinidad of conservation of the Swamp in its current pristine form.

The value of conservation was obtained by nonmarket valuation of the Swamp through contingent valuation exercise.

Applying the Net Present Value (NPV) Test

The discount rate selected was the U.S. single-currency cost of external borrowing by the government of the Republic of Trinidad and Tobago from the World Bank. This rate was 7.54%. The life of the project was taken to be 20 years. The feasibility of the project was tested by a determination of whether its net present value (the difference between the discounted benefits and costs) was greater than zero.

Contingent Valuation Exercise

The Survey

The contingent valuation (CV) survey was limited to the island of Trinidad. It was not conducted on the island of Tobago due to the limited project budget and because the people of Tobago would have much less access to the Nariva Swamp, since it lies on the neighboring island of Trinidad.

For the CV survey, the sample frame used was the listing of all households in Trinidad based on the 1990 census. Two-stage sampling was used. Enumeration districts (EDs; clusters of households for election and census purposes) were randomly selected at the first stage and, in the second stage, households were randomly selected. A final sample of 515 households was selected.

The survey was conducted by personal interviewing. The hypothetical market for the CV exercise was provided by presenting the respondent with a description of

(a) the location of the Nariva Swamp,
(b) its importance in terms of the flora and fauna it supports, as well as
(c) a summary of the economic and recreational activities that take place there.

The respondent was then given a single bounded dichotomous choice of voting 'yes' or 'no' to the payment of a randomly assigned fixed sum to conserve the Nariva Swamp, in the bid question.

The description of the Nariva Swamp that was used to set up the hypothetical market is given in Appendix 2, along with the payment question (question 1). Question 2 in Appendix 2 asked respondents to cite a figure for the largest one-time contribution that they would make to conserve the Nariva Swamp. This response was used to elicit the reasons for contributing to the preservation of the Swamp in terms of current use (Question 3a), future use (question 3b), bequest use (question 3c), and existence (question 3d). Other questions put to the respondents sought information on

(a) their knowledge of the Nariva Swamp,
(b) the importance they would place on protecting the Swamp,
(c) previous visits to the Swamp,
(d) attitudes and opinions with respect to natural resources and the environment, and
(e) individual and household variables, such as sex, age, residence, number of years of formal education of the respondent, and annual household income (scale from 1[<$1,600US] to 10 [>$40,000US]).

Valuation Model

The random utility model (Haab and McConnell 2002) was assumed in this study in a form that is additively separable in deterministic and stochastic preferences for individual j as

$$(1) \quad v_{ij}(y_j, z_j, \varepsilon_{ij}) = v_{ij}(y_j, z_j) + \varepsilon_{ij},$$

where y_j represents discretionary income, z_j is an m-dimensional vector of individual and household variables, ε_{ij} is a stochastic error term, and ($i = 1$) represents the CV program implemented and ($i = 0$) represents the damaged condition. Assuming linear utility in the deterministic part yields the indirect utility function

$$(2) \quad v_{ij}(y_j) = \alpha_i z_j + \beta_i(y_j),$$

where α is an m-dimensional vector of parameters such that $\alpha z_j = \sum_{k=1}^{m} \alpha_k z_{jk}$ and β_i represents the marginal utility of income. If the CV question requires the respondent to choose between ($i = 1$) at the required payment t and ($i = 0$), then the change in deterministic utility with the CV state ("yes" vote), can be expressed as

$$(3) \quad v_{1j} - v_{0j} = (\alpha_1 - \alpha_0)z_j + \beta_1(y_j - t_j) - \beta_0 y_j.$$

Haab and McConnell (2002) assume that the marginal utility of income is unaffected between the non CV and the CV states so that $\beta_1 = \beta_0$. However, this eliminates income as a variable for explaining the probability of a "yes" response in Equation (5). A modification of the analysis of Haab and McConnell was, however, adopted for this study, to include the income variable in Equation (5) because, in developing economies, income would always be expected to be a major determinant of consumption behavior.

