



Revitalizing Mangroves for Inclusive Ecotourism: A Participatory Model from Muara Gembong, Indonesia

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Abstract

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The destruction of the mangrove ecosystem in the coastal area of Muara Gembong, Bekasi Regency, has led to a decline in environmental quality and reduced economic potential for the local community. Mangrove rejuvenation is a strategic solution to support sustainable ecotourism development while improving community welfare. The purpose of this study is to offer more information regarding the use of mangrove revitalisation as a strategy for developing sustainable ecotourism in Muara Gembong. The method used is a Community-Based Participatory Research (CBPR) approach with participatory observation techniques and documentation studies. The data were analysed descriptively by following the stages of data reduction and drawing conclusions. The results of this study indicate that mangrove regeneration in Muara Gembong has great potential as a new opportunity to develop sustainable ecotourism. It is impact on ecological and economic outcomes able to improve the welfare of coastal communities while preserving the environment. In conclusion, mangrove revitalisation in Muara Gembong is an effective model for developing sustainable ecotourism that has a positive impact on the environment and local economy enhances overarching policies for sustainable tourism management. Moreover, the possibility for replication of community-based strategy that fosters socioeconomic empowerment across Indonesia's coastal areas.

Introduction

Indonesia is known as an archipelagic country with the second-longest coastline in the world, making coastal ecosystems a vital asset in supporting environmental and economic sustainability. One important coastal ecosystem is mangrove forests, which not only serve as a natural barrier against abrasion and seawater intrusion but also serve as a habitat for various flora and fauna species, as well as a source of livelihood for the surrounding community (Setyawan, 2020). Integrated management of mangrove ecosystems in coastal areas is a multi-sectoral effort between the government, communities, science, management, sectoral interests, and community interests (Harefa, 2023). The use of mangrove forests as ecotourism destinations is a tourism activity in natural areas that aims to support environmental conservation, maintain ecosystem sustainability, and improve the welfare of local communities (Safuridar, 2019). However, rapid land conversion, illegal logging, and a lack of environmental awareness have caused damage to mangrove ecosystems in many areas, including Muara Gembong, Bekasi Regency.

Muara Gembong is a coastal area that was once rich in mangrove forests but now faces serious challenges due to environmental degradation. The natural mangrove forest in Muara Gembong, covering 10,481.15 hectares, has been significantly reduced. Most of this area, approximately 93.5%, which is less affected by tides, has been occupied by the community for fishponds and agricultural land (Perhutani, 2024). Mangrove damage in this area not only impacts the loss of biodiversity but also increases the risk of abrasion, decreases fisheries yields, and decreases the quality of life of coastal communities (Rahmawati, 2019).

Prior research indicates that most community members realize the essential ecological and socioeconomic functions of mangroves and demonstrate a strong commitment to their conservation and rehabilitation (Jadin & Rousseau, 2022). Furthermore, studies have underlined the necessity of involving communities into mangrove governance and management strategies to promote long-term conservation success (de Oliveira et al., 2024). Nevertheless, the current study lacks in demonstrating how integrated ecotourism-driven mangrove regeneration may successfully strengthen the socio-economic resilience of local communities, especially in contexts such as Muara Gembong, where dependence on mangrove resources is high.

Recent initiatives have presented innovated strategies that integrate mangrove restoration with the growth of sustainable ecotourism in the face of these obstacles. This integrated concept aims to restore ecological damage while also enhancing revenue-generating for coastal communities, including environmental learning tours and the production of mangrove-based local products (Syahputra, 2021). Muara Gembong is a concrete example of innovative coastal tourism developments that priorities synergies between environmental conservation and community empowerment.

The government, the community, and the business sector have collaborated to initiate various mangrove replanting programmers. This initiative not only encourages the creation of environmentally friendly tourist destinations but also strengthens the socio-economic resilience of coastal communities. With multi-stakeholder collaboration and continuous involvement, Muara Gembong has the potential to become an inspiring model for coastal ecosystem management for other regions in Indonesia. (Ministry of Tourism and Creative Economy, 2022).

