Proceedings of the 5th International Conference on Civil Engineering for Sustainable Development (ICCESD 2020), 7~9 February 2020, KUET, Khulna, Bangladesh (ISBN-978-984-34-8764-3)

HOW MUCH VALUE DO PEOPLE PLACE ON CONSERVING THE COASTAL FRESHWATER WETLAND IN BANGLADESH?

Muhammad Mainuddin Patwary*[1], Md. Al Amin[2], Sadia Ashraf[3] and Faysal Kabir Shuvo[4]

[1]MS, Environmental Science, Khulna University, Bangladesh, e-mail: raju.es111012@gmail.com
[2] MS Student in Environmental Science, Khulna University, Bangladesh, e-mail: alamin.nesa@gmail.com
[3]MS, Environmental Science, Khulna University, Bangladesh, e-mail: sadiaes11@gmail.com
[4]PhD Candidate, Population Wellbeing and Environment Research Lab, University of Wollongong, Australia, e-mail: fkshuvo@yahoo.com

***Corresponding Author**

ABSTRACT

Wetland ecosystems are among the world largest biological productive system that provides wide range of ecosystem services and support livelihoods of local communities. However, their mulitple benfits and conservation values are often negelcted in decision making that resulted in overexploitation of resources. Bangladesh is a land with surrounded by numerous wetlands. Wetlands of Bangladesh have great siginificane to support rich biodiversity and provide the livelihood of local rural people through employment, commercial fishing, seasonal agriculture, livestock, wood collection and recreation. Beel Dakatia, such a coastal freshwater wetland, located in the southwest hydrological region of Bangladesh provide a large amount of ecosystem services to the people living near the beel. However, the rapid land use change, water logging and inundation condition, siltataion in nearby river, poor sluice gate managmeent and conflicts among the beel users has posed seirous challenges to the existence of beel. Quantifying the economic value of wetlands can inform decision-makers to design solutions for the sustainable use of wetlands resources. Therefore, this study attempted to place a value on the conservation of Beel Dakatia.

The present study conducted a CV survey by using a payment card questionnaire. The survey was performed during 1-30 November 2018. A reconnaissance survey of 50 local peoples living around the wetland was performed during 10-15 November 2018. Face to face interview was conducted for data collection during November, 2018. A total of 150 households residing near the wetland were selected for the final CV interviews. Stratified random sampling method was followed during interviews.

Results reveal that local people supported the wetland management proram and willing to pay money for the Beel Dakatia conservation. More than 80% respondents thought that water-logging, canal filling and poor management of sluice gate were the most threating factor to the existence of Beel Dakatia. The results show that households were willing to pay for Beel Dakatia conservation at an average of 0.65$ per month. This study also examined the effect of socio-economic factors on willingness to pay (WTP). The results of estimates of Ordinary Least Square (OLS) model show that socioeconomic factor such as age, income and education significantly influences the WTP level. The R^2 value for present study is 0.26 that seems to be reasonable good. Therefore, the present study can be considered to be reliable for CV estimation.

Thus, findings provide positive evidence of public monies to protect the environmental value of the resources and thus help policymakers and natural resource managers to make a better decision for sustainable management of coastal freshwater wetlands of Bangladesh.

Keywords: *Beel Dakatia, Economic value, Coastal wetland, CVM, WTP.*

1. INTRODUCTION

Wetlands are among the worls's most productive ecosystem that provides environmental, economic and social benefits to the human being (Islam and Gnauck, 2007; Islam, 2010). Wetlands are functioned as "kidneys" of the earth that plays major role to maintain biodiversity depend on this ecosystems for sustaining, as it serves habitat for a range of species flora, fauna, fish and endangered species (Bai et.al., 2013; Nishat, 1993). Globally, wetland is estimated to cover 5-10% of Earth's terrestrial surface (Mitsch and Gosselink, 2009). Many of the author recently given an actual extent of global wetlands that ranges from 600 million to 1.2 billion ha. Freshwater wetland comprises about 85–95% of the total (Burton and Tiner 2009). Wetland acts as transition between terrestrial and aquatic ecosystem that plays significant role in supporting high biodiversity and providing livelihood security to the people living in the area (Rebelo et. al. 2009). A recent study estimted that worldwide over 1 billion people directly dependent on wetlands for their livelihood such as fishing or farming (Finlayson et. al. 2005). Globally, wetlands contribute to be about USD 70 billion per year (Brander and Schuyt 2004). Conservation of wetlands is necessary as they play major role in sustainable development and poverty reduction by providing subsistence and livelihood of poor people (Finlayson et. al. 2005). However, their multiple roles and conservation priority is often neglected in policy decision that resulted in overexploitation of wetland resources.Therefore, it is imperative to incorporate the value of wetland conservation in environmental decision making.

