Households' Willingness to Pay for Wetland Conservation in Nepal: The Role of Perceived Ecosystem Services and Disservices in Ghodaghodi Lake

Govinda Raj Upadhyay [1], Ashutosh Priya[2*]

Abstract

The full value of wetland ecosystem services has been misunderstood in decision-making processes, leading to the continuous decline of wetlands. In this study, an estimation of non-market economic benefits of a wetland (Ghodaghodi Lake in Nepal) was conducted based on the premise of households' willingness-to-pay (WTP) for the conservation of wetland ecosystems. Empirical results, based on contingent valuation method (CVM), show that households are willing to offer some 1.82 million USD annually to communities for the sustainable use and management of the wetland ecosystems. Interplay of perceptions of ecosystem services, comprising of existence of biodiversity, water regulation, cultural values, and disservices, such as health risk and land-use restriction, on WTP are analyzed and discussed. Policies and strategies suitable for aquatic Eco residency, on the long-term ecological sustainability are recommended.

GRAPHICAL ABSTRACT

[1] PhD Scholar, Mahatma Jyotiba Phule Rohilkhand University, Bareilly, UP (India)
https://orcid.org/0009-0009-5204-3161 Email: megovinda@gmail.com
[2] Professor, Department of Regional Economics, Mahatma Jyotiba Phule Rohilkhand University, Bareilly, UP (India), https://orcid.org/0000-0003-0688-5797
[*] Corresponding author: Ashutosh Priya, Professor, Department of Regional Economics, Mahatma Jyotiba Phule Rohilkhand University, Bareilly, UP (India), https://orcid.org/0000-0003-0688-5797,
Email: ashutoshpriyamjpru@gmail.com

Keywords: Wetland conservation, WTP, Ecosystem services, Ecosystem disservices, CVM

1. Introduction

Wetlands are among the most productive ecosystems on the earth providing a diversity of ecological, economic, and social services that are fundamental to human well-being and sustainable development [1–3]. They provide invaluable services and benefits such as water quality improvement, natural flood control, temperature regulation, conservation of biodiversity, and cultural and aesthetic values [4–6]. However, wetlands are one of the most threatened ecosystems due to land use conversion pollution overexploitation, and lack of good governance structures [7, 8]. The loss and depletion of wetlands affect not only the environment but also the well-being of people, often impoverished, living in and around these ecosystems [9, 10].

To address the concern of the continued decline in wetland resources, more and more researchers argue that sustainable wetlands conservation planning must incorporate ecological insights into the economic and managerial decision-making process [11, 12]. Because many of the benefits delivered by wetlands are non-market goods and services, they cannot be directly perceived within traditional planning and budgeting procedures [13].So, these benefits are often neglected both in financial investment and public support for conservation initiatives. Economic valuation techniques, in particular willingness-to-pay (WTP), have been applied in value quantification of these nonmarket benefits and subsequent sustainable resource management decision-making [14–16].

Recent evidence shows that the public's influence is a previously underappreciated factor in conservation success [17]. Households' willingness to pay for conservation programs is influenced not only by income and socio-demographic variables, but also by their perceptions of the environmental services and disservices that natural resources provide [18].

Though the benefits of ecosystem services foster a sense of well-being and lead to positive attitudes toward conservation programs, disservices may have the opposite effect. Disservices incurred through ecosystem use, such as risks to health, damage or loss of crops and plantations and restrictions on land use, could diminish the public's support and enthusiasm for conservation programs [19].

Wetland conservation also faces difficulties in developing countries attributable to more conservation development pressures as well as limited public funding and weak valuation of the benefits of ecosystems services [20]. Nepal also has seen current degradation of many of its wetlands despite their environmental and cultural importance. Ghodaghodi Lake, located in western Nepal, is a Ramsar wetland that brings ecosystem services such as groundwater recharge, habitat of biodiversity, fisheries, and a source of cultural values, but it is under threat of degradation due to growing human anthropogenic pressures and the limited capacity of community based financing. Though several studies had focused on valuation and funding of wetland conservation across the world, empirical evidence from Nepal is limited and there has been no investigation about how perception of ecosystem service and disservice influences household WTP in this context.

This study so attempts to fill the knowledge gap by estimating non-market value of Ghodaghodi Lake and analyzing the determinants of household WTP for its conservation. By linking the economic valuation and perception-based analysis, the study brings evidence base for participatory wetland management, conservation funding and policy formulation for sustainable wetland conservation in future. This study contributes in successful implementation of participatory wetland conservation funding schemes in developing countries by integrating of economic valuation with perception-based analysis.

1.1 Contributions

The novel contributions of this study are:

1. This study provides the first monetary estimate of the annual non-market value of Ghodaghodi Lake wetland in Nepal using a household willingness-to-pay approach.
2. It empirically demonstrates how perceived ecosystem services and disservices jointly influence conservation support and payment decisions.
3. It offers practical evidence to guide wetland managers and policymakers in designing community-supported conservation financing mechanisms.

2. Literature Review

This section deals with prior evidence on wetland valuation, public participation, and policy-oriented approaches for sustainable wetland management. Table 1 shows summary of research gaps.

[21] Examines financial pitfall to privatization of wetlands within urban land concludes that 'owing to the incentives disincentives such as land use restrictions and competition in land conversion, landowners have no economic incentive for wetland preservation activities. Our result underlines this point, demonstrating that although ecosystem service benefits are generally appreciated in the case community's households, the WTP is much lowered by perceived disservices like land use restrictions. An estimated annual conservation value of USD 1.82 million indicates that community-based financing policy might work alongside regulatory policy which direct enforcement creates social resistance.

