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Estimating Socio-Cultural Services of Coastal Wetlands: A Case of Negombo Lagoon in Sri Lanka

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Abstract

Knowledge on social and cultural systems is essential for comprehensive understanding of ecosystem changes, monitoring biodiversity, development and implementation of resource management strategies. Social values of coastal landscapes reveal the attributes of locations and their relative importance for people. Aim of the study was to evaluate the cultural services and derive the monetary value of social landscape through valuing socio-cultural services of Negombo lagoon. A discrete choice experiment approach was used to estimate the individual's preference towards social landscape by incorporating featured attributes. The individual preference was expressed through the marginal willingness to pay (MWTP) by integrating a monetary attribute into choice sets. Thus, the MWTP or the implicit price of social landscape attributes included in the choice task was estimated and then the total social landscape value was derived as 13,055 LKR per monthly per household. The social landscape values of Negombo lagoon demonstrated the important ecological, and socio-cultural knowledge, which should be integrated as guiding policies in ecosystem conservation and management strategies. Further, the challenging management paradigm for coastal and marine landscape of Negombo lagoon, and associated services should contain not only the biological and physical benefits but also socio-cultural values too.

Keywords: *Costal wetlands, Negombo Lagoon, Social landscape, Socio-cultural services*

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1. Introduction

Cultural ecosystem services (CES) can be defined as the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation as well as aesthetic experience (Chan et al. 2012a; Chan et al. 2012b; Daniel et al. 2012a; Daniel et al. 2012b; Bieling and Plieninger, 2013). Cultural services consist of ten subcategories as affirmed according to the Millennium Ecosystem Assessment; (i) cultural diversity; (ii) spiritual and religious values; (iii) knowledge systems; (iv) educational values; (v) inspiration; (vi) aesthetic values; (vii) social relations; (viii) sense of place; (ix) cultural heritage values; and (x) recreation and ecotourism (Schaich et al. 2010; Milcu et al. 2013; Satz et al. 2013; Hernández-Morcillo et al. 2013; López-Santiago et al. 2014; Tenerelli et al. 2016; Guruge et al. 2017; Guruge et al. 2020).

Cultural and social services are the nonmaterial benefits that arise from human ecosystem relationships (Chan et al. 2012a) as well as the services that contribute to human wellbeing because of the existence of an interpretive 'lens' that has its roots in cultural background (Baulcomb et al. 2015). These services demonstrate a significant relationship between ecosystem structures and functions specified in the biophysical

domain and the satisfaction of human needs and wants (Daniel et al. 2012a) those are the strongest incentives for communities to become involved in environmental conservation (Schaich et al. 2010; Chan et al. 2012b; Hernández-Morcillo et al. 2013).

Cultural and social values belong to the ethical, spiritual and affective realm of human beings, which reflect the intangible dimensions of their relation with nature. The importance of cultural services is long recognized, but infrequently assessed due to its inherent characteristics. Those are intangible, subjective, invisible and nonmarket goods, which are difficult to quantify in biophysical or monetary terms (Daniel et al. 2012a; López-Santiago et al. 2014; Pleasant et al. 2014; Berkel and Verburg, 2014; Baulcomb et al. 2015).

Integrating the social values to the ecosystems provides more precise understanding of the relevance of ecosystem services to local inhabitants, allowing greater cultural sensitivity and recognition of trade-offs (Chiesura and De Groot, 2003; Fagerholm and Käyhkö 2009; Plieninger et al. 2013; Raymond et al. 2014). Appropriating of perceptions, values, beliefs, and attitudes will generate more meaningful insights regarding the contributions of ecosystem services to human well-being that have revealed a

preference for cultural services to regulate ecosystem services in comparable magnitude (Chan et al. 2012; Daniel et al. 2012). The social values attach to the landscape are place related, contextualized, and subjectively experienced and required to be captured through social knowledge and dedicated participation of local inhabitants. Therefore, social landscape values emerge from environmental experience activities i.e., aesthetic, religious, cultural or recreational that have socially approved constructs.

