



# Public preferences for biodiversity conservation and scenic beauty within a framework of environmental services payments

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## Abstract

Choice experiments are used to investigate the preferences and the willingness to pay of foreign tourists and Costa Ricans for increased support for nature conservation and scenic beauty through a system of Payments for Environmental Services (PESs). In order to assess preferences for these different public goods services of private forests, survey respondents were asked to choose between spatially differentiated areas to receive PESs. Through different experts and focus groups, the establishment of PESs in remote areas was acknowledged to favor nature conservation and their establishment in accessible areas, to favor scenic beauty.

A survey was conducted among Costa Rican residents and both Costa Rican and foreign tourists. Results of the nested multinomial logit model show that both populations support increased PESs dedicated to both nature conservation and scenic beauty. These results were robust across respondents with different socioeconomic characteristics, but among both populations higher income groups were more willing to contribute to PESs. Willingness to pay for nature conservation PESs was greater than for scenic beauty reflecting an acceptance of the existence value of nature. Respondents' preferences for alternative payment vehicles were mixed, with foreign tourists preferring voluntary contributions and Costa Ricans being indifferent. This research demonstrates that choice experiments, including a significant initial research step of experts and focus group consultation, can aid in incorporating stakeholder preferences into the design and evolution of conservation policy instruments. © 2005 Elsevier B.V. All rights reserved.

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## 1. Introduction

Policies to promote nature and biodiversity conservation have evolved rapidly throughout the world. It is increasingly acknowledged that restricting biodiversity conservation to efforts within national parks and protected areas can satisfy neither biological and

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ecological objectives nor social and economic objectives (OECD, 1996). This is especially important in Latin America where many native tropical forests have been reduced to fragments with the development of agriculture and cattle ranching (Kaimowitz, 1995). Forest sector incentive programs are among the policy instruments that have been reformed with the aim of better supporting biodiversity conservation objectives in developing countries (Haltia and Keipi, 1997). The use of economic incentives for conserving biodiversity on private lands is increasingly accepted, especially in buffer zones surrounding protected areas where they complement and improve traditional conservation practices (McNeely, 1993; OECD, 1996).

In 1997, Costa Rica initiated an innovative policy of incentives for forest conservation called Payments for Environmental Services (PESs). Through this program, landowners who adequately manage or protect forested lands are remunerated for the environmental services provided. This incentive scheme has been successful, but the program's success has been restricted by insufficient funds (FONAFIFO, 2000a,b).

This research intends to support the improvement of this forest protection policy by orientating its further development towards potential demands for two environmental services, biodiversity conservation and scenic beauty. This study is intended to contribute to an improved PES orientation by providing information about the perceived public benefits arising from these environmental services. The aim of the study is not to measure a total economic value derived from the biodiversity conservation and scenic beauty services in Costa Rican forests. It is rather to assess public preferences toward increased provision of biodiversity conservation and scenic beauty with increased PESs.

Choice Experiments (CEs) are used to analyze preferences of tourists and Costa Rican residents for providing the environmental services of biodiversity conservation and scenic beauty within the PES scheme. Marginal willingness-to-pay for greater biodiversity protection and greater scenic beauty protection are then estimated. Furthermore, preferences for alternative payment vehicles are analyzed.

This research addresses important methodological issues in the use of choice experiments to estimate

non-use values of forest lands. Specifically, the use of preferences towards spatially differentiated PESs provides a mechanism to distinguish the value attributed to two important passive use services of forest areas, biodiversity conservation and scenic beauty. Although these services are generally combined and are jointly remunerated for through Costa Rica's current system of PESs, the identification of remote areas as more conducive to conservation and accessible areas as providing greater scenic beauty allows these services to be differentiated, and potentially better targeted for funding.

The next part of this paper presents the major characteristics of the current PES program in Costa Rica. This is followed by a review of stated preference techniques and the valuation of environmental services associated with tropical forests. The third section of this paper presents the use of choice experiments to analyze preferences for biodiversity and scenic beauty within the context of Costa Rica's PES program. The paper's conclusions address the use of preferences for spatially distributed PESs to estimate the value of environmental goods and services, as well as policy implications for developing this PES program.

## **2. The environmental services payments in Costa Rica**

Costa Rica's system of PESs consists of voluntary incentive contracts targeted to small and medium parcels of privately owned forest land, up to a maximum of 300 ha. Through these contracts, the landowners commit to adopt specified forest management plans for five years. In exchange, they are compensated for the actual costs of protection and the foregone revenues from alternative land uses. The environmental services considered in the PES scheme have been enumerated in the Costa Rican 1996 Forestry Law 7575. These include: 1) carbon sequestration; 2) water protection; 3) biodiversity conservation; and 4) scenic beauty. The main source of revenue for the PES scheme is a fossil fuel tax paid by Costa Rican motorists. Additional payments are made under Joint Implementation projects such as the bilateral treaty signed with the Norwegian government in 1996. In some watersheds, payments are supported by small hydroelectric plants. Furthermore, additional funds are

being collected by potable water services to protect water sources through land management. The targeted provision of water protection and carbon sequestration exists in a rather well-defined structure of coordination between the suppliers of these services and the demand for them. However, biodiversity conservation and scenic beauty remain public goods without a well-defined private demand, and without targeted payments. The potential to market these services to particular groups, and thus supplement the payments from the fuel tax, has not been realized. Thus these services may be inadequately provided.

