Feasibility Study of Mangrove Ecotourism Development in Lakkang Village, Tallo District, Makassar City

Muh. Takbir Dg Sijaya[*], Chair Rani[*], Ahmad Bahar[*]

[*] Department of Integrated Coastal Resource Management, Hasanuddin University

Abstract- The development of ecotourism is one of the alternative activities that can help overcome the problem of utilization that is destructive and threatens the sustainability of resources. This study aimed to determine the bioecological potential of the mangrove ecosystem, analyze the suitability and the carrying capacity of the land, and develop the formulation of the ecotourism-based mangrove ecosystem. The research methods used analysis of the bioecological potential of mangroves, suitability matrix, carrying capacity analysis, and SWOT analysis. The results showed that the bioecological potential of mangroves consists of three types of mangroves, namely *Rhizophora mucronata*, *Avicennia alba*, and *Nypa*, while the associated biota includes fish, birds, and mollusks. The mangrove tourism feasibility index on the medium category with a carrying capacity of 209 people/day. The development directions to support the feasibility of mangrove ecotourism in Lakkang Village are maintaining the existence of the mangrove ecosystem, planting mangroves to increase their thickness, involving local communities, forming a network of natural tourism, providing supporting facilities and infrastructure, and forming a management unit.

Index Terms- Mangrove, Ecotourism, Feasibility study, Lakkang village

I. INTRODUCTION

Ecotourism development is one of the alternative activities that can help overcome the problem of destructive utilization and the sustainability of coastal resources. Ecotourism represented the various interests that grow from environmental, economic, and social concerns [1]. The mangroves on the north coast of Makassar City have experienced an increase in the past decade. The mangrove area in 2001 was 50.3 Ha, and in 2015 it was 58.53 Ha, an increase of 8.23 Ha [2]. The increase occurred due to the conservation and planting of mangroves in the north coastal area of Makassar City by various parties. The north coastal areas consist of Tallo District, Biringkanaya District, and Tamalanrea District.

One area of Tallo District that has a mangrove ecosystem is Lakkang Village. Lakkang Village is a unique area in the middle of Makassar City where has several interesting places, namely Japanese heritage bunkers, mangroves ecosystem, and traditional houses [3]. This area is also usually used by visitors to carry out several tourist activities such as panoramic views. Nowadays, there is no tourism management system for several destinations in the Lakkang Village area, so there required to extract valid information through a study.

Lakkang tourism development regulation shown on Local Government Regulation no. 4 of 2015 about Spatial Plans of Makassar City 2015-2034 and Makassar City Regional Tourism Development Master Plan 2015-2035. Lakkang village has several advantages, namely the local wisdom and ecosystem conditions that support the environmental quality of the Makassar coastal area. Lakkang Village is one of the areas on the list in the Regional Tourism Strategic Areas IV (KSPDIV). The strategy implementation program to be carried out is by the Historical and Ecotourism Creativity Center (RIPPDA Makassar City, 2015-2035). Furthermore, Lakkang Village has ecotourism potential that can be grown by linking the potential of the Lakkang Village area with ecotourism elements in the form of education, community empowerment (economic, social, cultural), and conservation activities.

Feasibility studies for the development of Lakkang Village as an ecotourism area have been out in several kinds of research that focused on examining attractions, access, facilities, infrastructure, social, economic, and cultural conditions. This research has not studied more deeply about the bioecological potential for the feasibility of developing mangrove ecosystems for ecotourism. So that further studies are needed about the feasibility and carrying capacity of the mangrove ecosystem in Lakkang Village as a tourist attraction. In addition, it is also necessary to develop a feasibility strategy for developing mangrove ecotourism in Lakkang Village.

II. METHODOLOGY

Research site and time

This research was conducted from July to January 2022 in the mangrove area of Lakkang Village, Tallo District, Makassar City (Figure 1). Lakkang village stands on a delta formed from the sedimentation process.
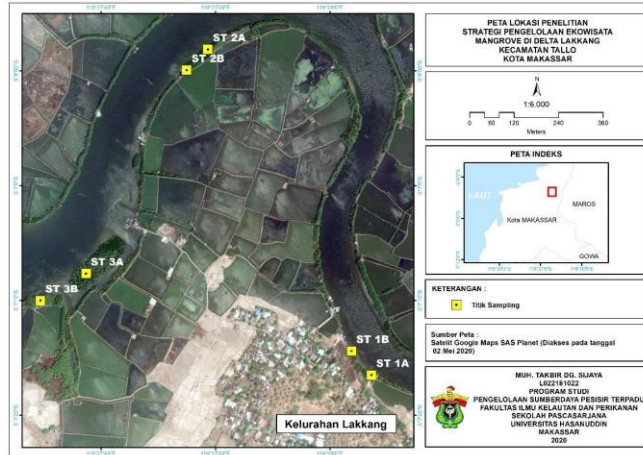