The social landscape has been looked through the several lenses, which includes a wide range of topics related to public attitudes, perceptions, values, behaviours, as well as community related topics like community networks, and social capital. Accordingly, the social landscape value has been approached with full set of values i.e., aesthetic, cultural, historic, spiritual, biological, economic, future, intrinsic, learning, life sustaining, recreational, subsistence, wilderness and therapeutic as well as some of the selected values. On this understanding, the aim of the study was to evaluate the cultural services and derive the monetary value of social landscape through valuing socio-cultural services of Negombo lagoon.

2. Materials and Methods

Study Site and Landscape Social Values

The landscape social values of Negombo lagoon demonstrate the importance and attributes of lagoon for traditional fishermen. The perceived attributes of Negombo lagoon are the result of human interaction with the landscape. These values are shaped by the aesthetic, spiritual, subsistence, and recreational services provided by the landscapes. The Negombo estuary associated wetland ecosystem supports a wide range of socio-economic activities through traditional fishing, recreational activities and its cultural heritage. Estuarine fisheries as one of the most important economic activities provides an average annual value of LKR 150 million (Department of Fisheries and Aquatic Resources, 2012). Apart from this substantial economic value, fishing communities who promote traditional fishing culture whose identities and practices are another social value of estuary. Negombo has the second-largest fish market which is known as the “*Lellama*”, with daily fish auctions (Department of Fisheries and Aquatic Resources, 2012). Negombo lagoon and its coastal environment have a long association with the fishing industry. The lagoon area is geographically segregated into areas known as “*Thotupola*” where the

fisherman can easily launch their fishing boats in to lagoon.

Each “*Thotupola*” has a unique name for its ease of recognition. Further it has a historic value with Dutch fort built in 1672, along with centuries-old Portuguese and Dutch houses, Dutch canal, churches, ceiling frescoes of St. Mary's Cathedral, and *Angurukaramulla* temple.

Further estuary socially perceived as a major tourist destination and ideal place of luxury and tropical lifestyle with those who want quick access to international airport and Colombo city. Estuary includes *Muthurajawela* marshland, which has a substantial biological value with the protected mangroves that are home to over 190 species of wildlife (Kotagama and Bambaradeniya 2006). These are some of the acknowledged evidences that can be used to prove the socio-cultural value of Negombo lagoon.

Theoretical Framework

Lancastrian (1966) consumer theory suggests that the utilities for goods can be decomposed into separate utilities for their attributes which is a key characteristic of environmental valuation. Individuals maximize utility by selecting the best choice among different alternative options that are made up of a set of attributes and the choice

is a function of attributes presented in multiple choice sets. Thus, accompanied with both Lancastrian consumer theory and Random utility theory the utility derived by an individual i 's utility U from alternative j is expressed as; $U_{ij} = X_{ij} + \varepsilon_{ij}$ (Adamowicz and Boxall, 2001).

Here the utility derived by an individual i from an alternative j doesn't depend only on the given attributes x , but also the several unobservable factors, which are captured by a random component ε , which describes in random utility theory as well (Lancaster, 1966; Adamowicz and Boxall, 2001). This logic forms the basis for Discrete Choice Experiments (DCE) method used below with multiple choice sets. Individual i selects alternative j_i over alternatives j when expected utility U_i is greater than expected utility from all other options U . The probability Pr that individual i will choose alternative j_i over other alternatives j in a complete choice set R is given by: $Pr(j_i/R) = Pr(U_i > U)$.

In order to identify the most preferred alternative, this can be econometrically estimated by assuming that the error term is identically and independently distributed and indirect utility V is linear in attributes x . Conditional logit (CL) model (McFadden, 1974) can be expressed as: $V_{ij} = ASC + \beta_{ij}$. Where, V_{ij} refers to indirect utility obtained

by the i^{th} individual for the j_i alternative and β_{ij} is the coefficient of the attributes x . The Alternative Specific Constant (ASC) captures the effect of unobservable factors on the selection of alternatives relative to the status quo.

The DCE approach was used to estimate the individual's preference towards social landscape by incorporating featured attributes.

The individual preference was expressed through the Willingness to Pay (WTP) by integrating a monetary attribute into choice sets (Ndunda and Mungatana 2013; Doherty et al. 2014; Oleson et al. 2015; Houessionon et al. 2017).

