

Living with the Mangroves: A Sustainability Assessment of Community Perception and Awareness in La Union, Cabadbaran City

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Abstract

Mangrove forest is considered the most productive, however they are also considered among the most endangered habitats despite their uniqueness and importance. Globally, mangrove studies focus on biophysical and ecological valuation, with limited attention to community awareness, especially in the Philippines. This study was conducted in La Union, Cabadbaran City. The study focused on the determination of the local residents' attitudes and awareness on mangroves ecosystem in order to provide scientific information and formulate plan for the conservation of the mangrove forest. A total of 289 participants were subjected in the study. Descriptive statistics were used to analyze the data. The results revealed that the participants benefit from mangrove ecosystem through direct provisioning services such as fish, crabs and timber products used for subsistence and occasional trade to nearby local markets. Participants demonstrated moderate awareness on ecosystem functions and services [M=2.127]. Notably, they expressed greater awareness on the causes of mangrove degradation [M=2.29] and potential adverse impacts of mangrove loss [M=2.651]. The results highlight the importance of community engagement and integrate local awareness into conservation strategies. The findings provide a scientific basis for local authorities in formulating policies that promote mangrove protection and sustainable use, ensuring that management efforts align with community values and socio-economic realities.

Keywords: Community Awareness, Ecosystem Services, Mangrove Conservation, Mangrove Ecosystem, Provisioning Services.

Introduction

Mangrove forest is an ecosystem consists of shrubs, trees that can be found in intertidal zone, they serve as buffers against storm surges, stabilize shorelines, and serves as nurseries for diverse marine organisms (1). It provides critical ecological, social and economic services to millions of people worldwide (2). There are 73 species of true mangrove that can be found in tropics and sub tropics (3). Ecologically, they support biodiversity, facilitate nutrient cycling and maintain coastal resilience. Despite their importance, mangrove ecosystem has experienced extensive degradation. In 1918, Philippines have an area of about 450,000 hectares of mangroves, but in 2010 it declined to 51.8%, this is due to expansion and development of fisheries and aquaculture in the Philippines (4, 5). This alarming trend underscores the needs for coastal communities. Mangrove resources are often vital to the subsistence of local communities and provide an economic foundation in many

tropical countries. Among the ecosystems in the Earth, mangroves area considered one of the most threatened ecosystems. For many coastal households in the Philippines, mangroves form the foundation of daily subsistence and income, particularly through fisheries and shellfish gathering (6). Economically, mangrove ecosystem provides multiple provisioning services like food resources, firewood and an even medicinal product that may help the community increase their economic status and promotes food security. Even though mangrove provides magnitude of benefits it is prone to exploitation and usually resulted to mangrove ecosystem degradation and some are being converted to aquaculture purposes (7). These have been the result of the misconception on the importance of the mangrove forest sustainability. Human community seldom evaluates the mangrove forest in terms of ecological benefits because they simply assess it in

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terms of economic benefits (8). In Cabadbaran City, a total of 302 hectares are classified as mangrove forest of which are located in the forestland areas and 195 hectares falls within the classified A and D lands. To include in here the mangrove forest / ecosystem of La Union Cabadbaran City having an area of 107 hectares mangrove ecosystem sporadically distributed throughout the Barangays. Mangroves are little by little become fragmented and important provisioning services are expected to reduce or lost. And these could be detrimental to the communities living and the welfare of the communities that heavily rely on mangrove's provisioning goods and services for daily needs and livelihood are at risk (9). In the general context, if these exploitation activities will not be given due deterrent actions, this mangrove ecosystem in the Barangay La Union will be degraded and that will eventually affect the lives of the local residents of the barangay.

Recent studies have consistently underscored imbalance between livelihood reliance and conservation awareness. For instance, a study reported that in Davao del Norte, community knowledge of mangroves was largely grounded in livelihood benefits, with limited recognition of regulating and cultural functions (10). Another study observed similar pattern in Misamis Occidental, where coastal residents were highly aware of the mangrove degradation drivers such as illegal logging but faced challenges in implementing conservation practices due to weak governance and community dependency of the community in the mangrove ecosystem in terms of livelihood (11). Likewise, a study in Eastern Samar highlighted the communities valued mangroves immediate resource extraction but underscored the indirect ecosystem services such as carbon sequestration and nutrient cycling (12). Beyond local contexts, regional assessment has shown that perceptions of mangrove loss often align with observable pressures like logging and aquaculture, though communities tend to undervalue indirect ecosystem services (13). Moreover, recent work (14) emphasized the role of participatory governance and cultural practices in fostering long-term mangrove stewardship, arguing that community engagement strategies should integrate both ecological education and livelihood support.

