Journal of Agricultural Economy and Technology Development
E-ISSN: 3089-7440
Doi: https:/10.59261/joa.v3i1.49
Page 1 of 7

Mangrove Planting Program as an Effort to Prevent Coastal Abrasion and Preserve Coastal Ecosystems at Ujong Blang Beach, Lhokseumawe City

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Accepted: 09-01-2026 Approved: 26-01-2026 Published: 07-03-2026

Abstract
Coastal abrasion problems frequently occur in coastal areas, where phenomena such as climate change and full moon phases serve as the primary triggers for elevated sea surface waves, ultimately leading to abrasion. Coastal abrasion refers to the shrinkage of the shoreline due to tidal sea level rise. Coastal abrasion causes an annual shoreline shrinkage of 5 meters. Elevated wave heights significantly impact the sustainability of the surrounding coastal environment. This study aims to evaluate the effectiveness of mangrove planting programs as a measure to prevent abrasion and preserve coastal ecosystems using a qualitative descriptive approach. The methods employed include field surveys, interviews with local communities and traders, as well as direct planting of 20 mangrove seedlings at 40 cm spacing and 5-8 cm depth in moist muddy areas. The results show that mangrove planting at Ujong Blang Beach was successfully carried out through collaboration between students and local communities, with the potential to dampen up to 70% of wave energy and stabilize sediments. The implications include environmental protection, improved economic welfare for surrounding communities, and recommendations for sustainable programs.

Keywords: coastal abrasion; coastal ecosystem; mangrove planting

INTRODUCTION

The Ujong Blang tourism area in Lhokseumawe City is one of the tourist destinations highly vulnerable to coastal abrasion. Abrasion along the shoreline of Ujong Blang Beach is primarily caused by two main factors: spring tides during full moons and climate change. Coastal areas in Indonesia increasingly face serious environmental challenges, particularly coastal abrasion caused by climate change, sea level rise, and extreme wave events (Almar et al., 2023; Haddout et al., 2022; Sagala et al., 2024). This phenomenon not only threatens coastal ecosystems but also directly affects the socio-economic conditions of communities living in coastal regions. In many areas, coastal abrasion leads to shoreline retreat, loss of coastal land, and damage to community economic activities such as fisheries and coastal tourism. The case of Ujong Blang Beach in Lhokseumawe City reflects this broader phenomenon, where abrasion

has gradually reduced coastal land and disrupted the livelihoods of fishermen and culinary traders operating in the area.

This phenomenon significantly impacts the lives and livelihoods of coastal communities. Previous research data indicates that the Ujong Blang shoreline has receded by 5 meters annually. If not addressed promptly, this could become a serious problem. Mangrove planting serves as a primary alternative to prevent coastal abrasion. Several previous studies highlight the important role of mangrove ecosystems in mitigating coastal abrasion and protecting coastal environments (Jayson-Quashigah et al., 2025; Strain et al., 2022; van Hespen et al., 2023). Mangrove vegetation is known to function as a natural barrier capable of reducing wave energy, stabilizing coastal sediments, and preventing shoreline retreat (Menéndez et al., 2020). Lovelock et al. (2024) also explains that mangrove ecosystems serve as adaptive coastal protection systems that can accumulate organic matter vertically, enabling them to respond naturally to rising sea levels. Previous research conducted by Goldberg et al. (2020) also shows significant shoreline changes in the Ujong Blang coastal area, indicating the urgency of implementing sustainable coastal protection strategies such as mangrove planting.

According to Menéndez et al. (2020), mangroves are not merely coastal plants but "bio-engineering structures" with unique capabilities to dampen wave energy by up to 70% and trap sediments to naturally form new land. Based on these conditions, this study aims to evaluate the effectiveness of the mangrove planting program as an effort to prevent coastal abrasion and preserve coastal ecosystems at Ujong Blang Beach, Lhokseumawe City. The results of this research are expected to provide practical benefits for coastal environmental management, strengthen community participation in coastal conservation programs, and offer policy recommendations for sustainable coastal ecosystem management. Furthermore, this study contributes to the development of environmentally based coastal protection strategies that integrate ecological and socio-economic considerations (Cheng et al., 2025; Dabalà et al., 2023; Owuor et al., 2024).