Figure 1. Map of research site and sampling area

Data types and sources

The types of data taken in this study are primary data and secondary data. Primary data consists of ecological parameters, namely the condition of mangrove ecosystems, tidal waters, and social parameters. Secondary data in the form of Sentinel-2A images, supporting data regarding the profile of Lakkang Villages, and other data obtained from literature studies.

Research procedure

Research site determination

Determination of research stations is done by looking at the distribution of mangrove ecosystems in the research location. From the distribution of existing mangroves, 3 main stations and 2 substations were determined at each main station. For more details, see the map in Figure 2. The first station represents the condition of mangroves that are close to residential areas, the second station represents the condition of mangroves in the pond area, and the third station represents 2 characteristics, namely mangroves in pond areas and mangroves on small islands (Little Lakkang Island).

Respondent determination

Collecting data on social conditions using questionnaires distributed to the public and visitors. Questionnaires are used if it is suspected that the answers vary between respondents [1]. Determination of the number of respondents using accidental sampling, namely sampling based on the fact that they happened to appear at the time of observation. Determination of respondents using a random data collection method. The social data collected consists of :

- Respondent characteristics
- Human activity on mangrove ecosystem area
- Respondent perception about mangrove ecosystem and ecotourism
- Public participation and acceptance of ecotourism planning

Mangrove bioecological data observation

- Identification of mangrove species
- Mangrove coverages
- Distribution and density of mangrove
- The width and extent area of mangrove

Data analysis

Mangrove bioecological potential analysis

Mangrove vegetation data that has been collected is then analyzed to determine species, genera, species density, relative density, species frequency, relative frequency of a species, species dominance, relative dominance, and important value index (INP) using the equation referring to Kusmana et al. (2015) [4].

$$Species\ Density = \frac{\sum individual\ number\ of\ a\ species}{Unit\ area}$$

$$Species\ Density = \frac{\sum individual\ number\ of\ i}{Unit\ area} \times 10.000$$

$$Relative\ Density = \frac{Species\ density}{\sum number\ of\ all\ species} \times 100\%$$

Distribution and density analysis

Based on the comparative analysis of wavelengths between Landsat 8 and Sentinel-2A, in this case to determine the RGB composite used in Sentinel-2A imagery for mangrove identification, band 5 (NIR), 8a (Vegetation Red Edge), and 11 (SWIR).

Suitable area assessment

Ecotourism development has certain ecological requirements that must be met in order to qualify as an ecotourism object. The conformity assessment approach in this study refers to Bahar (2014) with the parameter as follows [5] :

a. The suitability criteria from the supply side :
   - Diversity : species, number of vegetation species, number of animal species
   - Distinctiveness : ecological fungsion, geology, lagoon shape
   - Scarcity : Number of species of living groups
   - Representation
   - Authenticity : Vegetation coverage, natural succession, vegetation structure, diversity
   - Area characteristics

b. The suitability criteria from the demand side :
   - Law
   - Accesibility
   - Conservation

Each of these variables is divided into three levels, namely high with a score of 5, medium with a score of 3 and low with a score of 1 while the details are presented in the form of a mangrove ecotourism suitability matrix [5].

Table 1. Suitability matrix for mangrove ecosystem area

Criteria	Weight	High score (5)	Middle score (3)	Low score (1)	Score x Weight
1. Diversity					
- Species	5	5-6	3-4	1-2	Nk
- Number of vegetation species	2	> 11	6-10	<6	
- Animal species	2	4	2-3	1	
2. Distinctiveness	5	3	2	1	Nkh
3. Scarcity	5	4-5	2-3	1	NI
4. Representation	4	20-25	15-19	5-14	Nw
5. Authenticity					
- Vegetation coverage	4	70-100%	40-69%	<40%	Na
- Natural succession	5	80%	60-79%	<60%	
- Damage	3	40%	40-69%	>70%	
- Vegetation structure	2	3	2	1	
6. Area characteristics	4	4 def.	2-3 def.	1 def.	Nkk
7. Conservation	1	3	2	1	Nksv
8. Puddle presences	2	> 10 days/month	5-10 days/month	< 5 days/month	Ng
9. Regulation	3	3 reg.	2 reg.	1 reg.	Nleg
10. Fresh water requirements	3	≤ 2 km	> 2 - 2,5 km	> 2,5 km	Nat
11. Accessibility	1	4 def.	2-3 def.	1 def.	Nak
12. Demand	2	4 def.	2-3 def.	1 def.	Np
Total	Σbki				

