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The Role of the Community in Utilizing Mangrove Forests for Addressing Coastal Erosion in Pasar Banggi Village, Rembang District, Rembang Regency

Hasib Widya Azzahid[1], Khumaeroh[2], Dewi Liesnoor Setyowati[3], Puji Hardati[4]

[1,2]Master Program of Social Studies Education, Faculty of Social and Political Sciences. Universitas Negeri Semarang, Central Java, Indonesia
[3,4]Departemen of Geography, Faculty of Social and Political Sciences. Universitas Negeri Semarang, Central Java, Indonesia

Corresponding Author: Hasib Widya Azzahid

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ABSTRACT

Indonesia is one of the countries with the longest coastlines in the world. Its mangrove forests cover 4.25 million hectares, or 3.98% of the country's total forest area. However, only 58.82%, equivalent to 2.5 million hectares, of these forests are in good condition, while the remainder has been degraded for various reasons. This study aims to: 1) identify the efforts undertaken by the community to address coastal abrasion, 2) explore the utilization of mangrove forests as conservation areas, and 3) examine the community's role in rehabilitating mangrove forests to mitigate abrasion in Pasar Banggi Village. The research was conducted in Pasar Banggi Village, Rembang District, Rembang Regency, using a qualitative approach. Primary data were collected through direct observations, interviews with local residents, and documentation related to the mangrove forest area. The findings indicate that 1. the community has implemented several measures to manage coastal abrasion, 2. the mangrove forests in Pasar Banggi Village are utilized as conservation areas, and 3. the community plays a significant role in rehabilitating mangrove forest to address abrasion.

Keywords: Community Role, Mangrove Forests, Coastal Erosion

INTRODUCTION

Indonesia, with its 17,504 islands and a coastline stretching 95,000 kilometers, ranks among the largest countries in the world. Approximately 4.25 million hectares, or 3.98% of Indonesia's total forest area, consist of mangrove forests. However, only 58.82%, equivalent to 2.5 million hectares, are in good condition (K.L.H. and Forestry, 2024), while the remaining areas are degraded due to various factors. According to the Food and Agriculture Organization (FAO), in 2005, Indonesia's mangrove forests spanned 3,062,300 hectares, accounting for 19% of the world's mangrove forests. This area surpasses 10% of Brazil's mangrove forests and 7% of Australia's.

Mangrove ecosystems are unique because their formation is influenced by bo land and sea. They thrive on shores sheltered from strong waves and tides, where sediment from river estuaries can accumulate. These ecosystems have significant ecological, economic, and additional values, including touris research, and education. Ecologically, mangrove forests provide habitats for flora and fauna and produce economic commodities such as timber a shrimp.

Additionally, mangroves can serve as tourist destinations, educational sites, and training centers. Considering the vital role of mangroves in ecosystems, preserving mangrove forests is crucial.

Due to their susceptibility to damage, mangrove forests are considered fragile ecosystems. Abrasion and plant pests are natural factors contributing to mangrove degradation. Human activities, such as unsustainable land use, exacerbate this issue by exceeding the environment's carrying capacity, leading to ecological strain (Gumilar, 2012). A study by Mulyadi et al. (2009) revealed that population growth, averaging 1.3% annually, has caused 50% of mangrove forests to deteriorate. This growth drives the development of ports, settlements, and aquaculture ponds, intensifying environmental pressure.

Initially, mangrove forests served as natural coastal defenses against erosion caused by aquaculture. However, human activities have led to coastal abrasion, reducing fishery yields and causing failures in traditional shrimp farming (Redjeki, 2013). According to Cecep Kusmana (2010), mangrove ecosystem degradation results in both physical and biological coastal erosion, diminishing the coastline's resilience and threatening the economic, social, and environmental stability of coastal communities.

Effective management policies must balance the sustainable utilization of coastal resources for economic purposes with conservation efforts for future generations. Measures should focus on restoring the functions and benefits degraded mangrove forests.

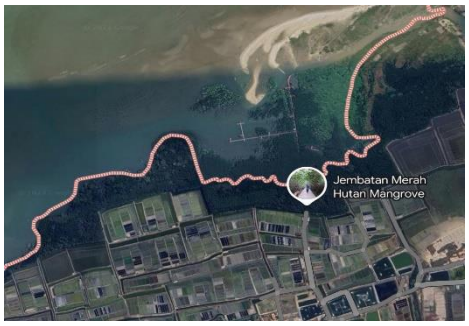
Community participation in mangrove conservation, as highlighted in studies by Ilyas et al. and Hutapea (2009), is generally moderate. However,research by Uswatun Nisa et al.revealed low community participation in preserving mangrove forests. This underscores the need for greater community involvement in mangrove conservation and rehabilitation efforts.

