Community Preference for Urban Coastal Ecosystem Conservation and Scenic Beauty

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ABSTRACT

A lagoon ecosystem provides a variety of ecological functions that directly or indirectly translate to economic services and values. The impact of the loss of cultural services is scarce in literature and particularly difficult to measure. This study generates monetary value for urban ecosystem services specifically the aesthetic value of a natural asset according to the perception of the adjacent community. The data were gathered by using a pre-structured questionnaire-based personal interview carried out with 300 households representing 15 *Thotupola* areas adjacent to the estuary. Contingent Valuation Method (CVM) and Choice Experiment (CE) were used to determine the preferences and the willingness to pay for conservation of urban ecosystem services and natural view. Highest value (530.75) was recorded for provisioning services. Marginal willingness to pay (MWTP) for prawns (272.25) was higher than the value of crabs (258.50). Second highest MWTP (309.50) was acquired by recreation attribute, scenic beauty of the lagoon. The study generate information for decision makers with regard the monetary values for conservation of different ecosystem services and estuary view, to protect the estuary ecosystem through implementing policies and management plans, on urban estuaries and mangrove environment protection.

KEYWORDS: Choice experiment, Contingent valuation method, Ecosystem services

INTRODUCTION

Ecosystem services are the benefits from ecosystems to support sustainable human well-being (Barbier and Strand, 1998). According to the ecology and economy the ecosystem services can be classified in to four major categories namely provisioning, regulating, cultural and supporting services.

Different habitats provide different types of ecosystem services, general classifications need to be adapted to specific types of ecosystems. Urban ecosystems are especially important in providing services with direct impact on human health and security such as air purification, noise reduction, urban cooling and run off mitigation.

Negombo is a major city in Western Province Sri Lanka, on the West coast of the island and at the mouth of the Negombo lagoon. It is one of the major commercial hubs in Sri Lanka with about 128,000 inhabitants within city limits. Negombo is known for its huge and old fishing industry with busy fish markets and sandy beaches.

The valuations of ecosystem services assess the relative contribution of ecosystem services towards sustainable human well-being. Some of these assessments are based on individual's perceptions of the benefits they derive. But support towards sustainable human well-being is a much larger goal. Therefore, it is essential to improve valuation methods to assess benefits to individuals that are not well perceived and incorporate benefits to whole communities and to sustainability (Costanza, 2000).

Understanding the degree and order of the non-use value of an ecosystem for its direct beneficiaries is critical for planning for the sustainable environment management (Wattage and Mardle, 2005). Therefore, when implementing policies rules and regulations for environmental conservation, it is necessary to consider the perception of the adjacent community. Monetary valuation of natural resources can easily understand for all the residents to initiate conservation activities from the adjacent community.

The specific objective of this study was to determine monetary value for urban ecosystem services according to the perception of the adjacent community, to assess the importance of diverse ecosystem functions.

The general purpose of this research is to generate information for decision makers with regard to the costs and benefits to protect the estuary ecosystem through implementing policies and management plans, on urban estuaries and mangrove environment protection.

METHODOLOGY

This study is based on two main approaches, stated preference where the conservation of these ecosystem services was priced by Choice Experiment (CE) and consumer preferences for lagoon view as a property attribute were assessed by Contingent Valuation Method (CVM).

Theoretical Framework to Assess the Value of Ecosystem Services (ESS)

The conceptual foundation of CE rely on two main theories, Lancaster's Theory of Value (Lancaster, 1966) and Random Utility Theory (Thurstone, 1927), which explains the dominance judgments made between pairs of offerings where each alternative (i) in the choice set, thus, has an associated utility level represented by;

$$U_i = V_i + \in_i$$

Where utility of the option $i = (U_i)$
Utility of the other option $j = (U_j)$

However, since the overall utility is random and
P {i chosen} $= p\{V_i + \in_i > V_j + \in_j\}c$

The marginal value of an attribute change could be given by the ratio of the coefficients of the attribute in question and that of the monetary attribute, holding all else equal. This can be conceptualized as the part-worth or marginal willingness to pay (MWTP) for the attribute calculated as;

$$MWTP_{attribute} = \frac{-\beta_{attribute}}{\beta_{monetary\ attribute}}$$

Where MWTP represent the marginal rate of substitution between the monetary attribute and the attribute in question, and β refers to the parameter estimates of the attribute levels.