Tourism activities can be considered to be a source of funds to support nature conservation and scenic amenities. Tourism has developed to be Costa Rica's most important source of foreign currency. Certain tourist enterprises do collaborate with conservation activities, and some private forest reserves receive payments from PES. But, until now, these private actors are scattered and not collectively organized for ensuring an effective provision of these services at the national level. In addition, no payment mechanism based on benefits people obtain from the provision of scenic beauty and biodiversity conservation had been developed. Thus, these two services can be under-provided relative to water protection and carbon sequestration.

This lack of a specified demand for biodiversity conservation and scenic beauty has two important consequences in terms of efficiency of the allocation of PESs. First, the current organization of the PES scheme could lead to a situation where scenic beauty and biodiversity conservation services are not efficiently taken into account in the design of the distribution of forested lands to be included in the PES system. Second, the present focus on carbon sequestration and watershed management could lead to a sub-optimal level of funding for financing the PES scheme. This lack of funds partly arises from deficiencies in the mechanism of collection of funds based on fossil fuel taxes, especially since the total amount that should be directed to FONAFIFO is never fully budgeted (De Camino et al., 2000).

Deforestation remains a concern in Costa Rica, although it is illegal to convert natural forests to other land uses and the global deforestation rate has dropped. There still exists a strong pressure on primary forests due to on going disproportionate use

in North and Atlantic regions and significant illegal cuttings (Campos Arce et al., 2001; MINAE, 2002). This contributes to forest fragmentation and degradation even as Costa Rica's forest area has slowly increased (Jimenez, 2003).

The value people derive from forest biodiversity protection comes from actual and potential recreational use and from the knowledge that such ecosystems and the species they host exist and will be passed on to future generations (Diamond and Hausman, 1994). Thus, the benefits of protecting forests in Costa Rica reflect both the use values associated with recreation and scenic beauty and the non-use values associated with protecting biodiversity in remote areas. These benefits associated with biodiversity conservation and scenic beauty services clearly have the characteristics of public goods. Thus, their assessment through non-market valuation techniques and stated preference models requires the design and implementation of sophisticated procedures of preference analysis.

### 3. Stated preference techniques and the value of environmental services

Choice experiments are a stated preference methodology that recently have been employed to analyze public preferences towards environmental goods and to estimate their economic value. Choice experiments are a generalized version of the popular dichotomous choice Contingent Valuation Method (CVM). Whereas CVM analysis presents a respondent with a simple "yes/no" decision for the provision of a particular environmental service at a particular price, CEs present the respondent with a menu of options of different environmental services, at different prices (see Fig. 1).

As reported by Hanley et al. (1998), CEs present several advantages over CVM for dealing with the valuation of the environmental services provided by forest protection. Like the CVM, CEs can estimate the willingness to pay (WTP) for a particular change from the status quo. However, being based on attributes that can describe various scenarios of management or protection, CEs can also assess trade-offs between various attributes of a particular good, service, or impact and they facilitate the disaggregating of values

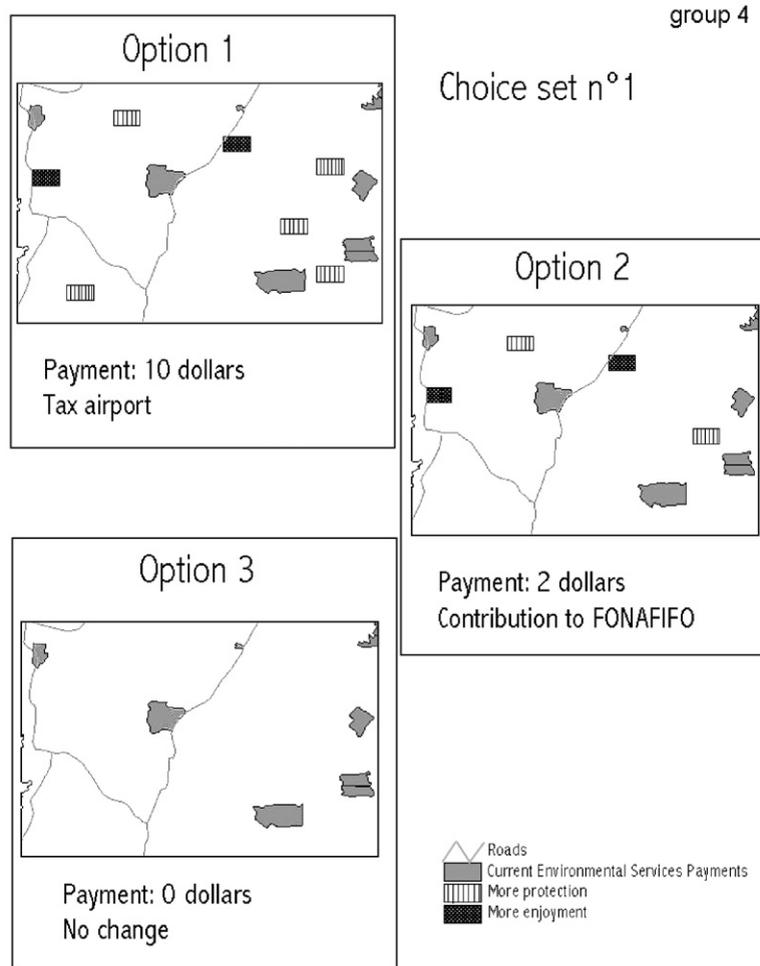


Fig. 1. A representative choice elicitation.

