

**Assessment of mangrove conservation and community participation
in the municipality of Orani, Bataan: Basis for the development
of a sustainable mangrove management plan**

Mario P. Ballesteros, Jr.*

Philippine Christian University, Manila, Philippines

James Paje

Philippine Christian University, Manila, Philippines

Leo Christopher M. Gaspar

Philippine Christian University, Manila, Philippines

Christine Mae V. Alagon

Philippine Christian University, Manila, Philippines

Lemuel John A. Hernandez

Philippine Christian University, Manila, Philippines

ABSTRACT

Mangrove ecosystems provide essential ecologic balance, economic, and social benefits by protecting coastlines from erosion, marine biodiversity support, sustaining the fisheries sector, and enhancing the resilience of coastal communities to climate-related hazards. In the Philippines, numerous mangrove conservation and rehabilitation initiatives have been implemented through the collaborative efforts of Local Government Units (LGUs), National Government Agencies (NGAs), international groups, academic institutions, and local communities. While many studies have evaluated the ecological outcomes of mangrove rehabilitation, comparatively limited attention has been given to assessing the effectiveness of community participation and institutional support in sustaining conservation initiatives over the long-term. This study aims to assess the current status of mangrove conservation and community participation in the Municipality of Orani, Bataan, with particular focus on the Mangrove Conservation and Protection Project in Barangay Kabalutan (Tubo-Tubo area). Specifically, the study examines the level of community participation, environmental awareness, stakeholder collaboration, institutional support, and implementation of local conservation policies that contribute to the sustainability of mangrove management initiatives. Guided by the principles of community-based natural resource management and participatory environmental governance, the study adopts a mixed-methods approach that integrates surveys, key informant interviews, focus group discussions, field observations, and document analysis.

*Corresponding author / Email: marioperonoballesteros@gmail.com

DOI: <https://doi.org/10.69651/PIJHSS05031352>

Recommended citation:

Ballesteros, M., Jr., Paje, J., Gaspar, L. C. M., Alagon, C. M. V., & Hernandez, L. J. A. (2026). Assessment of mangrove conservation and community participation in the municipality of Orani, Bataan: Basis for the development of a sustainable mangrove management plan. *Pantao (International Journal of the Humanities and Social Sciences)* 5 (3), 1603-1617. <https://doi.org/10.69651/PIJHSS05031352>

The findings are expected to provide a comprehensive assessment of the strengths and challenges of the municipality's mangrove conservation efforts beyond traditional ecological indicators. The study is anticipated to demonstrate that successful mangrove conservation depends not only on habitat rehabilitation but also on active community engagement, effective leadership, collaborative partnerships, and consistent institutional commitment. The results will serve as the basis for developing a Sustainable Mangrove Management Plan that will strengthen biodiversity conservation, improve community-based coastal resource management, enhance climate resilience, and support evidence-based environmental policymaking in the Municipality of Orani and other coastal communities with similar ecological and governance contexts.

Keywords: Mangrove conservation, community participation, community-based natural resource management, participatory environmental governance, sustainable mangrove management, coastal resource management, climate resilience, Orani, Bataan.

Date Submitted: July 06, 2026
Date Accepted: July 08, 2026
Date Published: July 16, 2026

INTRODUCTION

Mangrove Forests are among the most productive and ecologically significant coastal ecosystems in the world. Occupying the intertidal zones of tropical and sub-tropical coastlines, they provide a wide array of ecosystem services that contribute to both environmental sustainability and human well-being. Mangroves serve as natural barriers against storm surges, coastal erosion, and tidal flooding while functioning as important nursery grounds for fish and other marine organisms that support coastal fisheries. In addition, mangrove ecosystems play a vital role in climate change mitigation by storing substantial amounts of carbon in their biomass and sediments, making them one of the most efficient natural carbon sinks among coastal ecosystems (Alongi, 2012; Friess et al., 2019). Their ecological functions extend beyond biodiversity conservation, directly supporting food security, livelihood opportunities, disaster risk reduction, and the overall resilience of coastal communities.

The Philippines is recognized as one of the world's biologically diverse archipelagic nations, with approximately 36,000 kilometers of coastline supporting millions of people who depend on marine and coastal resources for their livelihoods. Historically, the country possessed extensive mangrove forests; however, decades of conversion for aquaculture, coastal development, illegal cutting, pollution, and unsustainable resource extraction have resulted in significant declines in mangrove cover (Primavera & Esteban, 2008). Although national conservation initiatives have slowed the rate of mangrove loss, many coastal areas continue to experience habitat degradation due to increasing anthropogenic pressures and the growing impacts of climate change.

Recognizing the ecological and socio-economic importance of mangrove ecosystems, the Philippine government has implemented various policies and programs aimed at protecting and restoring coastal habitats. Legislative measures such as the Philippine Fisheries Code of 1998 (Republic Act No. 8550), as amended by Republic Act No. 10654, the National Integrated Protected Areas System Act or commonly known as the NIPAS Act (Republic Act No. 7586), and the Local Government Code of 1991 (Republic Act No. 7160) provide the legal framework for coastal resource management and emphasize the shared responsibility of national agencies, local communities in conserving marine and coastal ecosystems. These policies encourage

participatory governance and recognize the role of local stakeholders in achieving sustainable environmental management.

