The Relative Economic Value of Tropical Forest Rivers for Social Recreation and Nature-based Recreation: Implications for Estimating the Economic Benefits of New Hiking Trails

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RESUMEN

Aplicamos el Método de Valoración Contingente utilizando un cuestionario administrado a 919 visitantes para determinar el valor de un viaje al Bosque Nacional del Yunque, calculando las diferencias en valor entre aquellos que participan principalmente en actividades sociales *versus* los que disfrutan esencialmente de actividades asociadas a la naturaleza. Nuestros resultados confirman la hipótesis de que los visitantes que participan principalmente de actividades dependientes del ambiente natural están dispuestos a pagar más que los que visitan primordialmente por motivos sociales. Hay un mayor número de sustitutos para las actividades sociales. No conocemos de investigaciones previas en bosques tropicales que estimen la valoración de actividades recreativas por tipo. Ambos tipos de usuarios asignan un valor positivo a la presencia de veredas en los lugares recreativos en el río. Las valoraciones de atributos naturales y construidos por tipo de actividad en las zonas recreativas del río pueden ser de utilidad para las entidades gubernamentales a cargo de la planificación y el mantenimiento de instalaciones recreativas. [***Palabras clave***: Método de Valoración Contingente, recreación en ríos, recreación social, naturaleza.]

ABSTRACT

We apply the Contingent Valuation method (CVM) using a survey of 919 visitors to determine the value of a trip to free-flowing rivers on the El Yunque National Forest, and differences in that value for those primarily participating in nature-based recreation activities versus those participating primarily in social-based recreation activities. We were able to confirm the hypothesis that visitors who come to the forest to engage in nature-related activities dependent on particular forest attributes, are willing to pay more than those who engage mainly in social activities. There are several substitute locations where social recreation activities can take place; nature-related recreation activities have more limited substitutes. We are not aware of any previous research conducted at tropical rain forests that estimates valuation of how river recreation values vary with whether recreation activities chosen are nature-based or social-based. All users, whether they engage in nature-related or social activities, place a positive value on the presence of foot trails at the river recreation sites. Site and built attribute valuations by type of recreation activity may assist government officials in planning for built features at recreation sites, as well as maintaining existing facilities. [***Keywords***: Contingent Valuation Method, river recreation, nature-based recreation, social-based recreation.]

Introduction

The El Yunque National Forest (EYNF) in Puerto Rico, formerly known as The Caribbean National Forest, is the only tropical rainforest within the USDA Forest Service National Forest System. The Espíritu Santo, Fajardo and Mameyes watersheds originate in the EYNF, and support a wide variety of recreational activities during the summer. The popularity of these three rivers is evident by the nearly 600,000 visitors every year who come to the EYNF. There is no entrance fee to these rivers.

Economists and sociologists (Barbier 2007; Bishop and Heberlein 1979; Champ et al. 2003; Gamborg and Rune 2004; Mitchell and Carson 1989) have developed non market valuation methods to appraise the economic value of recreation services on public lands that lack market prices. The Contingent Valuation Method (CVM) involves directly asking visitors the amount they would pay to maintain current recreation sites, and how much more they would pay for improvements to the site. Because these sites have no entrance fees, visitors do not reveal their willingness to pay (WTP) through market prices or entrance fees. One option is to use CVM to construct a hypothetical or simulated market so as to obtain what real visitors would pay. Another method would be to apply the Travel Cost Method, but this method may not reveal maximum willingness to pay due to the limited size of the island of Puerto Rico.

We apply CVM using a survey of visitors, including both residents and tourists, to determine the value of a trip to free-flowing rivers on the EYNF. CVM will be applied to provide an overall value of current recreation, and differences in that value for those primarily participating in nature-based recreation activities versus those participating primarily in social-based recreation activities (e.g., visiting with family and friends). If these values per trip are different we will then investigate the relative value of adding trails to social oriented visitors versus nature oriented visitors. It may be that the incremental value to social-oriented visitors from adding trails is so small that it may not be cost effective.