(Source : Bahar, 2004)

The analysis of the suitability of the mangrove area for ecotourism purposes is carried out based on the total value of all criteria with a mathematical model as follows :

$$NKE = \Sigma Nk + \Sigma Na + Nkh + NI + Nw + Nksv + Nkk + NG + Nhk + Nat + Nak + Np$$

Defintion :

NKE   : Amount of suitability criteria for mangrove ecotourism

ΣNk   : Diversity score

ΣNa   : Authenticity score

Nkh   : Distinctiveness score
NI   : Scarcity score
Nw   : Representation score
Nksv   : Conservation score
Nkk   : Score of area characteristics
NG   : Score of puddle presences criteria
Nleg   : Score of regulation criteria
Nat   : Score of fresh water requirements
Nak   : Score of accessibility
Np   : Score of ecotourism demands

The range of suitability for mangrove ecotourism is as follows :

- High suitability ≥ 212-250
- Moderate suitability = 106-211
- Low suitability ≤ 105

Carrying capacity analysis

Analysis of the area's carrying capacity is needed in the sustainable use of a coastal resource for tourism development. The concept of the carrying capacity of the area is the determination of the maximum number of visitors that can be physically accommodated by the area provided at a certain time without causing disturbance to nature and humans. The analysis of the area's carrying capacity is carried out using the equation proposed by Yulianda (2007) [6].

$$DDK = K \; x \; \left[\frac{Lp}{Lt}\right] \; x \; \left[\frac{Wt}{Wp}\right]$$

Definition :
DDK   : Carrying capacity (people/day)
K   : Ecological potention from visitor per unit area (people)
Lp   : Mangrove area for use (m^2 or m)
Lt   : Area for spesific use (m^2 or m)
Wt   : Time allocation for tourism activity per day (hours)
Wp   : Visitor's time spend for each activity (hours)

The provisions for the ecological potential of visitors, the length of the area to be developed and the time spent by visitors and provided by the area for tourism can be seen in the following table.

Table 2. Ecological potention (K), Visitor's area (Lt), Time allocation (Wt), Visitor's time spend (Wp)

Activity	Ecological potention from visitor (K)	Mangrove area for use (Lt)	Visitor's time spend (Wp)	Time allocation for tourism activity per day (Wt)
Mangrove ecotourism	1 person	50 m^2 (The track area is calculated from every 1 person walking along 50 m and the track width is 1 m)	2 hours	8 hours

Source : Yulianda (2007)

SWOT analysis

SWOT analysis can be used to analyze and identify environmental resources in four categories, namely Strengths (strengths), Weaknesses (weaknesses), Opportunities (opportunities), and Threats (threats). This analysis can be used in the strategic planning process of an organization or project [7]. Strengths and Weaknesses are internal factors, while Opportunities and Threats are external factors. Evaluation of internal and external factors is an important part of strategic planning to determine the ecotourism management strategy [8].

The first step is to classify and tabulate IFAS (Internal Strategic Factor Analysis Summary) and EFAS (Internal Strategic Factor Analysis Summary) [9]. Then these factors are weighted and scored by experts/professional people in their fields and then calculate the final score [8]. Apart from the experts, the assessment process is carried out by taking into account the field conditions to minimize the objective/subjective nature of the analysis. In general, the stages of SWOT analysis are as follows :

- IFAS assessment (Difference between strengths and weakness)
- EFAS assessment (Difference between opportunities and threats)
- Matrix determination (Plotting IFAS and EFAS values)

Figure 2. SWOT strategy matrix (Source : Rangkuti, 1997)

- Forming SWOT Matrix

Table 3. SWOT Matrix of mangrove ecotourism development strategy

EFAS/IFAS	Strength (S)	Weakness (W)
Opportunities (O)	Strategies using strengths to take advantage of opportunities	Strategies to minimize weaknesses to take advantage of opportunities
Threats (T)	Strategies using strength to overcome threats	Strategies to minimize weaknesses to avoid threats

Source : Rangkuti (1997)

III. RESULTS AND DISCUSSION

Mangrove Bioecological Potention

Mangrove species

The types of mangroves found at the research site were *Rhizophora mucronata*, *Avicennia alba*, and *Nypa*. This type of mangrove is located in the zone near the sea and the area near the land. The research location is included in the transition zone between open mangroves, middle mangroves, and brackish mangroves.

