RAIN FOREST TOURISM

— ESTIMATING THE BENEFITS OF TOURISM DEVELOPMENT IN A NEW NATIONAL PARK IN MADAGASCAR

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ABSTRACT

Travel cost and contingent valuation methods are applied to the problem of estimating the potential consumer surplus available to international nature tourists from a rain forest conservation project in Madagascar. Data are derived from surveys of nature tourists in Madagascar and international, nature tourism professionals in the U.S. and Europe. Typical trip travel cost models are used to estimate changes in nature tourists' consumer surplus when a new national park is developed for nature tourism. The results are compared with contingent valuation analysis of the willingness-to-pay of nature tourists to include the new national park in their current trip to Madagascar.

Keywords: Travel cost analysis, contingent valuation, non-market valuation, consumer surplus, willingness-to-pay.

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INTRODUCTION

As government agencies and development organizations devote increasing resources to tropical rain forest conservation projects, interest in and need for documenting the potential benefits and costs are growing. Compared to estimating the potential costs, measuring the economic returns from these projects is challenging because of the intangible nature of many of the benefits. Even though international nature travel has become "big business" (Laarman & Durst, 1987) and non-market valuation of recreation benefits has a long history in the U.S. (Smith, 1989; 1990; 1993); Smith & Kaoru, 1990), only a few attempts have

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been made to estimate the economic value of tourism to national parks and forests in developing countries (Abala, 1987; Brown & Henry, 1989; Dixon & Sherman, 1990; Durojaiye & Ikpi, 1988; Edwards, 1991; Eutriak & Grandstaff, 1986; Maille & Mendelsohn, 1993; Tobias & Mendelsohn, 1991). Most of these studies are limited to domestic tourists. We know of only two studies which include foreign tourists. Maille & Mendelsohn (1993) estimate a simple zonal travel cost model regressing airfare against visitation rates per capita to estimate an average value per foreign visitor to biological reserves in Madagascar. Edwards (1991) uses hedonic demand analysis to estimate the demand for Galapagos vacations. This dearth of studies results from inadequate data sources as well as theoretical and empirical difficulties in transplanting valuation techniques developed for industrialized countries to less developed countries (Kramer, Healy, & Mendelsohn, 1992).

The objective of this paper is to help fill this gap by using two non-market valuation methods to estimate the potential benefits that accrue to international nature tourists when a new national park is developed for nature tourism in a threatened rain forest in Madagascar. Using survey techniques, we examine the use of travel cost (TCM) and contingent valuation (CVM) methods for estimating international tourists' willingness to pay for visiting a new national park, Madagascar's Mantadia National Park.

Travel cost methods (TCM) use the amount of time and money visitors spend travelling to a site as price proxies, together with participation rates and visitor attributes, to estimate the recreational value of a site (Smith, 1989). Our TCM analysis is based on three primary assumptions. First, Madagascar is one of many potential international nature tourism sites (countries) available to nature tourism consumers. Second, the choice between which country to visit in any particular year or the choice of which combination of sites to visit over a multi-year period is predicated primarily on two factors, cost and the relative qualities of the sites for nature tourism. Third, developing the Mantadia National Park for nature tourism will improve one or more of the qualities Madagascar holds as a nature tourism site. This improved quality should produce increased willingness-to-pay and consumer surplus of international nature tourists.

Incorporating the role that site quality and characteristics play in determining demand for specific sites has been a major focus of recent travel cost research. Identifying the essential characteristics and qualities of nature tourism sites may enhance models for explaining why households exhibit different demands for different sites and provide information for determining optimal forest and park management policies (Kling, 1986; Smith, 1989). In this study, we examine the role that site quality plays in determining demand for international nature tourism and the impact on consumer surplus of increasing the quality of one site (i.e. by developing a new national park for tourism in Madagascar) out of the bundle of international nature tourism sites that nature tourists visit over a five year period. Each site in the current study refers to a specific country (one of Madagascar, Kenya, India, Indonesia, Mexico, Thailand, Nepal, and Brazil).

Survey techniques are also used in CVM analysis to estimate the value of non-market, non-traded, and non-priced goods and services. Demand for these goods are elicited by describing a simulated market for the goods and directly asking respondents how much they would be willing to pay for a specified quantity or quality change of the good (Mitchell & Carson, 1989). We use a 1991 survey of a sample of international nature tourists to Madagascar to compare the TCM and CVM estimates of potential benefits from a proposed new national park in Madagascar's increasingly threatened rain forests.

In the remainder of this section, we briefly describe Madagascar and the Mantadia National Park. The conceptual framework for the study is developed in the second section. Data collection methods and the resulting data are presented in the third. The methodology and results for the TCM and CVM analyses are given in the fourth and fifth section, respectively. Conclusions are offered in the sixth section.

Madagascar

A little smaller than Texas (590,000 square kilometers), Madagascar is an island located 400 kilometers off the southeast coast of Africa. The former French colony has a high deforestation rate. Between 1980–85, annual deforesta-

tion averaged 110,000 hectares (1.5%) (Green & Sussman, 1990). More unique plants and animals have evolved in Madagascar than probably anywhere else in the world with at least 150,000 of Madagascar's 200,000 species found nowhere else (World Bank, 1988). Given this high level of endemism, large number of species, rapid deforestation rate, and the relatively small size of the island, many major conservation organizations have declared Madagascar to be one of the most important global reservoirs for biological diversity and a major focus of rain forest conservation efforts. For example, the World Bank, other donor agencies, and non-governmental organizations (NGOs) are providing funding to the government of Madagascar (GOM) to establish a network of over 45 protected areas covering 1.4 million hectares over the next 4–5 years as part of a National Environmental Action Plan. The objectives of the protected area network include conserving the country's biodiversity and establishing a vibrant nature tourism industry.

