International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

What Drives Recreational Visits to Peri-urban Wetlands? Evidence from Deepor Beel, India

Supriya Hazarika[1], Partha Pratim Saikia[2]

[1]Post-Doctoral Fellow, The National Law University of Meghalaya, Shillong, India
[2]Research Scholar, Indian Institute of Technology Kharagpur, West Bengal, India

Abstract

The present research aims to identify the determinants of the demand for recreational use of a peri-urban freshwater wetland, Deepor Beel, located in the Northeastern region of India. Using the individual travel cost method, primary data were collected from 287 on-site visitors through systematic random sampling, and Poisson count data model were estimated for the annual number of visits under the status quo and under a hypothetical scenario of improved site quality with an entry fee. Travel cost has a negative and significant effect on visitation in both scenarios, confirming a downward sloping demand curve, while monthly income has a positive and significant effect. Under the status quo, visitors who perceive the site quality as good make significantly more visits, whereas under the improved scenario married visitors are found to make significantly lower visits than the unmarried visitors. Demand is inelastic, with travel cost elasticities of -0.23 and -0.21 under the status quo and improved scenario respectively. The findings suggest that a modest entry fee between INR 20 to 30, combined with improvements in environmental quality and amenities, can finance wetland maintenance without discouraging recreational use.

Keywords: Wetland ecosystem services, Recreational demand, Nature based tourism, Revealed preference, Non-market valuation

1. Introduction

Wetlands, with their dynamic characteristics of being seasonally aquatic or terrestrial, deliver a wide range of ecosystem services of significant social, economic, and environmental value that benefits people, society, and economy at large. The Ramsar Convention defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters" [1]. These ecosystems provide provisioning services such as food, fresh water and fiber; regulating services such as flood control, water purification and climate regulation; supporting services such as nutrient cycling and habitat for biodiversity; and cultural services such as recreation, tourism, aesthetic enjoyment and education.

The opportunities of nature-based tourism and recreations derived from the provisional and cultural ecosystem services of wetlands can be of much value to the government, tourism industry, and to the native wetland-dependent community for promoting economic and overall social development. Over the last few decades, there is a growing concern about the environmental issues and increasing demand for recreational activities and tourism in natural sites among the rural as well as the urban people. Sustainable tourism and recreation can contribute to the achievements of public policy targets related to wetland

conservation and wise-use, thereby maintaining the fundamental socio-economic wetland values and functions [2]. From socio-economic perspective, wetland ecosystems and the services are an integral part of the livelihood strategy of the wetland-dependent communities [3].

Many of these services, however, are not traded in markets, and their value is rarely reflected in land-use decisions[4]. For the same reason, wetlands are often treated as wastelands suitable for drainage, landfilling or urban expansion. Studies on the recreational services of wetlands address this gap. Using non-market valuation methods such as the travel cost method, they express the benefits that visitors derive from a wetland in monetary terms, and these benefits can then be weighed against the economic gains from converting the wetland [5]. Such studies also identify the factors that determine recreational demand, such as travel cost, income, and visitors' perceptions of environmental quality. This helps managers understand who uses the site and how visitation would respond to changes in site quality or access. The estimated consumer surplus and willingness to pay provide an empirical basis for designing entry fees and other user-based financing mechanisms [6]. The revenue from these can be reinvested in habitat protection, pollution control and visitor amenities, which reduces dependence on scarce public funds. Moreover, when the link between environmental quality and visitation is demonstrated, it strengthens the case for regulating encroachment, waste disposal and unplanned development [7]. For urban and peri-urban wetlands, which face intense development pressure, such evidence could be essential for integrating conservation into urban planning and ensuring the wise use of wetlands envisaged under the Ramsar Convention.

Revealed preference and stated preference are the standard approaches found in economics literature to study recreational use demand of nature-based tourism destinations [8], [9]. From these approaches, most widely used valuation methods are the travel cost method (TCM) and the contingent valuation method (CVM) [5], [10]. Contemporary applications of these methods include valuing the recreational benefits from visits to botanical collections, national parks, wetlands, and beaches [11], [12], [13]. Studies have also applied the TCM and the CVM to evaluate the impacts of change in environmental quality of natural areas on the recreational demand [8], [14]. The present study estimates the value of the recreational ecosystem services of Deepor Beel, a peri-urban wetland in the northeastern region of India, by examining the demand pattern for recreation in and around the wetland and its tourism potential for profitable investment in infrastructure development. The TCM method is used for the estimation process and identifying the determinants. The results of this study are expected to help the policy makers in understanding the variations among the visitors and faming suitable policies for the wise use and management of the wetland.

