Abdi Wisata, Volume 1, No 2, Halaman 60-68, Tahun 2024
e-ISSN 3063-1777

Sustainable Community Service Initiatives for Environmental Cleanliness and Coral Reef Restoration on Gili Tangkong

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Abstrak

Pulau-pulau kecil di Lombok, seperti Gili Tangkong, memiliki potensi wisata yang besar dengan keindahan alam dan kekayaan ekosistem lautnya. Namun, tingginya kunjungan wisatawan dan minimnya pengelolaan lingkungan telah menyebabkan kerusakan terumbu karang dan penurunan kualitas kebersihan. Program pengabdian masyarakat ini bertujuan untuk meningkatkan keberlanjutan lingkungan melalui transplantasi terumbu karang, penanaman pohon, dan pembersihan area pantai dengan melibatkan wisatawan dan masyarakat setempat. Kegiatan dilakukan selama dua hari dengan partisipasi dari dosen, mahasiswa, wisatawan, dan masyarakat sekitar. Hasil kegiatan menunjukkan perbaikan signifikan pada ekosistem laut, pencegahan abrasi pantai, dan peningkatan kesadaran lingkungan di kalangan wisatawan dan masyarakat setempat. Tantangan yang dihadapi antara lain adalah penyampaian informasi teknis, pemilihan lokasi yang tepat, serta pengelolaan sampah secara efektif. Program ini diharapkan menjadi contoh bagi konservasi lingkungan dan meningkatkan daya tarik wisata yang berkelanjutan di Gili Tangkong.

***Kata kunci**: pulau kecil; transplantasi terumbu karang; kebersihan lingkungan; penanaman pohon; pariwisata berkelanjutan*; *gili tangkong*

Riwayat artikel
Diajukan : 15 Oktober 2024
Diterima : 29 November 2024
Dipublikasikan : 30 November 2024

Abstract

Small islands in Lombok, such as Gili Tangkong, have immense tourism potential with their natural beauty and rich marine coral ecosystems. Nonetheless, large numbers of tourists and insufficient environmental management have contributed to coral reef damage and a decline in the quality of cleanliness. This community service initiative, which involves both tourists and local people, strives to increase environmental sustainability by transplanting coral reefs, planting trees, and cleaning beaches. The activities lasted two days and involved lecturers, students, tourists, and members of the neighboring community. The findings revealed major benefits in the marine habitat, avoidance of coastal erosion, and greater environmental consciousness among tourists and locals. The challenges include delivering technical information, selecting proper locations, and effectively managing waste. The goal of this program is to set a positive example for environmental conservation and enhance the appeal of sustainable tourism in Gili Tangkong.

***Keywords**: small island; coral reef transplantation; environmental cleanliness; tree planting; sustainable tourism; gili tangkong*

1. Introduction

Tourism on the small islands of Lombok has experienced rapid development along with the increasing interest of tourists in exotic natural destinations. These small islands offer unique natural beauty, especially in terms of seascapes, white sandy beaches, and underwater biodiversity (Chanif & Sarwito, 2014; Maulindayanaa, 2023). This natural potential has made small islands in Lombok a major attraction for local and foreign tourists (Hidayatullah, 2024; Indayani et al., 2024; Mas' ud et al., 2022). One of these small islands is Gili Tangkong. This small island is one of three islands located in the Sekotong District of West Lombok Regency including Gili Sudak and Gili Nanggu. Some travel service providers usually make travel packages for these three islands. However, the large number of tourists and unoptimal management pose an adequate threat to environmental sustainability (Fauzan & Burhanuddin, 2023; Han, 2021), including marine and coastal ecosystems which are the main attraction for tourists.

A significant threat faced by Gili Tangkong is the destruction of coral reefs. The degradation of coral reefs around Gili Tangkong has experienced significant degradation due to various factors, such as water pollution, the use of fishing gear that is not environmentally friendly, and direct contact with tourists (Agustina et al., 2023; De et al., 2020; Eka, n.d.; Ritonga et al., 2022). These damages result in coral reefs slowly becoming extinct, thus losing their function as habitats for various marine species and destroying the balance of ecosystems in coastal areas.

In addition to damage to the underwater ecosystem, cleanliness around the island is also a serious problem. High tourist activity often leaves traces of plastic waste and other waste on the beach. Not only that, trash carried from the mainland by ocean currents also worsens the hygiene conditions around the island. This accumulation of garbage not only damages the aesthetics of nature but also threatens the survival of marine life, which in turn negatively affects the tourist experience of enjoying the beauty of nature in natural and clean conditions.

