

Conservation of Kole wetlands – willingness to pay approach

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Abstract

The Kole wetlands of Kerala are part of India's largest Ramsar site, spread across the districts of Thrissur and Malappuram, Kerala. India. Agriculture is the primary economic activity undertaken in the wetlands, and in recent times, human activities like land encroachment, hunting, and unsustainable agricultural practices have jeopardised the ecology of the wetlands.

Objectives: The present study attempts to (i) understand the perception of local stakeholders towards conservation of the wetlands, and (ii) estimate the economic value that individuals place on the wetland ecosystem.

Methodology: The study uses a sample of 100 households selected from five panchayats of Thrissur district in Kerala, India. The stakeholders' perception towards participatory conservation of the wetlands and opinions on problems plaguing the ecosystem have been analysed in the study. The contingent valuation method (CVM) has been used to estimate the willingness to pay (WTP) of the stakeholders and ascertain the economic value of the wetlands.

Findings: The study reveals that stakeholders are conscious about the various ecological and economic roles played by the Kole wetlands, with Three-fourths of them highlighting participatory conservation of the ecosystem as crucial. Land reclamation, urbanization, pollution and unsustainable agricultural practices were considered a major problem by close to two-thirds of the sample. Climate change was also identified as a major problem in the wetlands, with 85 % of the sample stakeholders viewing it with concern. The study also finds that households are very willing to pay for the conservation of the ecosystem. An individual's education attainment, period of residency, income and land holding were identified as the most significant factors which determined the WTP. Using an annual green tax as the payment vehicle, the median WTP value was estimated to be ₹ 300 individually, with the total economic value of the wetlands estimated to be approximately ₹ 25 crores.

Application/Improvement: The study concludes that a bottom-up approach involving the public, state and action groups can change the ecosystem positively. The present study is, however, only an initial attempt to estimate the value of the Kole wetlands, and further analysis is necessary to see how the situation differs from one region to another.

Keywords: Kole wetlands, willingness to pay, Ramsar site, contingent valuation method, climate change

1. Introduction

Wetlands are generally considered to be fragile ecosystems which are of prime importance due to them being biodiversity hotspots around the world. They are described as 'complex hydro-ecological systems, whose structure provides us with goods or products involving some direct utilisation of one or more wetland characteristics, while wetland ecosystem processes provide us with hydrological and ecological services, supporting or protecting human activities or human properties without being used directly' [1-2] have cited [3] while observing that the global area under wetlands has been declining steadily throughout the course of the 20th Century. The Convention on Wetlands of International Importance especially as Waterfowl Habitat, convened at Ramsar, Iran in 1971 was the first step towards international cooperation on the conservation and intelligent use of this precious natural resource. The Ramsar Convention explicitly defines a 'wetland' in the following manner:

"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 metres"

India has a wealth of wetland ecosystems along the length and breadth of the country, from environments as diverse as the Himalayas to coastal zones along the Arabian Sea and Bay of Bengal. The National Wetlands Conservation Programme estimates that there are approximately 4.1 million hectares of wetlands in India, 1.5 million of which is natural and the rest man-made. NWCP also estimates the presence of 6750 km² of mangrove – dominated wetlands along the Indian coastline (NWCP, 2009). NWCP also enlists 115 wetlands as having critical importance, and 25 sites have been identified as of prime conservatory importance by the Ramsar convention.

The importance of wetlands is such that they are described as “*kidneys of the landscape*” and “*biological supermarkets*”[4]. The wetlands play a crucial role in maintaining the hydrological and chemical cycles of a region, while also being sustaining a wide variety of flora and fauna through extensive food webs. At the same time, wetlands have been increasingly used to satisfy human economic wants, primarily agriculture, and to a certain extent, other urbanized, industrialized activity. In many situations, the conversion of natural wetlands into agricultural and other commercial uses renders the ecosystem in ruins since the change has been observed to largely be irreversible in nature. Wetlands have thus been termed a non – renewable natural resource that must be conserved at all costs [5-6]. Studies have observed that environmental destruction can have great repercussions for human communities, as in the case of Odisha, where loss of the local mangrove ecosystem resulted in widespread damage to human settlements due to hurricanes [7]. The anthropogenic activities threatening wetlands are also routinely ignored in Regional Developmental Plans of Governments, as in case of the destruction of the estuary of the Periyar River in Kerala [8].

