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Suitability of Land in the Sapiang Island Group for Tourism Activities

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Abstract

The Sapiang Island cluster has potential for tourism activities, especially beach tourism. Data from the Central Sulawesi Tourism Office shows a continuous increase from 2022 to 2024. The number of tourists in Central Sulawesi in 2024 is highest in April and December, while the lowest is in August. By district/city, the highest number of visits is in Palu city with a percentage of 24.1 percent, followed by Morowali Regency with 12.2 percent, Sigi Regency with 10.4 percent, and Donggala Regency with 9.8 percent. The objective of this research is to analyze and evaluate the land suitability level for tourism development. The method used in this research is a descriptive quantitative approach with a survey method. The data analysis was measured using coastal tourism land suitability analysis with bio-physical parameters modified by the researcher, with eight parameters. The results at the three points were categorized as Suitable (S1) with different percentages. The first observation point, Darat Island, received a score of 88.69%, while the second observation point, Bobonoan Island, received a suitability index score of 98.81%. The third observation point, Laot Island, received a suitability index score of 86.31%. The land suitability index results from the three observation locations conducted by the researchers obtained a value of 91.27%, which falls into the Suitable (S1) category for tourism activities. The results of the grouping of tourism activities based on physical parameters show that these physical parameters are dominant for beach recreation activities, with fourteen parameters being met.

Keywords: Land suitability, Island cluster, Beach tourism.

INTRODUCTION

Statistical data collected through literature studies by the Central Sulawesi Provincial Tourism Office shows a continuous increase from 2022 to 2024. The overall number of tourists in Central Sulawesi Province in 2024 was highest in April and December, while the lowest was in August. By district/city, the highest number of visits was in Palu City with a percentage of 24.1 per cent, followed by Morowali Regency with a rate of 12.2 per cent, Sigi Regency with a percentage of 10.4 per cent, and Donggala Regency with a percentage of 9.8 per cent (Agustiningsih, 2025). Beach tourism is one of the activities that is popular with local and foreign people (Sunyoto et al., 2024). Tourism is inextricably linked to various aspects related to the structure and function of land, specifically land. Land is used as a place or space on the Earth's surface that humans use for various activities.

Effective and sustainable land use requires a thorough study of the land's suitability for specific uses. This suitability is often referred to as land suitability. Land suitability is an assessment of how suitable a type of land is for a particular purpose, such as agriculture or regional development (Zulkarnain & Hartanto, 2020).

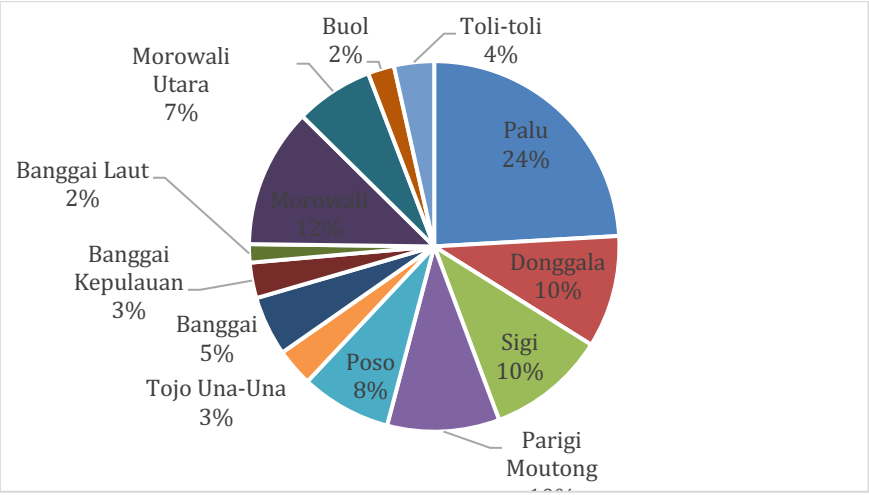

Figure 1. Graph of tourist visits throughout Central Sulawesi (Source: Tourism Office, 2024)

One of the industrial sectors that can generate significant profits from outside the country is the tourism sector (Rema & Maryani, 2022). The regional development referred to in the geographic context of this research is a spatial approach that discusses the distribution of land suitable for tourism activities. Tourism is supported by land factors such as vegetation, infrastructure, and accessibility, which play a significant role in the development of tourist attractions (Albarkah et al., 2022). The island group has a lot of potential from various aspects such as tourism activities, marine products, biodiversity, snorkelling, diving, fishing, and so on (Wouthuyuzen & Abrar, 2020).

The Sapiang Island group, with its sandy beaches, healthy coral reefs, and marine ecosystems that support a variety of tourism activities, has significant tourism potential. Based on the distribution of land and its potential, local communities utilise the island group for various activities. However, the area is still relatively unknown, and sustainable management is essential to maintain ecosystem balance.

