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Ecosystem-based mangrove conservation strategies and the role of communities for sustainable management

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ABSTRACT

Background: Mangrove ecosystems provide essential ecological, economic, and social benefits but face significant degradation from human and natural pressures. This study analyzes ecosystem-based conservation strategies in Muara Gembong District, focusing on integrating conservation with sustainable economic activities. **Methods**: A qualitative descriptive approach was employed through literature reviews and field observations, examining ecotourism and silvofishery systems, community involvement, and institutional capacity. **Findings:** Results highlight the importance of community participation in mangrove conservation through ecotourism and silvofishery systems. Key challenges include economic pressures, sectoral conflicts, weak institutional capacity, and limited technology. Collaboration among stakeholders, supported by education and policy reinforcement, is essential for success. **Conclusion**: A holistic approach combining ecological, social, and economic aspects is vital for sustainable mangrove conservation in Muara Gembong. **Novelty/Originality of this article:** This study integrates ecological, social, and economic dimensions into a cohesive conservation strategy, emphasizing community participation and collaborative governance.

KEYWORDS: mangrove conservation; ecosystem-based management; community participation; ecotourism; silvofishery; sustainable development.

1. Introduction

Coastal and ocean areas have multi-dimensional functions, including as a medium of diplomacy and social relations between nations, a medium of transportation and communication, a source of life for the welfare of the community, state income and foreign exchange, and a media of defense and security. The management of coastal and marine areas must be carried out in a sustainable pattern, both in economic, social, and ecological dimensions that are related. In the economic dimension, it must be able to realize efficiency, while in the social dimension, there must be a fair distribution and utilization to realize that the impoverishment of people in coastal areas is not widespread. Management of the ecological dimension must be focused on efforts to prevent the occurrence of various risks that can interfere with the function of ecological services, especially those that can threaten the sustainability of biodiversity in the region (Soedarsono, 2004).

Indonesia is the largest archipelagic country in the world with a water area of 5.1 million km2 and the longest coastline in Asia reaching 108,920 km (Muhlis, 2011). Indonesia has 16,056 islands, almost three-quarters of Indonesia's total territory is the sea (BPS 2019). Indonesia occupies the second position after Brazil based on the number of

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islands owned as a maritime country with the longest coastline in the world, which is around 99,093 km (Ministry of Maritime Affairs and Fisheries, 2018).

One of the potential marine resources of Indonesia that can be used to minimize the occurrence of natural disasters in the marine sector is the mangrove ecosystem. Ecosystem according to Odum in Effendi et al. (2018), is any entity that includes all living things in a certain area that interacts with the environment, until there is a flow of energy. According to Soemarwoto (1991), an ecosystem is an ecological system that is formed because of the mutual relationship between living things and their environment. Ecosystem is an ecological system formed by the reciprocal relationship between living things and their environment, both living and non-living. The conditions for the formation of an ecosystem are having biotic elements (producers, consumers, decomposers), abiotic elements (water, air, soil, energy), and the interaction between the two.

Mangroves are distinctive plants and are influenced by the tides of sea water and are able to adapt to brackish to fresh water (Wardana, 2016). Mangroves are plants that grow in tropical and subtropical coastal estuary environments (Field et al, 1998; Kustanti, 2018; Saenger, 2002). The origin of the term mangrove itself is still debated, but in English it can be used in two different ways, namely referring to individual plants or communities (Saenger, 2002). Mangrove forests can produce forest products that have high economic value, such as timber, food sources, animal feed, as fish and shrimp spawning grounds that can support pond fishermen (Garcia et al., 2014; Matatula, 2010; Ulumuddin & Setyawan, 2017). According to Waryono (2008) there are three main conditions for mangroves to live and develop, namely being in brackish water, calm or protected, and it is located in a relatively flat mud deposit.

The area of mangrove ecosystems in Indonesia reaches about 23% of the area of mangrove ecosystems in the world (Sitorus et al., 2017). Nowadays, many mangrove ecosystems in Indonesia are damaged. The total area of mangrove ecosystems in Indonesia is around 8.5 million hectares, but only about 3.6 million hectares are in good condition. Damage to mangrove ecosystems is often caused by the clearing of pond land or brackish water cultivation areas, mangrove logging, and abrasion that occurs along the coast (Descasari et al., 2016; Fitriana, 2006; Sitorus et al., 2017).