[22] Pointed out that most protected areas currently suffer from scarse financial resources, poor governance and few stakeholders' involvement, which make the conservation policy launched in these areas lack efficiency. Our result supports this argument by shows that income and education also Much affect WTP, and both the wealth and the knowledge level of the local people are crucial in determining it. The convincing positive impacts of the respondents' perception of ecosystem services onWTP also illustrate the necessity for multisectors involvement and coordinated conservation planning.

[23], emphasizes the need for traditional ecological knowledge and community based management in fragile wetland ecosystems. This is exemplified by the relatively high number of households willing to pay for conservation (78.6%) seen in this study, implying a strong community attachment to wetland services.Their work is further built upon in this case by showing how such positive perception of ecosystem services are actually realized in monetary benefits for conservation.

[24] Contends that environmental regulations can only be enforced efficiently if they are buttressed by a resilient institutional architecture and local involvement. Consistent with this, our study reveals that the perception of ecosystem disservices results in reduced willingness to pay suggesting that counterproductive policies without community-led conservation could hamper wetland preservation effectiveness.

[25], recognizes disjointed approaches to environment and social policy planning as perhaps the greatest obstacle to sustainability; the findings on the impact of socioeconomic factors on WTP in this research seems to confirm this to an extent, emphasizing the importance of integrating wetland conservation strategies with broader social and development policies; education and awareness as potential inflection points.

[26], advance decision-support systems that combine financial, institutionald and technical obstacles to ecological sustainability.The present study offers empirical monetary evidence in support of such a setup. The USD 1.82 million per year benefit identified that means can be used as an indicator of the value of benefits obtainable for wetland conservation finance.

[27], urges that institutional shortcomings and financial shortfalls be addressed if flows in stream wetlands are to be sustainable soon. Our research also confirms that people living further away from the wetland are less willing to pay since this supports the need for spatially targeted conservation study the results support the argument for an increase in site specific approaches to conservation.

[28], suggested lifestyles development as a potential contributor to land use change may have either a positive or a negative effect on biodiversity conservation. It is consistent with the result that land use restrictions are considered as the ecosystem disservice in the study area and affect pay. To maintain livelihoods flexibility may be important for implementing biodiversity conservation programs.

[29], [31], [32] demonstrates how lax enforcement coupled with rapid urbanization often means faster wetland deterioration and biodiversity erosion. This research complements those others by quantifying the dollar value linked to wetland preservation, and so can provide an even more solid economic rationale for early preventative action and more stringent enforcement efforts. The high level of household willingness to pay shows strong citizen support for further improvement in wetland management.

[30],[33] and [34] emphasize the role of innovative governance models, such as ecotourism and stewardship agreements, in achieving sustainable conservation outcomes. The present study supports this view by showing that ecosystem service recognition significantly increases willingness to pay, suggesting that linking conservation with livelihood opportunities can strengthen long-term wetland sustainability.

Table 1: Summary of Research Gaps in Wetland Conservation and Valuation Studies

Ref. No.	Authors	Focus of Study	Key Findings	Research Gaps
[21]	Mammen (2025)	Private wetland conservation under climate change	Highlights conflicts between private landowners and conservation regulations	Lacks quantitative valuation of public willingness to finance wetland conservation
[22]	Guadu et al. (2025)	Biodiversity threats and governance in protected areas	Identifies funding and governance gaps in conservation	Does not estimate household-level economic support for conservation
[23]	Meinam et al. (2025)	Community-based fisheries management in wetlands	Emphasizes role of traditional knowledge and community participation	Does not quantify financial willingness of households for conservation
[24]	Lema (2025)	Environmental regulatory frameworks	Shows variation in effectiveness of environmental governance	Ignores the role of public perception in conservation financing

Ref. No.	Authors	Focus of Study	Key Findings	Research Gaps
[25]	Adebayo (2025)	Integration of environment into social policy	Identifies policy gaps in environmental integration	Does not link social policy with willingness to pay for ecosystem conservation
[26]	Xiaoyu et al. (2025)	Decision-support frameworks for ecological sustainability	Identifies financial and institutional barriers to conservation	Lacks empirical monetary valuation to support decision-making
[27]	Mostafa (2025)	Sustainability of in-stream wetlands	Shows institutional and financial weaknesses	Does not consider household willingness to contribute to conservation
[28]	Xie et al. (2025)	Land-use change and environmental management	Identifies mixed impacts of lifestyle-driven land use	Does not assess perception-based economic valuation
[29]	Enock & Isaac (2025)	Urban sprawl and lagoon degradation	Quantifies ecological degradation due to encroachment	Lacks valuation of conservation benefits from community perspective
[30]	Castillo-Salazar et al. (2025)	Ecotourism and conservation governance	Highlights innovative conservation governance models	Does not integrate WTP-based financing evidence into governance models

2.1 Research gaps

Previous studies on wetland conservation and management, it is obviously that there are some gaps in the empirical valuation of wetlands from household demand for wetland ecosystem services and disservices. Literature providing evidence on the socioeconomic value of ecosystem services and disservices of the wetland ecosystem by the local households is extremely lacking and As a result a very limited knowledge exists on how far the perceived ecosystem services and disservices of the local households towards the wetland ecosystem correlate with their willingness to pay for the wetland conservation. Here, also almost all previous household-based wetland valuation studies has so far not included perception factors together with other socioeconomic variables in a unified econometric structure to account for wetland conservation funding behavior. This can be easily observed in case of the wetlands of Nepal, which have generated very few experiential knowledge. This study intend to fill such gaps by providing the estimate of the non-market value of Ghodaghodi Lake, identifying important factors contributing towards households' wetland conservation willingness to pay(WTP) as well as deriving policy recommendations.