Mangrove ecotourism contributes to the UN Sustainable Development Goals (SDGs), such as SDGs 1 (No poverty), 2 (Zero hunger), 11 (Sustainable cities and communities), 12 (Responsible consumption and production), 13 (Climate action), 14 (Life below water), and 15 (Life on land) (Blanton et al., 2024; Du et al., 2025; Lukman et al., 2025; Prayoga et al., 2024; Ruslan et al., 2022; Suryawan et al., 2025; Yuan & Lo, 2022). These contributions highlight the essential function of mangrove ecotourism as an integrated plan for merging preservation of the environment, socio-economic empowerment, and sustainable development on both local and global levels.

Thus, mangrove revitalization for sustainable ecotourism in Muara Gembong is a coastal management innovation that emphasizes not only conservation but also economic and social empowerment in the community. This initiative is expected to serve as an inspiring model for coastal tourism development in other regions in Indonesia, as well as support the achievement of the Sustainable Development Goals (SDGs), particularly those related to life below water and poverty alleviation.

Method

3.1. Data

This research uses a Community-Based Participatory Research (CBPR) approach to ensure collaboration between local and international students at President University, the local community of Muara Gembong, and industry partner PT Mulia Industri. The CBPR approach was chosen because of its emphasis on collaborative learning, mutual benefit, and the translation of research findings into practical strategies that can be directly applied in the field. By involving community members at every stage of the research process, from planning to implementation and evaluation, the goal is to effectively meet local needs and build community capacity.

3.2. Method

This participatory method ensures that the research is culturally relevant and responsive to the unique context of the community, ultimately leading to more impactful and lasting results (Commodore et al., 2017). Furthermore, this participatory method also ensures that the project is culturally and contextually relevant to the challenges faced by the coastal community in Muara Gembong. This activity was carried out in Muara Gembong District, Bekasi Regency, West Java, from June to July 2024. This location was chosen because it is a coastal area that has

experienced serious environmental degradation due to the conversion of mangrove ecosystems into fishponds and agricultural land, making it prone to abrasion and tidal flooding. Several stages were passed during this project, as described in the following section:

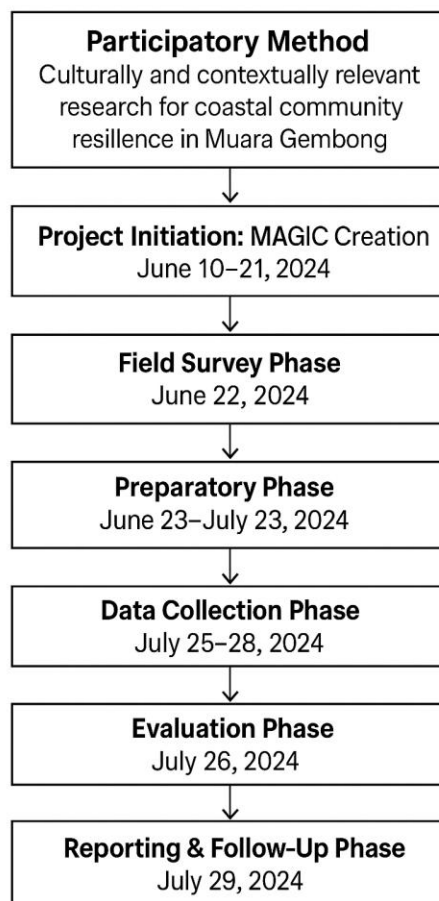


Figure 1. Flowchart of activities

The MAGIC (Mangrove Advocacy for Green Innovation & Conservation) initiative in Muara Gembong was executed via many participatory phases. A field study focused on recognizing critical environmental and social concerns and facilitating collaboration with PT Mulia Industri. The preparation phase included training student teams, equipping equipment, delineating mangrove planting locations, and orchestrating actions in accordance with local capabilities. The data collecting phase included participatory observation and informal sharing sessions to assess social, environmental, and learning outcomes. During the implementation phase, the project's main activities included planting 1,000 mangrove seedlings provided through collaboration with PT Mulia Industri, conducting training on producing local products such as dodol and batik from mangrove materials, and facilitating cultural exchanges between international students and the local community. During an assessment phase, results and a reporting and follow-up

phase to guarantee project sustainability. This participatory project used descriptive analysis based on field observations and reflections, with conclusions generated from activity results in connection to the primary aims and the local context of Muara Gembong.