Collectively, these findings point to a recurring research gap, while communities recognize heavily depend on mangroves provisioning services, there is a limited awareness on the regulating and cultural functions, creating challenges for holistic ecosystem management. La Union Community exhibit a profound reliance on mangrove ecosystems for sustenance and livelihood. However, there is a limited understanding of how community reliance on mangrove goods relates to their knowledge of the ecosystem's broader functions, which poses a challenge to sustainable mangrove use.

The purpose of this study is to provide crucial insights for effective, community-centric conservation strategies. Specifically, this study aims to describe the socio-economic profile of the community, and assess the community level awareness and perception on mangroves in terms of Mangroves Functions and Services, Causes of mangrove degradation and impact of mangrove loss.

However, this study focused on the community knowledge and awareness of mangrove ecosystem services in La Union, Cabadbaran City. It was limited to assessing awareness of socio-economic, environmental and cultural dimensions of mangroves. The study also concentrated on the provisioning and regulating services most relevant to daily subsistence and community livelihood rather than encompassing the whole spectrum spectrum of mangrove ecosystem services. These delimitations were set to ensure that the study remained feasible and focused and to provide baseline data that could guide future multi-disciplinary and wider scale research.

Building on the delimitations of this study, future research may also examine cultural and intangible values of mangroves which were beyond the present study's scope. Longitudinal studies are recommended to capture how awareness and perceptions evolve over time, particularly in response to conservation interventions or climate related impacts. Expanding the scope beyond household respondents to include policymakers, non-government organizations, private stakeholders and other coastal resources users would provide a more holistic understanding of mangrove management challenges and opportunities (15).

Methodology

Research Design

The study employed a descriptive-quantitative research design using a survey method. The descriptive approach allowed for the presentation of socio-economic characteristics of the respondents, while the quantitative approach enabled the measurement and statistical interpretation of the participants' awareness level.

Locale of the Study

The study was conducted in one of the coastal barangays of Cabadbaran City. La Union was situated in $9^{\circ}5'8.02$ [Latitude], $125^{\circ}32'8.98$ [Longitude], in the island of Mindanao shown in Figure 1. The Study area is also the area of the proposed Cabadbaran Mangrove Eco Park Project of Cabadbaran City Local Government Unit and the Caraga State University Cabadbaran Campus [CSUCC].

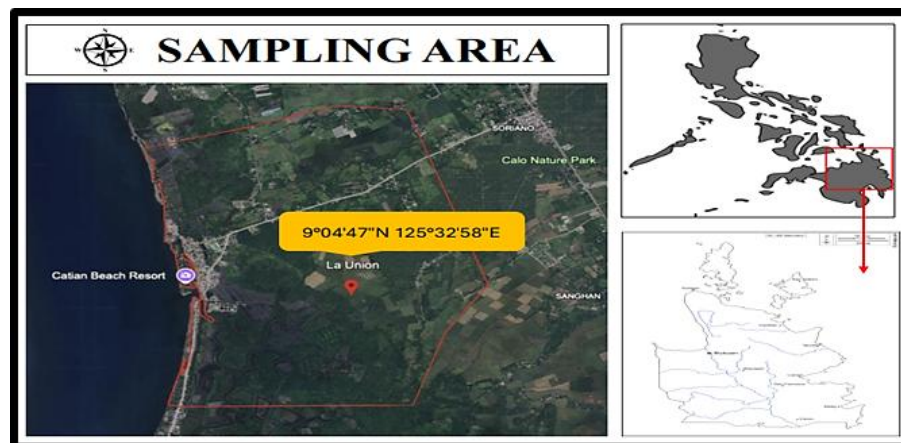


Figure 1: Map of the Study Area (La union, Cabadbaran City)

Population and Participants

The population of the study consisted of all households in the area. There are 1,241 total numbers of households distributed across 13 districts of barangay La Union, Cabadbaran City. The households head were considered as the main participant of the study, since they are assumed to possess adequate knowledge of the household's livelihood, resource use and community conditions. On their absence, the wife was considered as the alternate participant of respective household.