Let the difference in utility between the states be $v_{1j} - v_{0j} = \alpha z_j - \beta_1 t_j + (\beta_1 - \beta_0)y_j$, where $\alpha = \alpha_1 - \alpha_0$. Now let $(\beta_1 - \beta_0) = \alpha_{m+1}$, then income can be added to the vector z_j of individual and household variables, such that now $\alpha z_j = \sum_{k=1}^{m+1} \alpha_k z_{jk}$ and income is now the $m + 1$ member of the vector z_j.

Now there will be a "yes" response if $(\alpha z_j - \beta_1 t_j) > 0$. Therefore the probability of a "yes" response by respondent j is

$$(4) \quad \Pr(yes_j) = \Pr(\alpha z_j - \beta_1 t_j + \varepsilon_j > 0) = \Pr(\varepsilon_j > \alpha z_j - \beta_1 t_j).$$

To estimate the parameters of the deterministic component of the utility function, the nature of the stochastic terms should be specified. When the response to the bid question is expected to be binary in nature, i.e., "yes" or "no", then it is appropriate to assume that ε_j has a logistic distribution and can be normalized to $\theta = \varepsilon_j/\sigma_L$ and θ has a standard logistic distribution with a mean of 0 and variance $\pi^2/3$. Then, assuming the standard logistical distribution and using the cumulative distribution function (Mood, Graybill, and Boes), the probability that respondent j answers "yes" then becomes the logit model:

$$(5) \quad \Pr(yes_j) = \{1 + \exp[-(\alpha z_j/\sigma_L - \beta_1 t_j/\sigma_L)]\}^{-1}.$$

Maximum likelihood estimates of the parameters $\alpha^* = \alpha/\sigma_L$ and $\beta_1^* = \beta_1/\sigma_L$ can then be obtained by logistic regression, where β_1^* is the estimate of the parameter on $-t$ and $-\beta_0^*$ can be estimated as $\beta_1^* - \alpha_{m+1}^*$.

The willingness to pay (WTP) can be defined as the payment such that $v_{1j} - v_{0j} = 0$. With the assumption of a linear indirect utility model, the expected WTP can be derived as

$$(6) \quad E_z(WTP_j|\alpha, \beta_1, z) = \frac{\alpha z_j}{\beta_1},$$

Table 1. Distribution of Yes Responses by Payment Levels

Payment (X)	Number of Respondents	Number of Yes Responses	Proportion of Yes Responses (%)
5	57	50	87.7
15	57	46	80.7
30	53	40	75.5
50	49	34	69.4
100	52	32	61.5
200	50	25	50.0
300	53	27	50.9
500	49	21	42.9
800	44	11	25.0

Table 3. Calculation of Expected Willingness-to-Pay for the Protection of the Nariva Swamp

Variable	Parameter Estimate (α_k^*)	Mean of (z_k)	$\alpha_k^* \bar{z}_k$
Age	−0.014623	43.29741	−0.728782
Income	0.191	2.028017	0.4280333
Education	0.027304	10.50216	0.286751
Intercept	1.174675	1.0	1.174675
			$\sum$ = 1.1606773
			= $\alpha^* \bar{z}$

$$C^* = E(WTP) = \frac{\alpha^* \bar{z}}{\beta_1^*} = \frac{1.1606773}{-(-0.003324)}$$

= \$349.18TT = \$56.32 U.S.

A consistent estimate of the expected WTP can therefore be obtained from the estimated parameters α^* and β_1^* by substituting these values into Equation (6). Haab and McConnell then suggest that a sample mean of the expected WTP can be calculated based on the mean vector of z. This procedure was used in this study.

Results

Logistic Regression

Table 1 shows that 61.6% of respondents said "yes" to the payment level offered. It is also seen that as the payment level increased, the percentage of "yes" responses generally declined, indicating that the CV survey was internally consistent. In the logistic regression, the log:odds ratio (the logarithm of the ratio of the probability of a "yes" response to the probability of a "no" response) was regressed against age, education, income, and the payment level. The results of this regression using EViews 3.1 are given in Table 2.

Table 2 shows that all the explanatory variables, with the exception of education, are significant. The negative coefficients of both the payment level and age variables show that as the payment level and age of the respondent increased, the odds of stating a "yes" response declined. On the other hand, as income increased, the probability of a "yes" response increased.

