International Journal of Community Care of Humanity (IJCCH)
Vol 3, No. 6, June 2025 , pp.

MANGROVE WERE PLANTED IN COASTAL AREAS AS AN EFFOTR TO PROTECT THE ECOSYSTEM

Jumiati[1*], Arjulayana[2], Evita Anggereini[3], Widyastuti[4], Ali Mustofa[5]

[1]Department of Biology Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Buton
JL. Muhammad Husni Thamrin, No. 30, 93712, Waborobo, Betoambari, Kota Bau-Bau, Sulawesi Tenggara 93717 - Indonesia
[2]Universitas Muhammadiyah Tangerang, Banten - Indonesia
[3]Universitas Jambi, Jambi - Indonesia
[4]Universitas Negeri Surabaya, Jawa Timur – Indonesia

*Corresponding Author: : jumijumiati23@gmail.com

Article history:

Received: June 2025
Revised: June 2025
Accepted: June 2025

ABSTRACT Mangroves are coastal ecosystems that have a very important role in protecting and maintaining marine biodiversity, including in protecting coastal areas due to climate change. The utilization of coastal areas as nature-based tourism areas has caused a decrease in the number of mangroves, especially in the Batusori coastal tourism area of Palabusa Village and this has led to a decrease and even the absence of mangrove functions in the area. This condition will have an impact either directly or indirectly on the society and the coastal environment. So it is necessary to rehabilitate through planting mangrove seedlings. This service activity was carried out on February 3, 2024. The tools and materials used are raffia mangrove seeds, bamboo sticks, crowbars and small shovels. The implementation of activities is carried out in several stages, namely: 1) survey of the service location; 2) coordination with Kelurahan officials; 3) selection of mangrove species; 4) mangrove planting; and 5) evaluation. This activity succeeded in planting mangrove seeds with a spacing of 1x1 m with the Rhizophora stylosa species. The selection of this species is based on several reasons, one of which is the ability of this species to grow and develop on rocky sand substrates. The evaluation results showed that the success of planting reached 25%.

KEYWORDS: *Coastal Ecosystem; Mangrove; Planting; Rhizophora Stylosa.*

1. INTRODUCTION

Coastal areas are areas that are influenced by sea tides so that they become transitional areas between terrestrial ecosystems and marine ecosystems. This region has a high diversity of living things that contribute significantly to the community's economy, for example through fisheries, and tourism. Lakshmi (2021) states that coastal areas are areas that have rich biodiversity with high productivity. One component that plays an important role in maintaining the sustainability of coastal areas is the mangrove forest ecosystem.

Mangroves are plants that live tidal areas, between the ocean and land. Mangrove forest ecosystems are found throughout coastal areas and have a very important role. Mangroves provide spawning and breeding grounds for ecosystem-dwelling biota, coastal protection, biodiversity, and pollution interception (Marlianingrum et al., 2021; Qiao & Wang, 2024; Andarias et al., 2023).

According to Wang & Gu (2021) Mangrove ecosystems play a role in maintaining and protecting tropical and non-tropical marine biodiversity and have a very important function in global biogeochemical processes and climate change. This ecosystem also functions as a natural fortress that protects the coast from erosion and large wave attacks, one of which is the strong mangrove roots that help maintain soil stability around the coastline (Mamonto, et al., 2023).

This is in line with Choudhary et al. (2024) which states that mangroves help prevent storms, hurricanes, coastal erosion, and tidal waves and hold large carbon stocks, allow long-term carbon storage, have the capacity to control greenhouse gas emissions, and have the potential to reduce the increase in CO2 levels in the atmosphere.

Some activities that occur in mangrove ecosystems have an unfavorable impact on mangrove vegetation. According to Garcés-Ordóñez et al.(2021) mangroves are highly productive ecosystems for ecological, cultural, and economic functions that experience various impacts from human activities and natural events. Human activities that utilize mangrove forests for firewood and building materials, as well as tourism development, lead to changes in vegetation composition and structure.

This is in line with Garmaeepour et al. (2025) and Vargas-del-Río & Brenner (2023) who stated that mangrove ecosystems face risks from various challenges such as industrial development and economic instability and the desire of stakeholders to utilize mangrove areas as areas for nature-based tourism. human activities related to land use change are the main factors that drive changes in mangrove distribution (Tran et al., 2024). Society activities that throw garbage around mangroves are also one of the reasons for damage to mangrove ecosystems.

