

The Role of Community Participation in Mangrove Forest Conservation on Coastal Kaimana Regency West Papua

Yohanes Kamakaula¹, Meky Sagrim², Obadja Andris Fenetiruma³

^{1,3}University of Papua

²Faperta Unipa

Article Info

Article history:

Received September, 2025

Revised September, 2025

Accepted September, 2025

Keywords:

Community participation;

Mangrove forest;

Conservation;

Local wisdom;

ABSTRACT

This study examines the role of community participation in mangrove forest conservation in Kaimana Regency, West Papua, using a qualitative approach with five key informants, including local residents, community leaders, and environmental activists. Data were collected through in-depth interviews and field observations, then analyzed thematically. The findings reveal that community participation is central to mangrove conservation, manifested in activities such as planting, monitoring, and protecting mangroves from exploitation. Local wisdom and traditional norms, rooted in indigenous culture, serve as guiding principles that reinforce compliance and foster a collective sense of ownership. Nevertheless, challenges such as limited financial resources, lack of technical expertise, and external pressures from aquaculture and coastal development threaten the sustainability of these initiatives. Collaboration with NGOs, universities, and government agencies has strengthened local capacity, yet policy support remains inconsistent. This study concludes that integrating local wisdom, empowering communities, and fostering multi-stakeholder collaboration are essential strategies for effective and sustainable mangrove management in West Papua.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Name: Yohanes Kamakaula

Institution: Agribusiness Program, Faculty of Agriculture, University of Papua

Email: y.kamakaula@unipa.ac.id

1. INTRODUCTION

Mangrove forests are among the most productive coastal ecosystems, providing critical ecological, economic, and social functions as natural barriers against coastal erosion, biodiversity supporters, carbon storages, and sources of livelihoods through fisheries and ecotourism. In Kaimana Regency, West Papua, mangrove ecosystems play an essential role in supporting coastal resilience and sustaining the well-being of indigenous communities. However, these

ecosystems face increasing pressures from land conversion, aquaculture expansion, pollution, and climate change, leading to significant degradation that threatens both ecological balance and the livelihoods of local people. Mangroves act as natural buffers against erosion and storms by dissipating wave energy through their dense root systems [1], [2], and they also serve as significant carbon sinks, storing carbon in biomass and sediments critical for climate change mitigation [1], [2]. Moreover, mangroves

sustain biodiversity and provide essential resources for fisheries that coastal communities rely on [2], [3]. Despite these benefits, the conversion of mangrove areas into aquaculture land remains a major driver of habitat loss and reduced coastal resilience [1], [3]. Pollution and climate change further exacerbate this degradation and increase disaster risks for nearby populations [4]. Weak governance and inadequate policy implementation in Indonesia aggravate these issues, highlighting the urgent need for improved and context-specific conservation strategies [5].

Mitigation efforts should prioritize protecting mangroves with high carbon sequestration, rehabilitating degraded areas [1], and strengthening management by addressing policy barriers and avoiding business-as-usual practices [5]. Case studies across Indonesia, including Papua, show that replantation and community participation are vital for sustaining mangroves [4]. While conservation has been widely implemented by government, NGOs, and academics, its success depends heavily on community involvement, as local people hold ecological knowledge crucial for sustainability. Without meaningful participation, programs often fail, whereas active engagement fosters local wisdom and effective practices. In South Buano Village, communities join in planning, seeding, maintenance, and monitoring through Pokmaswas [6], while in Luppung Ecotourism, involvement includes concern, skills, and trust supported by local organizations [7]. Similar lessons emerge globally: in Sri Lanka, community-based management improves restoration [8]; in Tanzania's Rufiji Delta, participation is shaped by socio-economic factors [9]; yet in Sidodadi Village, engagement remains passive, highlighting the need for deeper involvement in planning and implementation [10].

