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A Glimpse of the Tiger: How Much are Indians Willing to Pay for It?

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INDRILA GUHA AND SANTADAS GHOSH

Vidyasagar College for Women and Visva-Bharati, Santiniketan
Kolkata, India

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Technical Editor
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English Editor
Rahul Goswami

Indrila Guha, Vidhyasagar College for Women, Kolkotta, Email: indrilaguha@hotmail.com
Santadas Ghosh, Visva - Bharati Santineketan, Kolkotta, Email: santadas_ghosh@yahoo.co.in

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Abstract

Our study estimates the recreational demand for the Indian Sundarban, which is a World Heritage site and a complex mangrove ecosystem that borders India and Bangladesh. In 2005-06, the Indian Sunderban received some 64,000 visitors, mainly from Kolkata and other parts of West Bengal. Tourism to the Sunderban is highly seasonal and characterised by few multipoint or foreign visitors. While a majority of the visitors are educated and employed in the service sector, this is a segmented market with high-end and low-end components. Based on the zonal travel cost method, we estimate the annual recreational value of the Indian Sundarban to be approximately INR 15 million (US$ 377,000). The current entry fees to visit the Sunderban are very low and park authorities are able to capture less than 10% of this consumer surplus. To maximize revenues, the current fees of INR 15 can be increased to INR 154 per visitor per day. This would increase total revenues by more than 300%, bringing nearly INR 5 million (US$ 0.12 million) per year to the park. Improved facilities and infrastructure are also likely to boost visitation and revenues.

Keywords: World Heritage Site, Zonal Travel Cost Model, Consumer Surplus, Sunderban, Optimum Entry Fee.

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1.   Introduction

In the south-east corner of India's state of West Bengal, the Sundarban is part of the largest riverine delta region in the world. It is a complex ecosystem which is well known for both its mangroves (one of the three largest single tracts of mangrove forest in the world) and for being the home of the Royal Bengal Tiger. It is the only mangrove forest in the world that is inhabited by tigers. The Sundarban was declared a reserved forest in 1926. The Sundarban Tiger Reserve was formed in 1973 by the Government of India under the Project Tiger scheme, to protect this highly endangered animal. In 1987 the Sundarban was recognised a World Heritage Site by UNESCO and in 1992 it was designated a Ramsar site.

The Sundarban is rich in biodiversity, which plays a significant role in physical coastal evolution. The entire riverine delta is a significant habitat for a variety of terrestrial and marine species – birds, spotted deer, crocodiles and snakes amongst them. The region has experienced a rapid depletion of forest cover and loss of faunal diversity due to human encroachment. Conservation in recent years has helped slow down such erosion of the Sundarban forest, but threats remain. Presently, the protected area is bounded by the Bay of Bengal in the south and the border with Bangladesh in the east. In the north and the west, the reserve forest is separated from human settlements by numerous lesser rivers and water channels. The present regime of protection is aimed at leaving the tiger habitat insulated from human interventions. Human movements are restricted only to a buffer zone by the issue of priced permits and the issuing authority (the Department of Forests) monitors all human movement in the forest.

The villages bordering the Sunderban forest are located on deltaic islands. Settlements on these islands are relatively recent: almost all have emerged within the last century and by clearing the forest. Residents of these islands are mainly dependent on rain-fed agriculture, but also on forest products and fishing. They are otherwise disadvantaged by their remoteness and lack of infrastructure like electricity.

In the Sundarban, conservation efforts have imposed a cost on the local stakeholders in the form of income that the poor have foregone by being barred from the forest. Thus, it is useful to view development interventions in the region through the lens of social cost benefit analyses. The costs borne by locals as a result of conservation need to be compared to the Total Economic Value (TEV) of the Sundarban, which includes both 'use value' and 'non-use value'. Studies carried out so far on the region estimate values for extractible forest products and its ecological contribution in terms of increased productivity of fish farms (Santhakumar *et al*. 2005, Chopra 2005).

For a protected area which receives visitors, the 'recreational services' it can provide is a major part of its use value. The Sundarban's unique mangrove forest landscapes and its position as a tiger habitat make it a singular tourist attraction. This is proved by the rising number of visitors in recent years despite poor transport options into and within the region, and major infrastructural

deficits like little or no electricity. This study aims to provide a baseline estimate of the recreational value of the Indian Sundarban.

Two alternative methodologies exist for estimating the value of a recreational site. The Contingent Valuation Method (CVM), as a 'stated preference' valuation technique, circumvents the absence of markets for environmental goods. This method asks potential visitors to a recreational site what they are willing to pay for the experience there. However, since this method does not record visitors' actual behaviour, literature on such techniques indicates that when there is a market for the service to be valued, CVM should be avoided. That is why we choose the Travel Cost Method (TCM), which has emerged as a more acceptable methodology for valuing recreational services. It involves the estimation of recreational demand for the site based on visitors' 'revealed' - as opposed to 'stated' - preferences. Apart from valuing the recreational services, TCM data also help the policy authority fix an entry fee that can either maximise revenue or control the number of visitors.

Our study relied on a primary survey of a sample of visitors to the Indian Sundarban from November 2005 to March 2006. Following TCM, the recreational demand for the site is estimated. Literature on the Travel Cost Method recognises that, other than travel cost, visitors' socio-economic conditions may have significant effects on their demand for recreational services from a site. Our study explores the survey data as well as data from secondary sources to bring out such determinants and quantitatively estimate their influences on recreational demand. The study also estimates an entry fee level that maximises revenue.

2.   Studies Estimating Recreational Value

Both CVM (Kadekodi, 2004) and TCM (Champ et al, 2003; Chopra, 2004; Markandya et al 2001) have been used to measure recreational values of environmental goods like protected wildlife areas. Some studies have used both methods (Herath & Kennedy 2004; Nam & Son 2001) and attempted a comparison of the two different estimates.

The use of TCM often follows two routes. The Individual Travel Cost Method (ITCM) considers the number of visits a single visitor pays to a site within a specified period. This represents quantity of demand, which is a function of the visitor's travel cost to the site as well as of other economic and qualitative indicators (Xue et al 2000; Khan 2004). Thus, a survey of visitors yields the number of data points equal to the sample size and the functional relationship between visitation and travel cost can be estimated.

ITCM, however, cannot be applied to sites that receive few multiple visits by the same vistors. In such cases, the Zonal Travel Cost Method (ZTCM) is adopted (Tobias and Mendelsohn 1991; Maille and Mendelsohn 1992). ZTCM estimates the demand for a recreational site in terms of 'visitation rate' from different zones to that site. Visitation for a zone is defined as the number of visitors per thousand population from that zone. The more distant the visitors' zone is from the tourist site, the greater the travel cost which lowers the visitation rate from that zone to the site. The functional relationship between 'visitation' from the zones and their 'average travel costs' to the site is empirically estimated in the form of a Trip Generating Function (TGF). In ZTCM, the number of data points equals to the number of zones that can reasonably be constructed with respect to visitors' originating places. The suitable functional form for the TGF is found to be varying across studies, with linear and log-linear forms appearing more frequently in the literature (Carr and Mendelsohn 2003, Nam and Son 2001).

3. Methodology for ZTCM

Travel Cost Method has frequently been used for valuation of recreational sites since it was conceived by Hotelling (1947). The method is based on the assumption that the costs incurred by a visitor for a trip can be used as a proxy for the recreational value placed by him for it. It is his *minimum* demand price for the recreational service the site is seen to possess. As travel cost increases, 'visitation' decreases following the law of demand. An empirical estimation of this demand is crucial for computing the value of recreational services offered by the site. Information on varying travel costs, along with other relevant socio-economic explanatory variables, is used to estimate the 'recreational demand function'.

