

# STUDY OF TOURISM SUITABILITY AND ECOLOGICAL CARRYING CAPACITY OF MINANG RUA BEACH IN SOUTH LAMPUNG DISTRICT AS AN ECOTOURISM DESTINATION

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## ABSTRACT

Tourism suitability analysis is important to determine the suitability of an area for beach recreation according to its ecological carrying capacity. This study aims to analyze the suitability and carrying capacity of the ecotourism area at Minang Rua Beach, South Lampung Regency, Lampung Province. Data collection of physical parameters of the beach was carried out using the field observation method. Data were analyzed using the tourism suitability index and area carrying capacity. The results showed that the ecotourism suitability index for beach recreation at Minang Rua Beach at station 1 was 2.875, at station 2 was 3.000, and at station 3 was 2.430. The level of suitability for beach recreation at Stations 1 and 2 was categorized as very suitable (S1), while at Station 3 was categorized as suitable (S2). The carrying capacity of the area at Minang Rua Beach for beach recreation activities at Station 1 was 119 people/day, at Station 2 was 364 people/day and at Station 3 was 158 people/day. The managers of this area are expected to be able to implement tourism activities according to their ecological carrying capacity so that their sustainability can be maintained.

**Keywords :** Suitability; Carrying Capacity; Ecotourism

## INTRODUCTION

Lampung Province, with a coastline stretching 1,319.021 km, possesses significant potential for coastal tourism development, particularly for beach-based recreational activities. One such recreational site is Minang Rua Beach, which is administratively located in Kelawi Village, Bakauheni Subdistrict, South Lampung Regency, Lampung Province (Bappeda Lampung Selatan, 2024). The Minang Rua coastal area has been designated as a tourism zone based on South Lampung Regency Regional Regulation No. 15 of 2012 concerning the Regional Spatial Plan. Furthermore, under South Lampung Regent Regulation No. 16 of 2022 regarding the Detailed Spatial Plan of the Bakauheni Integrated Tourism Area, Minang Rua Beach is targeted for development as a waterfront ecotourism destination.

Currently, tourism activities at Minang Rua Beach remain largely characterized by mass tourism, with no visitor limitations in place. Sustainable coastal tourism management through the concept of beach

ecotourism offers promising prospects for developing marine tourism in the area. Beach ecotourism refers to ecotourism activities conducted in coastal areas by utilizing beach and surface water resources (Muqsit, 2020), as well as marine attractions (Butarbutar, 2020).

Ecotourism is a concept that integrates conservation, community, and responsible tourism, while emphasizing learning and education (Wabang *et al.*, 2017). According to Walters (2001), ecotourism contributes to the protection of coastal ecosystems and supports the local economy. Rhormens *et al.* (2017) state that ecotourism has the potential to serve as an educational tool that enhances sustainable biodiversity conservation efforts and improves local livelihoods. This aligns with Yulianda *et al.* (2018), who emphasize that tourism activities must align with the resource potential and intended uses, taking into account the environmental conditions of the attractions to be developed. The management of natural resources for marine tourism is crucial, especially for limited

resources, as environmental damage may incur high restoration costs (Adam et al., 2024).

The aim of this study is to analyze the tourism suitability level and ecological carrying capacity of the Minang Rua Beach area in South Lampung Regency for ecotourism development.

