International Journal of Research Studies in Education
2026 Volume 15 Number 11, 269-284

Assessment of willingness to pay for the ecological services of mangroves at Sta. Rosa Del Sur, Pasacao, Camarines Sur

Salvidar, John Paul D. ✉
Central Bicol State University of Agriculture (Pasacao Campus), Philippines
(johnpaul.salvidar@cbsua.edu.ph)
Clemente, Ma. Arabelle P.
Lustre, Angie C.
Sibulo, Eliza Grace D.
Inaldo, Patrick James A.
Estacion, John Michael D.
Felezmiño, Jasper Ian U.
Nolasco, Michael N.

ISSN: 2243-7703
Online ISSN: 2243-7711

OPEN ACCESS

Received: 1 May 2026 **Revised**: 9 May 2026 **Accepted**: 10 May 2026
Available Online: 11 May 2026 **DOI**: 10.5861/ijrse.2026.26191

Abstract

Mangrove ecosystems provide vital ecological services such as coastal protection, habitat provision, and livelihood support; however, these services remain undervalued due to the absence of economic valuation. This study assessed the willingness to pay (WTP) of residents for mangrove conservation in Zone 6, Sta. Rosa Del Sur, Pasacao, Camarines Sur using the Contingent Valuation Method (CVM). A mixed-methods approach was employed, combining quantitative survey data and qualitative interviews from 40 purposively selected respondents aged 18 years and above. Data were analyzed using descriptive statistics and multiple regression analysis. Findings revealed that respondents were predominantly female, young adults, married, and low-income earners, with many engaged in small-scale livelihoods such as sari-sari store operations. Among the ecological services identified, coastal protection was the most recognized, while water quality improvement was the least recognized. Regression analysis showed that awareness of multiple ecological functions significantly influenced respondents' willingness to pay. In contrast, socio-demographic variables were not statistically significant predictors of WTP. Results further indicated that the majority of respondents were willing to contribute financially to mangrove conservation, with an average WTP of ₱378.125 per household annually. These findings suggest strong community support for mangrove protection despite economic limitations, highlighting the importance of environmental awareness in shaping conservation behavior. The study provides empirical evidence that may inform

conservation planning, policy formulation, and future valuation studies of mangrove ecosystems in the Bicol Region.

Keywords: contingent valuation method, ecological services, mangrove, multiple regression, willingness to pay

Assessment of willingness to pay for the ecological services of mangroves at Sta. Rosa Del Sur, Pasacao, Camarines Sur

1. Introduction

Mangrove ecosystem are among the most productive and ecologically significant coastal environments worldwide. The Food and Agriculture Organization of the United Nations (2025) described mangroves as salt-tolerant evergreen tree or shrub dominated ecosystems that occur in inter-tidal environments at the land-sea interface along tropical and subtropical coastlines, in shallow-water lagoons, estuaries, rivers and deltas. The Department of Environment and Natural Resources (DENR) classify mangroves as an essential component of marine and coastal ecosystems, alongside coral reefs and seagrass. These ecosystems provide a wide array of ecological services including coastal protection, carbon sequestration, and livelihood support. To assess these benefits, environmental economists use several methods, such as contingent valuation. Contingent valuation is a method used to estimate the economic value of non-market resources like environmental services, determining how individuals are willing to pay for the specific environmental improvements (McFadden, 2017).

Globally, mangroves cover approximately 14.8 million hectares. The Food and Agriculture Organization of the United Nations (FAO) compiles forestry data from 236 countries and territories and released their Global Forest Resources Assessment (FRA) for 2020. It stated that in 2020, 223 countries and territories, 113 reported having forest areas of mangrove swamp. More than 40% of the world's mangrove area is located in four counties: Indonesia (19% of the world's total), Brazil (9%), Nigeria (7%) and Mexico (6%). The largest amount of mangrove coverage can be found in Indonesia (S Darmawan et al., 2014). Meanwhile, in the Philippines, based on the report published in the Journal of Coastal Research in 2013, written by Jordan Long and Chandra Giri, the estimated total area of Philippine mangrove coverage at 256, 185 hectares in 2003. Based on the report, 66 out of 82 (80%) provinces with the most mangrove areas as a percentage of total national area. Palawan (22.2%), Sulu (8%), and Zamboanga Del Norte and Sur (9.86%), Surigao Del Norte and Sur (6.8%), Eastern and Western Samar (6.1%), Quezon (5.5%), Tawi-Tawi (4.4%), Bohol (3.69%), and Basilan (2.97%). Approximately 46 of the more than 70 salt-tolerant mangrove species found worldwide are found in the Philippines (Mendoza, 2017).

Philippine mangrove forests are one of the richest and have some of the highest species' diversity in the Indo-Pacific region and play a crucial role in sustaining coastal productivity. Brander et al. (2012) emphasized that mangrove ecosystems deliver substantial ecosystem services, including coastal protection, and nutrient cycling, which contribute significantly to both local and global economies. This forest provides not only food and resources but also protect coastlines preventing erosion (Rosario et al., 2021). It serves as a nursery breeding ground for many commercial and non-commercial fish and invertebrate species, providing employment and food for millions of people (Hutchison et al., 2020). Beyond their ecological and economic contributions, mangroves recognized as a significant carbon sinks. Studies by Alongi (2014) and Donato et al. (2011) revealed the exceptional ability of these ecosystems to store large amounts of carbon in their biomass and sediments up to four times more than most terrestrial tropical forests making them essential in climate mitigation efforts and maintaining ecological balance in coastal regions. These ecological and social benefits emphasize the urgent need to conserve mangroves as a key natural asset in the country's coastal management strategies (Garcia et al., 2014).

Despite the critical importance and ecological services provided by mangrove forests, they remain undervalued and severely threatened. Due to natural and anthropocentric activities like deforestation, pollution, urbanization, dam construction, and many more (Rog et al., 2016). As emphasized by Friess et al. (2019), the continued degradation of mangrove forests worldwide has led to substantial losses in ecosystem services, including declines in fishery productivity, carbon storage, and coastal protection. These losses not only threaten biodiversity but also heighten the vulnerability of coastal populations to extreme weather events and sea-level rise, underscoring the urgency of implementing evidence-based mangrove conservation and restoration initiatives. Like

many tropical nations, the Philippines continues to experience mangrove degradation due to these natural and anthropocentric activities.

The lack of valuation resulted in continuing degradation of mangrove forest and hinders the formulation of effective conservation and management strategies. According to Vegh et al. (2014), the valuation of mangrove ecosystem services through non-market approaches such as the Contingent Valuation Method (CVM) is essential in translating ecological functions into measurable economic terms. These economic assessments provide policymakers and stakeholders with concrete data that highlight the societal benefits of conservation, thereby promoting more informed and sustainable coastal management decisions.