Community participation in mangrove conservation goes beyond planting and monitoring, encompassing education, awareness, decision-making, and collaborative governance, which is highly

relevant in Kaimana Regency where communities maintain close cultural and economic ties with mangroves. Participation is influenced by income, education, and length of residence, while incentives and structured programs enhance engagement [11]. Cultural values also play a key role, as seen in Papuan communities and in Karangjaladri Village where local wisdom fosters collective responsibility [12]. Strengthening participation requires community-based management supported by government and NGOs [11], complemented by education, training [13], and mangrove-based ecotourism that integrates conservation with local development [12]. Against this backdrop, this study explores how communities in Kaimana Regency engage in mangrove conservation, the strategies they use, and the challenges they face, through a qualitative approach with five informants to provide insights that support participatory environmental management and community-based conservation in Indonesia.

2. LITERATURE REVIEW

2.1 Mangrove Forests and Their Importance

Mangrove forests in Indonesia, including those in Kaimana Regency, West Papua, are vital ecosystems that stabilize shorelines, sequester carbon, and support diverse flora and fauna, while also sustaining livelihoods through fisheries, aquaculture, and ecotourism. As the world's largest mangrove area with 157 plant species and numerous animal species [14], Indonesia's mangroves are globally recognized for climate change mitigation, especially in carbon storage and coastal protection [1], [15]. However, Indonesia also records the highest rate of mangrove deforestation, mainly from aquaculture and agriculture [16], exemplified by the Segara Anakan Lagoon in Java where deforestation and sedimentation have degraded ecosystem services [16]. In Papua, where coastal communities depend on mangroves for food security and cultural practices, conservation must combine national policies with community-based initiatives [15] and effective governance to

manage land-use change and ensure long-term resilience [16].

2.2 Community Participation in Environmental Conservation

Community participation is central to sustainable mangrove management, fostering ownership and responsibility in line with Pretty's (1995) typology and Ostrom's framework on collective action. In Indonesia, involvement varies: in Waiheru Village it is mostly passive or incentive-based [17], in South Buano supported by monitoring groups but still incentive-driven [6], in Luppung Ecotourism more active with planning and monitoring [7], while in Sidodadi Village it remains largely passive [10]. In the Arafura Sea, although 85% acknowledge mangrove importance, only 43% actively join planting programs [18]. For Kaimana, this indicates that despite high awareness, participation levels differ, requiring interventions that combine awareness-building, incentives, and inclusive governance to strengthen active community engagement.

2.3 Local Wisdom and Traditional Knowledge

Local wisdom is crucial in mangrove conservation, especially in Papua where traditions and ecological knowledge guide sustainable use through customary laws, rituals, and practices. In Cemara Labat, unwritten rules ban destructive activities like cutting mangroves or hunting animals [19], while in Karangjaladri, initiatives such as a Mangrove Seed Bank and conservation-based identity foster collective action [20]. The Bajo Tribe balances conservation with livelihoods [21], and in Rembang, bottom-up models rooted in local wisdom strengthen ownership [22]. Overall, integrating traditional wisdom enhances legitimacy, supports indigenous culture, and ensures sustainability [23], while in Kaimana, aligning customary governance with formal conservation is essential to harmonize ecological goals with cultural values.

2.4 Conceptual Framework of This Study

This study is grounded in the concept of participatory environmental management,

which emphasizes collaboration between communities and other stakeholders in addressing ecological challenges, and by examining the experiences of five informants directly involved in mangrove conservation in Kaimana Regency, it seeks to identify the roles, strategies, and challenges of community participation. The conceptual framework integrates ecological perspectives on the importance of mangroves, sociological views on participation and local wisdom, and governance theories of collective action, underscoring that sustainable mangrove management in Papua requires not only ecological and technical approaches but also the recognition of local traditions, inclusive governance, and multi-stakeholder collaboration.

3. METHODS

3.1 Research Design

This study employs a qualitative research design to explore the role of community participation in mangrove forest conservation in Kaimana Regency, West Papua. A qualitative approach was selected to capture the depth of local experiences, perceptions, and cultural practices in managing and conserving mangrove ecosystems. By focusing on narratives and lived experiences, this design allows the researcher to generate nuanced insights into the dynamics of community involvement and the interaction between ecological conditions, social values, and governance structures.