Tourism in Madagascar centers on two major activities: relaxing at the beach and nature tourism. Nature tourism is among the fastest growing sub-sectors of the tourist industry in Madagascar in spite of minimal promotion, high access costs, and poor infrastructure. For example, the number of tourists to Madagascar specifically to visit natural areas grew from 4,000 in 1985 to 8,000 in 1987 (World Bank, 1990). Because of Madagascar's nature tourism potential, the World Bank justified funding the protected area network on the basis of several important assumptions. First, the total number of tourists (including nature and non-nature based tourists) was assumed to increase from 30,000 to 200,000 by the year 2000. Due to this increase, tax revenues from nature tourism were assumed to grow to cover operating costs and add $12.5 million/yr to the economy by the fifth year of the project (World Bank, 1990).

Mantadia National Park

In 1988, as part of the Madagascar Forests Management and Protection Project (FMPP), the World Bank approved funds for creating a 10,000 hectare national park (Mantadia National Park) adjacent to the 810 hectare Perinet Special Forest Reserve in the Andasibe region east of Antananarivo,

the nation's capital. Increased benefits from nature tourism at the new national park are possible for several reasons. First, the new park, with inherent plans for visitor facilities and training programs for interpreters/guides, will be easily accessed from the Perinet Reserve which is adjacent to one of the two paved highways and one of the two railroad lines in Madagascar. Second, the Perinet Reserve enjoys a global reputation as one of the last remaining habitats for the indri lemur. Madagascar is the only place in the world where lemurs occur in the wild. Of the 20 species of lemurs still surviving on the island, the indri (*Indri indri*) is the largest (at about 5 ft in height) and in acute danger of extinction. When approving the FMPP, however, the World Bank did not include the national park component in its benefit-cost analysis because the benefits were considered "long-term in nature and difficult to quantify" (World Bank, 1988 p. 43). It simply assumed that cost recovery through tourism activities would be large enough to support the operation and maintenance of the reserve. In this paper, we estimate the international tourism component of the potential benefits associated with developing the new national park for nature tourism.

MODELS

Travel cost

Since Hotelling first suggested the approach almost 50 years ago, a wide variety of empirical models have been formulated to estimate willingness to pay based on travel cost models (Smith, 1989; Smith & Kaoru, 1990). These models have ranged from simple gravity models (e.g. Freund & Wilson, 1974) to complex multinomial logit, random utility models (e.g. Morey et al., 1991; Kaoru, Smith & Lieu, 1994). Recently, modelling the role that site quality and characteristics play in determining demand for specific sites has received much attention. Kling (1986) reviews the various theoretical and empirical models for incorporating site characteristics in multiple-site, travel cost models and Smith & Desvousges (1986) describe methods for including site characteristics and the impacts of substitution in travel cost analysis.

We experimented with a variety of different travel cost models. Ideally, a mixed-multinomial or random utility model would be employed to examine the effects of site characteristics on each decision to visit a site and the total number of visits to all sites over the season. Given our data limitations (see third section), this was infeasible. However, Kling (1988b) uses Monte Carlo simulation to compare a variety of recreation demand models for measuring willingness to pay (WTP) for recreation site quality changes. She found that the simple typical trip models consistently produced the most accurate estimates, generating the best estimates in two of three simulations and the second best in the third simulation. Therefore, we employ the typical trip model for this study.

Typical trip models pool data across all recreational sites to estimate a single demand equation (Kling, 1986, 1988a). As a result, all sites are viewed as the same commodity differing only in quality and price. For our study, this requires assuming that tourists view international nature travel as the commodity, with trips to different destinations such as Kenya, Brazil, or Madagascar differing only in quality and price. This assumption implies that, for example, an American choosing to consume an international nature tourism trip might decide between a higher cost trip to Kenya versus a lower cost trip to Brazil or Mexico. According to our survey of nature travel professionals (see Table 4), Kenya also provides a higher quality nature tourism trip than either Brazil or Mexico. This is analogous to individuals deciding between restaurants when consuming "dinner-away-from-home". One could go to the nearby hamburger stand for a low cost, low quality meal or drive across town to consume a high cost/high quality meal at an elegant restaurant. Verifying this assumption, however, requires further research into the decision process involved in choosing international nature tourism destinations.

Two techniques for estimating typical trip models differ in the definition of the dependent variable. The dependent variable is defined as either the sum of all visits to all sites or the number of trips to the "typical" site. We use the first approach, specifying the total number of visits to all sites (countries) by each individual over a five year period as a function of the average travel cost and quality characteris-

tics of the countries visited and socio-economic variables such as income, education, etc. Thus, a demand function of the following general form was estimated:

$$X_i = \alpha_0 + \sum_{f=1}^{n}\left(\alpha_{if}\overline{Q}_{if}\right) + \alpha_2\overline{P}_i + \sum_{k=1}^{m}\left(\alpha_{3k}S_{ik}\right) + e_i \qquad (1)$$

where

X_i = sum of the number of trips individual i takes to all the countries,

$\overline{Q}_{if}$ = average of the f quality characteristic for the countries visited by i,

$\overline{P}_i$ = average price (travel cost) for trips to the countries visited by i,

S_{ik} = k socio-economic variables for individual i,

e_i = error term.

The change in consumer surplus associated with changes in one or more site qualities (in our case the changes in quality of Madagascar as a destination which occur when the new national park is developed for nature tourism) is calculated as the difference in the consumer surplus before and after the change. Following Kling (1986, p. 20) the linear specification is:

$$CS_i = \frac{1}{2\alpha_2}\left(\hat{X}_{i0}^2 - \hat{X}_{i1}^2\right) \qquad (2)$$

The change in the $\hat{X}_{if}$ represents the shift in the demand curve resulting from the impact of the Mantadia National Park in Madagascar on the $\sum\left(\alpha_{if}\overline{Q}_{if}\right)$ quality variables in equation (1). Equation (2), therefore, measures the area between the old and new demand curves and the price line, i.e. the change in consumer surplus for individual i.

