International Journal of Ecology and Environmental Sciences 50: 727-737, 2024
ISSN: 2320-5199 (Online); https://doi.org/10.55863/ijees.2024.0195

Willingness To Pay (WTP) for Community-Based-Conservation Activities: A Comparative Study of Harike, Ropar and Nangal Wetlands in Punjab, India

GAURAV KUMAR[1], AMANDEEP KAUR[2], JAJATI KESHARI PARIDA[3], ARTI SINGH[4] AND KIRAN KUMARI SINGH[4]

[1]Department of Geography, Central University of Punjab, Bathinda, India
[2]Department of Geography, Baba Farid Group of Institutions, Bathinda, India
[3]Department of Economic Studies, University of Hyderabad, Hyderabad, Telengana, India
[4]Department of Geography, University of Allahabad, Prayagraj, India
E-mail: bansalgari001@gmail.com, ammmann79@gmail.com, jajatieco@gmail.com, singh.arti2011@gmail.com, kiran.singhgeo@gmail.com; ksingh@allduniv.ac.in
ORCID: 0000-0002-2233-180X (KKS)

ABSTRACT

Conservation of wetlands is essential because they provide numerous benefits to mankind in supporting human life, ecosystems and biodiversity, but predominant number of wetlands are at risk of degradation and loss due to both anthropogenic and natural processes. In this context, community participation is very important in the process of conservation of wetlands. Based on a primary survey of communities (401 households) living around three important wetlands of international importance (Harike, Ropar and Nangal Wetlands of Punjab), we examined the factors that determine individuals' willingness to pay for the protection of these wetlands. Using both qualitative (Likert scale) and quantitative (Probit regression) tools, we observed that these wetlands not only provide livelihood mechanisms to local people (living in villages and surrounding urban centers), but they also provide recreational opportunities. The respondents are aware about the ecological significance of the wetland and are willing to pay an average amount of INR 30 (US$0.5) per month. The standard of living, individual's level of education and awareness, and occupation significantly determine their willingness to pay for wetland protection in Punjab. Results of this study advocate the conservation of these wetlands from the perspective of sustaining the livelihoods of local people and provision of ecosystem services (ES) in Punjab, India.

Key words: Wetlands; Perceived benefits; Livelihood; Willingness to Pay (WTP); Community-based conservation; Punjab.

INTRODUCTION

Wetland provides a wide range of ecosystem services and benefits to millions of people. According to a recent estimate by Davidson et al. (2019), wetlands provide ecosystem services worth $47 trillion per year globally. Wetland supports the livelihood of local people and, maintains ecological balance and social wellbeing (Anonymous 2005, Moore 2006, Ghermandi et al. 2008, Kundu et al. 2008, Gopal and Ghosh 2008, Paul et al. 2011, Anonymous 2012, 2018). Locals, especially those living in rural areas of developing countries, depend immensely on wetlands for their livelihood (for example: fishing, collection of fuel wood, crop cultivation, livestock grazing and sand mining etc.) and food security (Nonga et al. 2010, Kakuru et al. 2013). About 5 per cent of the geographical area (15.26 million ha) of Indian sub-continent is wetlands, on which millions of people directly or indirectly depend on these for their livelihood (Anonymous 2011b).

Wetland ecosystems are very sensitive areas, which are easily affected by anthropogenic activities (Bassi et al. 2014). Wetlands are under threat due to encroachment, land use change and the development projects all over the world. Major threats responsible for the ecological degradation of wetlands include conversion of wetlands into agricultural land, population growth, development of infrastructure such as construction of roads and railways, disposal of liquid and solid waste (Prasad et al. 2002, Zedler and Kercher 2005, Anonymous 2007, Birol and Cox 2007, Bassi et al. 2014). The tendency for wetland loss in plain topography or low-lying area is greater due to conversion of wetlands for agricultural use (Vitousek et al. 1997, Ravenga et al. 2000, Ambastha

et al. 2007). For example, land use conversion from wetlands to agriculture resulted in the loss of approximately 80-90% of lowland wetlands (Dahl and Allord 1997, Keddy et al. 2009). The process of unplanned urbanization and lack of management or conservation activities has also put enormous pressure on the wetlands and seriously affected people's livelihoods and water supplies (Kumar and Singh 2020). Therefore, it is necessary to protect wetlands from encroachment and degradation to maintain the livelihood systems of a large number of poor and marginalized sections of the Indian society. Communities can play an important role in conserving wetlands. The community-based-conservation approach is based on the idea that the livelihoods of local people depend on local resources and therefore, communities can support conservation initiatives so that their livelihoods are not threatened (McNeely 1989). This approach involves the effective participation of local communities in conserving local resources for sustainable development.

This study selected three wetlands namely Harike, Nangal (both declared as wildlife sanctuaries) and Ropar wetlands (declared as a conservation reserve) in the state of Punjab (about 2% of its total geographical area is wetlands), India, to study the perceived benefits of the wetland and willingness to pay (WTP) for the conservation of these wetlands. Furthermore, it explores the socio-economic factors that determine WTP for the protection of these wetlands.