In South Asia, recreation and tourism are increasingly recognized as important wetland ecosystem services. Solayman et al. [15] included them in their economic valuation of Tanguar Haor, a Ramsar wetland in Bangladesh, while Guruge et al. [16], applying the travel cost method to the Beddagana urban wetland in Sri Lanka, found that travel cost reduces visitation whereas perceived environmental quality and accessibility increase recreational demand. From valuation studies of non-market goods and services, it is seen that the survey respondents have ascribed relatively more importance to water quality benefits of wetlands ecosystem services [17] . In marine as well as freshwater ecosystems, the total recreational value per year exceeds the cost of conservation and protection initiatives for the ecosystem and it is economically feasible [10], [18]. An evaluation of the recreational services of the forest ecosystem finds that the proximity and size of the forest environment has a positive effect on the household WTP for conservation [19], [20]. Moreover, the urban visitors consider recreational services as a valuable resource

and favor for legislative protection, whereas the rural communities, who are dependent on the natural resources place a lower priority to the protection of environmental resources and biodiversity [21].

The literature on recreational ecosystem services from wetlands shows that most of the studies have used TCM and CVM approaches to show the need and importance of wetland tourism for resource conservation. For the Ghoda Ghori Lake Complex in Nepal, Lamsal et al. [7] use Individual Travel Cost Method (ITCM) to find the recreational potential of the lake, which may be increased manifold in future through good management. Mishra [14] combines TCM and CVM considering on-site as well as off-site respondents to estimate citizens' WTP for improvements in environmental quality of a lake. The study found that off-site respondents respond differently relative to on-site respondents in case of change in environmental quality and entry fee. Studies on the recreational benefits of small islands in Indonesia and Thailand found that the marine tourism sector can generate large economic returns and the tourists have a positive willingness to pay for the conservation of those areas [18], [22] . Ghosh and Mondal [23] found that people of the locality were willing to contribute money for the resource management of Chanda Beel freshwater Lake, Bangladesh. The study has shown a way to use public hidden funds in the form of consumer surplus in wetland development or resources management decisions.

Most of the studies carried out in Indian wetlands have been directed at assessment of the degradation of wetland ecosystem, shrinkage, and human-wetland dependence [24], [25] A study on East Kolkata Wetlands reveals that the wetland shrinkage is primarily determined by the increasing force of urban growth, which can be reduced only through the efficient functioning of the local authorities and comprehensive land-use planning [25]. Over-exploitation of natural resources and siltation are recognized as the significant drivers of change of ecosystem services and its impact on people's livelihoods [26]. Studies related to environment, ecology, and land-use pattern of Deepor Beel have found that the wetland is subject to massive environmental degradation as well as decline in area over the last two decades [27], [28], [29]. From 1991 to 2010, it is reported that the wetland witnessed a decline of 59.19 per cent in the area [28]. The municipality sewage dumpsite on the eastern bank is identified as the point source of pollution in the water body contaminating the water with a high amount of lead and cadmium [27]. A railroad is running through Deepor Beel, thus fragmenting the wetland-forest ecosystem have established itself as a significant factor behind man-elephant conflict reported in the area [30]. Studies also indicate severe eutrophication in the water body over the past two decades, mainly generated by growing croplands, waste disposal, and illegal human settlements in the catchment area [27].

In India, including the northeast, the rich ecosystems and biodiversity of the wetland areas are threatened due to such mismanagement of wetland resources. Furthermore, the wetlands are subject to various conflicts of use among their stakeholders like fishermen, food stall owners, tourists, service providers and different departments of the state. Hence, from the perspective of environment and resource economics, it is imperative to study the demand for the recreational services of the wetland, and to examine whether the environmental impact of these problems affect its recreational use. With this intention, the study examines the demand for the recreational ecosystem services of the wetland and how it responds to changes in its environmental quality and recreational infrastructure. By identifying the factors that drive recreational demand for Deepor Beel and how visitors would respond to an entry fee and site improvement, this study gives wetland managers and policymakers evidence for designing visitor-financed conservation strategies that sustain both recreational use and the ecological integrity of the wetland.

2. Data and methodology

2.1 Study area and sampling

Deepor Beel is a marshy freshwater peri-urban wetland situated on the south-western border of the city of Guwahati with the coordinates 26°08' N and 91°39' E (Figure 1). It is the single Ramsar listed wetland of international importance in Assam. It covers an area of about 40 sq. km of which 4.14 sq. km is declared as the Deepor Beel Bird Sanctuary [31]. A part of the wetland is connected to the Rani and Garbhanga reserve forests in the south. Besides harboring a wide variety of fishes, it also provides critical habitat for about 18 globally threatened migratory bird species [32]. With such rich biodiversity, the Deepor Beel is a popular urban recreational spot for the people of Guwahati and its surrounding area. Change in environmental quality of protected areas and its impact on recreational demand is an important area of research in the domain of environment and resource economics.

The study is conducted using primary data collected from 300 on-site visitors to Deepor Beel through a structured questionnaire survey. Respondents were selected by systematic random sampling, with every 10th visitor approached at the exit point of the wetland. A preliminary visitor census conducted before the main survey estimated that approximately 3,000 visitors visited the wetland every month during the peak season from October to December. Accordingly, a sample of 300 visitors, representing 10 percent of the estimated monthly visitor population, was considered for survey, out of which 287 were finally considered for analysis.

