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ORIGINAL RESEARCH

Visitor's Willingness to Pay for Cultural Ecosystem Services in Bangladesh: An Assessment for Lawachara National Park, a Biodiversity Hotspot

Narayan Saha[1] · **Sharif A. Mukul**[2,3,4]

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Abstract

The valuation of natural ecosystems helps policymakers to allocate adequate resources for the provision of ecosystem services they provide. Cultural ecosystem services are the non-material benefits we obtain from nature, which include but are not limited to recreation, aesthetic enjoyment, physical and mental health benefits. They are essential for a proper sense of a place, human health, and wellbeing. We quantified the recreational and other non-material benefits of Lawachara National Park (LNP), one of the oldest and most diverse forest protected areas and tourist attractions in northeast Bangladesh. A Modified Travel Cost Method (MTCM) was applied for quantifying the recreational and other non-material values of LNP. Altogether 309 respondents were interviewed, covering both peak season and slack season. In our MTCM, we considered several additional factors, unlike the commonly used Travel Cost Method (TCM). The value of cultural ecosystem services of LNP was estimated to be Taka 476.70 million and Taka 476.44 million per annum using MTCM and TCM, respectively. The value estimated using MTCM was marginally higher than the value estimated using TCM and was due to the additional variables we considered in our modified approach. We believe our estimates using MTCM will guide policymakers to properly value natural ecosystems and facilitate adequate resource allocation for ecotourism in LNP and elsewhere.

Keywords Cultural ecosystem service · Ecotourism · Lawachara National Park · Travel cost method · Willingness to pay

✉ Sharif A. Mukul
smukul@usc.edu.au; sharif_a_mukul@yahoo.com

[1] Department of Forestry and Environmental Science, School of Agriculture and Mineral Sciences, Shahjalal University of Science and Technology, Sylhet 3114, Bangladesh

[2] Tropical Forests and People Research Centre, University of the Sunshine Coast, Maroochydore DC, QLD 4556, Australia

[3] Department of Earth and Environment, Florida International University, Miami, FL 33199, USA

[4] Centre for Research on Land-use Sustainability, Dhaka 1229, Bangladesh

Introduction

Forests are vital for providing us with a wide range of regulating, provisioning, and cultural ecosystem services (Ota et al. 2021; Saha 2021; Landell-Mills and Porras 2002). Regulating and provisioning ecosystem services mainly represents material benefits from the forest, such as biodiversity conservation, carbon sequestration, climate regulation, water retention, nutrient cycling (Sinha and Baten 2021; Mukul et al. 2017a). Cultural ecosystem services, on the other hand, represent non-material benefits, like recreation, aesthetic enjoyment, physical and mental health benefits that we derive from forests (Nadiruzzaman and Rahman 2021), and are still underrepresented in literature due to the complexity of their nature (Ezebilo 2016).

In forest areas, cultural ecosystem service also generates revenue through recreational benefits, which usually is an experience of enjoyment resulting from a complex interaction between travellers, their trip objective, local environment and cultural experience, the forest biodiversity, and other things (Sands 2005; Pant 1984; Carey 1965). Recreational opportunity in forest areas also generates employment and income needed for the local development (Pant 1984). Over the past decades, the ecotourism industry has been expanding worldwide due to its relatively lesser ecological footprint (Lenzen et al. 2018), and potentials to contributes to the maintenance of species and habitats either directly through conservation or indirectly by providing the local community with sufficient revenue (Drumm and Moore 2005; Goodwin et al. 1999). Ecotourism also encourages local people to value and protect wildlife heritage as a source of income (Mree et al. 2020; Mukul et al. 2012; Weaver 2008).