In some parts of the Philippines, there is growing literature about contingent valuation employed in placing value on the ecological services provided by mangrove forest. A case study conducted by Roldan (2022) aimed to estimate the total economic value (TEV) of mangroves in Tawi-Tawi using the contingent valuation method. The study found that the Total Economic Value ranged from USD 36.26 million to USD 53.35 million annually, with indirect use values compromising approximately 89.92% of the total a high level of community support for mangrove conservation, with an average WTP of Php 992 per household. Another study conducted in Ipil Zamboanga, Sibugay, a contingent valuation method was also employed to understand the Filipinos' support for mangrove forest conservation. A survey was conducted with 388 residents to assess their willingness to pay (WTP) for mangrove conservation. The study found that 70.4% of the residents were willing to pay for mangrove conservation at a bid amount of Php 32 per household (Hernando et al., 2024).

In contrast, a recent study by Gagarin et al. (2022) examined the Willingness to Pay (WTP) for Mangroves' Coastal Protection in Santo Angel, Calauag, Quezon, Philippines, employing the contingent valuation method (CVM) using a double-bounded dichotomous choice format. The researchers surveyed 210 households and found that approximately 79% of respondents were willing to pay an average of ₱15.44 per month per household to support mangrove conservation initiatives. The study identified several socio-demographic factors influencing willingness to pay (WTP), including sex, age, organizational membership, and awareness of mangrove importance. Their findings underscore that communities with greater awareness and participation in environmental programs exhibit stronger support for mangrove protection efforts.

Across various regions in the Philippines, contingent valuation studies consistently show high community support for mangrove conservation, it revealed the appreciation of local communities for the benefits of mangrove forest in some parts of the Philippines with WTP values ranging from ₱15 to nearly ₱1,000 per household annually. However, these studies also reveal that willingness to pay (WTP) varies depending on livelihood dependence, awareness, and socio-demographic factors. These literature of valuation across different regions, highlights the vital role of local knowledge and perception in shaping conservation behavior, an insight that reinforces the need to assess how socio-economic and awareness factors influence residents' willingness to pay for mangrove ecosystem services at Sta. Rosa Del Sur, Pasacao, Camarines Sur.

Despite the presence of 4.6 hectares of mangroves in Sta. Rosa Del Sur, and despite residents' direct reliance on these ecosystems for coastal protection and livelihood, no study has yet assessed the monetary value local residents place on these ecological services. This gap hinders evidence-based coastal management and conservation planning. Therefore, this study was developed to fill the gap in assessing the willingness to pay for the ecological services of mangroves at Sta. Rosa Del Sur, Pasacao, Camarines Sur, using contingent valuation method (CVM) to determine the monetary value residents place on the ecological services. By quantifying the economic value of mangrove services, providing data that can inform sustainable management practices and additionally, this study will contribute essential information for local conservation strategies and policy development that can increase public awareness of the hidden economic value of mangrove ecosystems.

In relation with the United Nations 2030 Sustainable Development Goals (SDG), the researchers came up with the study to promote SDG #12 responsible consumption and production, SDG #13 climate action, SDG #14 life below water, and SDG #15 life on land.

Objectives of the Study - This study aims to determine the amount that residents of Sta. Rosa Del Sur, Pasacao, Camarines Sur are willing to pay for the ecological services provided by mangroves, particularly in terms of protection and conservation. Specifically, it seeks to identify the socio-demographic profile of the respondents including their gender, age, civil status, main source of income or work, monthly income, and number of years residing in Sta. Rosa Del Sur. It also aims to identify the ecological services provided by mangroves as perceived by the local residents. Furthermore, the study intends to determine the monetary value that residents place on these ecological services by measuring their willingness to pay using the Contingent Valuation Method. Lastly, based on the findings, the study will develop policy recommendations to support and enhance mangrove conservation efforts in the area.

Significance of the Study - The results of the study will be benefitting several stakeholders. The Department of Environment and Natural Resources (DENR) and Local Government Units (LGUs) will gain valuable data to support evidence-based policies and effective mangrove management. Policymakers can use the findings to guide conservation and sustainable development decisions. Students and academic institutions will benefit through enhanced learning on ecological services and environmental valuation methods. Local communities particularly residents of Sta. Rosa Del Sur, will gain increased awareness of the importance of mangroves, encouraging active participation in conservation efforts. The environment will benefit from improved protection and sustainable strategies. Lastly, other researchers can use the study as baseline data, contributing to the limited literature on mangrove valuation in the Bicol Region and supporting future studies.

Theoretical Framework - This study is anchored on three theoretical perspectives to explain residents' willingness to pay; the Ecosystem Services Framework (Daily, 1997) as cited by Costanza et al. (2017), The Theory of Planned Behavior (Ajzen, 1991), and the Environmental Stewardship Theory (Chapin et., al 2011) as cited by Bennett et al., (2018). Together, these theories provide a comprehensive understanding of how individuals perceive value and act toward the conservation of mangrove ecosystems. (1) The Ecosystem Services Framework by Daily (1997) cited by Costanza et al. (2017) that mangroves provide essential services such as food provision, coastal protection, habitat support, carbon storage and cultural benefits that sustain human well-being and livelihoods. (2) The Theory of Planned Behavior (TPB) by Ajzen (1991), shows that willingness to pay (WTP) for mangrove conservation is influenced by attitudes, social pressures, and perceived ability to contribute financially. (3) And the Environmental Stewardship Theory by Chapin et al. (2011) cited by Bennett et al. (2018) highlights that moral responsibility of individuals as caretakers of the environment, which strengthens their support and willingness to pay for mangrove conservation.

2. Methodology

This section presents the methods and procedures that were used in the study, including the research design, research locale, population and sampling design, data gathering procedure, ethical consideration, and statistical treatment of data.

Research design - This study employed a mixed-method research design combining both qualitative and quantitative approaches to assess resident's willingness to pay for mangrove ecological services in Sta. Rosa Del Sur, Pasacao, Camarines Sur. The quantitative approach utilized a survey questionnaire through the Contingent Valuation Method (CVM) to measure the monetary value residents place on mangrove conservation by asking the maximum amount they were willing to pay under a hypothetical scenario. Meanwhile, the qualitative approach involved direct interviews with selected residents to gain deeper insights into their understanding of mangroves. Thematic analysis was applied to identify and interpret common themes (Fuchs, 2023) explaining the reason behind residents' willingness to pay for mangrove conservation.