between different components (Adamowicz et al., 1998). Hence, CEs can be superior to CVM when the decision making process focuses on definition of priorities. As outlined by Perrings et al. (1995), CEs can improve the appropriateness of the information obtained for evaluating policy instruments. And CEs avoid some of the biases that usually arise with CVM, namely, part-whole bias and “yea-saying” (Hanley et al., 1998).

Two major issues need to be carefully addressed when analyzing preferences for and estimating the value of environmental services such as biodiversity conservation and scenic beauty. First, the public perception and subjective appreciation of biodiversity conservation and scenic beauty need to be understood.

The correlation between this subjective appreciation and objective science should be utilized for better policy recommendations (Garrod and Willis, 1997). Second, institutional constraints in implementing environmental policy can possibly influence stated preference responses and the economic valuation process. As stated by Pearce and Özdemiroglu (2002, p.84), “. . . a Stated Preference survey values not only the simple physical definition of a good but the wider package which describes the mode of its provision including institutional arrangements, payment vehicle, paying and non-paying populations, who will use the good and who will be excluded, and so on”. This implies that an analysis of preferences for a payment vehicle within the one for conservation

policy should bring valuable information for policy analysis.

#### 4. Methodology

Choice experiments rely on the use of attributes combined to build different scenarios of policy implementation. These are gathered and presented in choice sets within which respondents have to make their choice. CEs have two major foundations that permit the linkage between the choice behavior stated in the survey and the respondents' preferences for the attributes. The first is Lancasterian utility theory which states that consumers derive utility from the attributes of a good or service to be valued, rather than from the good directly. The second is random utility theory, which postulates that individual utility ( $U$ ) is unknown but can be decomposed into a systematic or deterministic component ( $V$ ) and an unobserved or stochastic component ( $\varepsilon$ ). Thus, for individual  $j$  in scenario  $i$ , utility can then be expressed as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \tag{1}$$

Since the systematic component can be expressed as a linear function of explanatory variables,  $V_{ij}$ , can be referred to as

$$V_{ij} = \beta' \mathbf{x}_{ij}, \tag{2}$$

where  $\beta$  is a vector of coefficients associated with the vector  $\mathbf{x}$  of explanatory variables which are the attributes of scenario  $i$ , including price, and the socioeconomic characteristics of individual  $j$ .

The nested multinomial logit model is used when the scenarios are logically grouped into a decision tree

and the respondents' decision making process is seen to be iterative. In this case a respondent must first decide whether to opt for more PES services or for maintaining the status quo. If more PES services are chosen, then the respondent can decide if these services should be directed toward biodiversity conservation or scenic beauty. One advantage of the nested logit model is that it does not require the independence of irrelevant alternatives (IIA) assumption. The IIA assumption implies that the probability of choosing one alternative over another is unaffected by the presence or removal of additional alternatives (Blamey et al., 2000). The nested logit model assumes that an individual's probability of choosing a new proposed scenario  $i$  is a function of the probability of choosing any new scenario, as opposed to the status quo, as well as the preference toward scenario  $i$  over the other alternative new scenarios in the choice set  $J_s$ . Thus the alternative new scenarios are considered to be nested into one branch,  $s$ , in a decision tree that includes an alternative branch,  $n$ , for status quo (see Fig. 2). Assuming an extreme value distribution of the error term in the utility function, this probability can be expressed as:

$$P_{is} = P(i|s)P(s) = \left[ \frac{\exp(V_{is}|\alpha_s)}{\exp(I_s)} \right] \left[ \frac{\exp(\alpha_s I_s)}{\sum_{k=s,n} \exp(\alpha_k I_k)} \right] \text{ with} \tag{3}$$

$$I_s = \log \left[ \sum_{i=1}^{J_s} \exp(V_{is}/\alpha_s) \right] \tag{4}$$

where  $P(s)$  is the probability of choosing a new scenario,  $P(i|s)$  is the probability of choosing alternative  $i$  once the decision to choose a new scenario was

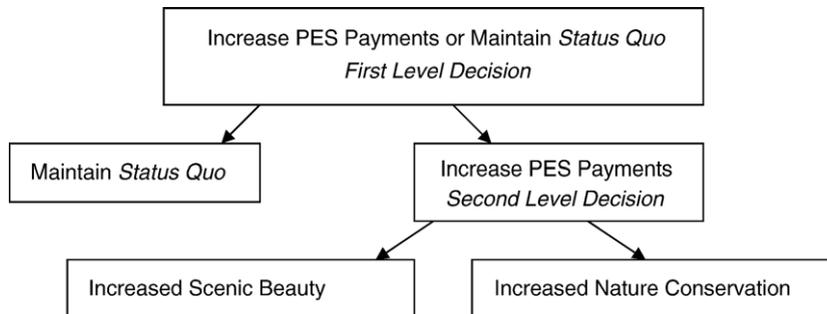


Fig. 2. The nested decision making structure.

made,  $V_{is}$  is the indirect utility of alternative  $i$ ,  $\alpha_s$  is the inclusive value coefficient which measures the substitutability across alternative insurance products.  $I_s$  is known as the inclusive value and is a measure of the expected maximum utility of the alternatives  $J_s$  (Greene, 2003; Kling and Thomson, 1996).