In Bangladesh, nature-based tourism, largely domestic, increasingly become popular in the last few years with the advancement of the country's economic development, improved road networks, and other factors such as access to social media like Facebook, etc. (Islam and Majumder 2015; Salam et al. 2000). A large and growing urban population and expansion of protected areas in the country, in recent years, also fuelled increasing visits to forest areas for recreation, aesthetic enjoyment, other mental health benefits (Mukul et al. 2017b). Uddin et al. (2013), for example, in the Sundarbans mangrove forest in southwestern coastal Bangladesh, found that, during 2001–2002 to 2009–2010, the number of tourists became doubled, and revenue increased by four fold. However, some of these forest protected areas provide free entrance or a nominal entrance fee and thus fail to register the real value in national accounts (Elands et al. 2015; Rana et al. 2010). Consequently, the revenue earned from cultural ecosystem services cannot be utilised for the management of natural ecosystems in the country (Mukul et al. 2018; Kawsar et al. 2015).

The travel cost method (TCM) has widely been used for the estimation of recreational sites globally (see—Solikin et al. 2019; Ortega et al. 2018; Muryani and Prabugati 2016; Islam and Majumder 2015; Spacek and Antouskova 2013; Bharali and Mazumder 2012; Bateman et al. 1996). TCM estimates the value of non-market goods and services, such as recreational sites, and assumes that this

value reflects by how many people are willing to pay to get there (Limaei et al. 2014). The basic premise of the TCM is the costs of time and travel expenses incurred by the individual travellers while visiting a recreational site (Leh et al. 2018). Therefore, the willingness to pay of visitors to visit a recreation site can be determined based on the number of trips at different travel costs. This method is called a revealed preference method because environmental values are estimated based on the actual behaviour and choices of the peoples rather than verbal responses to hypothetical scenarios (Limaei et al. 2014). TCM is relatively uncontroversial because it is a modification of standard economic techniques for measuring value.

Although TCM is considered as a robust method for the valuation of recreational sites (Solikin et al. 2019; Limaei et al. 2017; Spacek and Antouskova 2013), the method has several limitations. For instance, multi-purpose and multi-destination trips are not considered in the TCM, leading to an overestimation of the recreational value of a particular site (Leh et al. 2018; CBA 2014). Likewise, other costs involved in entry to recreational sites, charges associated with dormitories, guest housing, picnic spots, parking, guides, toilets, film shooting, etc. are not considered resulting in underestimating a site's valuation (Loomis et al. 2000). These technical aspects need to be considered while estimating recreational site values (World Bank 1995, 2004).

Here, we applied a Modified Travel Cost Method (MTCM) for quantifying the recreational and other non-material benefits of Lawachara National Park (LNP)—one of the oldest forest protected areas in Bangladesh with a rich biological and cultural heritage. We hypothesized that, MTCM can provide a more robust and reliable value of a recreational site of national importance than TCM. We considered several additional factors in our MTCM, unlike the commonly used TCM, which we believe minimize the uncertainty resulting from possible overestimation or underestimation of a particular site. The novelty of this study is to consider the variables, such as the costs of multi-purpose and multi-destination visits, while estimating the value of a recreational site. There have been very few studies in Bangladesh on cultural ecosystem services and/or recreation and other non-material benefits from forests (see—Kawsar et al. 2015; Uddin et al. 2013). Our study, therefore, will also guide policymakers and forest managers in resource allocation problems in LNP and other sites of biological and cultural significance in Bangladesh and elsewhere.

Materials and Method

The Study Area

LNP has an area of about 1250 ha, and geographically it is located between 24° 30'–24° 32' N latitude and 91° 37'–91° 39' E longitude (Mukul and Saha 2017). The park is located approximately 185 km northeast of Dhaka, the capital city of Bangladesh (Islam et al. 2019; Fig. 1). LNP was declared as a national park on July 07, 1996, by the gazette notification number 367 (Mukul et al. 2017a, b). The