CVM Model

The empirical CVM model is based on Hanemann's (1984) approach to estimating the mean willingness to pay from answers to the referendum style of contingent valuation questions used in the present survey. Mitchell & Carson (1989) describe the pros and cons of the referendum and alternative CVM question formats. Referendum CVM questions divide the sample into a discrete number of sub-samples. Each sub-sample is asked whether or not they would be willing to pay a specified amount for the particular non-market good and they respond either "yes" or "no". These "yes" and "no" responses to different bid levels are analyzed statistically to form a continuous bid function.

Tourists to the Perinet Special Forest Reserve[1] should be willing to pay an additional $C for the chance to visit the Mantadia National Park if their level of utility with the visit to Mantadia and subsequent lower income (I–C) is at least as great as their utility when they do not visit the park, as in the following equation (3):

$$U(0,I;A) \leq U(1,I-C;A) \tag{3}$$

where

0 = no visit to the Mantadia National Park,

1 = one visit to the Mantadia National Park,

I = income

A = a vector of attributes that may affect the willingness to pay for a visit to Mantadia Park.

Since many of its components are unobservable, the underlying utility function, $U(\bullet)$, is unknown to the researcher. Hence, it is viewed as a random variable with a given parametric probability distribution and an observable mean value. If $v(i,I;A)$ represents the mean value for $U(\bullet)$, then

[1] The Perinet Special Forest Reserve is an existing small nature reserve, heavily visited by foreign tourists. We collected our data at the Perinet Reserve because it is only a few kilometers from the Mantadia Park and at the time of the data collection, Mantadia existed only as a "park on paper".

$$u(i, I; A) = v(i, I; A) + \varepsilon_i \tag{4}$$

where the ε_i are i.i.d. random variables with zero means. Therefore, a tourist will respond positively to paying \$C to visit the new park during his current trip to Madagascar if

$$v(0, I; A) + \varepsilon_0 \leq v(1, I\text{–}C; A) + \varepsilon_1 \tag{5}$$

Although the tourist is certain which response maximizes her utility, the researcher treats the response as a random variable with the following probability distribution function:

$$P_1 = Pr\{\text{tourist is willing to pay \$C}\} = Pr\{v(0, I; A) + \varepsilon_0 \leq v(1, I\text{–}C; A) + \varepsilon_1\}$$

and

$$P_0 = Pr\{\text{tourist is unwilling to pay \$C}\} = 1 - P_1$$

Assuming that the cumulative probability density function, $F_\varepsilon(\bullet)$, is logistic, the probability that the tourist's willingness to pay (WTP) is less than the offered bid amount is

$$Pr[WTP \leq \$C] = F_\varepsilon(v_0 - v_1) = \frac{1}{\left(1 + exp^{-(v_0 - v_1)}\right)} \tag{6}$$

If $v(i, I; A) = \alpha_i + \beta I$, then the tourist is willing to pay \$C to visit the new park when $\alpha_0 + \beta I + \varepsilon_0 \leq \alpha_1 + \beta(I\text{–}C) + \varepsilon_1$. The parameter α_i is usually considered to be a "grand" constant containing the sum of all explanatory variables (except the bid amount) times their means (Cooper and Loomis (1992)). Substituting in equation (6) the probability of saying no to bid amount \$C is

$$Pr[WTP \leq \$C] = \frac{1}{\left(1 + exp^{-(\alpha + \beta C)}\right)} \tag{7}$$

where $\alpha = \alpha_1 - \alpha_0$.

Equation (7) allows the use of the logit regression model to obtain estimates of α and β. The logit regression results are used to create a function that plots the probability that WTP values will exceed specified bid amounts. Total WTP is then estimated as the area under the curve. The correct specification for estimating WTP is a current topic of debate in the literature (Cameron, 1988; Cooper & Loomis, 1992; Hanemann, 1984, 1989; Johansson et al., 1989). The crucial factor in this debate is whether one assumes that an individual's WTP can take negative as well as positive values. Our approach follows Cooper & Loomis (1992, p. 212), who state that "for most cases, WTP should be considered a non-negative random variable." Hanemann (1989) shows that the mean value of the WTP can be expressed as

$$E(WTP) = \int_{0}^{\infty} [1 - F_{\varepsilon}(\bullet) db] - \int_{-\infty}^{0} F_{\varepsilon}(\bullet) db \tag{8}$$

When WTP is assumed to be non-negative, equation (8) reduces to

$$E(WTP) = \int_{0}^{\infty} [1 - F_{\varepsilon}(\bullet) db] \tag{9}$$

where

$F_{\varepsilon}(\bullet)$ = logistic cumulative probability density function,

b = bid amount.

DATA

Most of the data used in our analysis are derived from a survey of tourists in Madagascar during July of 1991. Initial data collection efforts were successful with a total of 87 tourists completing the surveys. Unfortunately, political unrest and a general strike caused a drastic reduction in the number of tourists visiting Madagascar from mid July through the Fall of 1991. After tourist traffic became virtually non-existent, we halted on-site data collection efforts in late October 1991. As a result, we supplemented the data

collected in Madagascar with additional data collected from a survey of international nature travel industry experts. Data from both surveys are summarized below.

Madagascar Nature Tourist Survey

The on-site survey questionnaires included a series of questions on: the costs of the current trip to Madagascar; previous and expected international nature tourism related trips; willingness to pay for visiting the Mantadia National Park; and socio-economic and demographic background. Following revisions based on reviews by non-market valuation experts, the questionnaires were tested in Philadelphia on a focus group of previous nature tourists to Madagascar. Focus group participants were recruited by the Wildlife Preservation Trust, a conservation organization that has organized several tours of Madagascar. Draft questions were presented to the participants for comments and feedback. The final questionnaire was revised on the basis of the focus group's and non-market valuation experts' comments and translated into French. In Madagascar, the questionnaires were revised again following pretests with a small sample of visitors to the Perinet Special Reserve and discussions with our local Malagasy collaborators. Two local Malagasy research consultants (tri-lingual in English, French, and Malagasy) were hired to administer the questionnaires to visitors to the Perinet Special Forest Reserve.