MATERIAL AND METHODS

Study area

Out of a total of 1190 wetlands in Punjab (Anonymous 2011a), only three viz., Harike, Ropar and Nangal wetlands are selected purposively considering their recognition as the Ramsar sites, and their geographical locations. All these selected wetlands are freshwater anthropogenic wetlands. While Harike is located at the meeting point of three regions of Punjab viz., Malwa, Doaba and Majha regions, the wetlands Ropar and Nangal are located within the proximity of both Malwa and Doaba regions. Despite, high biodiversity values, the Harike and Ropar wetland are facing problems of degradation (Ladhar 2002) and encroachment for the residential and agricultural uses (Chopra et al. 2001). The wetland Harike is unique, because of its ecological significance. It is also declared as a National Wildlife Sanctuary for Indian, and migratory Siberian and Arctic birds. It was declared as Ramsar site in the year 1990. It is located in the western part on the confluence of Sutlej, Beas and Kali Bein Rivers in Punjab. There are 12 villages and 1 town located within 1 km buffer around the Harike wetland. About 0.2 million human population depend either directly or indirectly on this wetland as their source of livelihood. The wetland Ropar on the other hand, is situated near the city Roop Nagar, on the bank of river Sutlej in the eastern part of Punjab. It was also declared Ramsar site in the year 2002 due to its ecological significance. It provides livelihood to about 0.15 million human population. The wetland Nangal is located on the downstream of Dam Bharka, on the bank of river Sutlej in the eastern part of Punjab (Fig. 1). In the year 2009, the Nangal wetland was declared 'Wildlife Sanctuary' due to its favorable environmental conditions for breeding of migratory birds. Later on, in the year 2019, the Nangal Wildlife Sanctuary was included in the Ramsar site list (Anonymous 2021). It provides direct livelihood to about fifty thousand human population, and indirect benefits to many.

Sampling framework and sample size

Though wetlands are chosen purposively, sample households from each of the wetland region are selected using simple random sampling method. First, a buffer zone of one km was prepared around the wetlands, and then the villages/towns falling within this zone are selected at random. From Harike wetlans, out of total 12 villages that occur within 1 km radius of the wetland, 6 villages viz., Harike, Chamba Kalan, Kiriyan, Dhun, Kambo Dhaiwala and Rasulpur, and the only town i.e., Makhu are covered for data collection. Similarly, from Ropar, out of total 20 villages occurring within 1 km radius of the wetland, 9 villages viz., Chak Dhera, Laudi Majra, Bahardurpur, Dakala, Garh Bagga, Tabba Tiaprian, Patail, Katli and Alampura, and the only town i.e., Rupnagar are covered. From 1 km radius of the wetland Nagal, out of 9 total villages only 4 villages viz., Swamipur Bagh, Khera Bagh, Talwara and