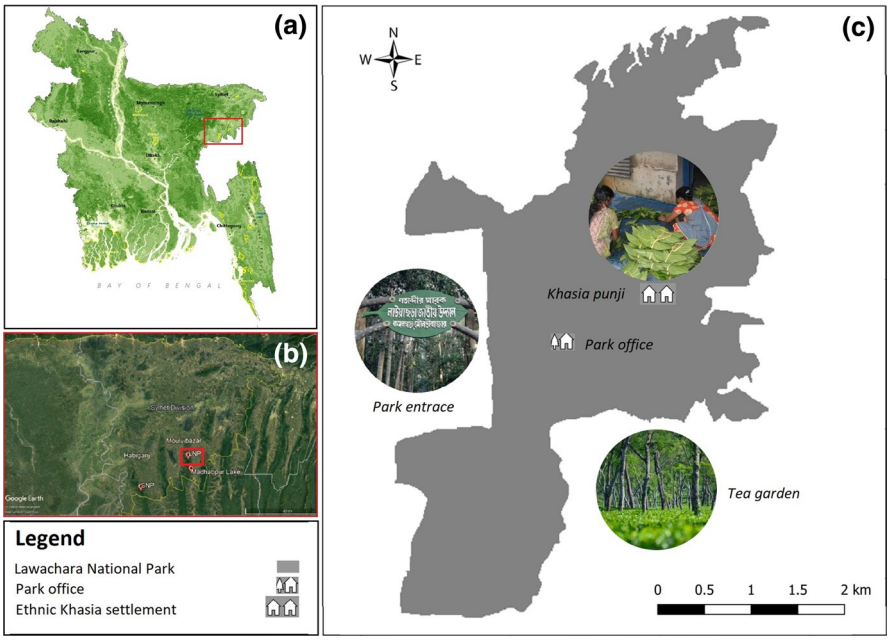

Fig. 1 Location map of Lawachara National Park in Bangladesh (**a**), within Sylhet region (**b**), and park boundary (**c**)

park is an IUCN category II protected area and is located under civil administrative unit of Kamalganj Upazilla, Moulvibazar district of Sylhet division (Mukul 2007, 2008).

The forest in LNP is semi-evergreen in nature, and it is located in the wettest region of the country (Mukul 2014). The park area is a habitat of at least 167 species of plants, 4 species of amphibians, 6 species of reptiles, 246 species of birds, 20 species of mammals, and 17 insect species (Pavel et al. 2016; Quazi and Ticktin 2016; Uddin and Hassan 2010). This park also represents one of the largest habitats of the critically endangered western Hoolock gibbon (*Hoolock hoolock*) in the country (Hasan et al. 2020). The Khasia indigenous community lives within the forest and cultivates betel leaves using forest trees as support for betel vines (Mukul and Saha 2017; Saha and Azam 2004).

LNP is famous for ecotourism, both domestic and international tourists come throughout the year, but the majority comes during the winter. LNP is extensively used by the visitors for seeing trees and landscapes, wildlife-watching and enjoying the clean air (Rahman and Shil 2012). LNP is surrounded by several tea gardens, which have also become attraction for tourists (Sohel et al. 2015). Two important tourist attractions, namely Madhabpur Lake and Satchari National Park (SNP), are situated near LNP. Furthermore, a local zoo and wildlife rescue center managed by Mr. Sitesh Ranjan Deb, and a large waterbody called Baikka Beel, which is famous for migratory birds and water lilies, are also located near LNP (Fig. 2).

Fig. 2 Some major tourist attractions of Lawachara National Park (clockwise): **a** main entrance of LNP, **b** elderly indigenous Khasia woman sorting betel leaf, **c** a board demonstrating the shooting place of Hollywood movie 'Around the World in Eighty Days', **d** rail tracks within LNP, **e** a perennial fresh water stream within the park, **f** Phayre's leaf monkey, one of the keystone primate species of the park, **g** tea garden surrounding the park, **h** betel vine growing using forest tree as support within the park. (Photo credits: Sharif A. Mukul)

Field Surveys and Data Collection

There are 2 recreational seasons in LNP, i.e. peak season (October to March) and slack season (April to September). Data for this study were collected through interview surveys supplemented by a semi-structure questionnaire during January 2019 and April 2019. A reconnaissance survey was carried out prior to the intensive interview surveys. During the reconnaissance survey, we trained up several research assistants and/or field investigators for conducting the field survey. Our reconnaissance survey was supplemented by a semi-structured questionnaire. A final semi-structure questionnaire was developed based on our reconnaissance surveys.