Approximately 50% (70000 to 80000 km^2) of the total land area is covered by wetlands in Bangladesh (Khan et.al., 1994). They have great importance for supporting the rich biodiversity and proividing the livelihood of rural communities through employment, commercial fishing, agriculture, seasonal livestock, wood collection and ecotourism (Nishat, 1993). Despite the immense significance of these ecosystems, wetlands of Bangladesh have been facing serious challenges from anthropogenic and natural changes (Ahmed et.al., 2008). Anthropogenic activities like drainages for agriculture, application of pesticide and herbicide in agricultural activities, land use changes, construction activities, industrial waste, sewage effluents, and large scale extraction of wetlands resources are the major threats to the survival of wetlands in Bangladesh (Siew et al., 2015). In addition, rapid expansion of roads and houses, agricultural activities has significant contribution to wetland degradation (Haq, 2016). According to Khan et.al. (1994) about 2.1 million ha of wetlands have been lost due to development activities in the GangesBrahmaputra-Meghna floodplain.

Economic valuation has been widely used in both developed and developing countries to assess environmental goods and services. Absence of adequate knowledge on economic value of wetlands services and proper understanding of potential revenue opportunities associated with it might led to make way for other developmental activities. Therefore, these concerns have necessitated the implications of wetland valuation to evaluate the public preferences on how much they willing to pay for conservation activities (Siew et.al., 2015; Jack, 2009). There are several methods that have been used to value the wetlands including market price method (Raphael & Jaworski, 1979), the contingent valuation method (e.g. Bateman and Langford, 1997), hedonic pricing method (e.g. Doss and Taff 1996), travel cost method (e.g. Cooper and Loomis 1993), and replacement cost method (e.g. Breaux et al. 1995). Among them, the contingent valuation method is most widely used technique to value economic benefits of wetland (Bateman et.el., 1992).

Beel Dakatia, a freshwater floodplain wetland, located in southwest hydrological region of Bangladesh and falls within the Ganges tidal deltaic plain, has a rich biodiversity and provides important ecosystem services that support the local livelihood (Kabir and Aftab, 2017). However, natural and anthropogenic activities such as water-logging, siltation n nearby river, poor maintenance of sluice gates and conflicts among beel users have been posed serious threat to the existence of Beel Dakatia in its natural condition (Ali and Syfullah 2016). A number of studies have been conducted on Beel Dakatia to assess its resource use, management strategies and associated livelihoods (e.g. Kabir and Aftab, 2017; Ali and Syfullah 2016). However, no study has been done so far to assess the

environmental benefits derived from the freshwater wetland. This study therefore made an attempt to quantify the values of Beel Dakatia conservation by Contingent Valuation Method (CVM).

2. METHODOLOGY

2.1 Study area

Beel Dakatia is a freshwater floodplain, located in the southwest costal region of Bangladesh. It is the second largest beel (smallest depression in floodplain) of Bangladesh. It covers a total area of about 17,400 hectares or 174,000,000 square metres. It lies between longitudes 89°20'E and 89°35'E and latitudes 22°45'N and 23°00'N under the administrative boundaries of Dumuria and Phultala sub-districts of Khulna district (Rahman 1995). The area is characterized with low elevation and having almost flat topography. Solmari, Hamkura and Salta are the three main rivers in this area that interconnected with the beel. The Beel Dakatia has experienced increasing degradation due to water-logging and inundation. Furthermore, the area has undergone a rapid land use change that affects the livelihood of the beel communities (Ali and Syfullah 2016). Fig 1 shows the geographic location of Beel Dakatia.

