Measuring Values for Wetlands Protection in a Developing Country
from Domestic and International Citizen Groups

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Nariva swamp is located in the island republic of Trinidad and Tobago, just off the coast of Venuezuela. It is one of the largest freshwater wetlands in the Caribbean, supporting a diverse population of flora and fauna, including waterfowl, anacondas, and manatees. Nariva swamp also offers recreation in the form of hunting, fishing, and eco-tourism. Furthermore, the swamp supports subsistence agricultural production, including rice and vegetable farming and natural sources of cascadura fish and conchs. However, some agricultural production by local residents, who do not have legal ownership of land, is causing serious environmental damage to the swamp.

Overuse of water due to commercial rice production with itinerant irrigation canals has increased the influx of sea water into the swamp, thereby increasing salinity of water in the swamp. If this continues, it could be devastating for flora and fauna in the swamp, local subsistence farming and fishing, and future ecotourism benefits. In order to avoid a worst-case scenario, human activities in the swamp should be balanced to provide economic benefits while protecting the ecosystem functions and services that support these benefits. Attaining such a balance requires knowledge of Nariva Swamp values and benefit-cost analysis of swamp use and management.

Toward this end the University of the West Indies and the University of Georgia developed a joint project to look at the benefits derived from the use of Nariva swamp and to compare them with alternative uses of it. The project included a contingent valuation survey implemented in both Trinidad and Georgia. A general sample of citizens in both countries was surveyed using this instrument. The data were then compiled for the purposes of these analyses. First, a common valuation model was used to calculate mean willingness-to-pay for Nariva Swamp protection for both Trinidad and Georgia residents. Second, the bi-country sets of responses to preferences toward protection of natural areas and values of environmental resources questions were compared side by side.

The usefulness of this implementation is broad. First, willingness-to-pay information can then be used in the development of a comprehensive policy for use and maintenance of the swamp. The bi-country nature of the survey helps to identify local support for potential projects as well as potential international support. This information could prove crucial in the decision to develop strategies for protection of the swamp's resources. Second, contingent valuation surveys, specifically, and non-market valuation techniques, generally, have been developed in the western economies, mostly in North America and Western Europe. Limited research has yet to determine the effectiveness of using these techniques in lesser-developed economies. This analysis offers some insights into theoretical reasons why one might expect differences in responses; it then looks at the responses to the questions the survey instrument to test some of those theoretical expectations.

Assessment tool

Because the project deals with pecuniary effects rather than directly measurable monetary effects, a survey using contingent valuation method techniques was designed by the University of Georgia and the University of the West Indies.. Originally designed in 1999, this survey has been implemented three times. In 1999 it was conducted in Georgia as a mail-out survey and in Trinidad by personal interview. In 2001 the survey was implemented again, using the same questions, but variant format. This treatment duplicated the mail-out survey conducted in Georgia. It served to increase the number of usable responses available from Georgia so that analysis would be more comparable to that in Trinidad. 464 usable responses from Trinidad and 140 usable responses from Georgia were used in this analysis.

The questionnaire is divided into four sections. Section one is used to determine knowledge about Nariva Swamp and to level of importance of several option, use, and non-use values. Section two focuses on Nariva swamp protection. Section three relates to Nariva swamp visitation and environmental attitudes. Section four focuses on demographic information.

Contingent Valuation Technique: Willingness-to-Pay

The data collected in this survey was analyzed using willingness-to-pay compensation, WTP^c, for a quantity increase by the gainers, i.e., the people who would benefit by seeing Nariva Swamp stay at its present environmental quality. This is determined in the following equation:

$$WTP^c = CS = |E^j(P^j, Q^1, U^0) - E^j(P^j, Q^0, U^0)|$$

$$= |M1 - M0)$$

Where: $Q^1 > Q^0$, and $M^0 > M^1$

Thus in the case of an imposed quantity increase, the compensating surplus is the individual's willingness-to-pay for the higher level of Q, or WTP^c, which is the Hicksian compensating welfare measure. This also implies that the individual has implicit or presumed rights to the initial situation. Compensating surplus is considered a deduction because the individual states that they are willing to decrease their income by some amount in order to remain at the initial level of recreational facilities.