Sample Size Determination

The sample size was computed using estimating proportion formula with a 95% confidence level, 5% margin of error and a conservation proportion of $[p=0.5]$. From the 1,162 households, a total sample of 289 households was derived. A stratified random sampling was used in determining the participants of the survey across the 13 districts of the barangay. The proportional distribution of participants across districts is shown in Table 1.

Table 1: Distribution of Participants over 13 Districts of the Study Area

District	Household Population	Percentage	Number of Participants
1	106	9.12	26
2	65	5.59	16
3	75	6.45	19
4	96	8.26	24
5	102	8.78	25
6A	122	10.50	30
6B	99	8.52	25
7	136	11.70	34
8	89	7.66	22
9	52	4.48	13

10	73	6.28	18
11	75	6.45	19
12	72	6.2	18
TOTAL	1162	100	289

Research Instrument

The study employed ecosystem services approach to collect quantitative data provisioning services that participants derived from the Mangrove ecosystem. Administration of the adopted and modified questionnaire through face-to-face interview was done in order to extract the significant quantitative data for the study. Pre-testing of the questionnaire was before the final implementation in order to reduce the risk of discrepancy and uncertainty.

The questionnaire for the household survey consisted two sections;

- Socio-Economic Profile – capturing participant's demographic information such as age, sex, educational attainment, occupation and sources of livelihood.
- Knowledge and Awareness of Mangrove Ecosystem – focusing on three major areas:

- Functions and services of mangrove ecosystems [12 items]
- Causes of mangrove destruction / degradation [8 items]
- Possible impacts of mangrove loss [3 items]

Responses were rated using four – point Likert scale. Table 2 shows the scoring and quantification of data on the Participants response related to their level of Perception and Awareness on Mangroves functions and services, Causes of mangrove degradation and Impacts of mangrove loss. Using the four point scale Likert scale form of response of the participants are to answer from totally aware, moderately aware, weakly aware and not aware in each item. Weighted mean scores were interpreted based on criteria shown in Table 2 of which each answer to the item was scaled and interpreted according to its scale [High, Moderate, Low and Very Low] (16).

Table 2: Scoring and Quantification of Data on the Participants' Knowledge and Awareness on Mangrove Ecosystem Functions and Services in Your Area, Mangrove Ecosystem Causes of Destruction/ Degradation and Impacts of the Mangrove Ecosystem Loss

Scale	Description	Interpretation
3.0 – 2.26	High	Totally aware
2.25 – 1.51	Moderate	Moderately Aware
1.5 – 0.76	Low	Less Aware
0.75 - 0	Very Low	Not aware

Data Gathering Procedures

A face-to-face interview was conducted to ensure a high response rate and to accommodate participants with varying literacy levels. This method was done to ensure high responses rate and minimize misunderstanding in the questions and capture nuanced responses from participants who have varying literacy level. The questionnaire was pre-tested prior to the actual survey to check clarity, address ambiguities and improve reliability. During the actual survey, participants were first briefed on the purpose of the study and informed of their participation and the assurance of confidentiality.

Data Analysis

The data obtained from the actual interview were processed and analyzed using descriptive

statistical analysis. Frequencies and percentages were applied to present the socio-economic profile of the participants, providing a clear distribution of variables such as age, sex, occupation and educational attainment. The level of knowledge and awareness regarding mangrove ecosystem functions, causes of degradation and potential impacts of mangrove loss was examined using the weighted mean. The data were quantified using four-point Likert scale. The resulting values were subsequently interpreted according to the categorical scale outlined in Table 2, which classified awareness into level ranging from very low to high. The used of these statistical techniques ensured that the findings were presented in both quantifications and interpretable form.