In ZTCM, 'quantity demanded' is represented by 'visitation from zones' to the site rather than the number of times a single visitor visits the site within a period. For a theoretically consistent negative relation between demand price and visitation, visitors' originating places are categorised into zones depending on their distance from the site. Assuming travel cost to be an increasing function of distance, the primary cause of variation in visitation rate from different zones is traced to their distances from the site (Figure 1). Implicitly, it also assumes that tastes and preferences of visitors across the zones are homogeneous.

Within a given period, a reasonably sized random sample of visitors surveyed at the site is expected to yield the shares of different zones in the total number of visitors. Suppose N_i is the estimated number of visitors from zone 'i' and P_i is its total population. Then visitation V_i (say, per thousand people) for zone 'i' is defined as

$$V_i = (N_i / P_i) \times 1000$$

The average travel cost from each zone is calculated on the basis of information collected from the sample of visitors from that zone. The travel cost is calculated 'per visitor' inclusive of all actual expenses from visitor's originating point (including the entry fee) as well as his/her opportunity cost, taken as potential earnings lost for the duration of the trip. If T_i is the average travel cost from zone 'i', then visitation from zone 'i' (V_i) is supposed to be functionally related as

$$V_i = f (T_i , Z_i)$$

where Z_i is a vector of zonal variables that are expected to influence V_i. The functional form and the components of Z_i are case-specific. These are usually decided by exploring the survey data. The relationship between V, T and Z is known as the Trip-Generating Function (TGF). The demand function for each zone is obtained by using the corresponding value of Z_i in the estimated TGF, and aggregate demand can be obtained as the sum of zonal demands.

The value of the recreational services offered by the site is measured by the difference between the estimated demand prices and the actual expenses that the visitor incurs during the whole trip. In other words, it refers to the Consumer Surplus (CS), estimated as the area under the demand curve and above the price-line representing visitors' actual travel cost. For each zone a 'choke-price' can be calculated using the estimated TGF which represents that maximum of all the demand prices from that zone (i.e, that value of T_i for which estimated V_i falls to zero). If T^0 is the

average (actual) price paid by visitors and T^C is the choke-price, then consumer surplus (per thousand people, or any other unit used for computing V_i) is

$$CS = \int_{T^0}^{T^c} V \, dT$$

The CS for each zone, thus estimated, needs to be adjusted by an appropriate multiplicative factor to account for the total population in that zone. Aggregate CS can be obtained as the sum of zonal surpluses, which represents the recreational value of the site. However, it should be recognised that this sum measures only the recreational value of the site and not its Total Economic Value.

In practice, ZTCM is beset by problems like 'zero visitation rates' and 'multipoint trips'. In the literature, ITCM has greater theoretical acceptance over ZTCM. Yet practical problems render the application of ITCM impossible in specific sites. The low standard of tourist amenities – in many conditions the utter lack of them altogether – and the problems with infrastructure, like little or no electricity, make it rare for a visitor to attempt more than one trip in a year to the Indian Sundarban. Moreover there is little variation in terms of time spent on the spot by visitors. This is why we have relied on ZTCM despite its shortcomings.

We confronted other issues specific to ZTCM, such as deciding the optimum number of visitors' originating zones. Literature on the method (Nillesen et al 2000; Font 2000; Nam & Son 2001) has dealt with how it must treat foreign tourists, multipoint tourists, the possibility of zero visitation from an originating zone and heteroskedasticity (unequal variance of the random error term across zones in the regression model) in zonal data. An application of ZTCM in measuring biodiversity value in Keoladeo National Park (India) provides a detailed listing of the above mentioned problems that confronts such studies (Chopra, 2004).

4.   Nature of a Sundarban Tour

Organised tourism in the Indian Sundarban began in the mid-1980s, after the inception of the nationwide tiger conservation programme Project Tiger.[1] In absence of any regular publications on visitor statistics, data collected from the office of the Field Director, Sundarban Tiger Reserve, show that visitor arrival in 2005-06 was 63,900 which increased to 75,000 in 2006-07. Local tour operators reported a steady increase in visitors' number since the beginning of this decade. Tourism in the delta still does not follow a master plan, but the forest cannot be entered without a permit, which is mandatory. The authority's role in promoting tourism has so far been limited to building and manning five watch-towers inside the buffer zone of the forest, and one Mangrove Interpretation Centre describing the Sundarban's flora, fauna and ecology through models and photographs.

Visitors can apply for their permits at any one of four different issuing offices, but these have to be shown and stamped at a single entry point to the forest. This is the village Pakhiralay where the Forest Range Office is located (Figure 2). There is still no restriction on the number of permits issued to tourists and this may indicate that tourism carrying capacity of the forest is not yet a consideration for the authority.

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[1]   http://projecttiger.nic.in/sundarbans.htm

A Sundarban tour is always a cruise through the water channels within the buffer zone of the reserve forest with halts at riverbank watch-towers. These cruises are conducted in hired private boats that can also house small groups of tourist for the night. However, on-shore accommodation in tourist lodges is also available in and around Pakhiralay village.

Tourism in the Indian Sundarban is still largely unplanned, although it is being slowly organised, and this is why prospective visitors to the Sundarban find little useful information. The area is relatively inaccessible which, combined with the minimal infrastructure, makes it difficult for a visitor to tour independently. This is where a number of small enterprises step in with 'tour packages' catering to visitors' tastes and budgets. Survey data, supported by focus group discussion with the tour operators, suggests that as many as 83 per cent of all visitors in the Sundarban use these tour packages.

Tourist arrival in the Sundarban is concentrated mainly in the winter months. Our study found that more than 73 per cent of annual visitors actually spent their trip time within a four-month period in the winter (2005-2006).[2] This gave rise to a separate problem as a ZTCM study addressing seasonal variation required sufficient visitation from all zones during different seasons. This was not feasible in our study as visitor arrival in other months is very thin and we had time and budget constraints. That is why we estimated recreational demand for the whole year and left out the seasonal effect.

4.1 The Tour Packages

Discussions with tour operators identified several common packages offered to visitors. Most operators offer their packages in the winter months only. We have assembled a broad categorisation of these packages.

- Around 25-30 operators, all located in Canning, the nearest town and rail-link from Sundarban, cater to visitors who are self-organized in large groups. They offer a return package using launches (big watercrafts) from Canning to Sundarban. Typically these trips are of two to three day's duration and visitors stay overnight in the launch. However, a visitor can also opt for staying on-shore near Pakhiralay at his/her own cost. These operators offer services which are almost a perfect substitute to each other and so the package cost vary within a narrow range only. (Canning package – Table 1)

- The West Bengal Tourism Development Corporation (WBTDC, a public sector enterprise) and two other private operators offer round trip 'all inclusive' packages from Kolkata to Sundarban. Visitors can avail these packages without being in a group. The package costs are significantly high and it targets visitors from the high-income group. (Kolkata packages I-III in Table 1)

- Some enterprising individuals, using their contacts in Sundarban, offer negotiable 'custom-made packages' to small-sized group visitors. These packages may or may not be 'all inclusive' and usually do not have any fixed point of origin or termination. . The tour itinerary is also customized fitting the preferences of the visitors' (Custom-made Package in Table 1).

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[2]   From (i) survey data on visitor arrival and (ii) data obtained from the office of the Field Director, STR

- In the peak tourist season, a few seasonal operators offer package tours originating from Sonakhali – the nearest road link to Sundarban. These are usually low-cost packages targeting low and middle income visitors. (Sonakhali Package in Table 1)

- Apart from the three types of packages described above, small groups of visitors also travel to Sundarban on a self-made tour package. In most cases, they arrive at Pakhiralay on their own, choose food and accommodation on their own, and hire a local boat (smaller watercraft) to enjoy the forest. (Self-made trip in Table 1)

These visit options can effectively divide the recreational market into segments and in our study the survey questionnaire contained seven options to identify the respondents' tour package. The options were devised to be mutually exclusive and exhaustive.