3.2 Research Location

The research was conducted in selected coastal villages of Kaimana Regency, West Papua, where mangrove ecosystems are abundant and community-based conservation initiatives are visible. Kaimana is well known for its ecological richness, with mangrove forests playing a vital role in shoreline protection, biodiversity support, and the cultural practices of indigenous communities. The location was chosen due to its ecological significance, the high dependence of local livelihoods on mangroves, and the increasing threats from

aquaculture expansion, land conversion, and climate change.

3.3 Informants

Informants were selected using purposive sampling to ensure relevance and diversity of perspectives. A total of five key informants participated in the study, consisting of local community members directly engaged in mangrove planting and protection activities, a village leader with knowledge of customary rules and decision-making processes, and an environmental activist actively involved in community awareness and advocacy programs.

The selection criteria included: (1) direct involvement in mangrove management activities, (2) familiarity with local traditions and ecological practices, and (3) willingness to share experiences and insights. This combination ensured that the study reflects both practical and cultural dimensions of community participation.

3.4 Data Collection Techniques

Data were collected through in-depth semi-structured interviews and field observations. The interviews enabled participants to elaborate on their experiences, perceptions, and challenges in mangrove conservation, while allowing the researcher flexibility to probe deeper into emerging themes. The interviews explored key topics such as the role of communities in conservation, the influence of local wisdom, challenges encountered, and collaboration with external stakeholders. Field observations were conducted to document on-site conservation activities such as planting, monitoring, and community meetings, as well as to assess ecological conditions. In addition, secondary data from government reports, NGO publications, and previous research were reviewed to provide context and triangulate findings.

3.5 Data Analysis

The collected data were analyzed using thematic analysis. The process began with careful reading and transcription of interview data, followed by coding to identify recurring patterns and ideas. These codes were then organized into broader themes

such as community roles, conservation strategies, local wisdom, challenges, and policy implications. Field observation notes were integrated to enrich interpretations, while secondary data helped validate and contextualize findings. The analysis emphasized the voices of informants while situating their perspectives within broader theoretical frameworks on participatory environmental management and the integration of traditional knowledge in conservation practices.

4. RESULTS AND DISCUSSION

4.1 Community Roles in Mangrove Conservation

This study found that local communities in Kaimana Regency are actively engaged in mangrove conservation through activities such as planting, routine monitoring, and patrols to prevent illegal logging and exploitation. One informant explained, *"We plant mangroves every year because it is important to prevent erosion and protect the livelihoods of fishermen"* (Interview, Informant 2), illustrating how community actions are directly tied to both ecological functions and economic security. These findings are consistent with Ostrom's (1990) theory of common-pool resource management, which emphasizes that collective action is crucial for the sustainable governance of shared natural resources. In various regions of Indonesia, community groups have taken a leading role in mangrove cultivation as a response to environmental degradation. For example, initiatives such as those in Pantai Bahagia Village demonstrate participation reaching the "Delegated Power" stage, where communities are entrusted with managing mangrove areas under government regulations [24].

The success of such collective action is closely linked to the establishment of participatory rules and local agreements that ensure sustainable outcomes [25]. Lessons from other regions highlight those strong social institutions can foster both collective responsibility and ecological sensibility, as seen in South Sulawesi where institutional

strength has been instrumental in supporting effective governance [26]. Nevertheless, challenges such as resource overutilization and competition remain, as exemplified in the case of Sinjai's bats, underscoring the importance of balancing individual economic interests with long-term community sustainability [26], [27]. Importantly, when communities recognize direct benefits from conservation—such as the link between mangrove health and fisheries productivity—their motivation to remain engaged in conservation efforts significantly increases. This dynamic is also evident in Kaimana, where the dependence of indigenous communities on mangrove-related fisheries serves as a strong driver for sustained participation in conservation practices.

4.2 Integration of Local Wisdom

Local wisdom (*kearifan lokal*) plays a central role in shaping mangrove conservation practices in Kaimana Regency, as traditional norms prohibit excessive logging and regulate community access to coastal resources. A village chief explained, *"Since long ago, there has been a customary rule that mangroves cannot be cut down indiscriminately, because this forest is considered the protector of the village"* (Interview, Informant 4). Such cultural values reinforce compliance within the community, embed conservation within local identity, and ensure the sustainability of collective efforts. These findings align with perspectives that emphasize how traditional ecological knowledge provides the foundation for sustainable environmental management, particularly in Indonesian coastal communities where cultural norms and customary rules guide the use of marine and mangrove resources.