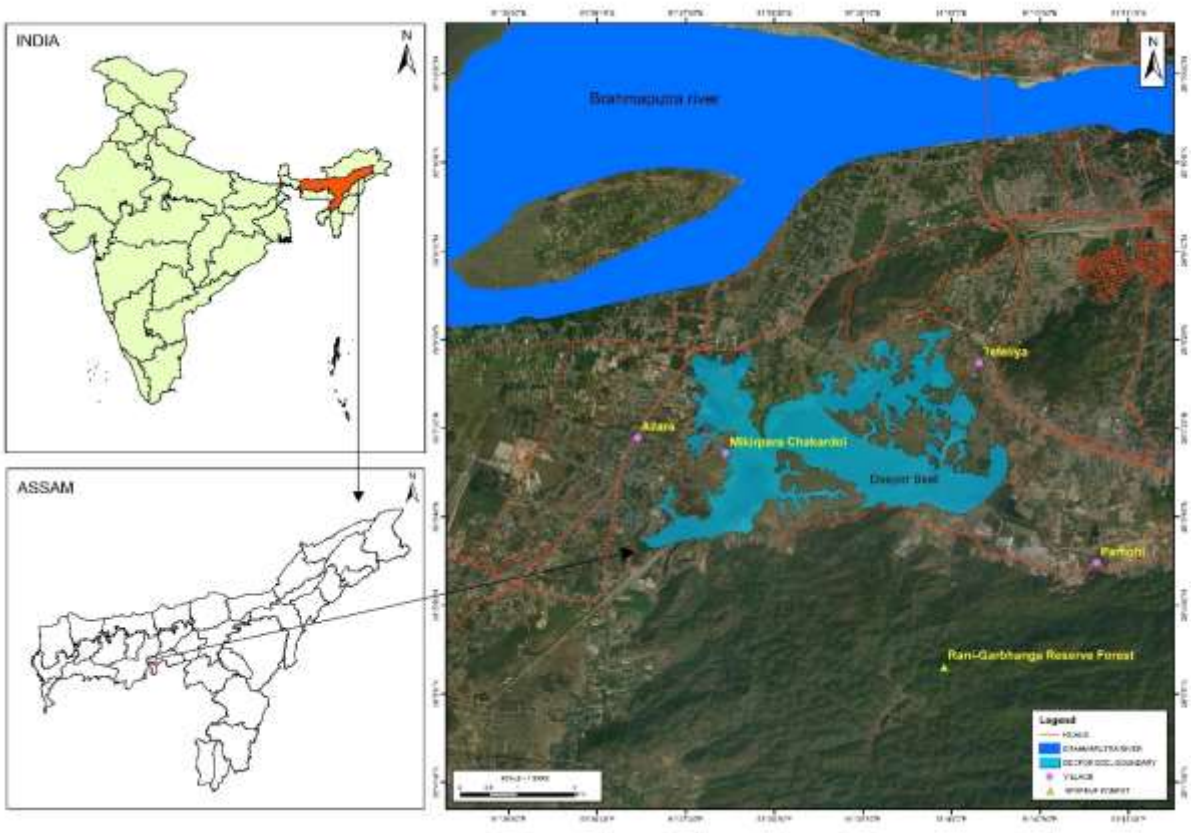


Figure 1: Map of study area (Deepor Beel)

2.2 Empirical Methods

The analytical framework for the evaluation of wetlands ecosystem services in the present study is designed based on the technical guidelines for wetlands provided by the Ramsar Convention [33], and The Economics of Ecosystem and Biodiversity [34]. Valuation methods can be divided broadly into the market

value approach, revealed preference approach, and stated preference approach. Since our objective is to identify the determinants of the demand for recreational ecosystem services, we are using the travel cost method (TCM) under the revealed preference (RP) approach.

2.2.1 Travel Cost Method

The Travel Cost Method (TCM) is a revealed preference method based on observed behavior reflecting utility maximization subject to a constraint [6]. Analysis of the demand relationship between the travel cost incurred in visiting a recreational site and the number of visits made per year is done with the help of regression models. Since the dependent variable, the annual number of visits, is a non-negative integer and the data were collected on-site, OLS estimation would yield biased and inconsistent estimates (Shaw, 1988). A count data model is therefore used to estimate the recreational demand function. This study uses the Poisson regression model, a basic count data model, to examine the impact of different socio-economic and visitors' perspective related variables on the number of visits to Deepor Beel. The expected value of the dependent variable can be expressed as:

$$E(y \mid x) = \exp(\beta.x) = \exp(\beta_o+\beta_1x_1+\beta_2x_2+\ldots..+\beta_nx_n) \quad (1)$$

where β_n is the estimated regression coefficient for the i^{th} variable in the model and β^0 is a constant.

For explaining the variations in the individual demand for annual visits to Deepor Beel across the entire sample, the following regression can be used.

$$\ln(\lambda) = \beta_0 + \beta_1\, tc + \beta_2 age + \beta_3 hh_sz + \beta_4 ym + \beta_5 male + \beta_6 mar + \beta_7 edu_{col} + \beta_8 locr + \beta_9 env_q + \varepsilon \quad (2)$$

where 'V' is the annual number of visits to Deepor Beel, 'tc' is the travel cost, 'age' the age of the visitor, 'male' for male gender, 'ym' for monthly income, 'mar' for marital status, 'edu_col' educational qualification, 'locr' location of residence and 'env_q' the visitor's perceived environmental quality of the site.