We conducted surveys on a total of 18 days, 9 days in peak and 9 days in slack season. Our survey period includes 4 weekend and 5 weekdays. Individuals and

groups who visited the park were selected randomly as our respondents. In the case of group visitors, only the group head was selected as a respondent to avoid any repetition of the transportation costs. Altogether we interviewed 309 visitors, which corresponds to all major visitor's types in LNP.

Visitors were surveyed at the time of their exit from the park. We collected demographic and socio-economic characteristics of the visitors, such as age, average monthly income, education levels and site visit type (i.e., group or individual). In LNP, three categories of visitors (student, adult, and foreigner) required to purchase ticket for entering the park. During our survey periods, every afternoon after closing the entrance of the visitors to the park, we also asked the ticket sellers of the park about the category wise total number of visitors (based on the sale of ticket) by category for that day. Based on this information, our sample size represents a sampling intensity of 3.10%.

Other travel characteristics, such as the origin of the travel (the starting point of the journey), purposes of visit, main destination, other costs (activity expenses as fees for entrance, dormitory, guest house, picnic spot, parking, guide, toilet, film shooting and so on) was also noted for each respondent.

The origin of travel was categorised into five zones based on their distances from LNP. Each zone has a radius of 100 km. Other travel related parameters such as transportation cost (round transport costs of the visitor in Tk[1]), travel time (round travel time plus time spent in the park) in hours and travel distance (round travel distance in km) were also gathered. Means of travel was categorized as reserved vehicles (micro bus, bus, car, three wheelers) and public vehicles (bus, train, and three wheelers).

Individuals travelling to a recreation site due to other reasons, such as research, study tours or official visit were included, because they spent money to access in the park. In the case of meandering tourists, like multi-purpose and multi-destination tourists, they were asked about their main destinations. If their main destination was LNP, then the extra amount of money spent for transportation was asked, for example, if a tourist rents a micro-bus, he/she had to pay additional money to visit other places, which was subtracted from the total transportation fare. Likewise, if the main destination was other sites, such as Madhabpur Lake or SNP (Fig. 1), only the additional amount for visiting LNP was counted as transportation cost.

Opportunity cost of time would be in the case of meanderer travellers, time costs needed to reach LNP from the origin of starting the journey and the time spent in the park. If the following cases, the origin of starting the journey would be for example, a tourist visiting Moulvibazar from Dhaka for business purpose and for last 3 days visiting LNP. So in that case, origin of starting the journey would be Moulvibazar. Another example, if a tourist visiting some recreation sites from Dhaka, origin of starting the journey would be Dhaka, if the tourist visited other places before entering LNP, the extra time would be deducted from total time or if tourist would visit other places after LNP, then the time would be counted as usual.

[1] Taka or Tk; Bangladeshi currency: ~ 84 Tk equal to 1 US$ (at time of study).

Valuation of Recreational and Other Non-Material Benefits

Among the three types of TCM that are used in estimating values of recreational sites (i.e. Zonal Travel Cost Method or zTCM; Individual Travel Cost Method or iTCM, and Random Utility Travel Cost Method or ruTCM), we used zTCM which is straightforward, and less expensive (von Grünigen 2016). The following equation was used to determine the travel cost or the recreational and other non-material value of LNP (V) (CBA 2014):

$$V = \{(T \times w) + (D \times v) + Ca\} \times Va$$

where T = travel time in hour; w = average wage rate in Taka/hour; D = distance in km; v = marginal vehicle operating cost in Taka/km; Ca = cost of admission to site (entry fee); Va = estimated number of visits per year for each zone.

In the above model or existing TCM, transportation cost, the opportunity cost of travelling to that site and entry fee used for valuation of recreation sites. The MTCM strengthens the valuation of recreational sites through the existing TCM by addressing multi-purpose and multi-destination trips, on-site expenditures including entry fees as additional variables. MTCM, therefore, overcomes some of the limitations of the existing TCM.