In our CVM hypothetical "market" we have used an increase in trip cost as a proxy for price. This increase in trip cost varies across the visitors in the sample. Using a logistic regression model a WTP function will be estimated to calculate the economic benefits of a trip to the two types of visitors and the incremental value of a trail to each. Socioeconomic variables are included in the logistic regression to control for their effects on WTP.

The contribution of this research is that it estimates different WTP values for visitors based on their preferred activities. We do this by classifying visitors according to two groups: those who come to the river recreation sites to engage in mainly nature-related activities and those who visit for primarily social activities. Our initial hypothesis is that visitors who come to the forest to engage in nature related activities, dependent on particular forest attributes, are willing to pay more than those who engage mainly in social activities. There are several substitute locations where social recreation activities can take place, while nature-related recreation activities have more limited substitutes. We are not aware of any previous research conducted at tropical rain forests that estimates valuation of how river recreation values vary with whether recreation activities chosen are nature-based or social-based.

We expect social activity patterns in Puerto Rico to be consistent with the literature on Latino preferences for recreation elsewhere. In particular, Latinos tend to recreate in large family groups rather than individually (Dwyer and Barro 2001) and significantly choose group activities and picnicking as compared to Anglos (Baas et al. 1993). Their decision making also is group oriented rather than individualistic (Lopez et al. 2005; Floyd 1999).

Theoretical Foundation of Dichotomous-Choice Contingent Valuation

The theoretical foundation of the dichotomous choice CVM follows Hanemann's approach (1984). We assume that a visitor's utility is a function of a recreation experience at the river recreation sites (represented by R) and the consumption of all other goods (represented by income I). The utility function may be represented as:

$$U = f(R, I) \tag{1}$$

Utility from visiting a recreation site may depend on an individual's income, and personal preferences known only to that individual, so a portion of the utility function is not observable to the researcher. Therefore, some components of each individual's utility function are treated as stochastic, resulting in an indirect utility function and a random term, as follows:

$$U = f(R, I) = v(R, I) + e \tag{2}$$

where e represents an error term.

Under the dichotomous-choice approach, survey respondents were asked whether or not they would still take their most recent trip to

the river recreation site if travel costs were $X higher. The respondent answered "YES" if utility from the recreation experience with the associated loss of $X in income would be greater than or equal to the individual's original utility level without taking the trip. The "YES" respondent would hypothetically take the trip (R = 1) at the higher travel cost, and the "NO" respondent would choose not to take the trip (R = 0). Therefore, the probability of a "YES" response is represented as follows:

$$P(YES\backslash\$X) = P[f(R = 1, I-\$X) \geq f(R = 0, I)] \quad (3)$$

Because the individual's utility function is not observable to the researcher, we can assume that the utility function has a stochastic term, which results in the following transformation of the probability function:

$$P(YES|X) = P[v(R= 1, I-X) + e_1, >= v(R= 0,I) + e_2] \quad (4)$$

where e_1, and e_2 are error terms with means of zero. If the distribution of the difference in the error terms is assumed to follow a logistic distribution, then a logit model can be estimated (Hanemann 1984; Hanemann 1989; Loomis 1987).

Econometric Specification of the Model

Primary data was collected in the visitor survey at the river recreation sites to estimate the effects of natural site attributes on the economic benefits of recreation considering recreationists' activities. In the survey, visitors responded to a single dichotomous-choice question regarding a dollar increase in travel cost (WTP) or what is called a bid amount (i.e., how much more the visitor would bid for a visit to the site) that varies across visitors in the sample.

The probability that a respondent would pay a given amount was statistically estimated using a logit model, assuming the utility difference is logistically distributed (Hanemann, 1984). The following empirical model was estimated to measure the relationship between the independent variables and the probability that a visitor would pay the added trip cost. For estimation purposes, the log of the odds ratio is used:

$$[\log((YES)/(1-YES))] = \beta_0 - \beta_1 (\$X) + \beta_2 (\$X*WF) + \beta_3 (FT) + \beta_4 (GEN) + \beta_5 (EDU) \quad (5)$$

where:

β_0 = the intercept,

β_1 = the coefficient on the bid variable,

$X = the bid amount that varies across the respondents,

β_2 = the coefficient on the cross term between the bid amount and the presence of waterfalls (WF) dummy variable ($X*WF),

β_3 = the coefficient on the formal foot trails dummy variable (FT),

β_4 = the coefficient on the gender variable (GEN), and

β_5 = the coefficient on the level of education variable (EDU).

