

**PUBLIC PREFERENCE FOR BIODIVERSITY CONSERVATION AND
SCENIC BEAUTY WITHIN A FRAMEWORK OF ENVIRONMENTAL SERVICE
PAYMENTS***

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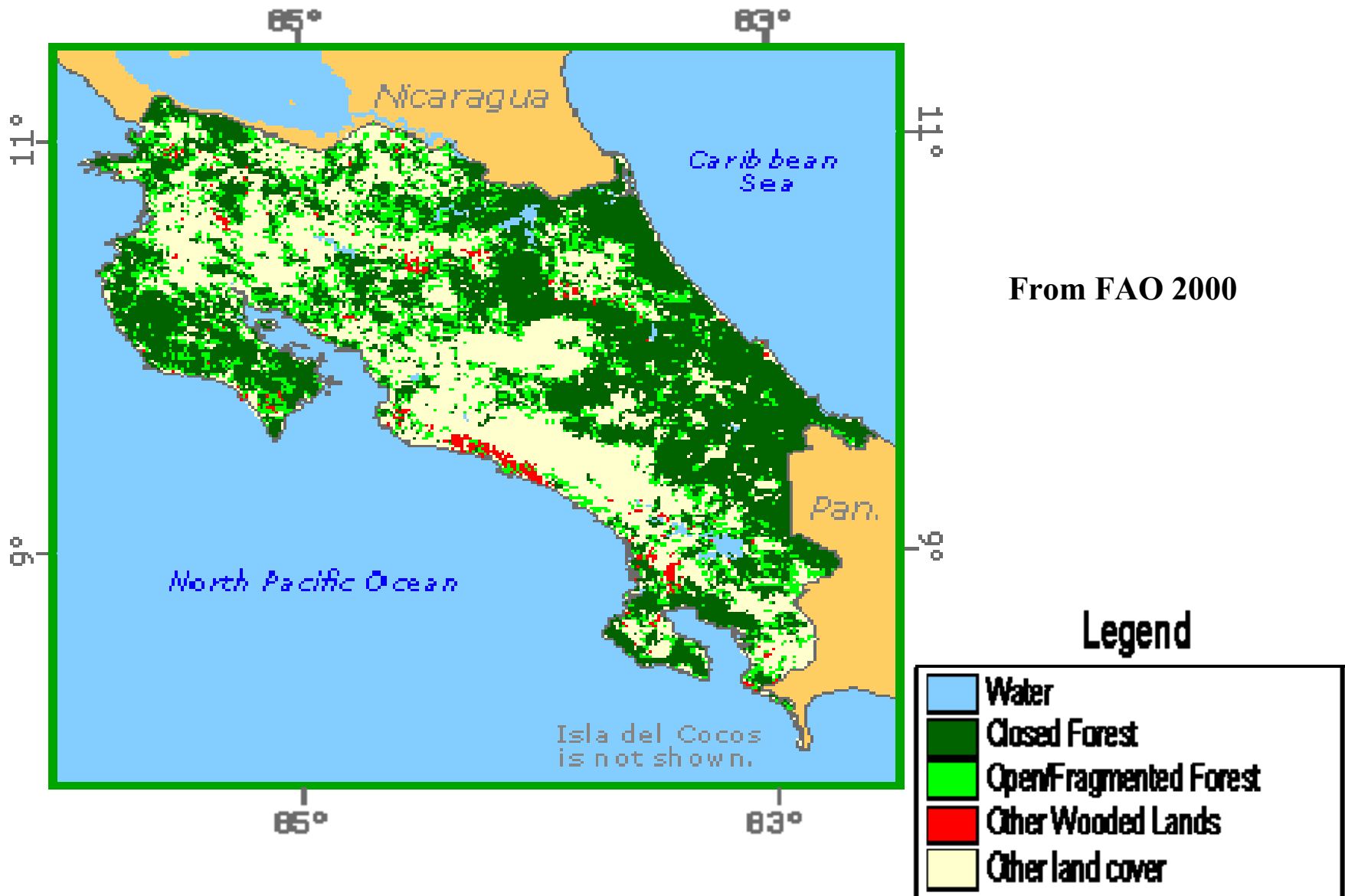
Forest Cover in Costa Rica

Prior to the 1990s there was a continued loss in forest cover in Costa Rica as land was converted to pasture and other agricultural uses.

