



Restoration of coastal ecosystems: Enhancing community involvement in mangrove adoption in Mampie, West Sulawesi

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Abstract

Mampie Hamlet, West Sulawesi, is experiencing coastal abrasion, increasingly frequent tidal flooding, and water pollution that threaten the environment and community economy. Previous efforts, such as the installation of breakwaters, have not been effective in addressing these issues. This community service aims to increase community awareness and involvement in coastal conservation through a mangrove adoption system. The methods include focus group discussions (FGDs) with stakeholders, participatory visual-based training, and mangrove planting and monitoring at two locations. Four hundred forty-five mangrove seedlings were planted using an adoption system involving the community, schools, and universities. Monitoring over three months showed that 87% of the mangroves survived at the first location, while the second location experienced higher losses due to waste and environmental disturbances. From these results, the mangrove adoption system effectively increases community participation and planting success, although further support is needed in waste management and environmental awareness to maintain the achieved results.

Keywords: Coastal abrasion; Tidal flooding; Mangrove adoption

Pemulihan ekosistem pesisir: Peningkatan peran masyarakat dalam adopsi mangrove di Mampie, Sulawesi Barat

Abstrak

Dusun Mampie, Sulawesi Barat, mengalami abrasi pantai, banjir rob yang semakin sering, dan pencemaran air yang mengancam lingkungan dan ekonomi masyarakat. Upaya sebelumnya, seperti pemasangan pemecah ombak, belum efektif dalam mengatasi permasalahan ini. Tujuan pengabdian ini adalah meningkatkan kesadaran dan keterlibatan masyarakat dalam konservasi pesisir melalui sistem adopsi mangrove. Metode yang digunakan mencakup focus group discussion (FGD) dengan pemangku kepentingan, pelatihan partisipatif berbasis visual, serta penanaman dan pemantauan mangrove di dua lokasi. Sebanyak 445 bibit mangrove ditanam dengan sistem adopsi, yang melibatkan masyarakat, sekolah, dan universitas. Pemantauan selama tiga bulan menunjukkan bahwa 87% mangrove bertahan hidup di lokasi pertama, sementara lokasi kedua mengalami kehilangan yang lebih tinggi akibat sampah dan gangguan lingkungan. Dari hasil ini, dapat disimpulkan bahwa sistem adopsi mangrove efektif dalam meningkatkan partisipasi masyarakat dan keberhasilan penanaman, meskipun perlu dukungan lebih lanjut dalam pengelolaan sampah dan kesadaran lingkungan untuk mempertahankan hasil yang dicapai.

Kata Kunci: Abrasi pantai; Banjir rob; Adopsi mangrove

Contributions to
SDGs



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1. Introduction

Mampie, a coastal *dusun* (hamlet) in Polewali Mandar, West Sulawesi, faces significant challenges related to coastal erosion, tidal flooding, and pollution. Severe coastal erosion threatens the sustainability of coastal ecosystems and the livelihoods of local communities ([Amuthalakshmi, 2023](#); [Inácio et al., 2022](#); [Jaharudin et al., 2019](#); [Rahimova, 2024](#); [Sundar et al., 2022](#)). Increasingly frequent tidal flooding, exacerbated by climate change and human activities such as land subsidence and coastal land exploitation, further increases the vulnerability of this region. Additionally, water quality is frequently compromised by pollutants entering through rivers and surface runoff from domestic and agricultural activities.

Previous mitigation efforts have primarily focused on installing breakwaters ([Akarsh & Chaudhary, 2023](#); [Saengsupavanich et al., 2022](#); [Y. Xia, 2025](#)). However, this solution has proven ineffective, particularly in addressing the threat of tidal flooding. These limitations stem from Mampie's geographic characteristics, which are entirely coastal, requiring more comprehensive and adaptive solutions.

