The suitability analysis of mangrove ecotourism in Balang Baru Village, Jeneponto District

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Abstract. The potential of mangrove ecosystem resources in the Balang Baru village, Torowangi sub-district, Jeneponto district is one of the mangrove ecosystem areas that is thought to meet the criteria to be developed into a mangrove ecotourism area, when viewed from both bioecological and socio-economic aspects. This research was conducted from February to March 2020. The purpose of the study was to identify the potential for ecotourism and analyze the suitability of ecotourism in the Balang Baru village, Jeneponto regency. Data collection was carried out through field surveys and interviews using a questionnaire. The data analysis used is the analysis of the suitability of the area for coastal tourism in the mangrove ecotourism category. The results showed that the potential for ecotourism in the Balang Baru mangrove ecosystem is that it has a mangrove forest area of about 50 ha. The mangrove species *Avicennia alba* and *Rhizophora apiculata* were found and various types of organisms, such as birds, reptiles, fish, molluscs and crustaceans, thus providing an attraction for the development of ecotourism in the Balang Baru village. Based on the results of the land suitability analysis with the mangrove ecotourism category, the mangrove area in Balang Baru is in the appropriate category to be developed into a mangrove ecotourism area.

1. Introduction

Ecotourism is a concept created for the development of sustainable tourism which has the aim of supporting environmental conservation efforts and increasing community participation in its management so as to provide economic benefits to the community and local government, as well as providing opportunities for present and future young people to utilize and develop it [1,2].

One of the ecosystems that has the potential to be developed as an ecotourism area is the mangrove ecosystem. The role of the mangrove ecosystem as a place of biota to interact on an ongoing basis and as a reservoir for sediment makes mangrove forests an ecosystem with a high level of productivity with a variety of economic, social and environmental functions. The use of mangrove ecosystems for the concept of tourism (ecotourism) is in line with the shift in tourist interest from old tourism, namely tourists who only come to do tours without any elements of education and conservation with new tourism, namely tourists who come to do tours in which there are elements of education and conservation. Utilization of mangrove ecosystem resources for ecotourism must still be considered, especially regarding its feasibility. The development of tourist areas in ecologically appropriate areas will have a positive impact, both on the ecological, social and economic side. So that the tourist area can be developed in a sustainable manner [3].

Mangrove ecotourism development is one of the efforts to utilize environmental services from coastal areas in a sustainable manner. Ecotourism development in mangrove ecosystems must be managed by

avoiding risks and negative impacts on the environment, such as by paying attention to aspects of suitability and environmental carrying capacity [4–6].

The Balang Baru Village is one of the villages in Tarowang District, Jeneponto Regency, South Sulawesi. Where the majority of people work as fishermen. The Balang Baru Village has mangrove potential that is good enough to be developed into an ecotourism area. The Balang Baru Village is one of the villages that is used as a tourism village in Jeneponto Regency. One of them is the mangrove ecosystem which must be further developed. This is what underlies this research to determine the extent to which the mangrove ecosystem in the Balang Baru Village is suitable as an ecotourism location by observing the ecological aspects of the area. So it is hoped that the results of this research can be used as information material in the management and utilization of coastal areas in the Balang Baru Village, Kecamatang Tarowang, Jeneponto Regency. The objectives of this study: (i) To identify the potential for ecotourism in the mangrove ecosystem in the Balang Baru Village, Jeneponto Regency, (ii) to analyze the suitability of mangrove ecotourism in the Balang Baru Village, Jeneponto Regency. While the use of this research is as a reference or information for the management of mangrove ecosystem areas using the concept of conservation.

2. Research methodology

This research was conducted in February - March 2020. The location of this research is located in the Balang Baru Village, Tarowangi District, Jeneponto Regency. The research location can be seen in Figure 1.

