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Original Research

Household Willingness to Pay for Constructed Wetlands as Nature-Based Solutions for Wastewater Treatment in Bayawan City, Philippines

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Abstract

Constructed wetlands are globally recognized as effective nature-based solutions to wastewater treatment providing significant ecological and socioeconomic benefits. This study aims to identify the ecosystem services provided by the constructed wetlands and evaluate their economic value. This study administered a survey questionnaire to 270 households of Fishermen's Gawad Kalinga Village in Bayawan City, Negros Oriental, Philippines. It employed a contingent valuation method to investigate their willingness to pay for the constructed wetlands. Respondents identified several ecosystem services of the constructed wetlands including the provisioning (water supply and biomass), regulating (wastewater treatment, water purification, climate regulation, flood prevention), supporting (habitat formation, nutrient cycling, hydrological cycle), and cultural (tourism, educational and research, recreation, aesthetic) services. Results showed that 96.3% of the respondents were willing to pay for the ecosystem services, with a mean of PHP 107.28. In terms of sociodemographic characteristics, age group and sex have no significant impact on WTP, while positive, weak, monotonic association for highest educational attainment and positive, very weak for monthly income. The findings hold a significant promise for the government and other stakeholders to adopt a constructed wetland to achieve more human ecological and sustainable peri-urban communities.

Keywords— *constructed wetlands, ecosystem services, contingent valuation method, informal settlement, NBS*

1 Introduction

Widespread water management problems plague peri-urban areas due to rapid population growth, increased water consumption, and increased waterborne diseases. Inadequate access to safe water, improved hygiene and sanitation facilities, and increased frequency and intensity of resource stress impact those affected family's livelihood, productivity, health, and well-being [1]. Moreover, water sources contaminated with oxygen-demanding wastes and pathogens cause various diseases, including typhoid, gastroenteritis, cholera, hepatitis, bacterial dysentery, and amoebic dysentery [2]. To address domestic wastewater management issues in peri-urban areas, a conventional sewage treatment plant is utilized to improve the water quality in terms of biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids, total dissolved solids, coliforms, nutrients, and others [3, 4]. From point source, the subsurface wastewater infiltration systems were widely used in decentralized domestic wastewater treatment due to their high removal performance, low operation cost, and easy maintenance [5]. Hydroponic technology is another decentralized system that naturally uptakes nutrients from wastewater for agricultural production [6].

Constructed Wetland (CW) is another water treatment technology. It is a nature-based solution (NBS) to wastewater treatment that mimics the natural wetlands [7]. CWs are cost-effective and sustainable technologies that are particularly effective at removing various pollutants from wastewater, including organic matter, nutrients, and specific pathogens. They are built to utilize many of the same processes in natural wetlands, including wetland vegetation, soils, and their associated microbial assemblages to treat wastewater [8].

In recent decades, CWs have played an increasingly important role in treating domestic, municipal, agricultural, and even industrial sewages [9, 10]. For instance, two of the most successful CWs in the Philippines are found in Bayawan City, utilizing vertical flow and horizontal flow CWs to treat domestic wastewater from Fishermen's Gawad Kalinga Village and an integrated aerobic pond-constructed to treat wastewater from the Sanitary Landfill [11, 12]. A CW project planted with dominant local macrophytes (Amaranthus spinosus, Eichhornia crassipes, Eleusine indica, and Pennisetum purpureum) was explored to treat the Balili River in Benguet [13, 14]. Another project utilized a series type vertical subsurface flow CWs planted with Napier Grass (Pennisetum Purpureum Schumach) at the University of the Philippines Los Baños (UPLB) Dairy Farm wastewater to reduce the fecal coliform concentration, electric conductivity, total dissolved solids content, nitrite and nitrate concentration, and improve pH level [15]. A laboratory-scale horizontal subsurface flow constructed wetland planted with cogon grass (Imperata cylindrica) was also tested to reduce the pollutant concentration of slaughterhouse wastewater in Zamboanga City [16]. Furthermore, a modular CWs project will be constructed at Panguil River Ecopark in Laguna to handle septage wastewater of around 200-300 tourists/visitors per day [17, 18]. Yet, its widespread adoption, particularly in developing countries, is challenged by inadequate expertise and technical support, sustainability and long-term performance, limited space or land, governance, and undervaluation [19, 20].

The CW projects, despite their usefulness and ecological benefits, are mostly undervalued as they are evaluated as wastewater treatment projects and not as an ecosystem [21]. CWs provide several ecosystem services, including provisioning, regulating, cultural, and supporting services [7]. Ecosystem services refers to the benefits people get from ecosystems, directly or indirectly. The monetary value of ecosystem services serves various important purposes in the relationship between human activities and natural systems. Several works have made major contributions to the valuation of ecosystem services [18, 22, 23, 24].

In comparison to research done to identify the economic value of natural ecosystem services, the number of studies done to evaluate the economic value of constructed ecosystem services has been far less. Natural ecosystem services and constructed ecosystem services are theoretically equivalent, according to Yang et al. [23]; nonetheless, natural ecosystem services and constructed ecosystem services differ in these key ways. Compared to natural ecosystems, constructed ecosystems are often generated for a specific purpose. Hence, increased supply of particular services decreases the provision of most other services. Also, constructed ecosystem services are often anticipated to have higher direct use values than indirect use values. Lastly, the assessment scale for constructed ecosystem services is more explicit than that for natural ecosystem services because the boundaries of a constructed ecosystem are typically more distinct than those of a natural ecosystem.

Given this background, valuing the ecosystem services benefits associated with the constructed wetland as an NBS for wastewater treatment issues is essential. Various methods are employed in the literature to value these ecosystem services including cost-benefit analysis, benefit transfer, shadow pricing, habitat evaluation, contingent valuation, travel cost, hedonic pricing, replacement cost methods [7]. Among these methods, the contingent valuation method (CVM) is commonly utilized as it can be used to value various ecosystem system services [7]. Yet, few studies [18, 23] employed this method to value the ecosystem services of constructed wetlands as a nature-based water treatment technology.

This study uses the contingent valuation method to evaluate nonmarket benefits associated with constructed wetland projects in the Philippines. The objective is to assign a monetary value to these benefits, ensuring comprehensive integration into the planning and execution of constructed wetland initiatives nationwide. Specifically, this study seeks to (1) identify the different ecosystem services provided by the CWs, (2) assess the respondents' willingness to pay for these ecosystem services, and (3) evaluate the association between the sociodemographic characteristics (age, sex, educational attainment, and income) of respondents and their WTP.