Tourism development on small islands like the Sapiang Island group requires an in-depth study of potential land suitability to ensure tourism sustainability and environmental protection. This includes identifying and analysing the level of land suitability for tourism activities. Furthermore, this analysis aims to analyse the level of land suitability for tourism development.

Land suitability for tourism is the level of suitability of a site for development as a tourist destination based on its physical, social, and environmental characteristics. This land suitability analysis is used to determine whether an area supports the development of tourism activities (Nuryadin & Rajab, 2021). If we break it down, each type of tourism is a movement or rotation from one point to a certain point and will return to the original point as the meaning or value of a trip (Wirawan et al., 2021). Tourism is also described as more specific tourism, often called tourist attractions, as places that have an attraction for the community (Safitri & Kurniansyah, 2022). An attraction is generally a unit that interacts with other units to form a structure and function called land (Mubarok et al., 2022). This process involves considering and determining land use classifications. Land with high suitability can be developed into attractive and sustainable tourist destinations. Conversely, land with low suitability requires more extensive intervention or should be converted to other uses.

In the research (Panigoro et al., 2023), land suitability analysis and attractions, as well as the carrying capacity of areas designated for ecotourism activities, namely swimming and camping, were considered. Meanwhile, the research (Hidayatullah et al.,

2021) still uses the same sampling technique and is intended for tourism activities on Breuh Island. This study differs slightly from Retraubun et al. (2023) in that it adds an analysis related to the role of stakeholders using a two-by-two matrix (grid model) and is intended for beach recreation and swimming. From these sources, this study uses an analysis of land suitability for beach tourism activities according to (Yulianda, 2019) using bio-physical parameters that researchers have modified.

The process of assessing the suitability of tourist areas must consider socio-cultural aspects holistically. The land of high cultural value needs to be protected from commercial exploitation to avoid social conflict (Bramwell & Lane, 2011). Multi-stakeholder participation is key, as stated (Tosun (2000), that the involvement of local communities, government, and industry players in the planning process can create sustainable synergy. This approach aligns with the principles of sustainable tourism outlined (Weaver, 2013), namely maintaining a balance between economic, social, and ecological aspects. In more depth, research (Guilarte & González, 2018) explains that community-based tourism development not only increases social acceptance but also strengthens cultural identity. This finding is supported (Scheyvens, 2002) through the concept of community-based tourism, which emphasises community empowerment. However, as reminded (McKercher & du Cros, 2003), the integration of cultural heritage in tourism must be managed carefully to avoid the commodification of culture. Studi (Dredge & Jenkins, 2007) further suggests the need for adaptive tourism governance policies, while (Holden & Fennell, 2012) emphasize ethical principles in ecotourism development.

In general, water tourism is divided into three main categories: beach tourism, marine tourism, and freshwater tourism. Beach tourism is a recreational activity carried out along the coastline, including playing in the sand, swimming, enjoying the ocean views, and other relaxing activities. Coastal tourist areas typically boast visual appeal in the form of beautiful landscapes, such as white sand, coral cliffs, and typical coastal vegetation. Furthermore, cleanliness and water availability can also contribute to the comfort and attractiveness of coastal tourist areas.

Marine tourism is similar to beach tourism, but has a broader scope because it includes various activities carried out in coastal areas or open sea waters (Widianto & Larassari, 2023). Types of marine tourism, including snorkeling, diving, island hopping, cruise tours, and marine biota observation, are an important part of the blue economy, thus providing economic benefits while encouraging the protection of the marine environment if managed sustainably (Sailesh, 2024). A marine spatial planning approach can mitigate conflicts over marine space use while increasing economic and social benefits. For example, in the Karimunjawa Islands, the carrying capacity for snorkeling and scuba diving is determined to maintain environmental conditions and prevent ecosystem damage (Wibowo et al., 2022). The concept includes freshwater tourism such as lakes, rivers, reservoirs, or natural springs with activities such as boating, fishing, and swimming that bring economic value to local communities while requiring sustainable management (Picken, 2025). Island ecotourism, such as in Penghu (Taiwan), demonstrates the importance of sustainability indicators such as biodiversity, safety management systems, and local community involvement in maintaining tourism sustainability (Hsiao et al., 2021). This model demonstrates that local community synergy is crucial in conserving both freshwater and marine resources through tourism. In general, marine and freshwater tourism both contribute to local economies, but their long-term success depends on strong sustainability principles. (Gössling & Higham, 2018; UNWTO as cited by (Sailesh, 2024).

RESEARCH METHODS

Balaesang Tanjung District consists of eight villages. One of the largest villages, and the village furthest from the district capital, is Pomolulu Village, with an area of 27.97 km2 and a distance of 27 km from the district capital. Geographically, Pomolulu Village is bordered by Teluk Tambu Village to the north, Walandano Village to the south, Palau Village to the east, and Rano Village to the west. The distance to Pomolulu Village is approximately one hour by motorbike. The residents of Pomolulu Village generally make their living from farming and fishing (such as fishing), working as carpenters, and some are civil servants.

