ORIGINAL ARTICLE
Bali Tourism Journal (BTJ) 2025, Volume 9, Number 2, May-August: 24-28
P-ISSN. 2580-913X, E-ISSN. 2580-9148

A model for implementing sustainable tourism in mangrove ecotourism at Batu Lumbang, Pemogan Village, Bali

I Made Swariga[1*], Bagas Anggara[2], I Gede Agus Raditia[3]

[1]Institut Teknologi dan Pendidikan Markandeya;
[2]Universitas Bumigora;
[3]Politeknik Pariwisata Lombok.

*Institut Teknologi dan Pendidikan Markandeya;
defendy7609@gmail.com

Received: 2025-04-22
Accepted: 2025-06-19
Published: 2025-07-16

ABSTRACT

The Batu Lumbang Mangrove Ecotourism area in Pemogan Village, Bali, has experienced significant transformation from a degraded coastal ecosystem to a sustainable tourism destination through multi-stakeholder collaboration. This study aims to analyze the sustainable tourism implementation model and the roles of various stakeholders in managing the ecotourism site. Using qualitative methods, including participatory observation and in-depth interviews with local communities, government officials, and private sector actors, the research reveals that community-based conservation practices, educational tourism activities, and eco-friendly product innovations are key strategies supporting sustainability. The collaboration among stakeholders follows a pentahelix governance model, enhancing environmental preservation and socio-economic benefits for the local community. These findings provide a valuable model for sustainable coastal tourism development that balances ecological restoration, cultural preservation, and economic empowerment.

Keywords: Sustainable Tourism, Mangrove Ecotourism, Community Empowerment, Batu Lumbang.
Cite This Article: Swariga, I.M., Anggara, B., Raditia, I.G.A. 2025. A model for implementing sustainable tourism in mangrove ecotourism at Batu Lumbang, Pemogan Village, Bali. *Bali Tourism Journal* 9(2): 24-28. DOI: 10.36675/btj.v9i2.129

INTRODUCTION / BACKGROUND

Indonesia, as the world's largest archipelagic nation, is endowed with rich natural resources, including extensive forested areas and coastal ecosystems such as mangrove forests.[1] These ecosystems are crucial not only for maintaining environmental stability but also for sustaining the livelihoods of coastal communities. In light of increasing environmental degradation, especially in coastal zones, sustainable management practices are urgently needed to balance ecological preservation with socioeconomic development. One promising strategy is the advancement of mangrove-based ecotourism, which integrates environmental conservation, community empowerment, and educational tourism.

Bali Province an internationally renowned tourist destination has experienced significant growth in tourism over the past decades[2]. However, this expansion has not been without consequence. Uncontrolled tourism development has exerted pressure on natural ecosystems and disrupted local socio-cultural dynamics[3]. Thus, implementing sustainable tourism models has become an urgent necessity to preserve ecological balance while enhancing local quality of life[4]. The Batu Lumbang Mangrove Ecotourism area, located in Pemogan Village, South Denpasar District, offers a compelling case of a nature-based tourism destination that has undergone transformation from a once-degraded mangrove ecosystem to a revitalized conservation site. It not only showcases ecological richness and biodiversity but also involves the local community in tourism activities that generate economic value. The gradual increase in both domestic and international tourist visits from 2019 to 2023, as shown in Table 1, reflects its growing appeal and potential as a sustainable tourism site

While existing literature highlights the importance of multi-stakeholder collaboration in sustainable ecotourism[6]. empirical insights into the specific governance strategies, community involvement, and innovation practices within mangrove-based tourism remain limited. This gap underscores the need for in-depth, localized case studies that document how sustainable tourism principles are operationalized at the community level.

This study, therefore, aims to analyze the implementation model of sustainable tourism in the Batu Lumbang Mangrove Ecotourism area. It focuses on examining the roles and collaborative mechanisms of government agencies, local communities, and the private sector in achieving a tourism model that promotes ecological resilience, cultural preservation, and economic empowerment. The findings of this research are expected to inform policy recommendations and provide a replicable model for similar coastal ecotourism initiatives across Indonesia.