The difference in value between a site with a waterfall and one without is obtained via an interaction term composed of the bid amount multiplied by a dummy variable indicating where there is a waterfall present (1) or not (0). Thus, for a site without a waterfall the interaction term becomes zero. A foot trail intercept shifter variable is included to estimate the added value that foot trails at a site provide to visitors.

To calculate mean WTP for recreation sites without waterfalls we use the logit coefficients following a formula from Hanemann (1989):

$$WTP = (\ln(1+\exp(\beta_0 + \beta_3 X3 + \beta_4 X4 + \beta_5 X5))/ |\beta_1| \quad (6)$$

We estimate separate logistic regressions for nature-based visitors and social-based visitors. Using the respective logit coefficients we then calculate separate WTP estimates for each type of visitor.

Hypothesis Investigated

Our hypothesis can be summarized as follows: the WTP of visitors engaged in mainly nature-related activities at the river recreation sites is greater than WTP of visitors conducting mainly social activities.

$$H_o: WTP_{SOCIAL} = WTP_{NATURAL} \quad (7)$$
$$H_A: WTP_{SOCIAL} < WTP_{NATURAL}$$

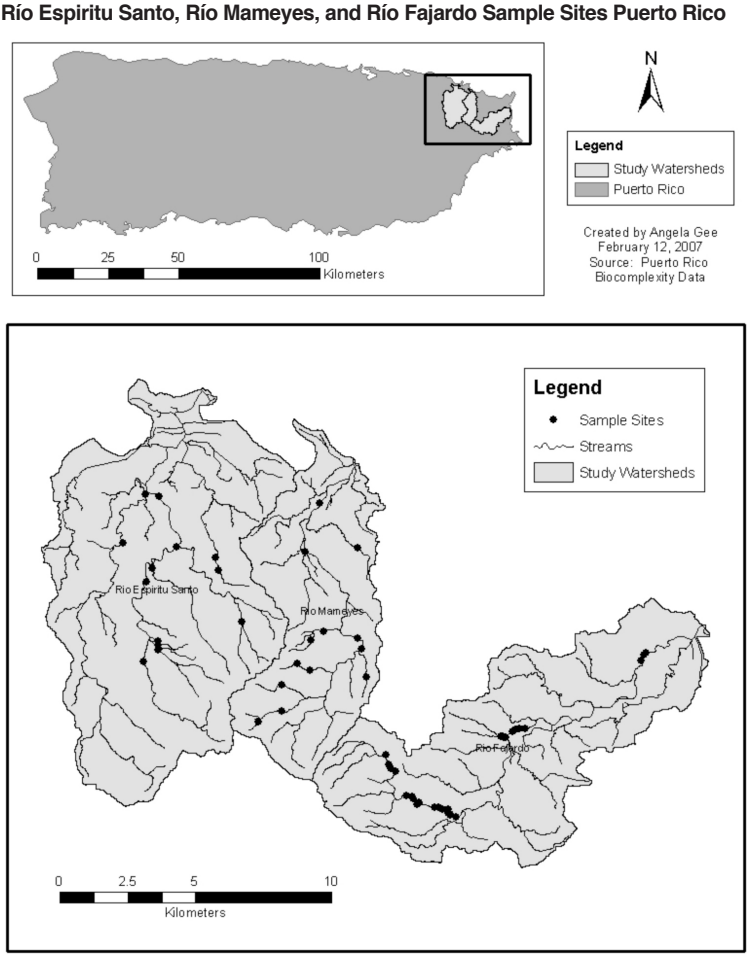
We expect the alternative hypothesis to be supported because there are many more substitute sites for social-based activities. Thus we would expect visitors primarily engaged in social activities would not want to

pay as much of a premium (i.e., additional WTP) to continue to visit the river sites in the forest, because they would go to any number of sites such as beaches or parks to picnic with family and friends.