The destruction of coral reefs and dirty environmental conditions around the island worsen the attractiveness of tourism in this area. The implementation of the concept of sustainable tourism, tourists are increasingly interested in destinations that prioritize environmental conservation and preserved natural beauty (Aminuddin et al., 2024; Desembrianita et al., 2024; Gonia & Jezierska-Thöle, 2022; Streimikiene et al., 2021). This trend demands the maintenance of healthy and sustainable environmental conditions as a form of shared responsibility between destination managers, tourists, and surrounding communities. Without significant environmental improvements, the competitiveness of tourism on other small islands in Lombok and even those outside Lombok is threatened and tourist interest will decline as their attention turns to other destinations that are better preserved.

Due to these conditions, environmental improvement is an urgency that needs to be followed up with concrete actions (Ahmad et al., 2022; Cardoso, 2020; Paramita et al., 2021; Sulistyadi et al., 2021). Small islands in Lombok have great potential to develop as sustainable tourist destinations, but this requires awareness and commitment from all parties to protect the environment. Steps to restore and preserve the environment are not only important to maintain tourist attractiveness, but also an ecological responsibility that must be fulfilled in an effort to maintain the natural balance in the area.

Based on the analysis of some of the problems above, as a form of social responsibility and commitment to environmental conservation, community service activities were carried out which focused on three main efforts, namely 1) transplanting coral reefs; 2) planting trees; and 3) cleaning the area around the island. The urgency of these activities lies in the immediate need to address environmental degradation that threatens the sustainability of tourism on Gili Tangkong and other small islands in Lombok. Without swift and concrete action, the continued destruction of coral reefs, accumulation of waste, and overall decline in environmental quality will not only diminish the islands' natural beauty but also jeopardize the ecological balance that supports marine biodiversity. This deterioration risks reducing tourist interest, impacting local economies and communities reliant on tourism. Coral transplantation was carried out to repair damaged marine ecosystems and help regenerate coral reefs around Gili Tangkong. Tree planting is done to prevent coastal erosion and improve air quality. While beach cleaning activities aim to reduce the amount of garbage and increase the awareness of local communities and tourists of the importance of environmental cleanliness. By implementing this service program, it is hoped that it can strengthen the natural tourism attractiveness of Gili Tangkong

and have a positive impact on the sustainability of tourism on small island tourism in Lombok as well as being a real example of environmental conservation efforts.

2. Methods

This sustainable community service activity was carried out for 2 days on 29th to 30th September 2023. Furthermore, the site of this activity focuses on a small tourism island called Gili Tangkong which is located in the Sekotong tourism area, West Lombok Regency, West Nusa Tenggara Province. The team gathered and departed from Lombok Tourism Polytechnic at 07.00 WITA. Then travel by bus to the dock with a travel time of 1 hour. Then proceed with a sea trip using 3 units of speed boat to Gili Tangkong with a travel time of 30 minutes. Arriving at Gili Tangkong, the team conducted a briefing and preparation. The first day of service activities focused on transplanting coral reefs and the second day focused on planting trees and cleaning up the area around the island. These three activities are carried out by dividing groups, each of which focuses on a predetermined field from planning to implementation as stated in Table 1.

Table 1. Focus Area and Team Members

No	Focus area	Team Members
1.	Coral Reef Transplantation	a. 2 Lecturer/ Supervisor b. 2 Marine Biologist c. 10 Students
2.	Tree Planting	a. 1 Lecturer/ Supervisor b. 10 Students
3.	Clean-up of the Island Surrounding Area	a. 1 Lecturer/ Supervisor b. 10 Students

Source: Community Service Team (2023)

The total number of teams involved in this activity was 36 people. Although it has been divided into small teams and focused on their fields, but in its implementation, all activities are carried out with good cooperation from all team members. In addition, in tree planting and cleaning activities around the island, the team was assisted by several volunteers from tourists and the surrounding community. The coral reef transplantation was carried out on the first day in the afternoon around 4:30 pm to 6:00 pm. This time was chosen because the water temperature was low which could reduce the risk of stress on coral reefs and the sea water lighting was still bright. While the implementation of tree planting and cleaning the area around the island was carried out on the second day starting in the morning at 07.30 to 11.30 which was carried out together.

3. Results and Discussion

The implementation of community service activities that carry the theme of sustainability has three main focuses, namely coral reef transplantation, tree planting and cleaning the area around the island in Gili Tangkong. Details of the results of this two-day activity are presented below.

3.1 Coral Reef Transplantation

During the implementation of coral reef transplantation in the waters around Gili Tangkong, there were 4 stages starting from briefing and preparation to planting at the transplantation site. These stages are important for the entire team so that each member understands the process and the implementation of coral reef transplantation can run smoothly. The stages are as follows:

3.1.1 Briefing and Preparations

Briefings and preparations are conducted to ensure all team members have the same understanding and also know their respective roles and responsibilities. During this stage, the entire team was given detailed information on the safety procedures and technical steps to be followed. During this briefing, the team from Marine Biogists gave an in-depth explanation on the use of the tools and their function and purpose in planting coral reef seedlings.