The Contingent Valuation Method (CVM) is described in detail by Mitchell and Carson in their book, Using Surveys to Value Public Goods: The Contingent Valuation Method. It was used here because it utilizes non-use values. Since a measure of total economic value of Nariva swamp is wanted, CVM is the best available option. A common application of CVM is to develop a survey that asks respondents to answer dichotomous choice questions. These data are then analyzed and used to calculate expected Consumer Surplus, E(CS). In this project the Hanemann Approach was used because it is more widely known, and respondents are assumed to have rights to the status quo.

First, calculate the indirect utility function:

$$U_i = V_i(W, y_i, s_i) + e_w$$

Where: w = state of environmental quality,

w=0—status quo, w=1—improved

y=income of respondent

si=vector of respondent characteristics

ew=random disturbance

Respondent's choice is:

W=0, yi=yi, environmental quality, income stay same

W=1, yi=yi-BID, environmental quality increases, income decreases by bid.

In terms of probability, the probability of a YES response is:

$$\text{Prob [``YES'']} = \text{Prob}[\text{delta}(V_i) >= \text{delta}(e_i)]$$

$$= F[\text{delta}(V_i)]$$

where F is the cumulative density function, CDF, a logistic distribution of delta(e_i):

$$\text{Logistic F} = \{1/[1+\exp[\text{delta}(V_i)]]\}(\text{logit})=\text{Prob[YES]}$$

Now, using the logistic and the Prob[YES]

$$\text{Mean WTPi} = E(CSi)=\text{integral(0-infinity)} \{1/[1+\exp[\text{delta}(V_i)]]\} \text{ dBID}$$

According to demand theory, factors that drive demand are income, price, prices of substitutes, and tastes and preferences. In line with these factors, the regressors that were chosen for this model theoretically should demonstrate these variables by displaying a significant level of deicision-making power for the respondent to accept or reject the bid price. The regressors that were chosen are: income (INC), sex (SEX), price (PRICE), age (AGE), and education (EDU). Because the regressors could be highly correlated, they were checked for correlation when the model was run. When the regressors are inserted into the WTP equation we are given the specific form as follows:

$$\textbf{WTP} = \{1/[1+\exp[-f(a + b_1 INC - b_2 PRICE + b_3 SEX + b_4 AGE + b_5 EDU]\}$$

Model Results

For the questionnaires, the bids randomly assigned were: $1, $2, $5, $8, $16, $33, $49, $82, $131. Recalling the WTP model:

$$\textbf{WTP} = \{1/[1+\exp[-f(a + b_1 INC - b_2 PRICE + b_3 SEX + b_4 AGE + b_5 EDU]\}$$

The correlation co-efficients between the variables can be seen in Tables 3A, 3B, and 3C. Recall that perfect correlation is reflected in a co-efficient equal to +1 for

positive correlation and −1 for negative correlation. The closer the co-efficient is to 0, the less the correlation between the variables. As you can see in the table, all the co-efficients are relatively close to 0. The one exception is SEX and BID in the Georgia sample, where the absolute value of the correlation co-efficient is .31589. This was taken into account in the model analysis, but it was decided not to remove this variable.

TABLE 1A Combined Georgia and Trinidad Pearson Correlation Coefficients, N = 604				
	Bid	Q17	Q18	Q28	Q29
Bid	1.00000	0.09820	-0.02062	-0.03959	0.04934
Bid		0.0158	0.6130	0.3314	0.2259
Q17	0.09820	1.00000	0.14363	-0.17128	-0.04688
Q17	0.0158		0.0004	<.0001	0.2499
Q18	-0.02062	0.14363	1.00000	-0.00991	-0.01483
Q18	0.6130	0.0004		0.8080	0.7160
Q28	-0.03959	-0.17128	-0.00991	1.00000	0.07572
Q28	0.3314	<.0001	0.8080		0.0629
Q29	0.04934	-0.04688	-0.01483	0.07572	1.00000
Q29	0.2259	0.2499	0.7160	0.0629	

TABLE 1B Georgia Pearson Correlation Coefficients, N = 140				
	Bid	Q17	Q18	Q28	Q29
Bid	1.00000	0.31589	0.15812	-0.01219	0.18219
Bid		0.0001	0.0620	0.8863	0.0312
Q17	0.31589	1.00000	0.20335	0.05152	0.02594
Q17	0.0001		0.0160	0.5455	0.7609
Q18	0.15812	0.20335	1.00000	-0.02302	-0.04103
Q18	0.0620	0.0160		0.7872	0.6303
Q28	-0.01219	0.05152	-0.02302	1.00000	-0.03099
Q28	0.8863	0.5455	0.7872		0.7163
Q29	0.18219	0.02594	-0.04103	-0.03099	1.00000
Q29	0.0312	0.7609	0.6303	0.7163	