Theoretical Framework to Assess the Value of Lagoon View

Contingent Valuation Method have been usually used to evaluate consumer preferences for non-market (eg: environmental) goods (Loureiro and Hine, 2002). It asks hypothetical questions from respondents about their willingness to pay (WTP) for products with specific attributes. Evaluation of the consumer responses to these questions can be used to estimate the proportion of population (i.e. market share) willing to purchase a product with specific attributes with alternative prices (Wattage and Mardle, 2008).

The estimated average WTP captures both use and non-use values of the environmental good.

Demand for an environmental resource is usually expressed as:

$$WTP_{ji} = \int (A_j, E_j, I_j, G_j)$$

Where;
WTP_{ji} = The willingness to pay of respondent j for environmental resource i;

A_j = Age of the respondent j;
E_j = Education level of the respondent j;
I_j = Income level of the respondent j;
G_j = Gender of the respondent j;

$$Mean\ WTP = \frac{1}{N} \sum_{I=1}^{N} X_i Y_j$$

Collection of Data

The lagoon area is geographically segregated in to areas known as *Thotupola* where the fisherman can easily launch their fishing boats in to lagoon.

Data collection was done within two phases. During the first phase of this research program; a pilot survey was conducted to identify the levels of ecosystem services which are crucial for households around Negombo lagoon and, to identify the bid values which represent the excess amount of money that they willing to pay for lagoon view. Questions were asked from 30 respondents representing five *Thotupola* areas for the pilot survey. According to the pilot survey findings; five attributes and three levels for each attribute, were selected as crucial for this study (Table 1).

Table 1. Findings of the pilot survey

Atb.	Level I	Level II	Level III
PS	Fish	Crabs	Prawns
CS	Full view	Partial view	No view
RS	Prevention soil erosion	Water purification	Flood reduction
SS	Sediment stabilization	Nutrient recycling	Biodiversity
AP	Rs. 243.75	Rs. 325	Rs. 162.50

Note: Atb.- attributes, PS- provisioning services, CS- cultural services (recreation), RS- regulating services, SS- supporting services, AP- annual payment

The pilot survey participants also identified the minimum (Rs. 162.50 per year) and maximum (Rs. 325 per year) they could contribute for the lagoon ecosystem conservation activities. According to the pilot survey findings Rs. 25000, Rs. 50000, Rs. 75000 and Rs. 100000 were the identified bid values.

Since each of the four ecosystem services and annual payment has three levels, these were combined in to a limited number of choice sets made up of optimal combinations of attributes and their levels. For this purpose, Statistical Package for the Social Sciences (SPSS 16.0) was used. Orthogonolization procedure was adopted to identify the main effects.

A full factorial design including all possible combinations of attributes and levels would use 243 (3*3*3*3*3 = 243) choice tasks.

From the 243 possible combinations, 18 lagoon profiles were randomly blocked into six different versions, each with three different lagoon alternatives (Table 2).

Table 2. An example of a choice card

Choice A	Choice B	Choice C
Full view	No view	Partial view
Prawns	Fish	Fish
Reduction of flood damage by mangrove	Reduction of flood damage by mangrove	Cleaning of polluted lagoon water by mangrove
Nutrient recycling by mangrove	Nutrient recycling by mangrove	Biodiversity around mangrove
Rs.325.00/year	Rs.243.75/year	Rs.162.50/year
☐	☐	☐

During the second phase, respondents were asked to select their best choice out of three alternatives present in one choice card. Further, the excess amount of money that they willing to pay for the scenic beauty of lagoon view per perch were assessed by using four different bidding values. Initial WTP elicitation question was presented with the highest bid value in the bid vector (Rs. 100000). The follow-up questions was conditional on the respondents' response to the bid value offered in the initial question, the amount offered was lower if the response was 'No'. This process was continued by reducing the bid value offered on each occasion, if the respondents' response is 'No', until the lowest bid value (Rs. 25000) and finally mean WTP for the lagoon view was calculated according to CVM.

The data collection was conducted by using 300 respondents, representing 15 *Thotupola* areas adjacent to the lagoon during February to April 2016.

Analysis of Data
Assess the Value of ESS - CE
For assessing the value of the ESS, Conditional Logistic (CL) Regression was employed when all the assumptions were met.

Assess the Value of Lagoon View - CVM
In this study, Ordinary Least Squares (OLS) regression was used to assess the urban residents' WTP for lagoon view with respect to one perch.

RESULTS AND DISCUSSION
Out of 300 participants, 55% of the respondents were males and 57% in the sample were educated above the 11th grade (Table 3).