Furthermore, in this preparation stage, several steps are carried out starting from checking the condition of diving equipment and substrate readiness. This process is done to ensure that there will be no technical problems when the transplantation begins. With careful preparation, it is expected to reduce the risk of coral reef damage during transplantation and maximize the success of the activity.

Image 1. Briefing and preparations
Source: Community Service Team (2023)

The challenge in this briefing activity is how the Expert Team can communicate and convey technical information and safety procedures in a way that is easily understood by all team members, especially for participants who are still new to coral reef transplantation.

3.1.2 Planting Site Selection

The selection of planting sites is an important part of the success of coral reef transplantation. The chosen location must be able to meet certain ecological criteria such as the right depth, sufficient light intensity, and not too strong currents. These factors are important so that coral reef seedlings can grow and develop optimally.

Initial observations have been conducted previously by a team of marine biologists to determine the ideal spots in the waters around Gili Tangkong. The expert team used direct observation and underwater mapping methods to ensure safe substrate conditions for coral reef seedlings. This carefully considered location determination will support the sustainability of the transplanted coral reefs.

The challenge in this stage is how to find the right location with the right depth, light intensity, and current so that the seedlings can grow well. This process requires sufficient observation time and careful mapping underwater, especially in waters with changeable conditions.

3.1.3 Coral Fragmentation

Coral fragmentation is performed carefully to ensure the equilibrium of the original ecosystem. The selected coral plantlets should come from healthy colonies that are resistant to the environmental conditions of the waters in Gili Tangkong. These should be undertaken with methods that minimize disruptions so as not to damage the original ecosystem.

Furthermore, it should be noted that the collection of coral seedlings must be done carefully, especially when cutting or removing coral seedlings and must use special tools, namely coral clippers to avoid damage. The expert team ensures that the seedlings are strong enough and suitable for transplantation. This approach is important so that the seedlings can adjust to their new habitat with a high survival rate. Once the seedlings are collected, they are then transported up the beach using baskets to be installed on the prepared substrate.

Image 2. Coral fragmentation
Source: Community Service Team (2023)

There are challenges in retrieving coral seedlings without damaging the parent colony or the original ecosystem. This requires precision and special tools. This process requires expertise and accuracy so that the original ecosystem is maintained.

3.1.4 Substrate Preparation

Substrate preparation is required to create a stable planting surface that can support coral reef growth. Substrates are selected and prepared from environmentally friendly materials that have high resistance to marine conditions. Structuring and cleaning the substrate is done to ensure that the seedlings are well attached and protected from strong currents. The substrate in this coral reef planting uses iron media that has been designed to form a welded frame to make it easy to install seedlings and safe for environmental conditions under the sea.

Image 3. Substrate Preparation Process
Source: Community Service Team (2023)

Substrate preparation also involves the process of placing the seedlings using safe techniques. This involves attaching the seedlings to the substrate using a special adhesive method so that they cannot be easily detached. The seedlings taken earlier are broken into small pieces so that a large number can be obtained. Coral seedlings were attached using wire rope as an adhesive. First, the expert team gave examples to the members on how to attach the seedlings to the substrate using a special adhesive or wire rope properly. After that, each member tried to install it themselves while being supervised by the expert team. The installation process is done with the seedlings in a straight and standing position and is done carefully to ensure that the seedlings can survive in their new environment until they grow and develop.

3.1.5 Coral Reef Planting Process

After the substrate is ready, the next step is coral reef planting. This process begins with the transportation of coral seedlings that have been prepared previously to the installation site in the coral reef area that has been determined by the marine biologist team. In this process, it must always be ensured that the coral reef seedlings remain in good condition and protected until they arrive at the planting site.

When they arrive at the transplantation site, the seedlings are placed on the substrate and carefully placed on the seabed. The placement of coral reef seedlings in a predetermined area with

consideration of several factors such as ocean currents and light intensity and depth to ensure that coral reef seedlings can develop optimally.

Those members of the outplanting team work under marine biologist's team supervision to ensure every step is done according to procedure. Upon establishment, the team of experts then ensures the seedlings are firmly attached to the substrate and reviews the position of each seedling to ensure it is not easily displaced by currents or other marine activity. This whole process is carried out with care and precision, as the positioning and stability of these seedlings will have a significant impact on the successful growth of the coral reef at the outplanting site.