Traditional institutions further demonstrate how local wisdom sustains conservation. For example, the *Panglima Laot* in Aceh integrates customary ecological rules into conservation practices, ensuring legitimacy and strengthening marine ecosystem preservation [28]. Likewise, in Cemara Labat Village, unwritten customary laws regulate mangrove use and prohibit

destructive practices. In Ambon Dalam Bay, communities employ cultural capital to maintain mangroves, demonstrating how local traditions can be integrated into policy frameworks [29]. Similar patterns are found in indigenous fisheries management, where revitalizing traditional rights is critical for adapting to ecological changes [30]. Moreover, sustainable practices such as rotational farming and fishing techniques, passed down through generations, reflect traditional ecological wisdom essential for resilience and long-term sustainability [23].

In the context of Kaimana, where indigenous communities strongly uphold customary rules and spiritual beliefs connected to nature, the integration of local wisdom into conservation strategies enhances legitimacy, strengthens collective participation, and increases the effectiveness of mangrove management. By aligning cultural traditions with formal conservation policies, local communities not only preserve their cultural heritage but also secure the ecological integrity of mangrove ecosystems for future generations.

4.3 Challenges in Sustaining Conservation Efforts

Despite strong community involvement in mangrove conservation in Kaimana Regency, several challenges continue to hinder long-term sustainability. The most pressing issues include limited funding, lack of technical expertise, and increasing external pressures from aquaculture expansion and coastal development. As one activist stated, *"Kami ingin menanam lebih banyak, tapi dana terbatas dan tingkat keberhasilan bibit sering rendah"* (Interview, Informant 1), highlighting those financial constraints and technical barrier often reduce the effectiveness of replanting programs. These obstacles mirror findings in other regions, where community-based initiatives struggle to sustain conservation without adequate institutional and financial support. Weak law enforcement further exacerbates the problem, as illegal land conversion for aquaculture persists despite strong community resistance.

Limited access to capital also forces many small aquaculture farmers to depend on patrons, thereby reducing their autonomy to adopt more sustainable practices [31]. In addition, the absence of strong governance institutions often leads to repeated program failures and weak community leadership [31]. Poor enforcement of maritime and environmental laws has enabled unauthorized land conversion and resource exploitation to persist, undermining collective conservation efforts [32], [33].

To address these governance challenges, participatory co-management approaches—where enforcement responsibilities are shared between communities and state actors—have shown promise in empowering local people to sustainably manage coastal resources [32], [33]. Building social capital by strengthening trust and collaboration among stakeholders, including communities, government agencies, and private actors, can further enhance collective action and improve conservation outcomes [31]. Nonetheless, legal and administrative complexity, along with institutional competition, often contributes to noncompliance, as local officials sometimes align with resource users rather than enforcing environmental regulations [34]. Even so, evidence suggests that co-management practices can reduce conflicts over fisheries and improve environmental governance, offering potential pathways for overcoming many challenges faced by community-based initiatives [35].

Overall, these findings indicate that while local participation in Kaimana is strong, the lack of structural support, financial resources, and consistent law enforcement remains a significant obstacle. Strengthening governance mechanisms and fostering collaborative approaches are therefore essential for ensuring sustainable coastal resource management in West Papua.

4.4 Collaboration with External Stakeholders

The findings underscore the importance of collaboration with external stakeholders—such as NGOs, universities, and government agencies—in strengthening

mangrove conservation in Kaimana Regency. Informants acknowledged that training programs, awareness campaigns, and technical assistance from external actors have significantly built local capacity. As one participant noted, *“Pelatihan dari universitas sangat membantu kami memahami ekologi mangrove dan cara menanam dengan benar”* (Interview, Informant 3). This reflects the principles of participatory environmental management, where partnerships between communities and external stakeholders create synergies that enhance both ecological outcomes and community empowerment.

