



Economic Valuation of Wetland Ecosystem Services: A contingent valuation study of Vaitarna Estuary Maharashtra, India

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Abstract

Wetlands play an important role in maintaining ecological balance and supporting human livelihoods by providing services such as flood control, water purification, biodiversity conservation, carbon storage, and recreation. Despite their importance, wetlands are increasingly under threat due to urban expansion, pollution, and climate-related changes. This study attempts to understand the economic value of wetland ecosystem services in the Vaitarna Estuary using the contingent valuation method. Primary data were collected through a structured questionnaire to examine their level of awareness and willingness to pay for wetland conservation. The study also considers how factors such as income and awareness may influence people's willingness to contribute financially. A logit model is used to analyze these relationships. Findings show that many respondents recognize the importance of wetlands and show a willingness to support conservation efforts. The study highlights the need for more detailed research and better data to support economic valuation and informed decision-making for wetland conservation.

Keywords: Wetlands, Economic Valuation, Contingent Valuation Method, Willingness to Pay, Vaitarna Estuary.

Introduction

Wetland ecosystems are one of the most productive ecosystems on the earth. They are defined as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters.

Wetland ecosystem includes- lakes, estuaries, rivers, marshes and peatlands. It also includes human made wetlands such as reservoirs, paddy fields, shrimp farms etc. Globally wetlands occupy 6% of the total land surface of the earth¹.

They provide many services that contribute to human wellbeing and poverty reduction². They also provide variety of ecological services. They are often referred to as 'kidneys of landscape' and 'biological supermarkets' due to the functions they perform. Wetland Services are classified as provisioning services- (direct services provided by wetland such as food, drinking water, irrigation water etc.), regulating services (flood control, climate regulation and ground water regulation), cultural services (spiritual and recreation services) and supporting services (Nutrient retention, biodiversity support etc.)³.

Despite of its economic and ecological significance, wetlands are under pressure and disappearing at an alarming rate. About 35% of the wetland have been lost since 1970⁴.

The Global Wetland Outlook report also reveals that 41.5% of the contracting parties of Ramsar Convention reported that there is a decline in the state of wetlands, as against 31.8% of the countries in 2011. Least Developed Countries register a higher rate of deterioration as compare to the developed countries.

Urbanization, industrial expansion and agricultural intensification are some of the key drivers of wetland loss. According to the water foundation report about 40% of the wetlands have disappeared entirely in the last three decades. Out of the remaining wetlands 50% of the wetlands are ecologically degraded and they have registered a biodiversity loss. Half a percent of the wetlands is lost every year since 1970.

In case of India, Urbanization, industrial expansion and agricultural intensification are some of the key drivers of wetland loss. In addition to this climate change also pose a threat to the wetland. Estimates suggest that a 1-meter rise in sea level due to climate change could lead to the loss of approximately 84% of India's coastal wetlands and about 13% of its saline wetlands⁵.

This loss does not only affect the biodiversity but also have economic costs. Wetland loss alters the services of the wetland that provide livelihood opportunities to the people. The economic cost of wetland loss is extremely high reaching up to USD 39 trillion in lost benefits that support people, economies, and the environment⁶.

To address this loss of wetlands Ramsar Convention has formulated strategic plan. Goal 1 of the Ramsar Strategic Plan (2016-24) emphasizes that wetland ecosystem services are required to be measured, valued and integrated in the policy making. Wetland valuation is a way to estimate ecosystem benefits to people and allows financial experts to carry out a Cost-Benefit activity which might be in favor of environmental investment⁷. Many services provided by wetlands such as -flood regulation, water purification, biodiversity support- are not traded in the market and therefore often overlooked in the development process. Therefore, valuing ecosystem services are essential.

Review of Literature

Wetlands are recognized as the important ecosystem because of them provides essential services for human wellbeing. These services include. These services include provisioning benefits such as fisheries and water supply, regulating functions like flood control and water purification, and supporting services including biodiversity conservation⁸, conceptualized wetlands as a natural asset. The author highlighted that wetlands are no less than a wealth to the economy and therefore the assessment of its values is essential to understand tradeoff between its conservation and development process. Reid et al.² also recognized the crucial role of wetland in supporting livelihood. The various studies conducted on the estimating global values of wetlands also demonstrate that wetlands are valuable assets⁹⁻¹¹.