Travel cost calculation: The total travel cost of TCM in includes the actual individual travel costs (tc) and the opportunity cost of time (oct).

$$ttc = tc + oct \quad (3)$$

The travel cost (tc) includes the respondent's perceived fuel cost or vehicle fare, food cost, and other equipments cost. The actual individual travel cost is calculated by dividing the travel cost by number of trip members. The opportunity cost of time (oct) has received much importance in the TCM literature [35], [36]. In oct calculations, the time value is often approximated as a fraction of the hourly wage rate [36]. In this study, we have considered one-third of the hourly wage rate of the respondents.

3. Results and discussion

3.1 Visitor characteristics

Table 1 provide a summary of the descriptive statistics of the socio-economic characteristics and travel cost of visitors.

Table 1: Descriptive statistics of the travel cost and socio-economic variables

Variables	Mean	Std. dev.	Min	Max
No of visits in 12 months in status quo (V1)	2.56	2.02	1	12
No of visits in 12 months with improved site quality (V2)	4.97	4.25	1	24

Travel cost (in INR)	707.15	433.73	25	2,440.48
Age	33.60	10.22	18	70
Respondent's income (in INR per month)	33,150	27,115.28	0	130,000
Household size	5	1.77	1	18
Group size	9	27	1	300
Travel distance (in km)	20.17	12.07	1	120
Time spent at site (in minutes)	224.40	109.77	30	480

On average, the respondents in the sample had visited the Deepor Beel two to three times over a period of 12 months. Also, with improved site quality and recreational infrastructure, the average number of visits stated by respondents is approximately five times. The average age of the sample respondents is 33 years with a minimum of 18 years and a maximum of 70 years, and a standard deviation of 10 years. Most of the respondents are graduates with an average monthly wage of INR 33,000, which varied considerably with a standard deviation of INR 27,000. The average travel cost per visit is INR 700 per person. The average group size in the sample is nine while the maximum group size is 300. This implies that most of the visitors come to the site in large groups. The average distance traveled by the respondents to reach the wetland is 20 km while the maximum distance reported is 120 km. On average, the respondents spend 3-3.5 hours at the wetland. Concerning the mode of transportation, the highest number of respondents (66%) travel by private car followed by two-wheelers (25%). In the sample, about 86 percent of the respondents are male and 50 percent are married, with average household size of four persons. About 60 percent of the respondents are employed in public as well as private sector, whereas almost 25 percent are self-employed in farming and small businesses (Table A1 in Appendix A).

For a majority of the visitors (82%), Deepor Beel is the only destination. Most of the respondents (79%) are not satisfied with the water quality and recreational facilities available there (Table A2 in Appendix A). When asked about how to finance site improvements, the majority (86%) opined that it was the responsibility of the government. However, on the matter of paying an entry fee, most of the respondents (91%) are found to be willing to pay if an entry fee is imposed to maintain the quality of the site (Table A2 in Appendix A). Household also plays a role in visitation as it was found that majority of the visitors (35%) visited the wetland up to five times in 12 months and they belong to the income category of INR 30,000-INR 49,999 per month (Table B1 in Appendix B). On the other hand, mostly the young people in the age group 18-30 years (47%) visit the wetland up to five times a year (Table B2 in Appendix B).

3.2 Regression results and discussion

Determinants of the recreational use demand of Deepor Beel is estimated by applying the Poisson count data model. The variables used in the regression model are listed in Table 2. Table 5 presents the Poisson regression estimates of the determinants of the recreational visits to Deepor Beel. Model 1 estimates the determinants of annual number of visits under the status quo, and Model 2 estimates the number of visits respondents stated they would make under a hypothetical scenario of improved site quality and amenities with the addition of an entry fee. The improved scenario was described to respondents as clean water, clean surroundings, better recreational facilities and hygienic and affordable eateries nearby.

The likelihood ratio test rejects the null hypothesis that all slope coefficients are jointly zero in both the models (LR $\chi^2(9)=26.58$, $p=0.0016$ for Model 1; LR $\chi^2(9) = 59.30$. $p<0.001$ for Model 2). The explanatory variables therefore jointly explain a significant part of the variation in visitation to the wetland. As expected from the demand theory, travel cost has a negative and highly significant effect on the number of visits in both models ($p<0.01$), indicating an inverse relationship between costs incurred while travelling to the wetland and the frequency of visits made by the respondents in a year. An increase of INR 100 in travel cost reduces the expected number of annual visits by about 3.2 percent under the status quo and by about three percent under the improved scenario. Thus, travel cost acts as the implicit price of a visit, and its negative sign confirms a downward-sloping demand curve for recreation at Deepor Beel, which supports the validity of the travel cost model. Additionally, the slightly smaller coefficient under the improved scenario also suggests that visitors would be marginally less sensitive to cost if the site were improved. This finding is consistent with Guruge et al. [16], who find that travel cost significantly reduces visits to an urban wetland park in Sri Lanka.