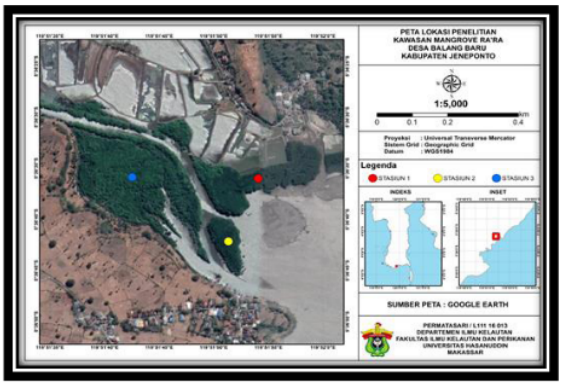

Figure 1. Map of research, location in the mangrove area of Balang Baru Village, Jeneponto Regency.

2.1. Work Procedures

This research includes several stages, namely the preparation stage, initial field observations, determining field stations, collecting data in the field, and analyzing data. The series of activities can be described as follows: Preparation stage, at this stage includes literature studies in assisting the process of preparing research reports, determining research locations in the field, preparing tools and materials to be taken during the research, conducting literature studies to determine the parameters and making a list of contents questions on the questionnaire. The description of the research stages, namely: (i) Observation Phase, this initial observation stage has been carried out in the mangrove area in the Balang Baru Village, Jeneponto Regency, including field surveys to identify and see firsthand the condition of the mangrove ecosystem at the research location and socio-economic conditions. Public. (ii) The Station Determination Stage, the determination of the observation station is carried out by considering the representation of the location where there are 3

stations, each of which has 3 randomly determined plots, namely. : (a) Station 1 is on the left side of the river in a mangrove cluster adjacent to residential areas, (b) Station 2 is in the middle of the river mouth in a mangrove cluster adjacent to the river mouth, and (b) Station 3 is on the right side of the river on mangrove clusters adjacent to rice fields. Furthermore (iii) Data Collection Phase in the Field, the data to be collected in this research are generally two of them:

(a) Primary data, namely data obtained directly in the field through interviews and direct observation [7]. Mangrove data collection is carried out through several observation and measurement procedures in the field, namely: i) Measurement of mangrove thickness is carried out manually using a rollmeter drawn perpendicular to the coastline starting from the mangrove forest at the sea boundary of the land area. Make a 10 x 10 meter terraced quadrant plot for the tree level; 5 x 5 meters for saplings and 1 x 1 meter for seedlings [8]. Identifying the name of the unknown mangrove plant species or by taking pieces from the branches, complete with flowers and leaves and identified based on the mangrove identification book [9]. Counting the number of mangrove species and measuring the diameter of mangrove tree trunks where the tree category is woody plants with a diameter of ≥ 10 cm [10]. Tide data are obtained through the procedure for installing tide signs that are placed in locations where at the highest and lowest tide, the tide signs are still submerged in water Tide measurements were carried out for 39 hours with an interval of 1 hour. Data on biota objects in the mangrove ecosystem were obtained through the following procedure: Fish and shrimp: collected using a 2 inch gill net (gillnet) fishing gear. The nets are installed across the waterlogged canal on the edge of the mangrove forest. Furthermore, the net is pulled along the canal so that the fish are caught by getting entangled and entangled in the net [11]. Birds were obtained using the visual census method, namely direct observation at the research location. Observations were made using binoculars in the morning at 07.30 and 17.30 in the afternoon[12] and using a camera to take pictures. Observations of crabs and reptiles were obtained by using the visual census method, namely direct observation at the research location and taking pictures with the camera. Macrozoobenthos: of the 9 predetermined plots representing each station, observations of the macrozoobenthos in the plot were also carried out. The sample that has been taken is then filtered using a benthic sieve and the filtered macrozoobenthic organisms are taken and put into a sample bag and then identified using a macrozobenthic identification book [13]. Socio-economic data were obtained by means of interviews and distribution of questionnaires. According to Tika (2005) [14], in the sampling theory, it is said that the smallest sample representing the normal distribution is 30 of the respondents consisting of local communities, government, fishermen, and others. Interviews were conducted with people who have direct contact with the mangrove ecosystem and visitors by asking oral questions that are structured based on research interests. The interview model used is a structured interview with reference to a list of questions compiled and deemed appropriate to the aspects of regional development planning and management. (b) Secondary data which constitute supporting data obtained from related agencies, namely the Jeneponto Regency Marine and Fisheries Service, regarding the area of the Balang Baru Village wildlife reserve, population data, and others.