Research locale - This study was conducted at Zone 6, Sta. Rosa Del Sur, situated approximately at 13.5120, 123.0360, in the island of Luzon (Municipal Government of Pasacao, Camarines Sur, 2022). A coastal Barangay located in the municipality of Pasacao, in the province of Camarines Sur, Region V (Bicol Region), Philippines

(Figure 1). The area was selected, as the study site due to its presence of 4.6 hectares of mangrove forest (Google Earth, 2025) and residents' dependence on mangrove resources for their protection against storm surge and livelihoods. Additionally, the Barangay is also part of the broader coastal zone where fishing, crabbing activities are common, thus making it an ideal site for applying contingent valuation method.

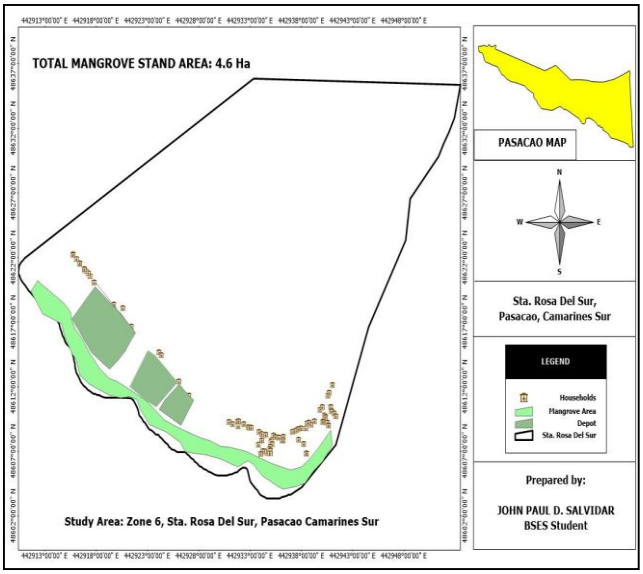

Figure 1. Study area map

Research method - This study involved semi structured survey questionnaire (combining both structured and open-ended questionnaire) that served as the main data gathering tool. The researcher conducted direct interview where they personally gave the questionnaires to the chosen respondent to ensure clarity and reliability of responses. Prior to data collection, researcher gave a letter to the Barangay Captain of Sta. Rosa Del Sur. This letter formally requested permission to conduct an interview in the area. When permission was granted, the researchers proceeded with the data collection (distribution of questionnaires and interviews) with the assistance from local officials in identifying the suitable respondents.

Population and sampling design - This study employed purposive sampling. Purposive sampling, also known as subjective sampling. Is a non-probability sampling technique where researchers intentionally select respondents based on specific characteristics relevant to their study (Bullard, 2024). This study has a total of 40 respondents; selected under purposive sampling method. Respondents intentionally chosen based on their direct interaction with mangrove ecosystems. Only adult respondent, 18 years old and above was interviewed to ensure informed response on environmental and financial decision. Employing contingent valuation method (CVM), purposive sampling is effective in capturing informed and experience-based perspective.

Data gathering procedure - The socio-demographic profile of the respondent was gathered through a semi structured survey questionnaire, while willingness to pay (WTP) of the residents was gathered through direct interview. Direct interviews were conducted with the residents of Sta Rosa Del Sur, Pasacao, Camarines Sur. The survey questionnaire consisted of three sections: section 1 contains the socio - demographic information of the respondent, it includes age, gender, civil status, main source of income, monthly income and length of residency in the community. Section 2 contains mangrove ecological services to comprehend respondent's understanding of the importance of mangrove ecosystem. And section 3 includes contingent valuation (willingness to pay). This section of the survey questionnaire measures the amount of the respondents are willing to pay for the mangrove's ecological services in mangrove protection and conservation.

Respondents were presented with a hypothetical scenario explaining the threats of climate change, sea level rise, and flooding in the community, as well as a proposed mangrove rehabilitation project. They were then asked

whether they were willing to contribute financially to the project and state the maximum amount they were willing to pay annually. Before conducting the survey, the researchers explained the purpose of the study and secured the respondent's consent. The hypothetical scenario was explained clearly to minimize and avoid bias, and questions were translated into Bikol or the respondent's preferred dialect when necessary. Participation was voluntary, and respondents who declined were respectfully excluded from the survey.

Ethical consideration - Prior to the conduct of the study, permission was approved by the barangay captain / barangay officials and respondents were informed of the study's purpose. Participation was voluntary and respondents are free to refuse participation or withdraw from the interview at any point without any consequence. All the data gathered or obtained will be treated with strict confidentiality and will be used solely for academic and research purposes, in compliance with RA 10173 also known as the Data Privacy Act of 2012.

Statistical Treatment of the Data - The data gathered from direct interviews and questionnaires were systematically recorded and analyzed using both descriptive and inferential statistics. 1.) Mean (Average); the mean was used to determine the average value of the responses obtained from the respondents. 2.) Percentage; it was used to determine the proportion of respondents belonging to each category. 3.) Contingent Valuation Method (CVM); used to determine willingness to pay (WTP) for mangrove conservation and restoration. This method allows researchers to measure the monetary value individuals assign to environmental goods and services that are not directly traded in the market. 4.) Mean Willingness to Pay (Mean WTP); the mean willingness to pay was calculated to determine the average amount that respondents were willing to contribute toward mangrove conservation and restoration initiatives. 5.) Multiple Regression Analysis; to further analyze the factors that affect the respondents' willingness to pay (WTP) for mangrove conservation, multiple linear regression analysis was performed. This inferential statistical method was used to assess the relationship between the dependent variable (WTP) and a set of independent variables, including respondents' socio-demographic characteristics and awareness. The analysis was performed using jamovi statistical software version 2.6.44, a free, open-source statistical software known for its user-friendly spreadsheet, similar to SPSS (The jamovi project, 2024). Two regression models were developed to evaluate the determinants of WTP for mangrove conservation based on a total sample size of 40 respondents.

3. Results and Discussion

This section provides the presentation, analysis, and interpretation of the findings gathered from the respondents' socio-demographics, perceived benefits of mangroves, and willingness to pay (WTP) for mangrove ecological services in Sta. Rosa Del Sur, Pasacao, Camarines Sur. It will also present corresponding analysis and interpretation of the regression analysis conducted, whether these predictor influences Willingness to Pay (WTP) towards mangrove conservation. Furthermore, this chapter includes policy recommendations based on the findings of this study. These recommendations aim to guide the conservation and sustainable management of mangrove ecosystems within the study area. The results are presented and organized accordingly to the objectives of the study.

3.1 Socio-Demographic Profile of Respondents

The socio-demographic characteristics of the respondents provide important background information that helps in understanding the respondent's experiences, perceptions, and valuation of mangrove ecological services. Identifying characteristics such as gender, age, civil status, main source of income/work, monthly income, and length of stay are crucial as they may influence the willingness to pay for mangrove conservation in the area. In this study, the socio-demographic results from the administered survey questionnaire for the forty (40) respondents are illustrated in table 1. The regression analysis was conducted to determine whether socio-demographic characteristics influence the Willingness to Pay (WTP) of residents for the conservation and protection of mangrove ecosystems.

