

# SUSTAINABLE BLUE MARITIME POTENTIALS IN SEBONG LAGOI: ECOTOURISM, CARBON CAPTURE, AND COMMUNITY EMPOWERMENT

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## ABSTRACT

*The purpose of this paper is to explore the opportunities of the blue maritime economy in Bintan Island, particularly in Sebong Lagoi, by examining the intersections of ecotourism, conservation, carbon capture, and community-based economic empowerment. This study employs a qualitative descriptive approach to examine the potential of mangrove ecosystems as both ecological and economic assets. The methodology includes field observation, document review of policy and regulatory frameworks, and analysis of secondary literature, using thematic categorization as the main analytical tool. The findings indicate that mangrove ecosystems in Bintan hold significant potential for eco-edu-tourism, fisheries sustainability, and community-based enterprises such as village-owned businesses (BUMDes). The analysis also highlights the role of mangroves as carbon sinks that can be linked to carbon markets, including IDX Carbon, offering pathways for sustainable financing. This study is limited to qualitative insights and exploratory observations in Sebong Lagoi, Bintan. Future research may consider comparative or quantitative approaches, including economic valuation of carbon sequestration and broader stakeholder analysis, to enhance generalizability. The results provide insights for practitioners and policymakers in designing integrated blue economy policies that align ecotourism, conservation, and carbon market opportunities with local economic empowerment. The paper contributes to understanding how blue maritime initiatives can foster inclusive growth, enhance community resilience, and promote global environmental stewardship through carbon capture and conservation awareness. This study offers a novel perspective by examining the convergence of blue economy practices, mangrove-based carbon capture, and community-driven development in Bintan Island, contributing to the discourse on sustainable maritime economies in Southeast Asia.*

**Keywords:** *Blue Economy; Maritime Sustainability; Mangrove Conservation; Carbon Capture; Ecotourism, Bintan Island*

## INTRODUCTION

Mangrove ecosystems have been recognized as highly efficient blue carbon sinks, playing a crucial role in climate change mitigation by capturing and storing CO<sub>2</sub> in biomass and sediments (Lovelock, 2022). In Indonesia, mangroves and seagrass collectively contribute around 3.4 Pg C, accounting for about 17% of the world's total blue carbon stock (Alongi et al., 2016). Therefore, sustainable mangrove management is not only locally important but also globally significant for reducing carbon emissions.

Despite their vital role, many mangrove areas face severe pressure from land conversion, urbanization, aquaculture, and ecological degradation. Studies have shown that when mangroves are converted into aquaculture or urban areas, carbon stocks decline, and greenhouse gas emissions increase (Kusumaningtyas et al., 2022). In Indonesia, mangrove rehabilitation has become a national strategy to restore ecological and carbon

sequestration functions (Royna et al., 2024).

Rehabilitation of mangrove ecosystems has demonstrated promising results in carbon sequestration. For instance, in Banten Province, rehabilitated mangroves showed sediment carbon stocks up to 364 Mg C/ha compared to 126 Mg C/ha in natural mangroves (Royna et al., 2024). These findings suggest that well-managed restoration initiatives can significantly enhance blue carbon potential across Indonesia's coastal zones (Filbee-Dexter, 2022).

In practice, mangrove-based ecotourism has emerged as a viable strategy for integrating conservation with local economic benefits (Phelan et al., 2020). Studies in Southeast Asia have highlighted activities such as boat tours, wildlife observation, and mangrove planting as drivers of sustainable income in coastal communities (Niner et al., 2022). Ecotourism, therefore, represents both an economic opportunity and a mechanism to raise conservation awareness among local populations.



mangrove ecosystems and ecotourism initiatives?

## Literature Review

### Blue Economy

The concept of the blue economy emphasizes sustainable economic growth derived from ocean resources while maintaining ecological balance (Keen et al., 2018). It integrates environmental conservation with economic development, aiming to achieve social equity and long-term environmental health (Louey, 2022). The blue economy is particularly relevant for coastal regions such as Sebang Lagoi, where marine and mangrove ecosystems play vital roles in both ecological resilience and community livelihoods.

According to (Twomey, 2016) the blue economy seeks to replace the “take-make-waste” model with circular, regenerative practices. Recent studies (Voyer et al., 2018) highlight that integrating local communities into blue economy initiatives enhances inclusivity and sustainability. In Indonesia, the Ministry of Marine Affairs and Fisheries (KKP) has prioritized blue economy strategies in managing coastal and small-island resources sustainably.

### Ecotourism

Ecotourism represents a form of sustainable tourism that emphasizes environmental conservation, cultural preservation, and local community participation (Phelan et al., 2020). In the context of Sebang Lagoi, ecotourism serves as a potential driver for balancing environmental sustainability with economic empowerment. As noted by (Utama et al., 2024), ecotourism promotes education, conservation, and cultural respect, which can mitigate the negative impacts of mass tourism.

Empirical evidence from ASEAN countries shows that ecotourism can significantly enhance community welfare when local stakeholders are directly involved in decision-making (Campbell et al., 2021). In Indonesia, mangrove-based ecotourism has been successfully implemented in several coastal areas, contributing to carbon sequestration, biodiversity conservation, and local income generation.