2.2 Data analysis

The data analysis of this study used an analytical process, using qualitative and quantitative methods, the data analysis process was as follows:a. Qualitative analysisDescriptive qualitative analysis method is a method of analysis that aims to describe and explain the results obtained in research on potential tourist objects Descriptive data collection techniques include interviews (interviews) and filling out questionnaires. The method is used to determine the socio-economic and cultural conditions related to mangrove management in the area. This analysis stage is also an initial observation that describes the condition of the mangroves and can also describe the problems that exist in the research location.Quantitative analysisQuantitative analysis is a data processing with mathematical rules against numerical data. Quantitative analysis was used for

mangrove ecological data. The data regarding ecological conditions based on the observation plot were processed to analyze the suitability of mangrove tourism based on the suitability matrix in Table 1 below.

Table 1. Area suitability matrix for mangrove category.

No	Parameter	weights	categories SS	Scores	categories S	Score	categories TS	Score	categories i N	Score
1	Mangrove Thickness (m)	0.380	>500	3	>200 – 500	2	50 – 200	1	< 50	0
2	Mangrove density (Ind/100 m²)	0.250	>15-25	3	>10-15	2	5-10	1	< 5	0
3	Number of mangrove species	0.150	>5	3	3-5	2	1-2	1	0	0
4	Tidal Range (m)	0.120	0-1	3	>1-2	2	>2-5	1	>5	0
5	Objek biota	0.100	Fish, shrimp, crabs, mollusks, reptiles, birds	3	Fish, shrimp, crab, mollusk	2	Fish, mollusk	1	One of the aquatic biota	0

source : Yulianda (2019) [15]

Furthermore, the determination of the Tourism Suitability Index uses the following formula [15]:

$$IKW = \sum_{i=1}^{n} (Bi \ x \ Si)$$

Where: IKW = Tourism Suitability Index, n = Number of Suitability Parameters, Bi = Weight Parameter I, and Si = Score Parameter IInformation: Fully Compliant: IKW ≥ 2.5, Compliant: 2.0 ≤ IKW 2.5, Unsuitable: 1 ≤ IKW 2.0 and Very Unsuitable: IKW 1.

3. Results and Discussion

3.1. Research Location Overview

Administratively, the Mangrove Area in Balang Baru Village is one of the areas in Tarowang District, Jeneponto Regency, South Sulawesi Province. The boundaries of the area or territory are as follows: North side: The Kelara Subdistrict, East: Balang Loe Village, South: Pao Village, and West: Tarowang Village. Then geographically it is located between 119 ° 51 '45' East Longitude - 119 ° 51 '57' 'East Longitude and 05 ° 36' 22 "South Latitude and 05 ° 36 '36" South Latitude, with the area's air temperature ranging from 30 ° C - 36 ° C and an altitude between 0 - 15 meters above sea level. This area is very close to the Jeneponto - Bantaeng main road, which is about ± 1 km, with roads that can be traversed using private vehicles such as cars and motorbikes. In January 2020, the total population recorded was 2,922 (two thousand nine hundred

and twenty two) people spread across 5 hamlets. Of the total population, 1,485 are male and 1,437 are female. This mangrove forest area is located at one of the mouths of the Babana Tarowang river. This estuary also has historical value from the days of the Tarowang kingdom in Jeneponto. This mangrove forest area is located on the shoreline, so that people who visit can see the beauty of the vast expanse of sea.

3.2. Parameters of Mangrove Ecotourism in Balang Baru Village

3.2.1. Mangrove thickness. Based on the results of research and measurements from the coastline towards the land carried out in the Balang Baru Village, the results of measurements of the thickness of the mangrove ecosystem for each station are as shown in Figure 2 below.