Incentives to convert land and high beef prices ended which led to a recuperation of forest cover which coincided with increased environmental awareness.

However forest fragmentation and illegal logging continue and the loss of primary forests remains a concern.

Forest Cover in Costa Rica



Environmental Services Payments in Costa Rica

The 1996 Costa Rican Forestry Law established a system of environmental services payments (ESPs) which are voluntary incentive based contracts for forest protection and plantation establishment on privately owned forest land.

Four types of environmental services were identified:

- carbon sequestration,
- water protection,
- biodiversity conservation and its sustainable use, and
- scenic beauty.

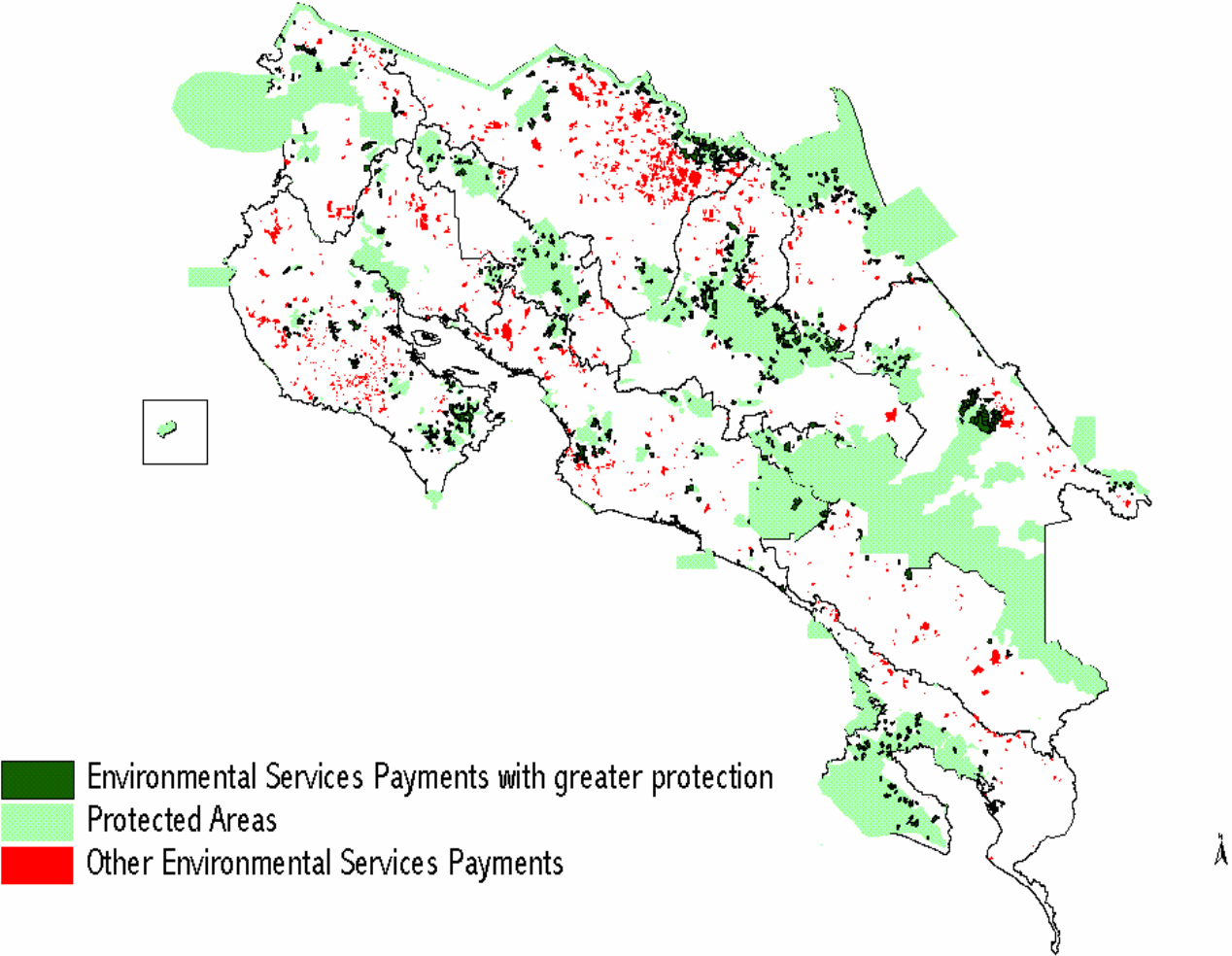
Environmental Services Payments in Costa Rica

ESPs can complement and strengthen the successful system national parks and protected areas.

