

Enhancing Environmental Preservation Through Mangrove Afforestation In The Youtefa Bay Area

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Abstract.

The degradation of mangrove areas is often caused by human activities such as timber exploitation, conversion of mangrove areas into roads, bridges, and residential settlements, as well as natural environmental changes. Youtefa Bay Nature Tourism Park is a conservation area characterized by stunning natural landscapes, extensive coastlines, mangrove forests, lowland tropical forests, and a rich marine ecosystem. If managed properly, the area holds great potential to generate substantial benefits for the surrounding communities. However, the current reality on the ground reveals that the management of the area remains fragmented and poorly planned. This uncoordinated approach has contributed to various environmental problems within the conservation area. Mangrove forests are among the most strategic coastal ecosystems. In Indonesia, the total area of mangrove forests continues to decline annually, primarily due to land-use changes for housing and the development of various infrastructure projects. This community engagement activity aimed to contribute to the conservation of mangrove forests in Youtefa Bay Nature Tourism Park. The initiative was carried out on October 18-19th 2023, by the Forum Manajemen Indonesia (FMI). The planting method used was the single planting technique. The mangrove planting event was successfully conducted and received appreciation from various stakeholders, particularly government representatives and lecturers from the Forum Manajemen Indonesia. To maximize the ecological function of this conservation area, it is crucial to ensure the ongoing preservation of its mangrove forests. One concrete effort undertaken is the reforestation of mangrove areas through collaborative action. This community services were part of a series of programs organized by FMI in Papua and was designed to support mangrove ecosystem rehabilitation while enhancing the roles of local communities, academic institutions, and government bodies in environmental conservation.

Keywords: Mangrove; Conservation; Youtefa Bay and Forum Manajemen Indonesia.

I. INTRODUCTION

Youtefa Bay, located in Jayapura, Papua, is an ecotourism area with high ecological and economic value. The area is characterized by a stunning natural landscape that includes extensive coastlines, lush lowland forests, mangrove vegetation, and rich marine biodiversity, all of which offer great potential to provide long-term ecological and socio-economic benefits if managed sustainably. However, the reality on the ground shows that the management of this area remains fragmented, uncoordinated, and largely unsustainable, contributing to increasing environmental problems within the region (Alfons, 2018). One of the most pressing environmental concerns in Youtefa Bay is the degradation of its mangrove ecosystem, which plays a vital role in maintaining the ecological balance of the coastal zone. Mangrove degradation in the region is frequently driven by anthropogenic factors such as timber exploitation, conversion of mangrove areas into infrastructure, roads, bridges, and settlements, in addition to natural processes (Alfons, 2006). According to Kodoatie and Sjarief (2010), mangroves represent one of the most vital and strategic components of the coastal environment. These ecosystems are complex and dynamic, linking terrestrial systems with offshore marine habitats (Sukojo et al., 2019). Mangrove forests comprise a diverse group of plants, including trees, shrubs, palms, and ferns, all of which are adapted to environments influenced by tidal activity.

Furthermore, mangroves serve as critical habitats for marine fauna such as fish, mollusks, and crustaceans, contributing to biodiversity conservation and supporting the livelihoods of coastal communities (Wahyudi, 2022). From an ecological standpoint, mangrove forests provide multiple ecosystem services, such

as shoreline stabilization, sediment trapping, and storm protection. According to Hari (2009), mangroves serve as a natural green belt capable of reducing coastal erosion, even in the event of extreme weather conditions or tsunamis. They also play a crucial role in climate change mitigation by sequestering significant amounts of carbon. In terms of economic value, mangrove forests support fisheries and aquaculture activities, providing habitat for commercially valuable species such as fish, shrimp, crabs, and sea urchins (Irma et al., 2021). In addition, mangroves are utilized as sources of fuelwood, building materials, salt production, and other livelihood needs (Valiela et al., 2001; Bosire et al., 2005). However, the multifunctionality of mangrove ecosystems has led to their overexploitation.