METHODE

This study employs a qualitative research approach to gain an in-depth understanding of the implementation model of sustainable tourism at the Batu Lumbang Mangrove Ecotourism site in Pemogan Village. A qualitative approach is selected to comprehensively examine the processes, the roles of various actors, and the dynamics of collaboration involved in the sustainable development of ecotourism. This approach enables the

Table 1. Tourist Arrivals from 2019 to 2023

No	Year	Domestic Tourists (persons)	International Tourists (persons)
1	2019	218	58
2	2020	157	38
3	2021	98	0
4	2022	2,590	52
5	2023	3,181	81
	Total	**6,244**	**229**

Source: Management of Batu Lumbang Mangrove Ecotourism, 2024 and[5]

researcher to holistically capture both social and ecological phenomena within the real context of mangrove ecotourism management.

Data collection techniques employed in this study include participatory observation, in-depth interviews, and literature review. The integration of these techniques aims to obtain valid data and triangulate findings from various sources, ensuring that the results are both credible and comprehensive.

Research Site

The research site is the Batu Lumbang Mangrove Ecotourism area, located in Pemogan Village, South Denpasar District, Denpasar City, Bali. This site is a mangrove conservation area of approximately 1 km^2, managed by the Bali Natural Resources Conservation Agency (BKSDA Bali) and supported by multiple stakeholders.

This ecotourism destination holds high ecological value and serves as an educational and conservation tourism site attracting both domestic and international tourists. Its strategic location near Denpasar City, Ngurah Rai International Airport, and Benoa Harbor makes it highly relevant for a study on sustainable ecotourism development.

Types and Sources of Data

Narrative descriptions illustrating the implementation of sustainable tourism, the roles of stakeholders, inter-actor collaboration, as well as the challenges and opportunities in mangrove ecotourism management. These data are collected through interviews, field observations, and relevant documentation.

Quantitative Data Numerical data supporting the qualitative analysis, including tourist visit statistics, demographic information of the surrounding community, human resource capacities, and other indicators relevant to ecotourism development[4,7].

Sources of Data

1. Primary Data
   Obtained directly from informants through interviews and field observations, including government officials, ecotourism managers, local communities, private sector actors, and academics.
2. Secondary Data
   Collected from documents, literature, reports, previous research, journals, and official archives related to mangrove ecotourism, sustainable tourism, and statistical data on Pemogan Village[8].

Informant Selection Technique

Informants were selected using purposive sampling, whereby participants were chosen based on their knowledge of and direct involvement in the management and implementation of sustainable tourism at Batu Lumbang Mangrove. Informants include: Government representatives (Denpasar City Tourism Office (2 person), Bali Provincial Marine and Fisheries Office (2 person) dan Pemogan Village Head) (1 person).

Local community leaders and ecotourism managers (5 persons), Private sector actors (2 persons), and Academics (2 persons)

The number of informants was determined based on data saturation, i.e., when no new information was emerging[4,8].

Research Instruments

The main research instruments include: Semi-Structured Interview Guide, A list of questions addressing key themes such as sustainable tourism implementation, stakeholder roles, collaboration mechanisms, encountered challenges, and achieved outcomes. Documentation Tools, Cameras and audio recorders were used to document interviews and field conditions for further analysis and verification.

Data Collection Methods and Techniques

1. Observation
   The researcher conducted participatory observation at the Batu Lumbang Mangrove Ecotourism site to directly observe ecotourism management activities, stakeholder interactions, and visitor responses to the sustainable tourism implementation.
2. Interviews
   In-depth interviews were conducted with key informants to obtain data on implementation models, inter-stakeholder collaboration, supporting policies, and challenges and opportunities in ecotourism development.
3. Literature Review
   Secondary data were gathered through literature reviews, policy documents, ecotourism management reports, and previous relevant research to support the analysis.

Data Analysis Technique

Data analysis followed the interactive model of Miles and Huberman, which includes: Data Reduction, Summarizing, selecting, and focusing on key data to clarify core issues and reveal emerging patterns, data Display, Organizing the data into narrative descriptions, tables, diagrams, and schematics that facilitate understanding of relationships among variables and themes and Conclusion Drawing and Verification, Drawing initial conclusions based on the evidence, which were then verified through cross-checking with field data to ensure the validity and consistency of findings.