At the local level, integrated coastal management has emerged as a comprehensive approach for balancing environmental protection with socio-economic development. Rather than relying solely on government-led conservation initiatives, integrated coastal management promotes collaborative decision-making among government agencies, international groups, academic institutions, civil society organizations, the private sector, and the local coastal communities. This governance approach recognizes that sustainable management of coastal resources depends not only of ecological restoration but also on strong intuitions, effective policy implementation, stakeholder participation, and continuous environmental education.

The Province of Bataan has become one of the country's recognized models for integrated coastal management through its long-standing partnership with the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA). Over the past two decades, the province has implemented various initiatives that promote habitat conservation, pollution control, disaster resilience, sustainable fisheries, and climate adaptation through collaborative governance. According to the Second State of the Coasts Report of Bataan Province, these efforts have contributed to improvements in coastal management systems, environmental monitoring, and institutional coordination while highlighting the continuing importance of strengthening community participation and local stewardship to sustain conservation gains (PEMSEA, 2024).

Within the province, the Municipality of Orani possesses ecologically significant mangrove areas that contribute to shoreline protection, fisheries productivity, biodiversity conservation, and climate resilience. Among its notable initiatives is the Mangrove Conservation and Protection Project located in Barangay Kabalutan (Tubo-Tubo Area), which has been implemented through the collective efforts of the municipal government, barangay officials, national government agencies, community organizations, educational institutions, volunteers, and private sector partners. These collaborative initiatives reflect the municipality's commitment to protecting its coastal resources while promoting environmental awareness and sustainable development among local communities.

Despite the implementation of various mangrove rehabilitation and conservation programs, there remains limited empirical evidence regarding their overall effectiveness beyond ecological restoration. Existing studies on mangrove conservation in the Philippines have primarily assessed plantation survival rates, vegetation growth, biodiversity recovery, and ecosystem services. While these ecological indicators provide valuable information regarding restoration success, they do not fully capture the social, institutional, and governance dimensions that determine whether conservation initiatives can be sustained over time.

Long-term conservation success depends on the active participation of local communities, effective leadership by local government units, institutional collaboration, adequate financial and technical support, environmental awareness, and consistent enforcement of environmental policies. Community participation is particularly important because local residents are not merely beneficiaries of conservation programs but also key stakeholders whose knowledge, attitudes, and behaviors directly influence the protection and sustainable use of mangrove ecosystems. When communities are actively involved in planning, implementation, monitoring, and decision-making, they are more likely to develop a sense of ownership and responsibility that strengthens environmental stewardship and enhances compliance with conservation regulations.

Environmental stewardship has become an increasingly important concept in contemporary coastal resource management because it emphasizes shared responsibility for

protecting natura resources across multiple sectors of society. Stewardship extends beyond compliance with environmental laws by encouraging individuals, organizations, and institutions to actively participate in conservation efforts and adopt practices that support ecological sustainability for present and future generations. In local coastal communities, stewardship is strengthened through environmental education, participatory governance, capacity-building initiatives, and sustained collaboration among stakeholders.

Although the Municipality of Orani continues to implement conservation initiatives through partnerships among government agencies, local organizations, and community volunteers, limited research has comprehensively examined how these efforts influence community participation, environmental awareness, stakeholder collaboration and institutional effectiveness. Likewise, there remains insufficient information regarding the strengths, challenges, and opportunities associated with the municipality's existing mangrove conservation initiatives. Without a comprehensive assessment, local policymakers and resource managers may have limited evidence to guide future conservation strategies, allocate resources effectively, and strengthen community-based management practices.

This research study addresses these gaps by assessing the current status of mangrove conservation and community participation in the Municipality of Orani, Bataan. Specifically, it examines the ecological and management aspects of the municipality's mangrove conservation initiatives, evaluate the level of community participation and stakeholder collaboration, identifies factors influencing the effectiveness of conservation efforts, and determines the challenges encountered in managing mangrove resources. Ultimately, the findings of this study will serve as the basis for developing a Sustainable Mangrove Management Plan that supports biodiversity conservation, strengthens community participation, enhances climate resilience, and promotes evidence-based coastal resource management in the Municipality of Orani. Beyond its local significance, the study is also expected to contribute to the growing body of knowledge on community-based coastal resource management in the Philippines and provide practical insights that may be adapted by other coastal municipalities pursuing sustainable mangrove conservation.

Statement of the problem

This study aims to assess the status of mangrove conservation and community participation in the Municipality of Orani, Bataan, particularly in the Mangrove Conservation and Protection Project in Barangay Kabalutan (Tubo-Tubo Area), as the basis for the development of a Sustainable Mangrove Management Plan.