The increasing rate of economic development and population growth has triggered excessive use of natural resources, further diminishing the environmental carrying capacity and contributing to ecological degradation (Supardjo, 2008; Kustanti, 2011; Pursetyo et al., 2013). Between the years 2000 and 2014, Indonesia experienced the highest global rate of mangrove loss, with a total deforestation of 4,354 km², or about 311 km² annually (Hamilton, 2016). Recent data indicates that from approximately 3.49 million hectares of mangrove forests in Indonesia, only 1.67 million hectares remain in good condition. The remaining 1.82 million hectares—or 52.14%—are categorized as critical and urgently require rehabilitation (Karimah, 2017). According to the Peatland and Mangrove Restoration Agency (Badan Restorasi Gambut dan Mangrove Indonesia, 2023), the current total extent of mangrove forests in Indonesia is approximately 3,364,081 hectares, signaling an ongoing decline. In the context of Youtefa Bay, mangrove degradation is especially alarming and has direct implications for the well-being of local communities. Based on data from the Balai Pemantapan Kawasan Hutan (BPKH) Wilayah X Papua in Handono et al. (2014), the mangrove area in Youtefa Bay decreased significantly from 511.24 hectares in 1967 to only 241.24 hectares by 2008. This trend continues due to high levels of coastal development in Jayapura City, particularly the construction of the coastal ring road, which directly and indirectly impacts mangrove forest sustainability (Handono et al., 2014; Paulangan, 2014; Antoh, 2015).

As mangrove coverage diminishes, the ecosystem's ability to support biodiversity, protect coastlines, and provide economic resources also declines, placing local livelihoods at risk (Wahyuni et al., 2014). For the indigenous Papuan communities, particularly women, mangrove forests have profound socio-cultural and economic significance. These ecosystems function not only as sources of subsistence—providing shellfish, snails, shrimp, and firewood—but also as spaces for social and cultural interaction. The loss of mangroves, therefore, threatens both material well-being and cultural practices. In light of this, the Jayapura City Government has implemented several programs aimed at restoring mangrove ecosystems. These initiatives are expected to improve local ecosystem resilience and reduce the risks of drought, food insecurity, and climate-related disasters. Nonetheless, environmental degradation continues to intensify due to unregulated urban expansion and socio-economic pressures. High sedimentation, turbidity in water bodies, and the accumulation of domestic and industrial waste contribute to declining water quality and environmental aesthetics, thereby undermining the ecotourism potential of the region (Manalu, 2012; Alam, 2022; Sari, 2022). At the same time, issues such as poverty, low education levels, limited access to environmental information, and changing social behavior pose further challenges to sustainable management.

Tamsil et al. (2023) also note that increasing demands for residential space and household resources such as firewood, charcoal, and building materials are exacerbating pressure on coastal ecosystems. In response, educational and participatory approaches to conservation have been introduced to raise public awareness and community engagement. A notable initiative is the eco-edu-tourism program developed by the Community Service (PKM) of Yapis Papua University. This program offers training, outreach, and alternative tourism experiences to promote environmental education and stewardship. The aim is to enhance local capacity, particularly among community groups such as Forum Manajemen Indonesia (FMI), to engage in sustainable mangrove planting and conservation activities. Through such efforts, it is hoped that a more holistic, inclusive, and sustainable management framework for Youtefa Bay can be realized, aligning ecological restoration with the socio-economic needs of local populations.

II. METHODS

The Community Service (PKM) was implemented in collaboration with the forum Manajemen Indonesia (FMI). The procedural steps adopted in this method include: (1) Socialization; (2) Extension/Education; (3) Training on site selection and selection of mangrove seedlings; and (4) Evaluation of program outcomes. The targeted participants of this activity consisted of members of FMI, comprising management lecturers from various higher education institutions across Indonesia, with a total of 90 participants. The participants engaged in this PKM initiative as partners working alongside the PKM Team from Yapis University of Papua, Jayapura.

Methodological Approach

The approach utilized in supporting this Community service was a participatory method, wherein the partner group actively participated in the process (Sari et al., 2023), particularly through training and assistance in mangrove planting activities. The mangrove planting activity took place on October 19, 2023, within the Mangrove Forest Conservation Area, Jayapura City, Papua. The event was attended by FMI administrators and participants, university students, representatives from the Jayapura city government, police authorities, and members of the local community.