Results and Discussion

Table 3: Socio-Demographic Profile of the Participants

Socio-Economic Characteristics		Frequency [n]	Percentage [%]
Age	25-35	74	25.6
	36-45	61	21.1
	46-55	64	22.1
	56-65	50	17.3
	66-75	31	10.7
	76-85	9	3.1
Gender	male	105	36.3
	female	184	63.7
Civil Status	single	4	1.4
	married	266	92
	widow	19	6.6
Residency [In Years]	1-5	16	5.5
	6-10	19	6.6
	11-15	6	2.1
	16-20	22	7.6
	21-25	12	4.2
	26-30	30	10.4
	31-35	35	12.1
	more than 35	149	51.6
Educational Attainment	elementary level	35	12.1
	elementary graduate	76	26.3
	high school level	59	20.4
	high school graduate	88	30.4
	college level	19	6.6
Household Size	college graduate	12	4.2
	1-3	92	31.8
	4-6	158	54.7
	7-9	31	10.7
	10-12	8	2.8
Monthly Income	less than 1000	24	8.3
	1001-5000	130	45
	5001-10000	115	39.8
	10001-20000	16	5.5
	more than 20000	4	1.4

Socio-Demographic Profile

Table 3 provides the socio-economic profile of the participants, the most of the participants [68.6%] are of middle-aged ranging from 25-55 years old, predominantly male [63%] while female population has only 36.7%. Most of the participants [92%] were married. A significant 51.6% of the participants have resided in the area for over 15 years, fostering a strong sense of place and generational knowledge of local environmental dynamics. Such stability indicated strong place attachment which has been associated with environmental stewardships and coastal

communities (17, 18). Educational attainment is generally low, as only 4.2% completed college, only 6.6% of the participants obtained college level, 30.4% of the participants graduated secondary level and nearly 26.3% graduated elementary level. In terms of income, the results indicated financial vulnerability, with 84.8% earning only Php 1,001 – Php10,000.00 per month and only nearly 1.45 earned more than Php 20,000.00 a month. Household structures are moderate in size and are commonly with 4 to 6 members, reflecting manageable but potentially resource-dependent family units. These socio-economic profiles have

direct implications for awareness and awareness of the mangrove ecosystem. Limited formal education among the participants may restrict their understanding of the broader ecological roles of mangroves. However, their long-term residency and heavy reliance on coastal resources suggest that local ecological knowledge is deeply rooted in lived experience particularly in concern with fisheries, shoreline protection (19). At the same

time, low-income levels may cause households to prioritize immediate livelihood needs over long-term conservation (20). Overall, the findings depict a stable but economically constrained community, whose awareness and awareness of mangroves are shaped more by dependence and experience than by formal education, highlighting the needs for community-based and livelihood-sensitive conservation approaches.

Table 4: Participant's Perception on the Functions and Services of Mangroves in the Community

Indicators	Mean [M]	Standard Deviation	Remarks	Interpretation	Rank [Top 5]
1. Mangroves has Aesthetic Appeal	2.10	1.08	Moderate	Moderately Aware	
2. Mangroves has cultural/ religious values	1.01	1.03	Low	Less Aware	
3. Habitat of different aquatic species	2.45	0.87	High	Highly Aware	2
4. Protects shoreline (against erosion/ storm surge)	2.42	0.83	High	Highly Aware	3
5. Source of foods (shells, different fishes and other organisms)	2.71	0.62	High	Highly Aware	1
6. Source of Wood / fuel and building materials	2.28	0.80	High	Highly Aware	5
7. Supports offshore and near shore fisheries production	2.11	0.90	Moderate	Moderately Aware	
8. Helps export nutrients to nearby ecosystem	1.85	0.92	Moderate	Moderately Aware	
9. Spawning ground of the marine organisms	2.34	0.86	High	Highly Aware	4
10. Mangrove purify air and water	1.88	1.04	Moderate	Moderately Aware	
11. Helps stabilize sediment in the coastal zone	2.24	0.94	Moderate	Moderately Aware	
Over-all	2.13		Moderate	Moderately Aware	