Results

This project is a concrete example of innovative coastal area development that integrates mangrove ecosystem revitalization with strong ecotourism potential and community economic empowerment. In the coastal area of Muara Gembong, which has experienced ecosystem damage due to abrasion, land conversion, and low environmental awareness, this project presents an integrated empowerment model based on community participation and cross-stakeholder collaboration. This project has several impacts on the community and the social environment, including:

Ecological impact

By introducing participants to mangrove tree species, planting techniques, and their role in maintaining the coastline and supporting marine life, the project's results demonstrated significant improvements in preventing erosion and restoring the mangrove ecosystem in Muara Gembong. This aligns with the initial objectives and demonstrates that a participatory approach with local communities can be effective in conservation. Mangroves are a unique ecosystem in coastal areas which plays an important role in maintaining environmental balance. Mangroves protect the coastline from abrasion, seawater intrusion, strong winds, and tidal waves. Furthermore, mangroves provide nutrients for marine life; they provide feeding grounds, breeding grounds, and spawning grounds for various species of fish, shrimp, shellfish, and other marine life. Given their crucial role, mangroves need to be preserved.

Therefore, students from President's University collaborated with PT Mulia Industri to revitalize mangroves in the Muara Gembong area while celebrating World Mangrove Day in July 2024. This aims to restore mangrove areas damaged by abrasion, land conversion, and human activity. This revitalization benefits the sustainability of the lives of the coastal communities of Muara Gembong village and is also beneficial for environmental sustainability. Hanan (2020) states that mangrove revitalization has an impact on the ecosystem. Mangroves can reduce ocean wave height by 13% to 66%, especially if the mangrove forest extends 100 meters inland. This indicates that mangroves can reduce abrasion. Furthermore, mangroves can improve the quality of marine life because they provide habitat for animals such as fish, crabs, shrimp, and even water birds.

According to Hanan (2020), his research in Pantai Mekar village found several key mangrove species, such as *Avicennia marina*, *Rhizophora mucronata*, and *Sonneratia alba*, which are indicators of satisfactory natural habitat quality.

Furthermore, mangroves also function as natural filters to control marine waste pollution, such as heavy metals, sediment, and household waste carried by river currents. Mangrove regeneration also has a positive impact on seagrass beds and coral reefs because they are interconnected units.



Figure 2. Event on celebrating World Mangrove Day.

Economic Empowerments

This project also introduces students and participants to local MSME products made from mangroves, ranging from snacks and herbal drinks to batik making. These products are introduced to build a local entrepreneurial ecosystem. Students are educated about the production, packaging, and marketing processes. This approach also serves as a means of promoting local products. This approach has the potential to create a thematic tourism market rooted in local potential and conservation values. The project also directly contributes to strengthening the community's economy through the development of processed mangrove products and business in revitalizing ecosystems. These actors involved particularly women's groups and the KEBAYA community, are involved in training in the production of products such as mangrove dodol (sweetened beverages), syrup, and natural dyes made from mangrove materials for revitalizing ecosystem not only intended for local consumption but are also promoted to international students as an effort to open wider market access.



Figure 3. Students' participation in Mangrove planting and introducing Mangrove-based products

This capacity building includes technical processing skills, creative product design, and digital marketing strategies. In addition to introducing the added value of a mangrove ecosystem, this programme also serves as a means of social and economic empowerment for communities previously affected by environmental degradation. With this approach, the ecoprogram developed is not only about natural scenery but also about local flavours, community stories, and the competitiveness of regional products. Collaborating with international students can enhance international relations and generate opportunities to promote Muara Gembong ecotourism to a global audience. Through their experiences, international students have the potential to become promoters of Indonesian culture and values in their home countries.