Table 1

Socio-demographic profile of the respondents

Variables	*Category*	Frequency	Percentage	Rank
Gender	Female	23	58%	1st
	Male	16	40%	2nd
	Preferred not to say	1	2%	3rd
	LGBTQIA+	0		
Age	18-27	11	27.5%	1st
	38-47	8	20%	2nd
	28-37	7	17.5%	3rd
	48-57	6	15%	4th
	58-67	6	15%	4th
	78-87	2	5%	5th
	68-77	0	0%	
Civil status	Married	20	50%	1st
	Single	17	43%	2nd
	Separated	2	5%	3rd
	Widowed	1	2%	4th
Main source of income/work	Sari-sari store owner	10	25%	1st
	Fishing	7	17.5%	2nd
	Unemployed	4	10%	3rd
	Welder	3	7.5%	4th
	Construction worker	3	7.5%	4th
	Gasoline boy	2	5%	5th
	Agriculture	2	5%	5th
	Barangay kagawad	2	5%	5th
	Bartender	1	2.5%	6th
	Promodizer	1	2.5%	6th
	OFW	1	2.5%	6th
	Healer (parahilot)	1	2.5%	6th
	Buy & sell (gasoline)	1	2.5%	6th
	Mechanical work	1	2.5%	6th
	Driver	1	2.5%	6th
Monthly income	Below ₱10,000	18	45%	1st
	₱10,000-₱20,000	16	40%	2nd
	No income (unemployed)	3	7.5%	3rd
	₱20,001-₱30,000	2	5%	4th
	₱30,001 above	1	2.5%	5th
Length of stay	41 years above	13	32.5%	1st
	21-30 years	10	25%	2nd
	Below 10 years	8	20%	3rd
	31-40 years	5	12.5%	4th
	10-20 years	4	10%	5th

Gender - The gender distribution is one of the significant demographic factors in this study. It is vital in explaining the composition of the respondents and possibly influencing the perspectives, experiences, and responses in the study. Out of the forty (40) respondents involved in the survey questionnaires, the majority of the respondents were female, with 23 respondents accounting for 58% of the total respondents. The results indicate a higher proportion of respondents are female compared to male. From this data, it is apparently shown that female residents were more available during the data collection or were more engaged in community-related activities. Several studies have shown that females in coastal communities often play a crucial role in coastal environmental management, significantly contributing to sustainability and conservation efforts. Younus et al. (2025) emphasized in their study that females often lead initiatives in waste management and environmental conservation. Moreover, in studies conducted by Amir et al. (2021), the core findings show that they're actively participating in maintaining cleanliness, and were involved in mangrove rehabilitation, contributing to planning, execution and evaluation of conservation projects.

On the other hand, one participant in the study chose to prefer not to disclose their gender. This represent the small proportion of the total sample, indicating that compare to other participants in the survey, he/she is not comfortable to express his/her gender. This represent the small proportion of the total sample, indicating that compare to other participants in the survey, he/she is not comfortable to express his/her gender. The presence of a single participant who preferred not to state their gender is a clear indication of awareness and respect for the

privacy and identity of the participants in the survey, in compliance with RA 10173, also known as the Data Privacy Act of 2012. To further analyze the impact of gender on Willingness to pay (WTP), regression analysis was conducted. The analysis revealed, that there is some variation in the willingness to pay. The coefficient for males relative to females is -375.44 ($p = 0.062$), which indicates that males may have lower willingness to pay than females. Although the result is not significant at the 5% significance level, it is on the borderline, indicating that female respondents may be more concerned about the protection of the environment, especially mangrove forests.

Age - The age distribution of the respondents shows that the majority fall within the 18–27 age group, comprising 11 individuals or 27.5% of the total sample. This indicates that the community is largely composed of younger individuals compared to older age groups. The findings suggest that a significant portion of the participants are young adults, reflecting a relatively young and economically active population. Young individuals are typically more active, aware, and exposed to environmental issues. This result is consistent with the study published in *the Journal of Tourism and Hospitality Research***,** which found that the largest proportion of respondents belonged to the younger age group (18–29 years old). This suggests that young adults are often the most active participants in surveys and community-based studies (Laurel et al., 2020).

In contrast, the lowest proportion of respondents falls within the 78–87 age group, with only 2 participants or 5% of the total. This indicates minimal participation from elderly individuals in the study. The limited representation of older respondents may be attributed to factors such as accessibility issues, health conditions, and lower levels of engagement. As supported by Dias et al. (2013), elderly individuals often experience health challenges, including hypertension and vision problems, which can hinder their ability to participate in social activities. Additionally, research by MA and Zhang (2015) highlights that insufficient enthusiasm for participation among older adults is a significant barrier, often influenced by societal attitudes and the availability of engagement opportunities. Furthermore, to determine whether age significantly influences willingness to pay (WTP), regression analysis was conducted. The result reveal that age has negative coefficient ($\beta = -1.82$, $p= 0.854$) indicating that as age increases, the willingness to pay (WTP) slightly decreases. However, the result means that age is not statistically significant, implies that age does not strongly influence residents' willingness to pay.

Civil status - In terms of civil status, the majority of the respondents were married, comprising 20 respondents (about 50%). Data indicated that married individuals comprise the largest group in the community-based survey. This result may be influenced by the age distribution. As we have seen in the age distribution of the respondents, most participants belong to younger-middle age groups who are more likely to be married than separated or widowed. Additionally, research conducted by Borja et al. (2017) found that the majority of the persons who participated in the research were married, as they were the permanent residents of the community. This is consistent with the research conducted, as the majority of the married persons were part of the study.

Meanwhile, widowed category was the least; only one respondent was widowed (making up 2%of the total population). The low number of widowed respondents may indicate that a small portion of the sample belonged to elderly age groups. Based on the article released by the Philippine Statistics Authority (PSA) in 2020, widowhood is common among elderly individuals, particularly for those aged 60 years and above, because of the higher mortality rates among spouses. This explains why widowed appeared least in the study. In multiple regression analysis conducted, none of the civil status categories showed a statistically significant effect on willingness to pay, as all p-values were greater than 0.05. This indicates that marital status is not important predictor of willingness to pay (WTP).

Main source of income or work - Data revealed that respondents have various sources of income or work. The highest percentage belonged to sari-sari store owners, representing 25% (10 respondents) of the population. This indicates that the main primary source of income within the study area is sari stores. This finding may have been due to the fact that sari-sari stores require minimal capital to start a business. Also, it is easy to put up a sari store because it provides them with the opportunity to earn a living while staying at home. In connection with this, based on the study by Villanueva (2025), he mentioned that sari-sari stores are common in coastal barangays as

they provide flexible income, and they can be managed alongside household responsibilities.