Evidence from other regions in Indonesia reinforces this dynamic. For example, NGO involvement in mangrove rehabilitation projects in Java has been shown to improve ecological restoration while simultaneously empowering communities through skills development and participatory decision-making processes [36]. Similarly, collaborative projects in rural East Java demonstrate that inclusive governance and transparent participation contribute not only to conservation success but also to social and economic empowerment of local communities [36]. In Central Java, diverse stakeholder engagement—including NGOs, community groups, and local government—has proven essential for balancing competing interests and ensuring more equitable distribution of benefits [37].

NGOs in particular play a pivotal role in providing technical expertise, financial resources, and organizational support for mangrove rehabilitation, thereby strengthening ecological resilience and community capacity [37]. At the same time, collaborative governance that integrates both governmental and non-governmental actors has been identified as a critical mechanism for addressing environmental management challenges in Indonesia [38]. However, the findings also reveal that government support in Kaimana remains inconsistent, especially regarding policy enforcement and the formal integration of community-based initiatives into regional development plans. This inconsistency reduces the long-term

sustainability of conservation programs [39], [40].

Overall, the case of Kaimana highlights that while external collaborations are vital for building community knowledge and capacity, stronger and more consistent governmental commitment is necessary to complement NGO and university-led initiatives. Only by ensuring alignment between local participation, external support, and policy frameworks can collaborative governance achieve its full potential in sustaining mangrove ecosystems in West Papua.

4.5 Discussion

The overall findings of this study highlight that community participation is the backbone of mangrove conservation in Kaimana Regency, West Papua. Communities are driven not only by ecological concerns such as shoreline protection and biodiversity preservation, but also by livelihood needs tied to fisheries and cultural values rooted in customary traditions. This dual motivation strengthens community ownership of conservation initiatives but also reveals several constraints, including financial limitations, technical challenges in ensuring seedling survival, and external pressures from unsustainable coastal development. These findings reinforce the perspective that successful mangrove conservation requires a balance between bottom-up initiatives and top-down policy support, where genuine empowerment—rather than symbolic or token participation—produces more sustainable outcomes. Strengthening community capacity, formalizing local wisdom within regulatory frameworks, and ensuring consistent governmental support are therefore critical strategies for maintaining the long-term resilience of mangrove ecosystems in West Papua.

Concrete examples from across Indonesia further illustrate how empowerment and participation manifest in different contexts. In Cemara Labat Village, for instance, unwritten customary laws that prohibit mangrove cutting and hunting have fostered moderate but growing levels of

community involvement in conservation [19]. In Tanjung Harapan, collaboration between communities, government, and local businesses has enhanced conservation through both tangible contributions such as labor and skills, and intangible contributions such as ideas and participatory decision-making [41]. Meanwhile, in Karangsong Village, community involvement has reached the “citizen power” stage, where locals not only participate but also actively plan and implement rehabilitation policies, supported by groups such as Pantai Lestari [42]. The role of local leaders is particularly significant, as their authority and respect within the community allow them to mobilize collective action [22]. Similarly, coastal care groups in Setapak Besar demonstrate how co-management models bridge governance gaps and increase community understanding, thereby reinforcing conservation success [43].

In the case of Kaimana, these comparative insights underscore that while local communities already play a strong role in mangrove conservation, scaling up these efforts requires institutional recognition of customary rules, integration of indigenous ecological knowledge into formal policies, and the creation of inclusive governance mechanisms. By aligning community-based initiatives with governmental policies and multi-stakeholder collaborations, mangrove conservation in Kaimana can become both ecologically resilient and culturally sustainable.

5. CONCLUSION

This study concludes that community participation plays a fundamental role in mangrove forest conservation in Kaimana Regency, West Papua. Communities act not only as beneficiaries of ecological services but also as active custodians of the ecosystem. Their engagement in planting, monitoring, and protecting mangroves is motivated by ecological needs—such as shoreline protection and biodiversity preservation—as well as by livelihood concerns tied to fisheries and local economic security. Local wisdom provides cultural

legitimacy, embedding conservation within customary norms and traditional practices, while collaboration with external stakeholders—including NGOs, universities, and government agencies—enhances community capacity, technical knowledge, and overall effectiveness. These combined factors underscore that sustainable mangrove conservation cannot be achieved without strong and continuous community involvement.