Table 3. Descriptive statistics of the sample

Parameter	Percentage (%)
Age (Years)	
< 35	22.00
36 – 50	37.67
50 <	40.33
Education (Grade)	
< 5	2.33
5 – 10	40.67
11 <	57.00
Monthly Wage (Rs.)	
< 10,000	9.00
10,000 - 20,000	40.67
20,000 <	50.33
Gender	
Male	55.00
Female	45.00

According to the survey, Flood control (92%), coastal protection (87%) and lagoon fisheries (85%) ranked as the major services provided by the lagoon (Figure 1).
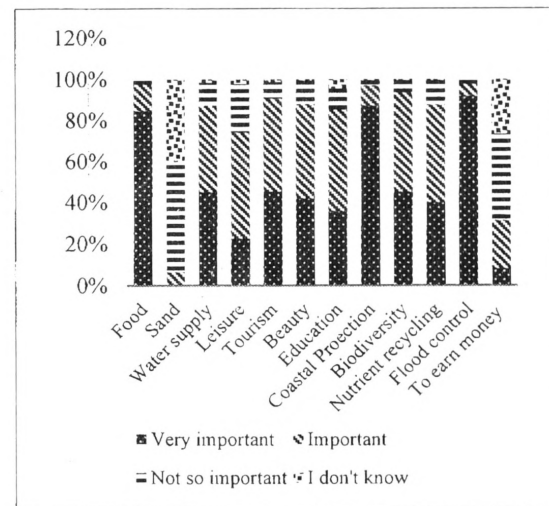

Figure 1. Importance given by the residents to the main functions of the lagoon

The residents of Negombo lagoon are more willing to provide participatory contribution (49%) than monetary contribution (20%) to conserve the lagoon for the future generation (Figure 2).
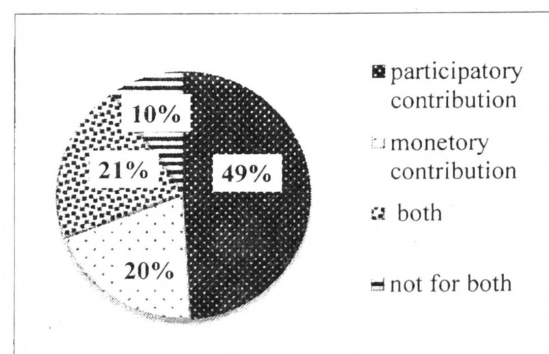

Figure 2. Contribution for conservation
Twenty one percent of them were willing to give contribution in both ways while 10% of

them were not willing to take part in any conservation activities. Ninety percent of the fishing households willingly contribute for the proper functioning conservation programs.

Because adjacent fishing community becomes the major stakeholder who directly deals with the ecosystem services provided by the lagoon and they have clearly recognized the direct benefits that they would receive through a conservation program.

Outcomes of CE

According to the results (Table 3), seven out of eight levels of ecosystem services considered in the analysis (i.e. crabs, prawns, partial view, full view, cleaning polluted water, reduce flood damage and biodiversity) were significant at 95% of significant level. Positive coefficients for the attribute imply that respondents' willingness to pay for conservation of those ecosystem services. According to the results of CE, respondents' are willing to pay for all ecosystem services except regulating services such as cleaning of polluted lagoon water and flood control.

According to the MWTP values, the fishing households around Negombo lagoon ranked the highest value (530.75) for provisioning services (Table 3).

Because their main livelihoods attached with provisioning services and nowadays majority of the aquaculture farms either non-functioning or abandoned due to law yields. Marginal willingness to pay for prawns (272.25) higher than the value of crabs (258.50). Second highest MWTP (309.50)

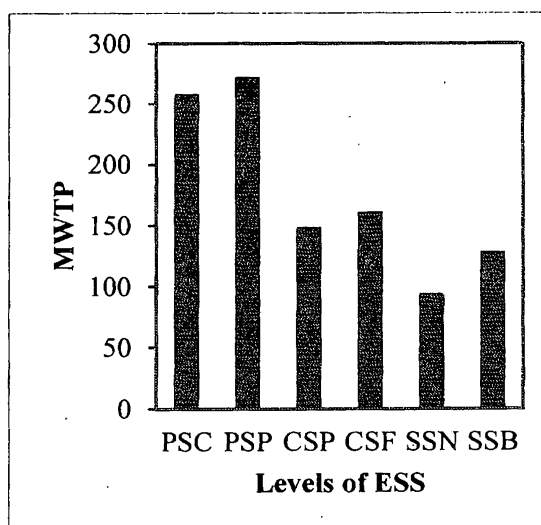acquired by recreation attribute, scenic beauty of the lagoon (Figure 3).