This research was conducted in the Sapiang Island Cluster, Pomolulu Village, Balaesang Tanjung District, located between 0°08'43"S - 0°05'53"S and 119°36'22"E - 119°46'37"E. Geographically, Balaesang Tanjung stretches from south to north and southwest. Balaesang Tanjung is approximately 57 km long and 10.13 km wide, with a total area of 161.62 km2, characterized by hilly and gently sloping terrain (BPS, 2024).

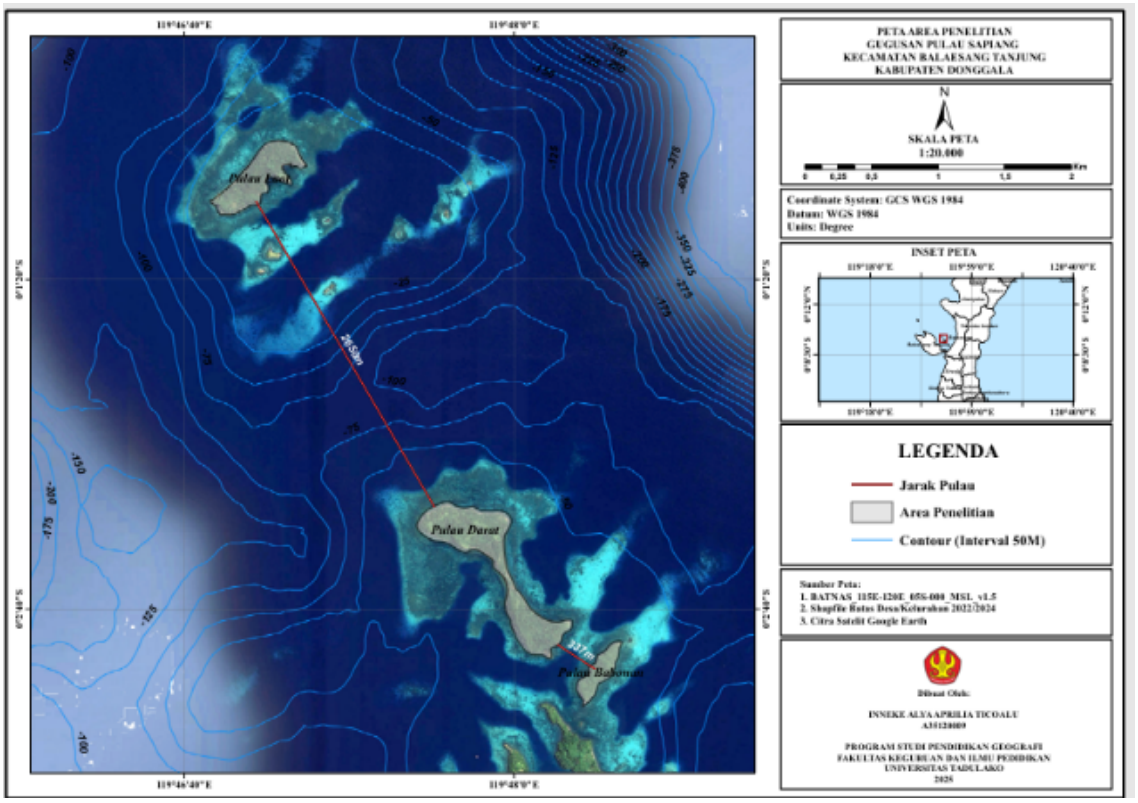

Figure 2. Research Area Map (Source: Research Data Processing, 2025)

This research uses a descriptive quantitative approach with a field survey method, which involves collecting data simultaneously and describing current conditions to obtain information that is consistent with reality. This quantitative research is a study in which data is measured based on criteria and numbers to conclude (Ardiansyah et al., 2023).

Analysis of data measured using coastal tourism land suitability analysis using bio-physical parameters (Yulianda, 2008) with researcher modifications. The implementation is as follows. 1) Analyze the matching of land with its respective suitability class. 2) Assign a value to a specific use. 3) Assign a weighting to each parameter adjusted to different weights. 4) Assessment/scoring and weighting of

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sixteen parameters used by researchers, namely land cover, erosion level, glisic width, coastal morphology, coastal flora type, tidal type, coastal material type, slope, slope shape, shoreline changes, temperature, glisic material size based on sediment, vegetation classification, coastal genesis, marine fauna type, and seawater salinity. Data collection for each measurement was carried out at each point on three islands, namely Darat Island, Bobonoan Island, and Laot Island, using a purposive sampling method (Abdussamad, 2021).