2.2 Problem Statement

The wetland of Nepal are under mounting pressure of these days to population expansion, land use change and lack of investment, financial and institutional capacity for the proper management of wetland even though they have ecological and socio-economic significance. Ghodaghodi Lake a Ramsar site in Nepal is an important source of ecosystem services such as biodiversity support, water regulation, and cultural provision, but these values are not acknowledged in management and policy First and foremost because these benefits are not translated into decisions. Conservation efforts are also constrained by the disservices perceived by local people such as land-use restrictions, human health hazards and damage to crops that can hinder community support for conservation actions. Lack of empirical understanding of the relative valuation of benefits and costs by local households for wetland conservation constrains the development of effective means of financing for wetlands so, estimates of household willingness to pay for wetland conservation services and the mechanisms that influences community conservation behaviors are urgently needed.

3. Objectives of the Study

General Objective

The general objective is to estimate the non-market economic value of Ghodaghodi Lake wetland by analyzing household willingness to pay (WTP) for its conservation.

Specific Objectives

1. To estimate the mean household willingness to pay for the conservation and sustainable management of Ghodaghodi Lake wetland.
2. To examine local households' perceptions and attitudes toward ecosystem services and ecosystem disservices provided by the wetland and their implications for environmental protection behavior.

3. To identify the socioeconomic, environmental perception, and attitudinal factors influencing households' willingness to pay for wetland conservation.

3.1 Research Questions

RQ1.What is the average household willingness to pay for the conservation and sustainable management of Ghodaghodi Lake wetland in Nepal?
RQ2. How do households' perceptions of ecosystem services and ecosystem disservices influence their willingness to pay for wetland conservation?
RQ3. Which socioeconomic and attitudinal factors significantly determine household willingness to pay for the conservation of Ghodaghodi Lake wetland?

3.2 Hypothesis

Hypothesis 1: Ecosystem Services and WTP

H_{01} (Null): Perceived ecosystem services have no significant effect on household willingness to pay for wetland conservation.

$WTP = \alpha + \beta_1 (ES) + \varepsilon$, where $\beta_1 = 0$

H_{11} (Alternative): Perceived ecosystem services have a significant positive effect on household willingness to pay for wetland conservation.

$WTP = \alpha + \beta_1 (ES) + \varepsilon$, where $\beta_1 > 0$

Hypothesis 2: Ecosystem Disservices and WTP

H_{02} (Null): Perceived ecosystem disservices have no significant effect on household willingness to pay for wetland conservation.

$WTP = \alpha + \beta_2(ED) + \varepsilon$, where $\beta_2 = 0$

H_{12} (Alternative): Perceived ecosystem disservices have a significant negative effect on household willingness to pay for wetland conservation.

$WTP = \alpha + \beta_2(ED) + \varepsilon$, where $\beta_2 < 0$

Hypothesis 3: Socioeconomic Factors and WTP

H_{03} (Null): Socioeconomic characteristics do not significantly influence household willingness to pay for wetland conservation.

$WTP = \alpha + \beta_3 (SES) + \varepsilon$, where $\beta_3 = 0$

H_{13} (Alternative): Socioeconomic characteristics significantly influence household willingness to pay for wetland conservation.

$WTP = \alpha + \beta_3 (SES) + \varepsilon$, where $\beta_3 \neq 0$

where

WTP = Household willingness to pay for the conservation of Ghodaghodi Lake wetland (measured in USD per year).
α = Intercept term representing the baseline level of willingness to pay when all explanatory variables are zero.
$\beta_1, \beta_2, \beta_3$ = Regression coefficients measuring the magnitude and direction of the effect of each explanatory variable on WTP.
ES = Perceived ecosystem services of the wetland (including biodiversity conservation, water regulation, cultural and recreational benefits).
ED = Perceived ecosystem disservices of the wetland (including health risks, land-use restrictions, nuisance factors).
SES = Socioeconomic characteristics of households (such as income, education level, occupation, age, and household size).
ε = Random error term capturing unobserved factors influencing willingness to pay.

4. Research Methodology

The flowchart illustrated in the **Figure 1** explains the flow of approach of we estimated household WTP for preservation of Ghodaghodi Lake wetland, Nepal. The proposed way starts from research design to ecosystem services, ecosystem disservices, and WTP to conservation. The primary data were collected by household survey, which contains socioeconomic data and perceptual data on services, disservices provided by the wetland. This survey-based valuation approach has estimated the average WTP for wetlands conservation and econometric approach has been used to analysis the factors (e.g. demographic, perceptual) determine the WTP for wetland ecosystem services. Finally, the output results of WTP and the drivers were utilized for decision recommendations for wetland conservation policy, wetlands planning, and public demand of ecosystem services supply.

