

Strengthening Community Capacity Through Tsunami Education Programs in the Mangrove Community of Kebumen

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Abstract

Coastal communities, such as the Mangrove Community of Kebumen, face significant risks from tsunamis due to their geographical location. This community service initiative aimed to enhance tsunami disaster preparedness through education and mangrove conservation. The objectives were to improve community knowledge on tsunami mitigation and to empower locals in mangrove planting and maintenance practices. The methodology involved a structured program conducted at Pantai Sawangan, Desa Puring, involving 30 participants from the mangrove community and local residents. The activities included pre-tests, educational sessions on tsunami mitigation and mangrove conservation, and post-tests to evaluate knowledge retention. Expert-led discussions highlighted the role of mangroves as natural barriers against tsunamis. Results showed a significant increase in participants' understanding of tsunami risks and mitigation strategies post-training (High knowledge to 56.6%). Participants actively engaged in practical sessions, demonstrating enhanced skills in mangrove planting and maintenance. Feedback indicated strong community support and a desire for continued educational initiatives. In conclusion, the program effectively improved community resilience through enhanced knowledge and practical skills in disaster preparedness and mangrove conservation. Continued socialization and educational programs are recommended to sustain community involvement and deepen understanding of disaster mitigation across diverse societal groups, ensuring long-term resilience against coastal hazards.

Keywords: Disaster preparedness; Education; Mangrove conservation; Tsunami mitigation

Abstract

Komunitas pesisir, seperti Komunitas Mangrove di Kebumen, menghadapi risiko besar terkena tsunami karena lokasi geografis mereka. Inisiatif pengabdian masyarakat ini bertujuan untuk meningkatkan kesiapsiagaan bencana tsunami melalui pendidikan dan konservasi mangrove. Tujuannya adalah untuk meningkatkan pengetahuan masyarakat mengenai mitigasi tsunami dan memberdayakan masyarakat setempat dalam praktik penanaman dan pemeliharaan mangrove. Metodologi yang digunakan adalah program terstruktur yang dilakukan di Pantai Sawangan, Desa Puring, dengan melibatkan 30 peserta dari komunitas mangrove dan warga sekitar. Kegiatan yang dilakukan meliputi pre-test, sesi edukasi mengenai mitigasi tsunami dan konservasi mangrove, serta post-test untuk mengevaluasi retensi pengetahuan. Diskusi yang

dipimpin para ahli menyoroti peran hutan bakau sebagai penghalang alami terhadap tsunami. Hasilnya menunjukkan peningkatan yang signifikan dalam pemahaman peserta mengenai risiko tsunami dan strategi mitigasi pasca pelatihan (Pengetahuan tinggi menjadi 56.6%). Peserta secara aktif terlibat dalam sesi praktik, menunjukkan peningkatan keterampilan dalam penanaman dan pemeliharaan mangrove. Masukan yang diberikan menunjukkan dukungan masyarakat yang kuat dan keinginan untuk melanjutkan inisiatif pendidikan. Kesimpulannya, program ini secara efektif meningkatkan ketahanan masyarakat melalui peningkatan pengetahuan dan keterampilan praktis dalam kesiapsiagaan bencana dan konservasi mangrove. Program sosialisasi dan pendidikan yang berkelanjutan direkomendasikan untuk mempertahankan keterlibatan masyarakat dan memperdalam pemahaman tentang mitigasi bencana di berbagai kelompok masyarakat, sehingga menjamin ketahanan jangka panjang terhadap bahaya pesisir.

Kata kunci: Kesiapsiagaan bencana; Pendidikan; Konservasi hutan bakau; Mitigasi tsunami

INTRODUCTION

The Mangrove Community of Kebumen, located near the shore, is extremely at risk to the damaging effects of tsunami. Despite the important need for preparedness, many community members lack the information and abilities required to respond effectively to disasters. This lack of understanding and preparation endangers their lives and livelihoods. As a result, the primary issue addressed in this community service project is the critical need to strengthen the community's ability to reduce the effects of tsunamis through focused education initiatives. The major goal of this community service effort is to improve the community's ability to respond to tsunamis. We hope to provide community people with the knowledge and skills they need to mitigate and prepare for disasters by conducting comprehensive educational programs. This includes training on early warning systems, evacuation protocols, and developing community-based disaster response plans. By incorporating these ideas, our initiative hopes to bridge the gap between academic understanding and actual application, providing that Kebumen's Mangrove Community is better prepared to handle future tsunami threats. The program is expected to result in enhanced community awareness, improved disaster response skills, and, eventually, a safer, more resilient coastal community.

GENERAL DESCRIPTION OF THE COMMUNITY, PROBLEMS AND TARGET SOLUTIONS

General description

The Kebumen Mangrove Community is located along the Kebumen coast in Central Java, Indonesia. This community's primary source of income is coastal resources, such as fishing, aquaculture, and mangrove conservation. The region is known for its rich biodiversity, particularly its as large mangrove forests, which play an important role in safeguarding the shoreline from erosion and providing habitat for a variety of marine species. The community is tightly connected with strong social relationships and a shared desire to preserve the natural environment. However, because to its geographical location, the community is exposed to natural calamities, particularly tsunamis, which affect their safety and well-being.