Specifically, this study seeks to answer the following questions:

1. What is the status of mangrove conservation in the Municipality of Orani, Bataan?
2. What is the level of community participation in mangrove conservation initiatives in the Municipality of Orani, Bataan?
3. What is the level of environmental awareness among community members regarding mangrove conservation?
4. What is the level of institutional support provided by the Local Government Unit, national government agencies, and other stakeholders for mangrove conservation?
5. What is the level of stakeholder collaboration in the implementation of mangrove conservation initiatives?
6. What is the extent of implementation of local policies related to mangrove conservation in the Municipality of Orani, Bataan?
7. What are the challenges encountered in the implementation and sustainability of mangrove conservation initiatives?

8. Based on the findings of the study, what Sustainable Mangrove Management Plan may be proposed to strengthen mangrove conservation and community participation in the Municipality of Orani, Bataan?

METHODOLOGY

This study employed a mixed-methods research design, specifically a convergent parallel design, to comprehensively assess mangrove conservation and community participation in the Municipality of Orani, Bataan. The mixed-methods approach integrates quantitative and qualitative data to provide a more comprehensive understanding of the current status of mangrove conservation initiatives than could be achieved through a single method alone. The quantitative component utilized a descriptive survey to determine respondents' perceptions regarding the implementation of mangrove conservation programs, level of community participation, environmental awareness, stakeholder collaboration, institutional support, compliance with conservation policies, and perceived challenges affecting mangrove management. Descriptive research is appropriate because it systematically describes existing conditions without manipulating variables and provides a factual basis for planning and decision making. The qualitative component consisted of Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), field observations, and document review. These methods generated contextual information regarding conservation practices, institutional arrangements, stakeholder experiences, implementation challenges, and opportunities for improving mangrove management. The integration of quantitative and qualitative findings enabled data triangulation, thereby strengthening the credibility and validity of the study. Ultimately, the results of both components were synthesized to formulate evidence-based recommendations for the development of a Sustainable Mangrove Management Plan for the Municipality of Orani.

The study was conducted in the Municipality of Orani, Province of Bataan, Philippines, with particular focus on the Mangrove Conservation and Protection Project located in Barangay Kabalutan (Tubo Tubo) Area. Orani is a first-class municipality situated along the eastern coast of Bataan facing Manila Bay. The municipality possesses coastal ecosystems that include mangrove forests, mudflats, estuarine environments, and fishing grounds that support local biodiversity and provide livelihood opportunities for coastal residents. These ecosystems also contribute significantly to shoreline stabilization, fisheries productivity, climate resilience, and disaster risk reduction. Barangay Kabalutan serves as one of the municipality's important mangrove conservation sites where rehabilitation, protection, environmental education, and community-based conservation activities have been implemented through partnerships among the Local Government Unit (LGU), barangay officials, national government agencies, people's organizations, academic institutions, volunteers, and other stakeholders. The study site was purposively selected because it represents the municipality's primary mangrove conservation area and provides an appropriate setting for assessing ecological conservation initiatives, stakeholder participation, institutional collaboration, and community engagement.

The respondents of the study consisted of individuals who are directly or indirectly involved in mangrove conservation activities within the Municipality of Orani. The quantitative respondents included coastal residents, fisherfolk, community volunteers, members of people's organizations or civil society organizations, barangay officials, and other community stakeholders residing or actively participating in mangrove conservation activities in Barangay Kabalutan. The qualitative participants included key officials from the Municipal Government of Orani, representatives from the Department of Environment and Natural

Resources, barangay officials, officers of people's organizations or civil society organizations, project coordinators, environmental advocates, and other individuals who possess substantial knowledge regarding mangrove conservation and coastal resource management. Participation in the study was voluntary, and only respondents who willingly provided informed consent were included.

The study employed a combination of purposive sampling and stratified random sampling. Purposive sampling was used in selecting key informants who possess extensive knowledge and experience regarding mangrove conservation initiatives in Orani, including municipal officials, barangay officials, program coordinators, DENR representatives, leaders of people's organizations or civil society organizations, and representatives from partner institutions. Their expertise provided valuable qualitative information concerning conservation planning, governance, implementation, and institutional collaboration. For the quantitative survey, stratified random sampling was utilized to ensure adequate representation of various stakeholder groups. Respondents were grouped according to their affiliation or sector, such as coastal residents, fisherfolk, community volunteers, barangay officials, and members of people's organizations, and random selection was then conducted within each group to minimize sampling bias and improve representativeness. The sample size may be determined using Slovin's formula at a 95% confidence level with a 5% margin of error, provided that the total target population is known, and if an official list of participants involved in mangrove conservation activities is available, proportional allocation among stakeholder groups may likewise be employed.

