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Valuation of non-use values of wetlands-A study of Kachan in West Bengal, India

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Abstract
Wetlands in India perform important role in terms of providing life sustenance to poor people and roof of habitat for numerous biodiversity. However, the fragile ecosystem is under threat to over-use and lost their non-use benefits. The study taking the case of a Kachan wetland, Uttardinajpur (West Bengal) which provides important policy signals regarding the conservation and management of natural resources. Using Contingent Valuation Method (CVM) people's Willingness to Pay (WTP) for protection and conservation of Kachan has been measured. Results showed around 49 percent of household respondents were WTP for its conservation. Using binary logistic model, the study demonstrated the sensitivity of socio-economic and other characteristics (like education, income, earning from wetland and shift from wetland) on WTP. The study also worked out average WTP of Rs. 286 per year for wetland conservation which indicated that rural wetlands have substantial conservation value. The results of the study will help decision makers to design enhancement programmes for per se and other natural resources.

Keywords: Contingent Valuation Method, Conservation, Willingness to Pay, Kachan Wetland

1. Introduction

Wetlands are considered as most productive ecosystem in the world (Ghermandi *et al*., 2008), provide numerous goods and services to human society (ten Brink *et al*., 2012).Wetlands across the world, particularly in India, provide much needed economic and other supports for millions of people be it water for irrigation, cultivation, fisheries, domestic uses, industrial uses among others (Bassi *et al*., 2014). People's livelihood activities, their traditions and cultures are much influenced by wetlands and wetland-based resources (Directory of Indian wetlands 1993). Lack of alternatives and over-dependence on agriculture and natural resource-based activities in India has pushed millions of people, mainly rural and poor, to depend more on natural resources like wetlands for their sustenance and survival.

Therefore, understanding the economic importance of wetlands (especially rural ones) for better and informed policy as well as social awareness there is need for undertaking wetland-valuation studies. Such studies will not only help us to decide the best possible uses of wetland resources but also would serve as an effective base for their sustainable uses. Several economic valuation studies have been conducted on wetlands like (Verma, 2001; Prasher *et al*., 2006; Chopra and Adhikari 2004; Bandyopadhyay *et al*., 2007; Wattage and Mardle, 2008) [21, 19, 10, 5]. The main aim of these studies is to quantify the economic values and highlighted the issue related to wetland conservation. They found wetlands have more economic significance and offer larger benefits for society. But the need to understand thousands of smaller but rather very important wetlands (especially rural) is equally important. Smaller wetlands face severe exposure to degradation. Against this backdrop the present study has focused on a small wetland (Kachan wetland) which is located in Uttardinajpur district of West Bengal. The district is famous for its migratory birds that visit the wetlands during the winter from as far as Siberia. The total number of wetlands are 4336 including 3981 < 2.25 ha. Out of 355 wetlands (> 2.25 ha), 212 are natural and the remaining 143 are man-made. The total area covered by aquatic vegetation is 2209 ha in post-monsoon and 2447 ha in pre-monsoon. Kachan wetland is one of them which has about 250 hectare in area (National Wetland Atlas, 2010) [18].

The aim of the study is to evaluate the Willingness to Pay (WTP) of the dwellers for protection and conservation of the wetland. It also determines impact of socio-economic and other determinants of households on their WTP for the proposed conservation scheme for wetland and suggests policy measures.

2. Methodology and Data Sources

Contingent Valuation Method (CVM) has been used as a standard and flexible tool for valuing non-marketed environmental resources (Hanemann 1994) [12]. It is a stated preference technique used to quantify economic value of non-marketed goods and services, by measuring individuals' consumer surplus (Mitchell and Carson 1989) [17]. It attempts to allocate values for public goods by people's maximum amount of willingness to pay to obtain non-market goods and service or minimum amount willing to Accept (WTA) to compensate for loss of environmental resources (King and Mazzotta 2000). We employed CVM for estimating dwellers' willingness to pay for conservation or improvement of wetland. CVM is a survey based technique, where a hypothetical market situation (improving status of Kachan wetland) is created to elicit people's preference by using open-ended questionnaire format to overcome the starting point bias of bids. For the present study we provided a brief introduction of the economic valuation of wetland biodiversity and a proposed "*Wetland Biodiversity Management and*

Preservation Fund" for the wetland in question to elicit the WTP information.