The stages of this community service activity included:

- a) **Proposal Preparation:** Preparatory activities involved conducting a literature review, coordinating with relevant governmental agencies, formulating a detailed activity agenda, and budgeting.
- b) **Site Survey:** Conducted to ensure the selected location was suitable for mangrove growth. The survey helped determine the area size to be planted, estimate the number of seedlings required, and identify optimal planting zones.
- c) **Procurement of Mangrove Seedlings and Equipment:** Seedlings were acquired from the local agricultural office, taking into account the age and health of the seedlings. Planting tools and equipment were also prepared to ensure smooth implementation.
- d) **Activity Implementation:** Participants were divided into groups of 2–3 individuals and assigned to specific planting points. Upon completing the planting, participants also engaged in eco-tourism activities within the mangrove forest.

Time and Venue of Activities

The Community Service (PKM) activities were conducted over two days, October 18–19, 2023. The educational sessions were held in the 9th-floor auditorium of the Governor's Office of Papua Province, while the mangrove planting took place in the Youtefa Bay area, a designated conservation zone.

III. RESULT AND DISCUSSION

Mangrove vegetation plays a vital role in producing oxygen (O₂), absorbing carbon dioxide (CO₂)—a toxic greenhouse gas—and serving as a natural barrier to coastal abrasion. However, the current condition of mangrove forests along Indonesia's coastlines is deeply concerning. Many areas have suffered significant degradation or total destruction due to illegal logging and other human activities. This degradation poses serious threats to environmental sustainability. Given the importance of mangrove ecosystems, it is imperative to implement effective solutions such as establishing conservation zones to protect and preserve mangrove forests, initiating reforestation efforts involving both governmental and local community actors, and implementing effective coastal spatial planning to enhance the economic potential of ecotourism in mangrove areas. Legal enforcement must also be strengthened to penalize those who destroy mangrove ecosystems.

This initiative was aimed at supporting the rehabilitation and restoration of mangrove ecosystems while enhancing public, governmental, and academic engagement in coastal conservation. Beyond their role in carbon sequestration, mangrove forests also help mitigate climate change impacts and protect coastal areas from the destructive force of tropical storms. The outcomes of this community service program included:

1. Improved air quality within the Mangrove Ecotourism Zone in Youtefa Bay, Jayapura, Papua;
2. Prevention of coastal erosion;
3. Expansion of mangrove forest areas.

The mangrove planting activities were carried out smoothly, resulting in positive ecological and aesthetic impacts on Youtefa Bay. These included re-greening efforts, reduced coastal abrasion, and increased appeal as a tourist destination. The overall program was conducted successfully with high levels of enthusiasm and participation from various stakeholder groups. This was evidenced by the active involvement of diverse participants and confirmed by remarks from the local FMI committee and public officials, who emphasized the significant environmental and tourism benefits of the initiative. The event was recommended to become a regular activity due to its far-reaching positive impacts. The PKM team organized the schedule, ensured the availability of materials and tools, and arranged transportation to the planting site. The team was divided into two sub-groups: a socialization team responsible for theoretical instruction, and a field team tasked with assisting participants during practical activities. Prior to the planting, participants were grouped and given orientation. The planting site was cleared of hazardous materials to reduce injury risks, and name boards were installed for regional representation.

Seedlings were also prepared in advance. Mangrove reforestation is a concrete expression of environmental responsibility, particularly toward preserving mangrove ecosystems for long-term sustainability. Mangrove forest conservation provides both direct and indirect benefits. As oxygen producers and carbon dioxide absorbers, mangroves play a critical ecological role while also preventing coastal abrasion. Unfortunately, many mangrove forests along Indonesia's coasts remain in a degraded state, primarily due to illegal logging and other damaging activities (Safar M.R. et al., 2024). Replanting efforts aim to rehabilitate damaged areas and protect erosion-prone coastlines. This community service activity engaged universities, students, local communities, and relevant stakeholders in selecting seedlings, planting, and maintaining mangrove forests based on conservation principles. This structured reforestation model made the service activities efficient and effective. Systematic mangrove planting also facilitates improved spatial planning of coastal zones—covering residential areas, vegetation, and more. Coastal regions can be developed into ecological cities and nature-based tourism destinations, provided public awareness and stewardship of mangroves are well-maintained. Through these reforestation efforts, integrated coastal ecosystem restoration can be achieved.