Rembang Regency has been recognized for its successful mangrove rehabilitation initiatives. In regions like Pasar Banggi and Tireman Villages, government programs and active community participation have been highly effective. Pasar Banggi Village is unique within the regency, with two distinct mangrove areas: an existing mangrove forest covering 18.25 hectares and a conservation area spanning 12.56 hectares. Established in 2005, the mangroves were initially converted for aquaculture activities, which led to tidal waves damaging residential areas. In response, a group of salt farmers initiated mangrove rehabilitation efforts in the region. Today, the mangrove forest in Pasar Banggi Village represents an ideal landscape, with a thickness exceeding 100 meters. Located directly along the coastline, the mangrove vegetation protects the fishponds behind it. T success of mangrove conservation in Pasar Banggi Village is attributed to the initiatives of the salt farmer community, who have independently managed, rehabilitated, and conserved the mangroves since 2005. The community-based management approach has been instrumental in the systematic rehabilitation of the mangrove forest, as documented in the "Rembang Environmental Agency Data" (2022).

MATERIALS & METHODS

This study was conducted in Pasar Banggi Village, Rembang District, Rembang Regency. Pasar Banggi Village is notable for its extensive mangrove area, which is considered to be in relatively good condition. This is attributed to continuous rehabilitation efforts carried out by various stakeholders involved in the development and maintenance of mangrove land.

Picture 1: Map of Pasar Banggi Village



Picture 2: Map of the Mangrove Forest Edge

Research Design and Data Collection A qualitative approach was employed in this research, aiming to gain an indepth understanding of the phenomena through interpretative and descriptive methods. Data were collected directly from the field using various technique including in-depth interviews, participatory observations, and document analysis. This combination allowed the researchers to explore the meanings, perceptions, and experiences of participants in their everyday contexts. The qualitative approach provides a broader and richer understanding of the complexities of social interactions, cultural values, and social dynamics that might be difficult to capture through quantitative methods. Additionally,th approach offers flexibility, enabling researchers to adapt the research proce to dynamic field conditions, ensuring more authentic and relevant finding depicting the existing realities. Informants The primary informant in this study was Mr. Ipur, the coordinator of mangrove management in Pasar Banggi Village. Supporting informants included Mr. Marlynda, Ms. Lilis Supriyani, and Mr. Ahmad Sholeh, who are local community members.

Data Analysis Data analysis in qualitative research was conducted comprehensively by grouping, interpreting, and understanding the data collected through interviews, observations, and documents. The process involved steps such as data reduction, categorization, and the identification of emerging themes patterns from the participants' narratives or experiences. The researchers applied an inductive approach to draw conclusions based on the meanings derived from the data, providing a comprehensive insight into the phenomena within the social and cultural contexts under study.

RESULT & DISCUSSION

1. Community Efforts in Addressing Coastal Abrasion Mangrove forests are critical coastal

Mangrove forests are critical coastal ecosystems that play a vital role in protecting shorelines from abrasion. The unique structure of mangrove trees, with their prop roots for breathing and arching roots that rise above water, makes them well-adapted to mitigate environmental threats. Pasar Banggi Village in Rembang District, Central Java, has successfully leveraged the benefits of mangrove forests to combat coastal erosion. Persistent shoreli erosion threatens environmental sustainability and the livelihoods of coastal communities, making mangrove planting an effective and sustainable mitigation strategy. Compared to other forest ecosystems, mangrove forests have distinct ecological functions. They act as natural barriers, preventing large ocean waves from penetrating inland areas. The joint efforts of the local community and the Rembang Regency Government have bolstered mangrove planting initiatives, highlighting the ecological importance of these forests.

Mangrove forests are established to mitigate coastal erosion (land degradation) and serve as a tourist destination as an indirect benefit. To enhance resilience against flood and tidal inundation threats, various measures have been implemented, such as localizing floods, elevating roads in residential areas, constructing flood containment structures, improving drainage systems, building pump houses, and planting mangrove forests.

Picture 1: One type of Rhizopora mangrove plant in Pasar Banggi Village

Proper disaster mitigation planning can prevent and minimize the impacts of coastal erosion, tidal flooding, and land subsidence in coastal areas. This includes identifying potential threats, assessing the levels of risk from minor to severe, and preparing for worst-case scenarios.