5.   Survey Design and Sampling

A study on ZTCM depends critically on the sample of visitors selected for collecting information on their places of origin and travel cost. Our study collects the information in two distinct sets. In the Indian Sundarban, every inbound visitor group must produce their entry permits at a single checkpoint. There is one permit issued per watercraft or per group. These permits contain number of visitors, place of origin (address) and the type of watercraft they used. Our study collects this data for all visitors between the third week of November (2005) and the second week of March (2006). This was achieved by manning the entry point for all the days during that period and information on place of origin could be recorded for 73 per cent of all visitors in one full year.[3]

The second set of data comprises travel cost and other individual and household level information obtained from the visitor survey conducted simultaneously during the same period. We collected data from returning tourists after their visit to the forest. We completed interview of 906 visitors using a structured questionnaire with a single respondent from each family chosen in the sample. The 'per capita travel cost' and other household level information are assumed to be same for the family members accompanying the respondent. By this count, the total number of visitors on whom information could be collected is 1,948 (based on 906 interviews, including foreign nationals). This total amounts to roughly 3 per cent of annual visitor arrival.

The first set of data was used to calculate the zonal visitation rates, while the second set has been used to estimate zonal averages of travel cost and to determine visitors' socio-economic profiles. Other zonal information which could be relevant for estimating the TGF was collected from secondary sources.[4]

The seven options for tour packages (Table 1) were arrived at during the pre-testing of our questionnaire (done in February 2005) and focus group discussions with tour operators. We foresaw that the recreational market could be segmented and therefore selected a stratified random sample of returning visitors. The proportion of each stratum in the sample was decided based on information collected from operators in the previous year. Interviews were conducted by trained field investigators who were instructed in random selection of respondents within strata, independent of gender and age.

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[3]   In this study, visitors are considered to belong to the same 'family' if they use a common kitchen.
[4]   Census 2001: Directorate of Census Operations; Government of India.

6.   Data exploration – Descriptive Statistics

The first set of data, comprising 73 per cent of annual visitors, showed us that more than half originated from the nearest metropolitan city, which is Kolkata. Of the balance, most had travelled from elsewhere in the state of West Bengal. Only a very few came from the rest of India and abroad. With the second set of data, comprising 3 per cent of annual visitors, we found that their distribution by place of origin is similar to the first set (Figure 3).

We found visitors mostly spent two to three days in the Sundarban. Almost half of them are salaried employees who came for the trip on their rest days/ holidays, which involved no opportunity cost of time. Very few visitors (around 1 per cent) reported agriculture as their source of earning. Visitors' education level in general is fairly high with 70 percent of them being graduates or more.

6.1   Some Practical Issues

As is the convention with TCM, we calculated per-capita travel cost of a trip to Sundarban accounting for all the monetary expenses from visitor's originating point. Since responses were elicited only from the returning tourists, the cost of return was assumed to be equal to the cost of arrival to the site and hence was double-counted. We asked visitors about their possible alternative usage of time during the trip and accordingly opportunity cost of time was included.

6.1.1   Multi-point Tourists

Multi-point tourists create a problem for estimation in the travel cost method. It is customary to account only that part of the total arrival cost of multi-point tourists which is incurred for this part of trip only. This is difficult since cost data may not be disaggregated in this way. In our study, multi-point visitors (those with a tour itinerary that has Sundarban as one amongst several destinations) stayed in the city Kolkata for some duration. We used the proportion of days spent in Sundarban out of the total days of the trip to deflate the Kolkata-home portion of their travel cost.

However, as Sundarban is located in one far-end of the country, a trip to Sundarban is usually not part of a multi-point tour circuit. Only visitors coming from distant districts or from outside the state show some evidence of multi-point tourists (Table 2). As the southern districts (near the Sundarban) of West Bengal generate the majority of visitors, we find the overall proportion of multi-point tourists in the sample is a low 5 per cent (Figure 4).

Alternatives to travel cost calculation for multi-point tourists may have a significant effect on empirical estimates. However, the effect is assumed to be less significant if such tourists constitute only a small proportion of total visitors, as is the case here.

6.1.2   Foreign Tourists

Foreign tourists are often treated as a separate segment when their share in the total number of visitors is significant. In our first data set (73 per cent of annual visitors) only 1 per cent originated from outside India. This is too small a share to be separately treated and we have left out this segment. So, the recreational value of Sundarban arrived at in this study would be interpreted as the value accrued to Indian tourists only.

6.1.3 Variable Duration of Stay

In ZTCM, per-capita travel cost is assumed to be related with zonal distances and other zonal characteristics. But travel cost is also greatly affected by visitors' duration of stay. The effect may cancel out while calculating zonal average of travel costs. But it requires that various durations of stay appear in the same proportion in the sample of visitors from each zone. We found that this is a rather stringent requirement and was not true in our study.

We found in our survey sample, the durations of stay of different visitors were ranging from 1-day to 6-days (Figure 5). One way of circumventing the problem is standardization of travel costs for a common duration of stay (like 'per day') and estimate demand for recreation. However, this would mean a 6-day trip to Sundarban, for example, generates 6 times the value of a 1-day trip. In reality, this could lead to over-estimation of the value. So, we considered different durations of stay as different 'recreational services' while estimating the TGF. However, longer durations of stay (above 3-days) are rare among visitors in Sundarbans. Also a very short duration (1-day) was found to be an outlier because people usually spend 3-6 hours in the forest and because of the remoteness of the area it is difficult to return home on the same day. So, we estimated separate TGFs for 2-day and 3-day trips

6.1.4 Market Segmentation

To identify the possible market segments from the survey data, each of the respondents is identified with one of the seven tour types (packages) described in Table 1. We examined the tour packages for whether they differ in the quality of service they provide to visitors, or whether visitors rate them by the watch-tower visits they include. Any difference on the later count might relate to the probability of sighting a tiger and the scenic beauty of the sites the towers occupy. To confirm, we asked respondents from each of the tour packages about which of the five watch-towers they visited. We found that under each of the seven tour packages, there is similar divergence in the coverage of five watch towers. Each package offers different durations of stay in the Sundarban and longer durations cover more of the towers during the forest trip (Figure 6).

With similar coverage of towers under each package, we conclude that, the packages do differ with respect to their quality of service and is picked up by visitors' depending on their per capita income (obtained from survey data). Table 3 contains the distribution of these average values across the seven tour types. The tour options can be broadly divided into 'high-cost' and 'low-cost' categories which appeal to visitors with different levels of per-capita income. Accordingly we opted for a two-segment split of the recreational market which is described in Table 4.

This analysis was possible using only the second set of data (3 per cent of visitors). However, the first set (73 per cent of visitors) had been used to decide zonal visitation rates. The number of visitors in each segment in first data set has been computed by splitting them into two segments using the ratio obtained from second data set.

6.1.5   Number of Zones

Deciding the number of zones in a ZTCM study is a challenging issue. Firstly, the zones should be identified in a way such that information on zonal socio-economic statistics is available from secondary sources. Secondly, the number of zones should not be too many so that a 'zero

visitations' appears in a zone and at the same time it should not be too few to limit the degree of freedom during estimation of TGF. Keeping these constraints in mind, we concluded in favour of 8 zones comprising one or several districts of West Bengal and Rest of India (ROI). The zones are described in Table 5. None of these zones have zero total visitation rates but a few zones showed zero visitation rate from one market segment. This is plausible because all types of tour packages are not picked up by visitors from all zones due to economic viability or convenience. For example, visitors residing in the zone nearest to the site did not avail high cost packages which originate from a farther point (Kolkata).

