



MANGROVE REFORESTATION IN TANJUNG PIAYU PANCUR SWADAYA RW 04 AS AN EFFORT TO PRESERVE THE MANGROVE FOREST ENVIRONMENT

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Abstract: The degradation of mangrove forests in the coastal area of Tanjung Piayu, caused by human activities and land conversion, threatens the sustainability of the coastal ecosystem and increases its vulnerability to abrasion. This community service activity aimed to rehabilitate the area through mangrove reforestation and to raise public awareness and active participation in environmental conservation. The implementation method began with a site survey and planting location identification based on natural hydrological principles, followed by technical planting briefings, participatory reforestation involving students and local residents, and the installation of educational banners. The results showed that 1,000 mangrove seedlings were successfully planted. Post-planting ecological impacts observed included increased coastal substrate stability and the reappearance of various marine biota, indicating the recovery of habitat functions. Socially, this activity successfully built collective awareness and a sense of ownership among the community towards the mangrove forest, which is key to its sustainability. It is concluded that the participatory approach in reforestation not only improves ecological conditions but also empowers the community to become guardians of the mangrove. Therefore, a periodic monitoring program and the expansion of partnership networks are required to ensure long-term sustainability.

Keyword: Reforestation, Mangrove, Conservation, Community Participation, Tanjung Piayu.

INTRODUCTION

The mangrove ecosystem in Bakau Pancur Swadaya RW 04, Tanjung Piayu, Batam, represents one of the most important coastal green belts in the area. It functions not only as a natural buffer that protects coastal settlements from abrasion, erosion, and tidal surges, but also as a highly productive ecosystem that supports the livelihood of the local fishing community. The mangrove serves as a nursery ground for various aquatic species such as fish, shrimp, and crabs, which are central to the economic activities of local fishermen. Beyond its ecological role, the mangrove forest also acts as a crucial carbon sink. As stated by Prof. Cecep Kusmana of IPB University, mangrove ecosystems have a carbon storage capacity four to five times greater than that of terrestrial tropical forests, making them significant contributors to climate change mitigation.

The residents of Pancur Swadaya RW 04 have a strong cultural and economic connection with the coastal environment, yet limited environmental management practices and community-based conservation initiatives have left the mangrove area vulnerable to degradation. This creates



an urgent need for collaborative conservation programs that integrate local wisdom, ecological knowledge, and sustainable economic practices

Despite its ecological importance, the mangrove area in Pancur Swadaya RW 04, Tanjung Piayu is currently facing severe environmental degradation. Field observations indicate that large portions of the mangrove cover have been converted into fishponds and residential zones. In addition, pollution from household waste and small-scale industrial activities has caused sedimentation and poor water quality, affecting mangrove regeneration.

The once-dense mangrove stands now appear sparse, with visible erosion along the shoreline and a decline in biodiversity. The loss of mangrove cover has also increased the vulnerability of the community to coastal hazards such as storm surges and tidal flooding. Furthermore, there is a noticeable lack of awareness and structured community involvement in mangrove protection. Many residents perceive mangrove planting as a one-time event rather than a continuous environmental stewardship effort. This gap between environmental awareness and practical conservation measures has become one of the major obstacles in restoring and maintaining the mangrove ecosystem.

To respond to these issues, a community-based mangrove rehabilitation and education program is proposed as a comprehensive and sustainable solution. The conceptual framework of this initiative is grounded in participatory environmental management, which positions the local community as the central actor in mangrove conservation. The approach emphasizes three key components:

- a. Ecological restoration, by planting and maintaining native mangrove species suited to the soil and tidal conditions of Tanjung Piayu;
- b. Community empowerment, through training programs, environmental education, and local leadership development to enhance knowledge and sense of ownership among residents; and
- c. Sustainable livelihood integration, by promoting eco-friendly economic activities such as mangrove ecotourism, crab and fish cultivation within mangrove zones, and small-scale processing of mangrove products.

As noted by Dr. Nyoto Santoso from LIPI, the true success of mangrove restoration depends not solely on the number of seedlings planted but on the long-term participation and empowerment of the surrounding community. Therefore, the program at Bakau Pancur Swadaya



RW 04 seeks to build a model of continuous engagement where ecological restoration and social empowerment are mutually reinforcing.