Both biodiversity conservation and scenic beauty are especially difficult to properly characterize and delineate. Indeed, there is no real consensus at any level within the scientific community about priorities for biodiversity conservation. Forest conservation can have effects on the ecosystem processes and structure and can contribute both to biodiversity protection and scenic beauty.

A necessary preliminary step to meaningful stated preference valuation and analysis of biodiversity conservation is a clear understanding of the specific services to be assessed in the scientific context and in the context of policy decision. Both scenic beauty, which is inherently subjective, and biodiversity conservation, which is subject to scientific complexities, need to be presented in a way that facilitates the elicitation of preferences. Experts and focus group meetings were conducted in order to contribute to an adequate definition and description of the pertinent characteristics of these environmental services. This led to a sound definition of the attributes to be analyzed.

The experts group meeting was organized in close collaboration with FONAFIFO, the institution in charge of developing the PES program. This group included 25 professionals representing different institutions concerned with forest and biodiversity management and protection, research and education, recreational activities, and tourism. Researchers included biologists, ecologists, foresters, geographers, and social scientists. The group was designed to consist of the different stakeholders concerned with the two environmental amenities of interest; namely, the scenic beauty of the forest landscape and the biodiversity conservation.

An important result of this meeting was the preliminary conclusion that the accessibility of protected forested lands was negatively linked to the “wilderness” of the forest ecosystem on that land and to biodiversity protection. Also, private forest land located in remote areas in buffer zones around national parks and protected areas had greater value

in preserving biodiversity. The experts also corroborated that there is a positive correlation between the benefits people derive from scenic beauty and landscape viewing and the accessibility of the forested land. Thus, the experts group emphasized the spatial differentiation between areas favorable to scenic beauty and areas more focused on biodiversity protection. The use of PESs in remote areas to favor biodiversity conservation and in accessible areas to favor scenic beauty was endorsed by the experts group. Another important result of the experts group meeting was the identification of the importance of the payment mechanism. The represented stakeholders considered the means of generating PES revenue to be a crucial factor in the acceptability of any extensions to the program. Finally, it was determined that Costa Ricans and foreign tourists usually take part in different tourism and recreational activities. Experts agreed that these two populations should be analyzed separately.

The conduct of the focus groups process was inspired by Krueger (1994). These focus groups provided key insights into: 1) the selection of attributes and levels; 2) the mechanisms for presenting these choice scenarios; 3) the development of the information to be developed and presented during the survey interview; and 4) the definition of the population and sampling procedures. These groups also validated the definition of the two populations: 1) foreign tourists and 2) Costa Ricans, who appreciate forest services as residents and tourists. Each group included five to ten participants. Focus groups composed of foreign tourists took place at the end of rafting tours on the Pacuare River, at the airport, and at the Poás volcano. Focus groups with Costa Ricans were conducted in: two districts in San José; in the rural town of Puerto Jimenez, which is near the important natural areas of the Osa peninsula; and at the Poás volcano, which is one of the most visited areas in Costa Rica. This mix of focus groups was designed to present a broad spectrum of open ended information on attitudes towards biodiversity conservation and the scenic beauty of forests. Participants were asked to express their opinions on biodiversity conservation and scenic beauty services, and how these services could best be described and explained in a survey. They were asked for the relative importance they grant to them.

Focus groups ensured that the most relevant variables used to describe the choice scenarios were included in the analysis. Particular attention was paid to the selection of choice attributes and levels in order to find a balance between presenting sufficient attributes to adequately portray the complexities of biodiversity conservation and scenic beauty and presenting a simple choice set that could be easily managed, interpreted, and answered. The focus groups process confirmed and sharpened the proposal that preferences for biodiversity conservation benefits and scenic beauty benefits could be assessed via two attributes based on the locations of PES payments. The lack of access to some pristine forested areas was considered to be a constraint to the enjoyment of scenic beauty, especially for Costa Ricans, but it was accepted as a means of preventing forest degradation.

Another conclusion of the focus groups was the substitution of the term “nature” (*la naturaleza* in Spanish) conservation for “biodiversity” conservation. Costa Ricans did attach a value to what they perceived as their God-given natural patrimony. However, they rejected the term “biodiversity” as being too scientific and encompassing issues which were not their principal concern. (Heretofore the terms “nature conservation” and “biodiversity conservation” will be used interchangeably.) Thus, these groups, somewhat unknowingly, supported the concept of an existence value. They demonstrated little concern for bio-prospecting and other biodiversity services, but did show concern for the continued existence of tropical forests and flora and fauna they contain. They accepted that the PES program should target remote areas to support nature conservation, although remote areas have disadvantages in terms of use values. Furthermore, these groups stressed the value of the existence of nature as “God’s creation.”