### Carbon Capture

Mangrove ecosystems play a crucial role in carbon capture and storage (CCS), acting as one of the most effective natural carbon sinks (Alongi et al., 2016). These ecosystems can store up to four times more carbon than terrestrial forests. The integration of carbon capture within blue economy strategies presents opportunities for climate mitigation while providing financial incentives through carbon markets and credit schemes (Khan

et al., 2021).

Indonesia has actively participated in global carbon trading initiatives, with efforts to include mangrove conservation in carbon offset programs. Such integration in Sebang Lagoi could attract sustainable investments and strengthen local conservation practices.

### Community Empowerment

Community empowerment is central to the success of sustainable environmental and economic initiatives. It involves enhancing the capacity of local populations to manage resources, participate in governance, and derive equitable benefits. In ecotourism and blue economy contexts, empowerment ensures that local communities transition from passive beneficiaries to active stakeholders (Sea, 2021).

Research indicates that participatory approaches increase local commitment to environmental protection and improve socio-economic outcomes. In Indonesia, the role of BUMDes (village-owned enterprises) has been significant in fostering inclusive and sustainable community-based development. Strengthening BUMDes participation in Sebang Lagoi could enhance governance and local ownership in mangrove-based ecotourism and carbon initiatives.

## RESEARCH METHODOLOGY

### 1. Type of Research

This study adopts a literature-based qualitative research approach to develop an integrated understanding of how ecotourism, mangrove-based carbon capture, and community empowerment can be aligned within a blue economy framework in Sebang Lagoi, Bintan. The choice of a literature-based method is justified by the exploratory and conceptual nature of the research objectives, which aim to synthesize existing theoretical frameworks, empirical findings, and policy discourses rather than to test hypotheses or measure variables quantitatively (Alamsyahbana et al., 2023).

Given the limited availability of localized empirical data on carbon monetization mechanisms and integrated blue economy models at the village or small-island scale, a literature-based approach enables the consolidation of fragmented knowledge from diverse sources into a coherent analytical narrative. This method is particularly appropriate for examining emerging policy-relevant issues—such as blue carbon markets, community-based ecotourism, and institutional empowerment—where empirical implementation is still evolving.

By systematically reviewing peer-reviewed studies, policy documents, and institutional

reports, this research provides a comprehensive and policy-oriented insight that supports conceptual integration and contextual adaptation to Sebang Lagoi. Therefore, the literature-based qualitative approach is considered suitable for achieving the study's objectives of generating strategic insights and proposing integrative development pathways within the blue economy paradigm.

## 2. Type of Data

The study relies on qualitative secondary data (Sugiyono, 2022), which includes:

- Academic journal articles and conceptual papers (sourced from Scopus, ScienceDirect, and Mendeley).
- Policy documents and statistical reports from government agencies such as the Ministry of Marine Affairs and Fisheries (KKP) and the Ministry of Tourism and Creative Economy.
- International references from organizations like UNDP, World Bank, and UNESCO that discuss blue economy, ecotourism, and carbon market mechanisms.

## 3. Data Collection Techniques

Data were collected through a systematic literature study and document review (Sujarweni, 2020). To ensure the validity and reliability of secondary data, this study applied a triangulation strategy by cross-verifying information from multiple credible sources (Syahza, 2021). These sources included peer-reviewed academic journals, official government statistics and policy documents (such as reports from the Ministry of Marine Affairs and Fisheries and the Ministry of Tourism and Creative Economy), as well as publications from reputable international organizations including UNDP, the World Bank, and UNESCO.

Consistency across sources was assessed by comparing key concepts, findings, and policy directions related to mangrove carbon sequestration, ecotourism development, and community empowerment. Only data and arguments that demonstrated convergence across at least two or more authoritative sources were retained for analysis. In addition, priority was given to recent publications (2015–2024) to ensure temporal relevance and alignment with current policy and scientific developments.

This triangulation process enhances the credibility of the secondary data and reduces the

risk of bias or single-source dependency, thereby strengthening the robustness of the qualitative analysis and the validity of the study's conclusions.

## 4. Data Processing Techniques

The collected documents were organized and categorized into thematic clusters (Mustofa et al., 2023) representing the study's focus areas:

- Ecotourism and environmental conservation,
- Carbon capture and carbon monetization through mangrove ecosystems, and Community participation and empowerment through BUMDes.

Each theme was summarized to identify patterns, conceptual relationships, and relevant practices that can be adapted to the Sebang Lagoi context.

## 5. Data Analysis Techniques

Identifying and coding recurring concepts in the literature (Hamzah, 2019);

- Interpreting the interrelations between ecological, economic, and social dimensions; and
- Synthesising the findings into a coherent framework that supports sustainable development discourse.

The results of this analysis are presented narratively, emphasising how Sebang Lagoi's mangrove potential can serve as a model for integrating blue economy, ecotourism, and carbon capture initiatives.