According to Barbier, Acreman, & Knowler¹¹, Total Economic Value (TEV) is most appropriate framework to estimate the value of wetlands. TEV approach divides wetland values into use and non-use values. Use values involve some form of human interaction with wetlands whereas non-use values refer to the benefits that people simply know that the resource exists. This framework captures both direct and indirect benefits of wetlands.

There are several market and non-market valuation methods used for wetland valuation. These methods are categorized into revealed preference methods, stated preference methods and cost based methods. Revealed preference methods are based on the market transactions these include Market Price Method, Hedonic Pricing Method, Travel cost method on the other hand stated preference methods. These methods are useful to estimate the direct benefits of wetlands.

The cost-based methods assume that value of ecosystem is the cost that is avoided because the ecosystem exists. It includes methods such as replacement costs, Mitigation costs etc. Stated Preference Methods predict the wetland values on the basis of simulated market surveys. It includes methods such as contingent valuation, choice modelling. These methods are appropriate for estimating values of indirect benefits of wetlands^{12,13}.

Contingent Valuation Method (CVM) is the most commonly used method¹⁴. CVM involves asking individuals about willingness to pay for the wetland conservation or Willingness to accept if the wetland ceases to exist. There are several wetland valuation studies based on the CVM¹⁵, used CVM to value Paya Indah wetland in Malaysia, Mai, N. T. et al.¹⁶ used CVM to assess community's willingness to pay for the conservation of Red River Estuary in Vietnam. Kafy, Ali, Ferdous, & Sheel¹⁷ determined economic value of Padma River Wetland in Bangladesh.

In Indian context Haque & Shah¹⁸, used the CVM to assess the non-use values of Kachan wetland in West Bengal. However, there are certain limitations of the CVM. The meta-analysis study conducted by Brouwer, Langford, Bateman, Croward, & Turner¹⁴, highlighted that there are variations in the estimated values due to socio-economic factors. The CVM involves the use of extensive surveys, this makes the valuation process time consuming and expensive¹⁹. Despite of these limitations, literature shows that CVM is most widely used and effective approach to measure the economic value of the wetland services.

Objectives of the Study: The current paper aims to assess the awareness of the people regarding the wetland ecosystem services and their willingness to pay for the conservation of wetlands. The study also analyse the influence of socio-economic factors on willingness to pay.

Hypothesis: H1: Income has significant impact on willingness to pay. H2: Awareness influence willingness to pay.

Methodology

Study area: Vaitarna Estuary is located at the Virar city in Palghar district of Maharashtra. It is an intertidal waterbody where Vaitarna River meets the Arabian Sea. Dativare coast (Latitude 19030'54"N and Longitude 72045'5"E) is at the beginning of Vaitarna Estuary. Whereas Pargaon Bridge (Latitude 19035'35"N and Longitude 72051'55"E) is at the end of Estuarine region at about 40 Km away from Dativare²⁰ coast. It is a biologically rich estuary characterized by the mangrove forest and finfish diversity. Local people generate livelihood through fishing from the estuary.

Research Design: The study is based on the quantitative approach. To estimate the value of Vaitarna Estuary the Contingent valuation method is used. Contingent Valuation method is used to estimate value of the wetland by asking individuals how much money they are willing to pay to conserve the wetland and get the benefits of the services that wetland provides. A dichotomous format was used; respondents were asked whether they are willing to pay or not to conserve the wetland. Further, the respondents who were willing to pay were asked how much they are willing to pay and the frequency of the payment in order to estimate mean willingness to pay.

Primary data was collected from 116 households around the study area. The data was collected using structured questionnaire. The questionnaire included questions on socio-economic characteristics (Age, income, education), awareness about the wetland services, willingness to pay for the wetland conservation. A convenient sampling method was adopted to select the respondents. To understand the determinants of willingness to pay a binary logit model was employed.

Results and Discussion

Demographic Findings: Gender: Out of the total respondents 60.3% of the respondents are male and 39.7% are female. While significant proportion of the respondents constitute male there is also a representation of female.

Table-1: Gender Distribution.

Gender	Frequency	Percent
Female	46	39.7
Male	70	60.3
Total	116	100

Age: Majority of the respondents are from the age group of 35-44 and 45-54 i.e. 33.6% and 34.5% respectively. Majority of the respondents are in the economically active age group.

Table-2: Age Distribution.