Nevertheless, significant challenges remain, particularly related to financial constraints, technical difficulties in ensuring seedling survival, and inconsistent policy enforcement. Weak institutional support leaves community initiatives vulnerable to

external pressures such as aquaculture expansion, land conversion, and coastal development. Addressing these issues requires an integrated approach that balances bottom-up participation with top-down governance, where policymakers prioritize community empowerment through training, financial assistance, and the formal recognition of traditional practices. Strengthening partnerships among communities, NGOs, universities, and government institutions is essential to ensure that mangrove conservation in West Papua is not only ecologically resilient but also socially inclusive and sustainable in the long term.

REFERENCES

- [1] G. Cuenca-Ocay, "Mangrove ecosystems' role in climate change mitigation," *Davao Res. J.*, vol. 12, no. 2, pp. 72–75, 2019.
- [2] A. Kumari and M. S. Rathore, "Roles of mangroves in combating the climate change," in *Mangroves: Ecology, Biodiversity and Management*, Springer, 2021, pp. 225–255.
- [3] E. A. Giofandi, D. Sekarjati, M. Arshad, H. Rahman, and B. Tjahjono, "Spatial Temporal Changes in Mangrove Forests on Tarakan Island, North Kalimantan, Indonesia," in *International Conference on Radioscience, Equatorial Atmospheric Science and Environment*, Springer, 2023, pp. 613–622.
- [4] M. Naskar, S. N. Tasneem, S. Mazumder, C. Mitra, and D. Datta, "Mangroves as coastal rainforests: imminent threats, hazards, and changing status of ecosystem services," in *Biological and Environmental Hazards, Risks, and Disasters*, Elsevier, 2023, pp. 335–357.
- [5] V. B. Arifanti, "Mangrove management and climate change: a review in Indonesia," in *IOP conference series: earth and environmental science*, IOP Publishing, 2020, p. 12022.
- [6] M. Kerlirey, M. Tjoa, and I. Iskar, "PARTISIPASI MASYARAKAT DALAM PENGELOLAAN HUTAN MANGROVE DI DESA BUANO SELATAN KABUPATEN SERAM BAGIAN BARAT," *MARSEGU J. Sains dan Teknol.*, vol. 1, no. 3, pp. 279–287, 2024.
- [7] E. A. Handayani, A. Sugiarti, and S. Burhani, "Partisipasi Masyarakat dalam Mendukung Konservasi Ekosistem Mangrove di Kawasan Ekowisata Luppung, Kabupaten Bulukumba," *J. Sos. Ekon. Kelaut. Dan Perikan.*, vol. 18, no. 1, pp. 15–23, 2023.
- [8] S. Sathiyamoorthy and T. Sakurai, "Effectiveness of community participation in Mangrove restoration: the evidence from northern Sri Lanka," *Environ. Econ. Policy Stud.*, vol. 26, no. 4, pp. 759–779, 2024.
- [9] L. N. Ntibona, M. S. Shalli, and M. M. Mangora, "Willingness and drivers of community participation in mangrove conservation in the Rufiji Delta, Tanzania," *West. Indian Ocean J. Mar. Sci.*, vol. 22, no. 1, pp. 31–45, 2023.
- [10] D. Alfandi, R. Qurniati, and I. G. Febryano, "Partisipasi masyarakat dalam pengelolaan mangrove (community participation in mangrove management)," *J. Sylva Lestari*, vol. 7, no. 1, pp. 30–41, 2019.
- [11] S. H. A. Koda, "Strategies for improving community participation in mangrove ecosystem conservation in teluk kupang coastal areas (a case study of nunkurus and oeteta villages)," in *IOP Conference Series: Earth and Environmental Science*, IOP Publishing, 2023, p. 12029.
- [12] B. Fannani and A. S. Ma'arif, "The Theological Imperative of Marine Ecosystem Conservation via Mangrove Forest Preservation: A Study of the Social Construction of Kyai Nahdlatul Ulama and Muhammadiyah," *KARSA J. Soc. Islam. Cult.*, vol. 32, no. 1, pp. 147–172, 2024.
- [13] D. Kresnasari, D. Mustikasari, and B. Handoko, "Konservasi Mangrove Berbasis Pendekatan Ekosistem Sebagai Penunjang Pengembangan Ilmu Pengetahuan Di Segara Anakan, Cilacap," *SELAPARANG J. Pengabd. Masy. Berkemajuan*, vol. 6, no. 4, pp. 1857–1864, 2022.
- [14] M. Basyuni *et al.*, "Mangrove biodiversity, conservation and roles for livelihoods in Indonesia," in *Mangroves: Biodiversity, livelihoods and conservation*, Springer, 2022, pp. 397–445.
- [15] C. S. Imburi, R. Angrianto, E. A. Tanur, I. Widodo, and G. A. Sitompul, "Peran hutan mangrove dalam menanggulangi dampak perubahan iklim di wilayah pesisir Indonesia," *J. Geosains West Sci.*, vol. 2, no. 03, pp. 122–132, 2024.
- [16] T. C. Jennerjahn *et al.*, "Mangrove ecosystems under threat in Indonesia: The Segara Anakan Lagoon, Java, and other examples," in *Science for the protection of Indonesian coastal ecosystems (SPICE)*, Elsevier, 2022, pp. 251–284.
- [17] R. Maros, M. Tjoa, and D. Pattimahu, "PARTISIPASI MASYARAKAT DALAM PENGELOLAAN MANGROVE DI