Valuation of the Project Site

Using Equation (6), the mean WTP of the sample was calculated as in Table 3. This mean WTP from Table 3 was then aggregated

Table 2. Results of Logistic Regression

Logit (Included Observations: 464)				
Variable	Coefficient	SE	t-Statistic	P-Value
C	1.174675	0.474925	2.473389	0.0137
Payment (t)	−0.003324	0.000463	−7.184347	0.0000
Income (y)	0.191000	0.066433	2.875101	0.0042
Age (z_1)	−0.014623	0.006904	−2.118111	0.0347
Education (z_2)	0.027304	0.025844	1.056458	0.2913
Log likelihood		−268.2533		
Obs with Dep = 1		286		
Obs with Dep = 0		178		

Table 4. Contribution of Values to Payment for the Preservation of the Project Site

Question[a]	Value	Percentage Contribution
3a	Current use	16.75
3b	Future use	23.72
3c	Bequest use	32.11
3d	Existence use	27.43

[a] In Appendix 2.

to the total number of households in Trinidad, which was 304,199, as given by the 1990 Population and Housing Census. Therefore, the total WTP for the population of Trinidad was

$$304{,}199 \times \$349.18 = \$106{,}220{,}206.82\text{TT} = \$17{,}132{,}291\text{US}.$$

The value of the Bush Bush Island and Manatee Observatory, where the site of the ecotourism project is located, therefore represents a portion of this total value. Because the total area of the Swamp is given as 6,234 hectares and the area of the project site is approximately 1,554 hectares, then, on the assumption of an equal value for all areas of the Swamp despite their current uses, the value of the project site was estimated as

$$1{,}554 \text{ ha}/6{,}234 \text{ ha} \times \$106{,}220{,}206.82 = \$26{,}478{,}376.87\text{TT} = \$4{,}270{,}706\text{US}.$$

Table 4 presents the results of the percentage contribution of the different values to payment for the preservation of the Nariva Swamp by the respondents. Here it is seen that bequest and existence values constituted approximately 60% of the total contribution to the preservation of the Swamp. Hence, it may be concluded that the respondents were valuing the Swamp mainly for its value in perpetuity. Therefore, it may be assumed that the respondents considered the value of the project site of $26.5 million TT mainly as its value in perpetuity.

Hence, to derive the annual conservation benefit through the life of the project, the following formula was used:

$$\Pi = D/r$$

where Π = present value of the conservation benefit, D = the perpetual benefit stream flowing at a uniform rate of D dollars per year, and r = continuous discount rate (Chiang).

Therefore, using $r = 7.54\%$, and the net present value of the benefit stream = $26,478,376.87TT, the annual conservation benefit (value) of the project site was calculated to be $1,996,469.62TT = $322,011US.

Tour Fees

Consultations with tour operators suggested that $10US was the average fee charged for similar tours to the famous Asa Wright Nature Center in the northern mountain range of Trinidad and the Caroni Swamp Bird Sanctuary on the west coast of Trinidad. An average of 16 visitors per day to the project site was assumed. Therefore, annual benefit from tour fees was calculated as

$$16 \text{ visitors} \times 7 \text{ days} \times 52 \text{ weeks} = 5{,}824 \text{ visitors per year} \times \$10\text{US per person} = \$58{,}240\text{US} (\$366{,}912\text{TT}).$$

Net Present Value Test

Table 5 gives the discounted cost and benefit streams and the calculated NPV. This table shows that the net present value was approximately $28,747,469.70TT ($4,563,090.43US). This therefore suggests that the proposed plan would be economically feasible because the cost–benefit analysis criterion states that a project would exhibit economic feasibility if its benefits exceed its costs.

Conclusions

This study demonstrates the successful use of contingent valuation for nonmarket valuation in a developing country. Sample sizes in developing countries are generally constrained to be small because of financial limitations.