Mangrove ecosystems support biodiversity conservation, by providing habitats, breeding grounds, childcare and foraging places for various types of animals. Including several groups of animals that are threatened with extinction, ranging from reptiles, amphibians, aves, and mammals. Mangrove ecosystems can also protect coral reefs and seagrass ecosystems (FAO, 2007).

Mangrove ecosystems are one of the coastal ecosystems that have an important role in maintaining environmental balance. Mangroves are not only a habitat for various species of flora and fauna, but also serve as abrasion barriers, carbon sinks, and coastline protectors from the impacts of natural disasters such as tsunamis and storms. In Indonesia, which has more than 23% of the world's mangroves, the existence of mangroves is very important to support biodiversity and the welfare of coastal communities (Giri et al., 2011). Mangrove roots can hold sediment (mud) and slow down the flow of water from the river, so that it will minimize sedimentation that will expand the edge of the coastline or accretion (Suwarga, 2008). The root structure of mangroves can precipitate sediment, so that it can protect the monitor from tides and waves, so that mangroves will be useful to prevent coastal abrasion that can erode the coastal land (Susanto, 2011).

According to data from Perum Perhutani in Muntalif, Hasian & Sembiring (2013), the initial area of mangrove forests in Muara Gembong District was 10,481 ha, until 2012 the area was only 103.75 ha. The decline in mangrove forest area is caused by the conversion of mangrove land into ponds. Yanuartati (2015) stated that environmental degradation in mangrove ecosystems is also caused by the increase in human population with increasing economic needs. Environmental degradation can be interpreted as a decrease in environmental quality caused by development activities characterized by the improper functioning of environmental components as they should. Environmental degradation is basically caused by excessive human intervention or intervention on the existence of the

environment naturally. Environmental degradation can be caused by several factors, but in general, the main supporting factors for environmental degradation are caused by: natural factors, space utilization, population pressure, institutions and weak governance (DTRLP2K-KKP, 2012).

Mangrove forests in Indonesia have experienced degradation and drastically decreased in area from 4.2 million ha in 1980 to 3.1 million ha in 2011. This condition also occurs in mangroves in the North Coast (Pantura) area. Kuswandono (2017) said that in 2015, only 15% of the Pantura mangrove forest area was in good condition. The state of mangroves in Indonesia until now has also continued to experience severe challenges. The shrinkage of mangrove forests has occurred so drastically, that currently it is likely that the area of mangrove forests has been much reduced.

The rate of mangrove degradation is mainly due to the conversion of land for various purposes, such as logging, dredging, ponds, reclamation, industrial waste pollution, garbage disposal, oil pollution, and settlements (Bengen, 2001). According to data from the Center for International Forestry Research (CIFOR), the threat of mangrove degradation that is currently occurring reaches 52,000 ha/year (Coordinating Ministry for Economic Affairs of the Republic of Indonesia, 2018). If viewed based on the composition of the distribution of mangrove forests in Indonesia, the largest number of mangrove forests is in Kalimantan, followed by Sumatra, Papua, Maluku, Sulawesi, Java, and Nusatenggara & Bali (Giri et al. in Basyuni et al., 2017).

The entire island of Java, including Pantura, only has a mangrove forest area of 34,326 ha or 1% of all mangroves in Indonesia. However, the Pantura area has a very dense population so that the problems faced by mangroves on the Pantura coast are becoming more complex. Areas that are expected to be ecological buffer zones and economic resources are no longer able to support life and even improve the quality of life of fishing communities.

However, in recent decades, mangrove ecosystems in Indonesia have suffered significant damage. Based on data from the Ministry of Environment and Forestry (KLHK, 2020), more than 30% of mangrove areas in Indonesia have been degraded due to land conversion into ponds, industrial activities, and unsustainable coastal infrastructure development. This damage not only threatens the sustainability of the ecosystem, but also affects local communities that depend on mangroves for their livelihoods. The mangrove ecosystem in Muara Gembong District, Bekasi, West Java, is one of the affected areas. The decline in mangrove quality in this region is triggered by economic pressure that forces local communities to use mangrove land as ponds or settlements. In addition, the lack of regulation and supervision of mangrove management further exacerbates this condition (Gunawan et al., 2022). This raises the urgency to develop a community-based mangrove management strategy.