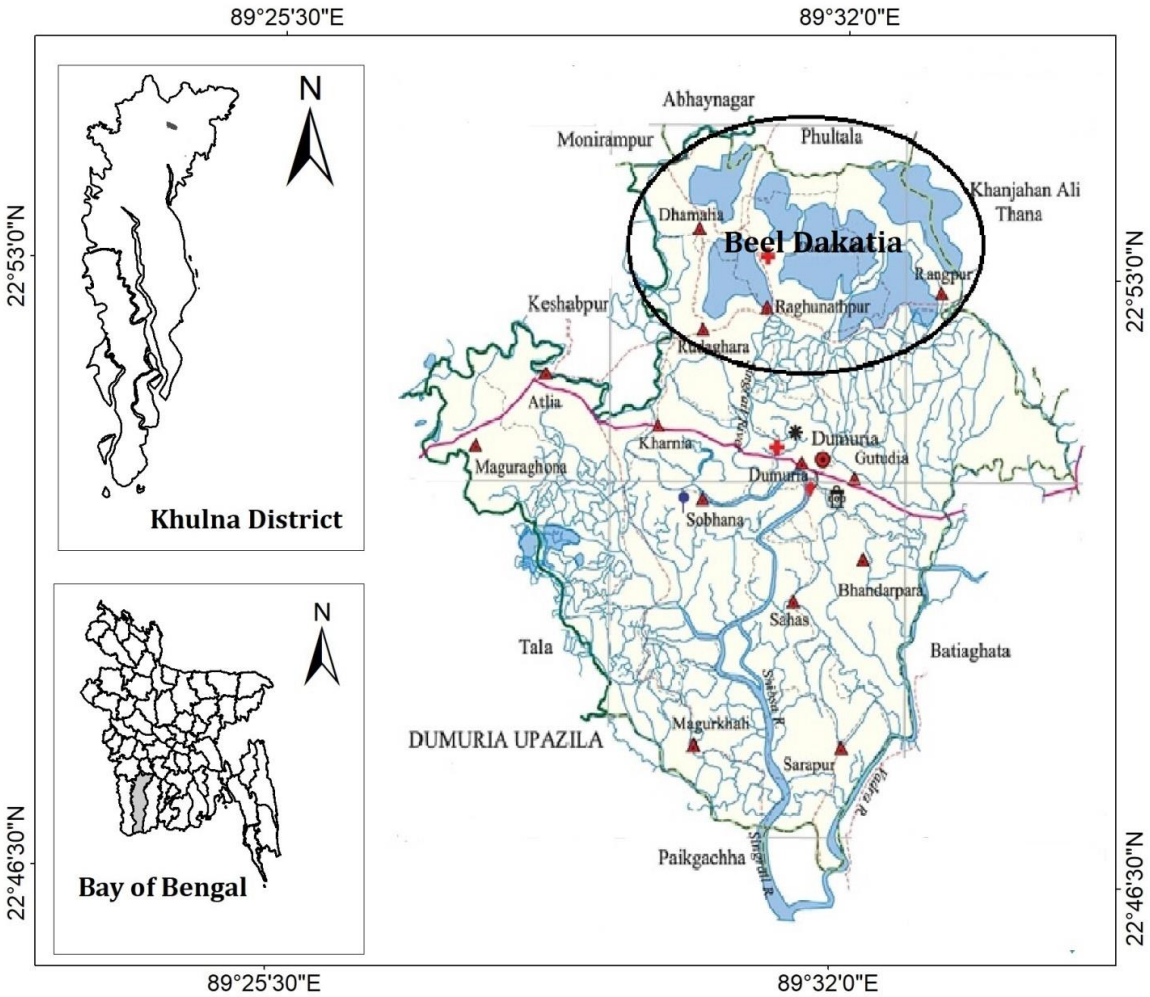

Figure 1: Study area location

2.2 Contingent valuation (CV) approach

In recent years, the CV technique has been widely used in developing countries to measure economics benefits of environmental goods and services (Kim et.al. 2018; Huh and Shin, 2018). Similarly, the present study used a CV survey to elicit public preferences to conserve Beel Dakatia. In CV survey, respondents are directly asked to determine their willingness to pay (WTP) for the use or conservation of natural goods and services. The CV survey is appropriate when no market data or their proxies are available. A major strength of using CV technique is that it does not rely on actual market behavior. According to Arrow et. al. (1993) CV survey is valid and accurate because it provides understandable and meaningful explanation of goods of concern to people.