According to Jayapala et al., (2024) there is a positive correlation between physical damage to roots, seedlings, and shrub vegetation with debris cover. In addition, the increasing development activities in the mangrove forest area will have a negative impact on the mangrove ecosystem therefore its function is not maximized.

Palabusa Village is one of the coastal areas in Baubau City. People in this village generally work as fishermen. This coastal area is utilized as a tourist spot with the construction of buildings and bridges to attract tourists. This has led to a decrease in the number of mangrove plants in the area. Though as explained earlier, these plants have a very important role both for the environment and society. So the rehabilitation process is very necessary. Mangrove forest rehabilitation is the main strategy to offset the loss of previous mangrove forests due to coastal development (Andarias et al., 2023). Mangrove rehabilitation is carried out for the protection of coastal areas and settlements, mitigation of long-term climate change impacts, and addressing the economic problems of surrounding communities (Djamaluddin, 2018).

2. METHOD

This society service activity was carried out on February 3, 2024 in the Batusori tourist area, Palabusa Village, Lea-Lea District, Baubau City. The materials used in this activity include mangrove seedlings, raffia rope, and bamboo sticks. The tools used are a crowbar and a small shovel. The implementation of the activity was carried out in several stages, namely: 1) survey of the service location; 2) coordination with Kelurahan officials; 3) selection of mangrove species; 4) mangrove planting. 5) Evaluate the success of planting mangrove seedlings.

3. RESULT AND DISCUSSION

This community service activity was carried out around the Batusori tourist area, Palabusa, Lea-Lea sub-district, Baubau City focusing on mangrove planting as a form of mangrove rehabilitation. The planting location was chosen based on the survey results and also coordination with the Palabusa Village Head. This is due to the development carried out to attract tourists to visit the place. This aligns with Matitaputty et al., (2024) findings that the reduction in mangrove forest area results from human activities, such as development for roads, recreation areas, restaurants, and aquaculture. Additionally, illegal logging, land-use change, and unsustainable exploitation of mangroves for firewood, building materials, and charcoal also contribute to damage to mangrove forest ecosystems (Rudianto et al., 2020).

Whereas the existence of mangroves is very important to protect the area from erosion and sea waves and other ecological functions. According to Agaton & Collera (2022) mangrove rehabilitation is carried out as a form of natural defense against climate change or extreme weather and this rehabilitation is an efficient solution for protection from damage due to climate change, carbon sequestration, and ecotourism. In addition, the existence of mangroves indirectly plays an important role for the society because mangroves support the presence of crab and fish populations that can be utilized by the society.

According to Untari, et al. (2020) mangroves provide a vital habitat for crabs, fish, and other marine life, which can serve as a primary source of income for local communities.

The results of the site survey also show the condition of the substrate at the planting site which shows the dominant substrate of rocky sand. This will certainly affect the type of mangrove plants that can grow in the area. Because each species has different adaptability to different substrate conditions. Based on the substrate conditions (rocky sand), the service team determined that the mangrove species planted was from the Rhizophoraceae family, namely Rhizophora stylosa which has the ability to grow in mud, sand and rock habitats. Rhizophora is a mangrove species that is widely planted for restoration because of its easier propagation and is the dominant species in Indonesian mangrove ecosystems (Craft, 2022; Kalasuba et al., 2023).

The research findings of Ariyanto & Pringgenies (2024) also indicate that the Rhizophora stylosa species has the highest nitrogen content (in leaves) and the highest phosphorus content (in leaves and fruit) compared to other species. These two elements are macronutrients that play a crucial role in plant growth and development, so selecting this species is expected to support the availability of N and P in the soil, thereby supporting ecosystem sustainability. This aligns with Aprilia et al. (2020) statement that the biogeochemical cycle, consisting of energy flow and nutrient cycles (including water, nitrogen, phosphorus, and sulfur), is necessary for living organisms in the mangrove ecosystem to survive.