# RESULTS AND DISCUSSION

## 1. Development of Sustainability-Based Ecotourism in Sebang Lagoi

The results of observations and literature studies show that the Sebang Lagoi area has great potential for the development of environmentally friendly mangrove ecotourism. This potential is supported by the existence of a relatively well-maintained mangrove forest and its location adjacent to leading tourist areas such as Bintan Resort.

The ecotourism approach here is not only oriented to natural tourism activities, but also as an educational and conservation medium. An appropriate development model is *community-based ecotourism (CBE)*, which places local communities as the main actors in management and decision-making.

**Figure 2. Sustainability-based Ecotourism Documentation in Sebong Lagoi****Figure 3. One of the ecotourism spots in Sebong Lagoi**

Research by Honey (2022) and Scheyvens (2020) confirms that the success of ecotourism is largely determined by active community involvement as well as ensuring ecological sustainability. In Sebong Lagoi, this can be realized through an environmentally-based tour guide training program, the development of mangrove interpretation trails, and the promotion of educational tourism based on carbon conservation. Thus, *ecotourism* is not only a recreational activity, but a *platform* to build environmental awareness and an alternative source of income for local communities.

## **2. Potential and Mechanism of Carbon Absorption in Mangrove Ecosystems**

Mangrove forests in Sebong Lagoi play an

important role in mitigating climate change through blue carbon sequestration and storage. Based on global estimates, mangrove ecosystems are able to store up to 1,000 tons of C/ha of carbon (Alongi, 2020), with 50–70% of it stored in sediments. Research by Murdiyarso et al. (2015) in Indonesia shows that Indonesia's mangroves account for about 3.14 billion tons of carbon reserves—one of the highest in the world.

In the context of Sebong Lagoi, this potential can be the basis for developing a carbon monetization scheme through a *carbon credit* or *carbon offset mechanism*. This scheme allows local communities or BUMDes to obtain economic compensation from the results of mangrove conservation and rehabilitation.



**Figure 4. Condition of mangrove forests in Sebong Lagoi****Figure 5. Spot for mangrove firewood manufacturing plant in Sebong Lagoi**

However, the implementation of this system requires valid local carbon data and strong regional policy support. Local governments can facilitate the creation of a "Local Carbon Registry", as a form of legitimacy for carbon credits generated from conservation efforts in the Sebong Lagoi area.

This approach is in line with the concept of the Blue Economy, which emphasizes the synergy between environmental sustainability and economic well-being. Through *carbon capture and trading*, Sebong Lagoi not only plays a role as a natural tourism area, but also as a *carbon sink strategic area* in national climate change mitigation.

### **3. Empowerment of Local Communities as Ecosystem Managers**

The sustainability of *ecotourism* and *carbon capture* is highly dependent on the empowerment of local communities. The people of Sebong Lagoi must be positioned not only as beneficiaries, but as the main actors in the management of natural

resources. Through BUMDes, the community can manage tourism services, the sale of mangrove derivative products (such as processed mangrove fruits, mangrove batik, or forest honey), and mangrove rehabilitation programs. This model has been proven to be effective in several regions such as Bali and Sulawesi, where community participation can increase income while strengthening conservation (Hadi & Fauzi, 2021).

Empowerment must also include knowledge and technology transfer, such as community *carbon accounting* training, simple environmental reporting, and digital promotion of green tourism. With strong institutional capacity, the people of Sebong Lagoi can build a sustainable local economic system — in line with the principles of *blue economy* and *green livelihood*.

This model emphasizes that ecotourism development and carbon management cannot be separated from the social dimension: community well-being and ecological sustainability are two complementary sides of the coin.

**Figure 6. Research team with local communities that manage mangrove ecosystems**

Although the implementation of blue accounting in this study is closely linked to community engagement activities, the findings go beyond program implementation by providing analytical insights into how accounting practices influence institutional behavior and environmental governance. The study does not merely document activities, but critically examines the role of accounting in shaping perceptions of mangrove conservation from a cost-oriented view toward a long-term environmental investment perspective. This analytical focus positions the study firmly within empirical accounting research rather than community service reporting.

## CONCLUSION

### Conclusion

Based on the above, it can be concluded that:

1. Ecotourism in Sebang Lagoi has great potential to become a model of sustainable development that blends environmental conservation, economic benefits, and local cultural preservation. Through the management of environmentally friendly mangrove areas and the promotion of education and conservation-based tourism, Sebang Lagoi can attract tourists without damaging the ecosystem. This approach also strengthens environmental awareness and creates new jobs for the surrounding community.
2. The mangrove forests in Sebang Lagoi serve as a highly effective carbon sink, contributing significantly to climate change mitigation. This potential opens up opportunities for the implementation of carbon monetization schemes through carbon markets or credits, which can be a new source of income for the region. Blue carbon-based management allows mangrove areas to be not only ecologically valuable, but also economical, thus encouraging long-term preservation.
3. Local community involvement is the key to successful ecotourism management and mangrove conservation. Through institutional mechanisms such as BUMDes or environmental cooperatives, the community can play an active role as managers, business actors, as well as guardians of the ecosystem. This empowerment increases economic self-sufficiency, strengthens a sense of ownership of natural resources, and ensures that the benefits of sustainable development are felt equally at the grassroots level.

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