- DESA WAIHERU KECAMATAN BAGUALA KOTA AMBON," *MARSEGU J. Sains dan Teknol.*, vol. 1, no. 5, pp. 452–466, 2024.
- [18] M. D. Widiastuti, N. Ruata, and T. Arifin, "Pemahaman dan partisipasi masyarakat dalam pengelolaan ekosistem mangrove di pesisir Laut Arafura Kabupaten Merauke," *J. Sos. Ekon. Kelaut. dan Perikan.*, vol. 13, no. 1, pp. 111–123, 2018.
 - [19] M. Tito, Y. Ludang, S. Sidauruk, and R. Sunaryati, "Kearifan lokal masyarakat menyikapi konservasi lahan pesisir di Desa Cemara Labat Kabupaten Kapuas," in *Unri Conference Series: Community Engagement*, 2022, pp. 261–274.
 - [20] E. Suyanto, W. Sotyanita, F. X. Wardhiyono, and R. Hendri, *Social Engineering on Mangrove Preservation Based on Fishermen's Local Wisdom*. Bandung Islamic University, 2017.
 - [21] U. Sulaiman¹ et al., "Contribution of local wisdom of the Bajo Tribe to preserve Indonesia's mangrove forests," 2023.
 - [22] P. Purwowibowo and N. D. Gianawati, "KEARIFAN LOKAL DALAM PELESTARIAN HUTAN MANGROVE MELALUI COMMUNIT DEVELOPMENT," *Bina Huk. Lingkung.*, vol. 1, no. 1, pp. 59–74, 2016.
 - [23] E. Asrawijaya, "Traditional Ecological Wisdom for the Resilience of Indigenous Peoples in Indonesia," *Besari J. Soc. Cult. Stud.*, vol. 1, no. 2, pp. 59–77, 2024.
 - [24] K. I. Majesty and M. Fadmastuti, "Degree of community participation in mangrove resources management as livelihood support in West Java, Indonesia," in *E3S Web of Conferences*, EDP Sciences, 2018, p. 10005.
 - [25] S. Suharti, D. Darusman, B. Nugroho, and L. Sundawati, "Conditions for successful local collective action in mangrove forest management: Some evidences from eastern coastal area of South Sulawesi, Indonesia," in *IOP Conference Series: Earth and Environmental Science*, IOP Publishing, 2022, p. 12024.
 - [26] A. Meilasari-Sugiana, "Collective action and ecological sensibility for sustainable mangrove governance in Indonesia: challenges and opportunities," *J. Polit. Ecol.*, vol. 19, no. 1, pp. 184–201, 2012.
 - [27] M. A. Janssen, "Introducing ecological dynamics into common-pool resource experiments," *Ecol. Soc.*, vol. 15, no. 2, 2010.
 - [28] C. Permatasari, T. Yuwono, and K. Kismartini, "Panglima Laot: Safeguarding Indonesia's West Coastal Marine Resources through Local Wisdom in Aceh, Indonesia," *Int. J. Sustain. Dev. Futur. Soc.*, vol. 1, no. 1, pp. 18–23, 2023.
 - [29] M. L. Salampessy, I. G. Febryano, E. Martin, M. E. Siahaya, and R. Papilaya, "Cultural capital of the communities in the mangrove conservation in the coastal areas of Ambon Dalam Bay, Moluccas, Indonesia," *Procedia Environ. Sci.*, vol. 23, pp. 222–229, 2015.