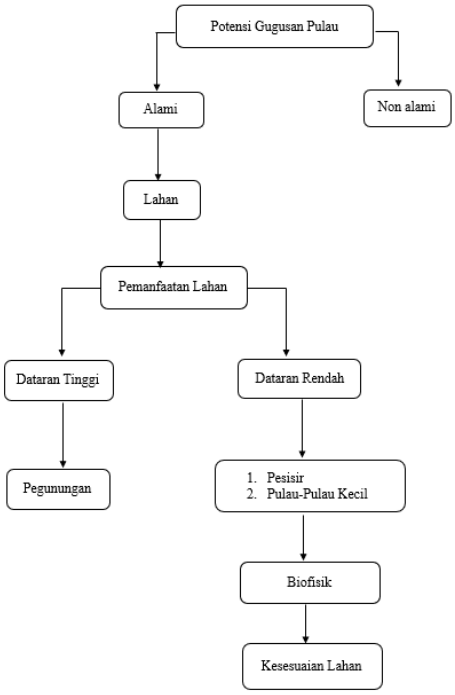

Figure 3. Framework of Thinking (Source: Research Data Processing, 2025)

Table 1. Tourism Suitability Parameters

No	Parameter	Weight	Category S1	Score	Category S2	Score	Kategori N	Score
1	Land cover	5	Coconut, Land open	3	Scrub	2	Mangrove, Settlement, Harbor	1
2	Distance/ Beach width	5	>25 meters	3	10-25 meters	2	<10 meters	1
3	Beach slope	5	0-7 °	3	8-25°	2	>25°	1
4	Beach type	3	White sand	3	White sand mixed with coral fragment		Black sand, mud, rocky, rugged	
5	Water bottom material	3	Sandy	3	Rocky	2	Muddy	1

6	Vegetation classifiaction	3	No vegetation	3	Rare	2	Meetings	1
7	Type of biota	1	Fish, starfish, shrimp, crabs, molluscs, snails, sdquid	3	Fish, starfish, shrimp, crabs,	2	Fish, starfish, shrimp	1
8	Biota Harmful	1	None	3	Feathers, pig, stingray	2	Sea urchin, stingray, shark	1

(Source: Yulianda, 2019 modification)

The results of measurements and observations in the field are adjusted to the scoring matrix of tourism land suitability. Then the value is entered into the Tourism Suitability Index (IKW) formula, which is as follows. The land suitability value is divided into three suitability classes found in the following Table

$$IKW = \left[\sum \frac{N_i}{Nmax}\right] x100\%$$

Description:
Maximum Value = 78
IKW = Tourism Suitability Index
Ni = Value of the i-th parameter (weight x score)
Nmax = Maximum value of a tourism category

Table 2. Tourism suitability category based on the suitability interval

No	Category	Percentage	Description
1	S1 (Suitable)	76% – 100%	Suitable, the land does not have a large limiting factor or there is a limiting factor but it is not influential limiting factors but not too influential.
2	S2 (Moderate Suitable)	50% - <75%	Moderate suitable, the land has a significant limiting factor and must be must improve management.
3	N (Not Suitable)	<50%	Unsuitable, the land has limiting factors greater, and must be overcome by further management snd development.

(Source: Research Results, 2024)

RESULTS AND DISCUSSION

Characteristics of Island Groups

The condition of the island group in Pomolulu Village, Balaesang Tanjung Sub-district, is a relatively natural area. The Sapiang Island group consists of 13 small islands, some of which have beaches with white sand and rocks and boulders that are relatively the same size in some areas. Some parts of the island group were formed due to the process of abrasion and sedimentation. Occurs because the sea waves exert pressure on the rocks through waves and ocean currents, resulting in

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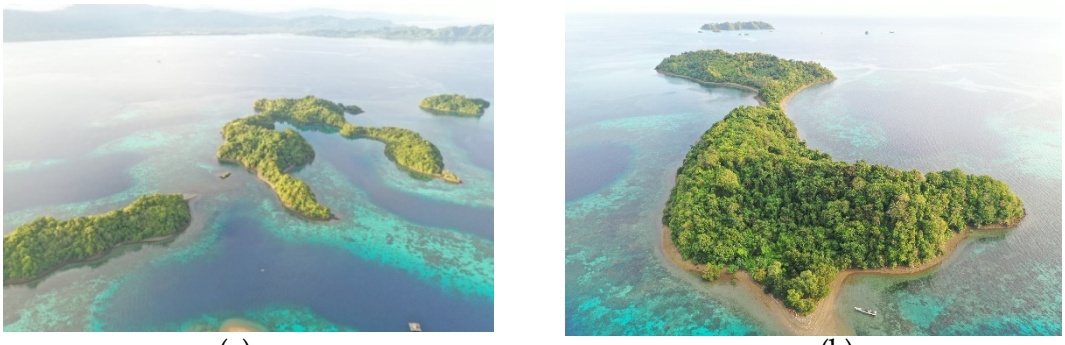
erosion of the island slopes, forming cliffs. ocean waves exert pressure on rocks through waves and currents, eroding the slopes of the islands to form cliffs. Sedimentation also occurs in some parts of the island due to the process of deposition of materials carried by waves and ocean currents to form additional island land. The following is a list of Sapiang Island Clusters, which are grouped into two, namely Coral Island and Atoll Island.