A researcher developed questionnaire served as the primary instrument for the quantitative component of the study. The questionnaire was developed based on relevant literature, the conceptual framework, existing environmental governance studies, and the objectives of the research. The questionnaire consisted of five sections. The first section gathered demographic information such as age, sex, educational attainment, occupation, years of residency, and involvement in mangrove conservation activities. The second section assessed respondents' perceptions regarding existing mangrove conservation initiatives, rehabilitation activities, habitat protection, monitoring practices, and overall conservation effectiveness. The third section measured the extent of community involvement in planning, implementation, monitoring, environmental education, volunteer activities, and decision making related to mangrove conservation. The fourth section evaluated respondents' perceptions regarding the support provided by the Local Government Unit, national government agencies, people's organizations, educational institutions, and other stakeholders involved in mangrove conservation. The fifth section identified the major issues affecting mangrove conservation, including policy implementation, financial resources, community participation, environmental awareness, enforcement, and institutional coordination. Responses were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

A semi structured interview guide was prepared to obtain detailed information from municipal officials, barangay leaders, representatives from DENR, people's organizations or civil society organizations, and other stakeholders regarding conservation strategies, governance arrangements, institutional collaboration, implementation challenges, and recommendations for improving mangrove management. Focus group discussions were conducted with selected community members, fisherfolk, volunteers, and people's organizations to explore shared experiences, perceptions, challenges, and recommendations regarding mangrove conservation. An observation checklist was used to document the physical condition of the mangrove area, conservation facilities, information signage, rehabilitation activities, accessibility, evidence of environmental degradation, and ongoing management

practices. Relevant documents such as municipal ordinances, environmental policies, management plans, annual accomplishment reports, project proposals, monitoring reports, and related technical documents were reviewed to supplement the primary data collected from surveys and interviews.

Prior to the actual data collection, the research instruments were subjected to content validation to ensure their relevance, clarity, and alignment with the objectives of the study. The researcher developed questionnaire, interview guide, focus group discussion guide, and observation checklist were evaluated by a panel of experts composed of professionals with expertise in environmental management, coastal resource management, research methodology, and local governance, and their comments and recommendations were incorporated to improve the content, organization, and wording of the instruments. Following expert validation, a pilot test was conducted among respondents with characteristics similar to the target population but who were not included in the actual study, aimed at determining the clarity, comprehensibility, and appropriateness of the questionnaire items. The internal consistency of the questionnaire was assessed using Cronbach's Alpha Coefficient, and a reliability coefficient of 0.70 or higher was considered acceptable, indicating that the instrument possessed satisfactory internal consistency for measuring the study variables.

The data collection process was conducted in several phases to ensure systematic implementation and compliance with ethical standards. Initially, the researcher secured approval from the graduate school and obtained endorsement letters authorizing the conduct of the study. Formal requests for permission were then submitted to the Office of the Municipal Mayor, the Municipal Planning and Development Office, the Municipal Agriculture Office, Barangay Kabalutan, and other concerned offices and organizations involved in mangrove conservation. Following the approval of the concerned authorities, coordination meetings were conducted with barangay officials and identified stakeholders to explain the objectives of the study, schedule data collection activities, and identify prospective respondents. The quantitative survey was administered personally by the researcher or with the assistance of trained research assistants. Before answering the questionnaire, respondents were informed of the purpose of the study, the voluntary nature of their participation, and their rights as research participants, and sufficient time was provided for respondents to complete the questionnaire, after which all accomplished questionnaires were checked for completeness and consistency.

For the qualitative component, key informant interviews were conducted with municipal officials, representatives of national government agencies, barangay officials, officers of people's organizations or civil society organizations, and other stakeholders involved in mangrove conservation. Semi structured interviews allowed participants to share their experiences, perceptions, implementation strategies, and recommendations regarding mangrove conservation initiatives. Focus group discussions were likewise conducted among selected community members, fisherfolk, volunteers, and representatives of community organizations to obtain collective perspectives regarding community participation, environmental stewardship, implementation challenges, and opportunities for improving mangrove management. Field observations were undertaken at the Mangrove Conservation and Protection Project in Barangay Kabalutan (Tubo Tubo Area), where the researcher documented the physical condition of the mangrove ecosystem, existing rehabilitation activities, information signage, accessibility, observed environmental issues, and ongoing management practices using an observation checklist and field notes. To supplement the primary data, documentary analysis was performed on relevant municipal ordinances, executive orders, environmental policies, project reports, accomplishment reports, management plans, and other available records related to mangrove conservation and coastal resource management. The

quantitative and qualitative data were collected during the same general period and analyzed independently before the findings were integrated during interpretation.