A community-based approach is considered one of the effective solutions to overcome this problem. Through the involvement of local communities in conservation efforts, such as rehabilitation, ecotourism management, and environmental education, mangrove sustainability can be achieved. This strategy also provides social and economic benefits for local communities, thus creating a synergistic relationship between environmental conservation and improving community welfare (Hertati, 2017; Kresnasari et al., 2022).

The mangrove ecosystem in Muara Gembong District has an important function in protecting the coastline from abrasion, providing habitat for various species, and supporting the economic life of the local community. However, this ecosystem has experienced significant degradation due to land conversion for ponds and other human activities. Data shows that the area of mangrove forests in Muara Gembong has decreased drastically from 10,481 hectares to only 103.75 hectares in 2012 due to massive land conversion (Muntalif et al., 2013). This condition is exacerbated by an increase in population and economic needs that lead to overexploitation of resources.

The need for land in Indonesia continues to increase along with population growth, so it becomes a challenge or threat to the existence of mangrove ecosystems in coastal areas. Uncontrolled use can damage mangrove ecosystems (Tanner et al., 2019). The use of

mangrove ecosystems is carried out by the community, among others, by exporting shrimp and crabs that have high value, so that they are able to improve the welfare of the community as is done in various regions in Indonesia, including the province of South Sulawesi.

Empowerment of coastal communities is needed in the sense of giving strength to groups of people who are considered to not have the necessary strength for their progress, in this case coastal communities who have the right to manage coastal areas, especially mangrove forests. According to Afriyani (2018), community empowerment in the management of mengvore forests can be done through several strategies, including: a) Persuasive Strategies. Persuasive strategies are carried out in the form of coaching. Coaching activities are an effort to increase the understanding and awareness of the target group to the message conveyed. The coaching material includes counseling on the importance of mengvore forests and their conservation, environmentally friendly pond management and the importance of community organizations/groups; b) Educational Strategy. Educational strategies are carried out in the form of trainings. Through training, it is hoped that it can improve the skills of the target group, towards a certain aspect. Training activities that have been carried out in improving the understanding and skills of target groups in the field of mangvore rehabilitation such as fruit selection, seedling and planting: training to increase understanding and skills in the field of fisheries, namely environmentally friendly pond shrimp cultivation and milkfish cultivation: training to develop skills in group management, such as administration, financial management, management and rules of the game for program implementation; c) Facilitative Strategy. The facilitative strategy is carried out in the form of providing business assistance which is one of the efforts to increase community participation in mangvore rehabilitation, the business assistance provided is generally related to the mangvore rehabilitation program, both directly and indirectly. In addition, the assistance is also aimed at improving the socio-economic conditions of the target group.

This study aims to analyze community-based mangrove management in the Muara Gembong area as a sustainable conservation effort. This research is expected to contribute to mangrove conservation policy planning and provide a management model that can be adopted by other regions with similar conditions. This research uses scientific references from related sources by collecting several literature relevant to the topic discussed. Here are some relevant literature representing the topics discussed in Appendix 1, to draw conclusions from several sources. In this paper, the author tries to provide an overview of mangrove conservation methods and techniques, the main causes of mangrove damage that have been researched in previous studies and how the community participates in mangrove conservation in Muara Gembong District.

2. Methods

This research uses a qualitative approach. This is intended to describe the methods and techniques of mangrove conservation, the main causes of mangrove damage that have been researched in previous studies and how the community participates in mangrove conservation in Muara Gembong District. A qualitative approach is used to adjust the method used, namely descriptive.

The method in this study is a descriptive qualitative method. The descriptive qualitative method is a research method that presents findings in the form of detailed, complete, and in-depth descriptive sentences that describe the actual situation to support the presentation of data. The data collected is in the form of words, sentences or pictures that have a deeper meaning than just the presentation of numbers or frequencies. The author of this study uses a literature study or literature review, which is research conducted through data collection or scientific papers used using scientific journal articles that are relevant to the selected discussion that aims to solve a problem that is basically focused on a critical and in-depth study of relevant literature materials. The stages in this study are

article selection, initial data collection, supporting data collection and then producing conclusions.