Activities undertaken before a disaster to reduce the impacts of coastal erosion include:

a. Risk Identification and Monitoring
   This activity involves identifying potential coastal erosion in vulnerable areas and monitoring risks that may trigger or exacerbate erosion. A clear understanding of erosion risks enables targeted mitigation efforts, such as mangrove planting in the most susceptible zones.
b. Raising Community Awareness of Disaster Risks
   Educating communities about the importance of mangroves in reducing the impact of erosion and other disaster risks. Increased awareness helps people understand their role in protecting the environment and supporting disaster mitigation efforts.
c. Planning for Community Participation in Disaster Management
   Engaging the community in disaster mitigation planning through mangrove planting initiatives. This includes forming community groups actively involved in planting, maintaining, and protecting mangroves as part of broader mitigation strategies.
d. Identifying and Recognizing Disaster Threat Sources
   This activity aims to identify the factors causing erosion, such as rising sea levels, damage to coastal ecosystems, or human activities harming the coastal environment. Mangrove planting is focused on areas most threatened to reduce erosion impact.
e. Implementing Physical and Non-Physical Disaster Mitigation Measures
   Mangrove planting is a physical effort to mitigate coastal erosion. Non-physical efforts include policy formulation, education, and enforcement of regulations supporting coastal protection and sustainable environmental management.
f. Supervising Land Use and Environmental Management
   Oversight ensures that land use in coastal areas does not harm mangrove ecosystems. Mangrove planting should be supported by spatial planning policies that protect coastal regions from developments contributing to erosion.

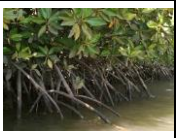
These activities are part of broader efforts to prevent and minimize disaster impacts. For instance, supervising spatial planning and environmental management by relevant authorities, such as urban planning and construction agencies, helps ensure green areas like riverbanks are preserved. Effective oversight and implementation of spatial planning can prevent river channel narrowing, which might otherwise lead to flooding (Konstruksi, 2022).

2. Mangrove Forests as Conservation

Areas The mangrove forests in Pasar Banggi Village cover approximately 30.82 hectares, with a width ranging from 30 to 220 meters and a density of 30 trees per 100 square meters. These forests host five major or true mangrove speci (Avicennia marina, Rhizophora apiculate, Rhizophora mucronata, Rhizophora stylosa, and Sonneratia alba) and five associated mangrove species (Calotrop gigantea, Sesuvium portulacastrum, Ipomoea pes-caprae, Hibiscus tiliaceus, and Pandanus tectorius). With approximately 75% of its

mangrove ecosystem in good condition, Pasar Banggi Village boasts a 3.5-kilometer-long green belt (Nulhaqim, 2021).

Table 1. Types of Mangrove Plants in the Mangrove Forest of Pasar Banggi Village, Rembang

No.	Jenis Tanaman Mangrove	Penampakan
1.	*Rhizopora Apiculata* (Bakau Minyak)	
2.	*Rhizopora Stylosa* (Bakau Kecil)	
3.	*Rhizopora Mucronata* (Bakau Kurap)	
4.	*Avicennia Marina* (Api-Api Putih)	

Source: Mangrove Forest Website

Mangrove forests play a vital role in the coastal ecosystem of Pasar Banggi Village. Mangrove plants not only serve as a natural barrier against coastal erosion but also provide habitats for diverse species of flora and fauna. Due to their critical ecological functions, many mangrove areas are now designated as conservation zones and developed into natural tourism or ecotourism destinations. This development allows local communities to gain economic benefits without compromising the fragile mangrove ecosystem.

Mangrove forest tourism is a type of nature-based tourism that offers a unique charm and attraction. Initially, mangrove planting was intended to prevent erosion, fulfill the need for Green Open Space (RTH), and establish conservation forests. The diverse mangrove ecosystems, ranging from fully developed forests to young ecosystems, present an appealing and affordable tourism potential for families, students, and academics alike (Khaeri, 2021).