2. Background of the study

Spread across an area of 151,250 ha., the Vembanad – Kol wetlands constitute India’s largest brackish, humid, tropical wetland ecosystem. Declared a Ramsar site in 2002, these wetlands are integral to the ecology and economy of Alappuzha, Ernakulam and Thrissur districts. Geographically, the wetlands are located between 09° 00’ – 10° 40’ N Latitude and 76° 00’ – 77° 30’ E Longitude. The average elevation of the wetlands has been observed to be 0.6 – 2.2 m below mean sea level (MSL). The Vembanad – Kol wetlands are fed by ten rivers, all of which originate in the Western Ghats before flowing westwards and draining into the Arabian Sea. The wetlands are also exposed to diurnal tidal cycles [9-10]. The Vembanad – Kol wetlands are home to a wide variety of flora and fauna, providing habitat for nearly 20,000 migrant and residential bird species, as well a variety of indigenous fish and mangrove species [11]. Agriculture is the main economic activity undertaken in the Kole wetlands, and it has been practiced for more than 200 years [12-13].

3. Objectives and Methodology

The primary objectives of the study are to examine the perceptions of residents to various issues associated with the Kole wetlands, and to estimate the economic value of the ecosystem based on the households’ willingness to pay for conserving the fragile ecosystem in the Thrissur Kole. The study is based on data collected from 100 households in five panchayats of Thrissur district. Analysis of the primary data has been done with regard to identifying three major aspects – perception towards participatory conservation of the wetlands, perceptions about problems plaguing the wetlands, and households’ willingness to pay for conserving the ecosystem.

The contingent valuation method (CVM) has been utilized to estimate the economic value of the Thrissur Kole wetlands. CVM as a technique has been used widely to ascertain the value of ecosystems based on human perceptions about their conservation, improvement and sustenance for the future [14-23]. The studies have generally found that income and education have a positive impact on an individual’s willingness to pay, and that people are usually very receptive towards such initiatives where public participation can help in environmental conservation. To know the willingness to pay (WTP) of each household, the payment card method was used – the respondent was handed out a payment card with six ranges to choose from for their WTP. They respondent was also asked to specify exactly how much they would be willing to pay. The participants in the survey were asked to imagine a hypothetical market scenario where there exists an agency akin to the Kole Development Agency, but with a focus on conservation instead of infrastructure development.

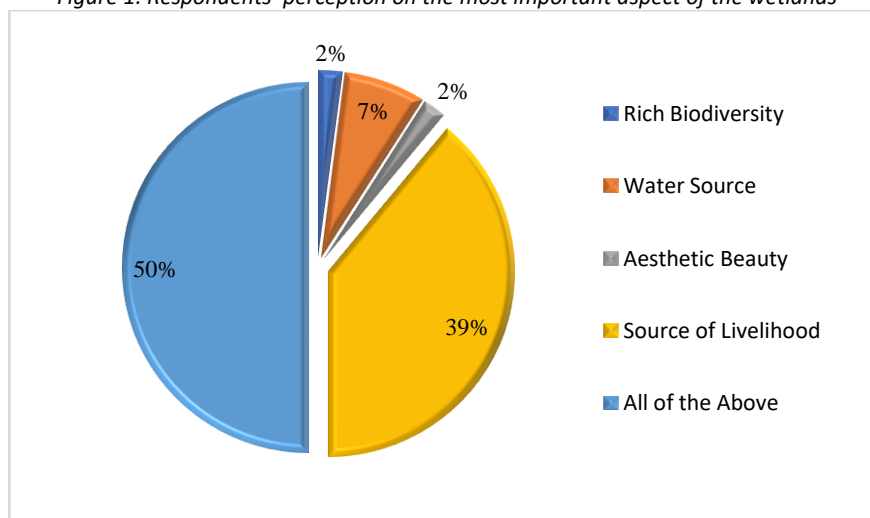
The proposed agency would be constituted in a participatory framework, incorporating the views and actions of local stakeholders like farmer collectives, people’s representatives in Local Self Governments (LSGs), the administrative machinery including high ranking officers like the District Collector, as well Members of the Legislative Assembly and Members of Parliament from Thrissur District. The creation of such agencies has been suggested to be effective in the management of wetland ecosystems as in the case of the Bhoj wetlands, which is another important Ramsar site in India [24]. The activities of the proposed agency would include implementing the following policy measures such as implement stringent measures to check land reclamation and reclaim illegally converted wetland area, regularly monitor the state of biodiversity in the region, undertake afforestation drives, establish and maintain sewage treatment plants to check water pollution, implement sustainable agriculture, and involve research and development activities for better agricultural practices [10, 25-26].