Using Geographic Information Systems, a series of simple maps were designed, based on a sample issued from maps provided by FONAFIFO, to elicit preferences for PESs to areas with and without access (see Fig. 1). On the original maps: 1) red areas represent actual areas that are currently receiving PESs; 2) green boxes represent proposed sites for future PESs that are located to specifically support nature conservation; and 3) blue boxes represent forested lands with relatively easy access that would better provide the environmental service of scenic beauty. To represent

these colors in the printed Fig. 1, red areas are grey, green boxes are striped, and blue boxes are dark. The selected attributes and levels are presented in Table 1.

In Fig. 1, the increases in the number of either green or blue boxes are used to reflect potential increments in the number of PESs for all of Costa Rica. The red areas are held constant to reflect the status quo. These green and blue boxes were arbitrarily defined to be adapted to the map, given that the quantity of forested lands that could potentially be involved in the PES scheme at the national level was not predetermined. And FONAFIFO did not wish to commit to a given quantity of new forested land for program expansion. Hence, future PESs depend on the level of funding reached by FONAFIFO, which could include additional contributions made for biodiversity conservation and scenic beauty.

Alternative payment vehicles to be analyzed as attributes in the choice experiments were proposed. Because the two selected populations would be expected to act and pay in distinct manners, separate prices and payment vehicles were assigned to each. Foreign tourist are expected to pay on site during their stay in Costa Rica whereas Costa Ricans can be expected to pay repeatedly, through a number of mechanisms. A voluntary and an obligatory payment were selected for each population. An addition to the current airport tax was an obvious and convenient option for foreign tourists. This was paired with voluntary contributions at hotels to support forest conservation. As reported in a Costa Rican focus group, Costa Ricans are accustomed to a national

Table 1  
Attributes and levels for foreigners and Costa Ricans

Attributes	Levels	
	Foreign tourists	Costa Ricans
Number of conservation focused zones (green (striped) boxes)	0, 2, 5	0, 2, 5
Number of scenic beauty/access focused zones (blue (dark) boxes)	0, 2, 5	0, 2, 5
Payment amount	2, 4, 10, 20 <sup>a</sup>	50, 100, 250, 500 <sup>b</sup>
Payment vehicle	Airport taxes Voluntary contributions	Municipal taxes Voluntary contributions

<sup>a</sup> \$ as a one time payment.

<sup>b</sup> Colons per month 318 colons=\$1.00 in January 2001.

campaign to raise funds for the Red Cross. A similar campaign was proposed for forest conservation. This voluntary contribution scheme was paired with a proposed supplement to the municipal tax paid on properties. The range of payment levels for both foreign tourists and Costa Ricans were chosen according to the results of the focus groups and of a trial survey.

Each choice set included three choice options, one corresponding to increased PESs with a focus on accessibility, another corresponding to increased PESs with a focus on conservation, and the third corresponding to the status quo. Thus, a base option was proposed as in a CVM survey. Respondents were given the option of not supporting an expansion of the PES program, and hence not to contribute to additional funding. An experimental design with three options was considered to be important because the focus groups revealed a very positive attitude towards PESs and a dichotomous choice decision could facilitate a warm glow effect, which arises from the moral satisfaction associated with the mere act of paying for a good cause, regardless of the level of the contribution and the quantity of the good (Andréoni, 1989; Kahneman and Knetsch, 1992). Also, as recommended by Blamey et al. (2000), the choice options were not labeled. However, so as to reach the differentiation between options oriented towards nature protection and options oriented towards scenic beauty viewing, a choice specific experiment was designed based on the introduction of a difference in the possible levels of the two location attributes between options 1 and 2 (see Table 2). Thus, in each choice set, respondents had to choose between two

possible orientations for expanding the PES program and the status quo option.

The experimental design relied on the efficient choice design based on the D-optimality proposed and described by Zwerina et al. (1996). The combinations of attributes forming each scenario, and the combination of choice scenarios forming each choice set were chosen for their fulfillment of the following criteria: (1) orthogonality, which aims at ensuring that the attributes vary independently one from another between scenarios; (2) level balance between attributes, meaning that the different levels of each attribute appear with equal frequency among the choice scenarios; and (3) minimal overlap between levels of each attribute within a choice set. The fourth criteria, utility balance between alternatives, could not be taken into account because of the lack of prior information on the public preferences for the different possibilities of PES spreading presented. These criteria are conditions to be used for the estimation of the parameters associated with each attribute when considering an underlying linear utility function. The results of a trial survey suggested that each respondent could answer four choice sets. When six choice sets were presented, the respondents demonstrated fatigue. Hence, the four choice sets and eight groups of choice sets forming each survey were built using a computerized search strategy adapted from Kuhfeld (2000) which permitted generating designs optimizing the three basic conditions for reaching the D-optimality.

