IMPACT: International Journal of Research in Business Management (IMPACT: IJRBM)
ISSN (E): 2321-886X; ISSN (P): 2347-4572
Vol. 4, Issue 3, Mar 2016, 125-134

ESTIMATING BIODIVERSITY VALUE OF EAST KOLKATA WETLAND IN WEST BENGAL -A CONTINGENT VALUATION APPROACH

ANWARUL HAQUE[1] & SHOWKAT AHMAD SHAH[2]

[1]Research Scholar, Department of Economics, Faculty of Social Science, Jamia Millia Islamia, Jamia Nagar, New Delhi, India

[2]Research Associate, ICAR-National Institute of Agricultural Economics & Policy Research, Pusa, New Delhi, India

ABSTRACT

Wetland biodiversity in urban areas is an issue of primary concern, especially in developing nations where major portion of people obtain their livelihoods from such type of wetlands. This paper highlighted the significance of East Kolkata wetland-based biodiversity. One of the most important factors which heavily contributed to degradation of East Kolkata wetlands is the lack of understanding of their economic, ecological and socio-cultural values among all the stakeholders. The study attempted to achieve the objective of valuing wetland biodiversity conservation by eliciting respondent's willingness to Pay (WTP) using Contingent Valuation Method (CVM). The results showed that about more than half of the household respondents were WTP for wetland biodiversity conservation. The study explored that respondents with high education, income are found more likely to accept hypothetical CV scenario than households earning directly income from it and who shift from wetland. The average WTP was found Rs. 410 per year for wetland biodiversity conservation indicated that urban wetlands have high conservation value. The findings from the present study can be used as a policy instrument for management and conservation of wetland biodiversity and other ecosystems. There is need for designing area-specific policy tools which may also help for efficient and better management of wetlands.

KEYWORDS: Wetland Biodiversity, Contingent Valuation Method, Willingness to Pay

INTRODUCTION

Wetland biodiversity is central to the stability of the earth's ecosystems (Schuyt and Brander 2004; Nijkamp et al. 2008; McCartney et al. 2010). Besides recreational, aesthetic and ecological values, wetland biodiversity is also a rich source of substances having high medicinal and therapeutic value for many diseases like quinine (*Chinchona officinalis*), used for the treatment of malaria and taxol etc. (Kumar and Kumar, 2012). However, due to high natural and human cantered pressures leads such property of wetland ecosystem to extinction. Hence, one of the crucial wetland functions is maintenance and sustenance of biodiversity. Non-market valuation methods like Contingent valuation Method (CVM), Travel Cost Method (TCM) and Hedonic Price Method (HPM) etc are effective tools to arrest the problems, aid and wise-use of wetland resources (see Barbier et al. 1997, deGroot 2002).

The status of wetlands and wetland-based biodiversity in West Bengal, are quite disquieting and dismal despite much hue and cry about the need for their preservation and management for sustainable uses. Among various reasons poverty, increasing pressure from population and additional demand for land for agriculture and development activities, unsustainable consumption of wetland resources, lack of policy and regulatory measures and lack of understanding of

wetlands' economic importance have made the situation very complex. There is no clear-cut policy which deals with the problem of management and conservation of wetlands. For our study we choose a wetland from West Bengal of International importance i.e. East Kolkata wetland (EKW). Due to its immense ecological and socio cultural importance, the Government of India, declared EKW as Wetland of International Importance under Ramsar Convention in 2002. East Kolkata Wetlands, situated on the eastern periphery of Kolkata city is one of the largest assemblages of sewage fed fish ponds stretch over an area of 12,500 ha. These wetlands uphold the world's largest and oldest integrated resource improvement practice based on a combination of agriculture and aquaculture, and provide livelihood support to a big, economically underprivileged population of around 27,000 families which depend upon the various wetland products, primarily fish and vegetables for sustenance (East Kolkata Newsletter, 2010; National Wetland Atlas, 2010).

Changes in land use, quick siltation due to changes in hydrological regimes, pollution and stakeholder conflicts have greatly impaired the wetland performance. The wetland located on the peri- urban interface of Kolkata City has been under continuous pressures for conversion for settlements and agriculture. A number of scientific studies on diverse aspects of the wetland have also been carried out by state government departments, research agencies, and others. Though, these efforts have largely been limited to academic exercises and research and no organized move towards conservation and sustainable development of these wetlands has been adopted. The wetland ecosystem faces serious threat to its ecological quality, and thereby endangering the overall sustainability of the resource recovery practices which forms the base of survival of the whole Kolkata city, and of the livelihoods of 0.2 million poor who depend on its resources for sustenance. Extensive studies has been carried out in exploring the economic value of wetlands and wetland-based biodiversity (see Pearce 1994; Craig et al. 1996; Nunes et al. 2000; Hammitt et al. 2001; Kwak et al. 2007; Flaming and Cook 2008and Nijkamp et al. 2008)

Wetland valuation is still inadequate in West Bengal, and particularly for a case like the present study on East Kolkata wetland. The present study is a modest effort to understand the economic importance of biodiversity of the selected wetland keeping in mind its larger policy perspective. Against this backdrop the aim of the study is to evaluate the Willingness to Pay (WTP) of the residents for protection and conservation of the wetland-based biodiversity.