RESULTS

The Batu Lumbang Mangrove Ecotourism site in Pemogan Village, Bali, represents a successful transformation of a once-degraded coastal area into a sustainable ecotourism destination. Originally exploited for aquaculture in the 1980s, the area underwent significant ecological degradation. Restoration efforts began in 1993 and gained momentum with the

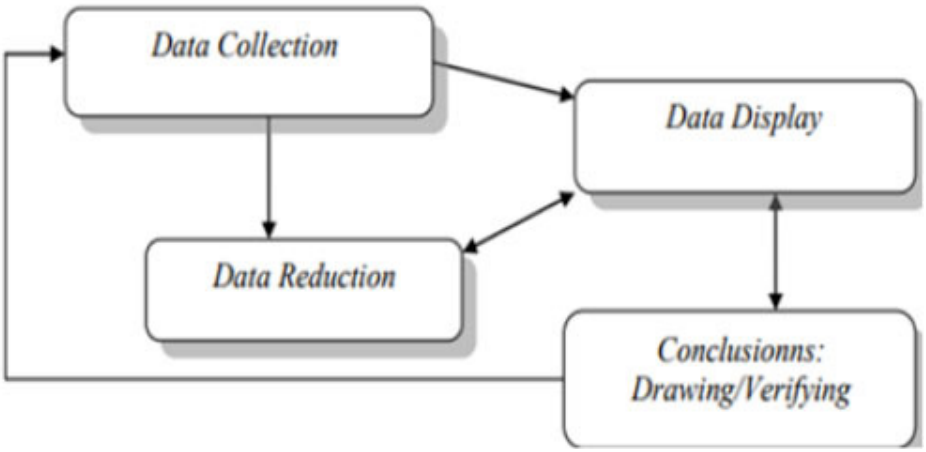

Figure 1. Interactive Model of Data Analysis. Source:[7, 8]

establishment of the Segara Guna Batu Lumbang Fishermen Group in 2005. This community group played a key role in reviving the mangrove ecosystem through conservation-focused activities and community-based tourism initiatives[9,10].

Multi-stakeholder collaboration including local government, private entities like PLN Indonesia Power, and civil society strengthened management capacity through training, infrastructure development, and the promotion of eco-friendly tourism practices[3,10,11]. The formal establishment of a community-based ecotourism management team marked a transition from conservation-only to a professional and sustainable tourism model.

A range of sustainable tourism practices is evident at the site. These include mangrove planting, educational trekking, eco-cruising using traditional jukung boats, birdwatching, and recreational fishing. The use of local wisdom in practices such as rumpon (fish aggregating devices) and bubu crab traps illustrates the integration of ecological sustainability with cultural heritage. These activities are seasonal and emphasize sustainable harvesting and ecosystem respect[12]. Additionally, mangrove-based product innovations—such as mangrove syrup, lindur sticks, mangrove coffee, jeruju tea, and ecoprint batik—demonstrate how the community utilizes non-timber forest products to create environmentally friendly and economically viable crafts. These efforts are coordinated by the local POKLAHSAR Mina Lestari group and have gained recognition at both national and international levels, including the use of mangrove syrup at the G-20 summit in 2022.

The formal establishment of an ecotourism management team in 2023 marks a shift from purely conservation-based efforts to a more professional and sustainable community-based tourism model. Tourists not only enjoy the natural beauty but also participate in educational activities that promote environmental awareness. This collaboration reflects the pentahelix governance approach, which has proven effective in developing tourism destinations that are not only marketable but also resilient to social, economic, and ecological pressures[10,12].

As such, Batu Lumbang Mangrove Ecotourism serves as a vital case study in destination management that supports sustainable tourism, where stakeholder collaboration becomes the foundation for balancing conservation, empowerment, and local economic growth[12].

DISCUSSION

Sustainable Ecotourism Practices in Batu Lumbang

The Batu Lumbang Mangrove Ecotourism site has successfully implemented conservation-oriented practices focused on environmental sustainability, tourist education, and local community welfare. These practices are aligned with the core principles of sustainable tourism, which aim to minimize environmental impact while generating long-term socio-economic benefits. Key exemplary practices include:

1. Mangrove planting and rehabilitation, where visitors actively participate in planting seedlings in ecologically damaged areas.
2. Educational and interpretative tours guided by local community members, offering insights into the significance of mangrove ecosystems, coastal flora and fauna conservation, and traditional fisherfolk knowledge.
3. Eco-nature tourism activities such as mangrove cruising, fishing, and nature photography that provide engaging yet non-destructive experiences for visitors.