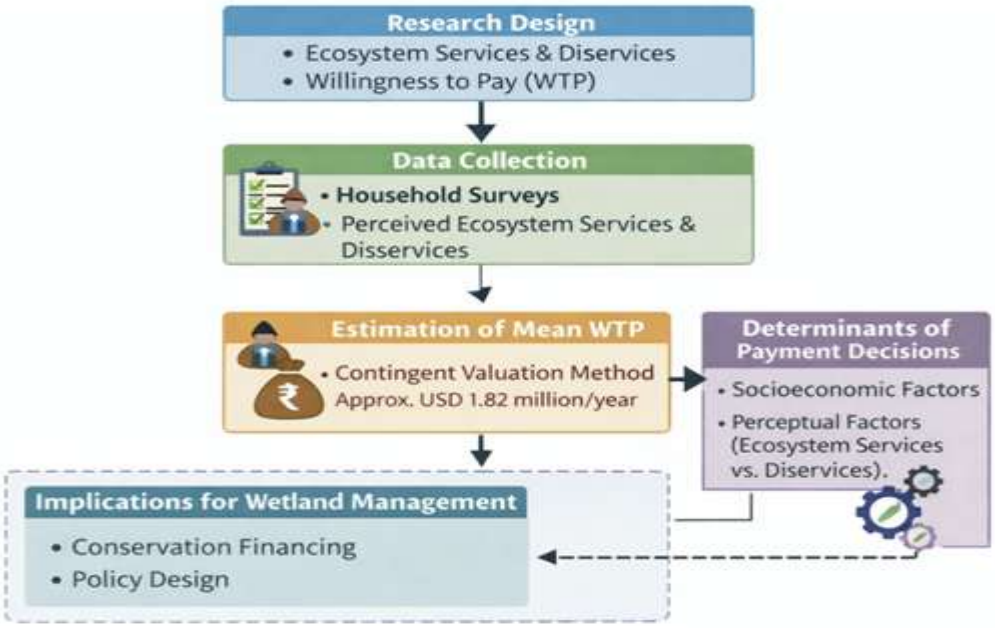

Figure 1: Proposed Method Workflow

4.1 Research Design

This study adopts a **quantitative, cross-sectional research design** to estimate the non-market value of Ghodaghodi Lake wetland and to examine the determinants of household willingness to pay (WTP) for its conservation. The research integrates contingent valuation with econometric modeling to analyze the influence of socioeconomic factors and perceptions of ecosystem services and disservices on conservation preferences.

4.2 Study Area and Sampling Framework

The study was carried out within the Ghodaghodi Lake wetland (inclusion of surrounding buffer zone) which is one of the Ramsar sites located in the Kailali District of Sudurpashchim Province in far-western Nepal. Ghodaghodi Lake is a 2,563 hectare level system of lakes and marshes together to the Siwalik foot hills. It makes up a vital link in the ecological network of the Terai plains and mid-hill areas and supports diverse ecological environment including migratory waterfowl, fish stocks, amphibians and aquatic plants [31],[32] and [34]. On top of this ecological benefits the Ghodhaghadi Lake gives various ecosystems services such as water regulation, water availability, re-charge fisheries fodder, educational and religious values and cultural benefits for communities adjoining it. Also the economic prosperity of households living outside the wetland directly depends on the ecological health of wetland. These socio-ecological drivers, crop grazing overharvesting pollution, alien species and no regulation of tourism activities, have led to more pressure and influence. Ghodaghodi Lake, with high conservation value and complicate participatory management process, could be the typical study site for testing household WTP for wetland conservation and identifying contribution of perceived ESs and EDs to conservation.

Figure 2. Map of the Study Area: Ghodaghodi Lake Wetland, Nepal

Source: Map generated using OpenStreetMap data (© OpenStreetMap contributors) and Google Earth satellite imagery, processed in QGIS 3.x

Figure 2. Location of the Ghodaghodi Lake wetland within Kailali District, Sudurpashchim Province, western Nepal. A map of the part of study area that is covered by the Ghodagodi Lake wetland is given in the wider context of Terai, Western Nepal. The position of the Siwalik foothills is indicated. Base map of study area was derived from Open Street Map and Google Earth satellite imagery and digitized in QGIS.

4.3 Sample Size Determination

Multi-stage sampling frame was employed to select households within the wetland proximity; with sample from representative sample of villages of varying levels of reliance on the resource. The sample size was determined using the Cochran (1977) formula for household surveys at 95% confidence and a 5% precision with standard deviation, which gave the minimum sample size of 384 households. Presuming an increase of 10% for non-participation and incomplete questionnaires, total sample size for the data collection was 420 households [34].

4.4 Survey Instrument and Questionnaire Design

A pre-tested structured interview schedule was prepared for the study site by drawing upon several extant wetland valuation studies with modifications introduced where appropriate to local circumstances. The interview schedule consisted of four sections; 1) socioeconomic data, 2) Evaluation of ecosystem services and disservices, 3) Willingness-to-pay for protecting the wetland, 4) Environment attitude and awareness [31], [33].

4.5 Data Collection Procedure

The primary data was gathered through direct household interviews using well trained enumerators, questionnaire in a formal and structured interviews. For the pre-test, a pilot field survey was carried out with the objective to test the original questionnaire and other means of data collection. Secondary sources data were derived from available written sources including the literature government Ramsar site, institutional and other relevant document to give the basic information about status of the wetland, and policies for wetland conservation and management.

4.6 Contingent Valuation Method (CVM) Design

To determine the non-market value of conservation of wetland (Ghodaghodi Lake), the method of contingent valuation was used. Respondents are explained the hypothetical condition of conservation of wetland with the benefit of wetland under the Ghodaghodi Lake and convincing them to give money for supporting the conservation [31, 32, 33, 34].

4.7 Willingness to Pay Elicitation Format

Household willingness to pay (WTP) was surveyed in a referendum style, dichotomous choice incentive compatible format with an open-ended question. Households were asked the value WTP in a hypothetical second payment, the open-ended question.

$$MeanWTP = \frac{1}{n}\sum_{i=1}^{n} WTP_i$$

Where; WTP_i is the stated willingness to pay of household i and n is the total number of respondents.

4.8 Measurement of Ecosystem Services and Disservices

Measurement of Ecosystem Services and Disservices Perceptions of ecosystem services and perceived disservices of ecosystems was measured through a set of statements centered on Ecological, Economic, Cultural and Health issues designed as a set of Likert-scale statements. Perceived ecosystem services, perceived ecosystem disservices indices developed to create a measure of perceived ecosystem services and a measure of perceived ecosystems disservices.

4.9 Variables and Model Specification

The dependent variable was household WTPi for wetland conservation. Independent variables included perceived ecosystem services, perceived ecosystem disservices, and socioeconomic characteristics such as income, education, occupation, age, and household size. These variables were incorporated into econometric models to estimate their influence on WTP.

Basic regression model:

$$WTP_i = \alpha + \beta_1 ES_i + \beta_2 ED_i + \beta_3 SES_i + \varepsilon_i$$

Where

ES = ecosystem services perception,

ED = ecosystem disservices perception,

SES = socioeconomic characteristics.