The objectives of this program are designed to address both ecological and social dimensions of mangrove sustainability

- (1) To restore the ecological integrity of the mangrove area in Bakau Pancur Swadaya RW 04, Tanjung Piayu, through systematic reforestation and habitat rehabilitation.
- (2) To strengthen community awareness and participation in environmental conservation by fostering a sense of shared responsibility and stewardship over the mangrove ecosystem.
- (3) To improve the resilience of the coastal area against natural hazards such as erosion, storm surges, and flooding, thereby reducing the vulnerability of local settlements.
- (4) To promote sustainable economic development through mangrove-based community enterprises that combine conservation efforts with income generation.
- (5) To create a replicable model of community-driven mangrove conservation that can be implemented in other coastal areas facing similar environmental challenges.

Through these objectives, the project aims to transform the people of Pancur Swadaya RW 04, Tanjung Piayu, into proactive guardians of the mangrove—individuals who not only restore the ecosystem physically but also uphold its sustainability for generations to come

METHODOLOGY

The implementation of this community service program was carried out directly in the field with an emphasis on practical and participatory approaches. The method was designed to address the real conditions of the mangrove area in Tanjung Piayu, where parts of the coastline have experienced abrasion and degradation due to human activities and tidal waves. Therefore, this activity not only aimed to plant mangroves but also to strengthen community awareness and involvement in protecting the coastal ecosystem. The methodology consisted of four main components: the approach and implementation, the stages of activities, the target and location details, and the activity flow diagram, which are described below.

The activity adopted a participatory field-based approach, emphasizing direct collaboration between students, local residents, and mangrove area managers. The implementation was carried out through practical reforestation activities supported by environmental education and awareness campaigns.



Before planting, the team conducted coordination with local leaders and mangrove caretakers to ensure the selected planting area was suitable in terms of soil stability, tidal flow, and accessibility. During the planting day, participants followed instructions from field supervisors on proper planting techniques, including seed spacing, depth, and the direction of root placement to prevent seedlings from being uprooted by waves. The participatory nature of the program enabled the local community to learn directly about mangrove maintenance and post-planting monitoring.

Table 1. Activity Stages

No	Activity	Description
1	Survey and Site Observation	This initial stage was conducted on September 5, 2025. The team visited the coastal area of RW 04 Pancur Swadaya to assess the current condition of the mangrove forest. Observations included identifying areas with high abrasion risk, analyzing soil texture and water salinity, and marking suitable planting points. Discussions with the mangrove caretakers were also held to obtain technical guidance about local planting methods and tidal patterns.
2	Coordination and Briefing	After the site survey, the coordination meeting was carried out with local residents, community leaders, and mangrove management representatives. The objective was to align the technical and logistical aspects of the activity. Participants were divided into several task groups: seedling transport, planting, and documentation. The briefing also emphasized safety procedures, environmental ethics, and teamwork to ensure an organized field implementation
3	Mangrove Planting Process	On September 6, 2025, the main activity of planting mangroves was carried out. The team brought mangrove seedlings to the designated sites and began planting under the supervision of the mangrove caretakers. Participants learned the correct planting method — including the ideal planting depth (10–15 cm), distance between seedlings (approximately 50 cm), and positioning of roots facing the tide to prevent uprooting. Despite the muddy terrain and moderate wave currents, the team successfully completed the planting process by midday. The activity continued with environmental cleaning around the site to remove waste materials
4	Evaluation and Documentation	After planting, the team conducted an initial evaluation to observe the condition of the planted seedlings and ensure that all areas were covered as planned. A short discussion was held with the local community to plan post-planting monitoring and maintenance schedules. Documentation was carried out in the form of photos, field notes, and a report banner installation as a sign of reforestation activity. The documentation also served as an educational reference for future environmental projects.