2.3 Survey design

The present study conducted a CV survey by using a payment card questionnaire. The survey was performed during 1-30 November 2018. A reconnaissance survey of 50 local peoples living around the wetland was performed during 10-15 November 2018. The final questionnaire was designed by following National Oceanic and Atmospheric Administration (NOAA) Panel guidelines. Face-to-face interview was conducted for each of the respondents. The length of the interview was lasted for no longer than 20 minutes to maintain the respondent's attention during interview. The questionnaire was divided into three sections. The first section assessed the respondent's willingness to take part in CV survey, second section contained questions on demographic and economic information and the third section focused on the perceptions, attitudes and awareness of the respondents towards the present condition of the wetland. A hypothetical wetland management program was explained to respondents whether they would be willing to pay for Beel Dakatia conservation. The statement of paying is expressed as follows:

"Considering your current income and expenses would you be willing-to-pay for proposed program at x BDT?"

Where, x ranges from BDT 4 to BDT 120. If the respondents stated "YES", the WTP is elicited and they were later asked to distribute their maximum value based on their income and expenditure. A total of 150 households residing near the wetland were selected for the CV interviews. Stratified random sampling method was followed during interviews. The survey was started randomly from any side of the village and every 10^{th} household was selected for the interview. If the respondent of 10^{th} household refused to participate, the nearest household was considered. Only head of the households were interviewed.

2.4 Willingness to pay estimation

In theoretical model, the income-compensating function is used to explain the individual's WTP for a CV survey. In this study, the Ordinary Least Square (OLS) method was used to reveal the mean WTP and identify factors that affect stated WTP. The explanatory variables used in this study are age of the household head (AGE), gender (GENDER), household size (HHS), monthly household income (INC), level of the formal schooling of the respondents (EDU), employment status of the respondents (OCU). The OLS model for the general individual WTP function is as follows:

$$WTP = \alpha + \beta_1 GENDER + \beta_2 AGE + \beta_3 INC + \beta_4 HHS + \beta_5 EDU + \beta_6 OCU + \varepsilon \quad (1)$$

where α and βi's are the estimated parameters and ε is the random error.

3. RESULTS AND DISCUSSIONS

3.1 Respondent characteristics

Table 1 shows the socioeconomic profile of the respondents of the studied villages. Of the sample interviewed, 88% were male and only 12% female. About 92.1% of the respondents were reported

married. The mean age of the respondent was 57.85 ± 11.06. The mean household size was 4.80 ± 1.72. With regard to education, about eighty-seven percent were literate and had studied at least till the primary level. About 44.4% of people lives in tin shed (semi-pucca) house while only 11.1% in bamboo and 14.3% in mud houses. The average landholding size was 1.24 ± 0.16 ha, with more than 90% of the families owning up to 4 ha of agricultural land. The monthly mean family income was 113.82 ± 79.69 US$. Majority of the respondents in surveyed villages were engaged primarily in fishing (51%) and agricultural (32%) activities. However, there were low numbers of respondents with other occupational activities including small business, laborer and services. The average duration of living near the wetland was 34 (± 12.34).

Table 1: Socio-demographic profile of the respondents (N=150)

Features		Percentage	Features	Mean (±SD)
Male		88	Age (yr)	57.85 (±11.06)
Married		92.1	Household size	4.80(±1.72)
Literate		87.3	Income (US$)	113.82(±79.69)
Housing pattern			Land (ha)	1.24 (±0.16)
	Bamboo	11.1	Duration of living (yr)	34 (±12.34)
	Mud	14.3		
	Semi-pucca	44.4		
	Pucca	30.2		
Occupation				
	Fishing	51		
	Farming	32		
	Business	9		
	Laborer	3		
	Others	5		

3.2 Perception towards wetland conservation

Approximately 52% of the total respondents said that food production e.g fish, crop, vegetables showed an increasing trend in Beel Dakatia. However, 35.6% said that Beel Dakatia has experienced a decreasing trend of food production since last decades. Only 12% said that food provision from Beel Dakatia remain same as before. More than 50% of respondents agreed that people are not getting economic benefit from the beel as many years ago. Most of the respondents (63%) respond that wetland environment has been degrading at an increasing rate. About 43% of total respondents said that Beel Dakatia has no more state of use as recreational purposes. Factors such as food production and economic benefit of mean scores had more than 3.5 suggesting respondents were more inclined to the economic aspects of beel.

