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Community Services to Improve the Quality of Ujung Pancu Beach

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Abstract

The purpose of this community service is to enhance the quality of coastal ecosystems by addressing abrasion and degradation of mangrove vegetation, thereby advancing environmental sustainability along Aceh's coast. It is anticipated that this initiative will foster greater environmental awareness among the younger population by disseminating knowledge and planting mangroves at Ujung Pancu Beach, Aceh Besar. This project was sponsored by the Sustainable Habitats and Ocean Restoration for Environment (SHORE) 2025 program. It involved the Tide Turners Community, Bina Antar Budaya Banda Aceh, and the Aceh Aquatic Youth group. The implementation included educational activities, socialization on the functions of the mangrove ecosystem, and planting 240 Rhizophora spp seedlings, and initial post-activity monitoring. The outcomes demonstrated high participant engagement and improved understanding of mangroves' role in mitigating abrasion and climate change. This initiative demonstrates that integrating ecological action with environmental education can enhance collective awareness and foster a participatory approach to sustainable coastal conservation in Aceh.

Keywords: mangrove, offshore rehabilitation, community participation, ecological awareness

INTRODUCTION

Mangrove ecosystems are crucial parts of tropical coastal areas, providing a range of important ecological and social functions. They serve as natural barriers that reduce wave energy and prevent shoreline erosion, act as carbon sinks (commonly called blue carbon), and provide vital habitats for marine life such as fish, crabs, and shrimp. Additionally, mangroves create alternative income sources through ecotourism and the collection of non-timber forest products (Alongi, 2018). In the context of climate change and rising sea levels, mangroves are increasingly seen as a strategic, nature-based solution to boost coastal resilience (UNDP, 2024). Beyond their ecological benefits, this program includes educational and social activities aimed at increasing economic literacy and empowering local communities, thereby raising public awareness of the economic importance of mangroves and enhancing community capacity for sustainable resource management.

Indonesia hosts the world's largest mangrove reserves; however, degradation persists due to land-use changes, including aquaculture, urban development, logging, pollution, and sedimentation (Spalding et al., 2010; Hamilton & Friess, 2016). While many mangrove restoration projects have been launched through community service programs, technical and social challenges often hinder their

long-term success. Research shows that the effectiveness of mangrove restoration depends not only on the technical aspects of planting but also on community involvement and the development of local institutions. Therefore, incorporating economic literacy and empowerment-focused educational activities is essential to help community members recognize the long-term economic benefits of mangrove conservation, such as sustainable fisheries, carbon credit opportunities, and community-based ecotourism. For example, activities in Kersik Village, Kutai Kartanegara, proved that engaging the local community significantly improved the sustainability of planting efforts (Kartarnagara et al., 2022). Likewise, in Mangunharjo Village, Semarang, community service initiatives focused on mangrove planting effectively raised residents' ecological awareness (Rahmah, 2021). Additionally, in Boalemo, Gorontalo, the success of the planting program was linked to a combination of outreach, knowledge transfer, and active community involvement (Daga et al., 2023), emphasizing the importance of integrated education and empowerment efforts.

Furthermore, the Community-Based Ecological Mangrove Rehabilitation (CBEMR) concept highlights that effective mangrove restoration requires addressing both biophysical and social factors, with community involvement being central to sustainability (Brown et al., 2014). This approach emphasizes that social elements, including training on economic opportunities derived from mangrove ecosystems and strengthening local economic institutions, are essential for achieving long-term restoration success. The Ujung Pancu Beach area in Lambaro Neujid Village, Aceh Besar Regency, is a highly relevant site for mangrove conservation efforts, given ongoing coastal erosion and the loss of coastal vegetation cover. Mangrove planting activities here are more than just physical efforts; they also serve as platforms for environmental education, raising awareness of local economic potential linked to mangrove conservation and promoting ecological and economic perspectives on sustainability among younger generations.

This activity is crucial because mangroves offer many benefits. Mangrove forests are vital coastal ecosystems that play important roles for both people and the environment. These ecosystems not only help sustain ecological balance but also provide significant benefits from geological, ecological, social, and economic perspectives. They serve as a natural barrier between land and sea, helping stabilize shorelines, store carbon, and enhance the resilience of coastal communities. From a geological perspective, mangroves are vital for coastal stabilization and sediment control. Their roots slow water flow, reduce erosion, and trap sediment carried by seawater, helping maintain coastal shape and preventing erosion and abrasion.