- Species density

The results of the research conducted showed that the highest density of mangrove species was at Station 2 for *Rhizophora mucronata* was 0.195 ind./m^2, while the lowest density was at Station 1 for *Avicennia alba* was 0.035 ind./m^2.
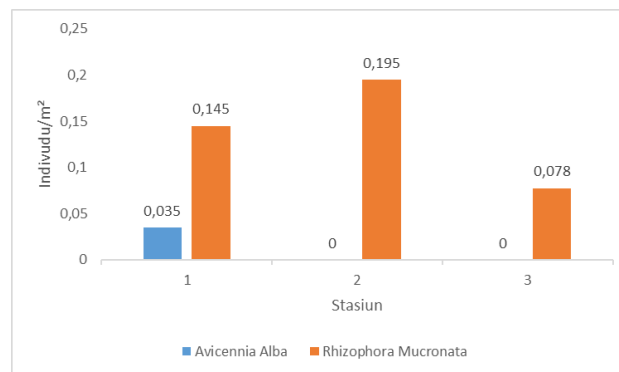

Figure 3. Mangrove species density

- Mangrove species coverage

The results of the research conducted showed that the highest mangrove species cover was at Station 1 for Rhizophora mucronata was 0.30 m^2, while the lowest species density was at Station 1 for Avicennia alba was 0.01 m^2.
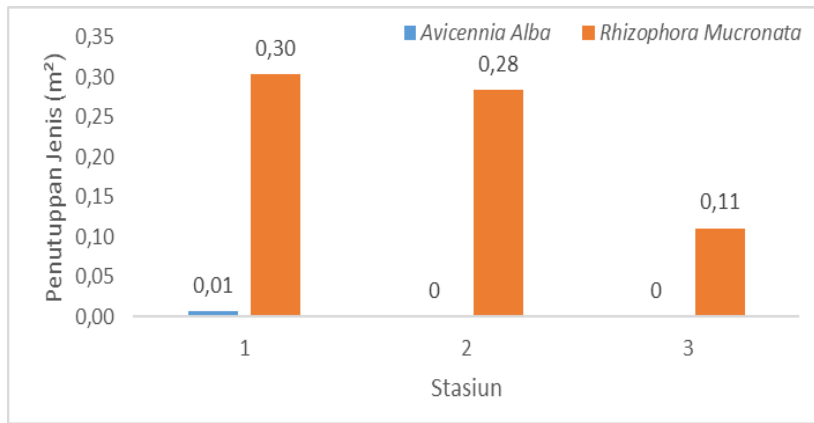
Figure 4. Mangrove species coverage

- Mangrove thickness

At the research location, it is known that the station with the highest mangrove thickness is at Station 3 while the lowest is at Station 2 (Table 4).

Table 4. Mangrove thickness

Station	Mangrove thickness (m)	Average (m)
1a	29	23
1b	17	
2a	33	22
2b	11	
3a	68	50
3b	32	

Based on the provisions of the suitability of mangrove tourism, the condition of the mangrove thickness in Lakkang Village that meets the requirements is at station 3 with an average thickness of 50 meters. Makassar City Regulation No. 4 of 2015 concerning the Makassar City Spatial Plan 2015-2034 states that the mangroves in Lakkang Village are included in the undamaged borderline in urban areas with the provision that they are at least 30 meters from the left and right banks of the riverbed along the river channel. River. The research results showed that several factors are causing the low-density level in Lakkang Village, namely land clearing for pond cultivation, settlement activities, and the mangroves utilization for fuel.

Animal species

The objects of observation of biota are fish, crabs, mollusks, monkeys, and birds that can add value to the attractiveness of mangrove habitats [6]. At the research site, several biotas exist, including types of fish, birds, crabs, mollusks (bivalves). Based on information from the public, there are also reptiles at the location, namely crocodiles.