Table 2: Variables and Model Specification

Variable Type	Variable Name	Symbol	Measurement / Description
Dependent Variables	Willingness to Pay	WTP	Annual amount household is willing to pay for wetland conservation (USD/year)
Independent Variables	Perceived Ecosystem Services	ES	Composite index based on Likert-scale items (biodiversity, water regulation, cultural value)
	Perceived Ecosystem Disservices	ED	Composite index based on Likert-scale items (health risks, land-use restrictions, nuisance)
Control Variables	Household Income	INC	Monthly household income (USD)
	Education Level	EDU	Years of formal schooling of household head
	Age	AGE	Age of household head (years)
	Household Size	HHS	Number of household members
	Occupation	OCC	Primary occupation of household head (dummy variable)
	Distance from Wetland	DIST	Distance of household from wetland (km)

Table 2 presents an econometric model for household WTP for wetland conservation based on the respondents' perceptions of ecosystem services (ES) and disservices (ED) as well as selected socioeconomic (SES) control variables.The perceived ecosystems services (ES) and ecosystem disservices (ED) were constructed based on the respondents' perceptions of the benefits and loss of wetland conservation; the socioeconomic variables seek to adjust for household availability of funds and perception of the environment. The variables were included in a logit and an OLS regression models to derive the effects on WTP.

4.10 Econometric Analysis Techniques

Both descriptive and econometric analyses were employed. Dichotomous WTP responses were analyzed with a logit regression procedure, while WTP values were analyzed with ordinary least squares (OLS) regression. All statistical analyses were performed with standard econometric software.

(a) Logit model for dichotomous WTP:

$$P(Y_i = 1) = \frac{1}{1 + e^{-(\alpha + \beta X_i)}}$$

Where, 1 if household is willing to pay, 0 otherwise.

(b) OLS model for continuous WTP:

$$WTP_i = \alpha + \sum \beta_k \beta_{ki} + \varepsilon_i$$

4.11 Reliability and Validity Tests

Reliability and Validity TestsThe reliability of the perception scales was determined by Cronbach's alpha and construct validity was checked by factor analysis to determine the strength of the measurement instruments.

Cronbach's alpha formula:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_T^2}\right)$$

Where k = number of items, σ_i^2 = item variance, σ_T^2 = total variance.

5. Results and Discussion

This section presents the empirical results of the study and discusses the key findings in relation to the research objectives and existing literature.

5.1 Socioeconomic Characteristics of Respondent Households

Table 3: Socioeconomic Characteristics of Respondent Households (n = 420)

Variable	Category	Frequency	Percentage (%)
Gender of household head	Male	312	74.3
	Female	108	25.7
Age (years)	< 30	68	16.2

Variable	Category	Frequency	Percentage (%)
	30–45	171	40.7
	46–60	124	29.5
	> 60	57	13.6
Education level	No formal education	96	22.9
	Primary	132	31.4
	Secondary	118	28.1
	Higher	74	17.6
Occupation	Agriculture	187	44.5
	Wage labor	89	21.2
	Business	76	18.1
	Service	68	16.2
Monthly income (USD)	< 150	143	34.0
	150–300	172	41.0
	> 300	105	25.0
Household size	≤ 4	176	41.9
	5–7	181	43.1
	≥ 8	63	15.0

Table 3 gives an overall picture of the general characteristic of the household on the socioeconomic condition of the sample of households in and around the Ghodaghodi lake wetland. From the interview, most of the interviewed household heads were male (74.3%) and most of the respondents belonged to age group 30-45(40.7%) and 45-60 (32.7%). The main occupation for the respondents was agriculture which showed high level of reliance on natural resources. On education, 22.1% of respondents did not have any formal education, which indicates the need for public-awareness program and 16.4% of our respondents had vocational school education. Most of the household of our sampled population have monthly income of less than US dollar 300, which is an indicator of a low livelihood but also high reliance on ecosystem services. The average households' size was large. These general characteristics of the household could influence the attitude and the willingness-to-pay for conservation.

5.2 Descriptive Statistics of Willingness to Pay

Table 4: Descriptive Statistics of Household Willingness to Pay (WTP) for Wetland Conservation (n = 420)

Statistic	Value (USD/year per household)
Mean WTP	4.33
Median WTP	4.00
Minimum WTP	0.00
Maximum WTP	15.00
Standard Deviation	3.21
Households willing to pay (%)	78.6
Households unwilling to pay (%)	21.4

In table 4, the demand of Ghodaghodi Lake wetland resources has been summarized with descriptive statistics. The mean of WTP was obtained and it was estimated USD 4.33 per household as it was answered for survey, median was 4 and the WTP of the willing respondents ranged unevenly between 4. Since 21.4% household responded to 0, there is clearly some constrains with limited income and presence of disservices or mistrust on institutions.. The power of variation (standard deviation among category wise household WTP) among the WTP values of individual household category wise shows heterogensity in demand of wetland and can be formal econometrically.

5.3 Perceptions of Ecosystem Services and Ecosystem Disservices

Table 5: Household Perceptions of Ecosystem Services and Ecosystem Disservices (n = 420)

Indicator	Mean Score	Standard Deviation
Ecosystem Services		
Biodiversity conservation	4.21	0.62
Water regulation & storage	4.08	0.71
Groundwater recharge	3.96	0.68
Fisheries & food resources	3.89	0.74
Cultural & religious value	4.34	0.55
Recreation & tourism potential	3.77	0.81
Composite ES Index	**4.04**	**0.59**
Ecosystem Disservices		
Health risks (mosquitoes, diseases)	3.42	0.83
Crop damage by wildlife	3.65	0.79
Land-use restrictions	3.21	0.72
Nuisance & unpleasant odor	2.98	0.85
Management conflicts	3.14	0.76
Composite ED Index	**3.28**	**0.71**

Note: Likert scale ranges from 1 = strongly disagree to 5 = strongly agree.