Study Sites

The following research was conducted at river-road intersections in the Mameyes, Espíritu Santo and Fajardo watersheds, located in Puerto Rico's northeastern region (see Figure 1). Eight of the interview sites were located within EYNF boundaries, while the remaining sites were located close to urban areas outside of the forest.

Figure 1
The Espíritu Santo, Mameyes and Fajardo River Watersheds



in Table 1. All three reach similar elevations (between 728 m and 800 m), originating in the EYNF, and their length varies from 15.5 km to 24.0 km. Watershed areas vary from 33.6 sq km to 51.3 sq km.

Table 1
Puerto Rico's Northeast Watersheds: The Espíritu Santo, Mameyes and Fajardo

Puerto Rico Northeast Rivers			
Features	**Espíritu Santo**	**Mameyes**	**Fajardo**
Length	19.2 km.	15.5 km.	24.0 km.
Elevation	740 m.	728 m.	800 m.
Watershed Area	33.6 sq. km.	48.4 sq. km.	51.3 sq. km.
Number of River Recreation Sites	5	5	3

Today, the Mameyes is one of very few rivers in Puerto Rico to run through most ecosystems present in the Island, including the rain forest in its higher elevations, the coastal flood plains, wetlands and mangroves (González-Cabán and Loomis 1997). The river traverses the EYNF Visitor Center and the municipalities of Río Grande and Luquillo. Given its access from the main highway (PR-3) and its location within the EYNF, the Mameyes attracts the largest number of local visitors and tourists from outside Puerto Rico. The Espíritu Santo and the Fajardo, on the other hand, are visited mostly by local residents.

The Espíritu Santo traverses less visited recreation locations of the EYNF and the municipality of Río Grande until it reaches the Atlantic Ocean. The river meets the sea at the easternmost part of Puerto Rico, traversing the municipalities of Ceiba and Fajardo. All three watersheds are characterized by bedrock stream bottoms and lush tropical forest canopy. A visitor can find many small pools for wading and sitting in, some of which have sufficient stream current to provide a hydromassage experience similar to a Jacuzzi.

Methods

Members of the research team evaluated the Espíritu Santo, Mameyes and Fajardo watersheds in 2003, identifying potential river recreation sites where public roads crossed the rivers, thus providing

visitor access. After conducting several initial visits to various watershed locations, thirty-four potential sampling sites were identified; twenty-six in the Mameyes and Espíritu Santo rivers, and eight in the Fajardo River. After eliminating twenty-one river road intersections that had zero visitation because of their remote location, difficult access, or location by busy highways, thirteen river sites were identified.

Prior to commencing our survey data collection effort, we conducted a pre-test during the months of July and August of 2004 to test the questionnaire in select sampling sites. A total of 205 interviews were completed in seven sites. The questionnaire and sampling methods were refined according to this initial sampling experience. Given budget constraints, very low use months were identified to focus our sampling effort. We found that few residents of Puerto Rico visit the rivers outside of the months of July and August, so it was only cost effective to sample during these two months.

Our full sampling effort was carried out during summer months of a two-year period. The first sample included visitation to the Mameyes and the Espíritu Santo rivers during the period from July 2, 2005 to August 21, 2005, and the second sample included visitation to the Fajardo river from June 28, 2006 to August 19, 2006. An adult from every visitor group was approached at the site by one of two interviewers, who were also asked to alternate between male and female respondents. Thus, our sample is close to a census of all groups of visitors at the site that day. The interviews were in-person while visitors were recreating at the river. The interviewers were trained graduate and undergraduate students who closely followed a script.

A closed–ended or dichotomous choice format WTP question was used. Respondents were asked whether or not they would pay a particular additional trip cost to the recreation location. The following question was presented in the survey to estimate Willingness to Pay:

> As you know the price of gasoline often goes up. Taking into consideration that there are other rivers as well as beaches nearby where you could go visit, if the cost of this visit to this river was $____ more than what you have already spent, would you still have come today? ___ Yes___ No

The bid amount presented to respondents began at $5, and increased by increments of $5 up to $160, for a total of thirty-two bid amounts. Given a response of 919 questionnaires, there were a total of 28 respondents who evaluated each bid amount.