Table 2. Types of Birds in the Essential Ecosystem Area (EEA) of Mangrove Wetlands

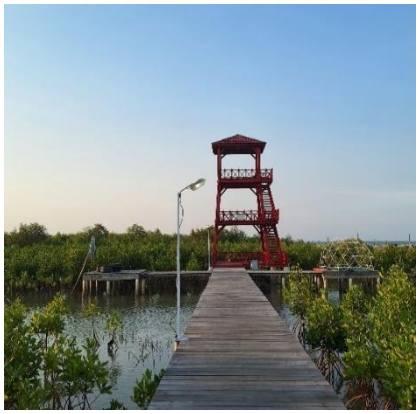
No	Jenis Burung	Penampakan
1.	Kuntul Besar (*Egretta Alba*)	
2.	Kuntul Kecil (*Egretta Garzetta*)	
3.	Cerek Jawa (*Charadrius Javanicus*)	
4.	Cerek Tilil (*Charadrius Alexandrinus*)	
5.	Cerek Pasir Besar (*Charadrius Leschenaultii*)	
6.	Dara Laut Kumis (*Chlidonias Hybrida*)	
7.	Prenjak Padi (*Prinia Inomata*)	

Source: Mangrove Forest Website

Conservation is an effort to preserve the environment, especially for ecosystems that are threatened or vulnerable to damage. Mangrove forests serve as habitats for various fauna, such as fish, birds, crabs, shrimp, and many other species that play a role in the coastal ecosystem cycle. Mangrove areas also provide breeding and hiding places for fish species vital to local fisheries. Additionally, mangroves can absorb a significant amount of carbon, making them crucial in mitigating climate change. These plants can absorb four times more carbon than tropical rainforests. Mangroves also play a role in filtering waste and maintaining water quality. These areas function as natural biofilters, filtering pollutants from the land before they reach the

sea, thereby maintaining the balance of coastal water ecosystems.

Besides serving as conservation areas, mangrove forests also have great potential to be developed as tourist attractions, particularly for ecotourism. Ecotourism is a sustainable form of tourism that focuses on direct interaction between visitors and nature while preserving the environment. Mangrove forests offer unique natural scenery where tourists can enjoy the rich flora and fauna that cannot be found elsewhere. Mangrove ecotourism can attract both local and international tourists interested in authentic natural experiences and environmental education. In the mangrove forest area of Pasar Banggi, there is a red bridge that is easily accessible to visitors. Additionally, facilities such as observation towers, tourist boats, and environmental information centers can be developed to enhance the tourist experience. Educational trails providing information about the ecological benefits of mangroves could serve as an additional attraction.



Picture 4. Mangrove Forest as a Conservation Area.

Mangrove parks are utilized for study visits by students, academics, practitioners, and researchers who conduct studies on their development. The Pasar Banggi mangrove forest continues to grow and attract more visitors, both residents and tourists from other cities. The mangrove park has other functions that can be utilized, such as educational or learning functions, ecosystem functions, tourism functions, and economic functions.

The development of the Mangrove Ecotourism site is expected to realize an integrated plan for coastal disaster prevention through planned mangrove planting and create a quality tourist area. The development of the Mangrove Tourism Object is also expected to have a positive impact on the area, both through direct community involvement and indirect benefits to the local economy, including its natural resources and culture. Positive impacts from tourism development include increased income for the local community, job creation, and improvements in infrastructure/public facilities in the tourist destination area.

Mangrove forests, which serve a dual function as both conservation areas and tourist attractions, offer significant benefits from both ecological and economic perspectives. With the right and sustainable approach, mangrove forests can be preserved as a natural barrier protecting the coast and coastal habitats, while also becoming an educational and enjoyable tourist destination. The synergy between conservation and ecotourism will ensure that this ecosystem is preserved for future generations while providing economic benefits to the surrounding communities.

3. The Role of Communities in Mangrove Forest Rehabilitation for Erosion Control

In the framework of mangrove ecosystem management and conservation, at least two main concepts can be applied. These two concepts essentially provide legitimacy and understanding that mangroves require management and protection to remain sustainable. These concepts are the protection and rehabilitation of mangrove forests. The responsibility for managing marine affairs, as stated in Article 2 of Presidential Regulation Number 63 of 2015, lies with the Ministry of Marine Affairs and Fisheries (Afriyani 2021).

Originally, the mangrove plants in Pasar Banggi Village grew due to the deposition of

mud and organic substances from water currents flowing into the area, resulting in the growth of various mangrove species that formed a Mangrove Forest. This forest grew naturally in the coastal area with the appropriate conditions. In 2005, the Mangrove area in Pasar Banggi Village was opened for shrimp, fish, and salt farming, which allowed tidal waves to freely hit the settlements, causing damage. This reality led a group of local people to initiate large-scale mangrove rehabilitation efforts in the area. The goal of mangrove rehabilitation is to restore and preserve the ecosystem so that it continues to provide ecological, economic, and social benefits. Currently, the mangrove area is directly adjacent to the shoreline, and the mangrove vegetation here helps protect the shrimp farms behind it.