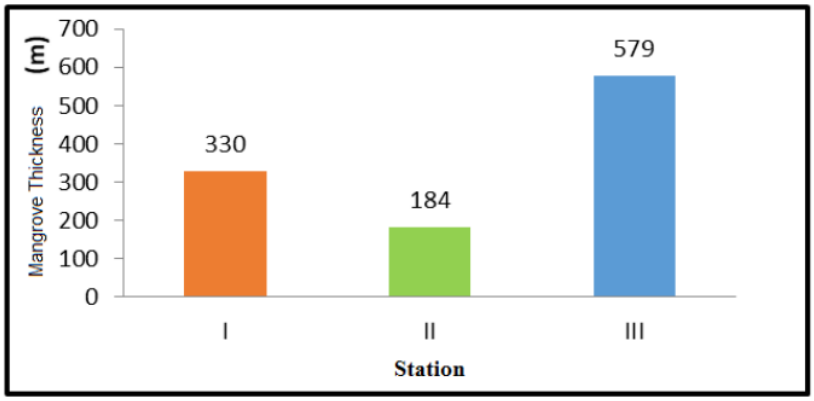

Figure 2. Mangrove thickness per station in the mangrove area in Balang Baru Village.

Based on Figure 2, it can be seen that station I has a mangrove thickness of 330 m, station II has a mangrove thickness of 184 m and station III has a mangrove thickness of 579 m. This explains that the highest mangrove thickness is at station III. From the data from the measurement of mangrove thickness with reference to the Mangrove Tourism Suitability Index [15], the categories for the station I and station III are suitable and very suitable for tourism activities. Meanwhile, station II is not suitable for ecotourism activities because it is less than 200 m. Based on Presidential Decree No. 32 of 1990 concerning the Management of Protected Areas provide more adequate protection against the green belt zone. According to the Presidential Decree, the coastal mangrove route is at least 130 times the average tide measured ashore from the lowest point at low tide. So the width limit of mangrove pathways in Indonesia ranges from 52-700 meters. A station I, II, and III are mangrove green lines, which means that the mangroves cannot be damaged. 2. Composition of Mangrove SpeciesBased on data from Balang Baru Village and observations, there are 2 mangrove families, namely Avicenniaceae and Rhizophoraceae. The species identified include: Avicennia Alba and Rhizophora apiculata. For data on the types of mangroves found in the mangrove ecosystem of the Balang Baru Village, it can be seen in Table 2 below.

Table 2. Composition of mangrove species found in the mangrove ecosystem of Balang Baru Village.

Station	Plot	Species	Number		
			Trees	Saplings	Seedlings
I	1	*Rhizophora apiculata*	25	7	12
	2	*Rhizophora apiculata*	26	15	10
	3	*Avicennia alba*	14	10	14
		TOTAL	66	32	36
II	1	*Rhizophora apiculata*	13	15	18
	2	*Avicennia alba*	9	10	15
	3	*Avicennia alba*	10	13	13
		TOTAL	32	38	46
III	1	*Rhizophora apiculata*	30	12	11
	2	*Avicennia alba*	25	10	19
	3	*Avicennia alba*	15	16	14
		TOTAL	70	38	44

Based on table 4, it can be seen that at station I there are 65 trees consisting of 2 species, namely Avicennia alba and Rhizophora apiculata, and there are also 32 seedlings and 36 seedlings. At station II there are 32 trees consisting of 2 species, namely Avicennia alba and Rhizophora apiculata and there are also 38 tillers and 46 seedlings. At station III there are 70 trees consisting of 2 species, namely Avicennia alba and Rhizophora apiculata. and 38 seedlings and 44 seedlings. Nontji (2005) [16] states that of the many types of mangroves in Indonesia, the types of api-api (*Avicennia sp*), mangrove (*Rhizophora sp*), tancang (*Bruguiera sp*) and pedada (*Soenneratia sp*) are the main mangrove plants that are most commonly found. These types of mangroves are mangrove groups that capture, hold sediment and stabilize the soil habitat. Alfira (2014) states that the number of mangrove trees with their curved shape, stems with uneven and strong texture, dense foliage, shady leaves, flowers and fruits that are unique to the mangrove ecosystem also provide quite attractive appeal.