**RESEARCH METHODS**

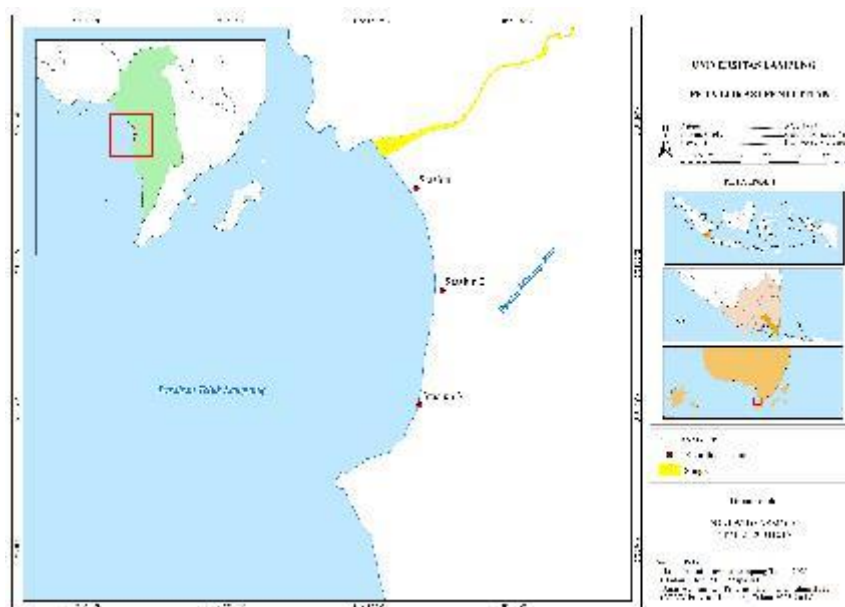
This study was conducted from September to October 2024 at Minang Rua Beach, located in Kelawi Village, South Lampung Regency, Lampung Province. The research area consisted of three observation stations: Station 1, Station 2, and Station 3. The geographic coordinates of each station are presented in Table 1. Data were collected through field observations. Field observation is a direct method used to observe various environmental phenomena and conditions in situ (Sugiyono, 2022). This method was employed to identify the tourism suitability level and ecological carrying capacity of the Minang Rua Beach area in South Lampung Regency. The physical parameters of the beach were assessed based on the beach recreation suitability matrix, including visual observations to determine the beach type

(Yulianda, 2019). The suitability parameters for coastal recreation ecotourism used in this study are listed in Table 2.

Data collection included several measurements related to coastal tourism suitability. Beach width was measured using a *measuring tape (roll meter)* by calculating the distance from the outermost vegetation line to the lowest low tide line. Beach substrate materials were assessed using a *sediment core*, followed by texture identification and classification. Current velocity was measured using a *drifted buoy* positioned 20 meters seaward from the shoreline. Water depth was measured using a *graduated rod* inserted vertically into the water at a location 20 meters from the coastline. Beach slope was measured using a *waterpass* by calculating the angle formed between horizontal and vertical lines (Hanifah et al., 2019). Identification of coastal vegetation and hazardous biota was conducted through visual observation based on species type. Freshwater availability was assessed using a *Global Positioning System (GPS)* to identify the nearest freshwater source utilized by local communities, followed by measuring the distance from this source to the designated research station

**Table 1.** Research stations coordinates

Station	Longitude	Latitude
1	105° 42' 51,74"	5° 51' 29,71"
2	105° 42' 53,94"	5° 51' 38,27"
3	105° 42' 52,04"	5° 51' 47,86"



**Figure 1.** Research Map Location

**Table 2.** Coastal Recreation Ecotourism Suitability Parameters

Parameter	Weight	Category	Score
Beach type	0,200	White sand	3
		White sand and coral fragments	2
		Black sand, slightly steep	1
		Muddy, rocky, steep	0
Beach width (m)	0,200	>15	3
		10-15	2
		3-<10	1
		<3	0
Substrate material	0,170	Sand	3
		Sandy coral	2
		Muddy sand	1
		Mud, silty sand	0
Water depth (m)	0,125	0-3	3
		>3-6	2
		>6-10	1
		>10	0
Water clarity (%)	0,125	>80	3
		>50-80	2
		20-50	1
		<20	0
Current velocity (cm/s)	0,080	0-17	3
		17-34	2
		34-51	1
		>51	0
Beach slope (°)	0,080	<10	3
		10-25	2
		>25-45	1
		>45	0
Beach land cover	0,010	Coconut trees, open land	3
		Low shrubs, savanna	2
		High shrubs	1
		Settlements, harbors	0
Presence of hazardous Biota	0,005	None	3
		Sea urchins	2
		Sea urchins, stingrays	1
		Sea urchins , stingrays, lionfish, sharks	0
Freshwater Availibility (km)	0,005	<0,5	3
		>0,5-1	2
		>1-2	1
		>2	0