2 Methodology

2.1 Case Study of Constructed Wetlands in Bayawan City

Bayawan City is a second-class component city in the 3rd Congressional District of the Province of Negros Oriental, Philippines. According to Bayawan City Official Website, it has a land area of 69,900 hectares with a population of 122,000 as shown in Figure 1. Farming and fishing are the two primary economic activities in the city, hence, being dubbed as the 'Agricultural Capital of Negros Oriental.' These complement the city's key landscape, agriculture, and the approximate 15-kilometer coastline, rich in coastal resources. In 2006, the coastal area of 3 km was heavily polluted and inhabited by almost 800 families with no proper toilets; most were fisherfolk.

Bayawan City acquired 7.4 hectares of social housing, where 750 households resettled. The social housing site is known as the Fishermen's Gawad Kalinga Village, consisting of a daycare center, a health center, a multi-purpose hall, a community center, and constructed wetlands. Bayawan City's CW, the first ever in the Philippines, was constructed with the assistance of German Technical Cooperation in a signed memorandum of agreement in compliance with the RA 9275 or the Clean Water Act. This CW has been operational since 2006 and continues to do so. The constructed wetland treats the effluent of the Fishermen's Gawad Kalinga Village from toilets and kitchen wastewater as shown in Figure 2.

The CWs have a total surface area of 2680 m2 with a total depth of the filter basins of 2 m for Reed Bed 1 (vertical flow) and 1.2 m for Reed Bed 2 (horizontal flow). The locally available reed called '*tambok*' (*Phragmites karka*) is used as the vegetation, which is regularly trimmed by phase [26]. The facility was designed for a flow rate of 50 L/person/day for 600 households, with an average of 5 people/household [25]. There are 67 septic tanks, with each serving 6 to 10 houses. The liquid portion of the wastewater is transported through a small-bore sewer system to a main sump for storage and solids removal. From there, the wastewater is pumped into header tanks and flows through a vertical and horizontal soil filter in a constructed wetland. The treated wastewater is

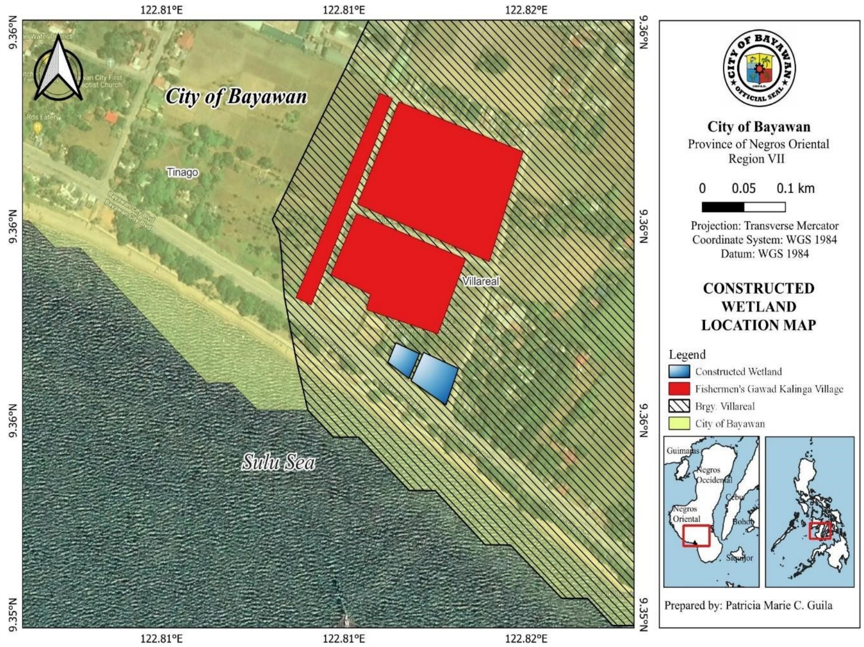

Figure 1.
Map of Constructed Wetland in Fishermen's Gawad Kalinga Village, Bayawan City, Negros Oriental, Philippines. Reproduced from Guila [21] under CC-BY-4.0

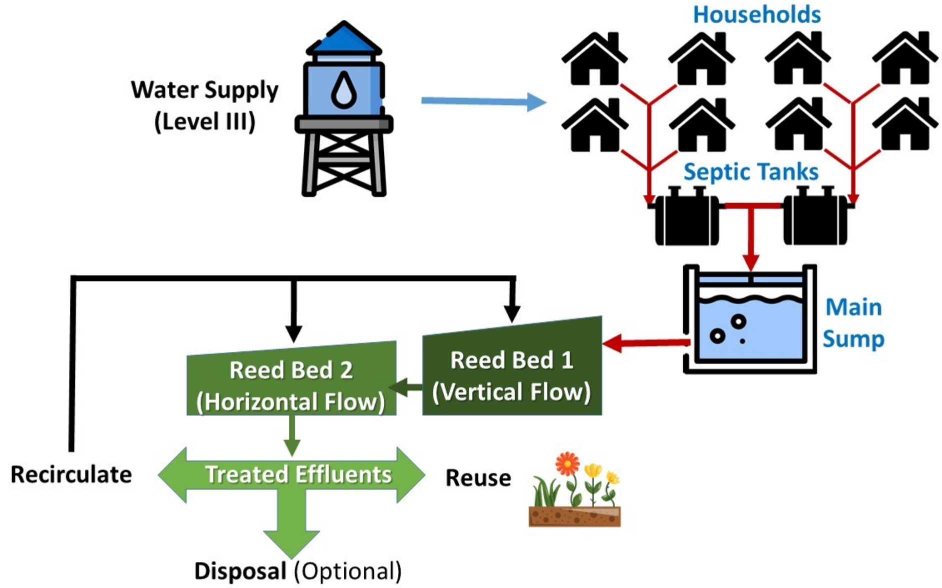

Figure 2.
Constructed Wetlands Wastewater Treatment System in Fishermen's Gawad Kalinga Village. Reproduced from Agaton & Guila [25] under CC-BY-4.0

stored and used for irrigation in farming projects. The vertical and horizontal vegetated soil filter was recommended based on treatment efficiency and space availability [21].

2.2 Contingent Valuation Method

The contingent valuation method (CVM) is a nonmarket valuation method that is widely used, notably in environmental cost-benefit analysis and environmental impact assessment. It is a stated-preference (survey) method in which respondents are asked to state their preferences in hypothetical or contingent markets, allowing analysts to estimate demands for goods or services that are not traded in markets [27]. For environmental goods and services, CVM can be used to estimate the economic values of multiple ecosystem services including use- and non-use values [28].

In this study, CVM attempts to elicit the monetary preferences for variations in the quantity or quality of ecosystem services provided by the CWs. The development of a precise and exhaustive questionnaire is essential to the success of any contingent valuation study. The questionnaire aims to obtain individuals' best estimates of how much it would be worth to them to have or not have the proposed change.