Before conducting survey on Kachan wetland a draft of questionnaire was made after: discussions with focus groups, interviews with key informants such as senior villagers', extension staff, concerned government authorities, vegetable growers, fishermen and other stakeholders. A structured CV questionnaire was used to generate required information. It consisted of two sections. First section of questionnaire deals with socio-economic and demographic profile of household members. Second part of questionnaire includes questions related to dichotomous choice WTP (yes/no) and other environmental issues about Kachan Wetland. A sample of 213 households has been selected within 5 km of radius from Kachan wetland using simple random sampling technique. However, finally 205 questionnaires were utilized for analysis purpose. The rest were excluded as they provided partial information regarding concerned problem.

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 improvement or conservation of Kachan wetland goods and services. Since WTP variable is binary in nature and to analyse dichotomous choices made by respondents, a Logistic Regression Model was considered as an appropriate for this type of study (Loureiro and Umberger 2003) [15]. Hence, Probability (P_i) reveals that one accepts to pay a maximum amount (in Rupees) for improving and maintenance of wetland (Kachan). A linear expression of the model is as follows:

$$WTP(yes = 1) = f(Age + Sex + Edu + TMI + Flys + ErW + WSW) \ldots .1$$

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.

3. Results and Discussions

3.1 Descriptive statistics

Descriptive statistics of variables used in demand function of Contingent Valuation analysis, based on 205 observations are depicted in Table-3.1.1.

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 49% of respondents were willing to pay for the improvement of wetland services and 51% of the respondents were not willing to pay.

TMI: 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. 8632.68.

Table 3.1.1: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
WTP(Yes=1)	205	0	1	0.49	0.501
Age	205	22	85	49.15	11.352
Sex(Male=1)	205	0	1	0.73	0.447
MSts (Married=1)	205	0	1	0.95	0.216
Edu (Mean years of schooling)	205	0	15	3.9	4.403
TMI	205	2000	22000	8632.68	3886.762
ERW (Yes=1)	205	0	1	0.97	0.499
WSW (Yes=1)	205	0	1	0.4	0.49
FlyS	205	2	12	5.65	2.056

Source: Field Survey Data (2015)

Age: Age was used as continuous variable representing age of adult respondents in years (above 18 years). It ranged from 22 to 85 years with a mean value of 49.15 years.

Sex: About 73% respondents are male and 27% are 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 15 years (graduation) in our sample whereas average number of schooling years was 3.90 years.

Marital Status (MSts): About 95% respondents are married and 5% are unmarried.

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 (0.55) showed that 55% 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 (0.40) reflected that about 40% 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 5.65 members.

3.2 Results

Estimated results of CVM were obtained by using Binary Logistic Regression Model in econometric software (STATA ver. 12.0). A Pseudo-Maximum Likelihood Estimation Technique was employed for estimating the parameters of variables and results were reported in Table-3.2.1 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 Kachan Wetland to other places (WSW)]. Four out of seven variables were found significantly associated with Willingness to Pay.