Basic current sources of funding are a percentage of the fossil fuel tax, Joint Implementation mechanism projects, and payments made by certain hydroelectricity generators.

Current demand for ESPs from landowners far exceeds the possible offer from FONAFIFO (institution in charge of the ESP program). FONAFIFO has not received all of its share of the fuel tax from the Treasury.

Environmental Services Payments providing greater protection



Environmental Services Payments in Costa Rica

Joint implementation projects, for carbon credits, and watershed protection projects can be conceived as Coasian bargains to provide targeted benefits from particular forests. Specific demand for these services can be identified via these transactions.

But biodiversity conservation and scenic beauty are non-excludable and non-rival in consumption public goods attributes of biodiversity conservation and scenic beauty make it difficult to target particular beneficiaries, new financing mechanisms may be required.

Environmental Services Payments in Costa Rica

A particular beneficiary of scenic beauty and nature conservation are tourists and Costa Rica's relatively prosperous tourism sector. Tourists generally spend time travelling between destinations and appreciating the scenic beauty of Costa Rica's landscape. Also the variety of flora and fauna impress tourists who are often attracted towards Costa Rica's perceived environmentalism.

Research objectives

- ◆ Analyze public preferences and measure the benefits people derive of forested lands protection via the ESP program.
- ◆ Assess the relative importance of scenic beauty and biodiversity conservation as attributes of protected forested areas.
- ◆ Assess the capacity of choice experiments to estimate the economic value of passive use and non-use values.
- ◆ Analyze preferences for alternative payment vehicles to support forest environmental services.

An Aside on Stated Preference Analysis and Passive Use Values

In the 1980s and 1990s economic research refined methods to estimate the economic value of non-market environmental goods and services.

Initially there was a lot of discussion of using contingent valuation (CV) to estimate the total economic value of ecosystems, including non-use values.

The 1992 Arrow commission report to NOAA supported the use of CV to estimate “passive use” values for purposes of damage claims assessments under the CERCLA act. Since then environmental economists have been shy of “non-use values.”

The Use of Choice Experiments in the Analysis of Environmental Services

Choice Experiments are a generalized version of the dichotomous choice CVM methodology. The multiple choice characteristic of choice experiments allows for the analysis of tradeoff and substitutions.

Choice Experiments (Choice Modelling) have evolved from marketing and transport literature and is closely associated with conjoint analysis, although conjoint analysis with ranking is not based on any theoretical behavioral model.

Choice experiments have recently been applied to the analysis of non-market environmental good and services.

The Use of Choice Experiments in the Analysis of Environmental Services

Choice Experiments are based on Lancasterian consumer theory as well as random utility theory.

Lancasterian theory of value suggests that utility is derived from the attributes of a particular good or service. Consumers gain utility not from a Coca Cola but from the sweetness, caffeine, carbonation, temperature, volume, container, nutrition, and the environment of the consumption. Price is another attribute of the consumption.

With its great access to market information Coca Cola Corp can assess preferences for these attributes and adjust the product in order increase sales and income.

Choice Experiments and Random Utility Theory

Random utility theory suggests that utility has both a systematic and a random component.

Thus:
$$U_i = V_i + \varepsilon_i \quad (1)$$

where: U_i is the unobservable, but true utility for alternative i ;
 V_i is systematic component of utility, which can be known;
and ε_i is a random component.

Thus the probability that the consumer will select alternative i among a set of alternatives Φ can be presented as:

$$P(i/\Phi) = P(U_i > U_j) = P[(V_i + \varepsilon_i) > (V_j + \varepsilon_j)] \quad \forall j \in \Phi \quad (2)$$

where $P(\cdot)$ indicates the probability of an occurrence.

Choice Experiments and Random Utility Theory

Since the systematic component can be expressed as a linear function of explanatory variables, V_i can be referred to as:

$$V_i = \beta' X_i, \quad (3)$$

such that:

$$P(i | \Phi) = P[(\beta' X_i + \varepsilon_i) > (\beta' X_j + \varepsilon_j)] \quad \forall j \in \Phi \quad (4)$$

where β is a vector of k coefficients associated with the vector x of explanatory variables which are the attributes, including price, from which utility is derived (Adamowicz, et al. 1998).