It is worthwhile to investigate the attitudes and behaviors associated with the goods to be valued, as well as to identify the most significant underlying forces driving respondents' attitudes toward the public good; provide respondents with a contingent scenario that outlines the commodity and the conditions under which it is to be valued. The final questions elicited information about the socioeconomic status and demographic composition of respondents to verify the extent to which the sample used for the survey accurately represents the population at stake and whether respondents would be willing to pay an additional fee. Following the survey, researchers employed statistical methods to generate welfare measures, such as the mean or median willingness to pay, and identify WTP's most influential factors. This is performed to conclude the treatment. The median may be the most accurate estimate of what most individuals are willing to pay based on the statistical indicators that will be utilized. This is because, unlike the mean, the median does not place as much emphasis on extreme values.

2.3 Research Instrument and Data Collection

A survey questionnaire was the primary research instrument used to collect the necessary data. It was divided into six (6) sections, each of which aimed to collect a different type of information. Before proceeding with the study, a summary was provided. The participants were asked to provide their informed consent to participate in the study in the first section of the questionnaire to meet the standards of ethical considerations. The questionnaire aimed to collect information regarding the respondents' socioeconomic backgrounds in the following section, as this was thought to affect their willingness to pay. The third section then moved on to ascertain whether or not respondents were aware of the presence of constructed wetlands in their community. The fourth section aimed to extract information about the ecosystem services constructed wetlands offer. With this, the WTP will be assessed in the part that follows. The final section elicited the problems and success factors that they believed had a significant impact on the implementation of the CW project to gain insights into the state of the CW in their community.

The survey questionnaire was written predominantly in English. It had been difficult to administer to the respondents because their primary language was Bisaya. To help with the language barrier, ten (10) enumerators were assigned to collect data. The enumerators are Southern Tech College Foundation Incorporated students. They are the Student Government officers. They are proficient in Tagalog (the researcher's native language), Bisaya, and English. Before the data collection, the enumerators were given an overview of the study and provided instructions and what was expected of them.

The data was collected in the Fishermen's Gawad Kalinga Village in February 2023. The convenience sampling method was used to select who would participate in the study from the village's 750 households. This occurred because the researcher was able to contact the local employees in charge of managing the community during the ocular visit, and she was informed that a cluster meeting about the monthly amortization for the housing units would be held in the coming days. The neighborhood is divided into nine (9) clusters based on the location of the housing units.

Because two clusters were scheduled for the first three days and three (3) clusters scheduled for the last day, the data gathering process took four (4) days. Those in attendance were chosen as the study's respondents. The household heads were the priorities to be interviewed because they are frequently responsible for the family's financial decisions. However, in some instances, the household heads were unable to attend the meeting and instead sent a representative. In such a scenario, the enumerators conducted interviews with their representatives. The survey received responses from 270 people in total, which are summarized in Table 1.

Table 1. Demographics of the Respondents

Sex	Civil Status	Age	Educational Attainment	Monthly Income (PHP)	Household Cluster
Male, 20% Female, 80%	Single, 11% Married, 63% Common Law, 7% Separated, 5% Widowed/ Widower, 14%	15-25, 8% 26-45, 40% 46-65, 45% above 65, 17%	Elementary level, 26% Elementary, 37% High School, 29% Vocational, 3% College, 4% Post-graduate, <1%	Below 5k, 61% 5k-10k, 32% Above 10k, 7%	1, 16% 2, 15% 3, 6% 4, 4% 5, 14% 6, 16% 7, 9% 8, 5% 9, 15%

Among the 270 households interviewed, 80% were female as their husbands or common law partners worked during the survey. Most of them were married or living with common law partner, 11% were single, and the rest were separated or widowed/widower. Most of the respondents were working, with 40% between 26 and 45 and 45% between 46 and 65 years old. In terms of educational attainment, majority of the respondents were high school graduates (29%), elementary school graduates (37%), or did not even finish elementary school (26%). These also related their monthly incomes with 61% below PHP 5 thousand a month, 32% between PHP 5 thousand and ten thousand, and only 7% above PHP 10 thousand. On the other hand, this reason allowed them to avail of the social services of Bayawan City to stay in the Fishermen's Gawad Kalinga Village [25].

2.4 Data Analysis

This study applied an exploratory sequential approach, a form of mixed methods design. First, a qualitative content analysis was applied to explore the ecosystem services of CWs from the perspective of the households. While a closed-ended response Likert scale could provide a greater understanding of what citizen stakeholders believe these services are [29], this study content analysis was employed as this method is more appropriate when a research is exploratory, eliciting the lived experiences of stakeholders [30]. The coded data was categorized to uncover patterns, themes, and linkages associated with ecosystem services and the frequency distribution was applied. Second, statistical approaches were applied: the Point-biserial correlation coefficient and Spearman rho correlation coefficient. The first statistical tool was used to determine the relationship between sex and WTPs, given that sex is a dichotomous variable while WTPs are continuous variables. To determine the relationship of age group, highest educational attainment, and monthly income to WTPs, the Spearman rho correlation coefficient was estimated, given that these socioeconomic profiles are in ordinal scale, while WTPs are continuous variables. We applied a 5% significance level on these analyses. These statistical parameters were computed using the Statistical Analysis Software (SAS). The following are used for the verbal interpretation of the calculated coefficients

The researchers combined the findings of both qualitative and quantitative data. This integration process entailed contrasting and comparing the qualitative insights generated from the

r_s	Verbal Interpretation
0-0.2	Very Weak
0.2-0.4	Weak
0.4-0.6	Moderately Strong
0.6-0.8	Strong
0.8-1	Very strong

content analysis with the quantitative findings on WTP. This integration aimed to create a more comprehensive and nuanced understanding of the link between ecosystem services and household WTP for these ecosystem services of the CWs.

3 Results and Discussion

3.1 Ecosystem Services of Constructed Wetlands in Bayawan City

Table 2 presents the breakdown of the respondents' perceived ecosystem services offered by constructed wetlands, categorized into provisioning, regulating, supporting, cultural, and other services.

Table 2. Perceived Ecosystem Services offered by Constructed Wetlands

ECOSYSTEM SERVICES		n	%
Provisioning Services	Water Supply	251	92.96
	Biomass	90	33.33
Regulating Services	Wastewater treatment	218	80.74
	Water purification	177	65.56
	Climate regulation	77	28.52
	Flood prevention	74	27.41
	Erosion control	40	14.81
Supporting Services	Habitat formation	163	60.37
	Nutrient cycling	115	42.59
	Hydrological cycle	66	24.44
Cultural Services	Tourism	214	79.26
	Educational and research	164	60.74
	Recreation	119	44.07
	Aesthetic	63	23.33
Other Services	Clean Air	5	1.85
	Good Health	1	0.37
	Improvement in the community	1	0.37
	Safety of the community	1	0.37
	Economic Progress	1	0.37
	Fertilizers	2	0.74
	Gardening	1	0.37

Provisioning services are those that directly provide resources and products. In the context of constructed wetlands, the main provisioning service identified is water supply, which is reported by 92.96% of the respondents. Constructed wetlands can act as natural filtration systems, purifying and supplying water for various purposes such as irrigation, industrial use, and even domestic consumption [31, 32, 33]. It can be noticed that the water supply has the highest value among other ecosystem services. This is because the community receives free water from CWs for other household purposes such as construction, ornamental gardening, backyard cleaning, and others [25]. Additionally, the table shows that biomass is another provisioning service, with 33.33% of respondents acknowledging the potential for biomass production within constructed wetlands. Currently, the biomass is derived from the reeds harvested from the CWs used for cooking or processing by the city in vermicomposting. Biomass can be used as a renewable energy source or as a raw material for various industries [34, 35].