In order to accomplish these measures, the agency would declare the Kole wetlands as a protected community reserve – the lands could be under public or private ownership, and the conservation would take place as a collective effort between the State and local stakeholders. A private party’s ownership of the wetlands would not be threatened, and their livelihoods would also be protected, but in accordance with the conservation aspect and overall improvement in the ecological balance of the region. The declaration of the Kole wetlands as a community reserve would entail the creation of a select panel, vested with the duty of achieving and maintaining the twin goals of sustainable agriculture and ecological conservation in a time-bound and systematic manner. The payment vehicle proposed to the sample was a Green Tax collected annually by the Government to fund the agency’s operations.

1. People’s perceptions towards conservation of the Kole wetlands

An individual’s view about protecting the Kole wetlands is dependent on what they perceive to be the best aspect of it. In the survey, the respondents were asked to specify what they thought was the best aspect of the Kole wetlands out of five given choices, viz., aesthetic beauty, water source, rich biodiversity, a source of livelihood, and all of the above. The responses from the survey showed that half of the households considered all facets to be equally important. 39% of the respondents were of the opinion that the most important aspect of the wetlands was its role as a provider of livelihoods. All 39 of these respondents were farmers whose livelihoods were entirely dependent on the farming system in the Kole wetlands. Only 2% each of the respondents stated that the most important aspect of the wetlands in their view was the rich biodiversity, or the pleasure derived from enjoying the aesthetic beauty of the paddy fields. 7% of the respondents remarked that the Kole wetlands were an important source of water, and this function trumped every other facet of the wetlands in importance. The results are shown in Figure 1.

Figure 1. Respondents’ perception on the most important aspect of the wetlands



Source: Primary Data

2. Perception of respondents to various conservation questions

To measure the perception of respondents towards the conservation of the Kole wetlands, a Likert scale was used with eight statements measuring the extent of the latent variable. A five-point scale was used, with the respondents asked to mark their response as either of strongly disagree, disagree, neutral, agree, or strongly agree. The scoring was 1 to 5 for each of these responses in their above order – strongly disagree is worth a score of 1, and strongly agree is worth 5, with all other values coming in between. The eight statements posed to respondents as part of this Likert scale are as follows:

1. The ecological importance of the wetlands is high, and once lost, it cannot be reclaimed.
2. The Kole wetlands are in a state of environmental degradation today as a result of human activities.
3. If left unabated, the destruction of the wetlands will continue at a rapid pace, which endangers both the natural ecosystem and human livelihoods.
4. The wetland biome must be preserved by the State, by putting a hold on all developmental projects in the area.
5. The local stakeholders must play an equally important role in the conservation of the ecosystem.
6. The elimination of the wetland ecosystem and its associated biodiversity in biggest Ramsar site is a major cause of concern.
7. Implementation of infrastructure development projects is harmful for the Kole wetlands.
8. Urbanization and implementation of employment – generating industries is detrimental for the sustenance of the wetland ecosystem.

From the responses given by the sample households are given in Table 1, it can be seen that an overwhelming majority agreed with respect to six of the eight statements. However, regarding the participation of local stakeholders in the conservation activities, and the impact of urbanization, the tone of responses was different. A quarter of the sample did not particularly agree that stakeholders need to be actively involved in the conservation of the wetlands, and an even greater figure (55%) were either neutral towards or disagreed with the statement that urbanization and employment-generating activities were detrimental to the wetlands.

Table 1. Participant responses towards various conservation aspects

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
S1	0	3	6	28	63	100
S2	0	0	2	28	70	100
S3	0	1	3	34	62	100
S4	0	1	7	49	43	100
S5	2	1	22	40	35	100
S6	0	0	2	14	84	100
S7	0	1	5	21	73	100
S8	4	9	42	16	29	100

Source: Primary Data

It is evident from Table 2 that both respondents who strongly disagreed with statement 5 are agriculturalists. A look at respondents who were neutral to action on the part of the stakeholders again reveals that half of them are farmers. The reason for this apparent lack of interest is that farmers expected the state to take up the initiative of conservation and ecosystem improvement. A general response given by the farmers to the enquirer was that they were experiencing monetary loss due to pest attacks; drought, salinity and crop loss, with the state doing nothing other than announce periodical compensation packages. The respondents fear that taking up any initiative spearheaded by local stakeholders would be a further waste of money, time and resources. They have thus sought to place all burden of conservation and wetland improvement on the shoulders of the state machinery and stand by as witnesses.