Dichotomous choice WTP questions are more market like

than open-ended WTP questions, since in the dichotomous choice questions visitors are only asked whether they would pay a given amount or not. However, this improvement in question format comes at the cost of a more complex statistical model that makes performing formal hypothesis testing on differences in WTP more difficult. For purposes of this paper we investigate whether there are substantial or systematic differences in WTP between the social and nature-based visitors, but we do not conduct formal statistical significance testing.

One main criticism of the CVM is the hypothetical nature of questions being posed to respondents. In this study, they were not asked about hypothetical improvements; the question was designed to determine willingness to pay using a payment vehicle with which most are familiar (trip costs), to visit a site already familiar for all respondents. Information bias was also minimized since respondents did not have to value attributes for which they had little or no experience. There is a possibility that some bias may result from a hypothetical payment, not the commodity. Further, the question reminded visitors of substitute recreation sites.

Another common concern is the non-response bias, because individuals who do not respond have different values than individuals who do respond. While refusals to be interviewed were not tracked, (a limitation of the study), discussion with interviewers indicate there were less than twenty refusals. Given the 919 completed interviews, the refusal rate was less than 1%, and hence the survey response rate is 99%. Interviewers were identified as university students working on a research project, and local respondents have historically shown a willingness to support university-related activities.

Our focus in this paper is in determining whether visitors attracted to the river recreation sites for mainly natural reasons would pay more than visitors who came to the sites for primarily social reasons. Visitors were asked to identify the activities they engaged in while visiting the river sites. The activities under the category "natural", because the river and its natural attributes are considered essential to carry them out, were enjoying nature, fishing, kayaking and swimming or wading in the water. Social activities, in contrast, do not necessarily have to be carried out at the river sites. This category included picnicking, sun bathing, listening to music, visiting with family and friends, relaxing and spiritual renewal. Visitors who indicated engaging in more natural than social activities while visiting the site were grouped in the nature category, while those who named more social than natural activities were grouped in the social category.

While this classification is somewhat subjective, it will be sufficient to illustrate our approach to evaluate whether these two groups have different economic values of recreation and the values of trails. Of course there could be differences between residents and tourists with respect to the natural versus social visitors. However, it is not clear what the prior would be regarding whether tourists or residents would be more social or not. This is an interesting issue that warrants future study but is not the focus of this paper.

Results

General Visitor Use Patterns

Seasonal estimates of the number of visitors for all three rivers in the study area indicated higher usage on weekdays than on either weekends or holidays (see Table 2). A season was defined as the four summer months of May through August, determined according to our previous experience in the study area. For the summer season of 2005 a total of 12,727 visitors were estimated for the Mameyes River; this is more than double the number observed for the Espíritu Santo. It is important to mention that the most used recreation sites in the EYNF are found in the Mameyes watershed, and attract local visitors as well as tourists from outside Puerto Rico. The Espíritu Santo and the Fajardo, on the other hand, are visited mostly by local residents.

Examining river visitation estimates by percentage distribution, both the Espíritu Santo and the Mameyes exhibit similar patterns by day of the week. More than 50% of seasonal visitation occurs on weekdays, followed by holidays and weekends. The Fajardo shows a lower percentage of holiday visitation, and a nearly even distribution among weekends and weekdays. One should note that even though the majority of seasonal visitation at the Mameyes and Espíritu Santo occurred during weekdays, a majority of the daily visitation at all three rivers is observed during holidays. There are 80 weekdays, 20 weekend days and 6 holidays during the established four-month season; seasonal figures are divided by number and type of days in the season to obtain daily estimates.