3. Results and Discussion

3.1 Causes of mangrove damage

Mangrove ecosystems can be degraded due to several factors, including the conversion of mangrove forests into ponds, oil palm plantations, agriculture, salt ponds, settlements, industry, logging, mining, and natural disasters. Of these various factors, the main cause of mangrove destruction is the conversion of mangroves for fish and shrimp ponds which developed rapidly in the period 1997-2005 and resulted in the construction of active ponds covering an area of 0.65 billion ha at low cost which caused at least 35% of the world's mangrove forest area to have been lost in the last 20 years (Valiela et al., 2001; Murdiyarso et al., 2015; Kauffman et al., 2017). The damage to the mangrove ecosystem in Muara Gembong District is mainly caused by the conversion of land into ponds for shrimp and fish farming.

During the period 1997-2005, pond expansion led to the loss of about 35% of global mangrove areas (Valiela et al., 2001; Murdiyarso et al., 2015). The change or conversion of mangrove ecosystems into shrimp and fish ponds has cleared areas of mangrove forests which have an important role in coastal stability, abrasion prevention, and the provision of habitat for various biota. Other contributing factors are the felling of mangrove trees for fuel and infrastructure development that disrupts the balance of the ecosystem. Illegal logging and exploitation of natural resources can also accelerate the decline in environmental quality. The high pressure of the population who need additional land and the lack of environmental awareness from the surrounding community and policy makers are the main factors that hinder the preservation of mangrove ecosystems.

Damage to the mangrove ecosystem will result in a decrease in the biodiversity in it, so that the function of mangroves as spawning grounds, nursery grounds, and feeding grounds is not optimal. Various biota such as macrozoobentos, fish, waterfowl, monkeys, and other animals are highly dependent on the Cilacap sapling Segara mangrove forest for their survival (Hariyadi, 2018; Hutabarat et al., 2016; Kresnasari et al., 2022; Suprastini et al., 2014). All of these biota are intertwined in forming food webs. Therefore, the existence of the mangrove ecosystem and all components in it need to be preserved. Mangrove conservation programs involving communities are essential to restore damaged mangrove ecosystems. This program includes planting, counseling, and education activities on the importance of protecting mangrove forests.

3.2 Mangrove conservation efforts by restoration

The degradation of mangrove ecosystems in Muara Gembong, Bekasi Regency, West Java can be restored by restoration. Restoration is an effort to restore environmental conditions to their original state naturally. Restoration that can be done in mangrove ecosystems is by ecological techniques, using transplantation of mangrove species. This restoration has been implemented several times in Indonesia and is considered successful, because it uses local types of mangroves whose regeneration and growth take place naturally. The species used in this mangrove plantation are Rhizopora mucronata (Nordhaus et al., 2019). However, there are several failures that can occur if the selection of species and habitats is not appropriate, root damage, human interference, improper maintenance techniques, and garbage sent from the mainland. So that the succession factors for the success of mangrove forest restoration are as follows (Alwidakdo et al., 2014) pest and disease control, tidal tides, proper planting technique, internal and external factors that can interfere with the life of mangrove plants, zoning suitability with plant type

Mangrove conservation efforts in Muara Gembong District can be carried out through three events, namely ecological restoration, using multiple use management

approaches/methods, and river restoration which are described as follows. Ecological restoration. This mangrove conservation is carried out by replanting mangroves using local species such as Rhizophora mucronata which has high adaptability to local environmental conditions. This technique has proven to be effective if supported by good maintenance and pest management (Nordhaus et al., 2019). Mangrove reforestation by planting local species such as Rhizophora mucronata which is proven to have a high level of adaptation, so that it can increase the potential for successful mangrove conservation.

Multiple use management approach/method. Area management that combines conservation activities with sustainable use of resources, integrating resource utilization with conservation through silvofishery systems (a combination of ponds and mangrove forests) to increase productivity without damaging the ecosystem. The purpose of this method is to increase productivity and area utilization based on the characteristics of coastal areas (Sobari et al., 2006). So that this area is able to overcome sea level rise with natural embankments (mangrove forests) and also artificial embankments. Mangrove forest restoration must be adjusted to the characteristics of the environment around the area. Its environmental characteristics are in the form of physical-chemical-biological and socio-economic characteristics. And there must be government policies to support sustainable coastal areas. The government and several other stakeholders, such as non-governmental organizations, academics, and research teams, must work well together to control the sustainability of mangrove conservation. Conservation of mangrove forest ecosystems in coastal areas can use the multiple use management method which can be seen in Figure 1.