Multi-purpose trips refer to individuals travelling to a recreation site due to reasons other than recreation (Menkhaus and Lober 1996). In most of the cases, individuals travel to the recreational site due to recreation, but they stay in other places for purpose like business. Multi-destination trip refers to individuals travelling more than one specific recreational site (Leh et al. 2018). The value of a recreational site (V) for each zone can be estimated by using the following equation of MTCM:

$$V = \left[(T \times w) + \{(D \times v) - M\} + \sum OC\right] \times Va$$

where T = travel time in hours; w = average wage rate in Taka/hour; D = distance in km; v = vehicle operating cost in Taka/km; M = multi-purpose/multi-destination visit cost; $\sum$OC = summation of on-site expenditures (entry fees, dormitory/guest house, picnic spot, parking, guide, toilet, film shooting and so on); Va = estimated number of visits per year for each zone. Summation of V values of all zones will give travel cost or the proxy price to access in a recreational site or value of a recreational site.

The demand function is usually estimated based on the relation between travel cost per zone and visitation rate (number of visitors from a zone to a recreation site divided by the total population of that zone). Willingness to pay (WTP) of a visitor to visit a recreational site can be estimated as follows:

$$WTP = V/N$$

where V = value of the recreational site and N = total number of visits per annum.

The steps involved in our MTCM are illustrated in Fig. 3.

We used exponential regression using a linear model to determine the correlation between travel cost per zone and visit rates per zone. A factor of 1.79 was

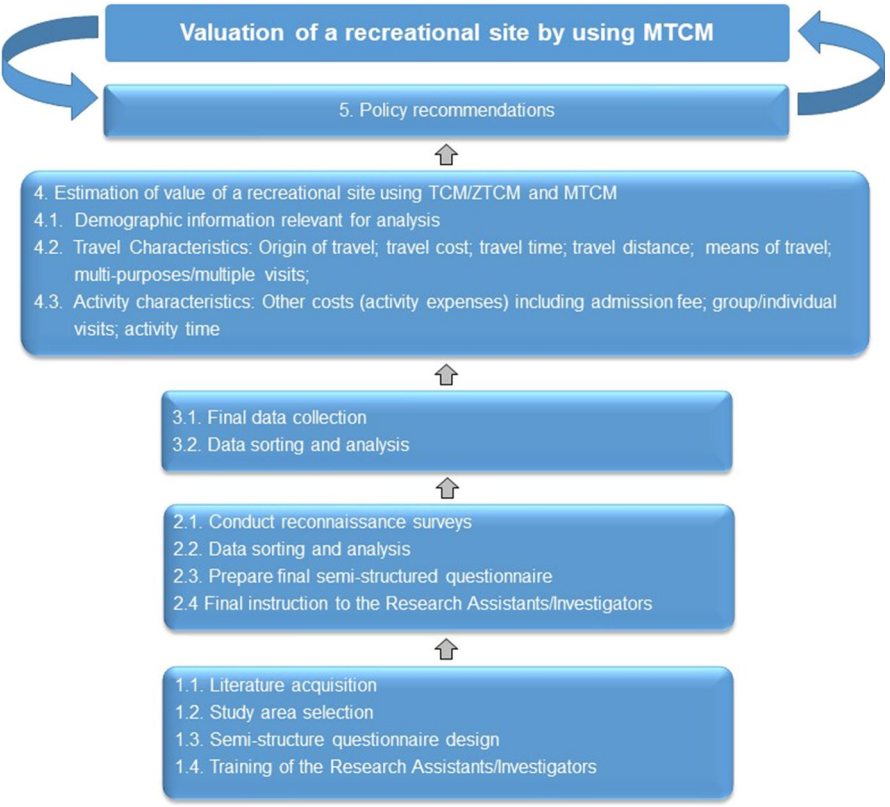

Fig. 3 Steps involved in the MTCM

used to estimate the actual number of visitors per day. This factor was estimated by using the following formula as described in Kawsar et al. (2015):

$$\{(\mathrm{Tv}/\mathrm{Nd})/\mathrm{Ov}\}$$

where Tv = actual number of visitors in survey period, Nd = number of days surveyed, and Ov = observed number of visitors in survey period.