Source : Yulianda (2019)

The tourism suitability analysis was conducted to assess the appropriateness of coastal areas for recreational activities. The Tourism Suitability Index was calculated using the following formula (Yulianda, 2019):

$$IKW = \sum_{i=1}^n (B_i \times S_i)$$

Where: IKW = Tourism Suitability Index;  $B_i$  = Weight of the  $i$ -th parameter;  $S_i$  = Score of the  $i$ -th parameter.

The carrying capacity calculation aims to determine the maximum number of visitors that can be physically accommodated in the available area at a given time without causing harm to the environment or human well-being. The Carrying Capacity (CC) was determined using the following formula (Yulianda, 2019):

$$DDK = K \times \frac{Lp}{Lt} \times \frac{Wt}{Wp}$$

Where: DDK = Carrying Capacity of the area; K = Ecological potential (number of visitors per unit area); Lp = Total usable area (m<sup>2</sup>); Lt = Area designated for a specific category (m<sup>2</sup>); Wt = Time provided by the management per day (hours); Wp = Average time spent by visitors (hours)

The ecological potential (K) and area utilized for beach recreational purposes were determined based on the natural resource characteristics, as shown in Table 3.

Visitor Activity Time (Wp) was calculated based on the duration spent by visitors engaging in tourism activities. The visitor time is considered in relation to the available time for the area (Wt), which refers to the number of hours the site is open to the public each day. The estimated duration for various beach recreational activities is presented in Table 4.

**Table 3.** Ecological Potential of Visitors (K) and Activity Area (Lt)

Activity	Visitor (person)	Area (m <sup>2</sup> )
Rekreasi pantai	1	50

Sumber: Yulianda (2019)

**Table 4.** Estimated Time Required for Beach Recreation Activities

Activity	Time Required (hours)	Maximum Time (hours)
Beach Recreation	3	6

Sumber: Yulianda (2019)

## RESULTS AND DISCUSSION

Minang Rua Beach is administratively located in Kelawi Village. The land area of Kelawi Village covers 9.54 km<sup>2</sup>. Kelawi Village is divided into nine hamlets, namely:

Way Bakak Hamlet, Kelawi I Hamlet, Kelawi II Hamlet, Kayu Tabu Hamlet, Minang Rua Hamlet, Kepayang Hamlet, Serungku Hamlet, Kubang Gajah Hamlet, and Sumber Sari Hamlet. The village boundaries are as follows: to the north, it borders Hatta Village; to the south, it borders the Lampung Bay waters; to the west, it borders Totoharjo Village; and to the east, it borders Bakauheni Village (Badan Pusat Statistik Lampung Selatan, 2023).

## Ecotourism Recreation Suitability Index

A coastal tourism area requires an assessment of resource and environmental suitability to determine the characteristics of tourism resources and to identify appropriate recreational activities for development in the coastal area. The results of the ecotourism recreation suitability index analysis for Minang Rua Beach are presented in Table 5.

Table 5 shows that the suitability index value at Station 1 is 2.875, Station 2 is 3.000, and Station 3 is 2.430. The ecotourism recreation suitability index analysis indicates that Stations 1 and 2 are classified as highly suitable (S1) for beach recreational activities, while Station 3 is classified as suitable (S2).

Based on the ecotourism recreation suitability index calculations, all three station locations are considered feasible and meet the criteria to be developed as coastal ecotourism recreation areas. Station 3, however, has a narrower beach compared to Stations 1 and 2, limiting visitor access. According to Yulianda (2019), a wider beach provides visitors more space to engage in recreational activities comfortably. The beach type at Station 3 consists of sand mixed with coral fragments.