Table 4 shows the overall mean score of 2.13 in terms of Participants' awareness on the functions and services of mangroves in the Community. It indicates that participants possess a moderate level of awareness of mangrove values and functions. However, awareness was highest for direct and tangible benefits, particularly as a source of food [M=2.71], habitat for aquatic species [M=2.45], shoreline protection [M=2.42], spawning ground for marine organism [2.34], and source of wood/fuel/building materials [M=2.28] Among

the indicators assessed the highest mean score was recorded for the awareness that mangroves serve as a source of food. This finding indicates that the community strongly recognizes the provisioning services of mangroves particularly in relation to food security and livelihood support. A study in the coast of India supports this result, emphasizing that mangroves play a critical role in providing essential livelihood opportunities to the local community thorough fishing, shellfish gathering and nipa harvesting that are important sources of

sustenance and household income (21). The close relationship between local communities and mangrove resources underscores the ecosystem's economic and social value, which in turn strengthens the argument for sustainable management and conservation efforts in La Union, Cabadbaran City. Recent studies also supported that community knowledge is shaped primarily by observable and livelihood-related benefits, consistent with studies highlighting the strong dependence of coastal communities on mangrove resources for subsistence and protection (22). Such awareness is not surprising, given that coastal communities often rely heavily on mangrove ecosystem for direct subsistence. The high level of awareness of the participants on mangroves' provisioning services as source of food also reflects the direct interaction between the community and their environment (23). These findings support the observation that communities such as of La Union Cabadbaran City are acutely aware of the tangible benefits that mangroves provide particularly as dependable source of food. In contrast, participants' awareness on direct ecological and cultural services was so limited. The cultural and religious value of mangrove was least recognized [M=1.01], while regulating functions such as nutrient export [M=1.85], air and water purification [M=1.88], and sediment stabilization [M=2.42] were only moderately acknowledged.

This reflects that there is a tendency for the communities to underappreciate less visible ecosystem services. Recent Studies support these results emphasizing that local ecological knowledge is often shaped in by the immediate and visible benefits derived from mangroves. In this case, daily reliance on mollusks, crabs and fish harvested from mangrove areas reinforce the recognition of mangroves as important source of food (24). However, this dependence also makes this community vulnerable to ecological decline as over harvesting and habitat degradation threatens long term food security. Thus, these findings imply that while the community is highly aware of the provisioning services of mangroves as source of food, conservation strategies must emphasize the sustainable management of these resources. There is really a need to strengthened environmental education and advocacy to broaden understanding beyond provisioning and protective services. Linking ecological services to food security, policymakers and local stakeholders can strengthen community engagement in conservation of mangrove and may reduce risk of overharvesting. Taking cultural heritage and ecological functions into awareness programs can also enhance community stewardship, ensuring both sustainable management and long -term coastal community resilience (25).

Table 5: Participant's Level of Awareness on the Causes of Destruction or Degradation to Mangroves in the Community

Indicators	Mean [M]	Standard Deviation	Remarks	Interpretation	Rank [Top 5]
1. Illegal logging / forest clearing is destructive to Mangrove Ecosystem	2.71	0.66	High	Highly Aware	1
2. Unsustainable agriculture practices is destructive to Mangrove Ecosystem	2.28	0.92	High	Highly Aware	5
3. Climate change is destructive to Mangrove Ecosystem	2.45	0.89	High	Highly Aware	3
4. Aquaculture is destructive to Mangrove Ecosystem	1.74	1.08	Moderate	Moderately Aware	
5. Water pollution is destructive to Mangrove	2.48	0.84	High	Highly Aware	2
6. Coastal reclamation is destructive to Mangrove Ecosystem	2.03	0.97	Moderate	Moderately Aware	

7. Unsustainable harvesting of wood is destructive to Mangrove Ecosystem	2.42	0.84	High	Highly Aware	4
8. Mining is destructive to Mangrove Ecosystem	2.21	1.12	Moderate	Moderately Aware	
Over-all	2.29		High	Highly Aware	