Table 5 reports on the perceptions of the household respondents for the ecosystem services and disservices of the wetland. The respondents were very much in agreement that the wetland offered key ecosystem services, in particular its religious/cultural values (mean 4.34) and conservation of biodiversity (mean 4.21). The value of our ecosystem services composite index (mean 4.04) reflected a very high level of awareness for the ecological and socio-cultural values of the wetland. The extent of the perceived disservices was less substantial, but mostly moderate with low levels of agreement, on agricultural damage and health hazard issue, which comprised the lowest and highest levels of the perceived disservices composite index (mean 3.28), respectively. All these patterns of perceptions could help explain the overwhelming community willingness to pay a fee for the wetland conservation as well as the apparently dramatic status of perceived disservices.

5.4 Estimated Mean Willingness to Pay for Wetland Conservation

Table 6: Estimated Mean Household Willingness to Pay (WTP) for Wetland Conservation

Indicator	Value
Sample size (n)	420 households
Mean WTP per household (USD/year)	4.33
Total annual WTP (USD/year)	1,818,600
95% Confidence Interval (USD)	1,642,000 – 1,995,200
Proportion of households willing to pay (%)	78.6

Note: Total annual WTP was estimated by multiplying mean WTP by the total number of households in the influence area.

The table 6 showed the estimate of mean household WTP for conservation of Ghodaghodi Lake wetland. The mean annual WTP for wetland conservation for a household is USD 4.33/household/year, providing a total annual value of USD 1.82 million. The confidence interval indicates that the estimate does not appear to be sensitive to sampling variation and, Because of this, the survey brings reliable data to local convening of conservation funding. The no-market value estimate reported here supports the building of the institutional capacity of the local people to secure a share of wetland benefits through a community-based financing of Ghodaghodi Lake wetland in the future. Among the three types of values, the percentage of households with positive WTP value is larger (78.6%), reflecting the ecological and socio-cultural benefits derived from wetlands.

5.5 Determinants of Household Willingness to Pay

Table 7: Determinants of Household Willingness to Pay for Wetland Conservation (Logit Model Results)

Variable	Coefficient (β)	Std. Error	z-value	p-value
Constant	–1.284	0.462	–2.78	0.005 **
Perceived ecosystem services (ES)	0.836	0.174	4.80	0.000 ***
Perceived ecosystem disservices (ED)	–0.512	0.161	–3.18	0.001 **
Household income	0.003	0.001	3.02	0.002 **
Education level	0.148	0.058	2.55	0.011 *
Age	–0.019	0.008	–2.38	0.017 *
Household size	0.091	0.039	2.33	0.020 *
Distance from wetland	–0.127	0.051	–2.49	0.013 *
Pseudo R^2	0.29			
Observations	420			

Note: *Significance levels: ***p < 0.001, **p < 0.01, p < 0.05

Table 7 shows the model of household WTP for conservation based on logit regressions to test the picture of different drivers in influencing household WTP for conservation efforts. Perceived ecosystem services has the strongest positive association with WTP (β=0.836), p41 lower log odds of payment. For socioeconomic variables, income and education were found to induce the household to pay for wetland conservation while age and distance had significant negative effects on WTP. The significant results between the predictors of ecosystem service and disservice perceptions and the household WTP indicate the need to promote ecosystem services benefits and decrease the perception of disservice to ensure effective household financing of wetland conservation.

5.6 Hypothesis Testing Results

Table 8: Summary of Hypothesis Testing Results

Hypothesis	Relationship	Expected Sign	Result	Decision
H1	Ecosystem Services → WTP	Positive (+)	β = 0.836, p < 0.001	Supported
H2	Ecosystem Disservices → WTP	Negative (–)	β = –0.512, p < 0.01	Supported
H3	Socioeconomic Factors → WTP	Significant	Income, education, household size significant	Supported

The summary of hypothesis testing results (based on the econometric analysis) is summarized in Table 8. The hypothesized large and positive effects of perceived ecosystem services on household WTP for wetland conservation is supported by the empirical results as supported in Hypothesis 1. The large negative impacts of perceived ecosystem disservices on household WTP are corroborated by the empirical findings (for the comparison is proved by Hypothesis 2). The effects of socioeconomic factors (income, education and household size) are supported (significant influence on WTP) by the empiric results, which has found the salience of these variables in decision making behavior. Hypothesis 3 is supported by the empirical results, which have found the significance of the three socioeconomic groups in influencing WTP decisions. This way the hypothesis testing results has supported the conceptual system of the paper and clearly indicated that household and ecological focus are act as determinants in conservation financing decisions.

5.7 Discussion

Like the goods [21], [22] and [23] which encourage mixing of participation of local community, community benefits, economic incentive and local view into wetland conservation, our findings show that (78.6%) of our sampled household are WTP for wetland conservation and felt the effect of ecosystem services People's WTP Really (β 0.836, p 0.01). Similar works have been reported in [24] , [31], [33] and [25], where the authors reported that the collapse of ecosystem management to make local communities believe in the equivalency of conservation and social policy and local conditions annihilated the public WTP. Our results also show that income, education and household size respectively have significant positive influence on WTP, indicating that both financial ability and awareness perception affect people's conservation behavior. The negative coefficient of the perceived ecosystem disservices (β = 0.512, p 0.01) on WTP reinforce the statement of the authors that the imposition of local costs from conservation

measures without any public input would weaken the public support for policies. Also, our finding has consistent with [27], [28], [29], [33], and [34] who attribute the cause of wetland degradation to with non-market incentives like land-use pressure, weak law enforcement and under-investment. The non-market valuation of USD 1.82 per year obtained in this project is globally a strong economic indicator that calls for a lot of attention for further investment. In addition, concurrent to [30], the findings imply that newly introduced governance and livelihood-based conservation strategies e.g. community-based stewardship and ecotourism are better approaches to promote sustainable development in wetland utilization.

