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Community-Based Forest Management Strategy to Maintain Biodiversity in Papua

Christian Soleman Imburi[1], Bambang Nugroho[2], Dominggas M.H. Renwarin[3], Rusdi Anggrianto[4], Sutiharni[5]
[1-5]Fakultas Kehutanan Universitas Papua Manokwari Papua Barat

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ABSTRACT

This study explores the Community-Based Forest Management (CBFM) strategy as a means to maintain biodiversity in Papua, Indonesia. Using a qualitative approach, data were gathered through interviews with five key informants, including community leaders, local government officials, conservation NGO representatives, and researchers. Data analysis was conducted using NVivo software. The findings reveal that community participation, underpinned by indigenous practices, plays a critical role in forest conservation and biodiversity preservation. However, challenges such as limited resources, ambiguous land tenure systems, and external pressures hinder the effectiveness of these strategies. The integration of modern technology, such as GIS, was identified as a potential enhancer of CBFM outcomes, though capacity-building remains essential. This study underscores the importance of collaborative approaches, policy reforms, and capacity development in strengthening community-based conservation initiatives.

Corresponding Author:

Name: Christian Soleman Imburi
Institution: Fakultas Kahutanan, Universitas Papua Manokwari Papua Barat
Email: Christiansoleman001@gmail.com

1. INTRODUCTION

Forests in Papua, Indonesia, are critical ecosystems that harbor a significant portion of the world's biodiversity, including unique species of flora and fauna. However, these forests face severe threats from deforestation and unsustainable practices driven by economic pressures. The need for sustainable management strategies is urgent to preserve these vital ecosystems. Papua's forests are home to diverse species, including unique orchids and newly recorded species like Litoria sanguinolenta, highlighting the region's rich biodiversity [1]. Forests also provide essential ecosystem services such as carbon sequestration, climate regulation, and water purification, which are crucial for human well-being and environmental health [2], [3]. Deforestation and land conversion for agriculture and infrastructure development are major threats, leading to habitat loss and biodiversity decline. Unsustainable practices, such as illegal logging, further exacerbate forest degradation, impacting both the environment and local communities [4]. Implementing sustainable forest management practices, including afforestation and reforestation, can enhance carbon sequestration and biodiversity conservation [3]. Recognizing indigenous rights and

incorporating traditional knowledge into forest management can support conservation efforts and sustainable development [3]. Furthermore, the economic valuation of forest services, such as carbon absorption and water regulation, can inform policy decisions and promote sustainable practices [4].

Community-Based Forest Management (CBFM) in Papua utilizes the traditional ecological knowledge and cultural practices of indigenous communities to promote sustainable forest governance. Communities such as those in Bintuni Bay apply ancestral knowledge reinforced by customary laws and rituals that support environmental sustainability [5]. Customary law plays a vital role in resolving environmental conflicts through restorative and collective approaches that align more closely with local values than formal legal systems [6]. Community empowerment, as demonstrated through the S-O-A-R approach in Central Sulawesi, enhances local capacity to protect forests while improving economic well-being [7]. Active community participation, like in the western forests of Gilan province, is crucial for adaptive conservation outcomes based on indigenous knowledge [8]. Furthermore, community forestry provides economic benefits through the management of commodities inside and outside forest areas, supported by the synergy of physical, human, natural, social, and financial capital to meet daily needs [9].

Despite the potential of CBFM, its implementation in Papua faces numerous obstacles. Limited access to resources, weak policy support, and external pressures from large-scale industries are significant barriers to its success. Furthermore, the integration of traditional knowledge with modern conservation approaches remains a complex task requiring careful negotiation between stakeholders. Understanding how CBFM can be optimized to maintain biodiversity in Papua is critical for developing sustainable strategies that align with both environmental and socio-economic objectives. This study aims to explore the effectiveness of CBFM strategies in maintaining biodiversity in Papua, focusing on the experiences and insights of key informants actively involved in forest management.

2. LITERATURE REVIEW

2.1 Community-Based Forest Management (CBFM)

Community-Based Forest Management (CBFM) in Indonesia is a participatory approach that empowers local communities to manage forest resources sustainably by integrating local knowledge and fostering a sense of ownership, making it effective for both conservation and livelihood goals. Its success depends on factors such as community capacity, participatory governance, institutional support, and the legal recognition of indigenous land rights. In Central Sulawesi Province, community empowerment through local wisdom has proven crucial for sustainable forest management [7], while participatory approaches in Masihulan Village have improved understanding of sustainable practices and facilitated access to government support [10]. Institutional strengthening in the same village highlights the importance of robust frameworks for resource access and governance [10], and legal recognition of indigenous land rights remains essential for equitable and empowered forest management [11]. Nevertheless, CBFM continues to face challenges, including resource scarcity and competing land-use interests, which require supportive policies and capacity-building programs [11]. At the same time, emerging technologies such as GIS and citizen science platforms present new opportunities to enhance community-led monitoring and conservation efforts [11]. While CBFM programs have shown promising results in reducing forest degradation, their effectiveness in biodiversity conservation remains a critical area of study.