The ecotourism attractions available at Batu Lumbang reflect[3,12] typology of tourist attractions natural, cultural, and artificial all of which are integrated with environmental education and community empowerment. A synthesized list of key attractions is shown below:

Ecotourism Attractions as an Implementation of Sustainable Tourism

Based on field observations, the attractions at Batu Lumbang Mangrove Ecotourism are categorized into three main types: natural, cultural, and artificial attractions. These attractions serve not only as recreational offerings but also as tools for education and conservation, thereby aligning with the core principles of sustainable tourism[10,11].

Mangrove Tracking

Tracking through the mangrove forest offers a tourism experience that brings visitors closer to natural ecosystems. The available trails ranging from family-friendly paths to more challenging routes enable tourists to directly observe the biodiversity of mangrove flora and fauna. Beyond enjoyment, this activity is also educational, as guides provide essential information about the ecological functions of mangrove forests and the importance of their conservation[5,10].

Mangrove Planting

Mangrove planting is a flagship activity that directly contributes to environmental conservation. Tourists are not only

Table 2. Ecotourism Attractions at Batu Lumbang Mangrove Ecotourism Site

No	Name of Ecotourism Attraction	Type of Attraction
1	Mangrove Tracking	Natural
2	Mangrove Planting	Natural
3	Bird Watching	Natural
4	Mangrove Cruising	Natural
5	Recreational Fishing	Natural
6	Traditional Fish Aggregating Devices and Crab Catching	Cultural & Artificial
7	Culinary Products from Mangrove Ingredients and Eco-Print	Artificial

Source: Field Research, 2024

encouraged to plant seedlings but also to learn about techniques and the ecological significance of coastal ecosystem restoration. This activity enhances public participation in protecting the shoreline from erosion, raises ecological awareness, and simultaneously provides a sustainable income source for local communities[9,10].

Bird Watching with Traditional Jukung Boats

Bird watching is conducted using traditional jukung boats owned by local fishermen. In addition to generating added economic value for local residents, this activity exposes visitors to the rich biodiversity of mangrove forests, which are home to numerous bird species including endangered and endemic species. This strengthens both the educational and conservation functions of the ecotourism experience[5,9].

Implications for Sustainable Tourism

The range of attractions at Batu Lumbang reflects a participatory and conservation-oriented ecotourism approach, in which tourists actively contribute to environmental sustainability. Activities such as mangrove planting and ecological education not only enhance the quality of the visitor experience but also serve as platforms for community-based economic empowerment. The involvement of local residents, the use of traditional jukung boats, and environmentally friendly tourism practices position this destination as a model for collaborative, sustainable tourism management.

Mangrove Exploration: Education and Conservation in One Journey

Mangrove exploration (susur mangrove) is one of the main and must-do attractions at Batu Lumbang Mangrove Ecotourism. This activity goes beyond nature-based recreation; it functions as an integral part of environmental education that enhances visitor awareness of the ecological significance of mangrove ecosystems[12].

The tour begins with an educational session at the wantilan (a traditional open pavilion), where visitors are introduced to the ecological roles of mangroves, including their functions in preventing coastal erosion, sequestering carbon, and protecting marine habitats. The journey then continues aboard traditional jukung boats, navigating through natural canals surrounded by lush mangrove vegetation[5].

Throughout the trip, local guides provide informative commentary on the various species of mangrove flora and fauna, the importance of food chain dynamics in maintaining ecological balance, and the critical need for ecosystem preservation. With 16 identified mangrove vegetation species in the area, visitors are offered not only natural beauty but also a rich, immersive, and participatory learning experience[9].

Contribution to Sustainable Tourism

The mangrove exploration activity exemplifies sustainable tourism practices through the following aspects:

1. It combines recreation and environmental education, enhancing ecological awareness.
2. It utilizes traditional local boats (jukung), thereby supporting the local economy.
3. It offers visitors an opportunity to actively participate in conservation efforts.

Thus, mangrove exploration not only enriches the tourist experience but also contributes significantly to environmental preservation and community empowerment two core pillars in the development of sustainable tourism[12].

In addition to the rich diversity of mangrove vegetation, the Batu Lumbang Mangrove Ecotourism area is also home to a wide variety of aquatic and terrestrial fauna that play a critical role in maintaining the ecological balance of the coastal ecosystem. Aquatic species found in this area include various types of fish such as Milkfish (Chanos chanos), Hawaiian Ladyfish (Elops hawaiensis), Mullet (Mugil cephalus), Barramundi (Lates calcarifer), as well as several species of shellfish, crabs, and shrimp.