Natural ecosystems like mangroves are in delicate condition, and affected mostly by the human activities (Table 5). Mangrove degradation in the Philippines has been extensive over the past century, largely driven by human pressure that led to huge degradation of mangrove forest and the remaining is increasingly threatened. A spatial analysis revealed that mangrove cover in the country declined by approximately 10.5% from 1990-2010, while comparative assessments indicate that more than half of the mangrove forest that existed in 1918 had already been lost by 2010. Although the rate of mangrove deforestation has shown signs of decline in more recent years, likely because of the increasing recognition of the ecological and socio-economic importance of mangroves (26). The findings in Table 5 revealed that the participants rated illegal logging [M=2.71] and forest clearing [M=2.48] as the most contributor of mangrove degradation. This finding reflects the community's recognition of the direct and tangible threats posed by unsustainable wood harvesting to mangrove ecosystem. The results also revealed that their level of awareness in causes of mangrove degradation like water pollution [M=2.48] and climate change with a mean of 2.45 is also high. This demonstrate that communities recognize both direct human pressure. Such Awareness is consistent with earlier studies highlighting deforestation, pollution, and climate change as major drivers of mangrove loss (27). Awareness of unsustainable harvesting of wood [M=2.42] was also high while unsustainable agriculture [M=2.28] though still classified as high but it was less prioritized. This may reflect a tendency to underrate threats such as sedimentation and nutrient loading compared to more visible activities like logging (28). By

contrast, awareness of aquaculture [M=1.74], coastal reclamation [M=2.03] and mining [M=2.21] was only moderate despite strong evidence of their destructive effects. This trend is consistent with the national and regional studies identifying aquaculture expansions and brackish water pond conversion as principal causes of mangrove loss, especially in coastal provinces (29). Moreover, land reclamation projects have also been shown to reduce coastal resilience by displacing mangrove habitats and altering sediment dynamics (30). Although these have been widely documented as major drivers of mangrove loss in the Philippines their relatively lower ranking reflects the community's limited exposure to or localized impact of these activities (31). Overall, the findings suggest that community awareness is shaped largely by direct, observable pressure, which have immediate consequences for both the livelihood and ecosystem. These results imply that there is a limited recognition of less apparent drivers like aquaculture and reclamation despite the communities are strongly aware of visible threats like logging and pollution. The high baseline of awareness provides a valuable foundation for promoting participatory conservation initiatives and integrating local knowledge into sustainable mangrove management strategies (32, 33). This presents an opportunity for policy and management interventions that build on existing awareness by promoting stricter enforcement against illegal cutting while integrating community-based monitoring and alternative livelihood programs. Approaches like this are consistent with recommendations in earlier research on participatory mangrove management in the Philippines and Southeast Asia (34).

Table 6: Level of Awareness of Participants on the Possible Impacts When the Mangrove Ecosystem is Lost

Indicators	Mean [M]	Standard Deviation	Remarks	Interpretation	Rank
Without Mangroves, no buffer for strong winds and storm surge	2.60	0.64	High	Highly Aware	4

Without Mangroves, the income of the fishermen will be reduced	2.62	0.61	High	Highly Aware	2
Without Mangroves, the coastal zone will be defenseless to sea water	2.61	0.70	High	Highly Aware	3
Without Mangroves, there will be less production of shellfish.	2.78	0.42	High	Highly Aware	1
Over-all	2.65		High	Highly Aware	

Table 6 shows that the participants exhibited a consistently high level of awareness regarding the potential consequences of mangrove loss with all indicators having a mean score of 2.65. Among the indicators, the highest score was recorded under the indicator “without mangroves, there will be less production of shellfish with a mean of 2.78, it indicates that the community has strong recognition on the critical role mangrove play in sustaining fisheries production. This recognition aligns with earlier research showing that households living near dense mangroves consume significantly more fish and aquatic products than those farther away, thereby contributing to community’s food security and coastal productivity (35). Participants strongly agreed that the absence of mangroves will reduce the income of fishermen [M=2.61], the results highlight the participants' awareness of the direct link between ecosystem integrity and economic stability in coastal households. The participants also recognized that mangrove loss would leave their coastal zone defenseless against seawater intrusion and it would remove natural buffers against strong winds and storm surges. This awareness makes parallel with previous study demonstrating the role of mangroves in reducing wave energy, mitigating storm surges and enhancing reliance on extreme weather events. Empirical evidence from both local and regional assessment highlights that coastal areas with well-preserved mangrove belts experience significantly low levels of impairment during extreme weather compared to mangrove areas where mangroves have been destroyed or cleared (36). This awareness also aligns with the previous study that stated that mangrove does not only provide vital sources of livelihood but also deliver regulating services as shoreline stabilization and storm protection. These functions highlight the complex value of the mangrove ecosystem, linking ecological resilience with socio-economic