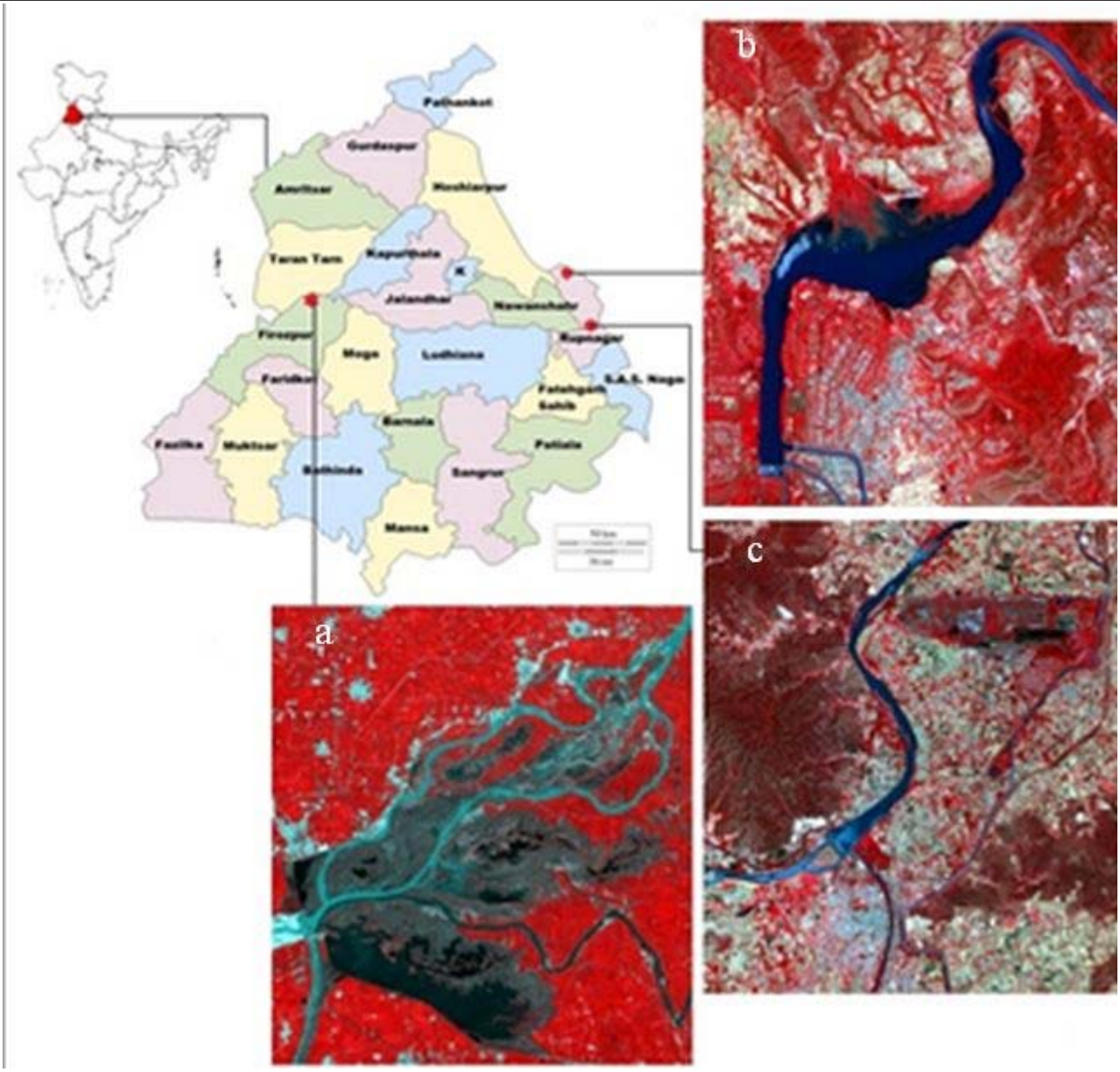

Figure 1. Location and Landsat 8 images for the year 2018 (a) Harike, (b) Nangal and (c) Ropar wetlands

Bhabahor Sahib and the only nearby town Nangal are chosen for collecting primary data. The inclusion of both villages and towns enables us to draw reasonable conclusions regarding willingness to pay for the protection of wetlands in Punjab. A sample size of 401 households is covered (170 from Harike, 145 from Ropar and 86 from Nangal wetlands) using the proportionate criteria. The field survey was conducted between November 2017 and January 2018.

Likert scale

The local perception about the significance of ecosystem services of wetlands is measured through a 3-point Likert scale. The perception was measured for seven ecosystem services (Table 1) and the dependency of people on the services. The respondents were given three options for every service and 1 mean high dependency, 2 mean medium dependency and 3 mean no dependency.

Econometric tools used

To find out the socio-economic factors determining an individual's WTP for wetland conservation programs, we have estimated a probit regression model. Since the dependent variable is binary (which

Table 1. Perception on significance and dependency of respondents on ecosystem products and services derived from wetlands (plotted on three points Likert scale)

Ecosystem services	Harike (170)		Ropar (145)		Nangal (86)		Total (401)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Food grains	2.25	0.70	2.51	0.72	2.80	0.43	2.46	0.69
Fuel woods	2.34	0.75	1.88	0.81	1.94	0.67	2.08	0.78
Recreational	2.13	0.56	1.86	0.75	1.26	0.44	1.84	0.70
Religious	1.43	0.60	1.68	0.63	1.26	0.46	1.48	0.61
Commercial fishing	2.84	0.54	2.77	0.60	2.87	0.40	2.82	0.54
Tourism	2.95	0.25	2.77	0.59	2.51	0.73	2.79	0.54
Commercial livestock	2.56	0.72	2.19	0.92	2.84	0.50	2.49	0.80

Note: 1 means high dependency, 2 means medium dependency and 3 means no dependency

assumes value '1' for willing to pay, and '0' otherwise), and the residual plot follows normal distribution, a probit regression model is appropriate in this case (Equation 1). The explanatory variables used in this regression model are derived from the accepted utility theory. According to Dougherty (2011), if Up is the expected utility when respondents are ready to pay for wetland restoration and Un means that they are not ready to pay for the conservation of wetlands, then, the WTP follows the following function:

$$WTP = \begin{cases} 1, & Up - Un > 0 \\ 0, & Up - Un \leq 0 \end{cases} \quad (1)$$

An individual is willing to pay for the conservation of wetlands if and only if $U^*_P > U^*_N$. The explanatory variables used in this study include both individual (X) and family-level characteristics (Z). These are family income, religion, social group, respondent's income, age of the respondent, level of education, occupation, recreational uses awareness, etc. The equations of the simple probit model is as follows:

$$P(WTP=1|X \& Z)=\Phi(X\beta; Z\theta) \quad (2)$$

$$P(WTP=0|X \& Z)=1-\Phi(X\beta; Z\theta) \quad (3)$$

Through the equation 2 and 3, we are going to estimate a latent variable WTP^* which lies between 1 and zero. For doing so we have to maximize the likelihood function generated through the standard normal cumulative distribution function (Φ), which is given below (Equation 4):

$$L(\beta, \theta; WTP; X, Z) = \prod_{i=1}^{n} \{\Phi(X\beta; Z\theta)\}^{y_i} \{1-\Phi(X\beta; Z\theta)\}^{1-y_i} \quad (4)$$