Table 3. Island Cluster in Pomolulu Village

No	Embossed Coral Island	Km2	No	Atoll Island	Km2
1	Laot Isand	13.058	7	Sapiang Island	0,35
2	Darat Island	23.340	8	Orang Island	0,11
3	Bobonoan Island	24.749	9	Bangkau Island	0,13
4	Loabolo Island	4.775	10	Cecerra Island	0,14
5	Big Katupat Island	4.546	11	Ullutbusai Island	0,12
6	Small Katupat Island	1.458	12	Orang Island	0,11

(Source: Research Results, 2024)

An emergent coral island is an island formed by coral reefs that are raised to the sea surface due to geological processes. When the seabed is close to the sea surface (<40m), coral reefs have the opportunity to grow and develop on the uplifted seabed. Over time, the coral reef will die, leaving a skeleton that forms a coral island. Atoll islands are coral islands in the form of a ring. Generally, the island is a volcanic island that is overgrown with coral reefs in the form of a fringing reef, which then turns into a barrier reef, so that it becomes an atoll island. Based on the table above, from the category of Embossed Coral Island, the smallest is Pulau Katupat Kecil with an area of 1,458 square meters, and the largest is Bobonoan Island. On the Atoll Islands, the smallest island category is Orang Island and the largest is Sapiang Island.



(a) (b)

Figure 4. (a) Sapiang Island cluster. (b) Land Island (Source: Primary Data 2024)

Environmental Conditions

The coastal area tends to have a gentle topography with heights ranging from 0 to 10 meters above sea level. It is the main area for human settlements and activities directly related to the sea. The eastern and southern parts of the village show more complex morphological characteristics, in the form of hills with quite sharp slopes. This condition reflects the physiographic transition from flat areas to areas with more significant elevation and slope, so that their use is limited to activities such as dryland agriculture.

Pomolulu village has 15% plains, 35% hills, and 50% mountains with an altitude of 8 meters above sea level. This village has varied landscapes, including lowlands in the coastal area and steep hills in the interior.

Pomolulu Village not only includes the mainland, but also several small islands, including Ketupat Island, Bangkau Island, and Sapiang Island. These islands generally have a flat morphology with a dominant material composition of sand or coral rock, and have a very low elevation of less than two meters above sea level. They are located in shallow waters and surrounded by coral reef ecosystems. The low topography makes these islands vulnerable to abrasion and the threat of sea tides. The existence of this group of islands adds to the complexity of the landscape of Pomolulu Village, while providing potential in the marine tourism sector and community fisheries activities.

In general, the topography of Pomolulu Village forms a diverse pattern, ranging from coastal plains on the western side, hills in the southeast, to small islands in the water area. This diversity of landforms has a direct Influence on land use and accessibility. Coastal areas tend to be more accessible and more intensively utilized for settlements and economic activities. In contrast, hilly areas with steep slopes have limited access and are difficult to reach. Hence, their utilization is limited and requires infrastructure that is suitable for the challenging topographic conditions.

Land Suitability Parameter

The results of the evaluation of tourism land suitability are obtained from modified parameters, namely land cover, beach distance/width, beach slope, beach material type, beach morphology, slope shape, beach flora type, beach type, water bottom material, vegetation classification, temperature, seawater salinity, tidal type type of biota, harmful biota and erosion rate, the analysis results of the 16 parameters can be seen in table 9.

Land cover analysis of the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates, found that the three islands are dominated by shrubs, with the category Moderately Suitable (S2), and the score obtained is 2 (two).

The distance/width of the beach carried out by the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at different coordinates, the results obtained that on Darat Island, the width of the shoal was more than 25 meters, so that the island was categorized as Suitable (S1) for tourism activities. On Bobonoan Island, researchers found that the width of the shoal was <10 meters, so the area was categorized as Unsuitable (N) for tourism activities. On the third island, Laot Island, the results obtained from the width of the shoal are between 10-25 meters, so it gets the category Moderately Suitable (S2) for tourism activities.

Slope Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at different coordinates, the results obtained that on Darat Island, the slope ranges between 8-25°, so that the island is categorized as Moderately Suitable (S2) for tourism activities. On Bobonoan Island, researchers obtained a slope of >25°, so the area is categorized as unsuitable (N) for tourism activities. On the third island, Laot Island, the result obtained from the slope of <7°, so it gets the category suitable (S1) for tourism activities.

Beach materials can generally be divided into three main categories, namely sandy, muddy, and rocky beaches. Sandy beaches consist of fine to medium-sized sediment grains, generally found in open coastal areas with high wave intensity, so they are often utilized for tourism activities (Ayuningtyas & Cahyono, 2021). Muddy beaches are dominated by fine particles such as silt and clay, commonly formed in sheltered areas such as river estuaries, and function as habitats important for the mangrove ecosystem.