5.8 Limitations

1. Contingent valuation is based on stated preferences, which could be different from actual willingness-to-pay in real situations.
2. The cross-sectional nature of the data means that changes in WTP over time are not captured.
3. The sample draws on data from peasant households in the Ghodaghodi Lake area which is a specific wetland ecology and an area specific socioeconomic setting, the results may not be generalized to other wetlands of Nepal with different ecological and socioeconomic setting.

5.9 Policy Implications

1. It demonstrated the cost effectiveness of investing to be exact in wetland land and water management and conservation as the measured value of non-market value for water treatment service.
2. Conservation programs should be aimed at conducting awareness programs that increase knowledge of the ecosystems while reducing the perceived disservices so that support can be enhanced.
3. Precise combined value of wetland services derived from water and other services can be utilized to justify community based financial schemes, conservation fee or a local trust fund, as a mechanism to sustain wetland management.

6. Conclusion

This paper has monetized the non-market economic values of Ghodaghodi Lake wetland, and surveyed the preferences of respondents by asking their WTP for wetland conservation on perception on simple indicator of ES and ED.from the wetland. The result clearly showed that 78.6% of households were WTP for wetland conservation with average annual WTP/household of USD 4.33, this way providing annual value of USD 1.82 million. Out of 4 perceived ES variables, perceived ES had a significant positive effect on WTP (β=0.836, p 001), while perceived ED meaningfully functioned negatively on perceived benefits and Because of this influenced household WTP negatively (β= 0.512) , p This and other socio-economic variables like age, year of schooling and long distance residing from the wetland Much affected WTP. This study presents promising empirical evidence of the value of wetland ecosystem service components and the importance of public preferences to wetland resource management and conservation funding decisions in Nepal. Future research should use follow-up and experimental valuation techniques to empirically quantify the WTP over time and evaluate the success of conservation measures implemented.

Ethical Considerations

No personal details were included on the forms, protecting their privacy. All responses remained confidential and were used solely for academic study. Plus, the research posed no physical or mental risks. Data from the study is not public because it belongs to the respondents. Access may be granted to the co-author through a reasonable request.

Data Availability Statement

The data from this study are not shared online because of privacy rules for participants. Yet, the principle investigator is willing to give access to anyone who requests it reasonably.

Funding Statement

The authors gratefully acknowledge the partial financial support provided by the University Grants Commission (UGC), Nepal, and Aishwarya Multiple Campus, Dhangadhi, for conducting and publishing this research.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References

[1] Isaac, G. O., Hamzat, A. B., & Daramola, O. O. (2025). Ecological Importance and Functions of Wetlands. In Wetland Ecosystems: Conservation Strategies, Policy Management and Applications (pp. 23-42). Cham: Springer Nature Switzerland.