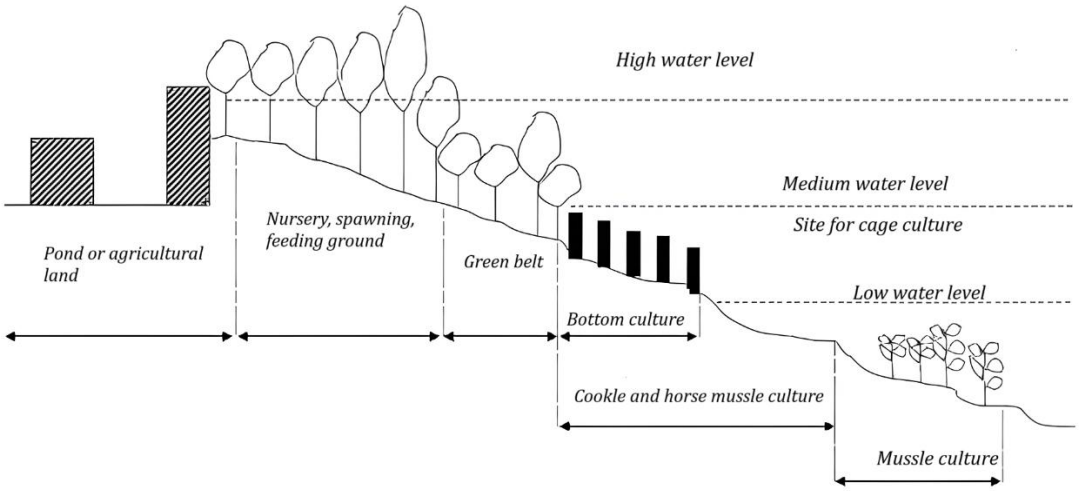

Fig. 1. Management of mangrove forest coastal areas with multiple use method (Eddy et al., 2019)

River restoration involves sediment control and water quality improvement to minimize negative impacts on ecosystems. Efforts to improve the condition of the watershed to reduce pollution that has an impact on the mangrove ecosystem. This restoration involves handling sediment, garbage, and improving water quality (Sujono et al., 2019). Watersheds will directly or indirectly affect the sea or coastal area. Because the river will flow from upstream, downstream, estuary, to the sea. So, if there is pollution and damage to rivers in the mainland area, it will also affect the coastal area as previously mentioned. Waste sent from land that pollutes mangrove forests is usually carried away by river flows. In addition, river sediments can affect the turbidity of seawater. For this reason, efforts are needed to restore the watershed, namely by restoring and renaturalizing the river. River restoration is an effort to restore rivers that have been degraded, while river renaturalization is an effort to restore rivers to their original natural condition. River restoration by applying several methods, such as hydrological, ecological, morphological, socio-economic, institutional and regulatory restoration (Sujono et al., 2019).

Restoration is one of the efforts to restore the mangrove ecosystem as part of conservation. Naturally, mangroves have the ability to self-recover through a secondary succession process, as long as the environmental conditions are stable and quality seedlings are available. However, this natural process takes a long time, which is about 15-30 years. Therefore, artificial restoration is carried out with the help of humans, which involves planting mangrove seedlings. These seeds are usually produced from the seed seedling process carried out at a local location (Gunawan et al., 2022).

3.3 Ecosystem-based mangrove conservation efforts

Ecosystem-based mangrove conservation is carried out by socializing about the important role of mangroves which is then followed by real action of mangrove planting. The action of planting and maintaining mangroves is in line with the SDGs (Sustainable Development Goals) goals made by the United Nations in achieving 2030, namely improving human welfare and being free from threats from various fields (Sembahen et al., 2022). Similar activities have been carried out in mangrove forests in Tanjung Luar Village, Keruak District, East Lombok (Japa et al., 2021) and the Situbondo area to make mangrove forests as natural laboratories (Fitriyaningsih, 2022). It is hoped that the sustainability of the establishment of this natural laboratory, namely the Segara Anakan mangrove forest, Cilacap can be used as an educational tourist attraction.