3.2.2. Mangrove Species Density. The density value of mangrove vegetation types in the mangrove forest area of Balang Baru Village can be seen in Table 3 below.

Table 3. Density values of mangrove vegetation types.

Station	Plot	Species	Number of Tree (Ni)	Area (m^2)	Density (Ind/100m^2)
I	1	*Rhizophora apiculata*	25	100	25
	2	*Rhizophora apiculata*	26	100	26
	3	*Avicennia alba*	14	100	14
		Total			65
		Average			21

	1	*Rhizophora apiculata*	13	100	13
II	2	*Avicennia alba*	9	100	15
	3	*Avicennia alba*	10	100	20
		Total			48
		Average			16
	1	*Rhizophora apiculata*	30	100	30
III	2	*Avicennia alba*	25	100	25
	3	*Avicennia alba*	15	100	15
		Total			70
		Average			23

From the measurement of mangrove species density values based on the ohon category in each plot, it shows that Rhizophora apiculata has the highest density value when compared to other species such as Avicennia alba. Based on the average density value for each station, station I has a density value of 21 trees / 100m², station II has a density of 16 trees / 100m², and station III has a density value of 23 trees / 100m². Station III has a higher density value than station I and station II. The high mangrove density indicates the number of trees in this station. Thus, the mangrove area in Balang Baru Village becomes a large oxygen supplier so that every visitor who visits the area can enjoy fresh air which is quite difficult to enjoy in urban areas.

3.2.3. Tidal Conditions. Tide measurements at the research location using tide pole at the coordinate position S = 5 ° 36'36.92 "and E = 119 ° 51'57.69". The tide chart is presented in Figure 3 below.

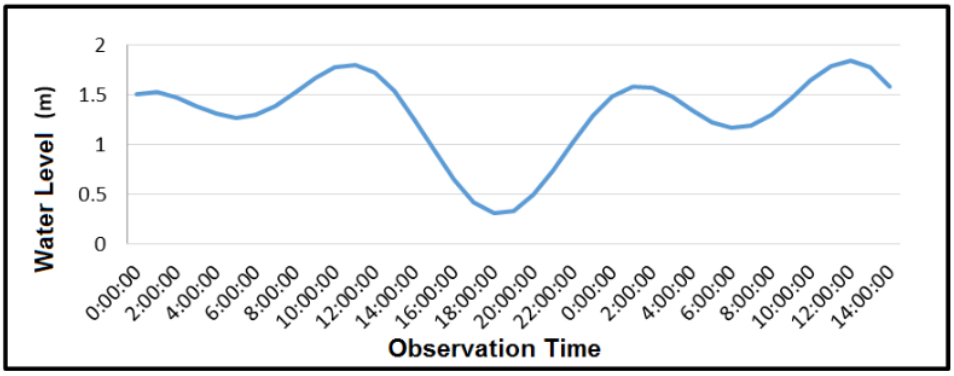

Figure 3. Tide Chart in the waters of Balang Baru Village on March 6, 2020.

Data regarding tides are primary data obtained from the results of measurements at the study site for 39 hours. The tide data analysis shows that the water level at the research location at the time of the highest tide reaches 1.8 m at the tide pole, while the water level at the lowest tide is 0.3 m. this indicates that the tidal range obtained is 1.5 m. The tidal range includes the appropriate range for the selection of coastal tourism locations in the mangrove tourism category for tidal parameters, which is> 1-2 m by considering safety and influencing the vertical distribution of mangroves. The type of tide in the mangrove area of Balang

Baru Village includes a mixed tide type that tends to double daily (mixed tide prevelailing semidiurnal tide), where in one day there are two times the tide and two times the tide, but the height and period are different [17].