Rhizophora stylosa seedlings were obtained directly from the society in Wadiabero Village, Central Buton. The results of Zhang et al., (2021) showed that Rhozophora stylosa is one of the mangrove species that has propagules with higher regeneration ability than Ceriops tagal, Bruguiera sexangula, Bruguiera gymnorrhiza, Bruguiera sexangula var. rhynchopetala and Avicennia marina. Rhizophora is a mangrove species with a very well developed leaf hypodermis layer that provides an advantage in water storage ability and prevents sunlight irradiation with high light intensity, and this species shows the highest salinity tolerance ability (Ankure et al., 2023). The production of mangrove reproductive organs is influenced by climatic factors and the adaptive characteristics of each species (Kamruzzaman et al., 2025).

a). **Figure 1.** Documentation of activities (planting)

b). **Figure 2.** Community service team with the Head of Palabusa Village

The seedling planting process is carried out by planting bamboo first with a distance of approximately 1 x 1 m (Figure 1.a). This is done to support the growth and development of mangrove seedlings. Mangrove planting distance adjusts to the purpose of planting, if planting with the aim of production then planting is done with a distance of 2 x 2 m while if it aims for conservation then planting with a distance of 1 x 1 m (Nurmadi, et al., 2021). After the bamboo is planted in the ground, then the seeds are planted into the excavated soil using a crowbar or small shovel and tied to the bamboo using raffia rope. This is done to avoid dragging the seedlings when there are waves of sea water. The seedlings used were taken directly from the community without a nursery. Direct planting of mangrove seedlings is a viable alternative for Rhizophora restoration as hypocotyls embedded in the substrate promote faster root initiation and formation (Mulloy et al., 2025). Mangrove planting serves as protection from coastal flooding and protects against erosion due to high wave energy (van Hespen et al., 2023; Vargas-del-Río & Brenner, 2023)

The results of the evaluation of mangrove planting showed a 25% success rate with the number of branches varying between 1 and 5 branches. The number of leaves produced also varied from having no leaves to having as many as 35 leaves. The absence of leaves during observation is likely due to leaf fall, as observations revealed several individual mangroves with yellowing or brown leaves. This is consistent with the research by Ihsan et al. (2023), which showed that the growth rate of mangrove leaves is low due to the high number of dead plants and fallen leaves during observation.

The low success rate of planting is likely due to the mangrove seedlings' weak anchorage to the substrate, making them easily washed away during high tide. It may also be influenced by salinity and temperature. The results of research conducted by Torres et al. (2022) showed that air temperature and water temperature affect mangrove development, including litter production influenced by salinity and water temperature.

4. CONCLUSION

The mangrove seedling planting activity went well with the planting point around the Batusori tourist area. However, it is still necessary to plant more at points around the coast in Palabusa Village with the aim of maintaining and protecting the coastal environment and supporting the life of marine organisms which will greatly benefit the surrounding society.

ACKNOWLEDGMENT

The service team would like to thanks to all parties involved in this activity, especially the Head of Palabusa Village who has provided support for this activity, and we would like to extend our gratitude to Universitas Muhammadiyah Buton for their financial support, which has enabled the successful implementation of this activity.

CONFLICT OF INTERESTS

This activity was carried out through collaboration and tasks allocation between the leader and team members. The leader was responsible for the entire process of community service activities, starting from preparation, procurement of mangrove seeds, observation of planting locations, coordination with the team and relevant parties, planting process, data collection (evaluation of planting results), and drafting publication articles. Team members assisted each other at every stage of the activity, with some helping with location observation and determining the type of seeds to be planted, others preparing mangrove seeds, some assisting the leader in coordinating with the village administration, and others assisted in drafting the community service publication article.

REFERENCES

Agaton, C. B., & Collera, A. A. (2022). Now or later? Optimal timing of mangrove rehabilitation under climate change uncertainty. *Forest Ecology and Management*, *503*, 119739. https://doi.org/10.1016/J.FORECO.2021.119739

Andarias, S. H., Aba, L., Taharu, F. I., Jumiati, J., Yanti, Y., Badaraf, A. T., Hartati, M., & Jamaludin, J. (2023). Sosialisasi dan Penanaman Mangrove di Sulawesi tenggara. *JMM (Jurnal Masyarakat Mandiri)*, *7*(4), 3371–3378. https://doi.org/10.31764/JMM.V7I4.15880

Ankure, S., Tah, M., Mondal, S., Murmu, A. K., & Naskar, S. (2023). Adaptive evolution of leaf anatomical features in mangrove Rhizophoraceae cues differential strategies of salt tolerance. *Flora*, *300*, 152225. https://doi.org/10.1016/J.FLORA.2023.152225

Aprilia, D., Arifiani, K. N., & Cahyaningsih, A. P. (2020). *Review : Biogeochemical process in mangrove ecosystem*. *10*(2), 126–141. https://doi.org/10.13057/bonorowo/w100205

Ariyanto, D., & Pringgenies, D. (2024). *Nutrient Distribution in Natural and Rehabilitated Mangroves with Various Types of*. *19*(6), 2171–2178.