Regulating services involve the regulation and maintenance of natural processes. Wastewater treatment is a prominent regulating service provided by constructed wetlands, reported by 80.74% of respondents. CWs effectively treat and purify wastewater by utilizing natural processes such as biological degradation and nutrient uptake [36, 37]. Water purification is another regulating service recognized by 65.56% of respondents. CWs naturally filter and remove pollutants, enhancing water quality [36]. It can be noticed that this value is lower than the wastewater treatment service of the CWs. This is because the main purpose of the CWs in the Gawad Kalinga Village is to treat the domestic wastewater from toilets and kitchen sinks for ornamental gardening or finally disposing the treated water in the ocean [25]. While the quality of the treated water from CWs is monitored and tested regularly, results should be communicated to the community to avoid biases on these two terms. Moreover, to ensure successful implementation of CWs projects, Devanadera et al. [17] emphasized key factors, including raising public awareness through effective information dissemination campaigns, community involvement, unwavering government commitment and support, proper operation and maintenance protocols, etc. Meanwhile, other regulating services mentioned in the table include climate regulation (28.52% of respondents), flood prevention (27.41%), and erosion control (14.81%).

Supporting services refer to the underlying processes that enable other ecosystem services to function effectively [38, 39]. In constructed wetlands, habitat formation is a crucial supporting service, identified by 60.37% of respondents. Constructed wetlands provide habitats for various plant and animal species, enhancing biodiversity. Nutrient cycling, reported by 42.59% of respondents, is another supporting service, as wetlands efficiently cycle and recycle nutrients within the ecosystem. The table also mentions the hydrological cycle (24.44% of respondents), which highlights the role of wetlands in regulating water flow and maintaining hydrological balance. While the water supply and water purification are part of the CWs treatment process hydrological cycle, the lower value can be improved through information campaigns on other benefits and ecosystem services of the CWs.

Cultural services are the non-material benefits that ecosystems offer to humans. Tourism is a significant cultural service associated with constructed wetlands, with 79.26% of respondents recognizing its potential. Constructed wetlands can attract visitors, providing opportunities for nature-based tourism and recreational activities [40, 41]. Additionally, constructed wetlands contribute to educational and research activities (60.74% of respondents), offering a unique setting for scientific studies and environmental education. Recreation (44.07% of respondents) and aesthetic values (23.33%) are other cultural services associated with constructed wetlands. Lastly, the table mentions other services provided by constructed wetlands, albeit at lower percentages. These include clean air, good health, community improvement and safety, economic progress, fertilizers, and gardening. While these services may have limited representation in the table, they demonstrate the potential for constructed wetlands to provide additional benefits beyond the commonly recognized ecosystem services.

Identifying and valuing the ecosystem services of CWs could increase the perceived value of CWs among individuals, communities, project planners, and policymakers. This increase in value may translate into an increased WTP for the wetland's services and benefits. People may be more ready to contribute monetarily or participate in the wetland's maintenance and sustainability if they recognize and value the environmental services it provides. Furthermore, ecosystem services add to the amenity value of a constructed wetland. The non-monetary benefits and enjoyment people obtain from natural or environmental elements are referred to as amenity value. The presence of a well-functioning wetland and the ecological services it provides can improve the beauty and quality of the surrounding environment. This can result in enhanced satisfaction, a higher quality of life, and a sense of well-being among people and visitors around the wetland [41, 42, 43]. The CWs' total economic value, in turn, might influence the overall value people place on it, potentially increasing their WTP for its maintenance and conservation.

3.2 Willingness to Pay for Ecosystem Services of Constructed Wetlands

Table 3 provides the summary of the WTP values, including the mean, standard deviation, minimum, first quartile (Q1), median, third quartile (Q3), and maximum. The table presents statistics for the overall WTP, maximum WTP, and minimum WTP.

Table 3. Summary Statistics of WTP (in PHP) for Constructed Wetlands

	n	MEAN ± SD	MIN	Q1	MEDIAN	Q3	MAX
WTP	258	107.28 ± 177.47	1	30	50	100	2,000
Max WTP	234	278.87 ± 692.48	5	75	100	300	10,000
Min WTP	239	60.15 ± 144.46	2	15	20	50	2,000

The summary statistics show that the distributions of WTP, maximum WTP, and minimum WTP are skewed to the right. This is indicated by the mean being higher than the median, suggesting a longer tail towards higher values. Additionally, the standard deviations for these variables are larger than their respective means, indicating a high degree of dispersion in the data. The presence of extremely high values, as indicated by the maximum values, further contributes to the skewness of the distribution. Various factors can influence the skewed distribution and high variability in WTP values. Previous studies have identified several factors influencing individuals' WTP for environmental goods and services. These factors include income, education, age, gender, environmental attitudes, and perceptions of the benefits of goods or services [44, 45]. For example, higher-income individuals are willing to pay larger amounts due to their greater financial capacity. Education can also play a role, as individuals with higher levels of education have a better understanding of the environmental benefits and thus exhibit a higher WTP.

Additionally, age, gender, and environmental attitudes can shape individuals' preferences and willingness to contribute financially [44, 46]. Furthermore, the presence of highly dispersed and extreme values in the WTP data may be influenced by individual heterogeneity in preferences and valuation methods. Different individuals may have varying levels of attachment or appreciation for the services provided by the constructed wetland, leading to a wide range of WTP responses.

The summary statistics of the WTP value for the constructed wetlands and their associated ecosystem services is presented in Philippine Pesos (PHP). The mean WTP for the constructed wetlands is PHP 107.28 (USD 1 = PHP 56) with a standard deviation of PHP 177.47. The minimum WTP reported by households is PHP 1, while the first quartile (Q1) value is PHP 30. The median WTP is PHP 50, indicating that 50% of the households are willing to pay up to or more than this amount. The third quartile (Q3) value is PHP 100, indicating that 75% of households have a PHP 100 or less WTP. The maximum WTP reported is PHP 100. The maximum WTP shows a higher mean of PHP 278.87 and a larger standard deviation of PHP 692.48. The minimum reported for maximum WTP is PHP 50, while the first quartile (Q1) is PHP 75. The median for maximum WTP is PHP 100, indicating that 50% of the households are willing to pay up to or more than this amount. The third quartile (Q3) value is PHP 300, suggesting that 75% of the households have a maximum WTP of PHP 300 or less. The maximum reported maximum WTP is PHP 10,000.