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Meanwhile, rocky shores are composed of hard materials such as rocks and pebbles, usually found on steep slopes with strong wave energy, and have high resistance to abrasion and support marine life attached to hard substrates.

Table 4. Classification of Beach Material Types

No	Island Name	Types of Beach Materials		
		Sandy (S1)	Rocky (S2)	Muddy (N)
1	Darat Island	✓		
2	Bobonoan Island		✓	
3	Laot Island	✓		

(Source: Primary Data 2024)

The type of beach material obtained on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at the coordinates of each, the results on Darat Island and Laot Island are included in the type of sandy beach material with the appropriate category (S1). While Bobonoan Island, which is categorized as Unsuitable (N) for tourism activities it is included in the type of material of the rocky beach. Morphology Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates, the results show that Darat Island and Laot Island are included in the type of sloping beach or sloping with the appropriate category (S1). In contrast to Bobonoan Island, which is classified as Moderately Suitable (S2) for tourism activities due to its rocky terrain.

The shape of the coastal slopes and small islands in general can be classified into several categories based on their topographic characteristics and land surface structure. First, the sloping slope form is characterized by a gentle and uniform slope, extending from the coastline towards the mainland, with a relatively flat surface without many topographic obstacles. Secondly, hilly slopes show diverse contours with a pattern of ups and downs that form small protrusions on the land surface, generally have moderate variations in height, and are commonly found on volcanic islands or old rocky islands. Third, irregular shapes have a complex morphology, with a combination of steep slopes, narrow plains, and irregularly scattered rock protrusions. These conditions are generally formed due to geological processes or coastal abrasion and tend to be less suitable for direct utilization without more in-depth technical and environmental studies (Kristiadhi, 2022)

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Table 5. Classification of Slope Forms

No	Island Name	Slope Shape		
		Sloping (S1)	Hilly (S2)	Irregular (N)
1	Darat Island	✓		
2	Bobonoan Island	✓		
3	Laot Island	✓		

(Source: Primary Data 2024)

The results on the three islands have a sloping or gentle slope and are included in the category Suitable (S1) with a score of 3 (three).

(a) (b)

Figure 5. (a) Sand beach. (b) Slope shape of Laot Island (Source: Primary Data 2024)

The potential for biodiversity in coastal areas is a key factor in the development of exotic beach tourism activities. Coastal areas are known to have a high level of biodiversity, especially in terms of marine vegetation (Kharimah & Ardiyansyah A, 2021). Various types of marine flora are generally spread in seagrass and coral reef ecosystems, which play a crucial role in maintaining the overall balance of coastal ecosystems.

Table 6. Classification of Beach Flora Types

No	Island Name	Types of Beach Flora		
		Corral reefs and Seagrass (S1)	One of them (S2)	None (N)
1	Darat Island	✓		
2	Bobonoan Island		✓	
3	Laot Island		✓	

(Source: Primary Data 2024)

Types of coastal flora. Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, the results show that Darat Island is included in the Suitable category (S1) because it has reefs, corals, and other seagrass. In contrast, Bobonoan Island and Laot Island are included in the category of moderately suitable coral reefs (S2).

Beach types can be classified into three based on the composition of the constituent material, namely white sandy beaches, white sandy beaches mixed with white sand coral material, and black sand beaches. White sandy beaches are generally formed from the weathering of limestone rocks and shells of marine organisms such as mollusks and corals, resulting in grains often found in tropical areas with a healthy coral reef ecosystem. White sandy beaches mixed with material coral have a sediment composition derived from carbonate sand and dead coral fragments, indicating the presence of biofragmentation processes in the vicinity of coral reefs, and are often found in the transition zone between the shallow sea and the coast. In contrast to black sand beaches, these sands are formed from volcanic materials such as basalt, obsidian, and volcanic ash carried by river flow from the upstream area of the volcano to the estuary, resulting in dark- colored sands with high content of heavy minerals, such as magnetite and ilmenite, which are

commonly found in coastal areas affected by volcanic activity (Noviadi & Setiady, 2020)

.

Table 7. Beach Type Classification

No	Island Name	Beach Type		
		White Sand (S1)	Mixed white sand coral fragments (S2)	Black sand, mud, rocky, steep (N)
1	Darat Island			✓
2	Bobonoan Island			✓
3	Laot Island	✓		

(Source: Primary Data 2024)

Beach type Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates, the results show that Darat Island and Bobonoan Island are included in the type of beach that is black sand and slightly rocky, with the category not suitable (N). While Laot Island, which gets the appropriate category (S1) for tourism activities it is included in the type of beach with white sand classification. Beach bottom material is the main component that forms the substrate of coastal areas and greatly affects the physical characteristics, ecology, and potential utilization of coastal areas. Based on the type of material, the beach bottom can be classified into three types, namely sandy, rocky, and muddy.