2.2 Biodiversity Conservation in Papua

Papua's forests are renowned for their rich biodiversity, hosting numerous endemic species and playing a crucial role in maintaining ecological balance and supporting indigenous communities.

Indigenous knowledge systems, such as those practiced by the Sougb Tribe, are central to biodiversity conservation through traditional practices like rotational farming, sustainable harvesting, and ethnobotanical uses exemplified by Noken-making, which help preserve biocultural diversity and habitats [12]. Communities in areas like Bintuni Bay rely on ecological knowledge passed down through generations, supported by customary laws and cultural rituals to manage their environment sustainably [5]. These community-based conservation efforts are deeply linked to rural livelihoods and promote diverse, sustainable economies beyond market-driven mechanisms [13]. However, Papua's forests face growing threats from illegal logging, mining, and agricultural expansion, leading to forest degradation and ecosystem disruption [5]. These challenges are further intensified by weak enforcement and conflicting land-use policies, underscoring the urgency of strengthening community-driven conservation [5]. Moreover, regions like South Sorong District demonstrate high biodiversity across varied ecosystems, including orchids and newly identified amphibians, highlighting the need for targeted conservation strategies to prevent species extinction [1].

2.3 Role of Indigenous Communities in Forest Management

Indigenous communities play a vital role in biodiversity conservation through traditional ecological knowledge (TEK) and sustainable resource management practices rooted in cultural traditions. In Papua, practices like sasi and customary rituals help regulate resource use and protect habitats, as demonstrated in Bintuni Bay where TEK balances exploitation with conservation. Similar practices in Kalinga, Philippines, such as natural farming, contribute to climate resilience and biodiversity protection [14]. However, integrating TEK into formal management frameworks faces challenges due to the invisibility and undervaluation of indigenous groups, as seen in Brazil's PNPCT policy struggles [15], and pressures from modernization in Kalinga [14]. Institutional barriers also persist, with international law often neglecting indigenous roles in forest governance [16], while limited local participation and recognition in places like Gilan, Iran, have led to forest degradation, underscoring the need for inclusive conservation strategies [8]

2.4 Research Gaps and Opportunities

While existing studies have extensively documented the role of CBFM in forest conservation, there is limited research on its specific impact on biodiversity in Papua. Additionally, the integration of indigenous knowledge with modern conservation techniques remains an underexplored area. Addressing these gaps can provide valuable insights into optimizing CBFM for biodiversity conservation.

This study contributes to the literature by examining the strategies, challenges, and opportunities associated with CBFM in Papua through a qualitative lens. By leveraging NVIVO for data analysis, the research aims to uncover nuanced perspectives from key stakeholders, offering actionable recommendations for sustainable forest management.

3. METHODS

3.1 Research Design

This study employs a qualitative research design to explore the strategies and effectiveness of Community-Based Forest Management (CBFM) in maintaining biodiversity in Papua. A qualitative approach was deemed appropriate for capturing the nuanced perspectives, experiences, and insights of key stakeholders involved in forest management and biodiversity conservation.

3.2 Research Setting

The research was conducted in Papua, Indonesia, a region renowned for its rich biodiversity and strong reliance on indigenous community involvement in forest management. The study focuses on areas where CBFM initiatives are actively implemented, providing a relevant context for examining the relationship between

community participation and biodiversity conservation.

3.3 Informants and Sampling

The study involved five key informants selected through purposive sampling to ensure participants had substantial expertise and firsthand experience in forest management and biodiversity conservation. The informants included community leaders representing indigenous groups involved in Community-Based Forest Management (CBFM) initiatives, local government officials providing insights into policy frameworks and governmental support, conservation NGO representatives offering perspectives on challenges and opportunities in biodiversity conservation, forestry experts sharing technical knowledge on sustainable forest practices, and academics or researchers contributing analytical views on integrating traditional knowledge with modern conservation approaches.

3.4 Data Collection Methods

The study utilized multiple qualitative data collection methods to ensure comprehensive and reliable findings. In-depth, semi-structured interviews were conducted with all five informants to gather detailed insights into their experiences, perceptions, and recommendations regarding Community-Based Forest Management (CBFM), with open-ended questions allowing for thorough exploration of key themes. Document analysis was also employed, reviewing relevant materials such as policy briefs, conservation reports, and community guidelines to provide contextual and supporting evidence. Additionally, field observations at selected CBFM sites were carried out to capture real-world practices, community dynamics, and ecological conditions.

3.5 Data Analysis

The collected data were analyzed using NVIVO software, a robust tool for qualitative research. The analysis began with organizing the data by importing interview transcripts, field notes, and relevant documents into NVIVO for systematic coding and categorization. Through thematic analysis, key patterns and themes related to strategies, challenges, and outcomes of Community-Based Forest Management (CBFM) were identified and grouped under broad categories such as community engagement, biodiversity impact, and policy implications. To ensure the credibility and reliability of the findings, triangulation was employed by cross-verifying data from interviews, observations, and documents to confirm consistency and strengthen the validity of the analysis.