RESULTS AND DISCUSSION

Local perception about the significance of ecosystem services of wetlands

The perceived benefits of wetlands for the respondents, living within the 1 km buffer zone of Harike, Ropar and Nangal wetlands are presented in Table 1. According to the respondents around Harike wetland, the wetland is significant for food grains production, fuel collection, livestock grazing, religious purposes and, recreational purposes. Tourism was not identified as an important ecosystem service of Harike wetland (Mean=2.9, SD=0.2) by the respondents. The perceived benefits of wetlands for the respondents of Ropar wetland are fuel woods availability, recreational and religious uses. The respondents do not consider commercial fishing or tourism as important activities near the Ropar wetland. In Nangal wetland, respondents are highly dependent for recreational and religious purposes while other ecosystem services such as food grains production, commercial livestock and commercial fishing were not found to be significant.

From all the respondents, the importance of the wetland for products and services is ranked as follows; religious uses > recreational uses > fuel woods > food grains > commercial livestock > tourism > commercial fishing (Table 1). The value

of SD is least scattered in the case of commercial fishing and tourism-related activities (SD=0.5) and is highly deviated from the commercial livestock variable. The result indicates that the local people perceive the benefits of ecosystem services provided by wetlands due to their dependency on livelihood and recreational activities.

Bid response on willingness to pay (WTP) for conservation of wetlands

The willingness to Pay (WTP) is one crucial aspect of knowing the preferences, attitude and awareness of the local people about the ecosystem services and goods provided by the wetland. To know the WTP, the question was asked from the respondents whether they were ready to pay or not for the conservation of wetlands since their livelihoods depend on it. The bid amount for WTP was also asked from the respondents who are ready to pay for it. In the present study the bid prices for the WTP were as: 50, 100, 200 and more than 200 rupees per month. Questions related to the reason behind refusing the bid amount for the conservation of wetlands were also asked. Household income was found to be the main reason behind their refusal. Few people believe that their efforts will have no impact and the government should play the role in wetland conservation. It was found that out of the total 401 respondents only 115 (28.7%) were willing to pay for the conservation of wetlands. The respondents from Harike (10.6%) and Ropar (31.1%) wetlands are less likely to pay for the conservation of wetland as compared to Nangal (60.5%) wetland. The proportion of respondents willing to pay for the conservation of wetlands also changed for the bid amount for WTP. Out of 115 respondents, 70 (60.9%) respondents are ready to pay 50 rupees (INR), 21 (18.3%) are ready to pay 100 rupees (INR), 9 (7.8%) for 200 rupees (INR) and 15 (13.1%) respondents are ready to pay more than 200 rupees (INR) per month (Table 2).

Table 2. Bid amount of WTP of respondents for the conservation of wetlands

Bid amount in INR/month	Number of respondents WTP	%
50	70	17.46
100	21	5.24
200	9	2.24
More than 200	15	3.74
Can't pay	286	71.32

The result indicated that the respondents' WTP for the conservation of wetlands, directly or indirectly, was affected by their sources of earning and occupation (Table 3). The respondents engaged in the secondary and tertiary activities were more willing to pay as compared to the respondents engaged in the primary activities. For the conservation of Harike wetland, about 31.4% respondents engaged in service sector (business activities), 33.3% in the tertiary sector and 6.3% in agricultural activities were willing to pay. The WTP for the conservation of wetland areas is affected by other socio-economic indicators. Therefore, a simple probit model was used to identify the variables affecting the WTP of the respondents for the conservation of wetland areas.

Probit model on WTP for the conservation of wetlands

The probit models 1 and 2 indicated that the family income, respondent earnings, occupation, education, and gender are significant variables for WTP, while religion, caste, and age are statistically not significant. The results are consistent with the finding of Zhu et al. (2016) that age has no impact over on the WTP for the wetland restoration programs. The respondents engaged in primary activities are not interested in conservation activities because the conservation programmes negatively affected their economic activities and impeded cultivation in the wetland protection zones.

The gender variable for the models 1 and 2 are statistically significant at a 1% level with WTP. While the male respondents were not willing to pay for the conservation, the female respondents were more likely to pay for conservation practices of the wetlands. Near Harike wetland, women depend on the wetland for the collection of raw materials for handicrafts and fuelwood. The use of water hyacinth as raw material for the making of handicraft items revealed that the female population used it for economic outputs and to raise their income.