[2] McCartney, M. P. (2025). Wetlands, Water and Ecosystem Services. In Routledge Handbook of Wetlands (pp. 206-218). Routledge.
[3] Elegbede, I. O., Hotaiba, A. M., Adewale, A. R., Saba, A. O., Akintola, S., Iduseri, E. O., & Rahamon, A. (2025). Wetland Ecosystems in Nigeria. Wetlands of Tropical and Subtropical Asia and Africa: Biodiversity, Livelihoods and Conservation, 317.
[4] Singh, V., & Singh, O. P. (2025). Integrating Provisioning, Regulating, Cultural, and Supporting Benefits. Revealing Ecosystem Services Through Geospatial Technologies: Beyond the Surface, 81.
[5] Roh, H., Park, J., & Chon, J. (2025). Trade-Off Analysis of Ecosystem Services in Regulated River Areas: Supporting, Regulating, and Cultural Services. Sustainability, 17(9), 3788.
[6] Paswan, N. G., & Pathak, S. (2025). Ecosystem services and Sustainable Development Goals: A comprehensive review. Geo-Data Revolution: Advances in Spatial Analysis and Natural Hazard Mapping, 1-17.
[7] Zekarias, T., & Gelaw, A. (2025). Impacts of land use/land cover change on wetland ecosystem services of Lake Abaya-Chamo Wetland, Rift Valley of Ethiopia. Geology, Ecology, and Landscapes, 9(1), 334-345.
[8] Babaniyi, G. G., Akor, U. J., Olagoke, O. V., & Daramola, O. E. (2025). Climate Change Impacts on Wetlands: Vulnerabilities, Adaptation, and Mitigation Strategies. In Wetland Ecosystems: Conservation Strategies, Policy Management and Applications (pp. 165-195). Cham: Springer Nature Switzerland.
[9] Olusola, J. A., Olofin, E. O., Eludoyin, A. O., & Awotoye, O. O. (2025). Climate Change and the Fragility of the Lake Chad Wetlands: Threats to Biodiversity and Ecosystem Services. In Handbook of Nature-Based Solutions to Mitigation and Adaptation to Climate Change (pp. 1-22). Cham: Springer Nature Switzerland.
[10] Nandi, S., Das, S., Gorain, S., Dutta, S., Roy Choudhury, M., & Das, S. (2025). Land degradation neutrality: a pathway to achieving sustainable development goals and ecosystem resilience. Discover Soil, 2(1), 48.
[11] Panda, G. K., Chakraborty, S. K., Sivaramakrishnan, L., Chatterjee, U., Karmakar, R., & Ghosh, A. (2025). Understanding Wetlands and Their Role in Urban Resilience. In Wetlands and Urban Resilience: A Global Outlook (pp. 3-21). Cham: Springer Nature Switzerland.
[12] Mwiinde, C., Simbule, T., & Munshifwa, E. K. (2025). Integrating Wetlands into Urban Planning for Resilience of Cities: A Pathway to the Achievement of Sustainable Development Goals. In Wetlands and Urban Resilience: A Global Outlook (pp. 337-355). Cham: Springer Nature Switzerland.
[13] Adewumi, A., Adeyemi, A. E., Bekun, F. V., & Olorunleke, J. O. (2025). Economic Value of Wetlands: Ecosystem Services and Benefits for Human Well-Being. In Wetland Ecosystems: Conservation Strategies, Policy Management and Applications (pp. 63-84). Cham: Springer Nature Switzerland.
[14] Bhatt, M. (Ed.). (2025). Non-market Valuation in South Asia: Bridging Theory and Practice in Environmental Economics. Taylor & Francis.
[15] Withey, P., Trenholm, R., McInnis, J., & Lantz, V. (2025). Willingness to Pay for Improved Groundwater due to BMPs in PEI. Environmental Management, 75(2), 286-306.
[16] Mozahid, M. N., Akter, S., & Iqbal, M. H. (2025). Willingness to pay for the conservation of Sundarbans mangrove ecosystem in the context of climate change: Application of contingent valuation method. In Non-Market Valuation in South Asia (pp. 65-84). Routledge.
[17] Suryawan, I. W. K., Suhardono, S., Nguyen, V. V., & Lee, C. H. (2025). Importance-Performance Evaluation of Coral Reef Conservation in Advancing the Bioeconomy of Marine Tourism in Bali, Indonesia. Aquatic Conservation: Marine and Freshwater Ecosystems, 35(3), e70085.
[18] Manojlović, B., Cvetković, V. M., Renner, R., Grozdanić, G., & Perošević, N. (2025). The Influence of Socio-Demographic Factors on Local Attitudes Towards Sustainable Tourism Development in Skadar Lake and Durmitor National Parks, Montenegro. Sustainability, 17(7), 3200.
[19] Nyathi, N. A., Musakwa, W., Azilagbetor, D. M., & Kuhn, N. J. (2025). Perceptions of cultural and provisioning ecosystem services and human wellbeing indicators amongst indigenous communities neighbouring the greater limpopo transfrontier conservation area. Heliyon, 11(1).
[20] Yadav, P. K., Jha, P., Joy, M. S., Bansal, T., Rawat, P., Begam, S., & Singh, A. K. (2025). Investigating the role of policies in the sustainable management of East Kolkata wetlands. Discover Global Society, 3(1), 79.
[21] Mammen, R. R. (2025). Urban commons in the face of climate change: The challenge of private wetland conservation. Jindal Global Law Review, 1-32.
[22] Guadu, T., Abera, B., Tesfay, K., Berhane, A., Tafese, A., Solomon, T., ... & Kaba, M. (2025). Biodiversity threats and socio-ecological dynamics in Chebera Churchura National Park: A one health approach. One Health, 101181.
[23] Meinam, M., Lahiri, B., Ghosh, A., Singh, S. K., Bharati, H., Upadhyay, A. D., ... & Ngasotter, S. (2025). Aquatic ecosystem, fish diversity and conservation strategies of the fragile Eastern Himalayas: A comprehensive review with a focus on Loktak Lake. Wetlands, 45(7), 96.
[24] Lema, M. W. (2025). Environmental regulatory frameworks in East Africa: A comparative mini-review. Environmental Development, 101314.
[25] Adebayo, W. G. (2025). Resilience in the face of ecological challenges: Strategies for integrating environmental considerations into social policy planning in Africa. Sustainable Development, 33(1), 203-220.

[26] Xiaoyu, H., Cuiying, Y., & Yiying, H. (2025). Building Sustainable Ecological Barriers Through Ecosystem Synergies and Socio-Ecological Integration. Land Degradation & Development.
[27] Mostafa, H. (2025). SWOT and PESTEL analyses in assessing the sustainability of In-stream wetlands in Egypt. Water Science, 39(1), 183-211.
[28] Xie, H., Pearson, D., McLaren, S. J., & Horne, D. (2025). Expansion of Lifestyle Blocks in Peri-Urban New Zealand: A Review of the Implications for Environmental Management and Landscape Design. Land, 14(7), 1447.
[29] Enock, A., & Isaac, A. (2025). Assessing the impacts of urban sprawl and encroachment on Muni-Pomadze Lagoon ecosystem at Winneba, Ghana. SN Social Sciences, 5(5), 1-28.
[30] Castillo-Salazar, I. P., Sanagustín-Fons, V., & Pardo, I. L. (2025). Ecotourism as a catalyst for sustainable development: Conservation governance in mountain regions. Societies, 15(7), 196.
[31] Upadhyay, G. R. & Priya, A. (2024). Assessing The Willingness To Pay For Conservation And Management Of Ghodaghodi Lake Wetland In Kailali District Of Nepal. (2024). International Journal of Environmental Sciences, 881-898. https://doi.org/10.64252/5xj5nx90
[32] Upadhyay,G.R.(2022).Willingnessto pay for conservation of Jokhor Taal Wetland in Nepal: A Contingent Valuation Method (CVM). Journal of Aishwarya Multiple Campus, 3(1), 55.
[33] Upadhyay, G. R. & Priya, A. (2025). Valuing Nature-based Solutions for Climate Resilience: Local Residents' Willingness to Pay for Wetland Restoration and Conservation of the Ghodaghodi Lakein Nepal. International Journal of Emerging Knowledge Studies. 4(8), pp.1207 – 1222. https://doi.org/10.70333/ijeks-04-10-030
[34] Upadhyay, G. R., Priya, A., Bhatta, D. D., Joshi, J. R., &Kadayat, G. R. (2025). Economic Valuation of Wetland Ecosystem Services: Determinants of Local Residents' Willingness to Pay for Conservation in the Jakhor Lake Complex, Nepal. Protagonist International Journal in Management and Technology (PIJMT), 11(5), 27–41. https://doi.org/10.5281/zenodo.17770249