3.2.4. Biota Objects. The mangrove ecosystem is a form of meeting between terrestrial and marine environments, so that animals from these two environments can be found in it. A small proportion of mangrove animals use mangroves as their only habitat, some can move around even though they are more often found in mangrove forests. The mangrove forests in Balang Baru Village have various types of biota including fish, birds, reptiles, crustaceans and mollusks. Based on observations in the field, the types of biota found from observations at each station are as follows: (i) Fish. Based on field observations, the types of fish found at the research location are: *Periopthalmus sp*., Moolgarda seheli and Marosatherina ladigesi. This species of fish is a group of fish that is a true resident whose entire life cycle is carried out in the mangrove forest area, while mullet and fish are temporary sedentary fish associated with mangrove forests during the larval to post larva period, but as adults they tend to cluster in along the coast adjacent to the mangrove forest. (ii) Birds, based on the results of observations at the research location, birds found in the research location, namely: Cicona sp and Halcyon sp. Mangroves are important habitats for annual migration and can provide shelter during the dry season. Birds are an interesting biota to look at when walking around the mangrove forest. (iii) Reptiles, based on the results of observations at the research location, the types of reptiles found in the research location, namely: Varanus sp and Dasia sp. The existence of reptiles in the mangrove forest is not something to be feared or avoided by visitors because their unique behavior and colors can provide quite interesting attractions in the mangrove forest area. In addition, reptiles also function as predators or balance ecosystems. (iv) Crustaceans, based on research results, the types of crustaceans found in the mangrove area of Balang Baru Village, namely: Sylla serrate and Episesarma sp. (v) Molluscs, based on the results of the study, Several types of mollusks were found in the mangrove forest area of Balang Baru Village, namely: Telecopium telescopium, Terebralia palustris, Achatina fulica, Pila ampullaceal, Nerita petiti and Chicoreus capucinus. The number of types of mollusks found shows the high diversity in the mangrove area of Balang Baru Village. Thus, it will add insight to every visitor who comes about the types of mollusks in the area.

3.2.5. Suitability Analysis of Mangrove Ecotourism in Balang Baru Village. Based on the results of the research conducted, it can be seen that the land suitability level category for Station I is presented in Table 4 below:

Table 4. Land suitability level at station I

No	Parameter	Weight	Rating Result	Score	Weight x Score
1	Mangrove Thickness (m)	0.380	330 m	2	0.760
2	Mangrove Density (Trees/100²)	0.250	21	3	0.750
3	Mangrove Type	0.150	2	1	0.150
4	Biota Object	0.120	Fish, Crab, reptile, bird, mollusk	3	0.360
5	Tidal range (m)	0.100	1.5 m	2	0.200
	Total				2.220

Based on the results of the research carried out, it can be seen that the land suitability level category for Station II is presented in Table 5 below.

Table 5. Land suitability level at station II

No	Parameter	Weight	Rating Result	Score	Weight x Score
1	Mangrove Thickness (m)	0.380	184 m	1	0.380
2	Mangrove Density (Trees/100²)	0.250	16	3	0.750
3	Mangrove Type	0.150	2	1	0.150
4	Biota Object	0.120	Fish, Crab, reptile, bird, mollusk	3	0.360
5	Tidal range (m)	0.100	1.5 m	2	0.200
	Total				1.850

Based on the results of the research conducted, it can be seen that the land suitability category for Station III has been presented in Table 6 below.

Table 6. Level of land suitability at station III

No	Parameter	Weight	Rating Result	Score	Weight x Score
1	Mangrove Thickness (m)	0.380	579 m	3	1.140
2	Mangrove Density (Trees/100²)	0.250	23	3	0.750
3	Mangrove Type	0.150	2	1	0.150
4	Biota Object	0.120	Fish, Crab, reptile, bird, mollusk	3	0.360
5	Tidal range (m)	0.100	1.5 m	2	0.200
	Total				2.600

Based on the results of the research carried out, it can be seen that the category of land suitability level for all stations has been presented in Table 7 below.

Table 7. Results of land suitability assessment for mangrove ecotourism.