The results of education variable revealed that it plays a positive role in response to the WTP for

Table 3. Occupation-wise WTP response for the conservation of wetlands

Wetland	Response	Agricultural	Livestock/fish catchers	Fish contractors/shops	Wages	Employees	Others	Total
Harike	Yes	5	0	11	0	1	1	18 (10.59%)
	No	74	24	24	26	2	2	152 (89.41%)
Ropar	Yes	6	9	10	6	14	0	45 (31.03%)
	No	36	24	3	29	8	0	100 (68.97%)
Nangal	Yes	2	3	9	3	29	6	52 (60.47%)
	No	3	0	6	11	9	5	34 (39.53%)

conservation activities. The sign of the positive coefficient for secondary and higher education shows that the level of education positively and more likely affects the WTP for the conservation of wetlands. On the other hand, the sign of the negative coefficient for the less educated people (primary and middle standard) revealed that they are less likely to pay. The results indicated that an increase in the education level of the respondents to secondary and graduation level will have a probability to increase the WTP by 0.16 and 0.60, respectively. On the contrary, the decline in education level to primary and middle level will have a probability of decreasing the WTP for the conservation of wetland areas by 0.40 and 0.10, respectively (Table 4).

From the occupation variables, the model results revealed that the respondent engaged in primary activities are less likely to pay for the conservation of wetlands. People living near the wetland have used the wetland areas for cultivation and grazing of livestock. The positive sign for the coefficients for the secondary and tertiary activities (Business and Job) shows that respondents engaged in these activities are more willing to pay. The respondents who worked in the NFL (National Fertilizer Limited), BBMB (Bakhra Beas Management Board) and other governmental or semi-governmental organizations were willing to pay for the conservation of wetland areas for aetheric value (to enjoy the scenic beauty of the wetlands). The positive sign of coefficient (0.97) for the business occupation which is significant at 1% level indicates that respondents engaged in the business (mainly fish contractors and restaurants) are in favor of the conservation and management of wetlands as their source of income is directly affected by the wetlands (Table 4).

Other variables being constant, the positive coefficient of the family income variable revealed that the respondents with good family income are positively and more likely to pay for the conservation of wetland. The WTP is affected by the income earned by the respondents. The positive but very low coefficient of the respondent's income indicates that one unit increase in the family income increases the WTP by 0.0002 (Table 4).

Furthermore, when the result of all the three wetlands is compared, it was found that the respondents from Nangal wetland are positively and

Table 4. Willingness to Pay (WTP) for the conservation of Harike, Ropar and Nangal Wetlands (probit regression results)

WTP	Model 1			Model 2		
	Coef.	Z	dy/dx	Coef.	Z	dy/dx
Religion dummies (Reference category: Other)						
Sikh	-0.31	-0.80	-0.07	-0.38	-0.95	-0.08
Hindu	0.04	0.11	0.01	0.04	0.09	0.01
Caste dummies (Reference category: SC/ST)						
General	0.15	0.61	0.03	0.11	0.43	0.02
OBC	-0.04	-0.16	-0.01	-0.11	-0.40	-0.02
Gender dummies (Reference category: Female)						
Male	-0.88	-2.98*	-0.19	-0.74	-2.46*	-0.15
Age dummies (Reference category: Less than 35)						
35 to 49	-0.14	-0.68	-0.03	-0.17	-0.76	-0.03
50-64	-0.22	-0.89	-0.05	-0.22	-0.86	-0.05
Above 64	-0.01	-0.02	0.00	-0.01	-0.04	0.00
Education dummies (Reference category: Illiterate)						
Primary	-0.40	-1.40	-0.08	-0.56	-1.90***	-0.12
Middle	-0.10	-0.37	-0.02	-0.14	-0.49	-0.03
Secondary	0.16	0.53	0.03	0.08	0.25	0.02
Graduation and above	0.60	1.91**	0.13	0.52	1.63***	0.11
Income dummies (Reference category: Quintile 1)						
Quintile2	———	———	———	1.09	2.51*	0.23
Quintile3	———	———	———	1.13	2.76*	0.23
Quintile4	———	———	———	0.93	2.18**	0.19
Quintile5	———	———	———	1.10	2.32**	0.23
Occupation dummies (Reference category: Agricultural)						
Livestock and fishing	0.21	0.64	0.04	0.25	0.73	0.05
Business	0.97	3.64*	0.21	0.93	3.40*	0.19
Labour and other	-0.15	-0.45	-0.03	0.06	0.17	0.01
Job	0.53	1.66***	0.11	0.57	1.79***	0.12
Respondent income	0.00	3.33*	0.00	0.00	3.37*	0.00
Per capita family income	0.00	1.00	0.00	———-	———	———
Wetland areas dummies (Reference category: Harike Wetland)						
Nangal wetland	1.24	4.45*	0.26	1.21	4.17*	0.25
Ropar wetland	0.75	3.13*	0.16	0.72	2.87*	0.15
_cons	-1.26	-2.16**		-2.11	-3.05*	
Pseudo R square	0.3639	0.3826				
Number of observations	401	401				

Note: *, ** and *** represent statistical significance level at 1, 5, and 10% levels, respectively

more likely to pay for the conservation of wetland as compared to Harike and Ropar wetlands (significant at 1%). The reason behind the changes in WTP among the three wetlands is the different sample size from rural as well as urban areas. In Harike wetland, the majority of respondents are

selected from rural areas, whereas in Nangal and Ropar wetlands they are from the urban areas. The occupation and level of education greatly affect the WTP of the respondents for the conservation of the wetland areas.