Table 2: List of variables used in regression

Variable	Explanation
V	Respondent's total number of visits to the wetland annually; V1= number of visits in status quo, V2= number of visits under improved site quality and entry fee
tc	Travel cost = transportation cost + food + opportunity cost of time (in INR)
age	Age of visitor (in years)
male	Gender of respondent (1=male, 0=otherwise)
ym	Visitor's monthly income (in INR)
hh_sz	Household size (in numbers)
mar	Marital status of visitor (1=married; 0=otherwise)
edu_col	Educational qualification: graduate (1 if visitor has at least a college degree; 0 otherwise)
locr	Location of respondent's residence (1= urban, 0= rural)
env_q	Respondent's perceived environmental quality of site (1 if visitor's perceived quality is good; 0 otherwise)

Monthly income has a positive and highly significant effect on visitation in both models ($p<0.01$). An increase of INR 10,000 in monthly income raises the expected number of visits by about 6.1 percent under the status quo and by about 7.4 percent under the improved scenario. The income elasticity of demand at the mean income of INR 33,150 is 0.20 under the status quo and 0.24 under the improved scenario, implying that recreation at the wetland rises less than proportionately with income. The marginally stronger income effect under the improved scenario suggests that higher-income visitors would respond more to improvements in site quality and amenities. This result is found to be consistent with the cross-

tabulation in Table A1 in Appendix A, where frequent visits are more common among higher income households.

Table 3: Poisson estimates of the determinants of recreational use demand of Deepor Beel

Variable	Model 1: Status quo	Model 2: Improved site
Travel cost (tc)	-0.0003292*** (0.0001054)	-0.0003037*** (0.0000746)
Age (age)	-0.0059195 (0.00545)	0.000582 (0.0037742)
Household size (hh_sz)	-0.018161 (0.0234807)	-0.0112605 (0.0166664)
Monthly income (ym)	0.00000595*** (0.00000178)	0.00000713*** (0.00000123)
Gender (male)	0.0084841 (0.1037835)	-0.0531604 (0.0737463)
Married (mar)	-0.1519864 (0.104171)	-0.2782173*** (0.075278)
Graduate (edu_col)	0.0033458 (0.097489)	-0.0263299 (0.0696319)
Location of residence (locr)	0.1740076 (0.1471908)	0.131805 (0.1041089)
Perceived site quality (env_q)	0.0411256** (0.0205629)	-0.0830723 (0.0534643)
Constant	1.169339*** (0.2487564)	1.719051*** (0.1757655)
Observations	287	287
LR $\chi^2(9)$	26.58***	59.30***
Log likelihood	-538.65	-707.57
Pseudo R^2	0.0241	0.0402

Marital status of respondents is not significant under the status quo, but it becomes negative and highly significant under the improved scenario ($p<0.01$). Married visitors would make about 24.3 percent fewer visits than unmarried visitors if the site were improved. Unmarried visitors, a significant number of them are youth and students, respond more strongly to better recreational facilities, whereas married people face greater constraints on their leisure time form work and family responsibilities, given that improved site quality comes with an additional cost in the form of entry fee. This implies that improved recreational

facilities would attract additional visits mainly from young and unmarried visitors, who already form a large share of the visitor population (Appendix B). Among the other socio-economic variables, age, household size, gender, education, location of residence are not statistically significant in either model. The frequency of visits to Deepor Beel therefore does not differ significantly between men and women, between college graduates and non-graduates, or across age groups.

Perceived site-quality has a positive and significant effect ($p<0.05$) on visitation under the status quo. The visitors who perceive the environmental quality of the wetland as good make about 4.2 percent more visits than those who perceive it as poor. Recreational demand therefore depends on the present environmental condition of the wetland and degradation from solid waste dumping, encroachment and water pollution discourages visits. This variable, however is not significant under the improved scenario, which is expected because the hypothetical scenario presents all respondents with the same improved site, so their perceptions of the present site quality no longer explain differences in intended visits. It also implies that the visitors who are currently dissatisfied with the site would increase their visits the most if its quality improved, closing the gap in visitation observed under the status quo. Improving the environmental quality of Deepor Beel would therefore not only benefit existing visitors but also increase the demand that is currently held back by its degraded condition.

At the mean travel cost of INR 707.15, the travel cost elasticity of demand ($\beta_{TC} \times \overline{TC}$) is -0.23 under the status quo and -0.21 under the improved scenario. Recreational demand for Deepor Beel is therefore found to be highly inelastic i.e., a 10 percent increase in the travel cost of a visit would reduce visits by only about 2.3 percent under the status quo and 2.1 percent under the improved scenario. There are several likely reasons for this low-price sensitivity. The average visitor travels only about 20 km to the site, and travel cost is small relative to the average monthly income of INR 33,150. Deepor Beel is also the only Ramsar wetland in Assam and one of the few large natural open spaces near Guwahati, so it has few close substitutes for nature-based recreation. In addition, 82 percent of respondents made Deepor Beel the sole purpose of their trip, which suggests that visitors value the site for its own sake and are willing to bear the cost reaching it. The elasticity is slightly lower under the improved scenario, so visitors would become even less sensitive to cost if the site's quality and amenities were improved. The recreational ecosystem service of the wetland, therefore, is a normal good with features of necessities, and visitation is expected to grow steadily as income in the region rises, and somewhat at a faster pace if the site were improved. This low sensitivity to price also reflects the short distances most visitors travel for recreation, the small share of travel cost in their income for such visits, and the lack of close substitutes for nature-based recreation near Guwahati, highlighting the potential of Deepor Beel as a nature-based tourism spot.