METHODOLOGY AND DATA SOURCES

The selected wetland has potential non-use values such as option value, passive value or bequest value. Vast diversity of identified and unidentified species of birds, reptiles, fishes, plants and trees and micro-organisms are found in this wetland which have high non-user value. Without understanding non-use values an economic valuation of wetland biodiversity cannot be appropriate. On that ground we chose a survey based technique i.e. Contingent Valuation Survey (CVS) for the present study to capture the non-user values (biodiversity) of the selected wetland. We used this technique on the basis of its credibility and effective non-marketable goods measuring method (Carson 2012 and Haab et al. 2013). Following the National Oceanic and Atmospheric Administration (NOAA) "blue ribbon" panel's guidelines a questionnaire was designed for CVS (see Arrow et al., 1993 for details).

After pre-testing questionnaire, a final Contingent Valuation questionnaire was used to elicit the willingness pay and other socio-economic and demographic determinants of respondents. On the basis of sample size determination formula a sample of 207 respondents was chosen within the radius of 5Kms from East Kolkata Wetland (EKW) randomly. These were the local residents and get directly benefited from the wetland. Before asking the question of WTP, a

hypothetical market scenario about wetlands improvement position was presented before respondent. Out of 207 questionnaires, 195 were used for estimating results[1].In the present study data collected via CVM had one dependent variable with qualitative and binary choice (Yes or No type of answers) nature. A 'Binary Logistic Regression Model' has been employed for analysis of respondents WTP for conservation of East Kolkata wetland biodiversity. Logistic Regression Model was considered as an appropriate for this type of study (Loureiro and Umberger 2003). Hence, Probability (P_i) reveals that one accepts to pay a maximum amount (in Rupees) for conservation of wetland. A linear expression of the model is as follows:

$$WTP(yes = 1) = f(Age + \text{Sex} + Edu + MI + FlyS + ErW + WSW). \quad (1)$$

Whereas WTP is probability of acceptance chances of willingness to pay is dependent variable and independent variables are socio-economic and other characteristics of respondents.

RESULTS AND DISCUSSIONS

Descriptive statistics of variables used in demand function of Contingent Valuation analysis, based on 195 observations are depicted in Table-1. These variables represent the socio-economic and demographic characteristics of the respondents in study area.

WTP: Willingness to pay for improving the wetland services is dummy (dependent) variable (yes or no).The Probability of yes [P(Yes)] represents response to WTP question attaining the value of '1' for yes and '0' for 'No'.About 62% of respondents were willing to pay for the improvement of wetland services and 38% of the respondents were not willing to pay.

MI: Total Monthly Income (TMI) is a continuous variable representing the household's monthly income from all sources in Rupees. It varied from Rs. 2000 to Rs. 22,000 with mean TMI of Rs. 9982.56.

Table 1: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age	195	25	85	49.16	11.39
Sex (Male=1Female=0)	195	0	1	0.93	0.25
MSts(Unmarried=1)	195	0	1	0.96	0.19
Edu(mean year of schooling)	195	0	17	4.49	5.28
MI (Rupees)	195	2000	22000	9982.56	3706.83
FlyS	195	2	12	5.91	1.85
WTP(yes=1)	195	0	1	0.62	0.48
Er_W	195	0	1	0.67	0.47
WSW	195	0	1	0.28	0.45

Source: *Field Survey Data (2015)*

Age

[1]The rest (11) were provide incomplete information and are protesting the hypothetical market scenario of CVM.

Age was used as continuous variable representing age of adult respondents in years (above 18 years). It ranged from 25 to 85 years with a mean value of 49.16 years.

Sex

It is a dummy variable. One represents male and zero represents female. About 93% respondents were found male and 7% were Female.

Education (Edu)

Education is a continuous variable representing number of schooling years completed. Maximum number of schooling years of respondents was found to be 17 years (Masters) in our sample whereas average number of schooling years was 5.28 years.

Marital Status (MSts)

It is a dummy variable. About 96% respondents were found married and only 4% are unmarried in the total sample.

ErW

Earning from wetland (ERW) was a dummy variable which takes value of 1 if the respondent's source of earning was from any wetland good or service, otherwise zero. Mean value (0.67) showed that 67% of the respondents earn from the wetland resources or were engaged in different economic activities.