Table 2

Estimate of Seasonal Number of Visitors by Watershed

Number of Visitors (%) Recreating at River Sites			
Day of the Week	**Espíritu Santo**	**Mameyes**	**Fajardo**
Weekdays	2,981 (56%)	6,618 (52%)	3,951 (41%)
Weekends	692 (13%)	2,291 (18%)	4,154 (43%)
Holidays	1,651 (31%)	3,818 (30%)	1,515 (16%)
Total	5,324 (100%)	12,727(100%)	9,620 (100%)

Visitor Recreation Activities

One way to determine if visitor use is nature-based or social-based would be to observe whether the visitor was in-river and out-of-river. However this would not account for the visitor's motivation to visit these rivers. Thus we conducted in-person interviews to provide more detailed information on recreationists' primary activities for visiting the river. Respondents were asked to mention all activities they were planning to engage in while visiting the river. A majority of visitors mentioned three activities: visiting with family and friends (79%), enjoying nature (63%), and swimming or wading in the river (59%). Other significant activities mentioned by visitors include picnicking, eating, and drinking (40%), relaxing (39%), and sun bathing (19%). Finally, those activities least mentioned by visitors include spiritual renewal and therapy (11%), listening to music (5%), fishing and shrimping (2%), and kayaking, canoeing, belly boarding and rafting (0.4%). It is important to point out that fishing and shrimping are prohibited within EYNF boundaries and thus constitutes a source of sampling bias. As can be observed, a substantial number of visitors engage in social activities such as visiting family and friends, picnicking, and relaxing. Also, many visitors came to enjoy nature or recreate directly in the river. Table 3 presents the distribution of each type of visitor. Models were run separately for each of the two visitor

categories, and WTP was then estimated for both groups of visitors according to logit econometric estimation results.

Table 3
Estimate of the Number of Social and Nature-based Visitors

Number of Visitors			
River	**Total**	**Social**	**Nature-Based**
Mameyes	422	319	103
Espíritu Santo	124	102	22
Fajardo	373	356	17
Total	919	777	142

Model Estimation Results

As seen in Table 3, a total of 142 visitors in the sample indicated being engaged in more natural versus social activities while visiting the river recreation sites. Model estimation results for these visitors indicated that they place a positive value on the presence of formal trails (Table 4). The bid amount is negative and significant at the 1% level. The negative sign and significance implies that there is internal validity, in that the higher the dollar amount the visitor was asked to pay, the lower the probability they would pay. The presence of formal trails was positive and significant at the 5% level, indicating that visitors do value positively this attribute at the river recreation sites. The control variables, gender and education level, turned out not to be significant. The McFadden R^2 was 23%, and the Likelihood Ratio statistic was significant at the 1% level, showing the model has a satisfactory goodness of fit.

Table 4

Logit Estimation Results for Visitors: Natural Based Visitors

Dependent Variable: Yes Would Pay = 1

	Coefficient	Std. Error	z-Statistic	Prob.
Constant	1.314183	1.199097	1.095977	0.2731
BID AMOUNT	-0.014977	0.005493	-2.726598	0.0064
WATERFALLS_YN*BID AMOUNT	-0.011257	0.007186	-1.566437	0.1172
FORMAL_TRAILS_YN	1.406942	0.644272	2.183771	0.0290
GENDER	0.563248	0.512988	1.097975	0.2722
EDUC_LEVEL	0.005631	0.077825	0.072358	0.9423

McFadden R-squared	0.228974	Mean dependent variable	0.744526
LR statistic	35.65255	Average log likelihood	-0.438151
Prob (LR statistic)	0.000001		

Obs with Dep = 0	35
Obs with Dep = 1	102
Total Obs	137

WTP for visitors who mentioned being engaged in more natural than social activities was estimated for a baseline scenario (Equation 8), where independent variables assume their mean value, and two additional scenarios: one where we assume no foot trails at the site (Equation 9), and another where there are foot trails (Equation 10).