The quantitative data were encoded, organized, and analyzed using appropriate statistical techniques. The profile of the respondents was analyzed using frequency counts and percentages to describe their demographic characteristics. To determine the respondents' assessment of mangrove conservation, community participation, institutional support, stakeholder collaboration, environmental awareness, policy implementation, and management challenges, the weighted mean and standard deviation were computed, with the weighted mean describing the overall level of agreement among respondents and the standard deviation measuring the consistency of their responses. Where appropriate, inferential statistical tests may be employed to determine significant differences or relationships among variables. If the study examines differences based on respondents' demographic characteristics, Independent Samples t-test or One-Way Analysis of Variance (ANOVA) may be utilized, and if relationships among variables are examined, Pearson Product-Moment Correlation or Spearman Rank Correlation may be applied depending on the nature and distribution of the data. The level of statistical significance was set at 0.05. For the interpretation of the five point Likert scale, a numerical range of 4.21-5.00 corresponded to a scale of 5, verbally interpreted as Strongly Agree/Very High; a numerical range of 3.41-4.20 corresponded to a scale of 4, verbally interpreted as Agree/High; a numerical range of 2.61-3.40 corresponded to a scale of 3, verbally interpreted as Moderately Agree/Moderate; a numerical range of 1.81-2.60 corresponded to a scale of 2, verbally interpreted as Disagree/Low; and a numerical range of 1.00-1.80 corresponded to a scale of 1, verbally interpreted as Strongly Disagree/Very Low.

Qualitative data obtained from interviews, focus group discussions, field observations, and document reviews were analyzed using Thematic Analysis following the procedures proposed by Braun and Clarke (2006). The researcher first transcribed all interview and discussion recordings verbatim, and the transcripts were read several times to gain familiarity with the data and identify recurring patterns. Meaningful statements were coded and grouped into categories according to their similarities, and these categories were then organized into broader themes that reflected the participants' experiences, perceptions, challenges, and recommendations regarding mangrove conservation and community participation. To enhance the credibility of the findings, the qualitative results were compared with documentary evidence, field observations, and quantitative survey findings through data triangulation.

Consistent with the convergent parallel mixed methods design, quantitative and qualitative findings were analyzed independently and integrated during the interpretation stage. The integration process involved comparing survey results with qualitative themes obtained from interviews, focus group discussions, observation, and document analysis. Areas of convergence, complementarity, and divergence were identified to provide a comprehensive understanding of the effectiveness of mangrove conservation initiatives in the Municipality of Orani. The integrated findings served as the basis for identifying priority concerns, institutional strengths, implementation gaps, and strategic interventions for sustainable mangrove management.

The final phase of the study involved the formulation of a Sustainable Mangrove Management Plan based on the integrated findings of the quantitative and qualitative analyses. The proposed management plan was designed to strengthen existing conservation initiatives by incorporating evidence-based recommendations on habitat protection and rehabilitation, community participation, environmental education, stakeholder collaboration, institutional capacity development, policy enhancement, monitoring and evaluation, and sustainable financing mechanisms. The proposed plan was organized into strategic objectives, recommended programs and projects, implementation strategies, responsible offices, potential

partners, time frame, resource requirements, monitoring indicators, and expected outcomes. The proposed Sustainable Mangrove Management Plan may subsequently be presented to concerned municipal offices, partner agencies, and community stakeholders for review, validation, and possible adoption as part of the municipality's long-term coastal resource management initiatives.

RESULTS AND DISCUSSION

This chapter presents the results of the study entitled "Assessment of Mangrove Conservation and Community Participation in the Municipality of Orani, Bataan: Basis for the Development of a Sustainable Mangrove Management Plan." A total of 100 respondents participated in the survey, drawn from among community members within the Municipality of Orani, Bataan. The study employed a descriptive research design utilizing a structured survey questionnaire as the primary data collection instrument, with responses analyzed through weighted mean computation to determine the level of agreement or perception across the various indicators examined. The discussion that follows is grounded strictly in the data gathered from the 100 respondents, and the results are interpreted in direct relation to the objectives of the study, namely to assess the status of mangrove conservation, the level of community participation, environmental awareness, institutional support, stakeholder collaboration, local policy implementation, and the challenges encountered in mangrove conservation efforts within the municipality. The findings are organized according to these objectives and are discussed in relation to relevant literature, the Community-Based Natural Resource Management (CBNRM) framework, Environmental Stewardship Theory, Common-Pool Resource Theory, and the Municipality of Orani's Coastal Resource Management Plan (CRMP).

Profile of the respondents

The respondents represented various age groups, occupations, and levels of community involvement. The largest proportion belonged to the 25-30 years old age group (22%), followed by respondents aged 31-36 years old (19%) and 49-54 years old (18%). This indicates that the study captured perceptions from economically active members of the community who are likely to be involved in local environmental activities and coastal resource management initiatives. The diverse age distribution suggests that awareness and participation in mangrove conservation are not limited to a specific demographic sector but involve different generations within the municipality, which strengthens the representativeness of the data gathered from the 100 respondents and supports the credibility of the interpretations that follow.

Status of mangrove conservation

The overall assessment of mangrove conservation obtained a grand mean of 4.63, verbally interpreted as Very High, indicating a very high level of agreement among respondents regarding the effectiveness of existing conservation initiatives in the municipality. Among the eight indicators evaluated, "Mangroves provide habitat for fish and wildlife" received the highest weighted mean of 4.88, interpreted as Very High, reflecting strong public recognition of the ecological value of mangrove forests as sanctuaries for marine and terrestrial species. This finding supports the observations contained in the Orani CRM Plan, which identifies mangrove ecosystems as critical habitats that support biodiversity and fisheries productivity.