For the minimum WTP, the mean value is PHP 60.15 with a standard deviation of PHP 144.46. The minimum reported is PHP 2, while the first quartile (Q1) is PHP 15. The median for minimum WTP is PHP 20, indicating that 50% of the households are willing to pay up to or more than this amount. The third quartile (Q3) value is PHP 50, suggesting that 75% of the households have a minimum WTP of PHP 50 or less. The maximum reported minimum WTP is PHP 2000.

These statistics provide insights into the range of WTP values for the constructed wetlands in terms of Philippine Pesos. They demonstrate that households are willing to pay varying amounts, with a wide range of values observed. The maximum WTP values represent the higher end of the range, while the minimum WTP values reflect the lower end. Understanding these WTP ranges and the distribution of values can help assess the affordability and financial feasibility of the constructed wetlands, considering the ecosystem services they provide.

The households in Fishermen's Gawad Kalinga Village have been free from paying for the services provided by the CW since its creation in 2007. Instead, the government assumed the entire cost of the CW, including construction, maintenance, and operation.

However, the findings of this study reveal a considerable shift in household attitudes. Households currently have a monthly mean WTP of PHP 107.28, which is equivalent to PHP 28,965.60 (with 270 households willing to pay) for the services provided by the CWs. This indicates that households recognize the value and benefits provided by the CWs and are willing to contribute financially to keep them operating. This WTP allows the government to generate revenue from the financial contributions of households. The government can generate funds to sustain the CWs by collecting monthly household payments. The funds raised can be utilized for various objectives, including the continuing maintenance and operation of the created wetland. Household monetary contributions can help ensure the CW's long-term viability by lessening the load on the government's budget. It is important to highlight that the CWs initially generated no revenue because the government bore the costs entirely. However, with households indicating a willingness to pay, the CWs now have the potential to become self-sustaining.

Overall, the change in household willingness to pay is a favorable development. It not only benefits the government financially, but it also indicates the potential for the CWs to generate revenue and become self-sustaining. Yet, other factors should also be considered such as the uncertainties in implementing CWs projects [25] and the parameters that may affect the households WTP.

3.3 Association of Willingness to Pay and Demographic Profile

Table 4 displays the relationship between the socioeconomic profile and the WTP of the Fishermen's Gawad Kalinga Village respondents. The WTP values are represented by WTP, Max WTP, and Min WTP. The socioeconomic profiles examined in this analysis include sex, age group, highest educational attainment, and monthly income.

The results show a very weak association between sex and WTP. The point-biserial coefficients quantify the intensity and direction of the association. The point-biserial coefficients for sex and WTP in this case are -0.006 (mean), -0.011 (Max WTP), and -0.027 (Min WTP). A negative coefficient shows that the variables have an inverse association. This suggests that, on average, people of one sex (presumably males or females) have lower levels of willingness to pay than people of the opposite sex. This supports previous claims that sex has a negative relationship with WTP for environmental conservation, usually with females having lower WTP [47, 48]. It is worth noting that the magnitude of the coefficients is minor, indicating a very weak negative association. Also, the calculated p-value 0.4680>0.05 indicates that sex has no significant impact on the respondents'

Table 4. Association between Socioeconomic and Demographic Profile and WTP

	WTP	MAX WTP	MIN WTP
Sex	-0.006	-0.011	-0.027
Age Group	-0.219	-0.139	-0.252
Highest Educational Attainment	0.217	0.184	0.290
Monthly Income	0.153	0.135	0.237

WTP.

The age group variable also demonstrates a negative relationship with WTP, as indicated by the Spearman rho coefficients for WTP, Max WTP, and Min WTP. The magnitudes of these coefficients are relatively larger compared to those for sex, suggesting a stronger relationship. This indicates that as the age group increases, the WTP tends to decrease. This relationship might be associated with the lower financial capability of the old-aged households compared to the young and the middle-aged households, as the former are expected to face labor shortages for farm practices and inability to engage in seasonal labor compared to the economically active aged households [47]. Additionally, older household heads may perceive high opportunity cost of choosing improved management alternatives because they may expect a decline or loss of benefits that they have been deriving from the associated wetland resources in their lifetime [49]. On the contrary, studies [50, 51] reported that an increase in the age of the household head has a positive influence on the WTP. This can be associated with more knowledge of the wetland and adaptive experience, such that older households may easily predict the consequence of deteriorating this wetland, hence, being willing to pay more for the rehabilitation intervention without hesitation [47]. However, the calculated p-value 0.1682>0.05 indicates that age has no significant impact on WTP.

In contrast to sex and age group, the highest educational attainment variable shows a positive relationship with WTP. The Spearman Rho coefficients for WTP, Max WTP, and Min WTP are all positive, indicating that as the highest educational attainment increases, the WTP also tends to increase. Also, the p-value 0.01030<0.05 indicates that the calculated coefficients are significant at a 5% significance level. The magnitudes of these coefficients are relatively larger compared to sex, indicating a weak relationship with WTP. Studies show that higher education levels increase the amount of WTP. Hence, formal and informal education and training to improve scientific and sustainability literacy levels is a conservation-relevant policy mechanism for long-term resource management [37].

Similarly, the monthly income variable exhibits a positive relationship with WTP. The spearman rho coefficients for WTP, Max WTP, and Min WTP are all positive, suggesting that as the monthly income increases, the WTP also tends to increase. The p-value 0.0174<0.05, which indicates that the calculated coefficients are significant at a 5% level of significance. The magnitudes of these coefficients are also relatively larger compared to sex, yet, very weak relationship with WTP. This supports previous claims that the higher the respondent's monthly income, the greater the likelihood of accepting the proposed intervention and paying more for its development and conservation [52, 53, 54].

On the other hand, this result contradicts the previous claim that, while the rich have stronger WTP for environmental protection, the marginal WTP for environmental protection declines. Hence, the WTP does not always rise with the increase in income and the middle-income class has the strongest WTP for environmental protection, particularly in more polluted cities [55]. The main reason for this difference is the current study area focuses on the city's poorest of the poor village, while the previous study combined microdata from the Chinese General Social Survey in 2010 with the macro data at the corresponding urban level of China. Yet, this study provides an important policy implication to increase the income by providing livelihood for the households in the village and consequently increase the public's willingness to pay for conservation measures [56].

4 Conclusion and Recommendations

Constructed wetlands in peri-urban areas offer multiple ecosystem services, making them valuable for human settlements planning. These wetlands provide a nature-based solution for wastewater treatment while simultaneously supporting the community's overall well-being by enhancing sustainability, resilience, and the overall livability of the resettlement areas. Several studies discussed the adoption of constructed wetlands as a nature-based water treatment from the technical, economic, environmental, and governance perspectives. This study contributes to the literature by analyzing the economic value of the ecosystem services provided by the constructed wetlands from the perspective of household heads of a community that directly benefits from the constructed wetlands. Using the case of Bayawan City, this research interviewed 270 household heads from Fishermen's Gawad Kalinga Village and asked about the ecosystem services of constructed wetlands and how much they are willing to pay for these services.