Results

Characteristics of the Respondents

Table 1 shows the socio-economic and demographic attributes of the respondents. The most of tourists who visited LNP belonged to the 21–40 year age category, literate, and both high income and no income groups. Most of the students and housewives belonged to the no income group. About 98% of the tourists came to the LNP as group. More than a half of the visitors (63%) visited LNP in peak season. There

Table 1 Socio-economic and demographic attributes of the respondents ($N = 309$)

Characteristics	Category	Relative frequency (%)
Age groups (years)	< 21	11.33
	21–40	63.75
	41–60	24.60
	> 60	0.32
Education	Primary	0
	Secondary	12.94
	Higher secondary and above	87.06
Income groups (Taka/month)	No income	29.77
	Up to 10,000	9.39
	10,001–20,000	3.56
	20,001–30,000	8.09
	30,001–40,000	13.92
	> 40,000	35.28
Purposes of visit	Recreation	98.38
	Study tour	0.97
	Research	0.32
	Official	0.32
Seasonal tourists	Peak	63.43
	Slack	36.57
Category of tourists	Group	98.06
	Individual	1.94
Types of tourist	Pure	47.57
	Meanderer	52.43
Vehicles	Reserved (including privately owned)	46.93
	Public	53.07

was no large difference in part of a vehicle use by the visitors as 47% used reserved vehicles and 53% used public vehicles. The most used reserved vehicle was a micro bus (43%), followed by a bus (41%), car (14%), and the least used reserved vehicle was crude natural gas (CNG) operated three wheelers (2%). The main destination of 48% of the visitors was LNP, and recreation was the sole purpose of majority (98%) of the visitors.

Relationship Between Travel Cost and Visiting LNP

The highest number (59.2%) of tourist visits per day in the LNP was from Dhaka, which is about 185 km away from the LNP (Table 2). Dhaka belongs to B zone (101–200 km) and require an average Taka 3,070.36 using MTCM and Taka 3,125.96 using TCM as travel costs to access LNP (Table 2). The next most frequent

Table 2 Relationship between travel cost and visiting LNP

Zone and districts	Distance from LNP (km)	Population	Observed number of visitors in 18 days	Actual number of visitors in a single day	Visits per 100,000 population/day	Travel cost using MTCM (Taka/trip)	Travel cost using TCM (Taka/trip)
A (0–100 km)	48.00	8,491,000	124	222	2.64	1,270.80	1,252.13
Moulvibazar	30	2,148,000	39	70	3.33	842.71	829.01
Habiganj	53	2,386,000	25	45	1.96	1,269.20	1,259.36
Sylhet	61	3,957,000	60	107	2.74	1,621.54	1,589.06
B (101–200 km)	157.29	34,327,000	155	277	0.81	2,889.93	2,897.45
Brahmanbaria	104	3,255,000	13	23	0.72	1,952.53	1,816.73
Narsingdi	146	2,489,000	14	25	1.04	2,762.65	2,785.58
Sunamganj	146	2,800,000	4	7	0.25	2,950.53	2,906.84
Kishoregan	161	3,311,000	6	11	0.33	3,021.84	3,123.44
Cumilla	167	6,046,000	9	16	0.27	2,773.57	2,777.21
Dhaka	185	13,142,000	102	183	1.40	3,070.36	3,125.96
Narayanganj	192	3,284,000	7	13	0.41	3,362.40	3,410.81
C (201–300 km)	265.50	17,030,000	21	38	0.22	3,615.32	3,653.69
Gazipur	201	3,809,000	11	20	0.53	3,955.33	3,811.49
Mymensingh	228	5,807,000	5	9	0.16	3,196.53	3,320.12
Noakhali	241	3,491,000	2	4	0.12	3,649.56	3,879.14
Tangail	246	3,923,000	3	5	0.13	4,030.67	3,974.84
D (301–400 km)	350.00	12,746,000	7	13	0.10	4,893.43	4,944.26
Chattogram	317	8,440,000	3	5	0.06	4,512.71	4,520.21
Jessore	350	3,029,000	2	4	0.13	5,497	5,612
Gopalganj	383	1,277,000	2	4	0.33	5,340.32	5,370.32
E (401–500 km)	405.00	5,697,000	2	4	0.07	5,597.47	5,410.70
Naogaon	405	2,844,000	1	2	0.07	6,509.20	5,904.20