Table 5. NPV Test of Ecotourism Project $TT

		Discounted Benefits	
Year	Discounted Costs	Discounted Annual Conservation Value	Discounted Tour Fees
0	572,596.00	0	0
1	59,811.17	$1,996,469.62	341,191.47
2	55,617.50	1,996,469.62	317,268.81
3	51,719.71	1,996,469.62	295,033.94
4	53,176.42	1,996,469.62	274,340.10
5	52,700.96	1,996,469.62	255,113.91
6	41,582.88	1,996,469.62	237,208.61
7	38,669.18	1,996,469.62	220,587.49
8	39,756.08	1,996,469.62	205,103.81
9	33,433.54	1,996,469.62	190,720.86
10	254,169.79	1,996,469.62	177,365.26
11	28,911.84	1,996,469.62	164,926.94
12	29,728.16	1,996,469.62	153,369.22
13	25,001.18	1,996,469.62	142,618.69
14	23,245.25	1,996,469.62	132,602.00
15	25,475.04	1,996,469.62	123,319.12
16	22,225.00	1,996,469.62	114,660.00
17	18,691.39	1,996,469.62	106,624.63
18	17,379.26	1,996,469.62	99,139.62
19	16,163.62	1,996,469.62	92,204.99
20		1,996,469.62	85,747.33
Total PV =	$1,460,053.97 (a)	$26,478,376.87 (b)	$3,729,146.80 (c)
	NPV = (b + c) − a = $28,747,469.7 TT		

However, quite useful results can nevertheless be obtained.

This study has shown that ecotourism represents a use of the resources of the Nariva Swamp that is economically feasible and socially desirable. The major benefit of ecotourism is the conservation of the resources of the Swamp, for which the average household in Trinidad showed that they were willing to pay approximately $56US.

However, even in the absence of the benefits of conservation, the project can be seen to be feasible based on its tour fees. At the level of demand of 16 visitors per day, these fees returned an annual revenue of almost $60,000US. Such an inflow to the rural communities surrounding the Swamp would represent substantial income and may induce the residents to willingly undertake the conservation of the Swamp, as they may see such conservation as protection of a viable source of livelihood.

Conducting tours for 16 individuals on a daily basis would be a major undertaking for villagers. In addition, the marketing effort necessary to realize that demand will also be substantial. However, a major benefit of ecotourism, once conducted in accordance with sustainability principles, will be the preservation of the Nariva Swamp, which still is a tremendous natural resource for the people of Trinidad and Tobago and, indeed, the world.

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Appendix 1. Undiscounted Costs of Project Over the 20-Year Project Life

	Total Costs Associated with the Implementation of the Project $TT														
Year	Upgrading Visitors Facility	Shelter at Bush Island Entrance	Jetties	Advertising	Residents Orientation	Supply of Large Bins	Purchase of Boats	Purchase of Kayaks	Purchase of Boat Engines	Maintenance of Engines	Life Jackets	Training of Operators	Clearing Boat Channel	Patrols (Hon. Game Wardens)	Totals
0	325,000	80,000	32,000	8,000	200	5,176	20,000	16,000	17,000	3,600	6,300	6,600	2,800	49,920	572,596.00
1				8,000						3,600			2,800	49,920	64,320.00
2				8,000						3,600			2,800	49,920	64,320.00
3				8,000						3,600			2,800	49,920	64,320.00
4				8,000	200					3,600		6,600	2,800	49,920	71,120.00
5				8,000		5,176				3,600	6,300		2,800	49,920	75,796.00
6				8,000						3,600			2,800	49,920	64,320.00
7				8,000						3,600			2,800	49,920	64,320.00
8				8,000	200					3,600		6,600	2,800	49,920	71,120.00
9				8,000						3,600			2,800	49,920	64,320.00
10	325,000	40,000	32,000	8,000		5,176	20,000	16,000	17,000	3,600	6,300		2,800	49,920	525,796.00
11				8,000						3,600			2,800	49,920	64,320.00
12				8,000	200					3,600		6,600	2,800	49,920	71,120.00
13				8,000						3,600			2,800	49,920	64,320.00
14				8,000						3,600			2,800	49,920	64,320.00
15				8,000		5,176				3,600	6,300		2,800	49,920	75,796.00
16				8,000	200					3,600		6,600	2,800	49,920	71,120.00
17				8,000						3,600			2,800	49,920	64,320.00
18				8,000						3,600			2,800	49,920	64,320.00
19				8,000						3,600			2,800	49,920	64,320.00
	650,000	120,000	64,000	160,000	1,000	20,704	40,000	32,000	34,000	72,000	25,200	33,000	56,000	998,400	2,306,304.00

Appendix 2

(To interviewer: Provide the respondents with a copy of "Description of Nariva Swamp" and read to them from this copy.)