TABLE 1C Trinidad Pearson Correlation Coefficients, N = 464				
	Bid	Q17	Q18	Q28	Q29
Bid	1.00000	-0.00893	-0.07753	0.01496	-0.00698
Bid		0.8478	0.0953	0.7479	0.8809
Q17	-0.00893	1.00000	0.14385	-0.09591	-0.16161
Q17	0.8478		0.0019	0.0389	0.0005
Q18	-0.07753	0.14385	1.00000	-0.03344	-0.04986
Q18	0.0953	0.0019		0.4724	0.2838
Q28	0.01496	-0.09591	-0.03344	1.00000	0.35855
Q28	0.7479	0.0389	0.4724		<.0001
Q29	-0.00698	-0.16161	-0.04986	0.35855	1.00000
Q29	0.8809	0.0005	0.2838	<.0001	

Bid =Amount of Bid; Q17=Sex; Q18=Age; Q28=Education; Q29=Income

From the data collected, we can insert real numbers into the model to determine the actual amount of consumer surplus that is measurable. The model was:

$$WTP = \{1/[1+\exp[-f(a + b_1 INC - b_2 PRICE + b_3 SEX + b_4 AGE + b_5 EDU]\}$$

The model describes the curve that bounds consumer surplus. In order to find the value of the consumer surplus, one should integrate the function with respect to Bid, from lowest to highest bid. A simplified for of this function is:

$$WTP = \frac{a + b_1 INC + b_3 SEX + b_4 AGE + b_5 EDU}{b_2}$$

Table 2 Results

	Combined	Georgia	Trinidad
Intercept	0.166801801	-1.190717799	0.55761133
Bid	-0.002437441	-0.001734375	-0.003285115
Q17	0.336195013	0.163553717	-0.134916511
Q18	3.22282E-05	0.018472424	2.6271E-05
Q28	0.015806606	-0.052689066	0.043067675
Q29	-0.024822158	-8.15321E-05	0.188134622

Where: Bid =Bid amount in the questionnaire
Q17=Sex
Q18=Age
Q28=Education
Q29=Income

By looking at the willingness-to-pay equation and the values for b_2 – the bid co-efficient- -it is clear that the willingness-to-pay estimation does not fit well for this data set. Due to the extremely small values of b_2 the WTP values derived would by unnaturally high. They should fall within bid parameters set by the bids in the questionnaire.

That Georgia respondents would have this tendency is perhaps not surprising. Generally, they had never heard of Nariva Swamp and had little interest in supporting environmental protection activities in the area. The tendency from Trinidad respondents is a bit more surprising. One possible explanation is that offered by Brechin and Kempton. Using cross-national surveys, they were able to determine that indeed respondents in lesser-developed countries had a strong willingness-to-pay for environmental protection, not unlike developed countries. The primary difference was that respondents from more advanced economies were more willing to pay in terms of cash, while in lesser advanced economies they were more willing to pay in terms of time. (Brechin and Kempton, 260) In inherent weakness in willingness-to-pay valuation is that

it is conducted explicitly in terms of cash. In the instance where a respondent might be willing to pay in terms of time, their valuation is lost.

The implications of these findings are important for planners both in the US and in Trinidad. First, WTP for Georgia respondents reveals little interest in supporting a potential project in Nariva Swamp. There is little reason to expect citizens would be interested in US government funding of such a project. So, a further implication is that it could be difficult for the Trinidadian government to seek aid for the US government to support environmental protection in the area. Second, the Trinidad responses show that they have little cash WTP for preservation of Nariva Swamp. It will be shown later that there is clearly interest in environmental protection, but cash support is not the method through which respondents felt able to act. Therefore, the local government would find little willingness to provide fees or taxes to support swamp protection. However, providing time and effort for that purpose might be more theoretically reasonable.