Summary statistics from the collected data are presented in Table 1[2]. The survey responses were also used to select the most important countries that serve as substitute nature tourism destinations for Madagascar. The most important substitute destinations were derived from a section of the survey in which respondents were asked whether or not they had visited (in the last five years) or planned to visit (in the next five years) 32 developing countries for nature tourism. The percentages of respondents who either visited or planned to visit the most popular alternatives

[2] Respondents were initially queried about the primary purpose of the current trip. Whenever the primary purpose was for business, scientific, or government related reasons, the interview was terminated immediately. Thus, the current sample is limited to respondents whose primary purpose for the current trip was tourism.

TABLE 1. SUMMARY STATISTICS

Summary statistics for sample of Madagascar nature tourists.

VARIABLE	RANGE	MEAN	MEDIAN
Income (US$)	3,040–296,400	59,156	38,779
Education (years)	10–18	15	16
Age	16–71	38.5	35
Number of Days in Madagascar	3–100 days	26.2 days	21 days
Number of Days in Perinet	1–8 days	2 days	2 days
Total Cost of Trip to Madagascar (US$)	335–6,363	2,874	2,895
Transport Cost to Madagascar (US$)	352–2,500	1,388	1,257
Number of Vacation Days per Year	0–97 days	33.3 days	35 days

VARIABLE	NUMBER	PERCENTAGE OF SAMPLE
Nationality		
British	19	20.2%
Italian	20	21.4%
French	15	15.5%
German	11	11.9%
Swiss	11	11.9%
US	5	4.8%
Other	13	13.8%
Type of Pay of Respondent:		
Salary	23	24.4%
Hourly wage	54	57.4%
Self-employed	7	7.4%
Other	10	10.6%
Environment/Nature Magazine Subscriber	52	55.3%

are provided in Table 2. The average of the "visited" and "plan to visit" percentages listed in Table 2 was used to select the seven most important substitute destinations for the analysis. These countries are: Kenya, India, Indonesia,

TABLE 2. ALTERNATIVE NATURE TOURISM DESTINATIONS

Percentage of Madagascar tourists who had visited alternative nature tourism destinations in last five years and who plan to visit in next five years.

SUBSTITUTE NATURE TOURISM DESTINATIONS	A. PERCENTAGE WHO HAD VISITED LAST 5 YEARS	B. PERCENTAGE WHO PLAN TO VISIT IN NEXT 5 YEARS	AVERAGE OF A. AND B.
Kenya	38.3%	38.8%	38.55%
India	28.1%	44.7%	36.5%
Thailand	26.6%	45.7%	36.15%
Indonesia	26.6%	54.2%	36.15%
Nepal	25.5%	48.9%	37.2%
Mexico	25.5%	47.9%	36.7%
China	21.2%	50%	35.6%
Tanzania	17.0%	47.8%	32.4%
Brazil	14.9%	57.4%	36.15%
Ecuador	14.9%	45.7%	30.3%

Thailand, Mexico, Nepal, and Brazil.

Figure 1a provides the frequency distribution of the number of trips respondents took to the 8 destinations (7 substitutes plus Madagascar) during the last five years while Figure 1b shows the distribution of the total number of visits made and expected to be made over a 10 year period (i.e. the actual number of trips made within the last five years plus the number of trips planned for the next five years). Respondents consumed an average 2 trips (median = 1; range = 1–7) during the previous five years and expect to consume 2.58 more trips (median =2; range = 0–7) over the next five years. Sixty-five percent of the sample had visited at least one of the other substitute sites in the last five years, while eighty-one percent planned to visit at least one other site in the next five years.

In addition, survey respondents were provided a list of characteristics (site quality attributes) of nature tourism destinations and asked to rate them according to how important each characteristic was in their choice of nature

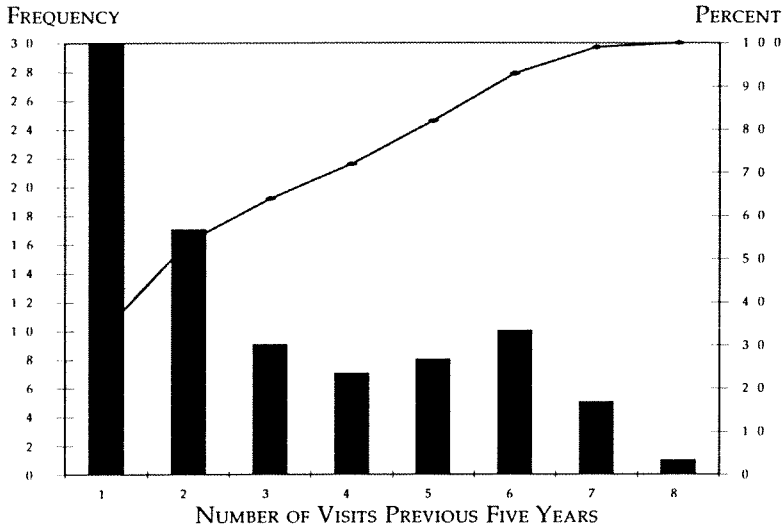

FIGURE 1a. NUMBER OF VISITS PREVIOUS FIVE YEARS
Frequency and cumulative distribution of visits by sample of Madagascar nature tourists to international nature tourism sites during previous five years.