6.2 Zonal Explanatory Variables

Although variables such as age and sex of the respondents are used very much as the determinants of visitation frequency to a site for estimating TGF in ITCM, in zonal models these variables normally do not appear because such variables remains undefined for a zone. On the other hand, per-capita income of zones may vary and so it stands as a regressor. Using the survey data, we calculated per-capita income from the visitors from each zone. However, we found that only richer visitors came from distant zones and the survey estimates of zonal average per capita income were not representative of true zonal averages. The effect of income is supposed to be captured in this study by the dummy variable used for two segments (high-cost and low-cost) of the market.

We also collected information on the primary occupations and educational qualifications of the respondents. Occupation wise, we found that maximum number of visitors came from service sector (Figure 7). A negligible percentage of respondents reported agriculture as their primary occupation implying that the farming community which is among the poorest of all does not spend money on a luxury good like 'nature tourism'. Turning to respondents' educational qualifications, we found that none of the visitors have failed to complete primary education (Figure 8). While detailed information on educational status at the zonal level are not readily available, 'literacy rates' (in percentage) are available district wise and for the country as a whole.

This exploration of survey data provided the clue that at zonal level, 'literacy rate', 'percentage of urban population to total population' and/or 'percentage of working population engaged in service sector' might be significant determinants for visitation rates. Secondary data show that there is a significant variation with respect to these variables across zones (Table 6).

Secondary data on districts were used from Census estimates of 2001. Using it for district level and assuming equal rate of change in these variables across zones over time, the district level data were projected for 2005-06. Since some zones comprised of several districts of West Bengal, data for each constituent district was weighted by its population to derive corresponding zonal averages.

7. Empirical Estimates

7.1 The TGF

The summary statistics from survey data (Table 7), show the distribution of average travel cost across zones, durations and market segments, and justify the use of dummy variables for segments and durations in estimation the TGF. The distinction in the market segments and durations is also

evident from the scatter plots shown in Figures 9 and Figure 10. We carried out estimation on the pooled data for eight zones, two durations of stay and two market segments. We also calculated zonal visitation as the estimated number of visitors 'per 100,000 people' from that zone. The visitation rate data from primary survey showed 28 non-zero entries resulting in the same number of data points. Scatter plot of data also showed evidence of non-linear relationship between them. Experiments with different alternative forms suggested a double-log relationship between visitation and travel cost as the most suitable for linear regression.

We found two possible regressors, percentages of service-sector workers and percentage of urban population, to be highly positively correlated and one of them had to be dropped as to avoid the problem of high multicollinearity. Zero and higher order partial correlations between them suggested 'percentage of workers in service-sector' as the more acceptable explanatory variable against 'percentage of urban population'. Zonal 'literacy', showed a weak correlation with visitation and did not provide statistically significant relationship during various regression runs. Table 8 shows the final set of variables used in estimating the TGF. After taking care of possible heteroskedasticity in zonal data, robust estimates of regression coefficients were obtained which are shown in Table 9.

We found travel cost and percentage of working population engaged in service sector in a zone are the two most important determinants of zonal visitation. While travel cost was negatively related with the visitation rate, the percentage of population engaged in service sector was found to have significant positive effect on the zonal visitation rate.

Both the dummy variables obtained significant positive coefficients implying that demand for a 3-day trip would be more than 2-day trips and that demand for a high-cost package would be more than the low-cost packages, if they were available at the same 'cost'.

7.2 Valuation – the Consumer Surplus

With the estimated TGF, we arrived at a recreational value of the site by estimating aggregate consumer surplus (CS). The TGF was used to derive the relationship between 'visitor number' (per 100,000 population) and travel cost for each zone ($j=1,2....8$) and for each segment and duration. As an example, for low-cost (HIGHCOST=0) and two-day duration (THREEDAY=0) trips, we estimated visitor (demand) per 100,000 population from zone 'j' as

$$LNVST_j = CONST + \beta_1 LNTRVCO + \beta_2 SRVC_j$$
$$= \beta_1 LNTRVCO + Z_j \qquad (Say)$$

$$or, \quad VST_j = TRVCO^{\beta_1} . e^{Z_j} \quad ....(1)$$

In a double-log form, the estimated number of visitors is never truly zero as the demand curve never touches the vertical axis. So, to calculate the choke price for demand given in (1), we raised the travel cost successively until the estimated number of visitors (for the specific segment and duration) from zone 'j' was *rounded off* to zero. Following the methodology described in section 3, if T_j^0 and T_j^C are the actual travel-cost and choke-price respectively, then CS (per 100,000 population) for zone 'j' is calculated as:

$$CS_j = \int_{T_j^0}^{T_j^c} VST_j \, d(TRVCO)$$

$$= e^{z_j} \int_{T_j^0}^{T_j^c} TRVCO^{\beta_1} \, d(TRVCO)$$

$$= e^{z_j} \frac{1}{\beta_1 + 1} \left[(T_j^c)^{\beta_1 + 1} - (T_j^0)^{\beta_1 + 1} \right]$$

This estimate was multiplied by the total population (unit of population in 100,000) to obtain the CS for zone 'j' for the specific segment and duration. Similarly, for other segments and durations and for other zones, we estimated CS and the sum of these estimates was considered the value of recreational services of the Indian Sundarban as revealed by Indian visitors.

The aggregate CS was obtained to be INR 15.1 million (US$ 0.377 million[5]) for the Indian Sundarban during 2005-2006. Table 10 shows its distribution across zones, segments and durations. We found that as a single zone, the city of Kolkata derived the most (34 per cent) of CS followed by the neighbouring district of North 24 Parganas (28 per cent). As for the segments and durations, we found that the three-day visitors under 'low-cost' packages contribute almost 60 per cent of the total CS for the Sundarban (Figure 11).

7.3   Revenue Maximising Entry-fee

A Travel Cost Method study is well suited for a site like the Sundarban to find an entry fee that can maximise revenue collection for the authority. With the TGF, successive changes in per capita travel cost (representing equal changes in entry fee) can be introduced. This will yield sets of estimated number of visitors and corresponding revenue collections. Initially, depending on the elasticity, higher entry fees will raise revenue collection. However, this positive relationship will reverse after some point. In our study, the entry fee of INR 15 per visitor per day is found to be grossly sub-optimal. Total revenue collection from domestic visitors is presently estimated at INR 1.39 million (US$ 0.03 million) whereas our study estimates show that it can be raised by over three times to INR 4.96 million (US$ 0.12 million) if revenue maximisation is the objective of the authority. The projections of revenue collection against various entry fee levels are shown in Figure 12 and we find the revenue maximising entry-fee is INR 154 per visitor per day.

8.   Conclusion and Policy Implications

In this paper, we estimate the recreational demand for the Indian Sunderban. The Indian Sunderban received 63,900 visitors during 2005-2006 and tour operators are unanimous that the number is growing each year. Of these, some 50% are from Kolkata and the rest mainly from various parts of West Bengal. Tourism is highly seasonal and characterised by few multipoint tourists or foreign visitors. A majority of the visitors are educated and employed in service sector.
We estimate the annual recreational value of the Indian Sundarban to be approximately INR 15

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[5]   Using Exchange rate US$ 1 = INR 40

million (US$ 377,000). This estimate of the recreational value of the Indian Sundarban needs to be read with certain provisos. We have left out of our calculations the small number of visitors whose durations of stay are one day and more than three days. We have also omitted foreign visitors. Though small in number, these categories would push our demand estimates upward. We have also likely underestimated population numbers since we use data from the 2001 Census and the likely increase in visitors from Kolkata and other metropolitan regions, both of which must exert a positive effect on the absolute value of consumer surplus.

The tourism market in the Sunderban is divided into two segments catering to tourists with differential income. It may be useful for park authorities to consider which part of the market they would really like to grow and in what fashion. The number of visitors is likey to swell with increased amenities for tourists and with information dissemination to attract new visitors as well as with the transformation of the Indian economy with more people being engaged in the service sector. Going by the present dynamics of Indian economy, it is not a distant possibility when such an increase may put pressure on the carrying capacity of the site.