WSW

Willing to Shift from wetland to other places (WSW) was used as dummy variable which attains the value of 1 if the respondents are willing to shift from wetland to other places, otherwise zero. Average value (0.28) reflected that about 28% of the respondents were willing to shift from wetland to other places.

Family Size (FlyS)

Family Size ranged from 2 to 12 years with a mean value of 5.91 members.

Psychology and Attitudes of Respondents towards Biodiversity

The survey surprisingly reported a higher level of concern and Positive attitude towards biodiversity. About 60.5% of the sampled respondents were very much concerned about the biodiversity of East Kolkata wetland. Among other respondents 17.4% are concerned and 22.1% are mildly concerned. It implies that people were concerned about environment and understand the need for its management and preservation.

Table 2: Respondents Psychology & Attitude towards Environment/Biodiversity of East Kolkata Wetland

Psychology	No. Of Household	Percent
Very concerned	118	60.5
Concerned	34	17.4
Mildly Concerned	43	22.1
Total	195	100

***Source**: Field Survey Data (2015)*

Table 3 below present respondents' opinions about the question of how to improve the environmental quality and biodiversity of East Kolkata wetland. Majority of the people suggested that stop pollution, give environmental awareness and stop encroachment and de-weeding can significantly improve and conserve the wetland based resources.

Table 3: Suggestion to Improve the Environmental Quality and Biodiversity of East Kolkata Wetland

Suggestions*	No. of Household	Percent
Awareness	26	13.3
Boundary Fencing	12	6.2
Deweeding	23	11.8
Govt Initiative	22	12.3
Staff for Cleaning	5	1.5
Stop Drains Inclusion	6	3.1
Stop Encroachment	25	12.8
Stop excess fishing	19	9.7
Stop Pollution	57	29.2
Total	195	100.0

***Source**: Field Survey Data (2015)*

* Taking into consideration of multiple answers for the same question

RESULTS FROM BINARY LOGISTIC REGRESSIONS

Estimated results of CVM were obtained by using Binary Logistic Regression Model in econometric software (STATA 12.0). A Pseudo-Maximum Likelihood Estimation Technique was employed for estimating the parameters of variables and results were reported in Table-4. Response of WTP (i.e. 'yes' taken as the dependent variable) was regressed on set of independent variables [i.e. Monthly Income of Respondent (TMI), Age of the Respondent (Age), Sex, Education of Respondent (Education), Earning from Wetland (ErW),Family Size (FlyS), Willing to Shift from East Kolkata wetland to other places (WSW)]. Five out of seven variables were found significantly associated with Willingness to Pay.

Table 4: Results from Binary Logistic Regression Model for East Kolkata Wetland

Wtp	Coefficient.	Standard. Error	Z	P>Izi	[95% Conf.] Interval	
Age	0.049	0.025	1.920	0.055**	-0.001	0.099
Sex	-0.592	0.846	-0.700	0.484	-2.251	1.067
Edu	0.430	0.080	5.390	0.000*	0.274	0.586
MI	0.000	0.000	1.850	0.064***	0.000	0.000
FlyS	-0.225	0.140	-1.600	0.110	-0.500	0.051
Er_W	-1.999	0.718	-2.780	0.005*	-3.406	-0.591
WSW	-1.847	0.589	-3.130	0.002*	-3.002	-0.692
_cons	-0.455	1.796	-0.250	0.800	-3.974	3.064
Number of obs	195					

Table 4: Cond						
LR chi2(7)	148.04					
Prob> chi^2	0.000					
Pseudo R^2	0.5718					
Log likelihood	-55.423					

Source: Field Survey Data (2015)

Note: *, **, and *** are significant at 1%, 5%, and 10% level respectively

Expected relationship between significant variables with the WTP was in line with the economic theory. Coefficient of household monthly income (MI) was found positive as expectation. The likelihood of WTP for wetland biodiversity conservation increases with the increased in income. It was found significant at 10% level (see Table-4). Previous studies conveyed mixed results. Coefficient of income was found positive and having significant influence on environmental WTP in some studies such as [Adekunle et al. (2006); Ahtiainen (2007); and Bhatt et al. 2014]. However, the coefficient of income was found significant and having negative effect on WTP as shown in Chen and Chern (2002) study.

Co-efficient of age was significant at 5% level with a positive sign. It implied that older the person more the willingness to pay for improving wetland. Earning from wetland (ErW) co-efficient was significant at 1% level with negative sign which means that more are the people directly getting benefits from wetland less they willing to pay for its conservation of biodiversity..