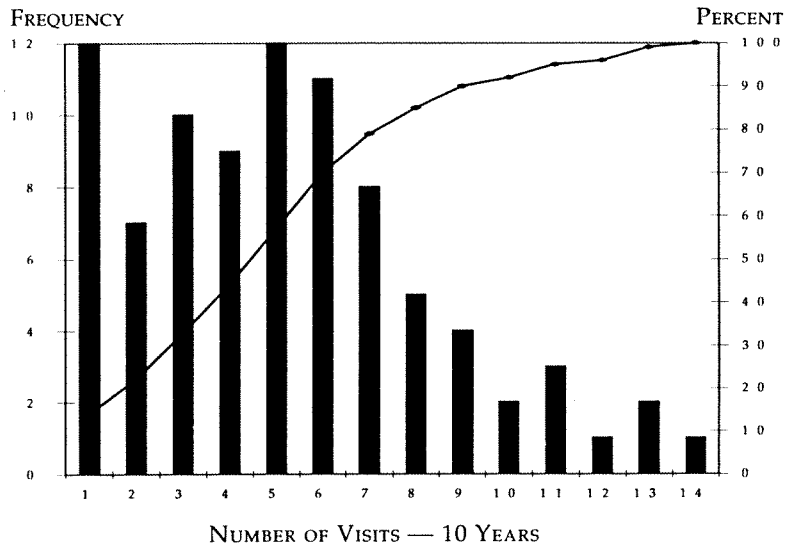

FIGURE 1b. NUMBER OF VISITS — 10 YEARS
Frequency and cumulative distribution of visits by sample of Madagascar nature tourists to international nature tourism sites during previous five years plus expected visits during next five years.

TABLE 3. AVERAGE RATING OF SITE QUALITY ATTRIBUTES

Average rating by nature tourists in Madagascar of the importance of 10 site quality attributes in their choice of international nature tourism destinations (scale of 1–10 with 10 being "very important and 1 being "not important").

QUALITY ATTRIBUTE	AVERAGE RATING
Exceptional beauty of the natural areas of destinations	8.22
The possibility of observing and interacting with people from different cultures	8.18
The possibility of seeing unusual animals in their natural environment	8.07
Availability of high quality guides, educational materials, and facilities for interpreting the natural areas	6.36
The total cost of the trip	5.95
Quality of transportation facilities within the country	5.39
The ability to see a number of different sites in a short period of time	5.03
Quality of the accomodations for eating and sleeping in the country	4.92
Availability of packaged tours	3.83
Amount of travel time involved in reaching the destination	3.70

tourism destinations[3]. Respondents rated attributes on a scale from 1-10, with *10* being "very important" and *1* being "not important at all". Table 3 provides the average rating for each quality attribute. These were used as the quality variables in the analysis. The actual values of the quality variables for each country were taken from the expert opinion survey described below.

In the CVM section of the tourist survey, visitors to the Perinet Special Forest Reserve were provided with background information about the new park such as the loca-

[3] Characteristics were identified through focus group and pre-test activities.

tion, size, purpose of the new park, number of nature and hiking trails, and educational/interpretive facilities. They were then asked if they would have been willing to pay $C more for their current trip to Madagascar to include a visit to the new national park to their itinerary (where C = $50, $100, $150, $200, $300, $400, $600, or $800). The values for the bid levels, C, were based on focus group responses and informal discussions with travel agents in Paris and Madagascar concerning the elasticity of package tour prices. Bid levels were assigned randomly to respondents. The tourists responded "yes" or "no" to the CVM question[4].

In addition, household responses to socio-economic and demographic questions were used in the analysis in order to explain variability in the willingness-to-pay responses and to identify sources of response bias. These data include household income, national origin, age, number of vacation days per year, marital status, employment status (i.e. full-time, part-time, student, etc.), type of pay (i.e. hourly, salary, etc.), whether or not the respondent belongs to conservation or environmental organizations, and whether or not the respondent receives conservation, environmental, or nature magazines. Due to the small sample size of our data set, mean values by nationality for survey respondents were used to replace missing values for the income, age, and education variables.

Expert opinion survey

To supplement the on-site tourist survey, we performed a telephone survey of twenty two U.S. and European international nature travel experts (travel agents and tour operators specializing in nature travel to the set of countries in our analysis) during November 1991 in order to collect data on the relative ratings of the 8 countries with respect

[4] When respondents answered "no", they were probed to find out their reason for saying "no" in order to detect protest responses. Responders were considered protesters if they reported their "no" response was for any reason other than an expressed willingness to forgo the good rather than to have to pay for it (see Mitchell & Carson, 1989, for a a discussion of protest bids). Using this criteria, 15 observations (17% of the total) could be considered as protesters. Econometric analysis was carried out with and without protesters included, with minimal variation in results. Due to the small sample size, we elected to retain "protesters" in the results presented below.

TABLE 4. EXPERTS' AVERAGE RATINGS

Nature tourism experts' average ratings of nature tourism destinations (based on a scale of 1–10 with 10 being the "very high quality" and 1 being "very low quality").

	DESTINATIONS							
ATTRIBUTES	*Kenya*	*India*	*Indonesia*	*Mexico*	*Madagascar*	*Thailand*	*Nepal*	*Brazil*
Local guides, educational materials and facilities for interpreting natural areas	8.05	6.29	6.06	6.56	4.15	7.00	7.00	6.41
Possibility of seeing unusual animals	9.10	7.13	7.06	5.08	8.47	5.88	6.16	7.00
Accomodation and transportation services	7.97	5.67	6.83	7.67	3.80	8.65	6.47	7.74
Exceptional beauty of the natural area	8.23	7.34	8.00	6.75	6.80	6.94	8.55	7.61
Possibility of observing and interacting with people from different cultures	6.84	7.56	7.83	7.00	5.50	7.88	7.78	6.88

to the quality attributes in Table 3[5]. Respondents were asked to rate each country for each attribute on a scale of 1–10 with *1* indicating very low quality and *10* very high quality. Average values for each of the destinations were used as the quality variables' values in the econometric analyses. The average scores for each country are presented in Table 4. It was not possible to collect this information directly from the tourists because of the length of the tourist survey. However, we believe it is reasonable to assume that average ratings from these agents and operators are accurate indicators of the relative nature tourism quality of each country because of their considerable experience in arranging and conducting tours to these countries. Furthermore, these operators are an important source of information for tourists planning international nature tourism trips.