An entry fee raises the cost of each visit, so its effect on visitation can be estimated from the travel cost coefficient. Table 4 shows the effect of alternative entry fees on visitation and on the annual revenue of the wetland authority. The bid most frequently chosen by respondents, INR 30 per visit, would reduce visitation by less than 1 percent in both scenarios. The average visitor would make 2.54 instead of 2.56 trips a year under the status quo and 4.93 instead of 4.97 under the improved scenario. A fee of INR 30 increases the average cost of a visit by only about 4 percent, and with such inelastic demand it would barely change visitor behavior.

Table 4: Effect of an entry fee on visitation and annual revenue

Entry fee (INR per visit)	Status quo			Improved site quality	
	Change in visits (%)	Annual revenue (INR)		Change in visits (%)	Annual revenue (INR)
10	-0.33	2,39,211		-0.30	25
20	-0.66	4,76,850		-0.61	32
30	-0.98	7,12,924		-0.91	135
50	-1.63	11,80,410		-1.51	578
100	-3.24	23,22,278		-2.99	997

At INR 30 per visit, the fee would raise about INR 0.71 million a year under the status quo and about INR 13,85,135 (approx 1.39 million) a year under the improved scenario. Revenue would almost double after improvement, mainly because visitors would make nearly double the number of trips (4.97 against 2.56) and would be slightly less sensitive to changes in travel cost. This amount is not sufficient to finance large-scale restoration of a wetland the size of Deepor Beel. It could, however, cover regular maintenance such as cleaning, waste collection, toilets and visitor services, and it could be supplemented by other user charges such as vehicle parking, boating and guided bird-watching.

Considering the fact that demand is inelastic, the wetland authority can introduce a modest entry fee of INR 20-30 per visit without significantly discouraging visitors. Since about 91 percent of respondents are willing to pay a fee for improved recreational benefits, the fee is likely to be socially acceptable, provided visitors see the revenue being used to improve the site.

4. Conclusion

This study examined the determinants of recreational demand for Deepor Beel, a peri-urban freshwater Ramsar wetland in Assam, using the individual travel cost method. The results show that recreational demand for the wetland is driven mainly by economic factors. Travel cost has a negative and highly significant effect on visitation under status quo as well as the hypothetical improved site quality scenarios, confirming a downward sloping demand curve and thus validates the travel cost model. Monthly income has a positive and highly significant effect indicating that higher-income visitors would respond more strongly to improvements in the site. Marital status becomes significant under improved scenario, with married visitors making about 24 percent fewer visits than the unmarried visitors. The additional demand from site improvement would therefore come mainly from young and unmarried visitors, who already form a large share of the visitor population. Under the status quo, visitors who perceive the site's environmental quality as good make about 4.2 percent more visits, which shows that degradation of the wetland directly discourages recreational use. Demand for recreation at Deepor Beel is found to be inelastic in status quo as well as under the improved scenario. Consequently, an entry fee of INR 30 per visit, the bid most frequently chosen by respondents, would reduce visitation by less than 1 percent, but would generate about INR 0.71 million a year under present conditions and about INR 1.39 million a year under the improved scenario.

These findings have several implications for the management of Deepor Beel. Since, demand is inelastic and most visitors are willing to pay, the wetland authority can introduce a modest entry fee of INR 20-30

per visit without significantly reducing visitation. The fee should be introduced together with visible improvements in water quality, cleanliness and facilities. Its revenue should be earmarked for the maintenance of the wetland and supplemented by other user charges. Concessions for students, local residents and low-income groups would keep access equitable. Investment should prioritize low-impact amenities such as nature trails, bird-watching towers and nature education programs, which would particularly attract young visitors, and these should be located away from the ecologically sensitive areas of the bird sanctuary. Recreational benefits should be weighed alongside the wetland's other ecosystem services in land-use decisions. Moreover, maintaining systematic records of visitor numbers through ticketing, would significantly support future valuation and the monitoring of the management outcomes.

The present study has some limitations. It is based on a single on-site survey, where the visitor population was estimated from the researcher's own census because no official record exists, and visits under the improved scenario are stated rather than observed. Moreover, the study takes into account only the recreational services of Deepor Beel, whereas the said wetland provides a wide range of other ecosystem services as well that need equal attention. Future research could address these issues by using truncated or negative binomial count models, incorporating site-specific attributes, and valuing the wetland's other ecosystem services alongside recreation.