Special care was devoted to the design of the information package and visual aids in the survey. This information intended to ensure that respondents really understood the proposed increases in the PES

Table 2  
Choice set options

Scenarios	Option 1	Option 2	Option 3
Attributes	Ecologically focused expansion of ESP system	Access focused expansion of ESP system	Current situation or status quo
Strategically located for nature conservation (green (striped) box numbers)	2, 5	0, 2	0
Strategically located for access and scenic beauty (blue (dark) box numbers)	0, 2	2, 5	0
Payment amount (US \$) <sup>a</sup>	2, 4, 10, 20	2, 4, 10, 20	0
Payment vehicle	Taxes Voluntary contribution	Taxes Voluntary contribution	No payment

<sup>a</sup> Based on the foreign tourists case.

program and in the provision of nature conservation and scenic beauty. Although most Costa Ricans have heard about the PES, they usually did not have a clear understanding of how this program functioned. Maps were used to show the current distributions of these PESs on the Costa Rican territory and their distribution between forested lands with easy access and lands that better supported nature protection. Prior to the implementation of the survey, interviewers were taught about the PES scheme so as to ensure they would transmit unbiased and clear information and responses to general questions. The capacity of enumerators to conduct surveys was ensured during the trial survey interviews. Face-to-face surveys lasting approximately one-half hour were conducted.

The preferences of two important populations were analyzed. Costa Ricans currently support the PES program through fuel taxes and maintain sovereign responsibility for their forested landscape. Tourists, especially foreign tourists, directly benefit from scenic beauty and are a potential source of increased revenue. Care was taken to reduce the bias that may appear in studies that only consider tourists. Given that Costa Ricans are also tourists, surveys to Costa Ricans were conducted at tourist locations as well as in their homes. Interviews were conducted in all of Costa Rica's provinces, only during the weekend not to distort the sample towards housewives. Costa Ricans in both urban and rural areas were interviewed, as well as in rich and poor neighborhoods. Table 3 presents the distribution of the sample across various sites. Four hundred and seventy-three Costa Ricans and 240 foreign tourists were interviewed. Foreign tourists were interviewed at the San Jose airport because of the convenience of the location, because it would account for the diversity of the tourists, and because the site reinforces the credibility of an increase in the airport tax as a payment vehicle. Almost identical English and Spanish language survey instruments were used. Differences included attribute levels of payment and payment vehicle and some attitudinal questions.

A two-level nested logit model was developed and estimated using LIMDEP, NLOGIT 3.00 (Greene, 2002). The first decision level is the choice between increasing PES payments and services or maintaining the status quo. This decision is expected to be a function of the payment level presented to the

Table 3  
Locations of survey application

Site	Number of completed surveys	Group
Airport	240	Foreign tourists
Cañas	32	Costa Rican residents
Ciudad Neily	32	Costa Rican residents
Desamparados	33	Costa Rican residents
Guadalupe	36	Costa Rican residents
Moravia	36	Costa Rican residents
Palmares	30	Costa Rican residents
Paraiso	33	Costa Rican residents
Siquirres	32	Costa Rican residents
Manuel Antonio	148	Costa Rican tourists
Poás	61	Costa Rican tourists

respondent as well as assorted socioeconomic characteristics of the respondent. The second-level decision, for those that have chosen increased PES services, is whether these services should be directed towards increased nature conservation or increased access and scenic beauty. This decision is expected to be based upon the attributes of the choice including the payment vehicle presented to the respondent. This nested structure is presented in Fig. 2.

The marginal willingness-to-pay for an increase in any attribute can be estimated using the results of the nested logit model. Following Blamey et al. (2000), given that the utility functions presented are linear representation of the CE attributes, the marginal rate of substitution between any two attributes is the ratio between the coefficients. And since the coefficient of the payment attribute,  $\beta_{\text{payment}}$ , can be interpreted as the marginal utility of income within the expenditure range presented (\$2.00 to \$20.00 for foreign tourists and 50 to 500 colones for Costa Ricans), then the ratio of any coefficient  $\beta_k$  to the price coefficient can be interpreted as the marginal willingness to pay for that attribute (Louviere et al., 2000). Thus, the marginal willingness to pay (MWTP) for attribute  $k$  can be calculated as:

$$\text{MWTP}_k = -\frac{\beta_k}{\beta_{\text{PRICE}}}$$

Two separate populations, foreign tourists and Costa Ricans, were identified in the design of this study, and given that these groups received different attribute levels for both payment amount and payment

vehicle, a test of parameter equality was not considered appropriate for these populations. Also, as seen in Table 4, two potentially distinct groups of Costa Ricans were identified in the design of the research: Costa Rican tourists, interviewed at National Parks; and Costa Rican residents, interviewed at their homes. A test of different preferences for these two groups was made to assess if tourists have a different appreciation for access than non-tourists.

## 5. Results and discussion

A likelihood ratio test as proposed by Swait and Louvière (1993) was conducted. Data from the combined Costa Rican sample was compared to that of the two separate groups. The equality of the combined coefficients and scale parameters was not rejected with the following test:

$$-2[\log\text{likelihood}(\text{pooled data}) - \log\text{like}(\text{residents}) - \log\text{like}(\text{tourists})] = 12.00\chi_7^2,$$

with seven degrees of freedom for the six restricted parameters and the scale parameter. Given that the calculated value would need to be greater than 14.07 in order to reject equality with 95% confidence, the preferences of the two groups are considered to be equal. This result demonstrates that Costa Ricans have consistent preferences independent of where they are

interviewed, and those that are encountered at tourist destinations are not a distinct population from those encountered at home.