Tabel 1. Target description

No	Name of target	Characteristics of target	Amount	General problem or targets
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1	The Mangrove Community	Group	10	Voultenters
2	Residents around the coast	Group	20	Local residents

Problem

Despite the inherent risk of tsunamis, the Mangrove Community of Kebumen faces several challenges in disaster preparedness and response. A major issue is the lack of comprehensive knowledge and awareness about tsunami risks and effective mitigation strategies among community members. This gap in knowledge results in limited preparedness and inadequate response capabilities during emergencies. Additionally, there is a scarcity of resources and infrastructure to support effective disaster management, including early warning systems and evacuation routes. The community's dependence on coastal resources also makes them particularly vulnerable to the economic impacts of natural disasters, further exacerbating their challenges.

Tabel 2. Problem and solution

No	Problem	solution	Indicators of goal
1	Education: Knowledge level	Knowledge transfer	Increase skor knowledge
2	Disaster risk reduction	Prevention	no disaster occurred

Target solution

To address these issues, the community service project intends to implement targeted solutions that will strengthen the community's capacity for tsunami preparedness and response. The major solution comprises creating and providing educational programs that are designed to meet the needs of the community. These programs will give thorough training in tsunami awareness, early warning systems, evacuation techniques, and community-based disaster response planning. In addition, efforts will be undertaken to improve the community's disaster management infrastructure, such as establishing designated evacuation routes and installing early warning systems. By providing the community with the required knowledge and tools, the project hopes to build a culture of resilience and proactive disaster mitigation, ultimately ensuring the safety and sustainability of Kebumen's Mangrove Community.

METHOD

The community service activities were conducted at Pantai Sawangan, Desa Puring, with the participation of 30 individuals, including members of the Mangrove Community and local residents from the surrounding coastal area. The activities were held on May 5, 2024, at Sawangan Beach. The methodology for these activities was structured into three main phases: preparation, implementation, and evaluation.

Preparation

In the preparation phase, the team coordinated closely with partner organizations and the Mangrove Community to finalize the schedule and location of the activities. This involved a series of meetings to ensure all logistical aspects were addressed. Educational materials and mangrove seedlings were prepared in advance to facilitate a smooth implementation. These preparations were crucial for ensuring that the participants would have all necessary resources and information readily available during the activities.

Implementation

The implementation phase took place in the morning, involving a total of 30 participants. The activities commenced with a pre-test to assess the participants' initial knowledge regarding mangrove conservation and tsunami mitigation. The educational sessions were led by experts in mangrove conservation and care, providing in-depth knowledge on the importance of mangroves, their role in coastal protection, and best practices for planting and maintaining mangroves. The participants engaged actively in the sessions, which were designed to be interactive and practical, ensuring that the information was both accessible and applicable

Evaluation

The evaluation phase was conducted to measure the effectiveness of the educational activities and to assess the participants' understanding and retention of the information provided. A post-test was administered, focusing on key aspects of mangrove care and tsunami mitigation covered during the sessions. The results of the post-test were compared with the pre-test to evaluate the knowledge gained by the participants. Additionally, feedback was gathered to identify areas for improvement and to refine future educational programs.

RESULTS AND DISCUSSION

The community service activity worked well, with 30 participants actively participating. The participants answered the questions correctly, both before and after the educational session. The event was divided into three segments. The first session included a pre-test. The second session featured a presentation of materials as well as a discussion about tsunami disaster mitigation and the mangrove community's role in disaster mitigation programs. The third session included the post-test and a feedback session. All participants gave favorable comments and stated a desire for more similar programs in the future.

Table 1 : Knowledge of Tsunami Disaster Mitigation (Pre Test)

Knowledge	n	%
High	8	26,7
Moderate	20	66,6
low	2	6.7

Table 2 : Knowledge of Tsunami Disaster Mitigation (Post Test)

Knowledge	n	%
High	17	56.6
Moderate	12	40
low	1	3.4

Education on tsunami disaster mitigation programs is crucial for coastal communities, particularly those as vulnerable as the Mangrove Community of Kebumen. Tsunami mitigation involves various strategies, among which the planting of mangroves is a vital component (Sarapang, Rogi, and Hanny, 2019; Tamuntuan, Pasau, and Takumansang, 2019). Mangroves play a significant role in reducing the impact of tsunamis by acting as natural barriers, dissipating wave energy, and minimizing coastal erosion. However, the effectiveness of this mitigation strategy depends not only on the initial planting but also on the long-term care and maintenance of the mangroves until they grow into mature trees that can provide maximum protection (Yang *et al.*, 2018; Zuhdi *et al.*, 2019).