The Mangrove Ecosystem Distribution

Based on the results of Sentinel-2A analysis, it has known that the mangrove area of Lakkang Village is about 61.67 hectares. The observation at the three research stations found that there were three types of mangroves, namely _Rhizophora mucronata, Avicennia alba,_ and _Nypa_ but in the second and third stations, only has _Rhizophora mucronata_. The condition of the location, which is an estuary area, is one of the causes of the unraveling of the distribution of mangrove species in the research location so that more _Rhizophora mucronata_ mangroves have more existed.
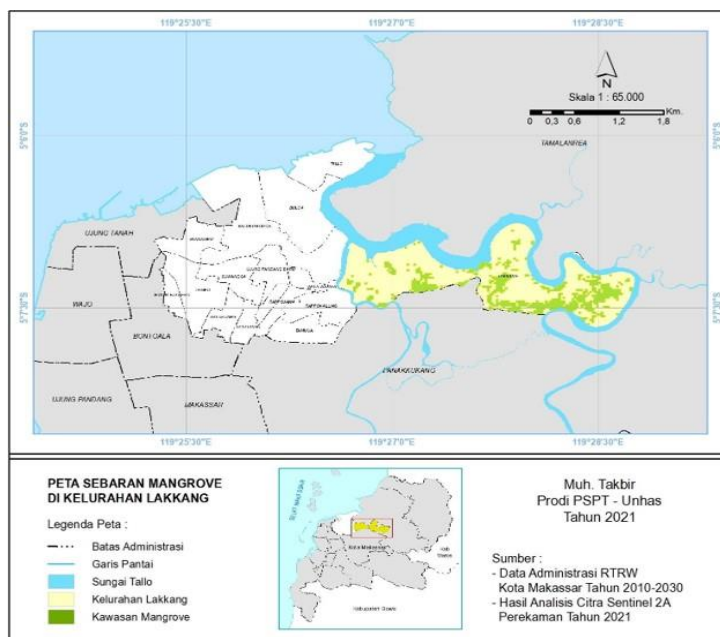
Figure 5. Mangrove distribution in Lakkang Village

Respondent Perceptions

Assessment of community perceptions related to the understanding and utilization of the mangrove ecosystem in the Lakkang village. The results of the assessment of public and visitor perceptions are in the table below.

Table 5. Results of public and visitors perception

No	Perceptions	Responses	Percentage (%)	Note
1	Knowledge and utilization of mangrove ecosystem	Know well	80	
		Uncertain	20	
		Do not know	0	
2	Ecotourism knowledge	Know well	40	
		Uncertain	40	
		Do not know	20	
3	Community activity related to mangrove ecosystem	Fishing	40	
		Wood	20	
		Other	40	Mangrove ecosystem conservation
4	Tourist's intensity	Rarely (≤5 times a week)	60	
		Frequently (> 5 times a week)	40	
5	Mangrove ecosystem	Good	20	
		Do not know	80	
6	Tourist's motivation	Relaxing and Fishing	20	
		Fishing	20	
		Taking picture and relaxing	60	
7	Travel expenses	Rp. 100.000	20	
		Rp. 50.000	80	
8	Tourist's duration	More than twice	80	
		Once	20	
9	Tourist's visiting time	Morning	20	
		Afternoon	80	
10	Reccomendation for ecotourism development	Store to buy bait for fishing	40	
		Cullinary spot	60	
11	Expectations of the ecotourism area visited	Could be better	60	
		More tourists	40	

From the results of the assessment of public and visitor perceptions regarding mangrove ecotourism, it is known that the level of understanding and utilization of mangroves is quite good. However, in terms of knowledge about the condition of mangroves in Lakkang, it is still lacking. From the visitor's side, information was obtained that

the support from visitor requests was good enough and supported the development of tourism, especially for mangrove ecotourism in Lakkang Village.

Suitability of Mangrove Ecosystem

Based on the results of the mangrove suitability analysis and the assessment matrix, overall, the diversity of the Lakkang mangrove species group and species is not suitable to be offered. In the aspect of the type species, the first station can declare as appropriate enough. On the uniqueness factor, scarcity and representation are less supportive, while from the authenticity/wholeness factor (vegetation cover), only station 3 is quite supportive.

The factors that stated as appropriate regarding the feasibility of developing mangrove ecotourism were animal species, natural succession, and area characteristics. The high-level suitability factors are damage, vegetation structure, conservation, inundation frequency, law/legality, freshwater, accessibility, and demand. The assessment results of the suitability of mangrove ecotourism in Lakkang Village are as follows.