An important observation is that the current entry fees to visit the Sunderban are very low and park authorities are able to capture less than 10% of this consumer surplus. If the fees are increased from the current value of INR 15 to INR 154 per visitor per day, total revenues can be increased by more than 300 per cent. This would bring nearly INR 5 million (US$ 0.12 million) per year in revenues to the park. Improved facilities and infrastructure are also likely to lead to both increased visitation and higher revenues. The authorities may need to devise long term plans to cope with potential increase in visitors and may want to use estimates of elasticity of demand in considering future entry fees.

9.   Acknowledgements

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APPENDIX

Questionnaire for Tourists

Letter of introduction[1]:

Dear Tourist,

We are carrying out a Research Project titled "Estimation of Tourism Demand in Indian Sundarban and its Contribution to Local Economy". **The Research is being hosted by the** Global Change Programme (GCP), Jadavpur University**, Kolkata and is being sponsored by** South Asian Network for Development and Environmental Economics (SANDEE)**, Kathmandu, Nepal.**

We ask for your valuable help, as this can lead to better tourism in Sundarban which can strengthen the local economy. We seek your cooperation in providing some information, which will enable us to successfully carry out the research. We will ask you about your experience in this region, your family, occupation and a few other questions that will be used to understand tourism-related economic issues.

In doing so, WE ARE NOT ASKING YOUR NAME OR ADDRESS OR ANY OTHER CONTACT INFORMATION. **Your help to the field investigators in filling up this questionnaire is highly appreciated. You can fill the questionnaire yourself too, with any necessary help from the investigator bearing this letter.**

The information collected by this questionnaire will be used exclusively for the GCP-SANDEE project under Jadavpur University during 2005-2006. The information you supply will be strictly confidential.

Thanking you,

Yours faithfully,

Dr. Indrila Guha
Principal Investigator, GCP-SANDEE Project

Dr. Santadas Ghosh
Co-Investigator, GCP-SANDEE Project

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[1] While conducting the questionnaire survey, our field investigators had handed over this letter to the visitors.

THE GCP-SANDEE PROJECT (2005-2006)[*]

Questionnaire for Tourists

Questionnaire No.

Date of filling up this questionnaire:

This Survey Questionnaire is to be filled up by tourists (excluding foreign nationals) staying in any of the hotels/lodges in Pakhiralay village (Gosaba) or WBTDC-run Tourists Lodge in the Sajnekhali Reserve Forest. Information should be collected only from tourists who have completed their trip inside the forest and are about to leave the Sundarban. Not more than one respondent from a single family should be interviewed.

[*] Information collected by this questionnaire will be used exclusively for the GCP-SANDEE project under Jadavpur University during 2005-2006. The confidentiality of the supplied information will be duly maintained

SECTION-A: Information relating to tour costs and composition:

1. Duration of your stay in the Sundarban:

Date of your arrival in the Sundarban	Date of your departure from the Sundarban
……………/……………/…………	……………/……………/…………

2. (a) With whom you have come to the Sundarban? (Please tick √)

As a single Person	With own family members	In a group of more than one family (with relatives/ office colleagues/ friends)	In a group of friends without families	Any other group of persons (please mention briefly)

(b) If you have not come as a single person in this trip:

Number of persons in your group/family	Male (above 16 years)	Female (above 16 years)	Children (below 16 years)

3. Place of origin of this trip

Name of the Place	Sub-division (if known)	District /State

4. (a) Information on Tour Costs:

Per head transport cost to reach Sajnekhali/Pakhiralay from the place of origin of your trip:	Rs. ---------------
Per head food and accommodation cost for the entire trip: (as you estimated so far)	Rs. ---------------

(b) Please mention your spending on items you may have brought during your current visit to the Sundarban:

Item	Money Spent (Rs)
Honey	
Fish & Crab	
Local artefacts	
Any other (please mention)	

(c) Did you hire a boat to go into the forest?   YES / NO

(d) If "Yes", then

How many days was it hired for?	………………...Days.
What was the hiring cost (total)?	Rs. -------------------------
How many persons hired the boat together?	………………Persons.
What are the places you visited? (Please tick √ the relevant names)	Sajnekhali / Sudhanyakhali / Dobnaki / Netidhopani / Burirdabri

5. (a) Is this Sundarban trip part of a longer one-time tour programme? Are you also visiting other places?

YES / NO

(b) If "YES", please write the names of the other places according to your priority
(1 being the most desired place, and others in declining order):

(1)	(2)	(3)	(4)	(5)

6. (a) Have you visited the Sundarban before? :   YES / NO

If 'Yes',
(b) How often (exclude this visit)?

…...……Times

SECTION-B: Personal Information:

7. Please provide some personal details:

Age	Sex (Please tick √)	Religion	Whether this visit is sponsored by your employer or expenses will be repaid by any project/organisation (Please tick √).
.......Years	M / F		YES / NO

8. If you were not visiting the Sundarban, would you be carrying out your usual professional activities (office/business) for these days? YES / NO

9. Your Highest Educational Qualification: (Please tick √ the appropriate box)

1. Post-graduate and above	
2. Graduate	
3. Higher Secondary	
4. Secondary	
5. Below Secondary	
6. Primary	
7. Below Primary	

10. Your Primary Occupation: (Please tick √ the appropriate box)

1. Student	
2. Salaried employee (permanent)	
3. Salaried employee (casual)	
4. Self employed (own manufacturing/trading enterprise)	
5. Agriculture/fishery	
6. Professional (Doctor/Consultant/Other)	
7. Any other (please mention)	

11. Details of your family composition:
(please mention number in the right column)

Number of adult Males	
Number of adult Females	
Number of Children (Dependent)	
Number of family members accompanying you on this trip	

12. Information on Income and expenditure:

Your estimated expense per head on this trip (including return journey plan, excluding purchase of local product, if any):	Rs.
Your Aggregate Monthly Household Income: (from all sources)	Rs.
Your Aggregate Monthly Household Expenditure: (approximate, including all expenses)	Rs.

13. Any other comment/complaint about this trip/tour:

- - - - - - - - - - -[**Name and Signature of the field Investigator**] - - - - - - - - - - - - - -

TABLES

Table 1:   Types of Tours Packages: seven options in the survey questionnaire

Package Code	Tour type/operator
1	Self-made trip for individual or group visitors - with or without any fixed points for starting or ending the trip, no prior deal on food or accommodation or on boats to visit the forest.
2	Canning Package - with launches operated from Canning. 25-30 operators are in operation from Canning. Packages usually targets tourist from low to middle-income group
3	Sonakhali Package - operating seasonally from Sonakhali. A handful of seasonal operators; these are usually low-cost packages
4	Kolkata package I - 'All inclusive' package offered by WBTDC from Kolkata; the public sector undertaking (targeting high-income group)
5	Kolkata package II - 'All inclusive' package tours offered by 'Help Tourism' from Kolkata. (A private initiative; catering to high-income group)
6	Kolkata package III -'All inclusive' package tours offered by 'Sundarban Tiger Camp' from Kolkata. (A private initiative; catering to high-income group)
7	Custom-made package - Tour package (may not be all inclusive) offered by some enterprising individuals operating seasonally and offered to tourists, with or without any fixed originating or terminating point.