On the other hand, the last occupation, which appeared in a smaller portion, included bartender, promodizer, Overseas Filipino Worker (OFW), healer, buy&sell (gasoline), mechanical worker, and driver, each represented 2.5% of the total respondents. These occupations appeared to have low representation due to the limited number of individuals engaged in these types of jobs within the selected sample. Some of the jobs, such as the promodizer, Overseas Filipino Worker (OFW) and the bartender may have been location dependent, require them to work outside the community or country, which reduces their presence among the respondents during the survey period. Meanwhile, jobs such as healers and buying and selling gasoline) are not commonly practiced in the community. Additionally, a mechanical worker and a driver may be possible for a smaller representation of the community. Overall, as can be seen from the data, it is evident that the community has a diverse set of livelihood activities.

To further analyze the predictive role of occupation, regression was also conducted. Different occupation was compared with agriculture as reference category. The analysis revealed that the majority of main source of income/work categories had negative coefficients, showing a lower willingness to pay (WTP) relative to the reference group (agriculture). It shows that none of the occupations significantly influence willingness to pay as all p-values exceed the 0.05 level. These results revealed that despite the community having diverse occupations, it still not affects actual income level, financial stability, or capacity to pay. For instance, individuals in different jobs may still belong to similar income bracket or experience similar economic condition.

Monthly income - The monthly income of the respondents was also identified because this is an important socio-economic indicator that reflects the economic condition and livelihood status of respondents. Based on the results, the income distribution among the respondents reveals that most of the respondents are earning below ₱10,000 with 18 respondents or 45% of the total respondents. The result implies that the majority of the respondents belong to a low income. In the Philippines, monthly income below ₱10,000 is classified as low-income but not poor (Government Ph, 2020). While the least portion, comprising 2.5%, or only one respondent, belonged to the ₱30,001 and above class of income. The presence of only one high respondent may be associated with limited access to high-paying jobs in the community and, as we have seen in the main source of income of the respondents, it may be due to the prevalence of small-scale livelihoods like sari-sari stores. So, the result indicates that high income earners are extremely rare even though the community has various occupations.

Additionally, based on the result of multiple regression analysis conducted, the coefficient for monthly income is positive ($\beta = 0.000479$), indicating that monthly income increases, the willingness to pay also slightly increases. However, the effect is extremely small. For further analysis, the p-value (0.973) is much higher than 0.05 and the value (0.973) means this is not statistically significant. Statistically, there is no strong evidence that income affects willingness to pay (WTP) in this study. From these findings, it apparently shows that income does not play a meaningful role in determining respondents' willingness to pay for mangrove conservation. Instead, the results support the notion that environmental valuation is largely driven by knowledge and perceived importance rather than income level.

Length of stay - The researcher also gathered how long they have been residing in Zone 6, Sta. Rosa, Del Sur Pasacao, Camarines Sur. Understanding of this, is crucial because it reflects the level of their familiarity and experiences with mangrove forest that is present in their area. From the data gathered, the findings revealed that the highest proportion of respondents have lived in Zone 6, Sta. Rosa Del Sur, Pasacao Camarines Sur for 41 years and above with 13 respondents or 32.5%. This indicate that a large of respondents are long term residents. The dominance of long-term residents means that many residents have developed strong connections with their community and have accumulated deeper knowledge and experiences regarding the mangrove forest present in their locality. This finding supported by the study of Rahim et al. (2022) they emphasized residents' knowledge, perception, and commitment to mangrove conservation are influenced by their locality and length of residency, implying that individuals who have lived longer in a coastal community tend to possess greater awareness and understanding of mangrove ecosystems and their conservation efforts. Longer stays may foster a stronger

emotional connection to the environment, enhancing the likelihood of conservation-related behaviors (Massingham et al., 2019).

Meanwhile the lowest proportion of respondents have stayed for 10 –20 years with 4 respondents or 10% of the total population. This shows that a small number of participants are relatively considered as mid-term residents. The limited representation of this group may imply a comparatively lower level of exposure and connection to the local environment. As a result, their awareness and involvement in environmental concerns, particularly in mangrove conservation may be less pronounced. The finding apparently shows that individual with shorter stays exhibited lower participation in conservation related activities. In connection, based on the study of Rahmasari et al. (2025) highlight that individuals with shorter stays often have less opportunity to engage deeply with their surroundings, leading to lower conservation awareness and participation.

To further determine whether the respondents' length of stay influences willingness to pay (WTP), regression analysis was conducted. The coefficient for length of stay is negative ($\beta = -6.24$, $p = 0.348$), indicating that longer stays have a slightly negative effect on willingness to pay. However, it is not statistically significant. This means that the number of years respondents have lived in the community does not have a meaningful influence on their willingness to pay. Long-term residency may build familiarity with the community, but it does not guarantee a heightened sense of responsibility or the financial capacity to contribute. Therefore, length of stay is not a strong predictor of support for conservation initiatives.

3.2 Identified mangrove ecological services of the residents of Zone 6, Sta. Rosa Del Sur, Pasacao, Cam. Sur

Mangrove ecosystems are known to provide a wide range of ecological services and Zone 6, Sta. Rosa Del Sur in Pasacao, Camarines Sur is home to approximately 4.6 hectares of existing mangrove forests. In this study, residents many of whom have lived in the area for several decades, were asked to identify the specific ecological services provided by mangroves based on their direct experiences and interactions with the ecosystem. Based on the result, the respondents reported seven key ecological services, as illustrated in table 2. Among the identified mangrove ecological services in Sta. Rosa Del Sur, Pasacao, Camarines Sur, data revealed that coastal protection is the most identified making it as top 1. A large majority of participants, 26 of the respondents, or 65% of the total population believed that this serves as coastal protection against storm surges. According to the respondents, they felt the guidance and services of mangrove forests in times of typhoons; it serves as a shield to lessen the impact of storm surges and prevent it from directly impacting their houses.

Table 2
Ecological services provided by mangroves.

Ecological Services	Frequency	Percentage	Rank
Coastal Protection	26	65%	1st
Flood Control	23	57.5%	2nd
Habitat for fish and wildlife	19	47..5%	3rd
Livelihood (e.g., fishing, wood)	15	37.5%	4th
Carbon sequestration	4	10%	5th
Ecotourism	4	10%	5th
Improvement of water quality	1	2.5%	6th

This indicates that the community strongly recognizes the visible and direct benefits of mangroves in shielding coastal areas, strong waves and flooding. Being a coastal community, respondents are more exposed to these risks, making protective functions of mangroves more noticeable and relevant to their lives. The appearance of coastal protection as the most identified among the services is an indicator that people value mangroves primarily for their role in ensuring safety and reducing disaster risks. This reflects that benefits that are immediately felt and observable are more appreciated than indirect or less visible ecosystem.