Comparison between Trinidad and Georgia Respondents

Background

One of the strongest views concerning environmental quality and conservation is that only those in the industrialized West are capable and interested in preserving environmental resources. Further, until only the last decade, it was presumed that only the socially elite in developed countries cared about environmental status. In fact, this view has had so much cache, that Brechin and Hempton suggest that "this stereotype – that only rich people and nations are environmentally concerned – has such political utility that it would probably survive without theoretical support" (Brechin and Hempton, 246). This post-materialist approach, discussed by Maslow extensively, focuses on the premise that citizens rank physical needs first. Once those needs are met, they can then turn to needs that are more abstract, such as desire for beauty and appreciation of their environment.

Support has come from other fronts as well. For example, Low and Heinen, contend that there are underlying biological forces, not unlike those propounded by

Maslow, which explain the ways in which humans make decisions about their use of resources. Further, Inglehart points to political considerations for two sources of interest in environmental protection. First, support for environmental protection is "greatest in countries with relatively severe objective problems <i.e. air pollution, water pollution>." Second, citizens with post-materialist values are more likely to express greater interest in environmental protection; "post-materialist publics rank relatively high in their readiness to make financial sacrifices for the sake of environmental protection." (Inglehart, 1995)

Generally, this approach has been accepted with theoretical support from the post-materialist argument but little actual data. However, there is mounting evidence that, , though grounded in theory, it is unfounded in experience. New comparative data have been generated that test conventional wisdom.

Brechin and Kempton cite the rise of grass roots environmentalism in developing countries as one example that runs counter to conventional wisdom. Local level movements in areas as diverse as India and Kenya suggest highly developed support values for environmental protection. In independent studies in the United States, Hunter and Pfeffer § Stycos found that immigrant attitudes and concerns were not significantly different from those of native born Americans. In fact, interest levels tended to be higher. However, Pfeffer and Stycos note a lower likelihood to participate in environmentally oriented political behaviors. Finally, in a very different type of analysis, Bechtel, Verdugo, and Pinheiro, found that students in the US, Mexico, and Brazil had different approaches to the environment and ecology, but not less interest. They highlighted the fact that the different groups reflected varying belief systems. Using the HEP-NEP dichotomy, they found that US students tended to fall into a clear dichotomy, indicating that they see a clear distinction between nature and culture. Mexican students were found to have a similar, though less pronounced, tendency to a distinction between nature and culture. The Brazilian students were found to have no clear distinction at all between the HEP and NEP. This indicates that they have a much more integrated view of nature and culture than the other two groups of respondents. This project spotlights the potential differences between cultures in a manner much different from the post-materialism tenets of other researchers.

Findings

Two of the questions in the survey were designed to focus on motivations and attitudes regarding environmental protection generally and Nariva Swamp specifically. Question 3 of the survey was designed to probe respondents about their motivations for protecting Nariva Swamp. The question had several subsections to look at several different categories of motivations. This was done in order to discover which motivations were the most important to the respondents. The categories were:

Part a: protection for agriculture users
Part b: current use values
Part c: option values
Part d: existence values
Part e: self-sufficiency of agriculture
Part f: bequest values
Part g: inter-generational altruism
Parts h, i, j, k: various types of values for ecosystem services

Question 16 looked at respondents' philosophies, attitudes, and opinions with respect to protecting Nariva Swamp. Sections of the questions looked at the following categories:

Part a: eco-centrism, protection of the whole ecosystem, both living and non-
 living components
Part b: utilitarianism and materialism
Part c: conservation and rational planning
Part d: stewardship
Part e: biocentrism
Part f: deep ecology
Part g: human subsistence
Part h: ecotourism
Part i: cultural tourism

Tables 3 and 4 show the many parts of questions 3 and 16 asked in the survey, and they show the Likert scale used as responses to the questions. The line graphs that follow each table compare the responses of Trinidad respondents with Georgia respondents for each part of each question. The purpose is to determine if there are similar or opposing trends in the responses between respondents from the two countries. If the post-materialist theory holds, one would expect US respondents to show great interest in environmental and natural resource values compared to Trinidad, presuming that the US respondents reflect a post-materialist public. If this is not the case, then trends

should be similar between the two groups of respondents. If that proves to be the case, it would represent a refutation of the post-materialist argument.