Recognizing the limitations of previous approaches, mangrove planting in Mampie's coastal zone emerges as a promising, cost-effective, and practical solution for community implementation. Given the absence of a pre-existing mangrove ecosystem, introducing this plant species represents a strategic intervention. Mangrove ecosystems are vital natural defenses, protecting coastlines from rising sea levels and extreme wave events. Research indicates that mangroves can absorb over 50% of wave energy ([Samiksha et al., 2019](#)), significantly reducing the risk of tidal flooding. Furthermore, the robust root systems of mangroves stabilize coastal soils and prevent erosion ([Kazemi et al., 2021](#)), which often exacerbates the impacts of tidal flooding. Mangroves also play a crucial role in improving water quality by filtering pollutants and sediments before they reach the sea ([Marchand et al., 2012](#)). With their ability to adapt to climate change and provide multidimensional protection to coastal environments, mangrove planting is a critical measure for disaster mitigation and long-term protection for coastal communities from the threat of tidal flooding.

A key constraint on the success of mangrove planting initiatives is a lack of community motivation and ownership. This project implemented a mangrove adoption system ([Gborie et al., 2016](#)). This system was designed to attract active participation from residents and educational institutions (universities and schools). Through the adoption system, each mangrove seedling planted would be "adopted" by an individual or group who would assign their name to the plant. Therefore, the responsibility for evaluating and monitoring mangrove health would rest with the Mampie community and involve the adopters. This mechanism is expected to increase planting success through greater attention and raise awareness and knowledge among adopters regarding the importance of mangrove ecosystems.

The primary objective of this community service activity was to enhance awareness and involvement among community members and stakeholders in coastal conservation efforts in Mampie by implementing a mangrove adoption system. The project's goal is to create a participatory model that can be effective in restoring coastal ecosystems in other vulnerable regions.

2. Method

This project was conducted from July 10, 2024, to October 14, 2024, at the coastal area of Rumah Sahabat Penyu in Mampie, Galeso Village, Wonomulyo District, Polewali Mandar Regency, West Sulawesi Province. The project's implementation involved three main phases:

2.1. Preparation phase

This phase included initial activities required prior to program implementation: (a) obtaining permits and identifying partner groups; (b) conducting a focus group discussion (FGD) with village officials, community partners, and the project team to explain the project's overview, objectives, timeline, and designation of group leaders; and (c) preparing the tools and materials required for training and mentoring.

2.2. Implementation phase

This phase involved the following activities: (a) providing participatory visual-based training to the community; (b) introducing tools and materials for mangrove planting and demonstrating their use; (c) demonstrating planting procedures, the mangrove adoption system (marking mangroves with adopter names and QR codes containing monitoring information), and initial monitoring; (d) providing direct hands-on mangrove planting by the community; (e) constructing mangrove media to support plant growth; and (f) implementing mangrove planting by partners and the project team.

2.3. Evaluation and monitoring phase

To measure the program's success, the following evaluation and monitoring activities were conducted: (a) monthly monitoring of mangrove growth by partners and the project team in August, September, and October 2024; (b) evaluation of the program's impact on environmental conditions and the level of community participation; (c) follow-up actions for improving program effectiveness in the future; and (d) administering satisfaction surveys using a Likert scale.

3. Results and Discussion

3.1. Mangrove planting

The project began with a focus group discussion (FGD) involving village officials, community partners, and the project team to agree on preparing tools and materials for training and support before mangrove planting. This training and support was conducted visually and in a participatory manner, gathering residents of Mampie in front of the Rumah Penyu (turtle conservation center) owned by the partner organization, Sahabat Penyu ([Figure 1](#)). Most participants were women from Mampie. Tools such as bamboo stakes, raffia rope, labels for adopters' names, and mangrove media were demonstrated during the training and support sessions, and their respective functions were explained.

After all participants understood the concepts and methods, mangrove planting was directly implemented by the community ([Mulloy et al., 2025](#); [Shao et al., 2025](#)). Mangrove planting was successfully carried out at two designated locations. Location 1, with coordinates latitude -3.45499911598269 and longitude 119.277706383945, was located east of Mampie Beach. Location 2, with coordinates latitude -3.4549372517128063

and longitude 119.27226671687407, was located west of Mampie Beach. Location 1 received 390 mangrove seedlings, and Location 2 received 55 seedlings. All participants were enthusiastic and collaborated to plant the mangroves (Figure 2), spacing them 0.5 meters apart in a parallel, intersecting pattern (Phong et al., 2017; Thivakaran, 2017; Van Bijsterveldt et al., 2022).