The finding supports by several studies which highlight that mangroves act as a natural barrier, protecting coastal communities, before the waves directly impact residential areas. With their tangle of above-ground roots and branches, mangrove trees absorb the force of storm surges and waves, reducing wave height by more than

66% (Brajcich, 2025). They make coastlines more stable in several ways. For instance, they cut down on wave energy and stop erosion from happening. They also allow sediment to build up over time. Researchers like Friess et al. (2020) pulled together data from all over the world. They pointed out that mangroves give strong protection to coastal areas. This protection comes from the way their structures work and how they affect land shapes. Such benefits prove especially important in communities where erosion threatens the coast. In those spots, natural barriers play a big role in holding shorelines together. The appearance of coastal protection as the most identified among the services is an indicator they recognized the services based on their interaction and how they benefited.

On the other hand, improvement of water quality was the least recognized ecosystem service, with only one respondent identifying it. This result indicates that although mangroves play a significant role in enhancing water quality, these benefits are not widely recognized or directly experienced by the local community. Several studies, however, have demonstrated the important role of mangroves in maintaining water quality. For instance, Lal (2002) reported that mangroves play a crucial role in filtering sediments and recycling nutrients, which contributes to the maintenance of water quality. In addition, a study by Paz Alberto et al. (2015) found that mangrove species such as Rhizophora apiculata and Sonneratia alba can absorb heavy metals, particularly copper, from contaminated sediments in areas like Subic Bay. This process helps reduce the concentration of toxic substances in the water, thereby improving water quality and protecting nearby ecosystems. These findings indicate that residents tend to recognize ecosystem services that are more visible or provide direct benefits, rather than indirect services such as water quality improvement.

To further examine the factors influencing the respondent's willingness to pay (WTP), for mangrove conservation, a multiple regression analysis was conducted. This analysis aims to determine whether the perceived ecological services provided by mangrove forests significantly affect the level of willingness to pay (WTP) among residents of Sta. Rosa Del Sur.

Based on the result, the model results show an R value of 0.783 and an R^2 value of 0.613 based on 40 respondents. This indicates a strong relationship between perceived mangrove benefits and willingness to pay (WTP), with about 61.3% of the variation in willingness to pay (WTP) explained by the variables included in the model, while the remaining 38.7% may be influenced by other factors. The regression coefficients reveal that the perceived combination of flood control, habitat for fish, coastal protection, livelihood, and carbon sequestration has a statistically significant influence on willingness to pay (WTP) ($p = 0.042$). This implies that respondents who recognize multiple ecological services of mangroves tend to show a higher willingness to financially support conservation efforts. However, most other predictors have p-values greater than 0.05, indicating that they are not statistically significant in influencing willingness to pay (WTP). This may be due to the limited sample size or similar perceptions among respondents regarding mangrove benefits. Overall, the findings emphasize that greater awareness of the diverse ecological services provided by mangrove forests increases residents' willingness to pay for their conservation.

3.3 Monetary value of mangrove ecological services through contingent valuation

Contingent valuation is a widely used approach in environmental economics to estimate the monetary value of non-market environmental goods such as mangrove ecosystem. Since the mangrove ecological services like coastal protection, carbon sequestration, water filtration are not directly traded in market, contingent valuation method is a way of environmental economist to determine the value of these services based on people's preferences. In this study, the questionnaire under hypothetical scenario measured how much the residents of Sta. Rosa Del Sur, Pasacao Camarines Sur are willing to pay for mangrove conservation and protection (Willingness to Pay). Based on the data gathered, there were 8 or 20% of respondents who were unwilling to pay for mangroves protection services, and 32 (80%) of total respondents agreed to pay for conservation and protection services.

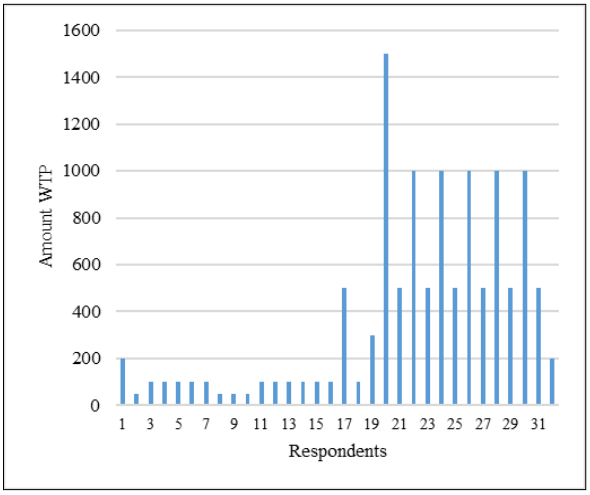

Figure 2. Amount willingness to pay of 32 respondents.

Determined monetary value of mangrove ecological services in Sta. Rosa Del Sur, Pasacao, Camarines Sur - The amount Willingness to Pay of 32 respondents is illustrated in *Figure 2* and was calculated using the formula above (using the WTP mean) Based on the calculation conducted, the total mean WTP was calculated at 12,100 pesos and divided by the number of respondents (32 respondents) willing to pay, the result shows that the determined monetary value of mangrove ecological services in Sta. Rosa Del Sur, Pasacao, Camarines is at 378.125 pesos. This amount represents that each household in the community is willing to contribute approximately 378.125 pesos for mangrove conservation.

Policy recommendation - Based on the determined monetary value of mangrove ecological services in Sta. Rosa Del Sur, Pasacao Camarines Sur, amounts to 378.125 pesos annually per household. It is recommended that the local government unit (LUG) of Pasacao establish a community-based mangrove conservation fund. The collected funds should be allocated for mangrove conservation, protection, rehabilitation and for a sustainable management program. To enhance effectiveness, the local government unit (LGU) should also strengthen community participation by organizing environmental education campaigns emphasizing the direct and indirect benefits of mangrove forest. Furthermore, it is recommended that this policy be formalized through a local ordinance to ensure long-term implementation and sustainability. While community contributions are valuable, collaboration with Non-Governmental Organizations (NGO's), and academic institutions like the Central Bicol State University of Agriculture - Pasacao Campus may also be pursued to provide technical and financial support to ensure sustainability and reduce the burden on low-income households.

4. Findings, conclusions and recommendations

This section presents the key findings, conclusions, and recommendations of the study. It summarizes the major results, draws conclusions based on the findings and provides recommendations for future actions and related studies.