Furthermore, the soil layer of mangrove ecosystems stores large amounts of carbon, making them a vital natural carbon sink (Hamilton & Friess, 2016). Ecologically, they offer important habitats for fish, crabs, and waterbirds, and act as nursery grounds for marine life. According to Bimrah et al. (2022), mangroves provide a wide range of ecosystem services, including supporting, regulating, provisioning, and cultural functions. Mangroves are also essential for maintaining water quality and the food chain in coastal ecosystems. These ecological services are enhanced by economic literacy components delivered during socialization activities, helping communities understand how healthy ecosystems support fisheries productivity, ecotourism revenue, and long-term economic resilience.

In addition, mangroves play an important social role in coastal communities. Besides protecting communities from disasters such as tsunamis and storms, mangroves also support livelihoods through marine products and mangrove wood. Garmaeepour et al. (2025) demonstrated that mangroves offer significant social and cultural value, are part of local community identity, and serve as sites for environmental education and research. The economic benefits of mangroves can be measured through various ecosystem services, including fisheries, tourism, and carbon valuation. Nopiana et al. (2024) estimated that the total economic value of mangroves in Karawang Regency exceeds 4 trillion rupiah per year, covering carbon sequestration, seawater intrusion control, and

fisheries production. By including education on community-based economic development models, the program enhances local capacity to sustainably utilize these benefits, making mangrove conservation not only an ecological effort but also a long-term economic investment for coastal communities.

Mangrove forests offer numerous interconnected benefits: environmentally, they help stabilize coastlines; ecologically, they serve as vital habitats and major carbon sinks; and socially and economically, they strengthen community resilience and promote sustainable development. Therefore, prioritizing mangrove conservation and restoration should be a key part of national environmental and economic policies. Improving mangrove quality is crucial because of their contributions to human well-being and ecosystem health, and because they play a vital role for future generations. Additionally, these efforts support the Sustainable Development Goals (SDGs), especially SDG 13 (Climate Action), SDG 11 (Sustainable Cities and Communities), SDG 4 (Quality Education), and SDG 3 (Good Health and Well-Being). Including economic literacy and empowerment education further enhances alignment with SDG 8 (Decent Work and Economic Growth) and SDG 14 (Life Below Water).

METHOD

The activity was carried out on October 12, 2025, at Ujung Pancu Beach, Lambaro Neujid Village, Peukan Bada District, Aceh Besar Regency, in a muddy coastal area suitable for the growth of Rhizophora sp. Sustainable Habitats and Ocean Restoration sponsor this community service activity for the Environment (SHORE), UNDP, USA, and other participants, including 60 young volunteers from Bina Antar Budaya Banda Aceh, the Aceh Aquatic Youth community, lecturers and students from the Faculty of Economics, Syiah Kuala University, and members of local village communities. A participatory approach was employed through five stages: (1) preparation and coordination; (2) education and socialization in the fields of economics and community empowerment; (3) field demonstration; (4) initial monitoring; and (5) social reflection.

IMPLEMENTATION AND RESULTS

This mangrove planting activity is conducted in four primary stages: i) preparation and coordination; ii) education and socialization in the fields of economics and community empowerment; iii) field demonstration; iv) initial monitoring; and v) social reflection. The activities in this community service primarily focus on preparing and planting mangroves.

i. Preparation stage, includes several essential activities designed to ensure the success of the mangrove planting program.

- Coordination and Education

The Community Service Team worked closely with the Village Head, Fishermen's Group, youth representatives, and community leaders of Ujung Pancu. During this step, a brief educational session was provided to inform participants about the ecological functions of mangroves, including shoreline protection, biodiversity support, and carbon sequestration, as well as proper planting techniques. This educational segment helps ensure that all volunteers understand the technical and ecological reasons behind the conservation effort.

- Site Survey

A comprehensive survey was conducted to determine the most suitable planting locations within the intertidal zone. A mixture of mud and sandy soil with high abrasion was observed at the

selected sites. These conditions were ideal for Rhizophora sp., which thrives in muddy substrates and serves as an effective natural wave breaker.