TABLE 3 Possible Reasons for Protecting Nariva Swamp

	Don't Care	Don't Know	Not Important	Somewhat Important	Important	Very Important	Extremely Important
a. Protecting the livelihood of the rice farmers in Nariva swamp.							
b. Providing me with current recreation uses such as hunting, fishing, or wildlife watching.							
c. Even if I do not plan on visiting Nariva swamp with in the next year I would like to go there in the future, if I choose.							
d. Just knowing that Nariva swamp exists and is protected, even though I don=t plan on going there in the future							
e. Contributing to self-sufficiency of rice production in Trinidad and Tobago							
f. Knowing future generations will enjoy Nariva swamp as it exists today, even though I don't plan on going there in the future.							
g. I enjoy knowing that other people currently able to visit Nariva swamp.							
h. Nariva swamp is an important to protect because there are possible plants and animals that live in the swamp that could have important scientific and medical values in the future (for example: sources for new or improved medicines or ways to improve agricultural crops).							
i. I believe that all of the elements of Nariva swamp (for example: plants, animals, landforms) have value independent of any kind of human benefit including visiting these areas, provision of clean air and water, scientific and human health benefits, and the satisfaction gained from knowing that natural areas and everything found in them exist.							
j. Nariva swamp is important to protect because it contributes to better local, regional, and global air and water quality.							
k. I enjoy watching television shows or looking at pictures that include the Nariva swamp.							

The response graphs below may be divided into three categories. First, responses to questions 3 D, F, G, H, I, and J show identical trends between the two countries. There is no significant difference between the responses from Trinidad or those from Georgia. The second category of responses is 3 A, B, and E. Each of these graphs shows some disharmony between the middle areas, but the trends are the same. There are light responses on the tail, and the heaviest percentages of responses fall on the median answers: Not important, Somewhat import, Important. A strong argument can be made