[5] A purposive sampling strategy was pursued in order to ensure a sample of experts on nature tourism in developing countries. The sample frame was constructed from a search of membership list of the Ecotourism Society supplemented with a list of international nature tourism operators from a search of advertisements in conservation oriented magazines. The experts arranged international nature tours for an average 2,080 tourists annually with an average cost of $2,875 for a two week trip.

Actual travel costs (round trip airfare plus in-country costs) for visiting Madagascar were taken from the on-site tourist survey. Travel costs for the substitute destinations were calculated in two steps. First the cost of round trip airfare from the capital city of the respondents' home country were estimated from published airfares. Then, average additional in-country costs for each country were calculated from the responses of travel agents and tour operators in the expert opinion survey. Finally, the airfare and in-country costs were summed to estimate the total travel costs.

RESULTS

This section is divided into two parts. First, the results from the TCM and CVM econometric analyses are presented and discussed. Then, the estimates of tourists' consumer surplus associated with nature tourism development in the Mantadia National Park are examined for the two methods.

A. ECONOMETRIC ANALYSIS

Travel Cost

Table 5 presents the maximum likelihood regression results from the TCM analysis. We tested a number of functional specifications suggested in the literature (Ben-Akiva & Lerman; Feenberg & Mills; Kling, 1986, 1988a, 1988b; Smith, 1989; Zeimer, Musser, & Hill, 1980). The linear and log-log specifications presented in Table 5 provided the best fit. The regressions were estimated with a truncated, maximum likelihood estimator (Greene, 1990), truncating below at 0 and above at 8, the minimum and maximum numbers of trips taken for all observations.[6] The dependent variable in the linear model is the sum of the number of trips each individual has made within five years to the eight developing country nature tourism destinations. In the log-log model, the dependent variable is the natural log of the total number of trips. The independent variables are listed

[6] Estimations were performed with the LIMDEP econometric software package (Greene, 1992).

TABLE 5. REGRESSION RESULTS — TRAVEL COST MODEL

Maximum likelihood estimates for travel cost analysis, t-values in parenthesis.

	REGRESSION PARAMETERS	
INDEPENDENT VARIABLES	Linear Model	Log-Log Model
Constant	–24.555*	–17.899*
	(–7.129)	(–9.289)
Quality of Nature Interpretation Facilities, (INTER)	1.0968*	3.5432*
	(2.659)	(7.762)
Cultural Interaction Possibilities, (CUL)	3.7246*	8.3374*
	(7.255)	(13.984)
Income	0.00002	–0.01982
	(0.492)	(–0.949)
Cost (COST)	–0.0011*	–0.3937***
	(–2.871)	(–1.876)
Education (EDYRS)	0.0519	0.0663
	(0.842)	(0.522)
French, dummy variable, (FREN)	0.4005	0.20056*
	(0.622)	(2.639)
British, dummy variable, (BRIT)	0.2982	0.0833***
	(0.847)	(1.601)
U.S., dummy variable, (US)	0.5438	0.2912*
	(0.507)	(3.069)
Number of observations	87	87
Log-likelihood	–67.49	23.44

* Significant at the 0.01 level.
** Significant at the 0.05 level.
*** Significant at the 0.10 level

in the left column of Table 5. All variables in the log-log model are natural logs except the dummy variables for nationality (French, British, US).

Despite the small sample size, two quality variables (quality of nature interpretation facilities, INTER, and quality of cultural interactions, CUL) were significant at the 0.01 level. The price variable (COST) was significant at the .01 level in the linear model and at the .10 level in the log-log model. In addition, the French and US dummy variables were significant at the 0.01 level in the log-log model. In addition, all the variables exhibit the expected signs in both specifications except the income variable. The low t-ratios for income suggest that with the relatively high incomes of the sample, income may simply not have been important. Although income ranged from $3,040 to $296,400 only 5 observations were below $15,000 while 5 were above $100,000. Regressions with these potential outliers omitted showed no significant differences with the regressions reported in Table 5.

Contingent Valuation

The bid amounts and respondents' answers (yes or no) to the bid amounts formed the dichotomous choice variables for estimating the logit function. The general form of the logit function is

$$Pr[Yes] = (1 + exp(-f(x)))^{-1} \tag{10}$$

and

$$Pr[No] = (1 - Pr[Yes]) = (1 + exp(f(x)))^{-1}. \tag{11}$$

where $f(x)$ is a function of variables (including the bid amount) which are expected to predict the respondents' answers to the WTP questions. A number of functional specifications suggested by Bishop, Heberlein, & Kealy (1983), Boyle & Bishop (1988), and Hanemann (1984) were tested with the logit analysis. The linear specification, which provided the best fit with the data, is presented in Table 6. The values represent the estimated coefficients for each independent variable regressed against the dependent variable, the probability of saying "yes" that the respondent is willing to pay the specified bid amount to include a visit to the Mantadia National Park during the cur-

TABLE 6. REGRESSION RESULTS — CONTINGENT VALUATION ANALYSIS

Maximum likelihood estimates for contingent valuation analysis, t-values in parenthesis.

INDEPENDENT VARIABLE	REGRESSION PARAMETERS
Constant	0.36675 (0.31)
Bid amount (CVAMT)	–0.0051* (–2.869)
British, dummy variable (BRIT)	1.2643 (1.588)
Italian, dummy variable (ITAL)	–2.1485*** (–1.627)
French, dummy variable (FREN)	–13.335 (–0.067)
German, dummy variable (GERM)	1.8242*** (1.631)
Type of pay dummy (PAYTYPE) (1=salaried, 2=other)	–1.2158 (–1.409)
Nature magazine dummy (MAG) (1=subscribes to a nature magazine, 2=does not subscribe)	0.63702 (0.887)
Number of vacation days per year	0.03079 (1.585)
Income	–0.000004 (–0.664)
Number of observations	87
McFadden's R^2	0.352

* Significant at the 0.01 level.
** Significant at the 0.05 level.
*** Significant at the 0.10 level

rent trip to Madagascar and Perinet. T-ratios are in the parentheses below the coefficient estimates.