Looking at the responses towards the eighth item in the Likert scale, ie., the effect of urbanization and employment generating projects on the wetlands, it can be seen that only a few individuals have an opinion that employment generating activities and urbanization need not be discouraged. However, the fairly large number of individuals who are neutral to the destruction of the wetland ecosystem can be interpreted as a cause for worry. More than a quarter of farmers, nearly half of business persons and 64% of salaried respondents have expressed this neutrality.

Table 2. Principal Source of Livelihood and Response to Statement 5

Response	Respondent's Principal Livelihood Option				Total
	Agriculture	Business	Salaried	Pension	
Strongly Disagree	2	0	0	0	2
Disagree	0	1	0	0	1
Neutral	11	3	5	3	22
Agree	15	12	10	3	40
Strongly Agree	13	9	10	3	35
Total	41	25	25	9	100

Source: Primary Data

In all, 42% of total respondents was neutral in their opinion. The reason for this expression of neutrality could be that these households equate a higher availability of employment opportunities, and expanding urban sprawls as markers of economic development. And indeed, from their responses to this statement, it was evident that they did not choose to give an opinion that they felt was against a general progress which could be witnessed in their region. It is thus the prevalence of an anthropocentric view that human progress can continue even if it means the environment has to pay a price for it as shown in Table 3.

Table 3. Principal Source of Livelihood and Response to S8

Response	Respondent's Principal Livelihood Option				Total
	Agriculture	Business	Salaried	Pension	
Strongly Disagree	1	3	0	0	4
Disagree	5	1	2	1	9
Neutral	11	12	16	3	42
Agree	6	5	3	2	16
Strongly Agree	18	4	4	3	29
Total	41	25	25	9	100

Source: Primary Data

3. Perceptions towards various problems in the wetlands

Measurement of the perception of respondents about the various problems present in the Kole wetlands again used a Likert scale with eight items. A five-point scale was once again utilised, with the respondents asked to mark their response as either of strongly disagree, disagree, neutral, agree, or strongly agree. The scoring was 1 to 5 for each of these responses in their above order – strongly disagree is worth a score of 1, and strongly agree is worth 5, with all other values coming in between. The eight problems which were presented before respondents are as follows:

1. Land reclamation in the wetlands for infrastructure development and urbanization.
2. Clay mining in the wetlands for the tile and brick industries.
3. Unauthorized hunting of migratory bird species.
4. Loss of indigenous species of fish due to introduction of predatory breeds.
5. Pollution of canals and rivers draining into the Kole wetlands.
6. Increased use of artificial fertilizers, chemicals pesticides and weedicides.
7. Climate change and drought.
8. Increasing salinity due to ineffective construction of bunds and improper management of regulators.

The responses of the survey participants to these statements are given in Table 4. Looking at these responses, it can be seen that land reclamation, loss of indigenous fish species, climate change, use of artificial agricultural inputs, and pollution were identified as major challenges, with a majority of respondents agreeing to the prevalence of these issues. Only 26 % of households agree to some degree that clay mining is an issue in the wetlands. Respondents largely identified it as a problem in the past, but which is nowadays becoming uncommon due to many brick and tile factories shutting down. The question on hunting of migratory birds drew a mixed response, with many choosing to stay neutral or disagreeing since in most panchayats, authorities have installed mechanisms to check illegal hunting. The problem of salinity also drew a mixed response, as it is a largely regional problem and was seen only in the last one or two years.

Land reclamation and pollution were viewed as the gravest threats in Adat and Kolazhy, with roughly 60 % of respondents in both panchayats strongly agreeing to the presence of large-scale land filling, and all but one household agreeing to the problem caused by pollution. In contrast, nearly half the respondents in Manalur, Mullassery and Venkitangu panchayats either disagreed or were neutral towards the problem of pollution. Salinity of the wetlands is an absolute non-issue in Adat and Kolazhy, but in the worst affected panchayats of Manalur and Venkitangu, half the respondents agreed it was a major issue. 43 and 35% of respondents in these two panchayats respectively also chose to maintain neutrality, hoping that last year's saline incursion was a one-off incident which can be averted in the future. Neutrality was also a major response in Kolazhy (67%) and Mullassery (32%) although rising salinity does not affect them. From the responses, this stand can be attributed to a latent fear that a rising incidence of such problems in the future might affect the entire ecosystem, with effects spreading far beyond their point of occurrence.