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

$MWTP = \beta_{attribute} / \beta_{payment}$, where MWTP represent the marginal rate of substitution between the payment attribute and the attribute in question, and β refers to the parameter estimates of the attribute levels (Doherty et al. 2014; Houessionon et al. 2017; Ndunda and Mungatana 2013; Oleson et al. 2015).

Experimental Design

The first step of DCE was to identify the different attributes that links to the social

landscape. Focus group discussions (FGD) were conducted to identify the social landscape values which are crucial for households around Negombo lagoon. Focus group participants were first asked to prepare a list of ecosystem service and rank them according to their importance. Those places were used to map the socio-cultural services that will be further discussed in data analysis and results. FGD participants were also asked to identify changes in services that could make a difference in their social values. Then those social values were grouped into five attributes to describe the social landscape value to the possible best level.

Building on these, the final attributes that developed for choice experiment were as follows: Negombo lagoon as a; (i) source of income, (ii) biological habitat, (iii) cultural domicile, (iv) scenic view and as a (v) a recreational site. Monthly fishing income was chosen as the monetary attribute and three levels were designed based on the answers given by FGD participants.

There were five attributes with three levels in each (Table. 1), combining into 243 possible combinations as the full factorial design. Orthogonalization procedure (Bernheim and Rangel, 2008) was used to identify the main effects and the full design was reduced into a limited and optimal number.

Table 1: Attributes and levels of the choice experiment

Attribute	Level I	Level II	Level III
Monthly fishing income (Source of income)	Low (LKR 10,000)	Medium (LKR 22,500)	High (LKR 37,500)
Visibility of flagship fish varieties (Biological habitat)	Low	Medium	High
Ancestry-his descent in lagoon (Cultural domicile)	Not Important	Important	Very Important
Your preference to have your home closure to Negombo lagoon (Scenic view)	Outside	Inside but with disturbed or no view	Inside and with lagoon view
How often you move to lagoon for having fun (Recreational site)	Once a month	Once a week	Daily

At last, 18 lagoon profiles were randomly blocked into six different versions, each with three different lagoon alternatives. Pretested choice cards were incorporated to the questionnaire. Respondents were asked to select their best choice out of three alternatives in the choice card. First, it was estimated the MWTP or the implicit price of particular attribute and then the respective choice task. At the end choice tasks were used in deriving the total social landscape value of Negombo lagoon.

Lagoon is bordered by 09 Fisheries Inspectors (FI) divisions. Apart from the FI divisions, the lagoon area is geographically segregated into areas known as “*Thotupola*”

where the fisherman can easily launch their fishing boats in to lagoon. There were approximately 3000 reported traditional fishing households. Ten percent of the population was taken as the sample by appropriating the traditional fishermen as the best group of respondents to describe the social landscape value.

Data and Data Analysis

The data were collected from 300 traditional fishing households with over 15 years of experience representing 15 “*Thotupola*”, identified using snowball sampling. There was a fishing society for each *Thotupola* and the president of the society directed to the

immediate two fishermen and they did the same.

The questionnaire had three main sections; (a) to identify the demographic details; (b) to find the distribution of cultural ecosystem services; and (c) to get the socio-cultural value of the lagoon through the choice sets.

Cultural services that were listed by respondents in questionnaire were mapped using GIS techniques. The number of locations within each subcategory was divided from total number of locations that were counted for all the subcategories. This index was used to describe the distribution of those services. Further, the respondents were asked to select their best choice card and the results were analysed by using Conditional Logit (CL) regression. In this regression, the dependent variable was choice (out of three alternatives in each choice set) where the selected alternative is coded as 1 and other two alternatives are coded as 0. The implicit price for attribute is estimated as a negative ratio of coefficients between the attribute and the monetary attribute. Since each respondent was asked to respond all six choice sets, there were 1,800 (300x6) observations in the data set.