The CVM model produced significant results for estimating the willingness to pay of tourists to visit the new national park during their trips to Madagascar. The bid

amount (CVAMT) is highly significant at the .01 level. Variables which are significant at the .10 level include the dummy variables for national origin for Germans and Italians. The significance and signs of the national origin variables are quite interesting. The results indicate (and appear to confirm opinions of some tour operators and travel agents) that different nationalities may value parks and protected areas differently and have different motivations and goals for nature tourism. However, given the small sample size, these results should be interpreted with caution and, therefore, suggest an area for more intensive research efforts. The negative sign on the CVAMT variable is as expected; as price increases "yes" responses become less likely.

B. WILLINGNESS-TO-PAY (WTP) ESTIMATES

Travel Cost

The TCM analysis allows one to estimate the average willingness-to-pay for quality improvements at the various nature tourism destinations. In the present study, we are interested in estimating the benefits that international nature tourists would receive from improving the quality of Madagascar as a tourism destination by developing nature tourism facilities in the Mantadia National Park. This analysis is based on two primary assumptions. First, we assume that the Perinet Special Forest Reserve and the Mantadia National Park are complements rather than substitutes and could be considered to be essentially the same site. Separated by only a few kilometers, we assume that, from the tourists' perspective, the Mantadia National Park will essentially represent an expansion of the current Perinet Reserve from 810 hectares to almost 11,000 hectares. A typical visit would perhaps begin with a morning stop at the Perinet Reserve to view the *indri* lemurs[7] followed by visits in the afternoon and following days to Mantadia to view primary rain forest, birds, additional *indri* and other lemurs and wildlife, and to learn more about this unique ecosystem.

[7] With the small size of the Perinet Reserve and relatively large numbers of *indri* lemurs, viewing the lemurs should be much easier at Perinet than at Mantadia.

Second, based on field visits to the sites and in-depth conversations with a variety of individuals in Madagascar including resource management and tourism professionals, we assume that the most likely impacts on tourists from the planned national park involves improvement in the quality of Madagascar's nature interpretation facilities (educational materials, trails, and guides for interpreting natural rain forest areas). Table 4 shows Madagascar to rate very low for this quality attribute (rating of 4.15 out of 10) in comparison to the other countries, all of which received ratings between 6.06 and 8.05. Of the other important quality variables, developing the National Park for tourism would not be expected to increase the natural beauty of Madagascar nor improve prospects for achieving significant interactions between tourists and native cultures. Although, there is a potential of improving the "possibility of viewing unusual animals" we felt the impact of the park on this variable would be negligible for two reasons. First, Madagascar already ranks very high for this attribute (second only to Kenya) and, second, viewing the *indri* lemur is already very easily accomplished at the current Perinet Reserve. The other attribute in which Madagascar ranks very low is the quality of accommodations and transportation services. However, we would not expect the park (as currently planned) to have a significant impact on these services. Therefore, we assume that the main benefit from the Mantadia National Park would be to improve the quality of this part of the Madagascar nature tourist's trip by providing better facilities (more trails, nature education center, trained guides, etc.) for viewing and learning about the rain forests of central Madagascar that provide the habitat for the *indri* lemur.

The quality of nature interpretation facilities variable is captured by the INTER variable in Table 5. INTER represents the average of the rating of the sites (countries) actually visited by each respondent (weighted by the number of visits to each site). Recall that ratings for each site (country) were obtained from the nature travel expert opinion survey. Then the average of the ratings for the specific combination of countries visited by each respondent was used in the typical trip travel cost models in Table 5.

Since the Mantadia National Park has yet to be completed, the WTP analysis uses sensitivity analysis to estimate impacts of a range of improvements in the quality of its nature interpretation facilities. The estimates presented in Table 7 are derived from the linear specification (Table 5) and are based on the assumption that nature tourism development in the Mantadia National Park will result in either a 10, 20, 30, 40, or 50% increase in the quality of the nature interpretation facilities areas in Madagascar. Using equation (2) the expected average change in consumer surplus with the new park ranges from $45.81 to $268.37. These estimates were obtained by multiplying the nature interpretation rating of Madagascar in Table 4 by "1 + the percentage increase". Then, the average INTER value for each observation (average for all countries visited) was recalculated and the expected number of nature tourism trips was re-estimated. Finally, the results were inserted in equation (2) and the change in consumer surplus calculated.

Contingent Valuation

In the CVM section of the survey, we first provided respondents information on how the new park would improve the current stop at Perinet by increasing the size from from 810 ha to 10,000 hectares, increasing the number of nature and hiking trails tenfold, and providing a nature education center for visitors. The estimated logit function reported in Table 6 was used to calculate the expected value of adding a visit to the Mantadia National Park during the current visit to Perinet and Madagascar. Calculating the integral in equation (9), the estimated mean willingness to pay for adding the Mantadia National Park to the tourists' trip itinerary in Madagascar is $61.39.

Discussion

Table 7 presents a summary of the benefits estimates for international tourists. The first column represents the average increase in consumer surplus per tourist. The second column is an estimate of the annual aggregate benefits of the park for foreign tourists using a conservative assumption that the total number of foreign visitors to the Mantadia National Park will remain the same as the number that visited the Perinet Reserve in 1990. In 1990 about 3,900

TABLE 7. ESTIMATES OF BENEFITS

Estimates of international tourists' benefits from developing the Mantadia National Park for nature tourism.