Ecosystem-based conservation will not succeed without policy support from the government and collaboration between stakeholders. There needs to be regulations that strengthen mangrove protection, provide incentives for communities involved in conservation, and adequate budget allocation for rehabilitation activities (Gunawan et al., 2022; Kresnasari et al., 2022). This ecosystem-based conservation approach is expected to be able to overcome the challenges faced in mangrove management, such as population pressure, damage due to land conversion, and lack of institutional capacity. Through this strategy, the sustainability of mangrove ecosystems and the welfare of coastal communities can be achieved.

3.4 Community participation in mangrove conservation efforts

The participation of local communities is essential for the success of conservation programs. The community in Muara Gembong District is involved in mangrove planting and maintenance activities, but limited knowledge and skills are often an obstacle. Education and empowerment programs such as training on environmentally friendly cultivation techniques and community group management can increase conservation effectiveness (Afriyani, 2018). Active community participation has a positive impact on mangrove ecosystem conservation activities, proven to be able to increase the success of mangrove conservation programs. The involvement of the community in planting and maintaining mangroves can create collective awareness about the importance of mangrove ecosystems. In addition, conservation engineering education and training activities will provide additional knowledge to the local community, strengthening the community's ability to manage natural resources in a sustainable manner.

The development of community participation in mangrove conservation efforts can be done in several ways, including Continuous education, conducting counseling programs related to the importance of mangrove existence needs to be improved, including the delivery of information about ecological and economic benefits that can be obtained from mangrove conservation. For example, with the socialization of environmentally friendly silvofishery techniques. The development of ecotourism, the potential of mangroves in Muara Gembong District as an ecotourism destination needs to be explored and developed. Community-based ecotourism can provide an additional source of income while increasing environmental awareness. Collaboration with stakeholders, there needs to be close cooperation between the government, Non-Governmental Organizations (NGOs), academics and the community to ensure the continuity of conservation programs.

Regulatory support and financial incentives for communities that contribute to conservation can be an additional driver.

Community involvement in the development of marine tourism and forest tourism in Muara Gembong District is the main focus of the Bekasi Regency Government. This is based on the community's desire to present different types of tourism, especially nature-based tourism. The author has collected information related to this issue several times, and the results show positive potential for more professional and independent tourism development. However, there are several things that need to be studied further, especially related to the commitment of the Bekasi Regency Government in developing the Muara Gembong Mangrove Forest as a new tourist destination in the eastern coastal area of Bekasi. In addition, the development of this tourism is expected to avoid the concept of mass tourism, even though this type of tourism has proven to be able to make a significant economic contribution in several regions.

The development of local community-based ecotourism is considered easier to do because it has a number of advantages. First, the limited number of tourists makes coordination easier and minimizes the negative impact on the environment compared to mass tourism. Second, local community-based ecotourism provides an opportunity to develop small-scale tourist attractions that are easier to manage and accept by local communities. Third, by taking advantage of the tourism potential in the vicinity, local communities have a greater opportunity to participate in decision-making related to tourism management. Fourth, this approach also helps to increase understanding of the importance of cultural sustainability and increase tourist appreciation for local traditions and culture.

3.5 Challenges in mangrove conservation

The development of mangrove tourism forests in Muara Gembong has several important things that must be considered to ensure optimal management. First, it is necessary to measure the carrying capacity of the micro environment, both in coastal ecosystems and local community environments that tend to be dynamic, to prevent excess capacity that can have a negative impact on the area. Second, community institutions must be strengthened to be able to manage the area independently, both in terms of soft skills and economic independence. Third, there is a need to restrict access to private transportation to the core zone of mangrove forests to prevent damage to access routes and interference with wildlife. Alternatively, the local community can provide bicycle rentals or parking areas, so tourists are required to walk to enjoy the area.

Involving local people in the management of tourist areas is an essential step, as they are key partners in conservation efforts. Not involving local communities in tourism activities would be a big mistake, because their role is very important in maintaining a balance between nature conservation and economic utilization. Therefore, a comprehensive approach to tourism management is needed to ensure a strong commitment to environmental conservation and great socio-economic responsibility to local communities. In the 1980s, the concept of ecotourism was introduced as part of tourism development oriented towards the regional economy while maintaining the sustainability of the ecosystem.

Although mangrove conservation has enormous ecological, economic, and social benefits, there are various challenges that must be faced to ensure the success of the conservation program. These challenges come from internal and external factors, which are often interrelated and require a holistic approach in solving them. To overcome these challenges, a holistic and collaboration-based approach is needed. The government needs to strengthen regulation and supervision, provide adequate funding, and actively involve local communities in every stage of management. In addition, environmental education, institutional capacity building, and the adoption of modern technology must be a priority to support the sustainability of mangrove conservation.