Respondents likewise strongly agreed that mangrove conservation contributes to shoreline protection (WM = 4.74, Very High), highlighting community awareness of the role of mangroves in reducing coastal erosion and enhancing climate resilience. Other indicators, including the perception that the condition of mangrove forests has improved (WM = 4.68, Very High), that illegal cutting is effectively prevented (WM = 4.61, Very High), that mangrove areas are regularly monitored (WM = 4.57, Very High), that mangrove areas are well protected (WM = 4.64, Very High), that rehabilitation activities are regularly conducted (WM = 4.49, Very High), and that conservation efforts are sufficient (WM = 4.40, Very High), were all rated within the very high category. These results are consistent with Alongi (2020) and Friess et al. (2019), who emphasized that mangrove ecosystems provide significant ecological services, including habitat provision, carbon sequestration, and coastal protection, thereby affirming that the community's high regard for mangrove conservation in Orani mirrors documented ecological realities rather than mere perception.

Community participation

The results revealed a very high level of community participation, with a grand mean of 4.47 interpreted as Very High. The highest-rated statement was "Community responsibility for mangrove protection" (WM = 4.89, Very High), indicating a strong sense of environmental stewardship among residents and suggesting that conservation is increasingly regarded as a shared civic duty rather than solely a governmental obligation. Community organizations support for conservation (WM = 4.67, Very High) and encouragement for community members to participate (WM = 4.57, Very High) were also rated very high, followed by women participation (WM = 4.49, Very High), consultation of residents before projects (WM = 4.39, Very High), participation in planting activities (WM = 4.27, Very High), youth participation (WM = 4.26, Very High), and availability of volunteer opportunities (WM = 4.24, Very High). These findings support the principles of Community-Based Natural Resource Management (CBNRM), which emphasize that local communities are more likely to support conservation initiatives when they perceive themselves as stakeholders and beneficiaries of environmental resources. The active involvement of community organizations further demonstrates the effectiveness of participatory governance strategies being implemented by the Municipality of Orani, and it reinforces the theoretical premise that ownership and inclusion are central to the sustainability of grassroots environmental action.

Environmental awareness

Environmental awareness recorded a grand mean of 4.60, interpreted as Very High, indicating that respondents possess a strong understanding of the ecological importance of mangroves. The statement "Mangroves help mitigate climate change" obtained the highest weighted mean of 4.95, interpreted as Very High, suggesting that respondents recognize the role of mangrove ecosystems in carbon sequestration and climate adaptation. This was closely followed by the perception that mangroves reduce coastal flooding (WM = 4.91, Very High), that mangroves improve fisheries productivity (WM = 4.87, Very High), and understanding of the importance of mangroves in general (WM = 4.84, Very High). The belief that awareness campaigns should be expanded (WM = 4.73, Very High) and the perception that schools promote conservation (WM = 4.25, Very High) were likewise rated favorably. However, awareness of environmental laws (WM = 4.18, High) and perceptions regarding the effectiveness of environmental education programs (WM = 4.07, High) received comparatively lower ratings, falling within the High rather than Very High category. This suggests

opportunities for the local government unit to strengthen information, education, and communication (IEC) campaigns, particularly those concerning legal frameworks governing mangrove protection. These findings align with Environmental Stewardship Theory, which emphasizes that environmental knowledge influences conservation behavior and long-term sustainability, implying that while ecological awareness is high, the comparatively lower familiarity with legal and educational mechanisms represents a gap that, if addressed, could further reinforce stewardship behavior among residents.

Institutional support

Institutional support obtained a grand mean of 4.19, interpreted as High, indicating a generally positive though comparatively more moderate assessment relative to the preceding indicators. Respondents rated DENR support highest at a weighted mean of 4.62, interpreted as Very High, suggesting strong confidence in national government involvement in local mangrove conservation. Government coordination followed with a weighted mean of 4.23, interpreted as Very High, while LGU support (WM = 4.19, High), barangay participation (WM = 4.15, High), adequacy of funding (WM = 4.09, High), availability of technical assistance (WM = 4.05, High), and support for community organizations (WM = 4.03, High) were all rated within the High category. These findings imply that while institutional arrangements are functioning effectively, particularly at the national level through the DENR, additional resources and technical support at the local and barangay levels may further strengthen conservation outcomes. The results support Ostrom's Common-Pool Resource Theory, which emphasizes the importance of institutional structures and collective governance in managing shared environmental resources, and they suggest that the comparatively lower ratings for funding and technical assistance point to structural constraints that could limit the full realization of institutional potential if left unaddressed.