This faunal richness not only reflects a healthy ecosystem but also serves as an educational attraction that enhances visitor awareness of the importance of conserving natural habitats. The well-preserved biodiversity is a key asset in developing sustainable ecotourism that integrates environmental conservation with local community empowerment[4].

Fish Aggregating Devices (Rumpon) and Crab Trapping: Local Wisdom in Sustainable Resource Management

The use of *rumpon* (Fish Aggregating Devices, FADs) represents a form of local wisdom practiced by the Batu Lumbang Segara Guna Fishermen's Cooperative (Kelompok Usaha Bersama, KUB). These rumpon are constructed by utilizing fallen mangrove trees as aggregation sites for fish, thereby facilitating more effective and efficient fishing without causing damage to the surrounding ecosystem.

In addition to *rumpon*, crab trapping using traditional gear known as bubu is an integral part of the fishermen's cultural heritage. Originally crafted from rattan, the traps have evolved into lighter and more environmentally friendly modern designs. Strict regulations are in place to prohibit the capture of juvenile fish and crabs to ensure the sustainability of marine resources.

This local wisdom also encompasses behavioral norms encouraging both fishermen and tourists to maintain respectful conduct and use eco-friendly materials during activities[1]. It reflects reverence for the spiritual guardian of the mangrove area. Since these activities are seasonal, rumpon operation and crab trapping are most effective between

June and December. These practices not only reinforce ecosystem conservation but also provide visitors with authentic and educational tourism experiences, aligning with the principles of sustainable tourism that respect both nature and local culture[1,9].

Mangrove-Based Product Innovations and Ecoprint Batik as Support for Sustainable Tourism.

In addition to natural and cultural attractions, Batu Lumbang Mangrove Ecotourism has developed innovative products derived from mangrove resources, managed by the local community through the Processing and Marketing Group (Kelompok Pengolah dan Pemasar, POKLAHSAR) Mina Lestari Batu Lumbang. These products include environmentally friendly culinary items and crafts that enrich the tourism experience while supporting the local economy sustainably[1,9].

1. Mangrove Syrup
   Syrup made from the fruit of the pidada tree is a flagship product that was selected as the "Welcome Drink" at the international G-20 event held at Tahura Ngurah Rai in November 2022. This product not only introduces local natural wealth but also demonstrates the potential of natural raw materials rich in antioxidants and vitamin C, contributing to health benefits and mangrove resource conservation.
2. Mangrove Sticks
   Made from the fruit of lindur (Bruguiera gymnorrhiza), mangrove sticks represent a culinary innovation utilizing non-timber forest products (NTFP). This product adds value and opens new business opportunities that support community empowerment and environmental conservation.
3. Mangrove Coffee and Jeruju Tea
   Mangrove coffee and Jeruju tea (Loloh Jeruju) are produced from the fruit of lindur and leaves of the jeruju tree, both known for their traditional health benefits. These products exemplify how sustainable forest resources can be processed into economically valuable items while preserving coastal ecosystems.
4. Ecoprint Batik
   The ecoprint batik technique uses natural dyes derived from various parts of mangrove plants, producing environmentally friendly and biodegradable fabrics. This process reflects sustainability principles by employing renewable and non-toxic materials while promoting local art and cultural values within craft products.

CONCLUSION

The Batu Lumbang Mangrove Ecotourism area in Pemogan Village exemplifies a successful model of sustainable tourism development that integrates ecological restoration, community empowerment, and multi-stakeholder collaboration. Through concerted efforts involving local communities, government institutions, academics, and private sectors, the previously degraded mangrove ecosystem has been rehabilitated into a vibrant ecotourism destination that balances conservation with socio-economic benefits.

Sustainable practices such as mangrove planting, educational tours, traditional fishing methods, and eco-friendly product innovations demonstrate how nature-based tourism can serve as an effective platform for environmental education and local livelihood enhancement. The pentahelix governance approach adopted in Batu Lumbang fosters participatory management and ensures the resilience of tourism activities against social, economic, and ecological pressures.

Moreover, the development of community-based attractions and locally produced sustainable products, including mangrove syrup, sticks, coffee, tea, and ecoprint batik, reinforces the synergy between cultural heritage and environmental stewardship. These integrated efforts highlight Batu Lumbang as a replicable case study for sustainable coastal tourism in Indonesia and beyond, providing valuable insights for policymakers, practitioners, and researchers aiming to achieve long-term ecological preservation and inclusive economic growth in tourism-dependent communities.

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