References

1. G. V. T. Matthews, *The Ramsar Convention on Wetlands: its History and Development*. Gland, Switzerland: Ramsar Convention Bureau, 1993.
2. MEA, "Ecosystems and Human Well-Being: Wetlands and Water Synthesis," Washington DC, 2005. [Online]. Available: http://berghahnjournals.com/view/journals/regions-and-cohesion/1/3/reco010305.xml
3. L. M. Brander, R. J. G. M. Florax, and J. E. Vermaat, "The empirics of wetland valuation: A comprehensive summary and a meta-analysis of the literature," Feb. 2006. doi: 10.1007/s10640-005-3104-4.
4. N. Yadav and N. C. Sahu, "Economic valuation of protected areas and recreational sites in India: some review findings," *International Journal of Environmental Policy and Decision Making*, vol. 1, no. 4, p. 297, 2015, doi: 10.1504/ijepdm.2015.074726.
5. A. M. Freeman, J. A. Herriges, and C. L. Kling, *The Measurement of Environmental and Resource Values*. Routledge, 2014. doi: 10.4324/9781315780917.
6. R. de Groot, M. Stuip, M. Finlayson, and N. Davidson, "Valuing wetlands Guidance for valuing the benefits derived from wetland ecosystem services Ramsar Technical Reports," Gland, Switzerland, 2006. Accessed: Jan. 29, 2018. [Online]. Available: https://www.ramsar.org/sites/default/files/documents/pdf/lib/lib_rtr03.pdf
7. P. Lamsal, K. Atreya, K. P. Pant, and L. Kumar, "Tourism and wetland conservation: application of travel cost and willingness to pay an entry fee at Ghodaghodi Lake Complex, Nepal," *Nat. Resour. Forum*, vol. 40, no. 1–2, pp. 51–61, 2016, doi: 10.1111/1477-8947.12089.
8. W. Adamowicz, J. Louviere, and M. Williams, "Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities," *J. Environ. Econ. Manage.*, vol. 26, no. 3, pp. 271–292, May 1994, doi: 10.1006/JEEM.1994.1017.
9. J. C. Whitehead, T. C. Haab, and J.-C. Huang, "Measuring recreation benefits of quality improvements with revealed and stated behavior data," *Resour. Energy Econ.*, vol. 22, no. 4, pp. 339–354, Oct. 2000,

doi: 10.1016/S0928-7655(00)00023-3.
10. M. Chaikumbung and H. Scarborough, "Local population preferences toward restoring ecosystem services of a wetland in Thailand," *International Business Management*, vol. 9, no. 5, pp. 771–783, 2015, doi: 10.3923/ibm.2015.771.783.
11. V. Dias and K. Belcher, "Value and provision of ecosystem services from prairie wetlands: A choice experiment approach," *Ecosyst. Serv.*, vol. 15, pp. 35–44, 2015, doi: 10.1016/j.ecoser.2015.07.004.
12. S. Gürlük and E. Rehber, "A travel cost study to estimate recreational value for a bird refuge at Lake Manyas, Turkey," *J. Environ. Manage.*, vol. 88, no. 4, pp. 1350–1360, Sep. 2008, doi: 10.1016/J.JENVMAN.2007.07.017.
13. E. E. Ezebilo, "Economic value of a non-market ecosystem service: an application of the travel cost method to nature recreation in Sweden," *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.*, vol. 12, no. 4, pp. 314–327, 2016, doi: 10.1080/21513732.2016.1202322.
14. P. P. Mishra, "The benefits of improving urban lakes in mega cities: A revealed and stated preference approach applied to the Hussain Sagar in Hyderabad, India," *Environ. Dev. Econ.*, vol. 22, no. 4, pp. 447–469, Aug. 2017, doi: 10.1017/S1355770X17000183.
15. H. Solayman, M. A. Baten, and M. B. Khan, "Status and economic valuation of ecosystem services of Tanguar haor: A wetland of Bangladesh," *Journal of the Bangladesh Agricultural University*, vol. 16, no. 2, pp. 237–243, Aug. 2018, doi: 10.3329/jbau.v16i2.37968.
16. T. P. S. R. Guruge, P. C. Abeysiriwardana, I. V. Kuruppu, and A. L. J. Bandara, "Valuing urban wetlands for sustainable land use: recreational services and economic insights from a travel cost framework," *Urban Ecosyst.*, vol. 28, no. 4, p. 166, Aug. 2025, doi: 10.1007/s11252-025-01778-4.
17. L. Crase and R. Gillespie, "The impact of water quality and water level on the recreation values of Lake Hume," *Australasian Journal of Environmental Management*, vol. 15, no. 1, pp. 21–29, 2008, doi: 10.1080/14486563.2008.9725179.
18. F. Zulpikar, L. A. Tambunan, S. R. Utami, and W. El Kiyat, "Economic Valuation of Marine Tourism in Small Island Using Travel Cost Method (Case Study: Untung Jawa Island, Indonesia)," *Omni-Akuatika*, vol. 14, no. 1, pp. 28–35, 2018, [Online]. Available: http://ojs.omniakuatika.net
19. L. Tuffery, "The recreational services value of the nearby periurban forest versus the regional forest environment," *J. For. Econ.*, vol. 28, pp. 33–41, Aug. 2017, doi: 10.1016/J.JFE.2017.04.004.
20. R. P. Acharya, T. N. Maraseni, and G. Cockfield, "Estimating the willingness to pay for regulating and cultural ecosystem services from forested Siwalik landscapes: perspectives of disaggregated users," *Ann. For. Sci.*, vol. 78, no. 2, p. 51, Jun. 2021, doi: 10.1007/s13595-021-01046-3.
21. J. O. Afriyie, M. A. Opare, and P. Hejcmanová, "Knowledge and perceptions of rural and urban communities towards small protected areas: Insights from Ghana," *Ecosphere*, vol. 13, no. 11, Nov. 2022, doi: 10.1002/ecs2.4257.
22. U. Seenprachawong, "Economic valuation of coral reefs at Phi Phi Islands, Thailand," *International Journal of Global Environmental Issues*, vol. 3, no. 1, p. 104, 2003, doi: 10.1504/IJGENVI.2003.002413.
23. P. K. Ghosh and M. S. Mondal, "Economic valuation of the non-use attributes of a south-western coastal wetland in Bangladesh," *Journal of Environmental Planning and Management*, vol. 56, no. 9, pp. 1403–1418, Nov. 2013, doi: 10.1080/09640568.2012.724667.
24. L. Bhatta, S. Chaudhary, A. Pandit, H. Baral, P. Das, and N. Stork, "Ecosystem Service Changes and Livelihood Impacts in the Maguri-Motapung Wetlands of Assam, India," *Land (Basel).*, vol. 5, no. 2,