The results of the nested logit analyses for both populations, Costa Ricans and foreign tourists, are presented in Table 4. The inclusive value parameter for the status quo option is restricted to unity for both populations which is expected for a single option branch (Blamey et al., 2000, Collins et al., 2005). In both models the inclusive value parameter for the increased PES option is greater than zero and less than one. This implies greater substitutability within the increased PES option than across the first-level decision to the status quo option. For both populations the overall model was highly significant. A number of socioeconomic indicators – such as income, education, age, sex – were tested as possible explanatory variables for the first-level decision. However, none of these indicators had a significant impact upon the respondents' choice for the foreign respondents. Thus for foreign tourists, the first-level decision is modeled as a function of a constant for increased PES services. Most socioeconomic characteristics were also insignificant for Costa Ricans. However, education was positive and significant implying that the more educated Costa Ricans had a greater preference for increased environmental services as opposed to the status quo.

For the second-level decision, on the type of environmental services to target with PES payments,

Table 4  
Costa Rican and foreign tourist preferences for ESP attributes

	Costa Ricans ( <i>n</i> =1892)		Foreign tourists ( <i>n</i> =960)	
	Coefficient	Standard error	Coefficient	Standard error
<i>First-level decision status quo or more PES</i>				
ASC increased PES	0.149	(0.304)	3.176***	(0.715)
Education level	0.355***	(0.052)		
<i>Second-level decision increased nature protection or increased scenic beauty</i>				
ASC nature protection	-0.020	(0.110)	-0.217	(0.161)
Taxes (payment vehicle)	-0.054	(0.067)	-0.181*	(0.098)
Conservation-oriented PESs (green (striped) boxes)	0.174***	(0.028)	0.376***	(0.043)
Access-oriented PESs (blue (dark) boxes)	0.130***	(0.028)	0.187***	(0.041)
Payment amount	-0.002***	(0.000)	-0.056***	(0.008)
<i>Inclusive value parameters</i>				
Status quo	1.000	Fixed	1.000	Fixed
More ESPs	0.947***	(0.277)	0.179	(0.511)
Significance of the model	$\chi_7^2=1351$ ***		$\chi_7^2=1326$ ***	

\*, \*\*\* significant at the 90%, 99% confidence level ( $P[|Z|>z]$ ).

both the nature conservation and scenic beauty targeted PES were highly significant for both populations. Thus both foreign tourists and Costa Ricans showed a strong preference towards increased environmental services of both types. However, the utility level for nature conservation oriented PES was higher than that of access oriented PES. For the foreign tourists there was a preference against the airport tax as a payment vehicle, with a preference towards voluntary payments at hotels. For Costa Ricans there was no significant preference among the payment vehicles. For both populations there was an expected highly significant negative preference towards payment amount, implying a desire to pay less that is consistent with a downward sloping demand curve. These results demonstrate the potential to expand Costa Rica's PES program through targeted payments for both biodiversity conservation and scenic beauty.

The marginal WTP for a one-level increase in protection of forested lands for nature conservation and scenic beauty are presented in Table 5. Payment is for an additional area of PES payments corresponding to one box in Fig. 1. Costa Ricans had a WTP of \$0.33 per month for increased protection of biodiversity in relatively remote areas, and a \$0.25 per month WTP for improved protection of scenic beauty in relatively accessible forest areas. Foreign tourists demonstrated a WTP, in a one-time payment, of \$6.77 for improved biodiversity conservation and a corresponding WTP of \$3.36 for scenic beauty. These payments can be considered to be quite reasonable, given the interest that was demonstrated in the focus group meetings and the importance of Costa Rica's image of nature conservation to its tourist industry. For foreign tourists it is a small contribution in relation to overall vacation expenditure, and the fact that many tourists spend considerable time traveling within the country and enjoying its overall natural beauty. Among both populations there is a higher WTP for PESs that favor

nature conservation in remote areas as opposed to PESs that favor accessible areas. This demonstrates a commitment to nature conservation for its own sake and support the idea of a significant existence value assigned to Costa Rican tropical forests. It also supports the prioritization of parcels of forest located in remote areas within the PES program. Furthermore, these WTP give guidelines for FONAFIFO and private tourist actors to define acceptable payments.

The impact of socioeconomic indicators on the payment attribute was tested by including interactive terms in the nested logit model. A variety of variables were tested, and most models tested showed that the results of the nested multinomial logit model were robust and socioeconomic interactions were insignificant. For both populations, respondents' age, sex, and preferred vacation or recreational activity had little impact on their preferences to PES payment amount. For foreign tourists the length of stay had no significant impact on preferences toward PES payments.

Tables 6 and 7 present models with significant socioeconomic interactions. For both populations there was a significant and positive impact of income on payment amount and WTP. This conforms to the belief that environmental protection is a normal good, and with increased income individuals will be willing to contribute more to the environment. As shown in Table 6, Costa Ricans with higher incomes are relatively more likely to prefer higher payments and Costa Ricans with large families are relatively less likely to prefer higher payments. It is possible that larger families have less disposable income available for contributions to environmental services. As shown in Table 7, foreign tourists with higher incomes and those that are employed in the tourism sector have a greater acceptance of higher payment levels and those that are members of environmental associations are relatively less likely to prefer higher payments. Those tourists that are employed in tourism may perceive

Table 5  
Marginal WTP for location attributes in dollars

Attributes	Costa Ricans ( <i>n</i> =1892)		Foreign tourists ( <i>n</i> =960)	
	Marginal WTP (\$/month)	Standard error	Marginal WTP (\$ one-time payment)	Standard error
Conservation-oriented ESPs	0.33***	0.064	6.77***	1.126
Access-oriented ESP	0.25***	0.059	3.36***	0.864

\*\*\*Significant at the 99% confidence level ( $P[|Z|>z]$ ).