Educational Exchange



Figure 4. Edutourism experiences

The success of this project relies on the participation of different groups, such as the KEBAYA community, PT Mulia Industri, students from various backgrounds, and the local community; together, they can help make Muara Gembong a leading ecotourism spot that focusses on working together and protecting nature while enhancing economic, cultural, and environmental values in a balanced way. In this project, mangroves are used as a medium for environmental education in the development of a creative economy and culture-based tourism by involving the local community and national and international students from President University. In this case, international students are invited directly to explore the mangrove forest, learn batik by making dyes from mangrove leaves, and make dodol from mangrove fruit with the local community there. All of this is a form of utilising mangroves as a medium for education and tourism.

Discussion

The study demonstrates how mangrove restoration may provide both ecological and social advantages, filling the void in current research that often overlooks the practical outcomes of community-driven ecotourism efforts. The Muara Gembong community gained practical knowledge about mangrove species, planting methods, and the ecological significance of mangrove ecosystems via active engagement, hence enhancing coastline restoration and erosion mitigation. These

results confirm prior study by Hanan (2020), which emphasized that mangroves not only safeguard coasts and purify waste but also provide essential homes for fish, prawns, and other marine life. In addition to ecological benefits, the project highlights the significance of adequate benefit distribution and the management of community expectations as important components for sustaining long-term engagement and motivation (Lukman et al., 2025). The Muara Gembong instance offers empirical evidence that the combination of mangrove rehabilitation with participatory ecotourism is a successful and repeatable model for strengthening coastal resilience and improving community quality of life.

The project also demonstrated that mangroves can support human livelihoods and are beneficial to the environment. Women's groups and the KEBAYA community learnt how to make natural dyes, syrup, and dodol, among other mangrove products. The fact that these products were promoted to international students demonstrated their potential for sale in larger markets. This approach helps the economy and the environment by teaching people how to create, package, and market products digitally.

Students from President University and individuals from other nations participated, which improved the educational and cultural exchange. Creating indigenous cuisine, dyeing batik, and planting mangroves all helped to promote Indonesian culture. International students can support Indonesian ecotourism when they return home.

Communities, universities, private companies, and international partners collaborated effectively, which is why this project was successful. This approach demonstrates how conservation, education, and community empowerment can all be used to grow ecotourism in a way that benefits the environment. Therefore, other coastal villages experiencing similar issues could use the Muara Gembong project as a model.

Conclusions

Mangrove revitalization in Muara Gembong, Bekasi Regency, is a strategic step to restore the ecological function of degraded coastal areas. Mangrove ecosystem rehabilitation efforts have not only succeeded in improving the quality of the coastal environment but also created new tourism attractions based on education and conservation. This has had a positive impact on increasing tourist visits and income for local communities. Therefore, the results of this study confirm that ecotourism management based on environmental conservation can provide dual benefits: revitalisation and ecotourism sustainability and encouraging local economic growth. Therefore, these results support the research objective of providing in-depth insight into the use of mangroves as a strategy for developing sustainable coastal tourism, which can ultimately serve as a good example of sustainable coastal tourism development in other areas with similar characteristics, with efforts to preserve the environment and empower coastal communities.

Declarations

No ethical issues have arisen during the study, and all procedures followed comply with the ethical standards.

Authors contribution

Author One, Ni Komang Indah Pratiwi, was responsible for draughting the introduction, including formulating the background, objectives, and theoretical context of the article. Author Two, Anggi Ananta Putri, wrote the abstract in Indonesian and English and draughted the conclusion based on the results of the activities and discussions that had been carried out. Author Three, Wa Ode Nesha Rahmadinah Koso, was responsible for draughting the methodology section, which included a description of the activity stages, the roles of partners, and the project implementation approach. Author Four, Amira Alrizky Manik, wrote the results and discussion section by analysing activity data and systematically describing the impact of the project. Author Five, Sefhia Helmayanti, assisted in developing the content and structure of the results and discussion sections and integrated field findings into the article narrative. Author Last, Filda Rahmiati, B.B.A., M.B.A., Ph.D., provided research direction, assisted in the design and draughting of the article, and supervised the overall writing and completion of the manuscript.

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Data availability

Data in this study is available by request.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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