4. RESULTS AND DISCUSSION

The analysis of qualitative data collected from the five informants revealed several key findings regarding the effectiveness of Community-Based Forest Management (CBFM) in maintaining biodiversity in Papua. These findings are supported by direct quotations from the informants, which provide deeper insights into their perspectives and experiences.

4.1 Community Participation in Forest Management

Community participation was highlighted as the foundation of successful Community-Based Forest Management (CBFM) strategies. Informants emphasized the crucial role of indigenous practices in forest conservation, particularly the enforcement of customary rules that regulate resource use and protect biodiversity. One community leader noted:

"We have customary rules that prohibit hunting certain animals and cutting trees in specific areas. This is how we keep the forest healthy and protect biodiversity."

Despite these traditional practices, some informants pointed out ongoing challenges in ensuring broader compliance, especially in the face of external threats. A local government official stated: *"There are still conflicts with external parties who want to exploit forest resources without respecting customary rules."*

4.2 Biodiversity Conservation Outcomes

The informants reported positive outcomes in terms of biodiversity conservation in areas managed under

Community-Based Forest Management (CBFM). Protected areas overseen by local communities demonstrated healthier ecosystems and greater species diversity. A conservation NGO representative shared:

"In areas managed by local communities, we see many endemic species, such as birds of paradise, still thriving. This is rarely seen in regions damaged by commercial activities."

However, the threat of illegal logging and mining remains a significant concern that undermines conservation progress. A forestry expert noted:

"These illegal activities not only damage ecosystems but also threaten the sustainability of community-based conservation practices."

4.3 Challenges in Implementation

Several challenges were identified in the implementation of Community-Based Forest Management (CBFM) strategies, including resource constraints, policy barriers, and external pressures. One academic/researcher highlighted:

"The main challenge is the lack of financial and technical support for communities to enhance their capacity for sustainable forest management."

Moreover, overlapping land tenure systems often led to conflicts between communities and external stakeholders. A local government official explained:

"Ambiguous legal systems result in overlapping land claims, making it difficult for communities to maintain their land rights."

4.4 Role of Technology in CBFM

The integration of modern technology was seen as a potential game-changer for enhancing the effectiveness of Community-Based Forest Management (CBFM). Tools such as Geographic Information Systems (GIS) offer new ways to monitor forest conditions, track biodiversity, and support decision-making in conservation efforts.

A conservation NGO representative stated:

"We have started using technologies like GIS to map forests and monitor biodiversity. This is very helpful, but training for local communities is still needed."

DISCUSSION

The findings underscore the critical role of community participation in preserving biodiversity. Indigenous knowledge and customary practices were found to be highly effective in regulating forest use. This supports the argument made by [5], [14], [16], [17] that community-based stewardship is essential for ecological sustainability. However, formal recognition of customary land rights remains a crucial factor in enabling communities to fully realize their conservation potential.

The challenges faced by CBFM initiatives in Papua reflect broader governance and resource issues. Collaboration between communities, government agencies, and NGOs is essential to overcome these barriers. Capacity-building programs, policy reforms, and financial support are critical to strengthening community-based approaches to forest management.

The integration of technology, such as GIS and remote sensing, with traditional knowledge presents an opportunity to enhance CBFM effectiveness. However, ensuring accessibility and adequate training for community members is essential to maximize the benefits of such technologies.

Implications for Policy and Practice

This study highlights several policy implications:

a. Policies should formally recognize customary land rights to empower communities.
b. Investment in training and resources for local communities is needed.
c. Partnerships among stakeholders can address systemic challenges and leverage diverse expertise.
d. Programs should focus on training communities to use advanced tools for forest monitoring.

5. CONCLUSION

This study demonstrates the potential of Community-Based Forest Management (CBFM) as an effective strategy for maintaining biodiversity in Papua. The active

participation of local communities, guided by indigenous knowledge and customary practices, plays a pivotal role in achieving conservation goals. However, the effectiveness of CBFM is often constrained by challenges such as limited financial and technical resources, unclear land tenure policies, and external pressures from activities like illegal logging and mining.

The findings emphasize the need for integrated efforts involving communities, governments, and NGOs to overcome these challenges. Collaborative approaches, capacity-building programs, and legal recognition of customary land rights are essential for strengthening CBFM initiatives. Furthermore, the integration of technology—such as GIS and biodiversity monitoring tools—offers valuable opportunities to enhance conservation outcomes, provided that local communities are equipped with the necessary skills and resources. Future efforts should prioritize creating a supportive policy environment, fostering multi-stakeholder collaboration, and scaling up successful practices to other regions. By addressing these critical issues, CBFM can become a sustainable model for biodiversity conservation in Papua and beyond.

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