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that these trends are qualitatively quite similar. Finally, the Trinidad responses to 3 C and K have a trend that is ever further to the right than Georgia responses. That means that for those two questions, Trinidad respondents show stronger value for the ecological/environmental values represented by those questions.
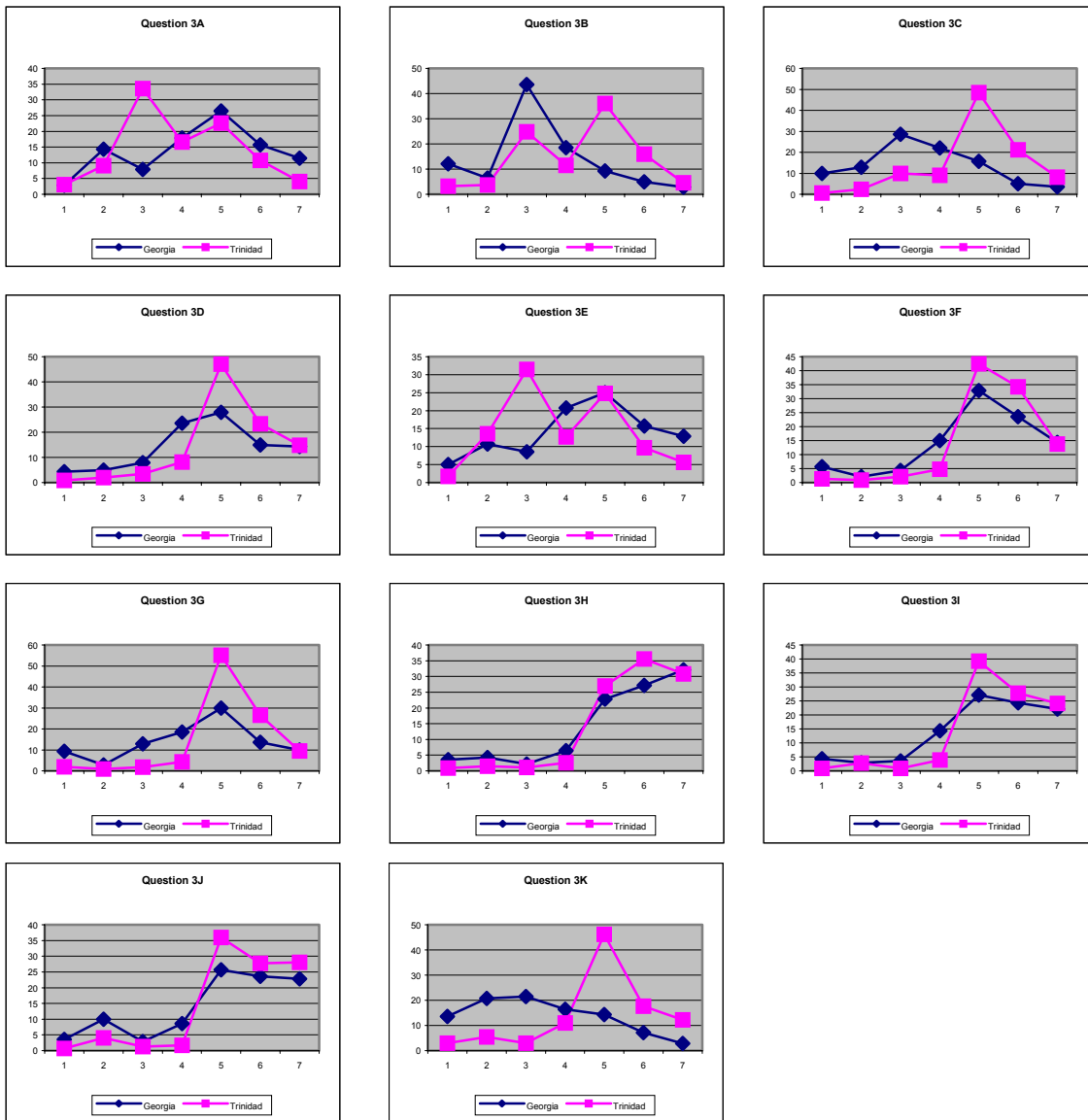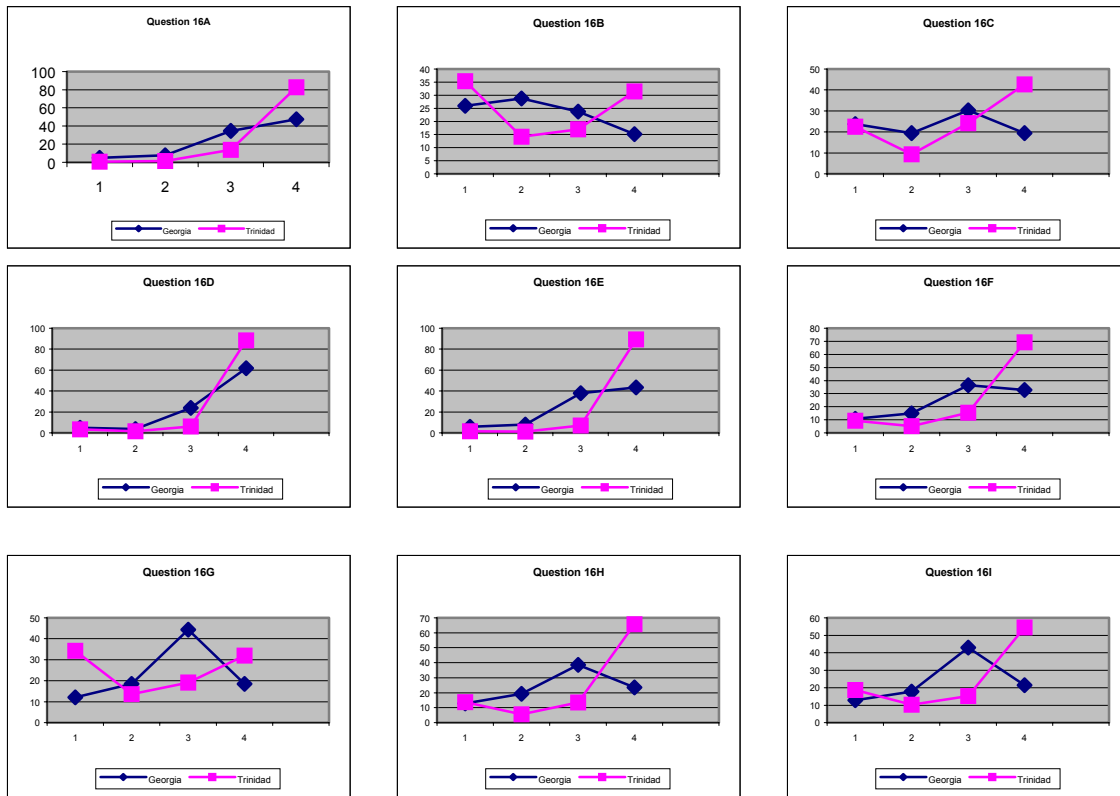

The questions in question 16 are more abstract and focus less on Nariva swamp and more on attitudes towards environmental/natural resource management generally.