Table 2 (continued)

Zone and districts	Distance from LNP (km)	Population	Observed number of visitors in 18 days	Actual number of visitors in a single day	Visits per 100,000 population/day	Travel cost using MTCM (Taka/trip)	Travel cost using TCM (Taka/trip)
Rajshahi	405	2,853,000	1	2	0.07	4,685.74	4,917.20
Annual travel cost/value of LNP (in Million taka)						476.70	476.44

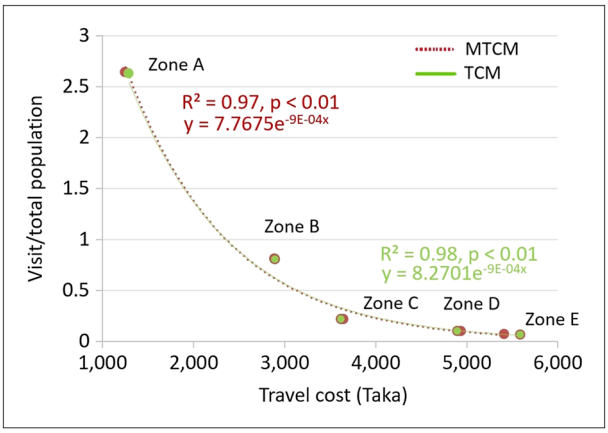

Fig. 4 Relationship of travel cost and visiting LNP in the MTCM and TCM

origin was Sylhet (107 tourists/day) which belongs to the A zone (0–100 km). Sylhet is about 91 km away from the LNP and costs an average Taka 1,621.54 using MTCM and Taka 1,589.06 using TCM to access LNP (Table 2).

The highest rate of visits per total population was 2.64 accounted for A zone, where the travel costs were lowest, Taka 1,270.80 using MTCM and Taka 1,252.13 using TCM (Table 2). The visits per total population were 0.81, 0.22, 0.10 and 0.07 accounted for B, C, D and E zones respectively (Table 2). The travel costs of B, C, D and E zones were respectively Taka 2,889.93, Taka 3,615.32, Taka 4,893.43 and Taka 5,597.47 using the MTCM, and respectively Taka 2,897.45, Taka 3,653.69, Taka 4,944.26 and Taka 5,410.70 using the TCM (Table 2; Supplementary material 1).

Our regression analysis revealed the demand functions of MTCM and TCM (Fig. 4). In both cases, the number of visits per total population decreased with increasing travel costs. The inverse relationship was strong in both the case of MTCM ($R^2 = 0.97$, $p < 0.01$) and TCM ($R^2 = 0.98$, $p < 0.01$).

Value of LNP and WTP

The value of the LNP was estimated to be Taka 476.70 million per annum using MTCM, while it was estimated to be Taka 476.44 million per annum using TCM. The estimated WTP of each visitor to visit the LNP was Taka 2,357.43 using MTCM and Taka 2,356.18 using TCM. About 40% of the visitors to the LNP originated their travel from A zone. They were provided benefits of Taka 1,086.63/trip using MTCM and Taka 1,104.05/trip using TCM, by visiting the LNP. Our estimation also suggests that about 60% of visitors to the LNP paid excess amount of money, i.e. their WTP was lower than the amount they paid for visiting LNP.

The entry fees to the LNP for student, adults and foreigners were Taka 20, Taka 50 and Taka 500, respectively. During the survey, it was also found thar more than 60% of the total visitors responded were willing to pay Taka 50 for student and Taka

100 adult entrance fee to the park to support park's improvements and biodiversity conservation. This would generate an additional Taka 8.38 million per annum, given that the total visitation rate will remain same.