	METHOD					
	Travel Cost Due to *xx* percentage increase in quality of nature interpretation facilities in Madagascar					Contingent Valuation
	10%	20%	30%	40%	50%	
Mean increase in consumer surplus per tourist per trip, US$	45.81	95.56	149.23	207.83	268.37	61.39
Total annual increase in consumer surplus, US$	178,671	372,670	581,998	806,637	1,046,672	239,421
Discounted present value, million US$, (4% discount rate)	4.47	9.32	14.55	20.17	26.16	5.98

foreign tourists visited the adjacent Perinet Reserve. The final column provides the discounted present value of the aggregate annual benefits assuming they will remain the same in perpetuity (another conservative assumption) and a 4% discount rate.

The values from the CVM should be interpreted somewhat differently than the TCM estimates for several reasons. First, the CVM question probably captures some existence values in addition to the recreation use values captured in the TCM analysis since we told the respondents that "the main purpose of the park is to protect and preserve the rain forest in its natural state." It is likely that nature tourists' existence value for tropical rain forests makes up a large component of their total willingness to pay. For example, in a contingent valuation study of Pennsylvania citizens, Griffith (1991) reports that the average non-user of tropical rain forests (one who has not visited nor plans to visit tropical rain forests) was willing to pay $28.45 to protect tropical rain forests. Griffith interprets this $28.45 as the average non-use or existence value that

Pennsylvanians hold for tropical rain forests. In contrast the average user (or potential user) of tropical rain forests was willing to pay $72.42 to protect rain forests. Assuming constant existence values across both users and non-users, Griffith's study suggests that non-use values may account for almost 40% of the total value that nature tourists hold for tropical rain forest protection.

Second, the impact of improvements in Madagascar in the typical trip model are diluted due to the necessity of averaging quality attributes across all the countries visited. It would be interesting to compare results with other TCM models such as multinomial logit, one of our original objectives that was abandoned due to the limitations of our data. Third, in her Monte Carlo analysis, Kling (1988b) found that TCM models generally underestimated willingness to pay for environmental quality changes. Fourth, since the value of travel time was not included in the TCM analysis, the consumer surplus values may by underestimated. Finally, the TCM values may differ from the CVM because the TCM incorporates substitute sites whereas the CVM model does not.

CONCLUSIONS

This study represents a first step in applying non-market valuation techniques to assessing the international tourism benefits associated with rain forest conservation projects. As such, the predicted changes in consumer surplus should be interpreted with caution. They are intended to serve as model illustrations rather than tools for actual decisions and should be viewed as potential ranges rather than specific estimates. The results, however, should be beneficial to future research valuing the non-market benefits of tropical rain forests and efforts to plan and manage protected areas in tropical rain forests.

We identified the most important substitute nature tourism destinations for our sample of international nature tourists to Madagascar. These destinations included one African country (Kenya), four Asian countries (India, Indonesia, Nepal, Thailand), and two Latin American countries (Mexico and Brazil). In addition we have identified and ranked the most important attributes that the nature tourists in our sample consider in choosing international na-

ture tourism destinations. With "the possibility of interacting with different cultures" being second in importance behind only "exceptional beauty of the natural areas", forest and park planners should take heed to include and promote local people and their cultural heritage in developing tourism opportunities in rain forests. It appears that nature tourists thirst to experience not only the natural world, but also the ingenuity of peoples in adapting and surviving in this "foreign" environment. Given the increasing competition for the international nature tourism dollar from projects hoping to finance rain forest conservation through tourism, this study suggests that projects that include a cultural or social component to rain forest tourism development are more likely to succeed. However, about 90% of our sample respondents were Europeans (primarily from France, Italy, Germany, and the United Kingdom). The reactions of U.S. citizens and other non-Europeans may be quite different. Indeed, dummy variables for French, Italian, U.S. and Germans were significant (at the .05 or .10 level) in one or more of our regressions. Additional studies of this kind with more U.S. and non-Europeans and larger sample sizes are required to allow generalizations with a higher degree of confidence.

Using survey data from nature tourists in Madagascar and tourism operators in the U.S. and Europe, the regression results indicate some success in explaining variation in trip choices and willingness-to-pay for enhanced tourism opportunities with both the travel cost and contingent valuation methods. While estimates for the travel cost analysis varied widely, (depending on assumptions for amount of quality improvements with the new national park) it appears that the most conservative assumptions of quality improvements from nature tourism development in the national park would generate average benefits between $46 and $61 per trip per household for a discounted present value of $2.37 million to $5.98 million. Our analysis, however, suggests these benefits would only be achieved with substantial improvements in Madagascar's nature tourism facilities. With so many countries, donor agencies, NGO's, and private entrepreneurs rushing headlong into the already crowded rain forest tourism market, our study suggests that significant tourism benefits may only be achieved with careful market analysis and plan-

ning. Any notion that one can simply "preserve it and they will come" as a way to finance rain forest conservation may doom these projects to failure.

Results from this study suggest a number of areas for additional research. First, the decision-making process of international nature tourists is likely to be complex, and little if any work has been done to explore this process. Both theoretical and empirical work is needed to enhance our understanding of how and why tourists decide to go to specific destinations. We have initiated this research area by empirically identifying important attributes that influence choice of sites. Increased understanding of the decision process should improve travel cost models and empirical analysis considerably. Studies combining a variety of tools such as conjoint analysis with travel cost and contingent valuation hold potential in this area (see Adamowicz et al., 1994, and Cameron, 1992). The role that alternative sites play in international nature tourists' demand and willingness-to-pay for visiting specific countries also needs additional work. We have made a first stab at this by identifying the most important potential substitutes for Madagascar. However, further research is needed in this area. In particular, determining whether or not these are pure substitutes at every point in time is an unanswered question. It is conceivable that early in a nature tourist's travel experiences alternatives serve as substitutes and then change to complements at later decision points. For example, a visit to the Amazon may stimulate the desire to visit other rain forests in different parts of the world. Finally, additional studies with improved data sets that would allow testing of additional valuation models and methods are needed in Madagascar and throughout the tropics to extend and validate the findings in the current study.

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