Figure 3. Marginal willingness to pay values for levels of ecosystem services. *Note: PSC-crabs, PSP- prawns, CSP- partial view, CSF- full view, SSN- nutrient recycling, SSB- biodiversity, MWTP- marginal willingness to pay, ESS - ecosystem services*

Although the flood control was appeared as very important service in community ranking order, people not willing to pay for that service due to the following reasons. Majority of the local fisher community stated that development activities and illegal constructions took place in this area are the major reasons behind these flood damages. Further they stated that flood damage can be reduced only by implementing proper functioning policies, rules and regulations.

Table 3. Outcomes of CE model

Attributes	Levels	Coefficients	Standard Error	P value	MWTP (Rs.)	MWTP for whole attribute (Rs.)
Provisioning (PS)	Fish (PSF)	*	*	*	*	530.75
	Crabs (PSC)	1.034	0.272	0.000	258.50	
	Prawns (PSP)	1.089	0.307	0.000	272.25	
Cultural (Recreation) (CS)	No view (CSN)	*	*	*	*	309.50
	Partial view (CSP)	0.594	0.193	0.002	148.50	
	Full view (CSF)	0.644	0.193	0.001	161.00	
Regulating (RS)	Prevention erosion (RSP)	*	*	*	*	-
	Cleaning polluted water (RSC)	-0.653	0.277	0.019	-	
	Reduce flood damage (RSR)	-0.674	0.285	0.018	-	
Supporting (SS)	Sediment stabilization (SSS)	*	*	*	*	222.50
	Nutrient recycling (SSN)	0.377	0.461	0.413	94.25	
	Biodiversity (SSB)	0.513	0.211	0.015	128.25	
Contribution conservation		0.004	0.001	0.005		

Note: MWTP in Rs. per perch per year, Log likelihood -516.07645, Pseudo R² 0.0732, N. Observations 900

Outcomes of CVM

Out of 300 respondents, 226 (75.33%) answered positively to the particular bid values listed and 96 (32%) respondents did not say 'Yes' to any of all the bid values offered by the payment principle questions.

Findings of the CVM study revealed that, the age, education level, income and gender characteristics were significant at 95% confidence level. Therefore, these independent variables influence the mean WTP of the lagoon view (Table 4).

Table 4. Outcomes of CVM model

Variable	Coefficients	P value
Age	273.00	0.040
Education level	2268.0	0.011
Income	0.4878	0.000
Gender	7160.00	0.042

Note: * Significant level 0.05%

The distribution of WTP obtained from the respondents' 'Yes' response to the given bid values (Figure 4).
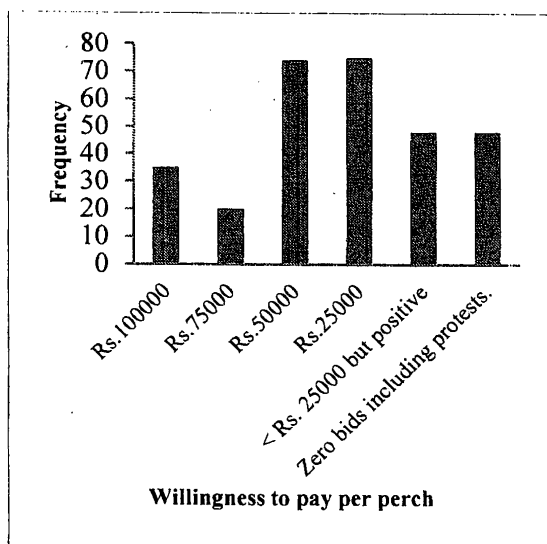

Willingness to pay per perch

Figure 4. Distribution of willingness to pay

The mean WTP (excess amount of money that they willing to pay for direct lagoon view) was Rs. 46,792 per perch. The mean WTP was calculated from 226 respondent results, excluding non-protest zeroes and less than Rs.25000 bids.

CONCLUSIONS

Economic valuation of ecosystem services and natural resources has become popular over the last two decades. But the focus towards urban ecosystems and their cultural services are lack in literature. Further the conservation of urban ecosystems means that the land cannot be put into alternative uses. Therefore, in formulating conservation policies one must account for the fact that the benefits to the local communities who are being asked to conserve must outweigh the costs to them. Otherwise it is unlikely that the policy will be accepted.

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