The findings showed that the household heads are aware of the constructed wetlands and identified the ecosystem services it provide to the community, including the provisioning (water supply and biomass), regulating (wastewater treatment, water purification, climate regulation, flood prevention), supporting (habitat formation, nutrient cycling, hydrological cycle), and cultural (tourism, educational and research, recreation, aesthetic) services. They valued these services with a mean WTP of PHP 107.28. This result demonstrated that, even if communities are economically disadvantaged and among the poorest of the poor, they recognize the importance of wastewater treatment and the potential benefits of constructed wetlands. It signifies their understanding of the value of improved water quality, reduced health risks, and enhanced living conditions. Despite their financial constraints, their willingness to contribute financially highlights their commitment to securing a healthier and more sustainable environment for their community.

Moreover, understanding WTP can assist decision-makers in determining the economic feasibility and long-term viability of constructing and maintaining wetlands in peri-urban settings. It can also help to guide resource allocation and funding for wastewater treatment infrastructure. Integrating willingness to pay into human settlement planning enables more thorough and participative decision-making processes that take into account both the environmental and financial benefits of nature-based solutions such as artificial wetlands.

This research had limitations that served as bases for further research. First, this study explored the stakeholders' lived experiences using qualitative analysis. A Likert scale could complement the themes generated from this research by providing a structured and quantifiable method for analyzing the stakeholders' opinions, attitudes, and perceptions. Additionally, the correlation between respondents' sociodemographic profile and the level of awareness of ecosystem services could also be included in the analysis. This study applied a contingent valuation method to quantify the willingness of the respondents to pay for the ecosystem services of the constructed wetlands. Other valuation methods such as travel cost method, shadow pricing, or real options valuation could be combined to cross-validate results or to capture different dimensions of the value of constructed wetlands. Lastly, the valuation method applied in the case of Bayawan City should also be applied to other constructed wetlands projects in the Philippines and other countries to make a robust decision in planning, implementing, upscaling, and replicating the project.

Statements and Declarations

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Data Availability

Data is available upon request from the author.

Ethical Considerations

The study was conducted following the Declaration of Helsinki. Free, prior, and informed consent (FPIC) was sought from the participants, which included explaining to them the purpose of the study, their voluntary participation in the study, and how the collected data would be used.

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Competing Interest

The authors declare no competing interest.

Author Contributions

P.M.C.G.: conceptualization, methodology, formal analysis, investigation, writing—original draft preparation, visualization. **C.B.A.**: conceptualization, methodology, writing—original draft preparation, supervision. **R.R.B.R.**: conceptualization, validation, writing—review and editing, supervision. **E.R.A.**: conceptualization, validation, writing—review and editing, supervision. All authors have read and agreed to the published version of the manuscript.

References

[1] Adeyeye, K., Gibberd, J., & Chakwizira, J. (2020). Water marginality in rural and peri-urban communities. *Journal of Cleaner Production*, *273*, 122594. https://doi.org/doi:10.1016/j.jclepro.2020.122594

[2] Agarwal, S., Darbar, S., & Saha, S. (2022). Challenges in management of domestic wastewater for sustainable development. In *Current directions in water scarcity research* (pp. 531–552, Vol. 6). Elsevier. https://doi.org/10.1016/B978-0-323-91838-1.00019-1

[3] Ishak, K. S. S., Panneerselvam, A., Ambikapathy, V., Sathya, R., & Vinothkanna, A. (2021). An investigation of sewage water treatment plant and its physico-chemical analysis. *Biocatalysis and Agricultural Biotechnology*, *35*, 102061. https://doi.org/10.1016/j.bcab.2021.102061

[4] Hasan, M. N., Khan, A. A., Ahmad, S., & Lew, B. (2019). Anaerobic and aerobic sewage treatment plants in northern india: Two years intensive evaluation and perspectives. *Environmental Technology & Innovation*, *15*, 100396. https://doi.org/10.1016/j.eti.2019.100396

[5] Yang, S., Zheng, Y., Mao, Y., Xu, L., Jin, Z., Zhao, M., Kong, H., Huang, X., & Zheng, X. (2021). Domestic wastewater treatment for single household via novel subsurface wastewater infiltration systems (swiss) with niimi process: Performance and microbial community. *Journal of Cleaner Production*, *279*, 123434. https://doi.org/10.1016/j.jclepro.2020.123434

[6] Magwaza, S. T., Magwaza, L. S., Odindo, A. O., & Mditshwa, A. (2020). Hydroponic technology as decentralised system for domestic wastewater treatment and vegetable production in urban agriculture: A review. *Science of the Total Environment*, *698*, 134154. https://doi.org/10.1016/j.scitotenv.2019.134154

[7] Agaton, C. B., & Guila, P. M. C. (2023). Ecosystem services valuation of constructed wetland as a nature-based solution to wastewater treatment. *Earth*, *4*(1), 78–92. https://doi.org/10.3390/earth4010006

[8] Vymazal, J. (2014). Constructed wetlands for treatment of industrial wastewaters: A review. *Ecological engineering*, *73*, 724–751. https://doi.org/10.1016/j.ecoleng.2014.09.034

[9] Sehar, S., & Nasser, H. (2019). Wastewater treatment of food industries through constructed wetland: A review. *International Journal of Environmental Science and Technology*, *16*, 6453–6472. https://doi.org/10.1007/s13762-019-02472-7

[10] Zheng, F., Fang, J., Guo, F., Yang, X., Liu, T., Chen, M., Nie, M., & Chen, Y. (2022). Biochar based constructed wetland for secondary effluent treatment: Waste resource utilization. *Chemical Engineering Journal*, *432*, 134377. https://doi.org/10.1016/j.cej.2021.134377

[11] Paul, J., Boorsma, J., & Lange, U. (2011). *Planning, establishment and operation of a waste management and recycling center in Bayawan City, Negros Oriental, Philippines* (tech. rep.). Technical Committee on Geotechnics of Landfill Engineering, German Geotechnical Society (DGGT) Osnabrueck, Germany.