Table 6  
Costa Rican preferences for ESP attributes with socioeconomic interactions with payment amount

Costa Ricans (no of observations=1892)	Coefficient	Standard error
<i>First-level decision status quo or more PES</i>		
ASC increased PES	0.009	(0.283)
Education level	0.242***	(0.055)
<i>Second-level decision increased biodiversity protection or increased scenic beauty</i>		
ASC nature protection	-0.026	(0.105)
Taxes (payment vehicle)	-0.028	(0.063)
Biodiversity-oriented PESs (green striped) boxes)	0.160***	(0.027)
Access-oriented PESs (blue dark) boxes)	0.115***	(0.026)
Payment amount	-0.004***	(0.001)
Payment amount* income	0.001***	(0.000)
Payment amount* family members	-0.000*	(0.000)
<i>Inclusive value parameters</i>		
Status quo	1.000	Fixed
More ESPs	1.536***	(0.250)
Significance of the model	$\chi^2_{10}=1503$ ***	

\*, \*\*, \*\*\* significant at the 90%, 95%, 99% confidence level ( $P[|Z|>z]$ ).

that a further expansion of the PES program is beneficial to tourism and thus have a higher WTP. There is no apparent explanation for the surprising result that members of environmental associations (69 out of the 240 respondents) had a lower acceptance of higher payments. However it is possible that these individuals are already contributing to environmental protection through their membership.

## 6. Conclusions and further perspectives

The initial qualitative research step of experts and focus groups consultation played a significant role in specifying the way individuals' preferences for nature conservation and scenic beauty should be analyzed within the context of Costa Rica's PES program. Based on this process of consultation, the spatial distribution of the forested lands to receive PES payments was used as a means to assess preferences towards scenic beauty and nature conservation. The participation of the various stakeholders through the different meetings was critical in the design of the

attributes, the use of spatially differentiated PESs, and the analysis of payment vehicles. The rejection of the concept of biodiversity as an attribute understood and valued by Costa Ricans, and the corresponding acceptance of nature conservation as a valuable attribute are interesting qualitative conclusions.

The CE analyses demonstrated a positive WTP to provide increased protection for public goods attributes of private forests. Both Costa Ricans and foreign tourists declared their preferences for increased nature conservation and scenic beauty. These results were robust across respondents with different socioeconomic characteristics, but among both populations, higher income groups were more willing to contribute to PESs. WTP for forest protection emphasizing nature conservation was greater than for protection emphasizing scenic beauty, which support the significance of the existence value assigned to Costa Rican tropical forests. Respondents' preferences for alternative payment vehicles were mixed with foreign tourists preferring voluntary contributions and Costa Ricans being indifferent. These conclusions conform

Table 7  
Foreign tourist preferences for ESP attributes with socioeconomic interactions with payment amount

Foreign tourists (no of observations=960)	Coefficient	Standard error
<i>First-level decision status quo or more PES</i>		
ASC increased PES	3.881***	(0.643)
<i>Second-level decision increased nature protection or increased scenic beauty</i>		
ASC nature protection	-0.161	(0.164)
Taxes (payment vehicle)	-0.165*	(0.098)
Conservation-oriented PESs (green striped) boxes)	0.371***	(0.044)
Access-oriented PESs (blue dark) boxes)	0.194***	(0.042)
Payment amount	-0.073 **	(0.030)
Payment amount* income	0.001*	(0.000)
Payment amount* environmental association member	-0.002**	(0.001)
Payment amount* employed in tourism	0.003***	(0.001)
<i>Inclusive value parameters</i>		
Status quo	1.000	Fixed
More ESPs	0.055	(0.434)
Significance of the model	$\chi^2_{10}=1343$ ***	

\*, \*\*, \*\*\* significant at the 90%, 95%, 99% confidence level ( $P[|Z|>z]$ ).

to the opinions expressed in focus groups. They demonstrate the continued appreciation of environmental services of tropical forests in Costa Rica.

This analysis does not denigrate the current PES system in Costa Rica. Results of this study support the expansion of the PES program by raising funds from both tourists and Costa Ricans. Since tourism represents an important, income-generating sector, the potential increase in PES services can be substantial. And PES payments targeted towards biodiversity conservation and scenic beauty should complement current PES payments.

This research also demonstrates that CEs, including a significant initial research step of experts and focus group consultation, can aid in incorporating stakeholder preferences into the design and evolution of conservation policy instruments. Choice experiments were shown to be an appropriate method for investigating public preferences about potential use and non-use values attached to forest conservation. The relatively high WTP for nature conservation-oriented PESs shows a mechanism to isolate and assess the non-use values of tropical forests.

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