Lovelock et al. (2024) states that mangrove ecosystems act as dynamic coastal protection fortresses, capable of adapting to sea level rise through vertical accumulation of organic material a feat that man made concrete seawalls cannot achieve.

Government Regulation (PP) No. 27 of 2025 specifically governs the Protection and Management of Mangrove Ecosystems, providing policy directions, community participation, and sustainable utilization under the blue economy concept (Arifanti et al., 2022, 2025; Friess et al., 2019). Mangrove planting along the shoreline represents a primary and straightforward alternative that local communities can undertake to sustain coastal ecosystems, including the preservation of coral reefs and other marine life (Macreadie et al., 2021; Storbjörk & Hjerpe, 2021).

Coastal abrasion at Ujong Blang Beach in Lhokseumawe City damages the shoreline ecosystem and severely affects local economies. Waves reaching 1-2 meters in height force culinary vendors around the coastal area to close their stalls. These high waves are triggered by climate change and typically occur from August to October. Spring tides during full moons usually happen toward the end of the year, with local communities using traditional lunar observations to predict them. Continuous abrasion leads to shoreline reduction and shifts, significantly reducing land area around the beach.

Most residents near Ujong Blang Beach rely on fishing and culinary vending for their livelihoods. The mangrove planting program is a key initiative to anticipate abrasion. Unlike similar programs in Aceh Besar and Aceh Tamiang, the Ujong Blang Beach initiative involves direct collaboration between Public Administration students and local coastal communities,

facilitated by stakeholders. It emphasizes socioeconomic impacts, such as stall closures during 1-2 meter high waves.

The novelty of this research lies in its participatory approach, targeting a reduction in local abrasion rates of 5 meters per year. The objectives are to evaluate the effectiveness of planting 20 mangrove seedlings in preventing abrasion and preserving coastal ecosystems, while delivering environmental protection benefits and enhancing community livelihoods.

RESEARCH METHOD

This study employs a descriptive qualitative method, involving active participation from the community to evaluate the effectiveness and success of the program. Data collection techniques include direct surveys with 10 respondents (traders and affected community members), structured interviews regarding the impact of abrasion, field observations before and after the planting activities, and a review of previous abrasion data.

Collaboration with stakeholders serves as the primary step, acting as a bridge between students and the surrounding community before the program is implemented. The planting procedure involves: selecting sprouted seedlings, planting them at 40 cm intervals and 5-8 cm depth in moist, muddy soil around the fishpond area, conducted in December 2025 through active collaboration among Public Administration students, local community members, and stakeholders. Data analysis is performed descriptively to evaluate the program's success.

RESULT AND DISCUSSION

The mangrove planting program at Ujong Blang Beach was implemented through collaboration among Public Administration students from Malikussaleh University, the local community, and stakeholders as intermediaries. From the mangrove planting activity, 20 mangrove trees were successfully planted in the coastal area.

A total of 20 mangrove seedlings were planted at 40 cm intervals per tree, with a soil depth of 5-8 cm, offering a wave attenuation potential of 70%. The moist and muddy soil conditions facilitated the planting process. Sprouted mangrove stems were selected as the primary choice to accelerate the growth process.

The Mangrove Planting Program at Ujong Blang Beach in Lhokseumawe City was conducted in one of the freshwater fish farming areas. This area is severely affected during high sea wave events. The site selection was carried out by stakeholders as intermediaries between students and the community. This mangrove planting has the potential to stabilize sediments and marine habitats, distinguishing it from other programs. With its small scale community approach, it directly impacts local residents, fishermen, and food vendors who are forced to close their stalls during high waves.