Choudhary, B., Dhar, V., & Pawase, A. S. (2024). Blue carbon and the role of mangroves in carbon sequestration: Its mechanisms, estimation, human impacts and conservation strategies for economic incentives. *Journal of Sea Research*, *199*, 102504. https://doi.org/10.1016/J.SEARES.2024.102504

Craft, C. (2022). Mangroves. *Creating and Restoring Wetlands*, 297–336. https://doi.org/10.1016/B978-0-12-823981-0.00008-3

Djamaluddin, R. (2018). *Mangrove-biologi, ekologi, rehabilitasi, dan konservasi* (pertama). Unstrat

Press. http://repo.unsrat.ac.id/2658/1/Mangrove_Biologi_Ekologi_Rehabilitasi_Konservasi_2018.pdf

Garcés-Ordóñez, O., Saldarriaga-Vélez, J. F., & Espinosa-Díaz, L. F. (2021). Marine litter pollution in mangrove forests from Providencia and Santa Catalina islands, after Hurricane IOTA path in the Colombian Caribbean. *Marine Pollution Bulletin*, *168*, 112471. https://doi.org/10.1016/J.MARPOLBUL.2021.112471

Garmaeepour, R., Alambeigi, A., Danehkar, A., & Shabani, A. A. (2025). Mangrove forest ecosystem services and the social well-being of local communities: Unboxing a dilemma. *Journal for Nature Conservation*, *84*, 126827. https://doi.org/10.1016/J.JNC.2025.126827

Ihsan, A., Adibrata, S., & Farhaby, A. (2023). Analisis tingkat kelangsungan hidup mangrove untuk mengukur keberhasilan rehabilitasi mangrove di Desa Tuik Kabupaten Bangka Barat. *Jurnal Sumberdaya Perairan*, *17*(2), 58–63.

Jayapala, H. P. S., Jayasiri, H. B., Ranatunga, R. R. M. K., Perera, I. J. J. U. N., & Bellanthudawa, B. K. A. (2024). Ecological ramifications of marine debris in mangrove ecosystems: Estimation of substrate coverage and physical effects of marine debris on mangrove ecosystem in Negombo Lagoon, Sri Lanka. *Marine Pollution Bulletin*, *201*, 116184. https://doi.org/10.1016/J.MARPOLBUL.2024.116184

Kalasuba, K., Miranti, M., Rahayuningsih, S. R., Safriansyah, W., Riscahya, R., Syamsuri, P., Farabi, K., Oktavia, D., Alhasnawi, A. N., & Doni, F. (2023). Red Mangrove (Rhizophora stylosa Griff.)—A Review of Its Botany, Phytochemistry, Pharmacological Activities, and ProspectsQ1Plants; H-Index: 47 SJR: Q1 HCERE: NA CORE: NA FT50: NA 1Plants; H-Index: 47 VHB: NA FNEGE: NA CoNRS: NA CCF: NA BFI: 1 AJG: NA ABD. *Mdpi.Com*. https://doi.org/10.3390/plants12112196

Kamruzzaman, M., Minarul Islam, M., & Hossen, N. (2025). Intra and inter specific variation of propagule settings of the family Rhizophoraceae in the Sundarbans mangrove forest. *Aquatic Botany*, *197*, 103834. https://doi.org/10.1016/J.AQUABOT.2024.103834

Lakshmi, A. (2021). Practice Coastal ecosystem services & human wellbeing. *Indian J Med Res*, *153*(March), 382–387. https://doi.org/10.4103/ijmr.IJMR

Mamonto, A.A.N., Sari, L., Mamonto, S., Irsan, Usulu, E.M., Suratini, Tuhumurry, H. . (2023). Kegiatan Pengabdian Masyarakat Penanaman Mangrove di Ciberi. *Jurnal Pengabdian Kolaborasi Dan Inovasi IPTEKS*, *1*(5), 582–587.