Co-efficient of education (Edu) variable turned out to be positive with significance at 1%. This implied that educated respondents were more willing to pay for improvement. They were supposed to have high understanding level of desirability of improvement and proper management of environmental resources. Result of this variable was in line with Jaffrey et al. (2012) and Bhatt et al. (2014), in which it was found that educated people would pay more for the conservation of environmental sites. Lastly, coefficient of willing to shift from East Kolkata wetland to other places (WStRs) had expected negative sign with a significance of 1% level. The direction of the variable reflected that a household if willing to shift from the wetland area to some other places, therefore, was not willing to pay for improvement of East Kolkata Wetland. It is also reported in Table-4that overall Model is significant with CV data. Loglikelihood was -55.42 with P-value less than 0.01and Pseudo R^2 was worked out as 0.57 which showed that overall model is significant.

Willingness to Pay For East Kolkata Wetland (EKW) Conservation Scheme and Welfare Estimates

EKW has potential use and non-use values. People living in and around the wetland obtained not only livelihood for their sustenance but also generate huge source of income and employment. Thus, it is, therefore, imperative to use the wetland in a sustainable manner. In the present study, CVM was used to estimate the conservation and management value of wetland by using open-ended questionnaire format for elicitation of responses of WTP (yes/no) and other related questions. The analysis done on the basis of responses from two main questions asked during CV survey i.e. “Are you

willing to pay for conservation scheme for EKW?" and "How much you are willing to pay for it?" showed 62% of the respondents (benefitted from the use values of the EKW) were WTP for its improvement. Respondents' willingness to pay ranges from Rs. 90 to Rs. 1800 per-year with a mean of around Rs. 410 per year (Rs. 34/month). The estimated results of WTP were almost similar with the results of WTP of stakeholders for conservation of East Calcutta Wetland in the study of Chattopadhyay et al., (2001) i.e. paying the amount varies from Rs. 60 to Rs. 1,200 per-household per-year and the average WTP for East Calcutta Wetland with an average of Rs. 380 per household per-year. Aggregate WTP for improvement of EKW was computed as Rs. 79950, which was calculated by multiplying mean WTP by total number of sampled households. Even though in monetary terms the value was not quite high due to the poor surrounding society of the wetland. But given 62% acceptance rate of the hypothetical preventive treatment interventions are highly desired and demanded in the study area. However, about 38% respondents among the sample of (205) were not willing to pay any amount (zero values) for proposed improvement or conservation programme. Almost in all the CV studies a proportion of respondents gave various reasons for not paying any amount for such programmes of environmental goods and services (Bradley et al. 2001). In the present study, households gave multiple reasons for rejecting to pay for proposed project are shown in table 5.

Table 5: Reason for Not Willing To Pay By Respondents of East Kolkata Wetland (N=195)

Reasons	No. of Household	Percent
Financed out of national and international funds	65	33.3
Residents have right to use	13	6.7
Paying taxes to the government	23	11.8
Lack of Management	6	3.1
Do not trust govt. Sponsored management	88	45.1
Total	195	100.0

***Source**: Field Survey Data (2015)*

It shows that around 33.3% respondents were not WTP because, they believed that it is funded by national and international organizations. People said wetland is a public good and it is government's duty to maintain and improve quality of the wetland. About 6.7% of households from the present study are not willing to pay as they were the residents of that place and they have the right to use the resources of that wetland. Almost all the households living in and around the wetland were paying some taxes or fees to government and consider that it should be used for lake's betterment. Against this backdrop, about 11.8% said that they were already paying taxes to government for this purpose and 3.1% respondents not willing to pay because of lack of management. About 45.1% of the sampled households did not trust any management scheme.

CONCLUSIONS

Present study is an effort to aware the conservation value of wetland. The study highlighted that people were willing to pay for its conservation even though having low economic status. We employed the Contingent Valuation Method (CVM) for obtaining households' WTP for conservation of the EKW. A Binary Logistic Model (BLM) was employed to obtain estimated results. These results depicted, relationship between Willingness to Pay (WTP) for conservation of wetland resources and various socio-economic and other determinants. It showed that WTP of households

was directly influenced by income, education, age and indirectly related with households shift from wetland and earnings from wetlands. Despite obtaining huge benefits from the wetland, households claimed that its health is far from satisfactory. Estimation of economic value of EKW reincarnates its significance as a precious natural asset providing varied functions and services to people. Hence its conservation, overall development and sustainable management should be an important policy objective and national priority.The findings of the study can also be used for larger societal awareness about the wetlands and wetland-based biodiversity, including other wetland resources. There is need for designing area-specific policy tools which may also help for efficient and better management of wetlands. Economic valuation studies should be undertaken for wetland-based resources like biodiversity to estimate their economic, ecological and other socio-cultural values.

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