sustainability in coastal communities (37). In the context of Cabadbaran City, such understanding reflects the community’s experiential knowledge of how mangrove buffer against coastal flooding and typhoon impacts. Moreover, recent study has shown that mangrove degradation leads to substantial economic losses, particularly through decline of fishery productivity and the reduction of coastal protection services. This observation aligns with the findings of this study where community participants expressed a deep and clear understanding of how mangrove loss directly affects their livelihood and safety. Many recognized that declining mangrove cover not only reduces the availability of fish and shellfish but also exposes their homes and farms to stronger waves and flooding during typhoons. Their awareness reflects a lived experience of ecological change and its socio-economic implications. Similarly, the World Bank and The Nature Conservancy reported that the degradation of mangroves in the Philippines could result in annual flood damages exceeding US \$ 1 billion, underscoring how vital these ecosystems are in sustaining both economic well-being and coastal resilience (38). The high awareness of these impacts suggest that the community has a well-grounded understanding of the ecological and livelihood functions provided by mangroves. Their high level of awareness on the impacts of mangrove loss can serve as a foundation for strengthening conservation initiatives, particularly those aimed at integrating livelihood protection with ecosystem management, it also reduces the information barrier to community participation and creates political legitimacy for mangrove protection. A similar study highlighted that the local communities in the country are well situated to take part in participatory mangrove conservation and management initiatives. Many residents already understand the dual importance of mangrove not only for their ecological role but

also for their contribution to local livelihoods. In several areas, conservation programs have been successfully integrated with income generating ventures such as ecotourism and community-based resource management, enabling residents to directly benefit from protecting their natural resources (39). Similarly, the present study in La Union, Cabadbaran City reveals that residents possess a comparable level of awareness regarding the ecological and economic functions of mangroves. This awareness reflects a strong foundation for collaborative conservation efforts, particularly when livelihood opportunities are linked to mangrove protection and resource sustainable use. Such alignment between conservation and economic well-being reinforces the potential community driven initiatives that can sustain environmental integrity and local development.

Conclusion

The socio-economic profile of the La Union, Cabadbaran City is characterized by long-term residency, moderated household size and strong place attachment but constrained by low income and limited education attainment. These characteristics show that community knowledge of mangroves is largely grounded in lived experience rather than formal ecological education, highlighting both the potential and the limitations of local ecological knowledge. The community demonstrated a strong awareness of the mangrove ecosystem, particularly on the provisioning and protective functions. The community recognizes mangroves as vital sources of food and fisheries support. The community displayed high awareness of degradation drivers such as illegal logging, pollution and climate change though less recognition was given to aquaculture, reclamation and mining. Importantly, participants clearly understood the socio-economic and ecological consequences of mangrove loss, particularly its impacts on fisheries productivity, income and coastal vulnerability. Overall, these findings suggest that while local knowledge is strong in relation to immediate livelihood and protective values, the community needs broader understanding on ecological functions of mangroves. In this regard, future conservation programs in the locality should prioritize community-based education through targeted

educational campaigns and participatory awareness programs, integration of sustainable livelihood options and participation through collaboration of the local government, academic institutions and civil society to institutionalized community-based monitoring mechanisms. These approaches would not only improve ecological awareness but also align conservation efforts with local socio-economic realities, thereby fostering more resilient and inclusive mangrove management systems.

Abbreviations

CSUCC: Caraga State University Cabadbaran Campus, SPSS: Statistical Package for Social Sciences, PES: Payment for Ecosystem Services.

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Author Contributions

All authors participated in the drafting and rigorous revision of the manuscript and agree to be accountable for the integrity and accuracy of the work. Each author made substantive intellectual contributions to the study from the research concept to designing of methodology, acquisition and analysis of data and critical interpretation of findings

Conflict of Interest

The authors declare no conflict of interest.

Declaration of Artificial Intelligence (AI) Assistance

The authors declare that this manuscript was entirely written and developed by them without the use of generative AI or AI assisted tools. All ideas, analyses and discussion presented in this study reflect the authors' own thinking, effort and academic judgments.

Ethics Approval

This study was conducted in accordance with the ethical principles outlined in the Certificate of Ethic Clearance. All participants were informed about the purpose of the study and assured them

of the confidentiality of their responses. (Ethics Approval Ref. # - CU ERC-2025-015)

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