Stakeholder collaboration

The findings indicate that stakeholder collaboration is perceived positively, with a grand mean of 4.24, interpreted as Very High. NGO support obtained a weighted mean of 4.47 (Very High), while private sector participation was rated at 4.41 (Very High), both emerging as particular strengths of the municipality's conservation efforts. Academic institution participation (WM = 4.15, High), overall collaboration (WM = 4.19, High), government agencies working together effectively (WM = 4.10, High), and information sharing (WM = 4.14, High) were rated within the High category. These partnerships contribute to resource mobilization, environmental education, technical assistance, and volunteer engagement. The findings validate the collaborative governance approach adopted under the Orani CRM Plan, which emphasizes multi-sectoral participation in coastal resource management, and they suggest that while collaboration among government agencies and information-sharing mechanisms remain functional, there is room to further institutionalize coordination processes to elevate these indicators from High to Very High levels of perceived effectiveness.

Local policy implementation

Respondents generally agreed that environmental policies are being implemented effectively, as reflected in a grand mean of 4.29, interpreted as Very High. Residents' compliance with policies was rated at a weighted mean of 4.35 (Very High), LGU monitoring

at 4.28 (Very High), and the perception that policies support conservation at 4.24 (Very High). However, the strong agreement that existing ordinances need improvement (WM = 4.60, Very High) suggests that stakeholders recognize opportunities to strengthen local policy frameworks despite the generally favorable assessment of implementation. Violators being penalized appropriately (WM = 4.16, High) and the enforcement of ordinances (WM = 4.12, High) were rated somewhat lower, falling within the High category. The findings indicate that policy implementation is functioning but could benefit from periodic review, stronger enforcement mechanisms, and enhanced stakeholder participation, particularly given that respondents simultaneously affirm compliance while calling for the improvement of existing ordinances, a pattern that suggests an informed and critically engaged community rather than passive acceptance of current regulatory frameworks.

Challenges encountered in mangrove conservation

The assessment of challenges affecting mangrove conservation yielded a grand mean of 4.74, interpreted as Very High Challenge, indicating that respondents perceive multiple significant obstacles to sustained conservation efforts. The highest-rated challenges were climate change impacts and the need to strengthen policy enforcement, both obtaining a weighted mean of 4.94, interpreted as Very High Challenge. These findings underscore the vulnerability of coastal ecosystems and the importance of robust governance mechanisms in addressing both environmental and institutional threats. The need for improved community participation followed closely at a weighted mean of 4.89 (Very High Challenge), while pollution was rated at 4.87 (Very High Challenge). Insufficient funding and the need for more environmental educational programs were each rated at a weighted mean of 4.83 (Very High Challenge), followed by the need for enhanced monitoring (WM = 4.69, Very High Challenge). Illegal cutting, while still a notable concern, obtained a comparatively lower weighted mean of 3.97, interpreted as High Challenge, the only indicator in this category not reaching the Very High Challenge threshold. Taken together, these results suggest that although direct threats such as illegal cutting are perceived as somewhat less pressing than in the past, systemic challenges relating to climate change, governance, funding, and education remain the most critical barriers to sustainable mangrove management in the municipality.

Synthesis

The findings collectively demonstrate that the Municipality of Orani has cultivated a strong foundation for mangrove conservation, as evidenced by the very high grand means obtained across the status of mangrove conservation (4.63), community participation (4.47), environmental awareness (4.60), stakeholder collaboration (4.24), and local policy implementation (4.29), all drawn from the responses of the 100 participants surveyed. Institutional support, while still favorable at a grand mean of 4.19, emerged as the relatively weaker dimension, particularly with respect to funding adequacy and technical assistance, echoing the challenges identified in the final section of the results, where insufficient funding (WM = 4.83) and the need to strengthen policy enforcement (WM = 4.94) were prominently cited. These results directly address the objectives of the study by establishing that while ecological awareness and community stewardship in Orani are exceptionally strong, translating this awareness and willingness into sustained institutional capacity and enforceable policy remains an ongoing challenge, particularly in the context of climate change, which respondents identified as the most pressing threat (WM = 4.94). The convergence of high community engagement with comparatively constrained institutional and funding support affirms the

relevance of the Community-Based Natural Resource Management framework, Environmental Stewardship Theory, and Ostrom's Common-Pool Resource Theory in explaining how local stewardship can flourish even amid institutional limitations, while also highlighting the continued necessity of strengthened governance structures as articulated in the Municipality of Orani's Coastal Resource Management Plan. These findings contribute to the broader field of coastal resource management by illustrating, through empirical data gathered from the 100 respondents, that community-driven conservation efforts can be highly effective when grounded in ecological awareness and collective responsibility, but that their long-term sustainability is contingent upon commensurate institutional investment, policy refinement, and multi-sectoral collaboration. Building on these results, the following chapter presents the summary of findings, conclusions, and recommendations derived from this study, culminating in the proposed framework for a sustainable mangrove management plan for the Municipality of Orani, Bataan.

CONCLUSION

The findings mirror challenges identified in the Orani CRM Plan, which highlights climate adaptation, environmental compliance, and sustainable financing as priority areas for coastal resource management.