Implementation Phases of the Activity

a. Socialization: The preparation phase began with site observation to discuss the strategy for the community service activity. As stated by Tang et al. (2023), site selection must be preceded by a suitability survey. During this phase, infrastructure and logistics were also prepared. Socialization served as the introductory phase of implementation, intended to inform target partners and stakeholders of the upcoming activities through direct discussion with the regional chairperson of FMI Papua.

b. Theoretical Class (Outreach): This phase involved the delivery of educational material and interactive discussions. Topics included:

1. The importance of mangrove ecosystem management;
2. Site selection for planting;
3. Selection of suitable mangrove seedling species based on location;
4. Proper planting techniques.

The outreach also addressed biological and ecological aspects of mangroves, as well as their direct and indirect economic value.

c. Field Practice and Planting Assistance: The mangrove planting training began with a site survey conducted through active participation. The PKM team and partner groups jointly inspected the planting site, assessing substrate conditions, local community activity, temperature, and salinity. Similar steps were taken by Tamsil et al. (2022), who emphasized selecting previously unplanted areas or replanting dead vegetation (gap-filling). Seedling selection and planting techniques were demonstrated by the PKM team through direct, hands-on practice.

d. Evaluation: Aspects assessed included attendance and engagement levels of partner groups, comprehension of the material, and the growth performance of planted mangrove seedlings. According to Tamsil et al. (2022), monitoring is essential to evaluate the success of PKM activities. Evaluations aimed to determine whether outreach and training had a positive impact—measured by improvements in knowledge, skills, attitudes, or behavior.



Fig 1. Documentation of Mangrove planting Activity

IV. CONCLUSION

The rehabilitation of mangrove forests in Youtefa Bay has contributed significantly to the revitalization of the area as an attractive ecotourism destination. Improvements such as cleaner seawater, an increase in fish and bird populations, and a reduction in the risk of natural disasters enhance the region's value as a sustainable nature-based tourism destination. The conservation of mangrove ecosystems is not only a strategic effort to preserve ecotourism potential but also serves as a legacy for future generations. With consistent implementation and the active support of multiple stakeholders, Youtefa Bay has the potential to become a model of successful coastal environmental conservation in Indonesia. The local government and community have expressed strong appreciation for the mangrove planting initiative, recognizing it as a manifestation of higher education institutions' concern for environmental sustainability, particularly within coastal areas. Findings from the implementation of the program indicate a high level of enthusiasm among participants during training sessions and guided mangrove planting activities. Moreover, the program serves as an important medium for introducing and enhancing public understanding of the significance of mangrove conservation. The replanting of mangrove trees in the conservation area of Youtefa Bay in Jayapura, Papua, represents a form of community service aimed at supporting the coastal ecosystem in Hamadi, Jayapura.

This initiative reflects a commitment to protecting aquatic and mangrove forest environments, with long-term objectives directed toward sustainable ecological preservation. More broadly, this conservation effort is expected to yield both direct and indirect benefits, such as oxygen production and, most importantly, coastal abrasion prevention. The program involves the collaboration of various parties, creating an effective and efficient model of community service in environmental protection. Moving forward, the active participation of local communities is crucial to ensure the continuity and success of these conservation efforts. An additional initiative includes the utilization of mangrove fruit as a food ingredient, with products such as pudding, bread, chips, and syrup already being developed. Notably, mangrove is also being explored as a natural dye for batik fabrics, with tangible results already being enjoyed by the local community. To further strengthen the protection of mangrove ecosystems in Youtefa Bay, it is recommended that local governments formulate the establishment of Community-Based Marine Protected Areas (MPAs). In several regions, MPAs have proven beneficial to communities, particularly through the preservation of coral reefs and mangrove forests, which in turn have brought fishing areas closer to shore. While the current state of coral and mangrove ecosystems remains relatively healthy, the formal designation of MPAs would provide legal authority and community empowerment to safeguard coastal and marine resources effectively.

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