4. Conclusions

The results of this study confirm that community-based mangrove ecosystem management is an effective strategy to overcome the challenge of mangrove damage in coastal areas. Case studies in Muara Gembong show that local community involvement, such as through mangrove replanting programs, ecotourism management, and the use of the creative economy. Then the results has a positive impact on ecosystem conservation while improving community welfare.

However, the success of this program requires strong institutional support, continuous monitoring, and collaboration between the government, NGOs, and the business world. In addition, environmental education and increasing public awareness are key in maintaining the sustainability of conservation programs.This research makes an important contribution to community-based conservation policy planning in coastal areas. The development of mangrove conservation programs needs to pay attention to a holistic approach that includes ecological, social, and economic aspects to ensure the sustainability of mangrove ecosystems and improve the quality of life of coastal communities.

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Author Contribution

This research was solely conducted by D. S. B, who was responsible for the conceptualization, literature review methodology, data collection, analysis, and manuscript preparation. The author developed the research idea, gathered and reviewed relevant studies, and conducted a literature study to analyze community participation in mangrove conservation. The author also drafted, revised, and finalized the manuscript.

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The authors declare no conflict of interest.

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Appendix 1. Related research and literature overview

Authors	Research Title	Research Methods	Research Results
Ghazali et al. (2014)	Community-based mangrove management on the East Coast of Surabaya	Survey method, using stakeholder analysis and SWOT analysis. Primary data collection It is carried out through observation of research objects and in-depth interviews, while secondary data obtained through literature studies.	The results of the study show that there are 50 stakeholders involved in the management of Pamurbaya mangroves consisting of the government, the private sector, and the community. Local wisdom that is a priority for the local community is mangrove ecotourism. The strategy used for the development of mangrove ecotourism is to improve the institutional system, creativity, and innovation of ecotourism workers, as well as increase cooperation with various related parties.
Hertianti (2017)	Community-Based Mangrove Forest Ecotourism Development in Wonorejo Surabaya	Descriptive analysis with a qualitative approach that focuses on is by studying the literature in the form of relevant references in order to coursed theory and several journals as an analytical knife, so that it can be drawn a conclusion from the results of analysis and synthesis.	– Mangrove forests in Wonorejo have flora and fauna – The local community is involved in several aspects such as tourism management as tour guides, parking managers, tour boat operators, and cleanliness guards – The role of the community in economic empowerment in opening small businesses such as the sale of food, beverages, and ecotourism souvenirs – The community is also involved in environmental education programs for visitors and students – Challenges in ecotourism development such as: lack of infrastructure such as toilets, rest areas, and inadequate information boards; limited capital of local business actors who often face capital constraints for business development; The problem of garbage from visitors and garbage carried by sea currents is the main problem in the management of the cleanliness of the area. – Community-based eco-development strategies, including: improving infrastructure from the government and the private sector working together to provide facilities that support visitor comfort; empowerment of local communities by providing training and assistance for location communities and managing tourism and utilizing natural resources in a sustainable manner; Holding ecotourism promotions using social media and digital platforms to increase tourist attraction – environmental management by providing better waste management facilities and environmental awareness campaigns for visitors
Hewandati (2018)	Sustainable Community-Based Mangrove Ecosystem Management:	A literature review that describes the involvement of the people of Blanakan Village related to mangrove forest	Blanakan fishermen's capture fishery products, which are abundant and available continuously, have not been optimally utilized to be used as post-fishery products that can increase added value. The abundant fish income in Blanakan is a great

