
STRENGTHENING SYNERGY OF MANGROVE ECOSYSTEM MANAGEMENT BASED ON BLUE CARBON ECOSYSTEM IN SETIU WETLAND TERENGGANU DARUL IMAN MALAYSIA

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ABSTRACT

Blue carbon ecosystems (Mangroves, Seagrass and Brackish Swamps) have a relatively small area compared to the ocean and other ecosystems. Coastal areas that are transitional between land and sea ecosystems are areas that are vulnerable to various types of changes, both on land and at sea. The mangrove ecosystem is one of the ecosystems in coastal areas that plays an important role in the sustainability of life for biota that live in coastal areas. The mangrove ecosystem has various very complex functions both ecologically and economically and socially. Management of the mangrove ecosystem in Setiu Wetland Terengganu Malaysia with an area of 1,574 ha which is currently known as the Setiu Wetland State Park is managed by a group of local volunteers. Management also collaborates with government agencies, non-governmental organizations and higher education institutions that have transformed the Setiu wetland area over the past two decades. The existence of mangroves is encouraged to become a conservation area along the coastline filled with fishing villages along the coastline. Improved management continues to be pursued to preserve the park's biodiversity and highlight its tourism attractions according to the Setiu District Regional Plan 2035.

Keywords: Synergy, Mangrove, Blue Carbon Ecosystem

INTRODUCTION

The mangrove ecosystem is one of the coastal ecosystems that plays an important role in sustaining the life of various biota living in the coastal areas. One of the most important ecological functions of the mangrove ecosystem in fisheries is providing nutrients for the coastal aquatic ecosystems and their

surroundings. The mangrove ecosystem has various complex functions, both ecologically and economically as well as socially.

Mangroves grow and develop well on beaches that have large and sheltered rivers. Mangrove plants have a special ability to adapt to extreme environmental conditions, such as flooded soil, high salinity levels, and unstable soil conditions. Under such environmental conditions, some mangrove species develop mechanisms that allow them to actively expel salt from their tissues. Others develop breathing root systems to help obtain oxygen for their root systems.

Blue carbon is one of the terms used to describe the environmental services of mangroves. Other ecosystems that also contribute to blue carbon include tidal wetlands and seagrass meadows. Coastal blue carbon ecosystems are among the most threatened on Earth, with approximately 340,000 to 980,000 hectares of these ecosystems being destroyed every year. If this continues at the same rate, 30-40% of tidal wetlands, seagrass meadows, and nearly all unprotected mangroves will be lost in the next 100 years. When lost, these ecosystems will become significant sources of carbon dioxide greenhouse gas emissions.

Blue carbon provides a new opportunity to promote and support the conservation (restoration and protection) of coastal ecosystems globally to maintain the various benefits provided by these ecosystems. Additionally, the utilization of blue carbon is also an implementation of the Sustainable Development Goals (SDGs), specifically Goal 14: Life Below Water – to conserve and ensure the sustainability of the oceans and marine life for sustainable development.

The Setiu Wetlands are part of the Setiu River Basin, covering an area of over 23,000 hectares. The Setiu Wetlands are the largest natural wetland in the East Coast of Peninsular Malaysia, encompassing various ecosystems including freshwater, seawater, brackish water, and a 14 km long lagoon. The Setiu Wetlands are a major aquaculture area, with the local population involved in brackish water fish cage farming, pond farming, mud crab farming, and oyster farming. This area is also a major source of grouper and oyster seeds. Furthermore, the lagoon serves as a natural harbor for fishing boats in the area. Local industries in the surrounding villages include the production of seafood-based delicacies such as *budu* (fermented fish sauce), fish crackers, dried anchovies, and *belacan* (fermented shrimp paste). The small fishing boat manufacturing industry is also carried out by local residents, along with the production of handicrafts made from *kercut* (a type of palm) and *nipah* (a type of palm tree).

METHOD

The following steps were implemented by the Community Service Team to offer solutions for addressing some of the issues faced by the state of Terengganu in mangrove management, which were hindered by local volunteers and government challenges:

1. Observations through communication with the Terengganu government: The team leader initiates communication with the Terengganu government to identify the issues regarding the existing mangrove management program.
2. Meeting with the team leader, team members, and partners: A meeting is held to determine the plan of action, task distribution among the team, solutions proposed by the team and partners, as well as the schedule for the community service activities.
3. Outreach and training on mangrove management: The team members with relevant expertise conduct outreach sessions about mangrove management efforts, providing guidance to both the government and local volunteers. These sessions are aimed at strengthening the local capacity for effective mangrove management.
4. Sustained mentoring: Continuous support is provided after the community service activities, both for the government and local volunteers, to ensure long-term impact and sustainable management practices.
5. Monitoring and evaluation: The team leader and all team members monitor and evaluate the results of the community service activities. This is done to assess whether the solutions provided are in line with expectations and effectively address the identified issues.
6. Team evaluation meetings: A follow-up meeting is conducted with the entire proposal team to evaluate the outcomes of the community service activities and discuss the results.
7. Reporting on community service activities: The outcomes of the community service are documented in the form of deliverables, which include a community service journal and online news articles that report on the success and challenges of the initiative.

The partners contribute to the activities in several ways. They participate in the planning meetings, the determination of solutions for identified problems, and the implementation of activities. Additionally, the partners are involved in the monitoring and evaluation of the community service results to ensure that the activities align with the plan and that the proposed solutions effectively address the issues.