TABLE 4 Attitudes/Opinions with Respect to Natural Resources and Environment

	Disagree	Somewhat Disagree	Somewhat Agree	Agree
a. I believe that protecting the ecological structure and integrity of Nariva swamp should receive the highest priority when managing the area.				
b. I believe that Nariva swamp should be used in a way that would support a maximum quantity of commercial products such as agricultural good that are grown for human consumption.				
c. I believe that providing a wide variety of goods and services (including commercial, recreational, and aesthetic goods and services) are the most important uses of Nariva swamp and therefore, the swamp should be managed to balance the economic benefits and costs of providing these goods and services over time.				
d. I believe that people are not the "owners" of the Nariva swamp and therefore should only act as responsible "caretakers" of the swamp which means allowing human use of the swamp as long as the natural environment is not abused, and prohibiting or restricting human use when it leads to abuse or overuse of the environment.				
e.I believe that protecting the biological components of Nariva swamp should receive the highest priority when managing the swamp.				
f. I believe that people and animals have equal rights to live, therefore Nariva swamp should be managed in a way that will protect the fish and wildlife in the area even if it means prohibiting people from visiting or using the swamp.				
g.I believe that Nariva swamp's resources should be used by a minimal amount of people and this use should be restricted to activities such as subsistence rice farming.				
h.I believe the Nariva swamp should be used by people but only for a responsible level of eco-tourism activities such as bird watching and sightseeing tours of the swamp.				
i. I believe that Nariva swamp should be used by people but only for a responsible level of cultural tourism. (For example: visiting and staying in recreated native villages while learning about the early native's relationship to the swamp as well as their way of life).				

The response graphs below may also be divided into three categories. First, responses to questions 3 D, E and F show identical trends between the two countries. There is no significant difference between the responses from Trinidad or those from Georgia. The second category of responses is 3 A, C, H, and I. Although each of these graphs shows some discrepancy between the final two areas – Somewhat agree and Agree-- the trends are the same. There are light responses on the left end and heavier percentages of responses on the right tail. A strong argument can be made that these trends are qualitatively quite similar. Finally, the Trinidad responses to 3 B and G have an inverse trend to that of the Georgia responses. In both bases, the Trinidad responses tend towards the extremes and the Georgia responses tend toward the median values. For both these questions, Trinidad respondents show stronger, more binary responses to the ecological/environmental values represented by those questions.

Question 16A

Question 16B

Question 16C

Question 16D

Question 16E

Question 16F

Question 16G

Question 16H

Question 16I

Georgia *Trinidad*

Conclusions

To obtain more insight on the causes of differences in preferences and values between developing and developed country citizens for protecting a natural area in a developing country, survey responses to a series of environmental values and attitudes questions were analyzed. Responses to environmental value questions indicate the relative weight Trinidad and Georgia citizens place on use and nonuse values of Nariva Swamp protection. We were interested to learn if nonuse values of Nariva Swamp protection are important to Trinidad citizens, and if use values are important to Georgia citizens since part of the purpose of the overall study was to gauge the potential of the Nariva Swamp as an international ecotourism destination. Results suggest that relatively few Georgia citizens would be interested in visiting the Nariva Swamp, but very many Trinidad citizens would like to visit the swamp. Nonuse values appeared to represent a small portion of Trinidad citizens support for Nariva Swamp protection.

We also compared responses from Trinidad and Georgia citizens to questions designed to assess their general environmental ethics and attitudes towards natural area protection. Research literature suggests that, generally, respondents from more

economically developed countries should show a greater interest in environmental issues and natural area protection. This is due to a shift from focus on physical sustenance and safety to a broader understanding and appreciation for quality of life, based on Maslow's hierarchy of needs. However, recent research suggests this approach could be inaccurate. The survey results provide evidence of consistent environmental ethics and natural area protection attitudes on the part of Trinidad and Georgia citizens. In this instance the post-materialism theory that has pervaded much of western thought with regard to valuation of environmental protection is not supported by the Trinidad responses. Generally, the responses in this project were qualitatively very similar between Georgia and Trinidad respondents.

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