Choice Experiments and Random Utility Theory

V_i can be generalized to include a variety of parameters and interactions, such that:

$$V_i = \beta_i + \sum_k \beta_k X_k + \sum_{pi} \varphi_{pi} \beta_i Z_{pi} + \sum_{kp} \Phi_{kp} X_k Z_p \quad (5)$$

where:

β_i is a parameter vector for intercept terms for choices i ;

β_k is a parameter vector for attributes k ;

φ_i is a parameter vector for interactions of socioeconomic characteristics p and intercept terms for choices i ;

Φ_i is a parameter vector for interactions of socioeconomic characteristics p and attributes k ;

Methodology: Stakeholders' participation in the survey design

An extensive consultative process including experts' groups and focus groups:

The experts group

1. Refined the research objectives;
2. Stressed the need to target ESPs towards isolated areas in order to support biodiversity conservation;
2. Proposed and validated the use of ESP location to represent preferences for scenic beauty and nature preservation;
3. Stressed the importance of the payment vehicle and proposed alternatives;

Methodology: Stakeholders' participation in the survey design

An extensive consultative process including experts' groups and focus groups:

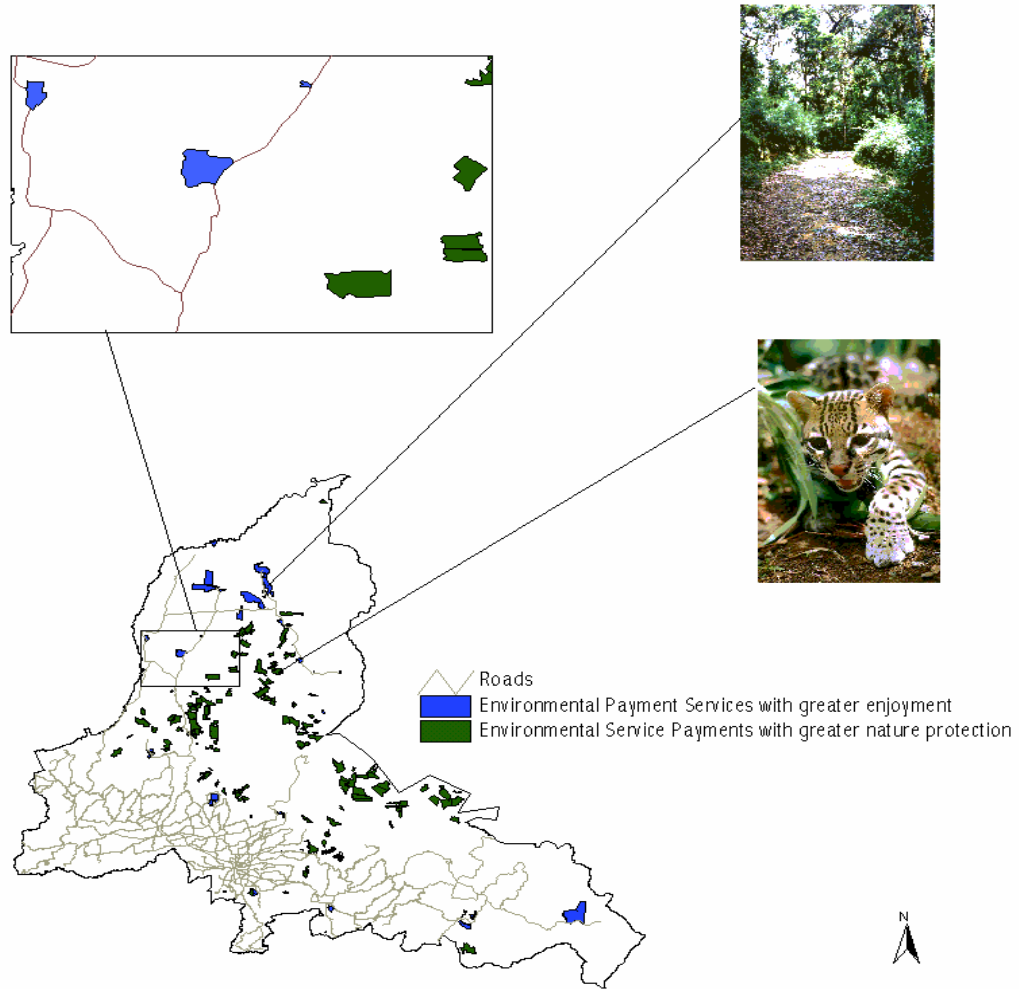
The focus groups

1. Corroborated the use of maps to identify preferences for payments in accessible and isolated areas;