Not willing to pay for conservation (Protest beliefs)

Protest responses for WTP were received from 286 (71.3%) respondents out of a total of 401. In this study, the protest belief is the unwillingness of the respondents to pay for the conservation of wetland areas. The respondents of the Harike wetland accounted for the maximum number (89.4%), followed by Ropar wetland (68.9%) and Nangal wetland (39.5%). The result suggested that the protest belief in the form of 'wetland conservation is the government responsibility' was the main response of 79.4% respondents of Harike, 39.3% of the Ropar and 13.9% of the Nangal wetlands (Table 5). The rank of protest or zero response for the respondents are as follows; its duty of government to pay for conservation expanses > not worth to me > less income hinders contribution > don't believe that respondent's payment will help in stopping the degradation of wetland areas.

This study explored community-based conservation activities through WTP and protest belief for three wetlands of Punjab and analyzed the determining factors. The findings of this study are consistent with previously available literature. Previous studies have identified that education and income significantly affect the stakeholder consistency towards the WTP for the wetland conservation programs (Yang et al. 2008, Vijayan et al. 2015, Lagbas 2018). A study by Zhang et al. (2011) examined that well educated people have better knowledge about the ecological benefits as compared to the less educated people. A study by Zhu et al. (2016) evaluated that the participation of farmers in the wetland restoration programs increased by 10.6 % due to an increase in the level of education. Similarly, other studies reported positive impact of the education level on the willingness to participate in the wetland renewal and preservation in New England, Sanjiang National Nature Reserve (China), coastal wetlands in Bangladesh and Poyang Lake in China (Stevens et

Table 5. Reasons unwillingness to pay (protest belief) for the conservation of wetland

Reason for unwillingness to pay (protest belief) for conservation of wetland	Harike		Ropar		Nangal		All respondents	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
I don't believe my payment will help in stopping the degradation of wetland areas	5	2.94	3	2.07	3	3.49	11	2.74
Government should pay for such expenses	135	79.41	57	39.31	12	13.95	204	50.87
It is not worth anything to me	10	5.88	27	18.62	9	10.47	46	11.47
My less income hinders contribution	2	1.18	12	8.28	7	8.14	21	5.24
Other	0	0.00	1	0.69	3	3.49	4	1.00

al. 1995, Zhang et al. 2011, Ghosh and Mondal 2013, Zhu et al. 2016). The number of education years affected the participation of people in the conservation programs, due to awareness about the threats and benefits related the wetland areas. In the same way, in our results, the WTP for the conservation and management of wetland can increase by 0.60 among the graduated respondents. Therefore, the policy maker should target improving the level of education among the respondents living around the wetlands.

Similar to the findings by Ghosh and Mondel (2013), our result showed that the income had a positive coefficient indicating that an increase in household income can lead to more participation of respondents in the conservation of wetlands. The third most important variable that affects the WTP for the conservation of wetlands is the occupation. Several studies have examined that farm size as well as farming experiences negatively affected the WTP for the wetland restoration activities (Yu and Belcher 2011, Zhang et al. 2011). On the contrary, a study by Ghosh and Mondal (2013) examined no relation between the occupation and WTP.

Although this study has very carefully sampled villages and analyzed the data and its findings are corroborated by the available literature, there are some limitations to this study. We selected villages falling within a 1 km buffer around the wetland, while the ecosystem services of the wetland cannot be limited in terms of distance. Samples from wider areas could have yielded different results.

CONCLUSION

The wetland ecosystem is one of the most productive and dynamic systems of the earth's surface as compared to other existing ecosystems. However, at present, the most productive ecosystem of earth's surface is under severe pressure due to activities like encroachment for agricultural activities, dumping of liquid and solid wastes, and siltation. Due to the immense importance of wetlands for the present and future needs of the local people and the sustainability of the ecosystem, effective conservation measures are needed. This study has focused on the WTP by the local people who are the stakeholders and who can play an effective role in the conservation of the wetlands. Since local people are directly related to the wetland ecosystem services, they will face immediate benefits from the conservation or threats due to the degradation of the wetlands system. The perception of local people on the importance of ecosystem services of the wetland and WTP for the conservation *Harike, Ropar* and *Nangal* wetland areas are immensely important. This study has showed that the people who depend on the wetlands for various goods and services are ready to contribute in conservation programmes. However, they are not willing when the conservation activities negatively affect their livelihood. The amount per household identified in this study can be a significant economic contribution by the local people towards wetland conservation efforts. Therefore, the future wetland conservation and restoration programmes can be more inclusive through community participation. Effective management and participatory governance are key to the protection of the wetlands.

ACKNOWLEDGEMENTS

The authors would like to extend appreciation to all the respondents who participated in the study. The authors gratefully acknowledge the financial support for the Research Fellowship to Gaurav Kumar from the University Grants Commission (UGC) and infrastructural support from the Central University of Punjab, Bathinda.