p. 15, 2016, doi: 10.3390/land5020015.

25. B. Mondal, G. Dolui, M. Pramanik, S. Maity, S. S. Biswas, and R. Pal, "Urban expansion and wetland shrinkage estimation using a GIS-based model in the East Kolkata Wetland, India," *Ecol. Indic.*, vol. 83, no. November 2016, pp. 62–73, 2017, doi: 10.1016/j.ecolind.2017.07.037.
26. K. G. Bhattacharyya and N. Kapil, "Impact of urbanization on the quality of water in a natural reservoir: A case study with the Deepor Beel in Guwahati city, India," *Water and Environment Journal*, vol. 24, no. 2, pp. 83–96, 2010, doi: 10.1111/j.1747-6593.2008.00157.x.
27. D. Choudhury and S. Gupta, "Impact of waste dump on surface water quality and aquatic insect diversity of Deepor Beel (Ramsar site), Assam, North-east India," *Environ. Monit. Assess.*, vol. 189, no. 11, p. 540, Nov. 2017, doi: 10.1007/s10661-017-6233-7.
28. J. Deka, O. P. Tripathi, and M. L. Khan, "A multi-temporal remote sensing approach for monitoring changes in spatial extent of freshwater lake of Deepor Beel Ramsar Site, a major wetland of Assam," *Journal of Wetlands Ecology*, vol. 5, no. 0, pp. 40–47, Dec. 2011, doi: 10.3126/jowe.v5i0.4696.
29. P. Sharma, R. Sarkar, J. P. Deka, S. Koley, and B. Saha, "Assessing water quality of Deepor Beel, Assam, NE India, using water quality index: a case of Ramsar wetland," *Arabian Journal of Geosciences*, vol. 17, no. 1, Jan. 2024, doi: 10.1007/s12517-023-11818-y.
30. S. Mitra and A. N. Bezboruah, "Railroad impacts on wetland habitat: GIS and modeling approach," *The Journal of Transport and Land Use*, vol. 7, no. 1, pp. 15–28, 2014, doi: 10.5198/jtlu.v7i1.360.
31. Ramsar Convention, "Information Sheet on Ramsar Wetlands - Deepor Beel," Ramsar Convention Secretariat, 2002. Accessed: Aug. 10, 2026. [Online]. Available: https://rsis.ramsar.org/ris/1207
32. P. K. Saikia and M. K. Saikia, *Biodiversity in Deepor Beel Ramsar Site of Assam India (Faunal Diversity)*, 1st ed. Germany: LAP LAMBERT Academic Publishing, 2011. [Online]. Available: https://www.researchgate.net/publication/307883899
33. Ramsar Convention Secretariat, "An Introduction to the Convention on Wetlands (previously The Ramsar Convention Manual).," pp. 15–18, 2016. [Online]. Available: https://www.ramsar.org/document/handbook-1-5th-edition-introduction-convention-wetlands
34. R. Brouwer, L. Brander, O. Kuik, E. Papyrakis, and I. Bateman, "A synthesis of approaches to assess and value ecosystem services in the EU in the context of TEEB Final Report," Amsterdam, 2013. Accessed: Mar. 14, 2018. [Online]. Available: http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/EU Valuation.pdf
35. M. A. I. Freeman, J. A. Herriges, and C. L. Kilng, *The Measurement of Environmental and Resource Values*, 3rd ed. RFF Press, 2014. Accessed: Feb. 15, 2018. [Online]. Available: http://econdse.org/wp-content/uploads/2016/07/Freeman-Herriges-Kling-2014.pdf
36. F. A. Ward and D. J. Beal, *Valuing Nature with Travel Cost Models: A manual*. Massachusetts: Edward Elgar Publishing Limited, 2000.