Yulianda (2019) explained that beach recreation activities are more suitable on beaches dominated by sandy substrates compared to those dominated by coral substrates, which can disrupt visitor comfort. Muddy and gravel beaches are generally less favored by tourists due to limited recreational opportunities (Mizan et al., 2018). Furthermore, Station 3 has a steeper beach slope compared to the more gently sloping beaches at Stations 1 and 2. Beach recreation is most suitable on gently sloping beaches. Steep beaches tend to have deeper waters near the shore, increasing the risk of drowning, especially for visitors who cannot swim.

**Table 5.** Ecotourism Recreation Suitability Index of Minang Rua Beach

Parameter	Weight	Station 1		Station 2		Station 3	
		Score	BxS	Score	BxS	Score	BxS
Beach Type	0,200	3	0,600	2	0,600	2	0,400
Beach Width	0,200	3	0,600	3	0,600	1	0,400
Substrate Material	0,170	2	0,510	3	0,510	3	0,340
Water Depth	0,125	3	0,375	3	0,375	3	0,375
Water Clarity	0,125	3	0,375	3	0,375	3	0,375
Current Velocity	0,080	2	0,250	2	0,240	2	0,240
Beach Slope	0,080	3	0,240	3	0,240	2	0,240
Coastal Land Cover	0,010	3	0,030	3	0,030	3	0,030
Hazardous Biota	0,005	3	0,015	3	0,015	3	0,015
Fresh Water Availibility	0,005	3	0,015	3	0,015	3	0,015
Suitability Index Value			2,875		3,000		2,430

Source: Primary data processed (2024)

### Carrying Capacity of the Area

Carrying capacity refers to the ability of an area to accommodate a certain number of visitors within a specific time frame, ensuring both visitor comfort and environmental sustainability. Proper management of carrying capacity allows visitors to enjoy their experience safely and comfortably, while also minimizing environmental impacts on coastal ecosystems. As a result, visitor satisfaction can be maintained at an optimal level (Johan, 2016). The analysis of an area's carrying capacity is essential to determine the maximum number of visitors that can be accommodated without causing ecological degradation. This ensures the protection and sustainability of both biotic and abiotic resources in coastal zones..

The calculation of carrying capacity is influenced by several variables, including: the ecological capacity or actual available carrying potential (K), the area available for tourism activities (Lp), the space required per person (Lt), the total available time for tourism activities (Wt) the average time spent by a visitor per activity (Wp). The carrying capacity assessment in Minang Rua focuses on ecotourism for beach recreation activities. The carrying capacity for this tourism category is illustrated in Figure 2.

Carrying capacity serves as a mechanism to accommodate visitors in a way that ensures high satisfaction while minimizing negative impacts on natural resources (Bibin, 2017). Limiting the number of visitors based on the area's carrying capacity helps protect the natural environment and ecosystems of Minang Rua

Beach from degradation caused by excessive tourism activities (Mizan et al., 2018).

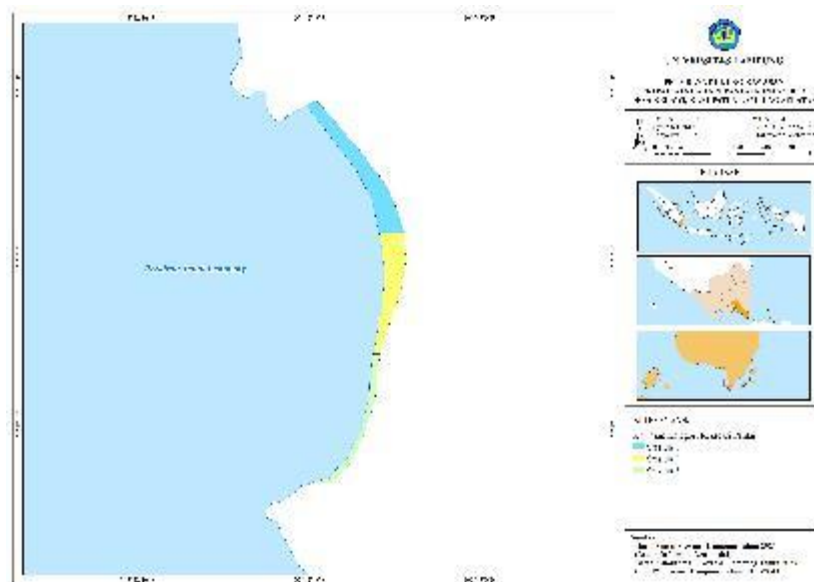
In this study, the carrying capacity is based on the tourism area size. Spatial analysis using Google Earth imagery and polygon measurements revealed that the areas suitable for beach recreation are as follows where station 1 d approximately 11.946 m<sup>2</sup>, Station 2 approximately 9.096 m<sup>2</sup> and Station 3 approximately 3.949 m<sup>2</sup>. The detailed calculation results of Minang Rua Beach's carrying capacity are presented in Table 6.