Author's contribution: Gaurav Kumar and Kiran Kumari Singh: Conceptualization, Methodology, writing original draft preparation Gaurav Kumar, Jajati Keshari Parida and Amandeep Kaur: Data collection and analysis, Visualization, Investigation. Jajati Keshari Parida and Arti Singh: Validation and Editing Kiran Kumari Singh: Supervision, and Editing. All authors read and approved the manuscript.

Conflict of interest: Authors declare no conflict of interest

REFERENCES

Ambastha, K. Hussain, S.A. and Badola, R. 2007. Social and economic considerations in conserving wetlands of indo-gangetic plains: A case study of Kabartal wetland, India.

Environmentalist, 27, 261-273. https://doi.org/10.1007/s10669-007-9003-1

Anonymous. 2005. Ecosystems and human well-being: Wetlands and water synthesis. Millennium Ecosystem Assessment World Resources Institute, Washington DC. https://www.millenniumassessment.org/documents/document.356.aspx.pdf

Anonymous. 2007. Conservation of Wetlands in India: A Profile (Approach and guidelines). Ministry of Environment and Forests (MoEF), Government of India, New Delhi. http://www.indiaenvironmentportal.org.in/files/wetlands.pdf

Anonymous. 2011a. National Wetland Atlas: Punjab. Space Apllication Centre, Ahmedabad, India. https://vedas.sac.gov.in/vcms/en/National_Wetland_Inventory_and_Assessment_(NWIA)_Atlas.html

Anonymous. 2011b. National wetland atlas: Punjab. Space Applications Centre, Indian Space Resreach Organisation, Ahmedabad, India. https://vedas.sac.gov.in/en/National_Wetland_Inventory_and_Assessment_(NWIA)_Atlas.html

Anonymous. 2012. Destination wetlands: supporting sustainable tourism. Secretariat of the Ramsar Convention on Wetlands and World Tourism Organization (UNWTO), Gland, Switzerland; Madrid, Spain:. https://www.ramsar.org/sites/default/files/documents/library/ramsar_unwto_tourism_e_sept2012.pdf

Anonymous. 2018. Scaling up wetland conservation, wise use and restoration to achieve the Sustainable Development Goals. Secretariat of the Ramsar Convention on Wetlands and World Tourism Organization (UNWTO), Gland, Switzerland https://www.ramsar.org/sites/default/files/documents/library/wetlands_sdgs_e_0.pdf

Anonymous. 2021. Ramsar Wetlands Sites. ENVIS center on Wildlife, Wildlife Institute of India, Dehradun. http://www.wiienvis.nic.in/Database/ramsar_wetland_sites_8224.aspx

Bassi, N., Kumar, M.D., Sharma, A. and Pardha-Saradhi, P. 2014. Status of wetlands in India: A review of extent, ecosystem benefits, threats and management strategies. Journal of Hydrology: Regional Studies, 2(11), 1-19. https://doi.org/10.1016/j.ejrh.2014.07.001

Birol, E. and Cox, V. 2007. Using chioce experiments to design wetland management programs: the case of Severn Estuary Wetland, UK. Journal of Environmental Planning and Management, 50(3), 363-380. https://doi.org/10.1080/09640560701261661

Chopra, R., Verma, V.K. and Sharma, P.K. 2001. Mapping, monitoring and conservation of Harike wetland ecosystem, Punjab, India, through remote sensing. International Journal of Remote Sensing, 22(1), 89-98. https://doi.org/10.1080/014311601750038866

Dahl, T.E. and Allord, G.J. 1997. Techincal aspects of wetlands: History of wetlands in the conterminous United States. National Water Summary-wetladn resoures: techinal aspectes. US Geological Survey. https://www.fws.gov/wetlands/documents/History-of-Wetlands-in-the-Conterminous-United-States.pdf

Davidson, N.C., Van Dam, A.A., Finlayson, C.M. and McInnes, R.J. 2019. Worth of wetlands: Revised global monetary values of coastal and inland wetland ecosystem services. Marine and Freshwater Research, 70, 1189-1194. https://doi.org/10.1071/MF18391

Dougherty, C. 2011. Introduction to Econometrics. 4th edition, Oxford University Press, Oxford.

Ghermandi, A., van den Bergh, J.C.J.M., Brander, L.M. and Nunes, P.A.L.D. 2008. The economic value of wetland conservation and creation: A meta analysis. FEEM working paper No. 79.2008. Gondazione Eni Enrico Mattei, Milan, Italy. https://www.econstor.eu/bitstream/10419/53239/1/644266198.pdf

Ghosh, P.K. and Mondal, M.S. 2013. Economic valuation of the non-use attributes of a south-western coastal wetland in Bangladesh. Journal of Environmental Planning and Management, 56(9), 1403-1418. https://doi.org/10.1080/09640568.2012.724667

Gopal, B. and Ghosh, D. 2008. Natural wetlands. Pp. 2493-2304. In: Encyclopedia of Ecology, Earth Systems and Environmental Sciences, Academic Press, New York. https://doi.org/10.1016/B978-008045405-4.00067-7

Kakuru, W., Turyahabwe, N. and Mugisha, J. 2013. Total economic value of wetlands products and services in Uganda. The Scientific World Journal, 1-13. https://doi.org/10.1155/2013/192656