The study revealed that respondents generally perceive mangrove conservation initiatives in the Municipality of Orani as effective and sustainable. High levels of environmental awareness, community participation, and stakeholder collaboration were observed, indicating strong support for conservation efforts. Despite these positive perceptions, respondents identified several challenges that may affect the long-term sustainability of mangrove ecosystems, particularly climate change impacts, policy enforcement, funding limitations, and the need for continuous environmental education.

Overall, the findings suggest that the Municipality of Orani possesses a solid foundation for community-based mangrove conservation. However, strengthening institutional support, improving policy implementation, enhancing monitoring systems, and expanding community engagement remain necessary to ensure the long-term success of mangrove management initiatives.

These findings provide empirical support for the development of a Sustainable Mangrove Management Plan that integrates ecological protection, participatory governance, environmental education, and institutional collaboration.

In view of the findings of the study, it is recommended that the Municipality of Orani continue strengthening its mangrove conservation programs by providing sustained support for rehabilitation activities, community participation, and environmental education. Existing local ordinances and conservation strategies should be regularly reviewed to ensure that they remain responsive to emerging environmental concerns and the changing needs of coastal communities. Strengthening coordination among the Local Government Unit, national government agencies, people's organizations or the civil society organizations, academic institutions, and other partners will likely enhance the effectiveness of conservation initiatives.

The proposed Sustainable Mangrove Management Plan may serve as a guide in planning and implementing future mangrove conservation programs within the municipality. Its integration into existing local development and coastal resource management plans can help ensure a more coordinated and sustainable approach to protecting mangrove ecosystems. Future researchers are encouraged to conduct more detailed ecological assessments and long-

term monitoring studies to evaluate the effectiveness of conservation interventions and generate additional evidence that can support environmental planning and policy development.

REFERENCES

- Alongi, D. M. (2012). Carbon sequestration in mangrove forests. *Carbon Management*, 3(3), 313-322. <https://doi.org/10.4155/cmt.12.20>
- Alongi, D. M. (2020). *The ecology of mangrove forests* (3rd ed.). Cambridge University Press.
- Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Institute of Planners*, 35(4), 216-224. <https://doi.org/10.1080/01944366908977225>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). Sage Publications.
- Department of Environment and Natural Resources. (2015). *Philippine biodiversity strategy and action plan 2015-2028*. DENR Biodiversity Management Bureau.
- Department of Environment and Natural Resources. (2023). *State of Philippine biodiversity*. DENR Biodiversity Management Bureau.
- Food and Agriculture Organization of the United Nations. (2007). *The world's mangroves 1980-2005* (FAO Forestry Paper No. 153). FAO.
- Food and Agriculture Organization of the United Nations. (2020). *The state of the world's forests 2020: Forests, biodiversity and people*. FAO. <https://doi.org/10.4060/ca8642en>
- Friess, D. A., Rogers, K., Lovelock, C. E., Krauss, K. W., Hamilton, S. E., Lee, S. Y., Lucas, R., Primavera, J. H., Rajkaran, A., & Shi, S. (2019). The state of the world's mangrove forests: Past, present, and future. *Annual Review of Environment and Resources*, 44, 89-115. <https://doi.org/10.1146/annurev-environ-101718-033302>
- Intergovernmental Panel on Climate Change. (2022). *Climate change 2022: Impacts, adaptation and vulnerability*. Cambridge University Press.
- Lee, S. Y., Hamilton, S., Barbier, E. B., Primavera, J. H., & Lewis, R. R. (2019). Better restoration policies are needed to conserve mangrove ecosystems. *Nature Ecology & Evolution*, 3(6), 870-872. <https://doi.org/10.1038/s41559-019-0861-y>
- Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being: Synthesis*. Island Press.

Municipality of Orani. (2026). Integrated coastal resource management plan 2026-2029. Municipal Government of Orani, Bataan.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.

PEMSEA. (2024). Second state of the coasts report of Bataan Province.

Primavera, J. H. (2005). Mangroves, fishponds, and the quest for sustainability. *Science*, 310(5745), 57-59. <https://doi.org/10.1126/science.1115179>

Primavera, J. H., & Esteban, J. M. A. (2008). A review of mangrove rehabilitation in the Philippines: Successes, failures and future prospects. *Wetlands Ecology and Management*, 16(5), 345-358. <https://doi.org/10.1007/s11273-008-9101-y>

Republic Act No. 7160. (1991). Local government code of 1991.

Republic Act No. 7586. (1992). National integrated protected areas system act of 1992.

Republic Act No. 8550. (1998). Philippine fisheries code of 1998.

Republic Act No. 10654. (2015). An act to prevent, deter, and eliminate illegal, unreported and unregulated fishing, amending Republic Act No. 8550.

United Nations Environment Programme. (2021). *Becoming #GenerationRestoration: Ecosystem restoration for people, nature and climate*. UNEP.

United Nations Educational, Scientific and Cultural Organization. (2021). *United Nations decade on ecosystem restoration 2021-2030*. UNESCO.

World Bank. (2022). *Blue economy for resilient coastal development*. World Bank.

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.