Table 6. Results of suitability analysis for mangrove ecotourism

No	Criteria	Weight	Score			Weight x Score		
			St1	St2	St3	St1	St2	St3
1	Diversity							
	- Species group	5	3	1	1	15	5	5
	- Mangrove species	2	1	1	1	2	2	2
	- Animal species	2	3	3	3	6	6	6
2	Distinctiveness	5	1	1	1	5	5	5
3	Scarcity	5	1	1	1	5	5	5
4	Representation	4	1	1	1	4	4	4
5	Authenticity							
	- Vegetation coverage	4	1	1	3	4	4	12
	-Natural succession	5	3	3	3	15	15	15
	-Damage	3	5	5	5	15	15	15
	-Vegetation structure	2	5	5	5	10	10	10
6	Area characteristic	4	3	3	3	12	12	12
7	Conservation	1	5	5	5	5	5	5
8	Puddle presences	2	5	5	5	10	10	10
9	Regulation	3	5	5	5	15	15	15
10	Freshwater requirement	3	5	5	5	15	15	15
11	Accesibility	1	3	3	3	3	3	3
12	Demand	2	3	3	3	6	6	6
						147	**137**	**145**
						Moderate	**Moderate**	**Moderate**

From Table 6, it is known that all research stations are included in the moderate suitability category with each score being station 1 with a score of 147, station 2 with a score of 137 and station 3 with a score of 145.

Carrying Capacity

The level of carrying capacity of mangrove tourism in Lakkang Village is measured based on the comparison of the mangrove area of each station and the ecological potential of visitors per unit area is one person, the time provided for tourism activities (8 hours), and the average time spent by visitors for activities certain (2 hours).

Table 7. Carrying capacity for mangrove ecotourism

Station	Ecological potension (person)	Useable area (m²)	Total area (m²)	Time spending (hour)	Time allocation a day (hour)	Carrying capacity (person a day)
1	1	4.251,7	50	2	8	340
2	1	13.722	50	2	8	1.098
3	1	2.415,8	50	2	8	193
					Total	1.631

Based on Table 7, the highest carrying capacity is at station two was 1,098 people/day, while the lowest carrying capacity is at station three was 193 people/day. The total carrying capacity for mangrove ecotourism activities at the research site is 1,631 people/day. Activities that support tourism at station one include culinary, residential

atmosphere, and historical tourism (Japanese heritages caves). The suitable activities at station three include enjoying the view of mangrove vegetation, observing birds, walking on pond embankments, boat trip, and fishing.
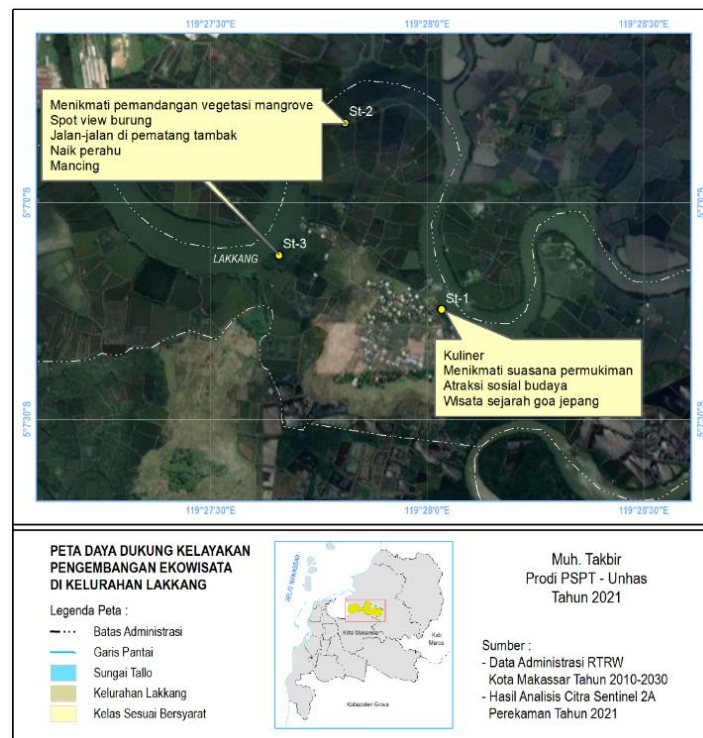
Figure 6. Map of carrying capacity for mangrove ecotourism at Lakkang Village

Figure 7. Settlements as an Alternative Object for Mangrove Tourism at Lakkang Village
(Source: Ihsan et al, 2021)

Feasibilty of Mangrove Ecotourism Development in Lakkang Village

        The first step in preparing the directive for the mangrove ecotourism development in Lakkang Village is to analyze and identify the strengths, weaknesses, opportunities, and threats. Strengths and weaknesses are internal, while opportunities and threats are external factors.