Age	Frequency	Percent
18-24	8	6.9
25-34	25	21.6
35-44	39	33.6
45-54	40	34.5
55-64	2	1.7
65 or Older	2	1.7
Total	116	100

Educational Background: The educational profile of the respondents reveals that majority of the respondents (30%) are having primary education. Equal proportion of people is having graduation degree. This shows the diverse sample which includes both relatively less educated and highly educated.

Table-3: Educational Background.

Educational Background	Frequency	Percent
Primary	35	30.2
Secondary	29	25
Graduation	34	29.3
Post-Graduation	18	15.5
Total	116	100

Family Income: A significant proportion of the respondents have income less than 50,000. Income plays an important role in determining the ability of the individual to contribute financially.

Table-4: Family Income.

Family Income	Frequency	Percent
Less Than 50000	47	40.5
50,000-1,00,000	22	19
1,00,000-1,50,000	15	12.9
above 1,50,000	32	27.6
Total	116	100

Mean Willingness to Pay: A total of 116 respondents were surveyed to estimate the mean willingness to pay for the Vaitarna estuary. The majority of respondents (60.3%) showed a positive towards contributing financially for the conservation of Vaitarna estuary. On the other hand, 39.7 % of the respondents were not willing to pay.

Table-5: Willingness to Pay.

Would you be willing to pay for the conservation and sustainable management of wetlands?				
Valid	Frequency	Percent	Valid Percent	Cumulative Percent
NO	46	39.7	39.7	39.7
Yes	70	60.3	60.3	100.0
Total	116	100.0	100.0	

The respondents were further asked to state the maximum amount they are willing to pay for the wetland. On the basis of the responses, the estimated mean willingness to pay is Rs.316 per year. The respondents who were not willing to pay were further asked the reason for their unwillingness. Majority of the respondents stated that they do not believe that their payment will help stop the degradation of the estuary; some respondents also stated that it is the government's duty to pay for such expenses.

Logit Model: To understand the determinants of the willingness to pay a binary logistic model is employed. The dependent variable is willingness to pay (1= willing to pay, 0 = not willing to pay). The independent variables are - education, income and awareness.

Table-6: Logit Model Summary.

Step	-2 likelihood	Cox & Snell R Square	Nagelkerke R Square
1	107.220a	0.342	0.463

The model summary shows that about 46% of the variation in willingness to pay is explained by the dependent variables. It shows moderate explanatory power.

Table-7: Omnibus Test of Model Coefficients.

	Chi-square	df	Sig.
Step	48.589	3	0
Block	48.589	3	0
Model	48.589	3	0

The Omnibus test of model coefficients was found to be statistically significant ($p < 0.05$), indicating that the model with explanatory variables performs better than the null model. This suggests that the selected variables contribute to explaining willingness to pay.

Table-8: Classification Table.

Observed	Predicted 0	Predicted 1	Percentage Correct
Would you be willing to pay for the conservation of wetlands?			
0 (No)	30	16	65.2
1 (Yes)	11	59	84.3
Overall Percentage			76.7

The classification table shows the predictive capacity of the model. The overall percentage is 76.7 which show good predictive performance.

Table-9: Variables in Equations.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Educational Background	0.087	0.243	0.128	1	0.721	1.091
Family Income	0.742	0.257	8.323	1	0.004	2.1
Awareness Index	1.275	0.376	11.532	1	0.001	3.58
Constant	-6.785	1.719	15.587	1	0	0.001

Family income and awareness are the significant factors in determining the willingness to pay. Both have a positive coefficient that means higher the family income and awareness higher will be the willingness of the individual to pay for the wetland conservation. Education is not significant in determining willingness to pay.

Conclusion

The present study aimed to determine the economic value of the Vaitarna estuary by using contingent valuation method. The findings reveal that mean willingness to pay is Rs. 316 per year. However, the section of the respondents was not willing to pay primarily because the perception that the wetland conservation is the responsibility of the government and they believe that their contribution will not help reduce the degradation of the wetland.

The results of binary logistic model highlight that the income level and awareness about the wetland services are the important determinants of the willingness to pay. The individual with higher income and better awareness contribute more for the conservation. The study shows that wetlands are not only the ecological assets but the communities also value it economically.

Recommendations

The study suggests that the economic value of wetland should be incorporated into the planning and policy process. It will help in the better allocation of resources. The study also suggests that there is a need to increase the public awareness about importance of wetlands. The future research can explore other techniques of valuation.

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