Note: The seven tour packages were identified using focused group discussions with 4 tour operators conducted prior to the survey and were finalized during pre-testing of questionnaire (in February, 2005)

Table 1:   Percentage of multipoint visitors across regions: survey-estimate

Origin of visitors	Per cent of visitors from the origin reporting multipoint tour
Five southern districts in West Bengal, including Kolkata	0 %
Seven districts in the west and central West Bengal	1 %
Five districts in north West Bengal	46 %
Rest of India	61 %
International	88 %

Table 3: Average travel cost and per-capita income across tour packages

Package Code	Average travel cost in INR per visitor (all durations)	Average per capita monthly income of visitors (INR)	Per cent of visitors taking the package
1	1,320	3,280	17.2
2	960	4,240	49.6
3	1,720	3,320	0.6
4	2,400	10,360	5.5
5	6,800	7,200	0.8
6	3,440	10,680	3.5
7	1,680	4,640	22.8

Table 4: The two-segment split of the recreational market used in the study

Segment 0 (Low cost)	Segment 1 (High cost)
Package codes 1, 2, 3 & 7	Package codes 4, 5 & 6

Table 5: Identification of zones used in estimating TGF (excluding foreign nationals)

Zone code	Composition
1	District of South 24 Parganas in West Bengal state, hosting the study site
2	Metropolitan city of Kolkata, itself a district in West Bengal, neighbouring zone 1
3	District of North 24 Parganas (West Bengal) neighbouring zone 1
4	District of Howrah (West Bengal) neighbouring zone 2
5	District of Hooghly (West Bengal) neighbouring zone 3
6	Districts of Nadia, Burdwan & Midnapore (East and West) (West Bengal)
7	Districts Bankura, Birbhum, Purulia, Murshidabad, Maldah, Dinajpur (Uttar & Dakhsin), Jalpaiguri, Coochbihar, Darjeeling (West Bengal)
8	Rest of India (ROI) - All of India excluding West Bengal

[The codes for the zones may be interpreted as their ranks with respect to geographical proximity to the recreational site]

Table 6: Zonal data from secondary sources[*]

Zone Code	Total zonal population	Per cent of zonal population living in urban area	Per cent of zonal population employed in service sector	Per cent of zonal literacy
1	6909015	16	52	69
2	4580544	100	96	81
3	8930295	54	72	78
4	4274010	50	73	77
5	5040047	33	56	75
6	21161927	22	41	71
7	29325333	12	36	59
8	948561239	28	35	65

[*] Directorate of Census Operations, Government of India, round 2001

Table 7: Summary statistics from survey data: distribution of visitors, travel cost and per-capita income across zones, durations and market segments

Zone	Low Cost Packages					
	Percent of sample visitors taking, such packages		Average travel cost per capita (INR)		Average per capita household monthly income (INR)	
	2-days Duration	3-days Duration	2-days Duration	3-days Duration	2-days Duration	3-days Duration
1	3.13	4.19	677	984	2,947	2,452
2	13.95	28.63	923	1,344	5,326	5,137
3	4.58	3.63	892	1,044	3,519	3,185
4	6.98	2.79	1,102	1,294	3,008	3,777
5	2.96	3.13	922	1,249	4,139	3,687
6	4.97	4.52	890	1,702	2,742	3,726
7	4.13	1.17	804	2,351	1,430	3,794
8	0.39	0.67	1,855	2,298	17,250	7,188
Zone	High Cost Packages					
	Percent of sample visitors taking, such packages		Average travel cost per capita (INR)		Average per capita household monthly income (INR)	
	2-days Duration	3-days Duration	2-days Duration	3-days Duration	2-days Duration	3-days Duration
1	0.00*	0.00*	-	-	-	-
2	4.02	1.67	2,306	3,824	8,516	8,440
3	0.11	0.11	2,938	4,727	NA**	5,000
4	0.50	0.00*	2,295	-	3,676	-
5	0.11	0.11	3,100	4,830	NA**	7,500
6	0.33	0.00*	2,796	-	7,708	-
7	0.33	0.39	2,592	5,066	9,732	6,352
8	1.28	1.23	2,768	5,313	22,552	11,560

No visitors in this category
**Visitors didn't reveal their income*

Table 8:   Variables used for estimating TGF

Variable	Description
LNVST	Natural log of visitation (visitation = number of visitors per 100,000 people)
LNTRVCO	Natural log of average travel cost per visitor
PCSRVC	Percentage of working population engaged in service sector - zonal variable
HIGHCOST	Dummy variable for segments = 1 for 'High-Cost Packages' = 0 otherwise
THREEDAY	Dummy variable for duration of stay = 1 if the respondent paid a 3-day visit = 0 otherwise

Table 9:   Regression Result for Trip Generating Function

Dependent variable: LNVST		Number of observations = 28
Regressor	**Coefficient**	**t-value**
CONSTANT	37.902	4.33***
LNTRVCO	-5.762	-4.46***
PCSRVC	0.066	7.49***
HIGHCOST	3.687	2.26**
THREEDAY	2.559	3.57***
$F(4, 23) = 31.57$ ** significant at 5% level; *** significant at 1% level	Prob > F = 0.0000;	$R2 = 0.8503$

Table 10:   Distribution of aggregate CS across zones, segments and durations
             (in Million INR)

Zone	2 days; Low cost	2 days; High cost	3 days; Low cost	3 days; High cost	Total
1	0.426	0.000	0.926	0.000	1.352
2	1.228	0.627	2.653	0.729	5.237
3	0.562	0.076	3.429	0.102	4.168
4	0.106	0.128	0.641	0.000	0.875
5	0.091	0.011	0.280	0.017	0.399
6	0.177	0.030	0.104	0.000	0.311
7	0.279	0.042	0.021	0.022	0.364
8	0.158	0.944	0.741	0.546	2.389
TOTAL	3.028069	1.857865	8.794947	1.414615	15.0955