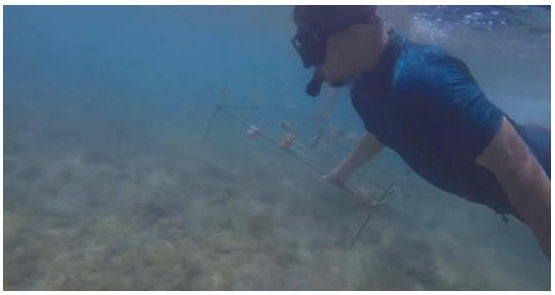

Image 4. Coral reef planting process
Source: Community Service Team (2023)

After planting, the seedlings will begin to acclimatize to the new environment, and a team of marine biologists will conduct regular monitoring to observe the progress and health of the planted corals. Then the challenge in this stage is how to keep the seedlings stable and firmly anchored in the substrate in conditions of ocean currents that can shake the seedlings. Each seedling must be carefully installed so that it does not easily come loose. This process requires care and expert supervision.

3.2 Tree Planting

During the second day, September 20, 2023, activities focused on tree planting and cleaning up the area around the island. Tree planting was carried out in the morning, starting at 07:30 until 09:00. The type of tree chosen was Shrimp Spruce *(Casuarina equisetifolia)* which has a resistance to the coastal environment and serves to protect the beach from abrasion and maintain the stability of the surrounding soil. The shrimp fir seedlings are taken from a specialized nursery in Central Lombok, which guarantees the quality of the seedlings so that they are ready to grow in the coastal environment.

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Image 5. Tree Planting Process
Source: Community Service Team (2023)

The first step is to choose the right planting point, where consideration of environmental conditions and the sustainability of tree growth are the main focus. Once the location is determined, the next step is digging the hole. The size of the hole dug is adjusted to the size of the roots of the tree to be planted, to ensure sufficient space for root growth. Next, the third step is to insert the tree into the hole that has been dug, carefully ensuring that the roots of the tree are not injured and the position is upright.

In the fourth step, earth stabilization is put around the tree after it has been planted to keep it in place and make it less likely that it will move because of wind or rain. The fifth step is to put pegs or logs on the sides of the tree to keep it standing. This will give it extra support during its early, weak growth phase. The sixth and final step is to water the plant. This helps it get used to its new home and makes sure it has enough water for photosynthesis and growth in general. It should be noted that choosing the right location so that the trees can grow optimally and not disturb the surrounding ecosystem is quite a challenge. Soil conditions, wind exposure, and other coastal factors are challenges in determining the planting location. In addition, soil conditions and regular watering are also important so that the trees can adapt well. This challenge is especially important in the early stages, where the trees need enough water and support to grow steadily.

3.3 Cleaning process around the island

The community work team cleaned up the island area at Gili Tangkong after planting trees. Our Community Service Team cleaned up the island area in a planned way, with help from some guests who were on Gili Tangkong. Using simple tools like gloves, plastic trash bags, and rope, they worked together to pick up trash that was lying around the beach and nearby.

The team and tourists picked up the trash and took it to a temporary collection place. They then safely threw it away according to waste management rules. At each step of implementation, the goal is to keep the island clean. This will not only protect Gili Tangkong's natural beauty, but it will also help the ecosystem around it.

Image 6. Cleaning Process Around the Island
Source: Community Service Team (2023)

This activity demonstrates a shared concern to create a healthier environment and support the sustainability of tourism in Gili Tangkong. A clean environment enhances the quality of the tourism experience and attracts more visitors who value a preserved destination.

Furthermore, the challenge in cleaning up is to collect a considerable amount of waste, especially plastic, and sort it for safe disposal. The sheer volume of waste and its location, which may be widely scattered and difficult to reach, is an obstacle. Also, the transportation of the collected waste to the final disposal point in a safe and environmentally friendly procedure. This process may be constrained by limited facilities and access to optimally manage waste in the island area.

4. Conclusion

By means of a sequence of specific actions in coral reef transplantation, tree planting, and area cleanup surrounding the island, sustainability-oriented community service activities on Gili Tangkong were effectively executed. All of these projects seek to protect the coast, enhance the marine ecosystem, and maintain cleanliness of the surroundings—all of which are absolutely vital for the viability of tourism on this small island. The crew effectively restored the marine life on Gili Tangkong by means of coral reef transplantation. This project is supposed to increase the appeal of underwater tourism by

building environments that sustain biodiversity. Planting trees on the shore helps to enhance air quality in tourist regions and acts as a preventive measure against coastal abrasion, therefore enhancing the surroundings for visitors. Additionally, beach cleaning projects involving visitors help to emphasize the need of environmental care and cleanliness all across the island. Conveying technical information to lay participants, selecting the appropriate site for transplantation and planting, and effectively handling the gathered debris presented other difficulties for the activity as well.

Furthermore, this project demonstrated how much great good cooperation among a team of professionals, students, and the community can accomplish for sustainable tourist promotion and environmental protection. Every aspect considered, this program is supposed to be a real model of environmental preservation initiatives that not only enhance the natural tourism appeal of Gili Tangkong but also help to conserve ecosystems and natural balance in other tiny tourist islands on Lombok Island.

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