Marlianingrum, P. R., Kusumastanto, T., Adrianto, L., & Fahrudin, A. (2021). Valuing habitat quality for managing mangrove ecosystem services in coastal Tangerang District, Indonesia. *Marine Policy*, *133*, 104747. https://doi.org/10.1016/J.MARPOL.2021.104747

Matitaputty, E. R., Retraubun, A. S. W., Selanno, D. A. J., Papilaya, R. L., & Puturuhu, F. (2024). *Dampak Pemanfaatan Ruang terhadap Kelestarian Mangrove di Teluk Ambon , Indonesia Impact of Space Utilization on Mangrove Sustainability in Ambon Bay , Indonesia mencakup Teluk Ambon Bagian Dalam*. *7*(2), 514–528.

Mulloy, R., Aiken, C. M., Dwane, G., Ellis, M., & Jackson, E. L. (2025). Scalable mangrove rehabilitation: Roots of success for Rhizophora stylosa establishment. *Ecological Engineering*, *212*, 107521. https://doi.org/10.1016/J.ECOLENG.2025.107521

Nurmadi, R., Elhanafi, A. M., Lubis, I., & Siregar, R. (2021). Penanaman Bibit Mangrove dan Penyuluhan Penting nya Budidaya mangrove di Daerah Pesisir (Kel. Nelayan Indah, Kecamatan Medan Labuhan). *Jurnal.Harapan.Ac.Id*, *3*(1), 21–27. https://www.jurnal.harapan.ac.id/index.php/Prioritas/article/view/376

Qiao, K., & Wang, W. X. (2024). The dual role of coastal mangroves: Sinks and sources of microplastics in rapidly urbanizing areas. *Journal of Hazardous Materials*, *480*, 136408. https://doi.org/10.1016/J.JHAZMAT.2024.136408

Rudianto, R., Bengen, D. G., & Kurniawan, F. (2020). Causes and E ff ects of Mangrove Ecosystem Damage on Carbon Stocks and Absorption in East Java , Indonesia. *Sustainability*, *12*, 1–17.

Torres, J. R., Sánchez-Mejía, Z. M., Arreola-Lizárraga, J. A., Galindo-Félix, J. I., Mascareño-Grijalva, J. J., & Rodríguez-Pérez, G. (2022). Environmental factors controlling structure, litter productivity, and phenology of mangroves in arid region of the Gulf of California. *Acta Oecologica*, *117*, 103861. https://doi.org/10.1016/J.ACTAO.2022.103861

Tran, T. V., Reef, R., & Zhu, X. (2024). Long-term changes of mangrove distribution and its response to anthropogenic impacts in the Vietnamese Southern Coastal Region. *Journal of Environmental Management*, *370*, 122658. https://doi.org/10.1016/J.JENVMAN.2024.122658

Untari, R Darma, P betaubun, A. A. A. (2020). Review of the use of mangrove forests in supporting the socio-economic life of fishing communities Review of the use of mangrove forests in supporting the socio- economic life of fishing communities. *IOP Conf. Ser.: Earth and Environ. Sci*, *575*, 1–5. https://doi.org/10.1088/1755-1315/575/1/012042

van Hespen, R., Hu, Z., Borsje, B., De Dominicis, M., Friess, D. A., Jevrejeva, S., Kleinhans, M. G., Maza, M., van Bijsterveldt, C. E. J., Van der Stocken, T., van Wesenbeeck, B., Xie, D., & Bouma, T. J. (2023). Mangrove forests as a nature-based solution for coastal flood protection: Biophysical and ecological considerations. *Water Science and Engineering*, *16*(1), 1–13. https://doi.org/10.1016/J.WSE.2022.10.004

Vargas-del-Río, D., & Brenner, L. (2023). Mangroves in transition. Management of community spaces affected by conservation and tourism in Mexico. *Ocean & Coastal Management*, *232*, 106439. https://doi.org/10.1016/J.OCECOAMAN.2022.106439

Wang, Y. S., & Gu, J. D. (2021). Ecological responses, adaptation and mechanisms of mangrove wetland ecosystem to global climate change and anthropogenic activities. *International Biodeterioration & Biodegradation*, *162*, 105248. https://doi.org/10.1016/J.IBIOD.2021.105248

Zhang, Y., Xin, K., Sheng, N., Xie, Z., & Liao, B. (2021). The regenerative capacity of eight mangrove species based on propagule traits in Dongzhai Harbor, Hainan Province, China. *Global Ecology and Conservation*, *30*, e01788. https://doi.org/10.1016/J.GECCO.2021.E01788