Table 2**:** Benefits perceived from the Beel Dakatia

Services	Increase	Unchanged	Decrease	Mean
Food production	52.4	12	35.6	4.10
Economic benefit	36	6	58	3.67
Recreation	32	25	43	2.88
Environmental Benefits	26	11	63	3.46

More than 80% respondents thought that water-logging, canal filling and poor management of sluice gate were the most threating factor to the existence of Beel Dakatia. Most of the respondents believed that overexploitation (71.9%), reduction of beel resources (77.3%), shrimp cultivation (65%) had moderate to very high impact to degrade the Beel Dakatia. In contrast, urban development (84%), salinity intrusion (67.1%), industrial waste (94%) and cyclone-flood (66.3%) had none to very little impact on the Beel degradation.

Table 3: Factors threating the existence of Beel Dakatia

Factors	**Threat (%)**					**Mean Score**
	None (1)	**Very little (2)**	**Moderate (3)**	**High (4)**	**Very high (5)**	
Water-logging			2	10	88	4.15
Poor management of Sluice gate			4	12	84	4.00
Canal Filling			12	6	82	3.89
Shrimp cultivation	10	25	45	13	7	2.78
Urban development	56	28	12	4		2.34
Salinity intrusion	18.2	48.9	31.1	1.8		1.89
Overexploitation	5	23.1	67.9	2.8	1.2	2.98
Reduction of Beel resources	10	12.7	12.3	46.3	18.7	3.14
Use of chemicals & insecticides		29.4	45.6	23.4	1.6	2.67
Industrial waste (effluent)	78.3	15.7	6			2.01
Cyclone-flood	6.4	59.9	31.1	3.6		2.31

The study also demonstrated the respondent's opinions of who should pay for the conservation of Beel Dakatia. Majority (64%) of the respondents believed that the Government solely should pay for the conservation activities. About 24% respondents thought that those who directly benefitted from the beel should pay. Only 7% of the total respondents believed that Government with private partnership should pay. Only a few numbers (3%) respond that polluter pay principle can be an option for conservation. This indicates that those who are causing pollution should be liable to pay damage cost. Only 2% believed that conservation of Beel Dakatia is a voluntary work.