The evaluation of the community service activities is carried out by assessing the extent to which the indicators set during the planning phase of the

activities are achieved. These indicators are agreed upon by the partners. The roles and responsibilities of each team member are crucial for ensuring that the expertise and skills of the individuals align with the tasks assigned, which include:

1. **Team leader's role:** The team leader is responsible for drafting the community service proposal, conducting direct observations with the partners, establishing communication with the partners, leading the implementation of the community service activities, and overseeing the preparation of the final report on the outcomes of the activities.
2. **Team members' roles:** The team members assist the leader in observing the partners, support the technical implementation of community service in the field, coordinate the overall execution of activities, manage the administrative aspects of the community service, and assist in preparing the final report of the community service activities

RESULT

The issue of mangrove management is inseparable from the dynamics of a nation's stability, which relies on the balance of several factors, including political stabilization, economic prosperity, social harmony, environmentally friendly technological modernization, and strict legal enforcement. Therefore, this innovation aims not only to improve mangrove management but also to create new job opportunities and accelerate economic growth by enhancing blue carbon-based mangrove systems, particularly in Peninsular Malaysia.

This community service initiative aims to provide understanding regarding the sustainable development programs relevant to the needs of local volunteer management. It is expected that this will increase competitiveness and innovation in the tourism sector through effective mangrove management. To achieve this goal, the initiative also encourages government support and active participation from various directly involved parties. The sustainability of mangrove management is the main focus of this initiative, which helps provide understanding regarding policies, adequate investments, and the development of proper infrastructure.

IPTEKS (Science, Technology, and Arts) is essential for both the proposing team and partners to achieve the expected outcomes. Knowledge, technology, and arts are expected to be applied in strengthening local volunteers. Specifically, this pertains to strengthening the synergy of mangrove management based on the Blue Carbon System in Setiu Wetland, which is expected to produce IPTEKS in the following ways:

1. **Knowledge of mangrove management:** Local volunteers are expected to gain knowledge in mangrove management in synergy with a government that is strong, democratic, and united, fostering collaboration among the government, community, and private sector.

2. Innovative and competitive mangrove management: Local volunteers should also understand how to build innovative and competitive mangrove management practices.
3. Rights and responsibilities of local volunteers: Local volunteers must understand their rights and duties in strengthening mangrove management practices.
4. Encouraging local volunteer participation: Local volunteers should be equipped with knowledge to actively participate in all stages of planning and improving mangrove management, enhancing the quality and capacity of human resources in the local community, and ensuring the implementation of sustainable development policies and programs.

The transfer of IPTEKS to local volunteers in Setiu Wetland, Terengganu, is expected to have a positive impact on the quality of these volunteers. The knowledge imparted to the partners aligns with the expertise of the proposing team, which specializes in social governance, particularly the functions of government such as service, education, empowerment, and law. These principles can be linked to the application of regulations and governance in the local environment, contributing to the betterment of the community's capacity in mangrove management and sustainable development.

Through this initiative, it is anticipated that there will be a measurable improvement in the skills, awareness, and capacity of local volunteers, which will contribute to more effective mangrove management in Setiu Wetland





Gambar 1 : Pelaksanaan pengabdian kepada masyarakat

CONCLUSION

To address the issues arising from local volunteers, a comprehensive approach has been proposed. First, outreach and education will be provided to local volunteers to increase their participation and empower those working at Setiu Wetland in Terengganu, Malaysia. This initiative aims to ensure that volunteers are fully engaged and well-informed about the critical role they play in mangrove management. By enhancing their knowledge about the importance of mangroves and how they contribute to the environment, local volunteers will be encouraged to actively participate in conservation efforts. Additionally, the capacity of these volunteers will be improved by offering training sessions and workshops that equip them with the necessary skills to engage in effective mangrove conservation practices. This will include practical experience in the field, providing them with a deeper understanding of sustainable management techniques. Furthermore, the initiative aims to empower local volunteers by enhancing their role in the community, increasing their leadership abilities and sense of responsibility. By strengthening the volunteer network, they can take on more significant roles in mangrove conservation and help influence the overall environmental practices of the local community.

In addressing the challenges posed by the local government of Terengganu, a set of solutions has also been outlined. One of the key actions is to provide outreach and education to local government officials. This effort aims to enhance their understanding of the importance of local volunteer involvement in mangrove management. By fostering greater collaboration between government officials and local volunteers, the government will be better equipped to support and guide community-led conservation activities. Moreover, local government officials will receive detailed insights into the roles that local volunteers play, particularly within Setiu Wetland. This knowledge will allow officials to appreciate the value of volunteer contributions and ensure that they are integrated effectively into government-led initiatives. Finally, the initiative also emphasizes the need to improve the capacity of local government officials. Through targeted workshops and training, government personnel will learn how to better engage and empower local volunteers, allocate resources effectively, and create policies that facilitate volunteer participation in environmental programs. By improving the government's ability to work with local volunteers,

more sustainable and efficient mangrove management can be achieved in Terengganu.

These solutions aim to foster a stronger partnership between the local volunteers and the local government, which is crucial for the long-term sustainability and success of mangrove management in Terengganu. The collaboration will create a more effective framework for preserving the region's mangrove ecosystems while empowering local communities and enhancing the role of volunteers in environmental stewardship

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