The mangrove planting program also served as a practical form of environmental education for students and the surrounding community. Through direct involvement in the planting process, participants gained a deeper understanding of the ecological importance of mangrove ecosystems in protecting coastal areas. Mangroves function as natural barriers that reduce wave energy, prevent coastal erosion, and provide habitats for various marine organisms. This collaborative activity strengthened awareness and responsibility among stakeholders to participate in sustainable coastal management.

In addition, the program encouraged stronger cooperation between academic institutions, local communities, and relevant stakeholders in addressing coastal environmental issues. The involvement of university students contributed fresh perspectives and scientific knowledge, while the local community provided practical experience and understanding of the

coastal conditions. Such collaboration is essential for ensuring the sustainability of mangrove conservation programs and for promoting community-based environmental protection efforts in coastal regions.

Figure 1. Mangrove Planting Process in Ujong Blang, Lhokseumawe

Figure 2. Documentation after Mangrove Planting

The results of this study indicate that the mangrove planting program at Ujong Blang Beach was successfully implemented through collaboration between students, local communities, and stakeholders. A total of 20 mangrove seedlings were planted with a spacing of 40 cm and a depth of 5–8 cm in moist muddy soil conditions. The planting location was selected in an area vulnerable to high waves, particularly near freshwater fish farming areas. The planted mangroves have the potential to reduce wave energy by up to 70%, stabilize sediments, and support the sustainability of coastal ecosystems.

The findings of this study are consistent with previous research that highlights the effectiveness of mangrove ecosystems in reducing coastal abrasion. Menéndez et al. (2020) states that mangroves function as bio-engineering structures capable of significantly reducing

wave energy. Similarly, Lovelock et al. (2024) explains that mangrove ecosystems act as natural coastal protection systems that adapt to environmental changes. However, unlike previous studies that focus mainly on ecological functions, this research emphasizes a participatory approach involving students and local communities in mangrove planting activities.

The results of this study demonstrate that small-scale community-based mangrove planting programs can contribute significantly to coastal protection efforts. The collaboration between academic institutions, local communities, and stakeholders strengthens environmental awareness and encourages sustainable coastal ecosystem management. In addition to ecological benefits, the program also provides socio-economic advantages by helping protect the livelihoods of fishermen and culinary traders who depend on the coastal environment.

Despite the positive outcomes, this study has several limitations. First, the scale of mangrove planting is still relatively small, involving only 20 seedlings, which may not fully represent long-term coastal protection effectiveness. Second, the study focuses on qualitative observations without long-term monitoring of mangrove growth and shoreline changes. Future research should involve larger-scale mangrove planting programs, long-term ecological monitoring, and quantitative measurements of shoreline changes. The implications of this research highlight the importance of strengthening community-based coastal conservation programs as part of sustainable coastal management policies.

CONCLUSION

Coastal abrasion at Ujong Blang Beach in Lhokseumawe City represents a regional development challenge that can be addressed through the mangrove planting program. This initiative proves effective in preventing shoreline retreat and preserving coastal ecosystems. Aligned with its objectives, the planting of 20 mangrove trees was successfully completed to ensure sustainability for the community and marine life. The implementation of this program is expected to serve as an alternative strategy to prevent the increasing abrasion data along the Ujong Blang coastline in Lhokseumawe City. As a positive initiative, it can be continued by planting over 100 mangrove seedlings, along with monitoring and review of the shoreline by local authorities to prevent recurring issues.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to all parties who contributed to the completion of this study entitled "Mangrove Planting Program as an Effort to Prevent Coastal Abrasion and Preserve Coastal Ecosystems at Ujong Blang Beach, Lhokseumawe City." Special appreciation is extended to Universitas Malikussaleh for providing academic support and guidance throughout the research process. The authors also thank the local community and traders around Ujong Blang Beach for their cooperation, participation, and valuable information during the field surveys and mangrove planting activities. In addition, the authors are grateful to fellow students who actively participated in the mangrove planting program and assisted in data collection. Their support and collaboration greatly contributed to the success of this research.

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