Table 3.2.1: Binary Logistic Regression (dependent variable = WTP)

Variables	Coef.	Std. Err	z	P>IzI	[95% conf.]	Interval
Age	0.08	0.09	0.98	0.33	-0.08	0.25
Sex	1.24	1.87	0.66	0.51	-2.43	4.9
Edu	1.38	0.42	3.3	0.00*	0.56	2.2
TMI	0	0	1.73	0.08***	0	0
FlyS	0.72	0.5	1.44	0.15	-0.26	1.7
ErW	-6.12	2.53	-2.42	0.02**	-11.07	-1.17
WSW	-4.33	2.54	-1.7	0.09***	-9.3	0.65
Constant	-13.49	7.49	-1.8	0.07	-28.17	1.19
No. of observations	205					
LR chi2(7)	268.71					
Prob> chi2	0					
Pseudo R2	0.95					
Log likelihood	-7.72					

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 (TMI) was found positive as expected showing that the likelihood of WTP for wetland improvement increases with the increased in income. It was found significant at 10% level (see Table-3.2.1). Previous studies conveyed mixed results. Coefficient of income was found positive and having significant influence on environmental WTP in some studies such as Mehrara *et al*. (2009) [16]; Adekunle *et al*. (2006) [1]; Ahtiainen (2007) [3]; Samdin *et al*. (2010) [20]; and Bhatt *et al*. 2014 [7]. But according to the study conducted by Chen and Chern (2002) [9], the coefficient of income was found significant and having negative effect on WTP. While some studies like Adesope *et al*. (2010) [2] found that income hasn't shown any significant effect on WTP.

Age was found positively associated with WTP. Though in line with expectations, it's co-efficient was insignificant. Its positive sign implied that older the person more the willingness to pay for improving wetland. Earning from wetland (ErW) co-efficient was significant at 5% level greater the willingness to pay for its improvement.

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 the Amirnejad *et al*. (2006) [4]; Jaffrey *et al*. (2012) [13] and Bhatt *et al*. (2014) [7], in which it was found that educated people would pay more for the conservation of environmental sites. Lastly, coefficient of willing to shift from Kachan to other places (WSW) had expected negative sign with a significance of 10% 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 Kachan Wetland. It is also reported in Table-2 that overall Model was significant with CV data. Log likelihood was -7.72, with P-value less than 0.01 which showed that Model was significant at 1% level. Pseudo R^2 was worked out as 0.95 which was reasonable for cross sectional data. Hence, overall predictability of the Model was satisfactory.

3.3 Willingness to Pay For Kachan Wetland Improvement Scheme and Welfare Estimates

Kachan wetland 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 Kachan Wetland?" and "How much you are willing to pay for it?" showed 49% of the respondents (benefitted from the use values of the Kachan wetland) were WTP for its improvement. Respondents' willingness to pay ranges from Rs. 20 to Rs. 3600 per-year with a mean of around Rs. 286 per year (Rs. 23/month). WTP results were almost similar with the WTP of stakeholders for conservation of East Calcutta Wetland provided the amount varies from Rs. 60 to Rs. 1,200 per-household per-year; however the average WTP for Kachan Wetland differ from East Calcutta Wetland with an average of Rs. 380 per household per-year (Chattopadhyay *et al*., 2001) [8]. Aggregate WTP for improvement of Kachan wetland was computed as Rs. 58720, 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 49% acceptance rate of the hypothetical preventive treatment interventions are highly desired and demanded in the study area. However, about 51% 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 3.3.1.

Table 3.3.1: Reasons for Not Willing to Pay (N=205)

Reasons	No	Percentage
Financed out of national and international funds	93	45.4
Residents have right to use	13	6.3
Paying taxes to the government	30	14.6
Do not trust govt. Sponsored management	8	3.9

Source: Field Survey Data (2015)

It shows that around 45.4% 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 6.3% 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 14.6% said that they were already paying taxes to government for this purpose. About 3.9% of the sampled households did not trust any management scheme.

4. Conclusion

Presently wetland conservation and its direct uses becomes an emerging issue especially in developing countries. Their overuse breeds scarcity and causes irreversible change to the environment (Daily 2000) [11]. 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 Kachan wetland. 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 Kachan wetland reincarnates its significance as a precious natural asset providing varied functions and services to people. Hence its preservation, overall development and sustainable management should be an important policy objective and a national priority.

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