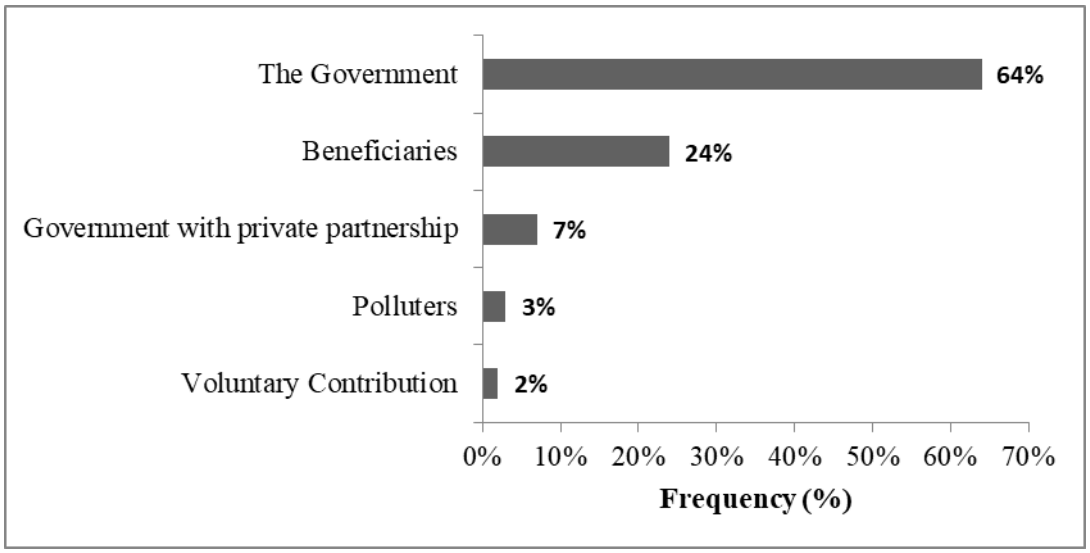

Figure 2: Respondent perception who should pay to conserve the Beel Dakatia

3.3 Estimation of WTP

Out of the 150 surveyed households, 92% were willing to pay for Beel Dakatia conservation. The respondent who did not agree to pay (zero WTP) for Beel Conservation were asked follow up question regarding their reason not willing to pay. The results show that about 23.6% of respondents showed their monetary incapability not to pay for the proposed program, 34.4% thinks that this is the sole responsibility of the government, 21.9% said that they would not get any benefit from the proposed program, 12.1% said that people who degrade the Beel should pay and about 8% responds that they would contribute to the program in labor. The results reveal that minimum WTP value per month per household is BDT 4.50 and maximum WTP is BDT 119. Therefore, the mean monthly WTP per household was estimated BDT 53.3± 25.6 (US$ 0.65). A similar study was conducted by Gosh and Mondal (2012) where mean WTP was estimated BDT 13.69 (US$ 0.20) per month per household of Chanda Beel, Bangladesh. Table 3 summarizes the mean WTP per month per household for Beel Dakatia conservation.

Table 4: Mean WTP (BDT* per month per household) for Beel Dakatia conservation (N=150)

WTP	**Statistics**
Mean	53.3 BDT
Minimum-maximum	4.50-119
Standard deviation	25.6
No of protest bids	12
% of total respondents	8

*BDT=Bangladeshi Taka, US$ 1 = 82 BDT (as of November 2018)

The Ordinary Least Square (OLS) method was used to identify the factors affecting the WTP and also to examine the reliability and validity of CV result. The results of regression showing factors affecting WTP for Beel Dakatia is given in Table 5. Results show that age, income and education were significant to determine the WTP. The coefficient of variable AGE (respondent age) was statistically significant at 5% significant level but with a negative sign. This suggests that younger people are more willing to pay than older ones. The coefficient of income variable was statistically significant at 5% significant level and positively influences the WTP. It seems that WTP is highly dependent on economic condition of the respondent. This finding is in line with Gosh and Mondal (2012) and Oglethorpe and Miliadou (2000). The coefficient variable education was also found positively and statistically significant at 1% significant level and it indicates that people with higher education tend to more willing to pay than lower education. According to Mitchell & Carson (1989), the simplest way to test the reliability of WTP amount is to obtain an acceptable R^2 value (R^2>0.15). The R^2 value for present study is 0.26 that seems to be reasonably good. Therefore, the present study can be considered to be reliable for CV estimation.

Table 5: Estimates of OLS regression model for the determinants of WTP

Explanatory Variables	**Coefficient**	**Standard Error**	**t-statistics**	**P value**
Constant	87.67	35.23	3.00	0.005**
Gender	2.34	5.564	0.67	0.45
Age	-1.56	0.002	2.56	0.004**
Income	2.93	0.034	2.87	0.005**
Household size	2.05	5.634	0.98	0.78
Education	2.12	0.015	2.89	0.00***
Occupation	3.13	6.578	1.56	0.987

Note: Number of observations = 150; R^2= 0.29, Adj. R^2= 0.26; **significant at p <0.05, ***significant at p< 0.01.

4. CONCLUSIONS

This study estimated the conservation value of Beel Dakatia freshwater wetland, using CVM. The results reveal that local communities support the program and willing to contribute money for the conservation of Beel Dakatia. This study also identified the socioeconomic factors that affect the level of WTP. Results show that respondents were willing to contribute monthly BDT 53.3 (US$ 0.65) per household that results in an aggregate value of US$ 7.8 yearly per household. The results of Ordinary Least Square model show that age of the household head, income and education has significantly influenced the households to pay for Beel Dakatia conservation. The findings of the study can assist the government and decision maker to incorporate public funds in freshwater wetland management decisions.

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