Strength
a)   There are three species of mangrove
b)   Mangrove index value about 215 to 300
c)   Mangrove potential area 61,67 Ha
d)   There are some biota such as fish, bird, crab, mollusca, and bivalve
e)   Mangrove coverages in Lakkang Village increased since 5-10 years a go
f)   The community support for mangrove ecotourism
g)   Low mangrove damage and completed vegetation structure
h)   High conservation activity

i) Puddle frequency supports the mangrove ecosystem
j) Regulation
k) Freshwater availability

Weakness
a) The mangrove thickness and density do not match to ecotourism development
b) Low knowledge of people around mangrove area
c) Limited infrastructure and facilities
d) The situation of mangrove area in Lakkang Village
e) Suitability index for mangrove ecotourism was moderate
f) Species group and individual still low
g) Low of distincitiveness
h) Low of vegetation coverages
i) Moderate of natural succession

Opportunity
a) People need alternative mangrove tourism area besides Lantebung
b) Easy of accessibility
c) High motivation from peopole to visit Lakkang Village
d) Affordable prices
e) Tourists can visit twice in a montu
f) The government pays attention to the Lakkang Village
g) Including natural tourism areas in local regulations
h) Including regional tourism strategic areas in the Makassar City Regional Tourism Development Master Plan

Threat
a) Lack of understanding of visitors about mangrove condition
b) There people around mangrove area still use mangroves as firewood
c) The local community visits mangrove area rarely as a form of monitoring support
d) There is no mangrove ecotourism manager in Lakkang Village

After identifying the internal and external factors process, determining the rating for every factor on mangrove management at the research site. The ranking results can be seen in the following table.

Table 8. IFAS strategy assessment

No	IFAS	Weight	Rating	Score
	Strength			
1	There are three species of mangrove	0,07	1	0,1
2	Mangrove index value about 215 to 300	0,06	3	0,2
3	Mangrove potential area 61,67 Ha	0,11	3	0,3
4	There are some biota such as fish, bird, crab, mollusca, and bivalve	0,09	3	0,3
5	Mangrove coverages in Lakkang Village increased since 5-10 years a go	0,07	3	0,2
6	The community support for mangrove ecotourism	0,11	3	0,3
7	Low mangrove damage and completed vegetation structure	0,10	2	0,2
8	High conservation activity	0,12	2	0,2
9	Puddle frequency supports the mangrove ecosystem	0,10	3	0,3
10	Regulation	0,08	3	0,2
11	Freshwater availability	0,10	3	0,3
			Total	**2,6**
	Weakness			
1	The mangrove thickness and density do not match to ecotourism development	0,15	1	0,1

2	Low knowledge of people around mangrove area	0,06	1	0,1
3	Limited infrastructure and facilities	0,09	1	0,1
4	The situation of mangrove area in Lakkang Village	0,18	1	0,2
5	Suitability index for mangrove ecotourism was moderate	0,18	1	0,2
6	Species group and individual still low	0,12	1	0,1
7	Low of distincitiveness	0,07	1	0,1
8	Low of vegetation coverages	0,07	1	0,1
9	Moderate of natural succession	0,07	1	0,1
			Total	**1,0**
		Difference between Strength and Weakness		**1,6**

Table 9. EFAS strategy assessment

No	EFAS	Weight	Rating	Score
Opportunity				
1	People need alternative mangrove tourism area besides Lantebung	0,1	4	0,5
2	Easy of accessibility	0,1	3	0,2
3	High motivation from people to visit Lakkang Village	0,1	3	0,4
4	Affordable prices	0,1	3	0,3
5	Tourists can visit twice in a month	0,1	3	0,2
6	The government pays attention to the Lakkang Village	0,1	3	0,3
7	Including natural tourism areas in local regulations	0,2	2	0,4
8	Including regional tourism strategic areas in the Makassar City Regional Tourism Development Master Plan	0,2	2	0,4
			Total	**2,8**
Threat				
1	Lack of understanding of visitors about mangrove condition	0,1	3	0,4
2	There people around mangrove area still use mangroves as firewood	0,4	2	0,8
3	The local community visits mangrove area rarely as a form of monitoring support	0,2	4	0,8
4	There is no mangrove ecotourism manager in Lakkang Village	0,3	2	0,6
			Total	**2,6**
		Difference between Opportunity and Threat		**0,2**