Table 4. Participant responses towards various problems in the wetlands

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
P1	1	6	26	25	42	100
P2	2	26	46	16	10	100
P3	5	20	33	27	15	100
P4	0	3	8	47	42	100
P5	0	14	21	11	54	100
P6	0	1	18	33	48	100
P7	1	4	10	41	44	100
P8	8	22	40	16	14	100

Source: Primary Data

4. Estimating the willingness to pay

Assuming the existence of the hypothetical scenario presented to them, the respondents were asked whether they would co-operate with such an agency. They were also asked whether they would commit an annual voluntary payment to the agency for it to attain its laid-out objectives. 97% of respondents in the sample expressed a willingness to wholeheartedly support the creation of such an agency, while 3 respondents were sceptical about the efficiency of such a mechanism. However, the sceptics also said that they would have no issues in extending support to the formation of such a collective. Also, no household in the sample expressed an unwillingness to pay for conserving the ecosystem. Everyone was equivocal in expressing a willingness to be a part of a positive change which they would witness in their lives.

Table 5. Income Class and WTP Value

Income Class	WTP Range						Total
	<100	101-200	201-300	301-400	401-500	>500	
<100,000	9	5	0	0	0	0	14
100000-200000	5	18	4	0	0	1	28
200000-300000	0	0	11	3	2	4	20
300000-400000	0	0	1	2	7	3	13
400000-500000	0	0	1	2	1	2	6
>500000	0	0	0	0	1	18	19
Total	14	23	17	7	11	28	100

Source: Primary Data

When asked to state how much they were willing to part with for conserving the environment, participants gave responses which varied from as low as ₹ 50 to as high as ₹ 2,500/-. The value of WTP expressed by the households was divided into six slabs. Analysing the data shows that households who were willing to pay a high WTP value comprised 39 % of the sample.

Households which were willing to contribute an amount less than ₹ 200 constituted 37% of the sample, while the rest of the households were willing to make a contribution between ₹ 200 – 400. Previous studies have indicated that a household’s willingness to pay will be higher if they have a higher income. In the present study also, such a trend is visible, as respondents with higher annual incomes expressed a higher level of WTP. This is shown in Table 5.

5. Determinants of the willingness to pay

A number of factors have been identified, which could influence an individual’s willingness to pay for conserving and further improving the state of the Kole wetlands. Variables thus identified are age, education, income, period of residency, and land holding size. In addition to these socio – economic factors, an individual’s perception on the conservation of the Kole wetlands is also included as a determinant of WTP in the model. For this, a perception score has been calculated based on the opinion given by respondents to the first Likert scale measuring their view on conservation and development measures to be adopted in the Kole wetlands. Each opinion on the 5 – point Likert scale was given a score of one to five, and since all eight questions asked were intended to measure one latent variable, the scores of the eight questions summed up to give a score out of 40. Every household could get a score ranging from 8 to 40 in this manner. The value thus derived has been considered an interval variable and used in the model as one of the determinants of the WTP value.

Attempt is made to examine the relationship between the aforementioned variables and a respondent’s willingness to pay. The model to explain willingness to pay can therefore be expressed as a function of the following socio-economic variables:

$$WTP = f(A, R, E, P, L, Y), \text{ where}$$

A = Age of the respondent

R = Period of residency in the locale

E = Years of education

P = Perception Score with regard to conservation

L = Total size of land holding, including agricultural land

Y = Average annual income of the household

In terms of the variables, the model is expressed as follows:

$$WTP = \alpha + \beta_1A + \beta_2R + \beta_3E + \beta_4P + \beta_5L + \beta_6Y$$

Among the independent variables, two variables – period of residency, and total land holding size, are assumed to not have a positive relationship with the WTP value. All other variables are assumed to have a direct and positive relationship with the independent variable. Running an OLS regression to estimate the effect of the above determinants on the willingness to pay of the households gives the results described in Table 6.