According to Yulianda (2019), for beach recreation activities, one visitor requires a space of 50 m<sup>2</sup> (Lt), with 6 hours available for tourism activities (Wt), and an average time spent of 3 hours (Wp). Meanwhile, Andika (2015) noted that to observe sea turtle nesting habitats, one visitor requires an area of 200 m<sup>2</sup>.

Based on the calculations in Table 6, the carrying capacity for Station 1, which has been identified as a sea turtle nesting area and has an area of 11,946 m<sup>2</sup>, is 119 people per day. This number represents the maximum number of visitors the site can support without reducing its ecological integrity. Station 2, with an area of 9,096 m<sup>2</sup>, can support up to 364 visitors per day, and Station 3, with an area of 3,949 m<sup>2</sup>, can accommodate 158 visitors per day. The number of visitors allowed at Station 1 is more limited compared to Stations 2 and 3. This is in line with ecotourism principles, particularly in areas that serve as turtle habitats, which aim to prevent direct exploitation of organisms and destruction of natural ecosystems.

**Table 6.** Carrying capacity for beach recreation activity

Station	Variable	unit	value
Station 1	Ecological visitor potential (K)	Person	1
	Beach area (Lp)	m <sup>2</sup>	11.946
	Area per person (Lt)	m <sup>2</sup>	200
	Available time (Wt)	Hours	6
	Visit duration (Wp)	Hours	3
	Carrying Capacity (DDK)	people	119
Station 2	Ecological visitor potential (K)	Person	1
	Beach area (Lp)	m <sup>2</sup>	9.096
	Area per person (Lt)	m <sup>2</sup>	50
	Available time (Wt)	Hours	6
	Visit duration (Wp)	Hours	3
	Carrying Capacity (DDK)	people	364
Station 3	Ecological visitor potential (K)	Person	1
	Beach area (Lp)	m <sup>2</sup>	3.949
	Area per person (Lt)	m <sup>2</sup>	50
	Available time (Wt)	Hours	6
	Visit duration (Wp)	Hours	3
	Carrying Capacity (DDK)	people	158

**Figure 2.** Carrying capacity map for beach recreation activities at Minang Rua Beach

## CONCLUSION

The suitability level for beach ecotourism at Minang Rua Beach is categorized as Highly Suitable (S1) at Station 1, with a suitability index score of 2.875. Station 2 is also categorized as Highly Suitable (S1) with an index score of 3.000, while Station 3 is classified as Suitable (S2) with a score of 2.430. The Carrying Capacity (CC) for beach recreation activities at Minang Rua Beach is as follows where Station 1 is 119 visitors/day with an area of 11,946 m<sup>2</sup>, Station 2 is 364 visitors/day with an area of 9,096 m<sup>2</sup> and Station 3: 158 visitors/day

with an area of 3,949 m<sup>2</sup>. This results in a total carrying capacity of 641 visitors per day for beach recreation at Minang Rua Beach. It is therefore recommended that tourism activities at Minang Rua Beach be implemented in accordance with its ecological carrying capacity to ensure sustainable management of the area.

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