In the context of the Mangrove Community of Kebumen, the reality of disaster preparedness reflects a blend of traditional knowledge and modern scientific understanding. The community has a long history of interacting with their coastal environment, yet the frequency and intensity of tsunamis necessitate enhanced mitigation efforts (Suwaryo and Waladani, 2020). By

incorporating modern educational programs that emphasize the science behind mangrove ecosystems and their protective benefits, the community can better appreciate the importance of their conservation efforts. This educational approach helps bridge the gap between traditional practices and contemporary disaster management strategies (Suwaryo, Sarwono, and Yuwono, 2020; Maolani *et al.*, 2021).

From a theoretical perspective, the role of mangroves in disaster mitigation is well documented. Mangroves can absorb and dissipate the energy of incoming waves, reducing the height and force of tsunamis before they reach the shore. The dense root systems of mangroves also help stabilize the soil, preventing erosion and maintaining the integrity of the coastline (Hariyadi, 2020; Natawidjaja, 2021). Additionally, mangroves provide critical habitats for various marine species, which contribute to the overall health of the coastal ecosystem. The theory underscores the multifaceted benefits of mangroves, not just in terms of disaster mitigation but also in enhancing biodiversity and supporting sustainable livelihoods (Syamsidik *et al.*, 2019; Rerung, Rahman, and Yahya, 2022).

The practical implementation of this theory in the Mangrove Community of Kebumen involved a comprehensive approach that began with education and extended to active participation in mangrove planting and maintenance. During the community service activity, participants were educated about the importance of mangroves and trained in best practices for their care. This hands-on approach ensured that community members were not only aware of the theoretical benefits but also equipped with the practical skills needed to sustain their mangrove forests. This dual focus on theory and practice was essential for building a resilient community capable of withstanding future tsunamis (Majid *et al.*, 2016; Wulung and Abdullah, 2020).

Feedback from the participants highlighted the success of this integrated approach. The positive responses and the expressed desire for more such activities indicated that the community valued the education and saw the tangible benefits of their efforts. This reinforced the idea that disaster mitigation is an ongoing process that requires continuous education, community engagement, and sustained effort. By fostering a culture of resilience and proactive mitigation, the Mangrove Community of Kebumen could better protect themselves against the threats of tsunamis and contribute to broader goals of environmental conservation and sustainable development (Agusti and Rahmah, 2019; Husna *et al.*, 2019; Khambali, Rachmaniyah, and Rokhmalia, 2020).

Following the successful implementation of the community service activities, comprehensive follow-up steps were crucial to ensure the sustainability and effectiveness of the tsunami disaster mitigation program in the Mangrove Community. The first step was to establish a task force or monitoring team responsible for regularly checking the condition of the planted mangroves. This team consisted of community members who had received training and were committed to maintaining the mangroves. They conducted periodic maintenance, such as replanting dead seedlings, pruning, and controlling pests or diseases. Consistent monitoring ensured that the mangroves grew well and provided maximum protection against tsunamis.

We plan on conducting advanced training sessions to improve community members' knowledge and skills in disaster mitigation. These workshops will focus on specific areas of mangrove management and other attempts to mitigate tsunamis. We will invite experts or practitioners with experience in mangrove conservation and disaster prevention to lead this program. This method will provide the community with not just fundamental knowledge, but also practical skills. The creation of supporting infrastructure is also a priority in this further inquiries strategy. We will work to establish or upgrade evacuation routes and early warning systems so that they

are more effective. In addition, we will perform simulations or evacuation drills on a regular basis to guarantee community preparation in disaster scenarios. Adequate infrastructure and regular training will significantly boost community readiness.

Collaboration with external partners is another critical stage. We will work with government agencies, non-governmental organizations (NGOs), and educational institutions to get technical and financial assistance for the creation of this disaster mitigation program. We will also submit bids for money or technical assistance to help expand and deepen the community's disaster mitigation program. We believe that with the participation of numerous stakeholders, this initiative may be more effective and sustainable. Finally, the program's efficacy will be assessed by ongoing evaluation and research, as well as the exploration of new catastrophe mitigation strategies. Regular evaluations will help you discover your skills, flaws, and areas for progress. In addition, research will be done to document program outcomes and serve as a resource for future program development.

Regular socializing and education initiatives involving many community groups, including schools, will also help to raise awareness and encourage community participation. With these planned and detailed follow-up procedures, we hope to ensure that the tsunami hazard mitigation program in the Mangrove Community of Muhammadiyah Kebumen operates sustainably and benefits the entire community.

CONCLUSIONS AND SUGGESTIONS

This education had a positive impact on the knowledge of the mangrove community and the surrounding population. The follow-up plan included organizing regular socialization and education activities to enhance awareness and active participation in disaster mitigation programs. Additionally, programs involving various community groups, including schools, were created to ensure broad community involvement and a solid understanding of disaster mitigation.

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