Findings - The findings of the study revealed that the majority of the respondents were female, mostly aged 18–27 years old, and predominantly married. Most respondents identified sari-sari store operations as their primary source of livelihood, while a large proportion earned below ₱10,000 monthly, classifying them as low-income earners. In addition, many respondents were long-term residents of Zone 6, Sta. Rosa Del Sur, Pasacao, Camarines Sur, having lived in the community for 40 years or more. Despite these socio-demographic differences, regression analysis showed that variables such as gender, age, civil status, source of income, monthly income, and length of residency were not significant predictors of willingness to pay (WTP) for mangrove conservation.

The study further revealed that residents recognized various ecological services provided by mangroves, including coastal protection, flood control, habitat provision for fish and wildlife, livelihood support, carbon

sequestration, ecotourism opportunities, and water quality improvement. Among these, coastal protection was identified as the most recognized ecological service, while water quality improvement was the least recognized. This suggests that respondents were more aware of ecosystem services that provide direct and visible benefits to the community compared to indirect ecological functions. Moreover, regression analysis indicated that residents' perceptions of ecological services significantly influenced their willingness to pay, implying that individuals who recognized more ecological benefits were more likely to support mangrove conservation financially. In terms of willingness to pay, the findings showed that the majority of respondents were willing to provide financial contributions for mangrove conservation efforts. The computed mean willingness to pay among respondents was ₱378.125 per year, reflecting a moderate level of community support for mangrove conservation initiatives.

Conclusions - The study concluded that the residents of Zone 6, Sta. Rosa Del Sur, Pasacao, Camarines Sur are mostly female, low-income earners, long-term residents, and economically active young adults who rely on small-scale livelihoods. Females showed greater interest in conservation initiatives, while socio-demographic characteristics were not significant predictors of willingness to pay (WTP). Residents demonstrated considerable awareness of the ecological services of mangroves, particularly coastal protection, flood control, and habitat provision, which influenced their willingness to support conservation. Despite low-income levels, residents were willing to contribute an average of ₱378.125 per household annually for mangrove conservation and protection.

Recommendations - Based on the findings and conclusions, the following recommendations are proposed: 1) Strengthen environmental education and awareness program. 2) Make an IEC material emphasizing the lesser-known benefits of mangroves (indirect benefits) like carbon sequestration and improvement of water quality. 3) Develop sustainable livelihood alternatives (establishing community mangrove nurseries for seedling production for additional income of the residents). 4) Expand the scope of future research. While, future researchers are encouraged to consider larger sample size to thoroughly examine the relationship between socio-demographic characteristics and willingness to pay. Integrate willingness to pay (WTP) results into local policy and planning. Establish community-based mangrove conservation fund (CBMF). Develop transparent and accountable funding mechanisms.

Implication for Students. The study may help students understand the ecological, social, and economic importance of mangrove ecosystems. It may also increase their awareness of the key benefits of mangroves such as coastal protection, biodiversity support, flood mitigation, and livelihood support. With this understanding, students may be encouraged to actively participate in environmental conservation activities and adopt more sustainable practices in their daily lives. The study may also develop their sense of environmental responsibility and appreciation for natural resources. In addition, the findings may serve as a reference for future research related to environmental conservation, ecosystem valuation, and willingness to pay (WTP). Overall, it may also help improve students' critical thinking and research skills in addressing environmental issues.

Implication for Schools and Educators. This study may provide schools and educators with relevant local-based information that can be used in environmental education and research. It may strengthen students' understanding of mangrove ecosystems and their importance in promoting environmental sustainability. The findings may also help teachers integrate real environmental issues into classroom discussions, making learning more meaningful and relevant. In addition, it may encourage research-based learning and increase environmental awareness among students. Schools may also use the study to support activities such as coastal clean-ups, tree planting, and other conservation programs. Overall, it may help strengthen environmental stewardship and promote active community involvement in conservation efforts.

AI Disclosure. We used **Grammarly, v1.2.255.1882**, February 2025, for grammar checking, **Perplexity AI, v26.16**, October 2025, looking for Related Literatures and Studies, and **ChatGPT-5** for grammar checking, sentence improvement, and organization of ideas. All outputs were reviewed, verified, and edited by the authors. No confidential or personally identifiable data were entered into AI tools. The authors take full responsibility for the content.

Authors Contributions: All authors contributed significantly to the successful completion of this study. **John Paul D.**

Salvidar conceptualized the research topic and assisted in the development of the study design and objectives. He also contributed to the writing, editing, and proofreading of the manuscript to ensure clarity and coherence. **Ma. Arabelle Clemente** assisted in the formulation of the methodology and was responsible for preparing and managing all communication letters related to the study. **Angie Lustre** conducted the review of related literature and gathered relevant references to support the research. **Patrick James Inaldo** and **John Michael Estacion** were responsible for data collection, including the administration of surveys and interviews, as well as the organization of gathered data. **Eliza Grace Sibulo** performed the data analysis and interpretation of results. **Jasper Ian Felezmiño** supervised the overall progress of the study and provided technical guidance and recommendations throughout the research process. All authors read, reviewed, and approved the final version of the manuscript.

5. References

Abdul Rahim, A., Jemali, N. J. N., Che Aziz, R., Abdul Majid, S., Muhammad, M., Razafbinrabe, B., Abong, N. N. D., Mohd Nordin, S., & Yusof, M. (2022). Evaluation of knowledge and perception of locals toward the conservation effort in mangrove forest at Delta Tumpat, Kelantan, Malaysia. *IOP Conference Series, 1102*(1), 012086. https://doi.org/10.1088/1755-1315/1102/1/012086

Ajzen, I (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50* (2), 179-1211. https://doi.org/10.1016/0749-5978(91)90020

Alongi, D.M. (2014) Carbon cycling and storage in mangrove forests. *Annual Review of Marine Science, 6*, 195-219. https://doi.org/10.1146/annurev-marine-010213-135020

Amir, A., Maturbongs, M. R., & Samusamu, A. S. (2021). The existence of Marind Imbuti coastal women in mangrove forest rehabilitation on Payum Beach, Merauke Regency. *Indonesian Fisheries Policy Journal, 13*(2), 103–110. https://doi.org/10.15578/jkpi.13.2.2021.103-110

Berry, L. G. (1986). Participation of the elderly in utility-sponsored residential conservation programs. *Osti.gov.* http://www.osti.gov/scitech/biblio/5462689

Borja, M., Farin., E. N., Briones, R. C., & Farin, A. N. (2017). Client satisfactions on the housing and other services provided by the different subdivision developers in Zambales, Philippines. *Ijcar.net.* https://ijcar.net/assets/Uploads/Articles/8-2.pdf

Brajcich, K. (2025, October 17). Mangroves: coastal forest guardians. *Sustainable Travel International.* https://sustainabletravel.org/mangrove-forests/#:~:text=Mangroves%20act%20as%20natural%20barriers,Mangrove%20Tourism