2. Costa Ricans rejected the term “biodiversity” as being too scientific and laden with concerns which were not theirs.
3. But they supported policies to protect “nature” and accepted the goal of protecting their “God given” natural patrimony;
3. Validated the survey instrument.

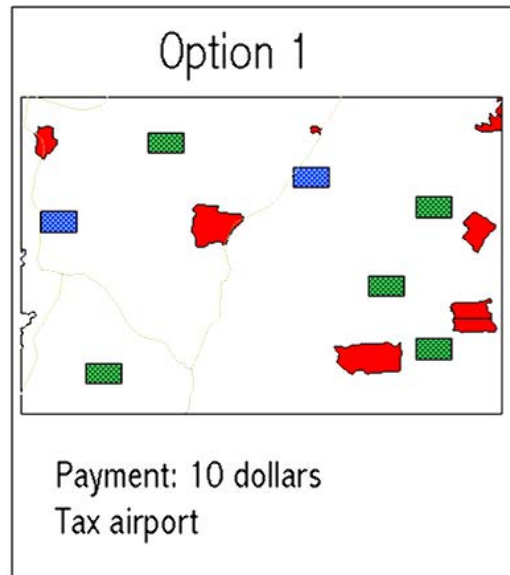
Table 1 Attributes and levels for foreigners and Costa Ricans		
Attributes	Levels	
Population	Foreign tourists	Costa Ricans
Number of ecologically focused zones (green boxes)	0, 2, 5	0, 2, 5
Number of access focused zones (blue boxes)	0, 2, 5	0, 2, 5
Bid amount (Price)	2, 4, 10, 20 *	50, 100, 250, 500 **
Payment vehicle	Airport taxes Voluntary contributions	Municipal taxes Voluntary contributions
* \$ as a one time payment		
** colons per month 318 colons = \$1.00 in January 2001.		

Table 2: Choice Set Options			
Scenarios Attributes	Option 1 Ecologically focused expansion of ESP system	Option 2 Access focused expansion of ESP system	Option 3 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 \$)	2, 4, 10, 20	2, 4, 10, 20	0
Payment vehicle	Taxes Voluntary contribution	Taxes Voluntary contribution	No payment

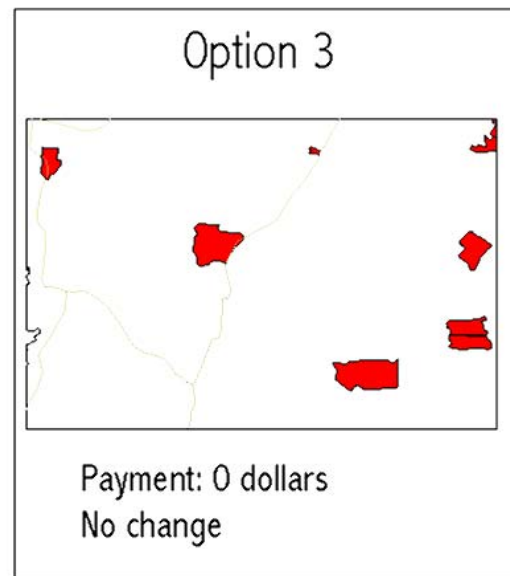
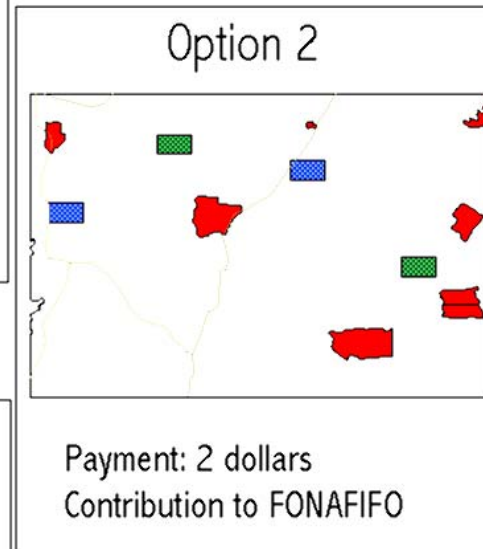
Actual situation in the Central Volcanic Mountains Range and sample