3. Results and Discussion

As the first objective of the study, we plotted

the distributions of cultural services as shown in Fig. 1

Socio-cultural places in and surround Negombo lagoon as recognized by adjacent community as follows; spiritual, recreation and ecotourism, social relation, aesthetic, inspiration, educational places and places with cultural heritage. Further the polluted areas as identified by the community has an apparent relationship with the other cultural services. According to the derived indices, maximum number of places were found under spiritual and religious services.

Table 2 shows the demographic characteristics of the sample. Only 91% of respondents were above 35 years old. 56% of respondents had more than 25 years of experience in fishing and 23% of respondents were ill literate.

Table 3 shows the results for the CL model that estimated coefficients can be interpreted in terms of sign and significance. The coefficients of attributes in model were significant. This suggests that these variables are relevant in explaining services that respondents achieve and the choices they make. Further, the table shows estimated implicit price of each attribute in monetary terms.



Figure 1: Distribution of the socio-cultural services of Negombo lagoon

Table 2: Demographic details of respondents

Parameter	Percentage (%)
Age (Years)	
<35	9
36-50	61
51<	30
Literacy	
Both Reading & Writing	57
Neither Reading & Writing	23
Only reading	20
Gender	
Male	100
Female	0
Experience (Years)	
25<	43
26-40	44
41>	12

This price revealed the importance of service to the fishing community in monetary terms. Visibility of flagship fish varieties had the highest MWTP (Rs.5960)

per month per household, as it has direct impact towards the traditional fishing and their income. Lagoon, not only as the main source of income, but also as a sense of view creates high MWTP (Rs.3080) per month per household. The “importance of his descent in lagoon” addresses the collective identities as well as social view as they are reflected in daily lives. The MWTP for “importance of his descent in lagoon” is Rs. 2510 per month per household, which is 42% with respect to the MWTP for “visibility of flagship fish varieties”. Thus, lagoon reflects a powerful socio-cultural relationship but not just a scene or a view of nature that often portraits of the social face of its adjacent community. This further proves, that they perceived lagoon not just as a source of income but also as a valuable

socio-cultural landscape. The total value for the social landscape was derived as Rs. 13,055/month/household.

Table 3: Results of choice model

Variables	Coef.	MWTP
ASC	0.305*	-
Monthly fishing income (Source of income)	-.0002*	-
Visibility of flagship fish varieties (Biological habitat)	1.192*	5960
Importance of his descent in lagoon (Ancestry) (Cultural domicile)	.502*	2510
Your preference to have your home closure to Negombo lagoon (scenic view)	.616*	3080
How often you move to lagoon for having fun (Recreational site)	.301*	1505

MWTP in Rs. per month, Log likelihood -516.07645, Pseudo R20.0732, Observations 1800

This study may have limitations as the study solely focused on socio-cultural values which were captured through how fishing community perceived those services. Thus, these values are that they placed on particular attribute but not the real value of it. Further the attributes that have been selected to represent the socio-cultural services may not fully express those services. For an example “visibility of flagship fish varieties” may not fully express the importance of lagoon as a biological habitat. Also, the perceived value of “visibility of flagship fish varieties” could

have impacted as it has an impact in income too.

4. Conclusions

This paper focused on the identification and assessment of socio-cultural services of Negombo lagoon in Sri Lanka. Within this context, a set of deliberative (in-depth discussion groups) and participatory (questionnaire) assessment research techniques were employed. The results showed that the fishing community hold diverse socio-cultural values of Negombo lagoon (e.g., aesthetic, recreation, spiritual and educational). The landscape social values of Negombo lagoon demonstrate the important ecological, cultural, and aesthetic knowledge, which should be integrated as guiding policy principles in the ecosystem conservation and management strategies. Further, the challenging management paradigm for coastal and marine landscape of Negombo lagoon, and associated services should comprise not only the biological and physical knowledge but also socio-cultural values. The results of the study show that the socio-cultural values can be used as “awareness-raising tools” regarding the importance of landscapes, ecosystems, and their services. Within this context, identifying and valuing socio-cultural services of Negombo lagoon can contribute to enhancing the relationship between

fishing community and the lagoon and also to controlling the degradation of the systems and associated resources too.

Conflicts of interest: The authors have no conflicts of interest regarding this publication.

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