[12] Velasco, P., Devanadera, M. C., Dalisay, M., Mueca, C., Estorba, D. S., & Lecciones, A. (2023). Nature-based solutions for domestic wastewater treatment in the philippines. In N. Pachova, P. Velasco, A. Torrens, & V. Jegatheesan (Eds.), *Regional perspectives of nature-based solutions for water: Benefits and challenges* (pp. 175–201). Springer, Cham. https://doi.org/10.1007/978-3-031-18412-3_7

[13] Napaldet, J. T., & Buot Jr, I. E. (2019). Treatment of Balili River in Benguet, Philippines with constructed wetland planted with dominant local macrophytes. *International Journal of Phytoremediation*, *21*(14), 1463–1473. https://doi.org/10.1080/15226514.2019.1633268

[14] Napaldet, J. T., & Buot Jr, I. E. (2020). Rehabilitation of eutrophic rivers through phytoremediation in constructed wetland: The case of Balili River in Benguet, Philippines. In I. Buot Jr (Ed.), *Methodologies supportive of sustainable development in agriculture and natural resources management: Selected cases in Southeast Asia* (pp. 203–229). Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) and the University of the Philippines Los Baños (UPLB): Laguna, Philippines.

[15] Galve, J. C. A., Sundo, M. B., Camus, D. R. D., De Padua, V. M. N., & Morales, R. D. F. (2021). Series type vertical subsurface flow constructed wetlands for dairy farm wastewater treatment. *Civil Engineering Journal*, *7*(2), 292–303. https://doi.org/10.28991/cej-2021-03091654

[16] Flores, R., & Adil, J. (2019). Treatment of slaughterhouse wastewater utilizing cogon grass (*Imperata cylindrica*) in a subsurface flow system constructed wetland in Zamboanga City, Philippines. *Proceedings of the 16th International Conference on Environmental Science and Technology, Rhodes, Greece*, (CEST2019$_0$0679).

[17] Devanadera, M. C. E., Estorba, D. S., Guerrero, K. M., & Lecciones, A. (2024). Social acceptability assessment for nature-based solution for wastewater treatment. In V. Jegatheesan, P. Velasco, & N. Pachova (Eds.), *Water treatment in urban environments: A guide for the implementation and scaling of nature-based solutions*. Springer Nature, Cham. https://doi.org/10.1007/978-3-031-49282-2_5

[18] Agaton, C. B., Guila, P. M. C., & Rodriguez, A. D. H. (2024). Economic analysis of nbs for wastewater treatment under uncertainties. In V. Jegatheesan, P. Velasco, & N. Pachova (Eds.), *Water treatment in urban environments: A guide for the implementation and scaling of nature-based solutions*. Springer Nature, Cham. https://doi.org/10.1007/978-3-031-49282-2_4

[19] Makopondo, R. O., Rotich, L. K., Kamau, C. G., et al. (n.d.). Potential use and challenges of constructed wetlands for wastewater treatment and conservation in game lodges and resorts in kenya. *The Scientific World Journal*, *2020*, 9184192. https://doi.org/10.1155/2020/9184192

[20] Vymazal, J., Zhao, Y., & Mander, Ü. (2021). Recent research challenges in constructed wetlands for wastewater treatment: A review. *Ecological Engineering*, *169*, 106318. https://doi.org/10.1016/j.ecoleng.2021.106318

[21] Guila, P. M. C. (2023). *Gray to green: Will households pay for constructed wetlands as nature-based water treatment in peri-urban areas in the Philippines*. [Undergraduate Thesis] University of the Philippines Los Baños. https://www.ukdr.uplb.edu.ph/etd-undergrad/9643/

[22] Sannigrahi, S., Chakraborti, S., Joshi, P. K., Keesstra, S., Sen, S., Paul, S. K., Kreuter, U., Sutton, P. C., Jha, S., & Dang, K. B. (2019). Ecosystem service value assessment of a natural reserve region for strengthening protection and conservation. *Journal of Environmental Management*, *244*, 208–227. https://doi.org/10.1016/j.jenvman.2019.04.095

[23] Yang, W., Chang, J., Xu, B., Peng, C., & Ge, Y. (2008). Ecosystem service value assessment for constructed wetlands: A case study in Hangzhou, China. *Ecological Economics*, *68*(1-2), 116–125. https://doi.org/10.1016/j.ecolecon.2008.02.008

[24] Costanza, R. (2020). Valuing natural capital and ecosystem services toward the goals of efficiency, fairness, and sustainability. *Ecosystem Services*, *43*, 101096. https://doi.org/10.1016/j.ecoser.2020.101096

[25] Agaton, C. B., & Guila, P. M. C. (2024). Success factors and challenges: Implications of real options valuation of constructed wetlands as nature-based solutions for wastewater treatment. *Resources*, *13*(1), 11. https://doi.org/10.3390/resources13010011

[26] Lipkow, U., & von Münch, E. (2010). *Constructed wetland for a peri-urban housing area Bayawan City, Philippines - case study of sustainable sanitation projects*. Sustainable Sanitation Alliance (SuSanA). https://www.susana.org/_resources/documents/default/2-51-en-susana-cs-philippines-bayawan-constr-wetlands-2009.pdf (Retrieved 20 January 2024).

[27] Markandya, A., Ortiz, R. A., & Chiabai, A. (2019). Estimating environmental health costs: General introduction to valuation of human health risks. In *Encyclopedia of environmental health* (2nd). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.10657-8

[28] Butterfield, B. J., Camhi, A. L., Rubin, R. L., & Schwalm, C. R. (2016). Tradeoffs and compatibilities among ecosystem services: Biological, physical and economic drivers of multifunctionality. In *Advances in ecological research* (pp. 207–243, Vol. 54). Elsevier. https://doi.org/10.1016/bs.aecr.2015.09.002

[29] Baur, J. W., Tynon, J. F., Ries, P., & Rosenberger, R. S. (2016). Public attitudes about urban forest ecosystem services management: A case study in oregon cities. *Urban Forestry & Urban Greening*, *17*, 42–53. https://doi.org/10.1016/j.ufug.2016.03.012

[30] Batac, K. I. T., Baquiran, J. A., & Agaton, C. B. (2021). Qualitative content analysis of teachers' perceptions and experiences in using blended learning during the covid-19 pandemic. *International Journal of Learning, Teaching and Educational Research*, *20*(6), 225–243. https://doi.org/10.26803/ijlter.20.6.12

[31] De la Varga, D., Soto, M., Arias, C. A., van Oirschot, D., Kilian, R., Pascual, A., & Álvarez, J. A. (2020). Constructed wetlands for industrial wastewater treatment and removal of nutrients. In *Waste management: Concepts, methodologies, tools, and applications* (pp. 559–587). IGI global. https://doi.org/10.4018/978-1-7998-1210-4.ch027

[32] Hdidou, M., Necibi, M. C., Labille, J., El Hajjaji, S., Dhiba, D., Chehbouni, A., & Roche, N. (2021). Potential use of constructed wetland systems for rural sanitation and wastewater reuse in agriculture in the Moroccan context. *Energies*, *15*(1), 156. https://doi.org/10.3390/en15010156

[33] Stefanakis, A. I. (2019). The role of constructed wetlands as green infrastructure for sustainable urban water management. *Sustainability*, *11*(24), 6981. https://doi.org/10.3390/su11246981