 - [30] D. A. A. Sari and E. Latifah, "Revitalization of traditional fisheries rights of indigenous people in sustainable fisheries management in Indonesia," in *IOP Conference Series: Earth and Environmental Science*, IOP Publishing, 2021, p. 12117.
 - [31] C. F. Rianny, S. Partelow, and B. Nagel, "Governance challenges for Indonesian pond aquaculture: a case study of milkfish production in Gresik," *Front. Aquac.*, vol. 2, p. 1254593, 2023.
 - [32] Dirhamsyah, "Maritime law enforcement and compliance in Indonesia: Problems and recommendations," *Marit. Stud.*, vol. 2005, no. 144, pp. 1–16, 2005.
 - [33] B. R. Crawford, A. Siahainenia, C. Rotinsulu, and A. Sukmara, "Compliance and enforcement of community-based coastal resource management regulations in North Sulawesi, Indonesia," *Coast. Manag.*, vol. 32, no. 1, pp. 39–50, 2004.
 - [34] R. Simarmata, "Legal complexity in natural resource management in the frontier Mahakam Delta of East Kalimantan, Indonesia," *J. Leg. Plur. Unoff. Law*, vol. 42, no. 62, pp. 115–146, 2010.
 - [35] U. Muawanah, R. S. Pomeroy, and C. Marlessy, "Revisiting fish wars: conflict and collaboration over fisheries in Indonesia," *Coast. Manag.*, vol. 40, no. 3, pp. 279–288, 2012.
 - [36] T. Lesmana, "Impact of Supply Chain Integration, Supplier Collaboration, and Quality Management on the Performance of Manufacturing Companies in Indonesia (Case Study of a Manufacturing Company in West Java)," *West Sci. Interdiscip. Stud.*, vol. 1, no. 05, pp. 68–76, 2023.
 - [37] S. Suharti, "Analisis berbagai peran para pihak dalam kemitraan pemanfaatan sumberdaya mangrove," *J. Penelit. Hutan dan Konserv. Alam*, vol. 13, no. 2, pp. 73–84, 2016.
 - [38] R. Sahraini, "Collaborative Governance Dalam Upaya Pelestarian Mangrove Dikawasan Pesisir Desa Tongke-Tongke Kabupaten Sinjai," 2019.
 - [39] T. Lesmana and K. Sulandjari, "Pemberdayaan Komunitas Lokal Dalam Pelestarian Lingkungan: Tinjauan Atas Proyek Kolaboratif, Keberlanjutan, Dan Pengambilan Keputusan," *J. Multidisiplin West Sci.*, vol. 2, no. 09, pp. 808–818, 2023.
 - [40] I. Erawati, "Partisipasi masyarakat dalam pengelolaan sumber daya lingkungan mangrove di Desa Bedono, Kecamatan Sayung," *Ruang*, vol. 1, no. 1, pp. 31–40, 2013.
 - [41] M. Hartono, I. Ronyastra, and T. A. Fajrin, "Human-Side Emotional Service Design for Experience-Centric Amusement Park," 2022.
 - [42] M. L. Salampessy, I. Lidiawati, A. Metak, and D. Fitrianti, "Women's Participation in Mangrove Conservation in Pantai Bahagia Village, Muara Gembong Regency, Bekasi," *For. Nat.*, vol. 1, no. 2, pp. 56–66, 2025.
 - [43] S. W. Tia and W. Fitrianti, "Pilihan tipe co-management konservasi hutan rawa mangrove dalam kasus kehadiran kelompok peduli pesisir," *Holist. J. Trop. Agric. Sci.*, vol. 1, no. 1, 2023.