$$WTP_{NATURAL\ BASELINE} = LN((1+EXP(\beta_0 + \beta_3 * FT + \beta_4 * MEAN\ GEN + \beta_5 * MEANEDUC))/((-\beta_1)) \quad (8)$$

$$WTP_{NATURAL}(TRAILS=0) = LN((1+EXP(\beta_0 + \beta_3 * (TRAILS=0) + \beta_4 * MEAN\ GEN + \beta_5 * MEAN\ EDUC))/|\beta_1|) \quad (9)$$

$$WTP_{NATURAL}(TRAILS=1) = LN((1+EXP(\beta_0 + \beta_3 * (TRAILS = 1) + \beta_4 * MEAN\ GEN + \beta_5 * MEAN\ EDUC))/|\beta_1|) \quad (10)$$

The baseline mean WTP for the users in mainly nature-related

activities was estimated at $174.29, while the median was $169.16. When the value attributed to foot trails was included, mean WTP increased to $214.22, and median WTP to $211.46. The final scenario, where formal foot trails were not included, indicated a mean WTP of $128.12, and a median WTP of $117.52. Users who mentioned more natural than social activities are willing to pay $86.10 for the presence of formal foot trails.

Table 5
Logit Estimation Results for Visitors: Social Visitors

Dependent Variable: Yes Would Pay = 1				
	Coefficient	**Std. Error**	**z-Statistic**	**Prob.**
Constant	1.932876	0.420302	4.598778	0.0000
BID AMOUNT	-0.015967	0.001562	-10.22355	0.0000
WATERFALLS_YN*BID AMOUNT	0.002144	0.002105	1.018214	0.3086
FORMAL_TRAILS_YN	0.395531	0.218432	1.810777	0.0702
GENDER	0.387315	0.169569	2.284115	0.0224
EDUC_LEVEL	-0.045437	0.028327	-1.604050	0.1087
McFadden R-squared	0.140448	Mean dependent var		0.627297
LR statistic	141.3497	Average log likelihood		-0.567630
Prob (LR statistic)	0.000000			
Obs with Dep = 0	284			
Obs with Dep = 1	478			
Total obs	762			

The second model included a total of 777 visitors in the sample who indicated being engaged in more social than natural activities while visiting the river recreation sites. Model estimation results indicated significance in four of six criteria (Table 5). The bid amount is negative and significant at the 1% level. The negative sign and significance once again implies the internal validity of the model, in that the higher the dollar amount the visitor was asked to pay, the lower the probability they would pay. The presence of formal trails was positive and significant at the 10% level, indicating that visitors do value

positively this attribute at the river recreation sites, but not as highly as visitors engaged in more nature-related activities. The control variable gender was positive and significant at the 5% level, while the education level was not significant. Even though the McFadden R^2 was lower than the value observed for the model including users engaged in more nature-related activities, the Likelihood Ratio statistic was significant at the 1% level, thus indicating an adequate goodness of fit.

As in the previous model, mean WTP for visitors who mentioned more social than natural reasons was estimated for a baseline scenario (Equation 11), where independent variables assume their mean value, and two additional scenarios, (1) we assume no foot trails at the site (Equation 12), and (2) there are foot trails (Equation 13).

$$WTP_{SOCIAL\ BASELINE} = LN((1+EXP(\beta_0 + \beta_3 * FT + \beta_4 * MEAN\ GEN + \beta_5 * MEANEDUC))/((-\beta_1)) \quad (11)$$

$$WTP_{SOCIAL}(TRAILS=0) = LN((1+EXP(\beta_0+\beta_3*(TRAILS=0)+\beta_4*MEANGEN+\beta_5*MEAN\ EDUC))/|\beta_1|) \quad (12)$$

$$WTP_{SOCIAL}(TRAILS=1) = LN((1+EXP(\beta_0+\beta_3*(TRAILS=1)+\beta_4*MEAN\ GEN+\beta_5*MEAN\ EDUC))/|\beta_1|) \quad (13)$$

A comparison of mean WTP of the two types of visitors and the marginal value of trails to each of the groups, as well as the percentage difference in WTP values indicated that overall median WTP was higher for nature-based visitors (Table 6).