Figure 1. Mangrove planting training and support for community members



Figure 2. Mangrove adoption planting by Mampie residents and volunteers

3.2. Mangrove monitoring

Following planting, mangrove monitoring was conducted monthly from August to October 2024 (Figure 3). The monitoring results indicated a gradual decrease in the number of surviving mangroves.

Table 1 shows a gradual decrease in surviving mangroves at Location 1. In contrast, Location 2 experienced a complete loss of surviving mangroves. This decline can be attributed to external factors such as large tree trunks and plastic waste carried by currents from the sea to Mampie Beach (Figure 4). These large tree trunks toppled a significant portion of the planted mangroves. Plastic waste hindered mangrove growth, preventing optimal development and causing mortality. Akram et al. (2022) explain that one contributing factor is a lack of attention to the coastal environment. Nguyen et al. (2024) also support the claim that some local residents have low levels of understanding and awareness regarding ecological functions. Evidence of trash, such as large tree trunks that were not removed from the planting site and plastic waste, remained.



Figure 3. Monitoring of planted mangroves after planting

Table 1. Progress of mangrove adoption program from planting to monitoring

| Location No. | Number of Mangroves Planted | Number of Surviving Mangroves | | |
|--------------|-----------------------------|-------------------------------|----------------|--------------|
| | July 2024 | August 2024 | September 2024 | October 2024 |
| 1 | 390 | 351 | 302 | 260 |
| 2 | 55 | 11 | 0 | 0 |



Figure 4. Large tree trunks and plastic waste carried by ocean currents, contributing to mangrove mortality

Despite these challenges, the Mampie community benefited significantly from the mangrove adoption program. This is supported by the satisfaction assessment from participants in the mangrove planting (Figure 5). Statements measuring the satisfaction of Mampie residents and participants in the mangrove adoption program indicated high satisfaction levels on 3 and 4, where 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree. These scores indicate strong agreement regarding the community service activity (Table 2). The percentage satisfaction rates, ranging from 85% to over 90%, demonstrate high satisfaction among the Mangrove Adoption program participants.

This high level of satisfaction is supported by Duryat et al. (2022) who suggest that a correct understanding of knowledge related to mangroves can shift community attitudes

from a lack of awareness to an increased focus on mangrove conservation. This satisfaction also indicates successful community engagement, with [Izzudin et al. \(2024\)](#), noting that this form of community engagement is an appropriate collaboration for preserving and maintaining the sustainability of mangrove ecosystems in coastal areas. Mangrove conservation provides satisfaction to the local community and positively impacts the environment [Hartini et al. \(2023\)](#), point out that communities with increased understanding of mangrove conservation can recognize the ecotourism potential of mangrove ecosystems, which can support economic development in the region.

Table 2. Satisfaction scores during the community service project

| No | Total Score per Statement | Expected Total Score | Score Percentage | Statement |
|----|---------------------------|----------------------|------------------|--|
| 1 | 119 | 140 | 85% | Participants strongly agree that the community service material meets their needs. |
| 2 | 120 | 140 | 86% | Participants strongly agree that the community service activities met their expectations. |
| 3 | 121 | 140 | 86% | Participants strongly agree that the presenters delivered the material in an engaging, clear, and easy-to-understand manner. |
| 4 | 122 | 140 | 87% | Participants strongly agree that the community service team provided services that met their needs. |
| 5 | 124 | 140 | 89% | Participants strongly agree that all complaints/questions/problems were appropriately addressed by the presenters/community service team. |
| 6 | 124 | 140 | 89% | Participants strongly agree that they directly benefited from the community service activities. |
| 7 | 125 | 140 | 89% | Participants strongly agree that the community service activities that have been implemented can be continued by the partners. |
| 8 | 129 | 140 | 92% | Participants strongly agree that they are satisfied with the implementation of the community service. |