Discussion

Both MTCM and TCM are quantitative assessment methods and show the actual behavior of the tourists are based on revealed preferences (Das 2013). The revealed preference approach assumes that observed behavior follows from an intrinsic utility maximization process (Limaei et al. 2017). TCM is widely used for valuing recreational services around the world and is believed to better than the Contingent Valuation and Hedonic Price, which use willingness to pay in hypothetical situations rather than the actual behavior of the visitors (Ward 2000; Pant 1984). In TCM, however, there is no consensus about calculating the values for multi-purpose and multi-destination visits (Loomis 2000). The MTCM, that we developed and used in the present study, eliminates the chances of underestimating and overestimating the value, thus offering a more accurate value of natural recreational sites.

In our study, the value estimated using the MTCM is marginally higher than the TCM. The essence of the application of the MTCM is that it controls the chances of overestimation and underestimation of the value of a particular recreation site. When the values of multi-purpose and multi-destination visits were lower than the values of other costs excluding entry fees, the travel costs to access the LNP were higher in the MTCM than the TCM and vice-versa. The entry fee is the common variable for the TCM and the MTCM, resulting in no difference in the values estimated by either approach. Our study also reveals that it is essential to consider the values of multi-purpose and multi-destination visits and other costs or on-site expenditures while estimating recreational sites' values by using the MTCM for more accurate results.

In our study, there was an inverse relationship between the number of visitors and the travel cost/distance. That is, as travel costs/distance increase, the number of visits (and visitors) decreases, and vice-versa. However, visitors from B zone were maximum, although the travel cost of this zone was not cheaper than the A zone. There might have several reasons behind this. B zone included Dhaka, the capital city of Bangladesh, characterized by relatively high population density, with a population of a high-income group and a high literacy rate. A higher number of visitors from Dhaka arguably can also be due to good transportation systems between Dhaka and the LNP (Elands et al. 2015; Kawsar et al. 2015).

There were no visitors from most of the districts of Bangladesh due to long distances and associated higher travel costs. Our study also finds a higher visitation rate per population with the lowest travel cost. The origin of the journey does not necessarily mean the home district of the traveller rather their present address or job station. If the study considers the home district of the travellers, then it is possible to catch the travellers from all the districts of Bangladesh. There is also a minimal chance of visiting the LNP from the districts where there are already forest protected areas and other environmental recreational sites (Kawsar et al. 2015).

The value of forest protected areas like LNP is incredibly significant for the national development of Bangladesh. Local inhabitants of such protected areas need

socio-economic protection, and ecotourism development can help ensure the protection and conservation of biodiversity (Mree et al. 2020; Rana et al. 2010). With increasing populations, urbanization, and economic development, the demand for recreation in protected areas is projected to steadily increase (Lenzen et al. 2018). The WTP indicates that the LNP management authority has ample scope to increase the entry fee for generating extra money for the development of the park and biodiversity conservation.

Conclusion

Although the TCM is an old method for estimating the values of cultural ecosystem services, and more particularly, recreational sites, the MTCM approach used in our study is the first application in Bangladesh and provide more accurate and robust results by eliminating the chances of overestimation or underestimation. The value of cultural ecosystem services of LNP estimated in our study were Taka 476.70 million and Taka 476.44 million per annum, respectively, using MTCM and TCM, respectively. Our modified approach considers the variables, such as the costs of multi-purpose and multi-destination visits, while estimating the value of the main cultural ecosystem services of the LNP, which presumably contributed to the slightly higher value calculated using MTCM versus TCM. Our study will help policymakers and forest managers in proper resource allocation to manage and protect biologically and culturally significant areas of national importance both in Bangladesh and elsewhere with similar socio-ecological context.

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Authors Contribution Conceptualization: Narayan Saha (NS) and Sharif A. Mukul (SAM); Methodology: NS and SAM; Investigation: NS and SAM; Data curation and Formal analysis: NS; Writing—Original Draft: NS and SAM; Project administration: NS.

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Availability of Data and Material Supplementary data related to this manuscript/study has been provided as Supplementary material 1.

Declarations

Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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