Keddy, P.A. Fraser, L.H., Solomeshch, A.I., Junk, W.J., Campbell, D.R., Arroyo, M.T.K. and Alho, C.J.R. 2009. Wet and wonderful: The world's largest wetlands are conservation priorities. BioScience, 59(1), 39-51. https://doi.org/10.1525/bio.2009.59.1.88

Kumar, G. and Singh, K.K. 2020. Mapping and monitoring the selected wetlands of Punjab, India, using geospatial techniques. Journal of Indian Society of Remote Sensing, 48, 615-625. https://doi.org/10.1007/s12524-020-01104-99

Kundu, N., Pal, M. and Saha, S. 2008. East Kollata wetlands: A resource recovery system through productive activities. pp. 868-881. In: Proceedings of Taal2007: The 12th World Lake Conference, Jaipur. International Lake Environment Committee Foundation, Japan. https://www.teebweb.org/wp-content/uploads/2017/03/TEEB-India-Wetlands-Synthesis.pdf

Ladhar, S.S. 2002. Status of ecological health of wetlands in Punjab, India. Aquatic Ecosystem Health & Management, 5(4), 457-465. https://doi.org/10.1080/14634980290002002

Lagbas, A.J. 2018. Social valuation of regulating and cultural ecosytem services of Arroceros Forest Park: A man-made forest in the city of Manila, Philippines. Journal of Urban Management, 8(1), 159-177. https://doi.org/10.1016/j.jum.2018.09.002

McNeely, J.A. 1989. Protected areas and human ecology: how national parks can contribute to sustaining societies of the twenty-first century. pp. 150-157. In: Western, D. and Pearl, M.C. (Eds.). Conservation for the Twenty-first Century. Oxford University Press, New York.

Moore, P.D. 2006. Biomes of the Earth:Wetlands. Chelsea House Publishers, Hong Kong. 241 pages

Nonga, H.E., Mdegela, R.H., Lie, E., Sandvik, M. and Skaare,

J.U. 2010. Socio-economic values of wetland resources around lake Manyara Tanzania: Assessment of enviormental threats and local community awareness on environmental degratdation and their effects. Journal of Wetlands Ecology, 4, 83-101. https://doi.org/10.3126/jowe.v4i0.4153

Prasad, S.N., Ramachandra, T.V., Ahalya, N., Sengupta, T., Kumar, A., Tiwari, A.K. and Vijayan, L. 2002. Conservation of wetlands of India-A review. Tropical Ecology, 43(1), 173-186. https://wgbis.ces.iisc.ac.in/energy/water/paper/conservation_wetlands/index.htm

Ravenga, C., Brunner, J., Henninger, N., Kassem, K. and Payne, R. 2000. Pilot analysis of global ecosystems: Freshwater systems. Washington, DC: World Resources Institute. https://www.wri.org/research/pilot-analysis-global-ecosystems-freshwater-systems

Stevens, T.H., Benin, S. and Larson, J.S. 1995. Public attitudes and economics values for wetland preservation in New England. Wetlands, 15, 226-231. https://doi.org/10.1007/BF03160702

Vijayan, A., Job, E. and Thomas, A. 2015. Willingness to pay to conserve wetland ecosystems: A case study of Vellayani Fresh Water Lake in South India. Indian Journal of Applied Research, 5(4), 1-5. https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/recent_issues_pdf/2015/April/April_2015_1427893944_01.pdf

Vitousek, P.M., Mooney, H.A., Lubchenco, J. and Melillo, J.M. 1997. Human domination of earth's ecosystems. Science, 277, 494-499. https://doi.org/10.1126/science.277.5325. 494

Yang, W., Chang, J., Xu, B., Peng, C. and Ge, Y. 2008. Ecosystem service value assessment for constructed wetlands: A case study in Hangzhou, China. Ecological Economics, 68, 116-125. https://doi.org/10.1016/j.ecolecon.2008.02.008

Yu, J. and Belcher, K. 2011. An economic analysis of landowners' willingness to adopt wetland and riparian conservation management. Canadian Journal of Agricultural Economics, 59(2), 207-222. https://doi.org/10.1111/j.1744-7976.2011.01219.x

Zedler, J.B. and Kercher, S. 2005. Wetland resources: Status, trends, ecosystem services, and restorability. Annual Review of Environmental Resources, 30, 39-74. https://doi.org/10.1146/annurev.energy.30.050504.144248

Zhang, C., Robinson, D., Wang, J., Liu, J., Liu, X., Tong, L. 2011. Factors influencing farmers' willingness to particpate in the conservation of cultivated land to wetland program in Sanjiang National Nature Reserve, China. Environmental Management, 47, 107-120. https://doi.org/10.1007/s00267-010-9586-z

Zhu, H., Guan, Z., Wei, X. 2016. Factors influencing farmers'willingness to participate in wetland restoration: Evidence from China. Sustainability, 8(12), 1325. https://doi.org/10.3390/su8121325

Received: 11th February 2024
Accepted: 11th May 2024