Parameter	Weight	Station					
		I		II		III	
		Score	Value	Score	Value	Score	Value
Mangrove Thickness (m)	0.380	2	0.760	1	0.380	3	1.140
Mangrove Density (Trees/100²)	0.250	3	0.750	3	0.500	3	0.750
Mangrove Type	0.150	1	0.150	1	0.150	1	0.150
Biota Object	0.120	3	0.360	3	0.360	3	0.360
Tidal range (m)	0.100	2	0.200	2	0.200	2	0.200

Total	2.220	1.850	2.600
suitability category	S	TS	SS

From the calculation of the land suitability category at station l, the values for each parameter were obtained. The mangrove thickness has a parameter of 330 meters. Mangrove density parameters obtained 18 Ind / 100m². For the parameters of mangrove species, 2 types of mangroves were obtained, namely Avicennia alba and Rhizophora apiculata. For parameters of biota objects that are associated in the mangrove ecosystem, there are birds, fish, crabs, reptiles, mollusks and bivalves. The tidal amplitude parameter in the mangrove ecosystem of Balang Baru Village is 1.5 meters. For mangrove ecotourism activities, the amplitude in these waters is included in the appropriate category. According to Ismawati (2018), the assessment of area characteristics is based on the following considerations: (1) the existence of interesting objects, both flora, fauna and physical aspects; (2) there is a panoramic beauty, which has a certain charm; (3) Nice landscape; (4) Endangered or protected animals and plants. In the mangrove ecosystem of Balang Baru Village, there are two criteria, namely the existence of interesting objects, both flora, fauna and physical aspects, and there is a panorama or beauty, which has a certain attraction. Based on the calculation of the land suitability level category at station II, the values for each parameter were obtained. For the mangrove thickness parameter the measurement results obtained were 184 meters. For mangrove density parameters, the results obtained were 16 Ind / 100 m². For mangrove species parameters obtained 2 species, namely Avicennia Alba, Rhizophora apiculata. For biota objects associated with mangrove ecosystems, there are birds, reptiles, fish, crustaceans and mollusks. And the tidal amplitude in the mangrove ecosystem of Balang Baru Village is 1.5 meters which is categorized as unsuitable for mangrove ecotourism activities.

Based on the calculation of the land suitability level category at station III, the values for each parameter were obtained. For the parameter of mangrove thickness, the measurement result was 579 meters and it was the highest mangrove thickness of the three stations. For mangrove density parameters obtained 23 Ind / 100m² and is the highest density of the three stations. Parameters of mangrove species were 2 species, namely Avicennia alba, and Rhizophora apiculata. For biota objects associated with mangrove ecosystems, there are birds, reptiles, fish, crustaceans and mollusks. And the tidal amplitude parameter in the mangrove ecosystem of Balang Baru Village is 1.5 meters and is a suitable category for mangrove ecotourism.

Based on the table, it can be concluded that the suitability value for station I is 2,370 in the appropriate category. Station II is 1,850 with the unsuitable category, and for Station III it is 2,750 with the very suitable category. It is not suitable for Station II to be made into an ecotourism area, namely due to the lack of diversity of mangrove species at this station, as well as having a low mangrove density.

4. Conclusion

Based on the results of research on the development of mangrove ecotourism, it is concluded as follows: (1) The potential for ecotourism in the mangrove ecosystem of Balang Baru Village, among others, has a large stretch of mangrove forest and various types of animals, in this case birds, reptiles, fish, molluscs and crustaceans, thus providing power. attraction for the development of ecotourism in Balang Baru Village, and (2) Based on the results of the suitability analysis it shows that the mangrove areas in Balang Baru Village are included in the appropriate category at stations I and III to be used as ecotourism areas.

Suggestion

Based on the results of research on mangrove ecotourism development, it is suggested as follows: (1) It is necessary to develop infrastructure in a planned manner to support ecotourism activities, and (2) The need for community involvement in various planning for the development of ecotourism areas in Balang Baru Village.

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