Description of Nariva Swamp

Located in Trinidad and Tobago off the coast of Venezuela, Nariva Swamp is one the largest freshwater wetlands in the Caribbean. Nariva Swamp is considered to be very important to this region because it supports the most diverse vegetation of all wetlands in the Caribbean. The Swamp sustains animal populations of waterfowl, anacondas, and manatees. Nariva also offers recreation in the form of ecotourism, hunting, and fishing. Some of the residents rely on the Swamp for agricultural activities that mainly consist of rice and vegetable farming as well as harvesting cascadura fish and conches.

Currently, squatters who live in Nariva Swamp are engaged in agricultural activity that is damaging the Swamp. This problem is predominantly caused by Trinidad and Tobago having a land tenure system that is difficult to enforce. This illegal squatting was first recorded in the 1980s, mainly in the nearby Bush Bush wildlife sanctuary. By allowing several decades of farming without official land assignments, squatting has been able to develop strongly in Nariva Swamp.

A general concern about squatters is the excessive amount of water use associated with their rice cultivation. The water coming into the flood plain has been overdrained due to the channelization of Nariva Swamp, which began in the 1950s. These channels cut into the Swamp and they lead out into the sea. This contributes to the premature drying of the marsh during the dry seasons.

There is also an excessive loss of water during the wet season due to the dilapidated state of the irrigation structures that are used in rice farming. The water used in farming is not only draining the Swamp but is also increasing the salinity of the water. The increasing percentage of water salinity occurs because Nariva is below sea level. This allows the salt water from the ocean to flow back through the channels that are cut into the Nariva Swamp.

The main problem that needs to be resolved is the balancing of agriculture, recreation, and biodiversity in the Nariva Swamp area. This balance requires information on the costs and benefits associated with alternative water use. While some information does exist regarding alternative water uses, there is no present information on the benefits and costs of water use at Nariva Swamp.

The University of the West Indies is performing this survey to determine the benefits (if any) you derive from the resources at Nariva Swamp. The information on benefits will be compared with the costs associated with the alternatives. Please help us with these important issues by answering these few short questions. Even if you have not visited Nariva Swamp, your answers are important. Thank you!

Nariva Swamp Protection

Protection of wildlife, vegetation, and habitat will require Trinidad and Tobago to alter water and land use regulations so as to allow more water to remain in the Swamp. Suppose a protection program was developed by the Trinidad and Tobago government to implement and enforce the new water- and land-use regulations necessary for keeping Nariva Swamp in a natural state. This protection would involve elimination of farming in the Swamp. Without the protection program, water diversions for farming would continue, causing Nariva Swamp to dry up. The major costs of the protection program would be in the form of costs of enforcing the new water- and land-use regulations, the costs of educating the residents of Nariva, and costs of managing natural resources in the Swamp. Funding to pay for these enforcement and management costs will come from a special Nariva Swamp Conservation Fund administered by the Trinidad and Tobago Government.

1. Would you make a one-time contribution of $\$$ _____ to the Nariva Swamp Conservation Fund to help ensure protection of the Swamp in a natural state through the protection program described above? (Circle the answer)

   A. YES B. NO (If NO go to question 3)

2. What is the largest one-time contribution that you would make to the Nariva Swamp Conservation Fund to ensure protection of the Swamp in a natural state through the protection program described above? $\$$ _____

3. There are many reasons for preserving Nariva Swamp. Please indicate what percent of your dollar amount is for each of the following reasons. Read all four parts first, then answer each part. Together your four answers should total 100 percent (%).

a.	Value to you to actually visit Nariva Swamp this year	_____	Percent (%)
b.	Value to maintain the opportunity for you to visit Nariva Swamp next year or sometime in the future	_____	Percent (%)
c.	The value to you from knowing that Nariva Swamp will be preserved for other people in current or future generations to enjoy, even if you do not visit the Swamp this year, next year, or anytime in the future	_____	Percent (%)
d.	The value to you from just knowing that Nariva Swamp exists as a natural place even if people, including youself, would not be allowed to visit the Swamp this year, next year, or anytime in the future	_____	Percent (%)
	TOTAL	100	Percent (%)