Sandy beaches consist of fine to medium-sized loose sediment grains, which are derived from rock weathering or biogenic (such as shells of marine organisms), and generally support the activities of the sea. Rocky shores are composed of large rocks and pebbles that are relatively stable against erosion, typically found in areas with high wave energy and steep topography, and play a crucial role in reducing abrasion. Meanwhile, muddy beaches are dominated by fine particles such as silt and clay, which are often found in estuaries or sheltered coastal areas, and serve as important habitats for organisms such as mollusks, crustaceans, and water birds, and play a role in the process of accumulating organic matter (Muhardi et al., 2023).

Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at the coordinates of each researcher, the results show that the three islands have the same basic material classification, namely sandy and included in the Suitable category (S1) with the score obtained that is 3 (three). Vegetation classification. Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates, the results show that Darat Island is included in the sparse vegetation classification with the Moderately Suitable (S2) category. Bobonoan Island and Laot Island were classified as having dense vegetation with the category Not Suitable (N) and received a score of one.

Temperature Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates, the results show that the three islands have temperature between 21-27°C, so as to provide comfort in conducting tourism activities and Laot Island, so that it provides comfort in carrying out tourism activities and is

included in the suitable category (S1) and the score obtained is 3 (three).

Seawater salinity refers to the amount of salt dissolved in seawater, which is a key factor in determining the physical and chemical characteristics of waters. This salinity level affects the balance of the marine ecosystem, including the distribution of organisms, the osmoregulation process of living things, and the dynamics of water circulation (Harfiyanto et al., 2020). Therefore, salinity variations can affect the survival of various marine species and the ecological processes that occur within them.

Table 8. Classification of Seawater Salinity

No	Island Name	Seawater Salinity		
		33-37 (S1)	<33 (S2)	>37 (N)
1	Darat Island	✓		
2	Bobonoan Island	✓		
3	Laot Island	✓		

(Source: Primary Data 2024)

Sea water salinity Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates the results show that the three islands have a measure of water salinity between 33-37‰ and are included in the Suitable category (S1) and the score obtained is 3 (three). Tidal type Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at the coordinates of each researcher, the results show that the three islands have a daily tidal type, which occurs in one high tide and one low tide in a day (about 24 hours). That is, in one day, there is only one peak tide and one peak ebb, and they are included in the category (S1) with a score of 3 (three).

Aquatic biota in island and coastal areas are an important component in coastal ecosystems, consisting of various types of marine organisms, such as fish, shrimp, crabs, snails, squid, mollusks, and starfish, among others. These types of biota reflect the level of biodiversity and health of the coastal environment, which can be classified into three categories, namely high, medium, and low.

This classification is based on the number and variety of species of biota found. The high category reflects conditions that are very suitable for a rich and optimally functioning ecosystem, characterized by the presence of various types of organisms in abundance. The medium category indicates the level of suitability. The high category indicates good conditions but a decline in diversity. Meanwhile, the low category indicates less suitable conditions, where the number and types of biota are increasingly limited, reflecting significant environmental pressure or habitat degradation. The fewer types of biota found in a coastal area, the lower the level of suitability for the sustainability of the aquatic ecosystem (Kasmawati et al., 2023).

Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at the coordinates of each researcher, the results show that the three islands have various types of biota, including fish, starfish, shrimp, snails, and others. The more species found, the better the classification, so the classification gets a score of three. Dangerous biota in diving activities on islands and beaches refer to marine organisms that have the potential to endanger the safety and comfort of divers, either through stings, bites, or direct physical contact. Common types of

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harmful biota found in the waters include stingrays, sea urchins, and sharks. The presence of these three species is an important indicator in assessing the risk level of diving activities in an area (Ramlan et al., 2021).

Based on the number and type of harmful biota found, the classification of diving areas is divided into three categories, namely high, medium, and low. The high category indicates areas that are less suitable for diving because various types of dangerous biota could potentially threaten safety. The medium category reflects a medium level of risk with a limited number of harmful biota. Low category indicates the most suitable area for diving activities because of the minimal or no harmful biota found. The fewer types of harmful biota found in a water area, the safer the area is for diving activities. Dangerous biota. Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates, the results show that on Darat Island and Bobonoan Island, there are no dangerous biota, so they get the appropriate category (S1). Meanwhile, Laot Island received a category of unsuitable (N) with a score of one (1) because baby sharks were found on the coast.

Erosion is the process of moving soil particles in relatively small amounts over time. Erosion can be classified as a disaster caused by natural factors and human activities. The occurrence of surface flow is triggered by the low ability of the soil to absorb water, and is influenced by high rainfall intensity, causing a reduction in soil layers (Purnama & Malolok, 2022). The rate of topsoil erosion varies depending on the type of erosion and the magnitude of factors that Influence the process. This research was conducted by classifying erosion rates ranging from mild to severe categories.