The presence of debris underscores the limited awareness among some individuals residing near Mampie Beach, highlighting an area for future evaluation. Interventions that can be implemented include behavioral change training, such as daily practices for cleaning up organic waste/home composting ([Barrena & Sanchez, 2022](#); [Garcia et al., 2023](#)) and inorganic waste such as plastic ([Çolakoglu & Uyanik, 2024](#); [Kjaer & Joly, 2025](#); [Restrepo et al., 2024](#); [Thran et al., 2024](#)) in addition to facilitating the proper disposal of waste ([Bulati et al., 2025](#); [Escario et al., 2022](#); [B. Xia et al., 2020](#)) Regardless of the actions of a few individuals, the responsibility falls to the government of Polewali Mandar Regency, as Mampie is a well-known destination for mangrove and coastal ecosystem tourism. Therefore, the synergy between the local government, partners, community

members, and the academic community is needed to preserve the mangrove ecosystem in Mampie jointly.

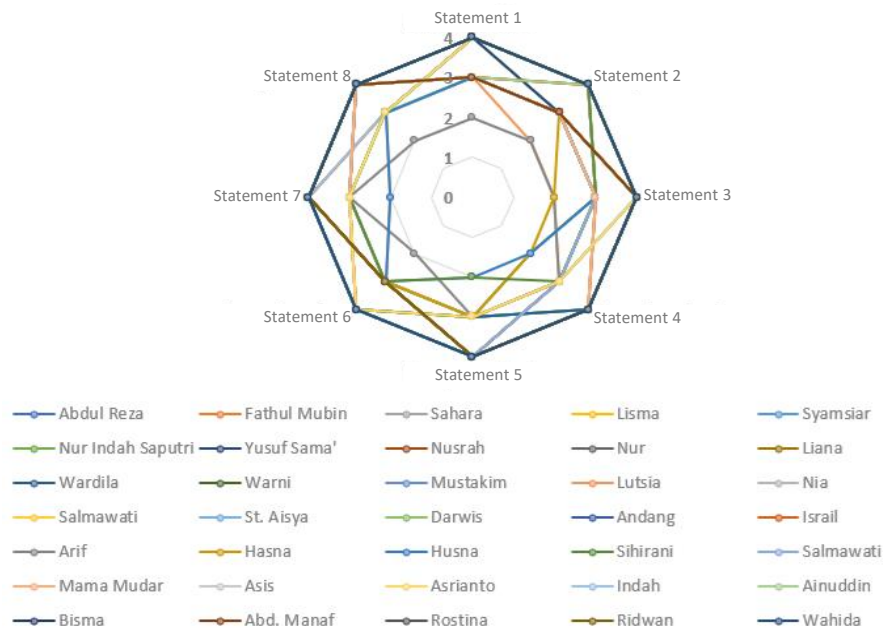


Figure 5. Radar chart of satisfaction assessment for planters and adopters during the mangrove adoption program

4. Conclusion

The community service project effectively enhanced the understanding and awareness of most Mampie residents and participants from outside Mampie who served as mangrove adopters, particularly the women who enthusiastically participated in planting and acquired up-to-date knowledge and information during activity monitoring. The results demonstrate that, despite the lack of awareness from some individuals not directly involved in the activity, the community needs dedicated knowledge and training. Future activities will prioritize including those members of Mampie who have not previously participated in the community service program. In this way, shared aspirations for preserving mangrove and coastal ecosystems can be realized in the future, supported by the local government for this project in Polewali Mandar Regency concerning the beauty and preservation of mangrove and coastal ecosystems in Mampie Beach.

Author Contributions

Activity Implementation: AKSP, MRKY, Isd, MT, MA; Article Preparation: AKSP, Isd; Analysis of Community Service Impact: AKSP, MRKY; Presentation of Community Service Results: MT, MA; Article Revision: AKSP, MRKY, Isd.

Conflict of Interest

All authors declare that there are no financial or non-financial conflicts of interest related to this article.

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