Table 6
Comparison of Per Trip WTP Values and Value of Trails for Social and Nature Visitors

Dominant Activity	Trips to Sites with Trails	Trips to Sites without Trails	Marginal Value of Trails
Nature-based Visitors	$214.22	$128.12	$86
Social-based Visitors	$128.22	$107.25	$21
Percent Difference between Nature & Social Visitors	67%	19%	310%

As shown in Table 6, mean WTP of nature-based visitors to

sites with formal foot trails is $214.22 (with a median WTP $211.46), while mean WTP is $128.12 (a median WTP $117.52) for sites without formal trails. For nature-based visitors, the presence of formal foot trails added $86.00 to a trip.

The value per trip for social-based visitors at sites with formal foot trails has a mean WTP of $128.22 (median WTP is $119.57), and to sites without formal foot trails the mean WTP decreased to $107.25 (the median WTP is $94.79). Trails added just $21.00 to the value of a trip. The large percentage difference in mean WTP between nature-based visitors and social-based visitors appears to suggest that there is some systematic difference in WTP for nature and social-based visitors, especially at sites with trails.

When we compared the corresponding values per trip to users who mentioned more nature-based activities at sites with trails ($214.00) to those who mentioned more social activities at sites with trails ($128.00) there was a substantial 67% difference in values per trip. The difference in values per trip to sites without formal trails is less, ($128.00 for nature-based visitors versus $107.00 for social visitors) or a 19% difference. While both groups valued trails, the incremental gain in WTP for trails among nature-based visitors was much larger than for social visitors. Mean WTP of visitors engaged in more social than nature-related recreation activities is lower than the mean WTP of those who visit the river for mainly nature-related activities. We believe this is due, in part, to greater availability of substitute areas for social activities than for nature-based activities.

Conclusions and Policy Implications

The EYNF is under the jurisdiction of the US Forest Service, and 8 of the 13 sampled sites are found within this forest. The remaining 5 sites are under the jurisdiction of both the Puerto Rico Department of Natural and Environmental Resources and the municipalities of Río Grande, Luquillo, Ceiba and Fajardo. The valuation estimates in this study can help inform public policy at these Federal, Commonwealth and Municipal government agencies and departments. Facilities and site improvements, and the budget increases necessary to carry them out, may need to be justified with estimates of their potential value to visitors.

Site and built attribute valuations by type of recreation activity may assist government officials in planning for built features at recreation sites, as well as maintaining existing facilities. The

estimated economic values among the 2 different profiles of visitor activities presented in this study also may be useful in informing the USDA Forest Service, the Puerto Rico Department of Natural and Environmental Resources and municipal government officials about the economic benefits of adding facilities for social recreation such as picnic tables, trash cans, etc., and formal trails for nature-based visitors. Only 3 of the 13 sites where we conducted interviews have formal foot trails. All users, whether they engage in nature-related or social activities, place a positive value on the presence of foot trails at the river recreation sites, although the trails are worth much more to visitors interested in nature-based recreation. The valuation data may be of particular assistance in the planning, construction and maintenance of formal foot trails at the more heavily visited locations.

Using our data we can illustrate how the valuation information in this paper can be used to calculate the gain in seasonal value of recreation in this area with the addition of trails. Some 85% of visitors participate in predominantly social activities. We can multiply 85% times our estimate of seasonal visitation (27,261) to yield the number of social visitors. The added value of trails to this group is $21.00, so this yields an added seasonal value of $493,927 for trails at these sites. Likewise, 15% of the 27,671 visitors are nature-oriented. Their incremental value for a trail is $86.00, yielding $356,956.00 in added seasonal value. This gain in annual value can be compared to the annualized cost to construct and maintain trails to determine if the social benefits outweigh the costs.

In addition to the lack of trail maintenance, locations outside the EYNF boundaries generally don't have adequate parking facilities. There are generally no trash cans or picnic areas, and there may be no regular trash collection. The attribute and site valuation data gathered in this study, and the seasonal visitation estimates provided for the Mameyes, Espíritu Santo and Fajardo rivers may provide Commonwealth and municipal government officials with the necessary data to support not only the improvement of built site features, but also to obtain and assign resources for trash collection, as well as general maintenance of these sites, which are mainly used by their residents.

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