Brander, L. M., Wagtendonk, A. J., Hussain, S. S., McVittie, A., Verburg, P. H., de Groot, R. S., & van der Ploeg, S. (2012). Ecosystem service values for mangroves in Southeast Asia: A meta-analysis and value transfer application. *Ecosystem Services, 1*(1), 62–69. https://doi.org/10.1016/j.ecoser.2012.06.003

Bullard, E. (2024). Purposive sampling. *EBSCO Information Services.* https://www.ebsco.com/research-starters/social-sciences-and-humanities/purposive-sampling

Costanzas, R., de Groot, R., Braat, L., Kubiszewski, I., Fioramonti, L., Sutton, P., Farber, S., & Grasso, M. (2017). Twenty years of ecosystem services: How far have we come and how far do we still need to go? *Ecosystem Services, 28*, 1-16. https://doi.org/10.1016/j.ecoser.2017.09.008

Dias, F. A., & Tavares, D. M. dos S. (2013). Factors associated with the participation of elderly people in group educational activities. *Revista Gaúcha de Enfermagem, 34*(2), 70–77. https://doi.org/10.1590/S1983-14472013000200009

Donato, D. C., Kauffman, J. B., Murdiyarso, D., Kurnianto, S., Stidham, M., & Kanninen, M. (2011). Mangroves among the most carbon-rich forests in the tropics. *Nature Geoscience, 4*(5), 293–297.https://doi.org/10.1038/ngeo1123

Food and Agriculture Organization of the United Nations. (2025). Mangrove management. https://www.fao.org/forestry/mangrove/en

Friess, D. A., Rogers, K., Lovelock, C. E., Krauss, K. W., Hamilton, S. E., Lee, S. Y., Lucas, R., Primavera, J., Rajkaran, A., & Shi, S. (2019). The state of the world's mangrove forests: Past, present, and future. *Annual Review of Environment and Resources, 44*(1), 89–115. https://doi.org/10.1146/annurev-environ-101718-033302

Fuchs, K. (2023). A systematic guide for conducting thematic analysis in qualitative tourism research. *Journal of*

Environmental Management and Tourism. https://doi.org/10.14505/jemt.v14.6(70).17

Gagarin, W., Eslava, D. F., Ancog, R., Tiburan Jr, C. L., & Ramos, N. (2022). Willingness to pay for mangroves' coastal protection: A case study in Santo Angel, Calauag, Quezon, Philippines. *Forest and Society, 6*(1), 436–449. https://doi.org/10.24259/fs.v6i1.18129

Food and Agriculture Organization of the United Nations. (2020). Global forest resources assessment 2020. https://doi.org/10.4060/ca9825en

Google. (2025). Google Earth Pro (Version 7.3) *[Computer software].* https://earth.google.com/

Government PH. (2020, April 16). Philippine income classes: Where do you belong? https://governmentph.com/income-classes/

Hernando, A. M. V., Tirasol, M. a. B., & Rosete, M. a. L. (2024). Contingent Valuation Study: Understanding Filipinos' support for mangrove forest restoration and conservation in IPIL, Zamboanga Sibugay, Philippines. *Journal of Environment, 4*(5). https://doi.org/10.47941/je.2433

Hutchison, J., Spalding, M. & zu Ermgassen, P (2020). The Role of mangroves in fisheries enhancement. *Vol. 54, p. 434 (The Nature Conservancy and Wetlands International, 2014)* https://www.wetlands.org/publication/the-role-of-mangroves-in-fisheries-enhancement/

Lal, P. N. (2002). Integrated and adaptive mangrove management framework — an action-oriented option for the new Millennium (pp. 235–256). *Springer Berlin Heidelberg.* https://doi.org/10.1007/978-3-662-04713-2_5

Laurel, R. D., & De Castro, M. (2020). Demographic profile and travel behavior of tourists in Batangas Province. *Journal of Tourism and Hospitality Research, 17(1).* https://research.lpubatangas.edu.ph

McFadden, D. (2017). Stated preference methods and their applicability to environmental use and non-use valuations. *153–187.* https://doi.org/10.4337/9781786434692.00012

Paz-Alberto, A. M., Vizmonte, J. L. D., & Sigua, G. C. (2015). Assessing diversity and phytoremediation potential of mangroves forcopper contaminated sediments in Subic Bay, Philippines. *The International Journal of Plant, Animal and Environmental Sciences.* https://www.fortunejournals.com/ijpaes/admin/php/uploads/865_pdf.pdf

R Core Team. (2024). R: A language and environment for statistical computing (Version 4.4) [Computer software]. *R Foundation for Statistical Computing.* https://cran.r-project.org

Rog, S., Ritchie, E. G., & Kelaher, B. P. (2016). The influence of human disturbances on mangrove ecosystems: A global synthesis. *Marine Pollution Bulletin.* https://www.sciencedirect.com/science/article

Roldan, R. B. (2022). Economic valuation of mangroves in Tawi-Tawi islands. Southern Philippines: A market price and contingent valuation approach. *In Zenodo (CERN European for Nuclear Research)*. https://doi.org/10.5281/zenodo.6481956

S Darmawan, W Takeuchi, Y Vetrita, G Winarso, K Wikantika and D K Sari (2014). Characterization of mangrove forest types based on ALOS-PALSAR in overall Indonesian archipelago. https://wtlab.iis.u-tokyo.ac.jp/wataru/publication/pdf/indonesia_mangrove.pdf

Municipal Government of Pasacao, Camarines Sur. (2022, September 26). Sta. Rosa Del Sur. https://pasacao.gov.ph/index.php/2022/09/26/santa-rosa-del-sur/

Jamovi Project. (2024). jamovi (Version 2.6) *[Computer software].* https://www.jamovi.org

Vegh, T., Reid, J., Beck, M. W., & Narayan, S. (2014). Mangrove ecosystem services valuation: State of the literature (NI WP 14-06). *Nicholas Institute for Environmental Policy Solutions, Duke University.* https://nicholasinstitute.duke.edu/sites/default/files/publications/ni_wp_14-06.pdf

Viray-Mendoza, V. (2017). Mangrove forests in the Philippines. *The Maritime Review.* https://maritimereview.ph/mangrove-forests-in-the-philippines/

Villanueva, I. T. (2025). The role of sari-sari stores in the economy Dumaguete City. *16*(1). https://doi.org/10.71097/ijsat.v16.i1.1205

Younus, M., Kurniawan, D., Nurmandi, A., Yasmine, S. M., Agusta, R., Triwiyanti, T., Mutiarin, D., Manaf, H. A., Prianto, A. L., & Akbar, I. (2025). *Empowering Coastal Communities. 91–116.* https://doi.org/10.4018/979-8-3693-8232-5.ch005