FIGURES

Figure 1:   Distribution of zones around recreational site – in theory

Figure 2:   The Study Site

Survey of visitors had been carried out at the village Pakhiralay (P in the map) which is situated in one corner of the island of Gosaba (G). The nearest railway station is Canning (Cng) and the nearest road-link to the mainland is Sonakhali (Snkhli)
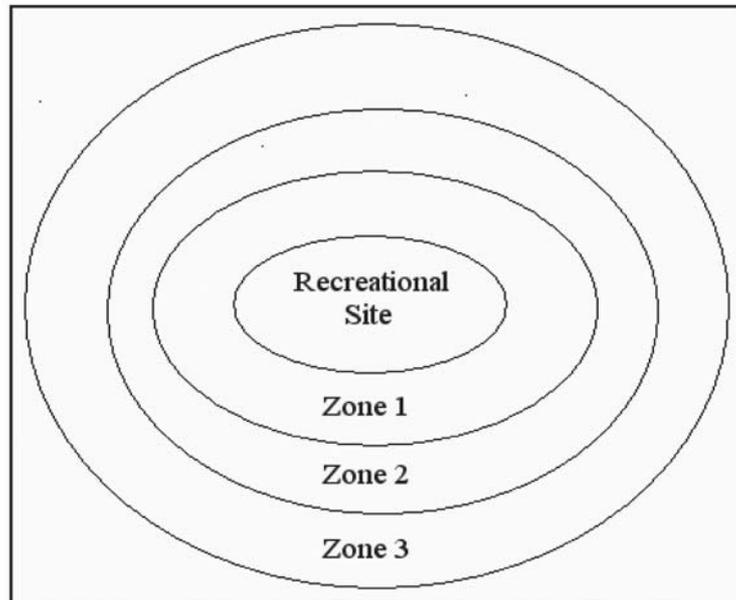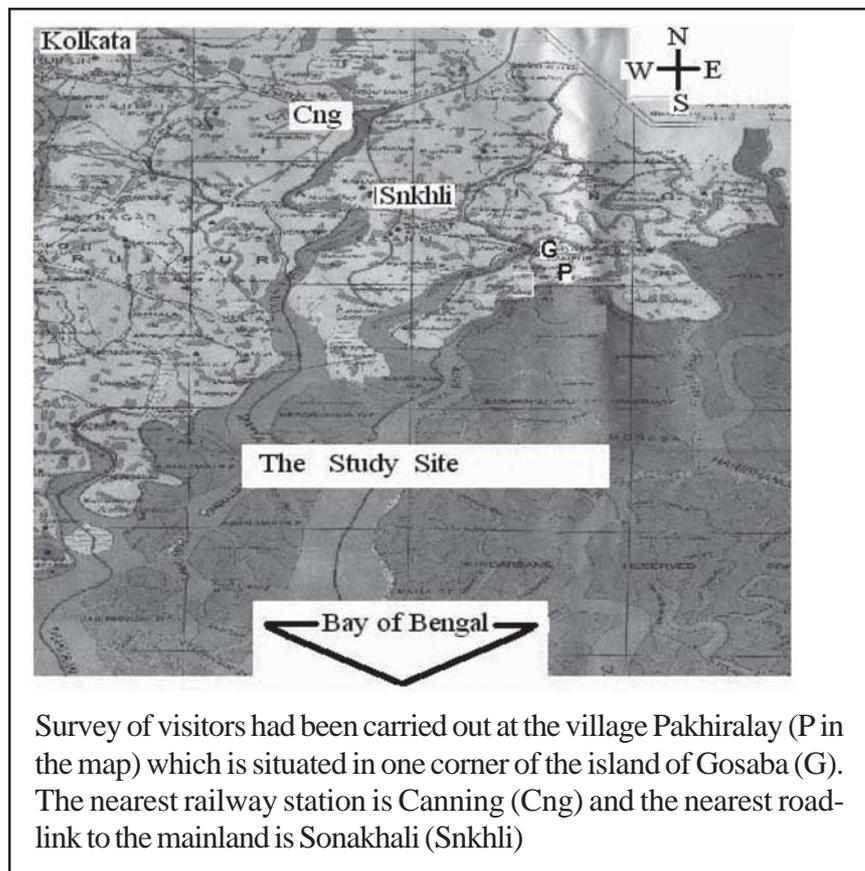
Figure 3:   Visitors' place of origin
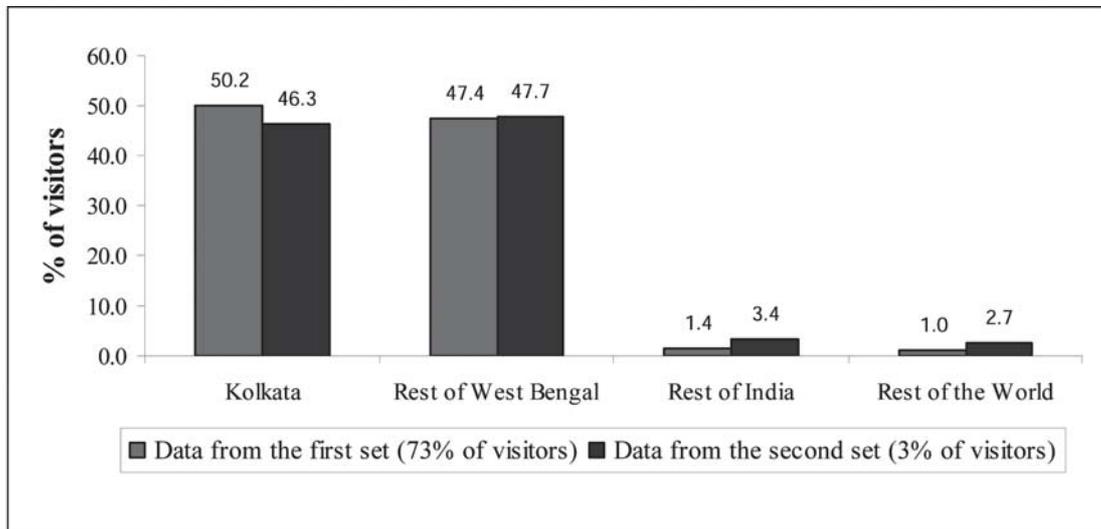
Figure 4:   Proportion of multipoint visitors in the survey
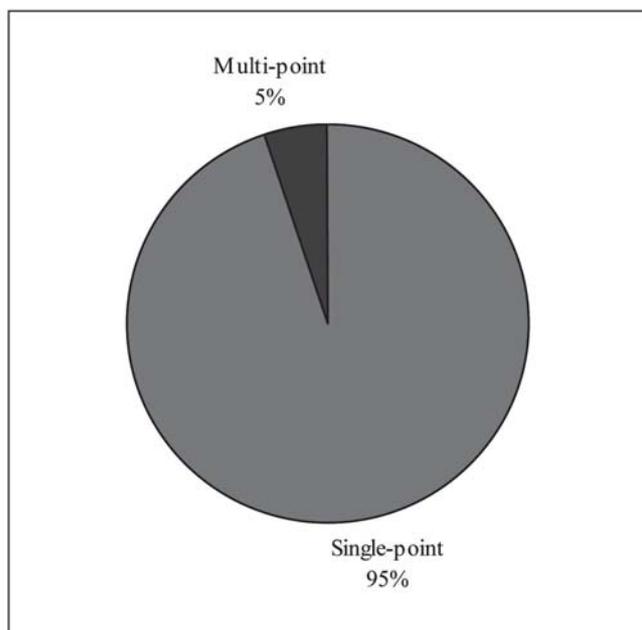
Figure 5:   Durations of stay from the sample of visitors
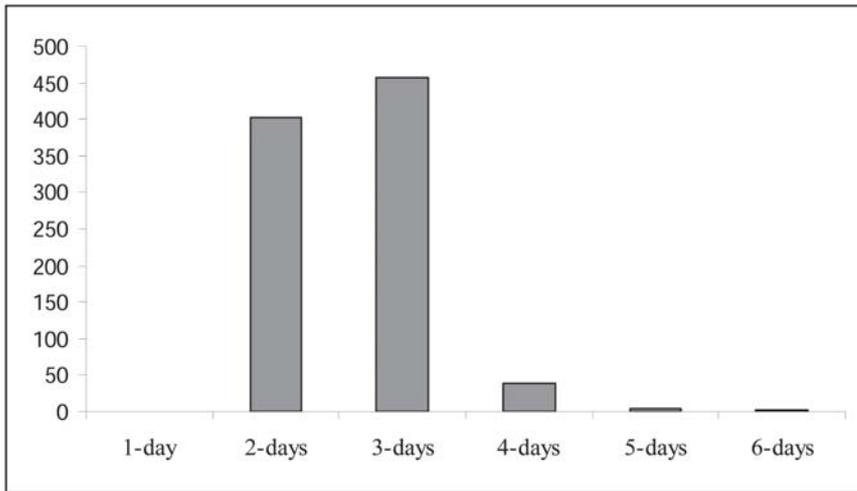
Figure 6:   Distribution of visitation rate for five watch-towers across seven tour packages
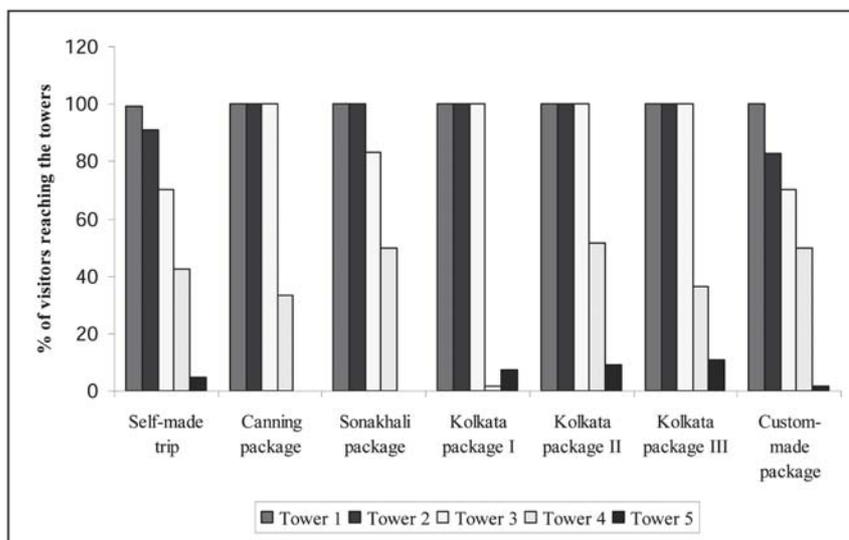
[The towers have been ranked according to their distance from the starting point (Pakhiralay), Tower 1 being the closest to it]