This shows the success of the rehabilitation program, which has restored the ecosystem to a sufficiently healthy level, so much so that the Ministry of Environment and Forestry (KLHK) has developed the area into a famous mangrove forest area known as the Red Bridge Mangrove Ecotourism in Rembang. To this day, organizations, youth forums, NGOs, and others regularly conduct mangrove planting activities around the mangrove forest area. This has a positive impact on all living beings in the area. As stated in Article 70 (1) of Law No. 32 of 2009 on Environmental Protection and Management, everyone has the right and the same opportunity to actively participate in the protection and management of the environment (Ministry of Environment and Forestry 2023).

This strategy begins with identifying the areas most affected by erosion, followed by an ecological study to understand the environmental conditions and select the appropriate mangrove species. Mangrove species such as *Rhizophora*, *Avicennia*, and *Sonneratia* are chosen because each has characteristics that are suitable for facing coastal challenges. The structure of mangrove forests plays a significant role in reducing flood risks and coastal erosion. The dense mangrove roots can hold sediments and slow down water flow. Surrounding the mangrove forests are critical habitats for both land and marine species, enabling a high level of biodiversity where various species interact.

To rehabilitate coastal areas, the Rembang Regency Environment Office (DLH) has carried out mangrove replanting activities, particularly in several priority areas. This activity is expected to accelerate appreciation and awareness among stakeholders regarding the importance of mangrove ecosystems as part of efforts for rehabilitation, adaptation, and mitigation to increase the resilience of coastal areas to the impacts of climate change. The Ministry of Environment and Forestry, according to Article 2 of Presidential Regulation Number 16 of 2015, is tasked with managing environmental and forestry affairs, including rehabilitation policy implementation as stated in Article 16 (b). From 2010 to 2013, the Ministry of Environment and Forestry carried out mangrove forest rehabilitation through the National Budget (APBN) covering 31,675 hectares.

Mangrove rehabilitation efforts, besides restoring degraded lands, also help preserve carbon stocks. According to CIFOR, mangrove forests in Indonesia are capable of storing 4-5 times more carbon than terrestrial forests (Kusmana 2010). Thus, mangrove forests, which cover about 2% of the total forest area in Indonesia, can store about 10% of all emissions. Additionally, junior and senior high school students from Adiwiyata Schools carry out mangrove jamboree activities annually, allowing the younger generation to participate in the conservation and restoration of coastal environments. Participants in the jambore plant coastal vegetation (mangroves) en masse as part of efforts to save and restore the coastal environment. These activities help raise public awareness about the mangrove ecosystem (Aji 2024).

To further enhance rehabilitation efforts, starting in 2025, the Rembang Regency Government has allocated IDR 2 billion for infrastructure development of the Red Bridge

Mangrove Ecotourism in Pasar Banggi Village, Rembang District. The budget will focus on improving access roads to the tourist location, which is known for its coastal views and dense mangrove vegetation.

The government and the community play a critical role in maintaining natural resources and culture, which have great potential as tourist attractions. Community participation is the foundation of sustainable tourism. All stakeholders utilizing mangrove forests should help maintain the balance of the mangrove forest functions as a research space, a breeding ground, and a tourist destination. Therefore, strengthening local institutions around the mangrove forest area is needed. Collaboration between the government, non-governmental organizations, and local communities is essential to support these rehabilitation efforts. Strict environmental protection policies must also be enforced to prevent land conversion and destructive activities in mangrove areas. Through a sustainable approach, Pasar Banggi Village can utilize its mangrove potential to improve the environmental condition and boost the local economy.

CONCLUSION

The mangrove ecosystem plays a crucial role in protecting coastal areas from the threats of abrasion and seawater intrusion while maintaining environmental balance by providing habitats for diverse species. Through community participation and government support in mangrove planting, sustainable abrasion mitigation efforts can be achieved. The mangrove forests in Pasar Banggi Village not only serve as environmental protectors but also as an economic resource for the local community. With significant potential as educational and attractive ecotourism destination,the development of sustainable tourism facilities in this area can improve community welfare by increasing income and creating job opportunities. Through protection and rehabilitation efforts involving multiple stakeholders,the mangrove ecosystem in Pasar Banggi Village has been successfully restored and developed into an ecotourism destination that supports education and research. The Rembang Regency Government's commitment to infrastructure development aims to attract tourists and boost the local economy.

Declaration by Authors

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