Figure 1. Location for Mangrove Plantation

- Seed Procurement

Seedlings of Rhizophora sp. (black mangrove) were selected due to their durability, strong root systems, and high adaptability to dynamic coastal environments. As recommended in coastal conservation guidelines, this species is effective in reducing wave energy and stabilizing soft coastal soils. The seedlings were planted at 1-meter intervals on a muddy substrate approximately 15 cm deep.

ii. Education and Socialization in Economics and Community Empowerment

Before the planting activity, participants, comprising students, youth communities, and local villagers, received educational socialization focused not only on ecological functions but also on economic literacy and community empowerment. The session highlighted:

- The economic value of mangrove ecosystems,
- Potential livelihood benefits (e.g., fisheries productivity, ecotourism, and non-timber products),
- community-based conservation models, and
- Strategies for integrating mangrove protection into local economic planning.

This stage aims to strengthen community ownership of the program and ensure long-term sustainability through increased economic awareness and empowerment.

iii. Implementation of the plantation

This stage represented the core implementation phase and involved collaboration among the community service team, university students, and Ujung Pancu residents.

- Planting Spacing Determination

A planting pattern of 1.5 x 1.5 meters was adopted. This spacing allows optimal density for early growth while ensuring that Rhizophora sp. root systems develop properly without nutrient competition.

- Planting Technique:

a) Stake Installation: Each planting point was marked with bamboo stakes to keep seedlings stable against wave action.
b) Hole Digging: Planting holes were prepared manually or with basic tools, with depth adjusted to fit the root structure of the polybag.
c) Seedling Planting: Seedlings were gently removed from the polybag, placed upright in the prepared hole, and packed with soil. Care was taken to avoid covering the respiratory roots (pneumatophores) too much. Seedlings were loosely tied to the bamboo stakes for protection from the movement of waves and tides.

These precise planting techniques are essential to improve seedling survival rates, particularly in dynamic intertidal environments.

Figure 2. Seeding Planting

- Documentation and Measurement

Baseline data, including the number of seedlings planted, planting coordinates, and environmental conditions, were recorded to support future monitoring activities.

Figure 3. Mangrove Planting Process

iv. Initial Monitoring

The initial monitoring phase involved visually inspecting seedlings shortly after planting to assess survival, stability, and potential environmental stressors. Early checks help teams spot seedlings displaced by waves, buried by sediment, or affected by pests, enabling timely corrective action if needed.

Figure 4. Group Photo after Mangrove Planting

v. Social Reflection

At the end of the activity, a reflection session was conducted involving participants, community representatives, and project facilitators. This session served to:

- Evaluate the implementation process,
- Capture community feedback,
- Strengthen environmental stewardship, and
- Discuss the socio-economic benefits of mangrove restoration.

The reflection stage also strengthened shared commitment between academic institutions, youth groups, and local communities to continue collaborative conservation efforts.

CONCLUSIONS

The mangrove planting activity in Ujung Pancu has produced measurable positive impacts in four main dimensions. First, the installation of 500 new mangrove stands is expected to significantly increase the coastal area's capacity to dampen waves and retain sediment, the primary functions of this ecosystem. Ecosystem-wise, the area will again function as a spawning and nursery ground for marine biota. The discussion shows that these new mangrove stands will be an important source of detritus for the food chain, supporting local biodiversity. In addition, the area's potential to store blue carbon has also increased. Second, the improvement in mangrove ecosystem health is believed to be directly proportional to increased catches of seafood (fish, shrimp, crab) for fishermen. In the long term, this area has the potential to be developed into a Mangrove Ecotourism. This potential can open new business opportunities for the Ujung Pancu community. Third, this activity has strengthened social cohesion and the spirit of cooperation between academics and the community. The most significant social impact is the creation of collective community awareness of the importance of coastal conservation. Fourth, this mangrove planting catalyzes the formation of community-based conservation groups focused on maintaining and monitoring newly planted mangrove areas, ensuring the program's independent sustainability.

Coastal rehabilitation activities through Rhizophora planting on Ujung Pancu Beach have been successfully implemented as planned. The expected benefits are multidimensional, encompassing ecological, ecosystem, economic, and social aspects. This activity recommends continuous, regular monitoring and local government support for the designation of the Ujung Pancu mangrove rehabilitation area as a conservation area.

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