group 4

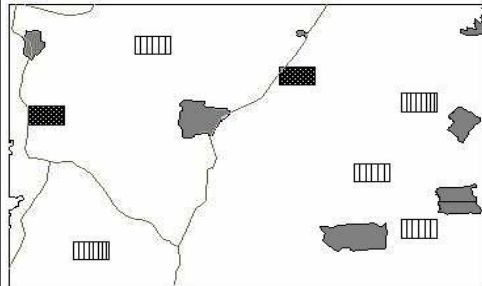


Choice set n°1



group 4

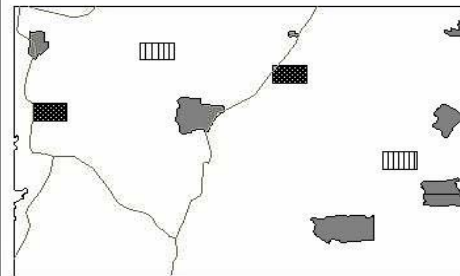
Option 1



Payment: 10 dollars
Tax airport

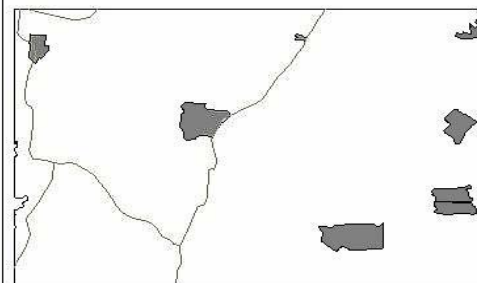
Choice set n°1

Option 2



Payment: 2 dollars
Contribution to FONAFIFO

Option 3



Payment: 0 dollars
No change

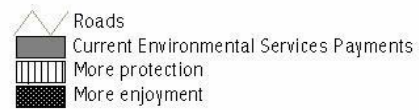


Figure 2 : The Nested Decision Making Structure

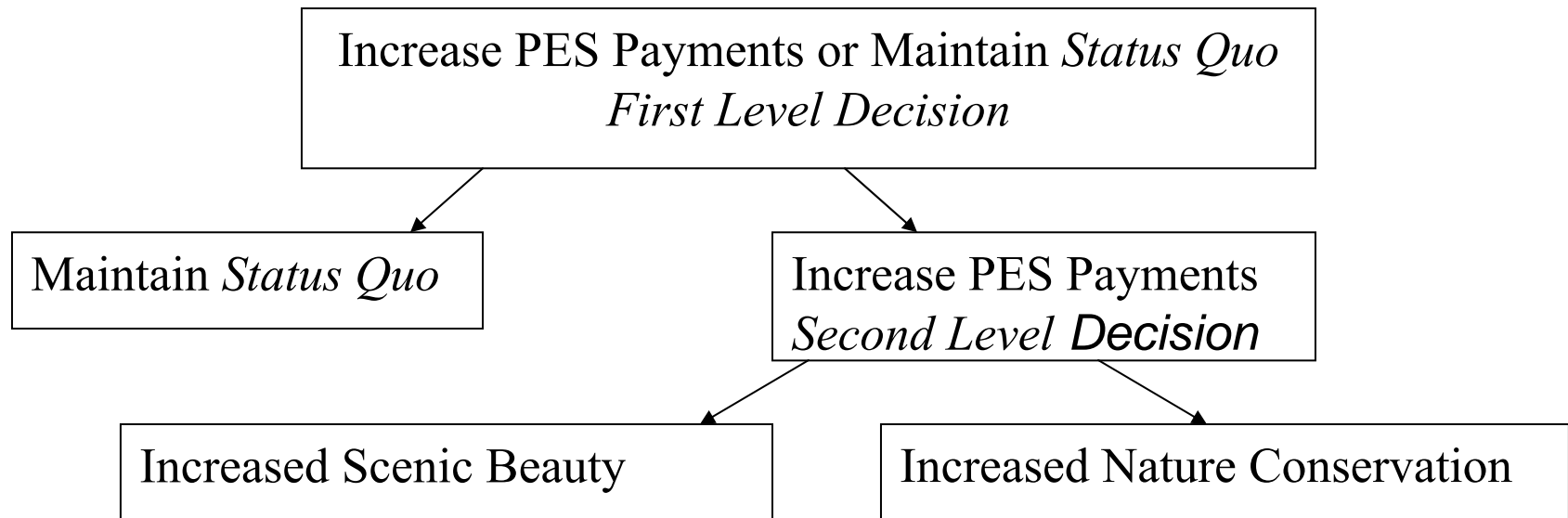


Table 3: Locations of Survey Application

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

Table 4: Costa Rican and Foreign Tourist Preferences for ESP Attributes						
	Costa Ricans(n = 1,892)			Foreign Tourists(n = 960)		
	Coefficient		Standard Error	Coefficient		Standard Error
First Level Decision Status Quo or More PES						
ASC Increased PES	0.149		(0.304)	3.176	***	(0.715)
Education Level	0.355	***	(0.052)			
Second-Level Decision Increased Nature Protection or Increased Scenic Beauty						
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 boxes)	0.174	***	(0.028)	0.376	***	(0.043)
Access-oriented PESs (blue boxes)	0.130	***	(0.028)	0.187	***	(0.041)
Payment Amount	-0.002	***	(0.000)	-0.056	***	(0.008)
Inclusive Value Parameters						
Status Quo	1.000		Fixed	1.000		Fixed
More ESPs	0.947	***	(0.277)	0.179		(0.511)
Significance of the model	$\chi^2_{27} = 1351^{***}$			$\chi^2_{27} = 1326^{***}$		
*, *** significant at the 90%, 99% confidence level (P[Z >z])						

Table 5: Marginal WTP For Location Attributes In Dollars				
	Costa Ricans (n = 473)		Foreign Tourists (n = 240)	
ATTRIBUTES	Marginal WTP (\$/month)	Standard Error	Marginal WTP \$ (one payment)	Standard Error
Biodiversity ESP	0.33 **	0.064	6.77 **	1.126
Scenic beauty 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 (n° = 1,892)	Coefficient	Standard Error	
First Level Decision Status Quo or More PES			
ASC Increased PES	0.009		(0.283)
Education Level	0.242	***	(0.055)
Second-Level Decision Increased Biodiversity or Increased Scenic Beauty			
ASC Nature Protection	-0.026		(0.105)
Taxes (payment vehicle)	-0.028		(0.063)