Figure 7: Occupational distribution of survey visitors
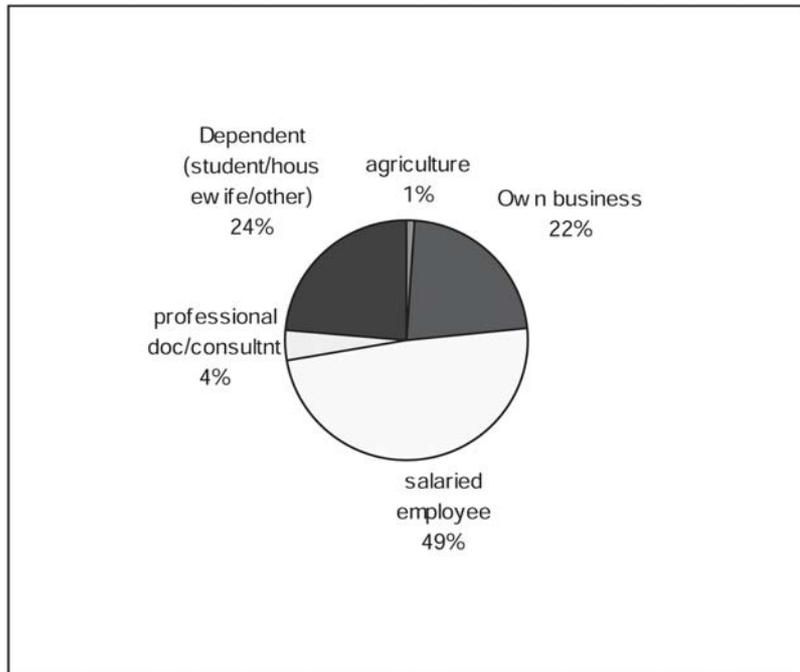
Figure 8: Educational qualification of survey visitors

Figure 9:   Scatter plot of visitation against travel cost – duration wise

(Black dots: 2-days; Red dots: 3-days)

Figure 10:   Scatter plot of visitation against travel cost – segment wise

(Black dots: Low-cost; Red dots: High-cost)
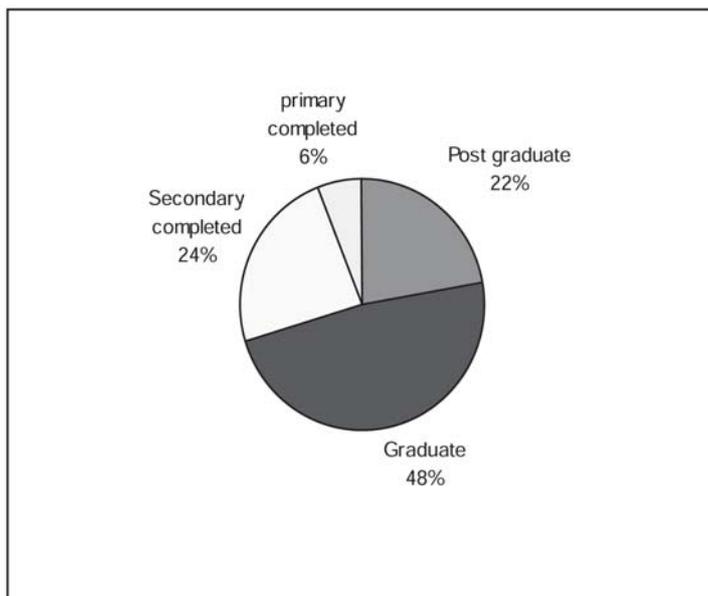
Figure 11:   Shares of durations and segments in aggregate consumer surplus
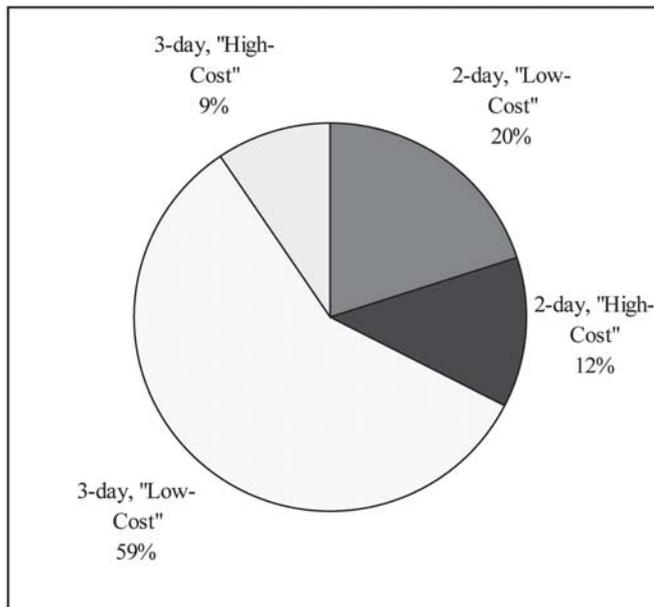
Figure 12:   Projection of revenue collection with varying entry-fee rate
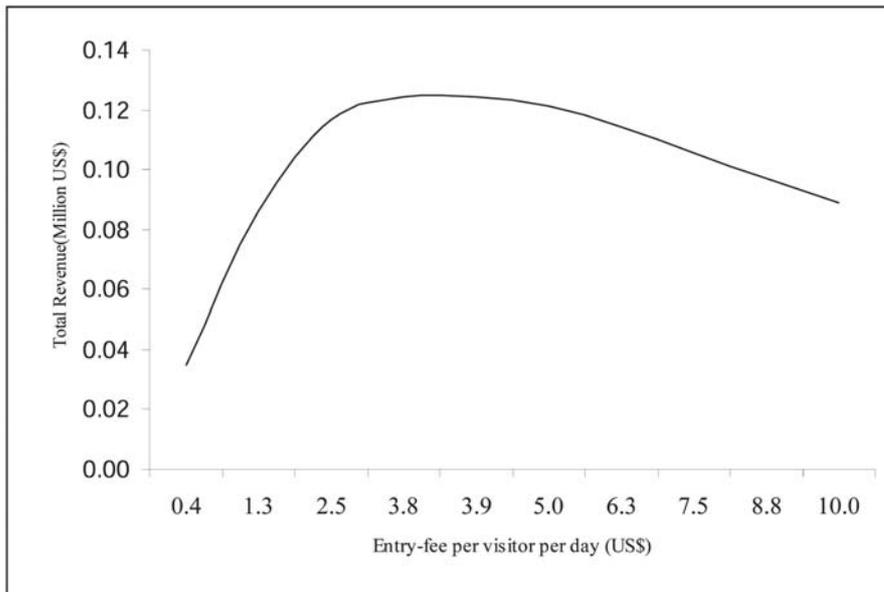
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South Asian Network for Development
and Environmental Economics

SANDEE
PO Box 8975 EPC 1056
Kathmandu, Nepal

Tel: 977-1-552 8761
Fax: 977-1-553 6786
E-mail: info@sandeeonline.org
Website: www.sandeeonline.org

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