RESULTS AND DISCUSSION

The mangrove reforestation program was implemented in the coastal area of RW 04 Pancur Swadaya, Tanjung Piayu, Batam, where environmental degradation had become a serious issue due to tidal waves, abrasion, and land conversion. The local community relied heavily on coastal resources such as aquaculture and small-scale fishing, which made mangrove sustainability crucial for their livelihoods. The implementation of the program was designed not only as a tree-planting activity but also as an educational and participatory initiative that encouraged community members to take responsibility for their coastal environment.

The activity was conducted over two days and included field observation, coordination meetings, mangrove planting, and evaluation sessions. Through this field-based implementation, the program successfully combined academic engagement with local wisdom and environmental awareness.

The level of participation in this program was high and collaborative. The activity involved 26 university students, 5 local residents, and mangrove area caretakers as direct field partners. The students took the lead in technical planning, data recording, and documentation, while the local community contributed practical knowledge of the site and assisted in field operations. The mangrove caretakers acted as facilitators who provided technical guidance on the appropriate planting methods and site management.

This collective engagement created a sense of shared responsibility between academic institutions and local communities. It also provided students with hands-on experience in environmental conservation and community-based project management.

The program involved three main groups of participants:

- (1) University students from Universitas Riau Kepulauan as field implementers.
- (2) Local residents of RW 04 as community partners and custodians of the area.
- (3) Mangrove caretakers as technical advisors and site supervisors.

The implementation of the mangrove reforestation program demonstrated that participatory collaboration is an effective model for sustainable environmental management. By combining academic resources with local knowledge, the program addressed both ecological and social dimensions of coastal restoration.

From an ecological perspective, mangrove planting contributed to improving coastal resilience by reducing abrasion and supporting biodiversity recovery. This aligns with previous studies by Kusmana (2014) and CIFOR (2020), which emphasize that successful mangrove



rehabilitation depends on community involvement and site-specific planting techniques. From a social perspective, the activity succeeded in raising environmental awareness among residents who initially had limited understanding of mangrove functions. The interaction between students and community members fostered mutual learning, bridging scientific knowledge with traditional practices.

Overall, the program produced not only environmental benefits but also strengthened local participation and academic contribution in achieving sustainable development goals (SDG 14 – Life Below Water and SDG 15 – Life on Land). The combination of practical fieldwork and social empowerment proved to be a sustainable approach to preserving mangrove ecosystems in coastal communities such as Tanjung Piayu.



Figure 1. Figure 1. Activity Program

CONCLUSION AND RECOMMENDATIONS

Conclusion

The mangrove reforestation program in RW 04 Pancur Swadaya, Tanjung Piayu, demonstrated that participatory and community-based environmental action can effectively restore degraded coastal ecosystems. The activity successfully improved shoreline stability, reduced the risk of abrasion, and created new habitats for marine life.

Beyond its ecological benefits, the program significantly enhanced community awareness and cooperation in environmental protection. Local residents, students, and mangrove caretakers worked collaboratively, reflecting a shared sense of responsibility for maintaining coastal sustainability. This collaboration also provided a valuable learning experience for students, bridging academic knowledge with real-world application.

Overall, the implementation of mangrove planting not only restored the natural environment but also fostered long-term environmental stewardship within the local community.



The project's success illustrates the importance of combining scientific approaches, local knowledge, and collective participation to achieve sustainable coastal management in Indonesia.

Recommendation

1. **Continuous Monitoring and Maintenance:** Regular monitoring should be conducted to ensure the growth and survival of the planted mangroves. Community patrol groups or youth volunteers could be formed to inspect the site and replace damaged seedlings.
2. **Community Empowerment Programs:** Further training and environmental education should be provided for local residents to strengthen their capacity in mangrove conservation, waste management, and coastal ecosystem restoration.
3. **Collaboration Expansion:** Future programs should involve a broader range of stakeholders — including local government, NGOs, and private companies — to secure funding, share technical knowledge, and expand the impact area of reforestation.
4. **Integration with Sustainable Tourism:** The reforested area can be developed as a small-scale eco-tourism or educational site, promoting mangrove awareness while providing additional economic opportunities for local residents.
5. **Replication and Policy Support:** The success of this project can serve as a model for other coastal communities in Batam and across Indonesia. Institutional support from universities and government agencies is essential to replicate similar community-based conservation efforts at a larger scale.

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