Biodiversity-oriented PESs (green boxes)	0.160	***	(0.027)
Access-oriented PESs (blue 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)
Inclusive Value Parameters			
Status Quo	1.000		Fixed
More ESPs	1.536	***	(0.250) ₂₇
Significance of the model	$\chi^2_{10} = 1503^{***}$		

Table 7: Foreign Tourist Preferences for ESP Attributes with Socioeconomic Interactions with Payment Amount			
Foreign Tourists (n° of observations = 960)	Coefficient	Standard Error	
First Level Decision Status Quo or More PES			
ASC Increased PES	3.881	***	(0.643)
Second-Level Decision Increased Nature Protection or Increased Scenic Beauty			
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)
Inclusive Value Parameters			
Status Quo	1.000		Fixed
More ESPs	0.055		(0.434)
Significance of the model	$\chi^2_{10} = 1343^{***}$		

Results

Results demonstrate WTP by both populations for both nature conservation in remote areas and scenic beauty in accessible areas. There is a higher WTP for protection in remote areas which favor biodiversity nature conservation.

Foreign tourists had a slight preference against an airport tax, which can be attributed to the inconvenience they encountered at the airport prior to the survey administration. Significant preferences for payment vehicles were recorded.

The results for the general model are robust with little significant socioeconomic interaction. But there was a positive income effect for both populations with higher WTP among richer respondents.

Conclusions and Observations

Experts and focus groups did contribute to the research design and provided some qualitative observations. The values that scientists attribute to biodiversity may be distinct from citizens respect for nature.

Costa Ricans respect for nature as “God given” presents an interesting hypothesis for further research.

Because of the spatial differentiation between forests that provide nature conservation and forests that provide scenic amenities, it is possible to use choice experiments to estimate non-use values as well as passive use values.