Table 6. OLS regression results

Variable	Unstandardized Coefficients		Standardized Coefficients	t – value	p – value
	β	Standard Error	β		
Constant	-741.600**	313.317		-2.367	0.02
Period of Residency	2.621**	1.238	0.14	2.117	0.037
Years of educational attainment	24.980*	7.348	0.234	3.4	0.001
Age of the respondent	-2.058	1.801	-0.079	-1.143	0.256
Perception Score	16.895**	8.024	0.116	2.106	0.038
Total Land Holding	.547*	0.172	0.244	3.189	0.002
Average Monthly Income	.012*	0.002	0.531	6.658	0.000
R ²			0.728		
Adjusted R ²			0.71		
Sample Size			100		

*: Significant at 1% level; **: Significant at 5% level

An R^2 value of 0.728 indicates that the model is a good fit for the given data. From the results of the OLS regression performed, it is visible that all variables except the age of the respondent are significant at 95% confidence level. The average monthly income, land holding size and level of educational attainment are also significant at a 99% confidence level. Looking at the standardized coefficients reveals that it is the average income and land holding size that act as the biggest influences over the value of WTP stated by the respondent, with the level of education also playing a role almost as important as the size of land holding.

The age of the respondent has a seemingly negative relationship with the value of WTP, indicating that the younger generation is more conscious about conservation of the wetlands and is willing to pay more than respondents who belonged to the older generations. The increasing length of a respondent's residence in the area proximate to the wetlands also has a positive effect on WTP, as does the household's general perception towards conservation of the wetlands. However, these two variables pale in comparison to income and land holding, which could indicate that wealthier families have a tendency to pay higher sums as their WTP.

6. Estimating the Value of the Kole Wetlands

Calculating the economic value of the Kole wetlands entails estimation of the WTP for the individual households in the sample and then extrapolating it for every household in the population. The mean maximum WTP value for the entire sample of 100 households is ₹ 476, with a standard deviation of ₹ 414. The presence of a large standard deviation could mean that the median is a good measure of WTP for extrapolation. The median WTP for the entire sample is ₹ 300. The total number of households living in the proximity of the Thrissur – Ponnani Kole wetlands as per the 2011 Census is 4,18,248. Based on the above, the total WTP for households in the Thrissur – Ponnani Kole wetlands for the conservation and improvement of the wetland ecosystem can be estimated to be ₹ 12,54,74,400.

However, given the fact that the Kole wetlands contribute to nearly 15% of Kerala's total domestic rice production, and have the highest average productivity of paddy among bigger districts, the Kole wetlands assume greater significance. It also needs to be noted that the benefits of the wetlands extend not just to residents in the area, but also to other individuals living in other parts of the district. When the ecological importance of the wetlands as outlined is taken into consideration, WTP needs to be estimated for a population that includes all individuals who would potentially be affected by the destruction of the Kole. Taking this approach would entail calculating WTP for the whole of Thrissur district. The total number of households in Thrissur district is 759,210. Applying the obtained median value of WTP to this population gives the total WTP of Thrissur district for preserving ecological services in the Kole wetlands to be equal to ₹ 22,77,63,000/-. Adding the population of Ponnani taluk to that of Thrissur district would increase median WTP for the entire population to ₹ 25,01,61,000/-.

4. Conclusion

The Kole wetlands are vital to the livelihoods of a large number of agriculturalists in Thrissur district, while also serving as a breeding ground of a rich diversity of flora and fauna. The study reveals that people in general are quite receptive towards the idea of conserving the wetland ecosystem, with the perception of the Kole wetlands as a source of livelihood acknowledged by a majority as being critical. However, not all of them are in favour of local stakeholders playing the major role in conserving the ecosystem, with the state being identified as the agent of change. Many respondents were also neutral towards the idea of the wetlands area being used for housing the expanding population and creating new employment opportunities.

When expressing their willingness to pay, households with a higher income were observed to state a higher WTP value. The OLS regression shows that all variables except the respondent's age are significant. A person's perception score about the wetlands, educational attainment, and period of residency were identified as being most important in determining WTP, overshadowing income as a factor. It can be concluded that people in general are keen on conserving the Kole wetlands for the future, taking into consideration the various functions served by the ecosystem. The large-scale public interest in conserving the ecosystem can fuel a state-sponsored initiative for the same. Revenue generated from the public for the conservation efforts, can be channelled towards conservation and sustainable agricultural practise either directly by the state or through action-oriented NGOs.

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