	A Case Study of Blanakan Village, Subang, West Java.	conservation, problems, and alternative solutions in order to support sustainable development. The field survey was carried out in the context of verifying mangrove areas, fish auction sites (TPI), crocodile breeding ecotourism, and obtaining data from Blanakan Village as study material.	potential to further advance the cooperative by utilizing the caught fish into products that have a higher selling value that can increase the income and quality of life of the fishing community. Meanwhile, better management of TPI and crocodile breeding as a service for ecotourism activities needs to be carried out considering that Blanakan is a village that is visited by many local and out-of-town tourists, including being used as an example and object of research for researchers, lecturers, and students.
Sari et al. (2018)	Perception of Coastal Communities in Mangrove Forest Ecosystem Management in Muara Gembong, Bekasi, West Java	Qualitative surveys, interviews with coastal communities	– Communities are highly aware of the importance of mangroves, but limited understanding of how sustainable management can hinder conservation. – The community in the research area has a high awareness to maintain the mangrove ecosystem, but has limited knowledge about mangrove conservation.
Rahmasari et al. (2019)	Study on Mangrove Diversity of Mekar Beach, Muara Gembong District, Bekasi Regency	Quantitative, descriptive, identification of mangrove vegetation	– 33 types of mangrove vegetation were found on Mekar Beach, predominantly Avicennia alba. The diversity index shows an increase indicating the recovery of mangrove ecosystems. – An increase in mangrove species diversity was found as an indication of ecosystem depletion.
Wulandari et al. (2019)	Study on the Impact of Mangrove Protector Innovation on Mangrove Ecotourism in Mekar Beach Village	The analysis used was descriptive analysis (quantitative and qualitative). Environmental and social impact analysis, economics is the focus of the study.	The environmental impact given is in the form of an increase in the population of mangrove plants in the area due to planting activities, expansion of planting areas, reduction of waste, contribution to the reduction of CO_2 and CO. In the social aspect, the impact of activities can be measured from the formation of new institutions, the number of beneficiaries or communities directly involved and the partnerships formed. In the welfare aspect, the involvement of vulnerable groups, in this case, the underprivileged community in environmental education programs and activities is a measurable indicator.
Suryadi et al. (2022)	Conservation-Based Mangrove Ecosystem Revitalization Strategy in Muara Gembong, Bekasi Regency, West Java	Spatial analysis, conservation area suitability index, stakeholder role study	– Mangrove rehabilitation, silvofishery utilization, and active stakeholder involvement are suggested. The need for revitalization to overcome abrasion, flash floods, and improve ecosystem functions. – A conservation-based approach is needed to mitigate abrasion and flash floods

Kresnasari et al. (2022)	Mangrove conservation is based on an ecosystem approach to support the development of science in Segara Anakan, Cilacap.	– Field observation to map the physical condition and environment of mangroves. – Interviews and discussions involving local communities, managers, and academics to gain perspectives on mangrove conservation challenges and opportunities. – Literature study by analyzing scientific references related to mangrove conservation and ecosystem approaches.	– The Segara Anakan area has a significant area of mangrove forest, but in recent years it has been damaged due to sedimentation, land conversion into ponds, and industrial activities – Ecosystem approaches in mangrove conservation include: mangrove rehabilitation by replanting mangroves in severely damaged areas, involving local communities as implementers; community empowerment by involving local communities in conservation training programs, such as mangrove seedling making and environmental monitoring; Ecological education with the development of learning modules and environmental education activities to increase public and student awareness of the importance of mangrove ecosystems. – Ecosystem-based conservation in Segara Anakan is proposed to support scientific research and environmental education through field research programs and educational tourism development
Monica et al. (2022)	Community-Based Mangrove Conservation Efforts (Case in Purworejo Village, Pasir Sakti District, East Lampung Regency).	Data collection uses an interview method using a questionnaire with random sampling. The data that has been collected is then calculated using a likert scale and then analyzed descriptively.	The results of the study showed that 66% of respondents must maintain beauty, 70% stated that they must maintain mangrove ecosystems as a barrier against waves, 66% stated that they must maintain mangrove ecosystems as a function of marine biota habitats, 68% stated that they must maintain mangrove ecosystems as habitat for wildlife, 54% stated that they have disposed of garbage in its place, 64% stated that they must plant mangroves, 60% are allowed to catch animals in mangrove areas, 59% are allowed to bring home animals from mangrove areas, 63% are allowed to cut down mangrove trees, 69% state that there is destruction of mangrove plants, 67% use flora and fauna in mangroves for nursery purposes, 67% use fauna as one of the economic goals of forest products, 67% use mangrove fruits as basic materials for making syrup, chips, dodol and sponges, 65% use environmental services. Among the mangrove conservation efforts that can be carried out include protection efforts, preservation efforts and utilization efforts. Conservation efforts according to respondents are in the good category, so this kind of management can be a model for other management examples.