Based on the results of research conducted on the three islands studied, namely Darat Island, Bobonoan Island, and Laot Island, at their respective coordinates, the results show that the three islands have a mild level of erosion, so they do not damage the beach in the term time which is near and is included in the Suitable (S1) category and the score obtained is three.

Table 9. Weighting of Tourism Suitability Index

$IKW = \left[\sum \frac{N_i}{Nmax}\right] x100\%$	$IKW = \left[\sum \frac{N_i}{Nmax}\right] x100\%$	$IKW = \left[\sum \frac{N_i}{Nmax}\right] x100\%$
$= \left(\frac{149}{168}\right) x100\%$	$= \left(\frac{166}{168}\right) x100\%$	$= \left(\frac{145}{168}\right) x100\%$
$= 88{,}69\%$	$= 98{,}81\%$	$= 86{,}31\%$
S1 (Sesuai 75% -100%)	S1 (Sesuai 75% -100%)	S1 (Sesuai 75% -100%)

$$\sum IKW = \frac{\Sigma P1 + P2 + P3}{3\,P} = \frac{88{,}69\% + 98{,}81\% + 86{,}31\%}{3}$$

$$= \frac{273{,}81}{3}$$

$$= 91{,}27\%$$

(Source: Primary Data 2024)

The table above shows the land suitability index value in the Sapiang Island cluster at each observation point. At the three points, the category of Suitable (S1) was obtained with varying percentages. The first observation point, namely Darat Island, received a value of 88.69%, and for the second observation point, Bobonoan Island, the suitability index value was 98.81%. At the third observation point, Laot Island, the suitability index value was 86.31%. The results of the land suitability index of the three observation locations carried out by researchers obtained a value of 91.27% which is included in the Suitable (S1) category for tourism activities, with shortcomings at several parameters, including the type of beach at the first and second points (Darat Island and Bobonoan Island) with unsuitable (N). At the second observation point there is also a category of unsuitable (N) in the parameter distance/width of the beach which is less than 10m, at the third observation point, Laot Island, there is one parameter that is not suitable (N), namely the parameter of dangerous biota because baby sharks were found at the research location. Based on the analysis of all parameters, the three islands can be utilized for tourism activities, including the following.

Table 10. Category of Suitability for Tourism Activities

No	Coastal Resources and Environment Parameters	RP	WS	WL	WM	SL	WK
1	Land cover	✓					
2	Distance/Beach Width	✓					
3	Beach Slope	✓					
4	Beach Material Types	✓				✓	✓
5	Beach Morphology	✓				✓	
6	Slope Shape	✓					
7	Beach Flora Types		✓	✓			✓
8	Beach Type	✓					
9	Water Bottom Material	✓	✓			✓	✓
10	Vegetation Classification				✓		
11	Temperature	✓	✓	✓	✓	✓	✓
12	Seawater Salinity	✓	✓			✓	
13	Tidal Type	✓			✓	✓	
14	Biota Type	✓			✓		
15	Harmful Biota	✓	✓	✓		✓	✓
16	Erosion Rate	✓					

(Source: Primary Data 2024)

Notes: RP = Beach Recreation WM = Mangrove
WS = Diving Tourism SL = Surfing
WL = Seagrass Tourism WK = Snorkling Tourism

Based on the physical parameters, it is found that these parameters are crucial for beach recreation activities, as they fulfill fourteen suitable parameters, in addition to seven parameters suitable for surfing activities. Two tourist activities meet five parameters, namely diving tourism and snorkeling tourism. In addition, four parameters fulfill mangrove

tourism. Finally, three parameters are suitable for seagrass tourism activities.

CONCLUSION

Based on the result of the land suitability analysis that has been carried out, the Sapiang Island group has the potential to be developed as a tourist activity because it meets the criteria for land suitability based on land suitability parameters, namely as follows, land cover, erosion rate, width of shingle, coastal morphology, type of coastal flora, tidal type, type of beach material, slope slope, slope shape, shoreline change, temperature, size of shingle material based on sediment, vegetation classification, coastal genesis, type of marine fauna, and seawater salinity, which are all included in the category (S1) according to the percentage value of the three islands which is a value of 84.66%.

The results of the study can also be taken into consideration by the village district government to regulate the management of its tourism potential so that its development does not overlap with the village government's development report to the district government. In addition, the district government also made a regent regulation (PERBUP) or regent decree (SK Bupati) related to the legality of the potential of the Sapiang Island Cluster in the Donggala district, especially Pomolulu Village.

This research has similarities with research conducted by Retraubun (2023), which focuses more on marine tourism on the coast, while this research focuses on a cluster of small islands and also the suitability factor for all tourism activities in general so as to provide a perspective in determining the suitability and management of island tourism, especially small island groups.

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