[34] Srivastava, R. K., Shetti, N. P., Reddy, K. R., Kwon, E. E., Nadagouda, M. N., & Aminabhavi, T. M. (2021). Biomass utilization and production of biofuels from carbon neutral materials. *Environmental Pollution*, *276*, 116731. https://doi.org/10.1016/j.envpol.2021.116731

[35] Clauser, N. M., González, G., Mendieta, C. M., Kruyeniski, J., Area, M. C., & Vallejos, M. E. (2021). Biomass waste as sustainable raw material for energy and fuels. *Sustainability*, *13*(2), 794. https://doi.org/10.3390/su13020794

[36] Kamilya, T., Majumder, A., Yadav, M. K., Ayoob, S., Tripathy, S., & Gupta, A. K. (2022). Nutrient pollution and its remediation using constructed wetlands: Insights into removal and recovery mechanisms, modifications and sustainable aspects. *Journal of Environmental Chemical Engineering*, *10*(3), 107444. https://doi.org/10.1016/j.jece.2022.107444

[37] Rana, V., & Maiti, S. K. (2020). Municipal and industrial wastewater treatment using constructed wetlands. In B. Shmaefsky (Ed.). Springer, Cham. https://doi.org/10.1007/978-3-030-00099-8_10

[38] Li, Q., Long, Z., Wang, H., & Zhang, G. (2021). Functions of constructed wetland animals in water environment protectiona - critical review. *Science of The Total Environment*, *760*, 144038. https://doi.org/10.1016/j.scitotenv.2020.144038

[39] Zhang, C., Wen, L., Wang, Y., Liu, C., Zhou, Y., & Lei, G. (2020). Can constructed wetlands be wildlife refuges? a review of their potential biodiversity conservation value. *Sustainability*, *12*(4), 1442. https://doi.org/10.3390/su12041442

[40] Gitau, P., Ndiritu, G., & Gichuki, N. (2019). Ecological, recreational and educational potential of a small artificial wetland in an urban environment. *African Journal of Aquatic Science*, *44*(4), 329–338. https://doi.org/10.2989/16085914.2019.1663721

[41] Barmelgy, M. E., Elsaman, S., Refaat, D., Haron, A., & El Maalt, A. (2022). Constructed wetland park as happy public space to achieve quality of life: Case study of 10 Ramadan City. *IOP Conference Series: Earth and Environmental Science*, *992*(1), 012009. https://doi.org/10.1088/1755-1315/992/1/012009

[42] Li, J., Pan, Q., Peng, Y., Feng, T., Liu, S., Cai, X., Zhong, C., Yin, Y., & Lai, W. (2020). Perceived quality of urban wetland parks: A second-order factor structure equation modeling. *Sustainability*, *12*(17), 7204. https://doi.org/10.3390/su12177204

[43] Pedersen, E., Weisner, S. E., & Johansson, M. (2019). Wetland areas' direct contributions to residents' well-being entitle them to high cultural ecosystem values. *Science of the Total Environment*, *646*, 1315–1326. https://doi.org/10.1016/j.scitotenv.2018.07.236

[44] Faccioli, M., Czajkowski, M., Glenk, K., & Martin-Ortega, J. (2020). Environmental attitudes and place identity as determinants of preferences for ecosystem services. *Ecological Economics*, *174*, 106600. https://doi.org/10.1016/j.ecolecon.2020.106600

[45] Halkos, G., & Matsiori, S. (2017). Environmental attitude, motivations and values for marine biodiversity protection. *Journal of Behavioral and experimental Economics*, *69*, 61–70. https://doi.org/10.1016/j.socec.2017.05.009

[46] Ren, Y., Lu, L., Zhang, H., Chen, H., & Zhu, D. (2020). Residents' willingness to pay for ecosystem services and its influencing factors: A study of the Xin'an River basin. *Journal of Cleaner Production*, *268*, 122301. https://doi.org/10.1016/j.jclepro.2020.122301

[47] Asmare, E., Bekele, K., & Fentaw, S. (2022). Households' willingness to pay for the rehabilitation of wetlands: Evidence from Gudera Wetland, Northwest Ethiopia. *Heliyon*, *8*(1), e08813. https://doi.org/10.1016/j.heliyon.2022.e08813

[48] Baffoe, J. D., Mizunoya, T., & Yabar, H. (2021). Determinants of rice farmers' willingness to pay for conservation and sustainable use of Swampy Wetlands in Ghana's Northern and Ashanti regions. *Agriculture*, *11*(6), 507. https://doi.org/10.3390/agriculture11060507

[49] Dechasa, F., Senbeta, F., & Guta, D. D. (2021). Economic value of wetlands services in the Central Rift Valley of Ethiopia. *Environmental Economics and Policy Studies*, *23*, 29–53. https://doi.org/10.1007/s10018-020-00277-4

[50] Báez-Montenegro, A., Echeverría, R., Sepúlveda, E., & Calcagni, V. (2022). Does an environmental disaster influence the tourists' willingness to pay for a wetland? the case of the Cruces River Wetland in Southern Chile. *Wetlands*, *42*(7), 82. https://doi.org/10.1007/s13157-022-01600-3

[51] Ghanian, M., Ghoochani, O. M., Noroozi, H., & Cotton, M. (2022). Valuing wetland conservation: A contingent valuation analysis among iranian beneficiaries. *Journal for Nature Conservation*, *66*, 126140. https://doi.org/10.1016/j.jnc.2022.126140

[52] Sethy, M. K., & Senapati, A. K. (2023). Perceptions towards ecotourism practice and the willingness to pay: Evidence from Chilika Coastal Wetland Ecosystem, Odisha. *International Journal of Geoheritage and Parks*, *11*(3), 497–513. https://doi.org/10.1016/j.ijgeop.2023.08.001

[53] Aseres, S. A., & Sira, R. K. (2020). Estimating visitors' willingness to pay for a conservation fund: Sustainable financing approach in protected areas in Ethiopia. *Heliyon*, *6*(8), e04500. https://doi.org/10.1016/j.heliyon.2020.e04500

[54] Guno, C. S. (2024). Diesel to solar irrigation system: Economic, environmental, and social acceptability analyses by small-scale farmers of Calapan, Oriental Mindoro. *Journal of Human Ecology and Sustainability*, *2*(1), 3. https://doi.org/10.56237/jhes23015

[55] Shao, S., Tian, Z., & Fan, M. (2018). Do the rich have stronger willingness to pay for environmental protection? new evidence from a survey in China. *World Development*, *105*, 83–94. https://doi.org/10.1016/j.worlddev.2017.12.033

[56] Gong, Y., Bi, X., & Wu, J. (2020). Willingness to pay for the conservation of the endangered Red-crowned Crane in China: Roles of conservation attitudes and income. *Forest Policy and Economics*, *120*, 102296. https://doi.org/10.1016/j.forpol.2020.102296