The results of the IFAS and EFAS factor assessments become a reference in determining the position of the strategic quadrant where IFAS is the X coordinate while EFAS is the Y coordinate. Based on these results, the appropriate strategy is in the first quadrant, as shown in the following figure :
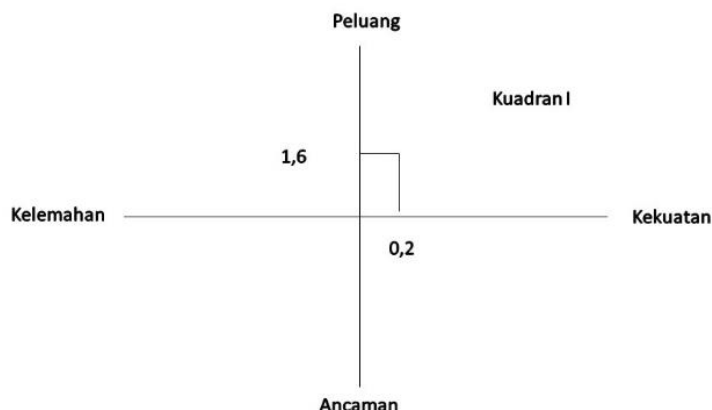

Figure 8. The strategic position of the Lakkang mangrove ecotourism development in the SWOT quadrant

Based on Figure 8, the strategic position is in the strength and opportunity quadrant, which means that the mangrove ecotourism development directions are existing strengths to take advantage of opportunities. The strategies for developing mangrove ecotourism in the Lakkang Village that can be carried out include :

1. Increase the existence of the mangrove ecosystem along the coast in Lakkang Village, which is a habitat for important biota and a source of livelihood for the community.
2. Planting mangroves increase the area of mangroves and their thickness. It is an effort to support the suitability and carrying capacity of mangrove ecotourism development in Lakkang Village.
3. The local community involvement in the mangrove ecotourism development in Lakkang Village is needed. Mangrove tourism development requires the preparation of human resources with specific qualifications. The need for human resources is based on the mangrove tourism development plan, which consists of the activity type, location, frequency, and form of service. Every provider of mangrove tourism services requires human resources, namely location coordinators, tour guides, and tourist safety officers [10]. Strengthening management is needed to overcome deficiencies in aquatic tourism activities that have been running and anticipate the development of marine tourism in the future. Evaluation of the implementation of existing activities will assist the process of identifying aspects of deficiencies or weaknesses so that recommendations will be obtained regarding problem-solving efforts and improving management. In addition, management recommendations should be dynamic then the marine tourism development can be dynamically managed.
4. Establish a network of natural tourism, especially mangroves, as a unit of Lantebung ecotourism. This network will indirectly support promotion efforts. Promotion is an effort to optimize the use of marine tourism services by increasing the interest of visitors, investors, or stakeholders in managing marine tourism [10]. Promotion should involve many stakeholders so that mutually beneficial cooperation is established without compromising the conservation values of natural resources, which are characteristic of tourist areas
5. The provision needs to support facilities and infrastructure in the development of mangrove ecotourism. The procurement of tourism facilities is a very important program, however, the development of facilities should still pay attention to carrying capacity [10]. If ecotourism is developed in conservation areas such as Natural Tourism Parks and National Parks, following the provisions of PP No.18/1994 concerning Nature Tourism Business in the Utilization Zone of National Parks and Nature Tourism Parks, the area is permitted for the construction of facilities and infrastructure is 10% of the total area. Facilities and facilities built in tourist areas should not change the landscape so that natural authenticity can still be maintained. The lodging facilities, such as hotels, are not recommended. The lodging is recommended to be more environmentally friendly, traditional, and limited such as small resorts and cottages. Other alternatives, such as hotel facilities, should be built outside the ecotourism area or develop a homestay concept using the houses of the surrounding community. If the tourist area is located on small islands, accommodation and support facilities should be concentrated on the nearest mainland. The authenticity of nature is an ecotourism priority to be maintained so that ecotourism does not experience market saturation in the short term.
6. The government establishes a management unit that will manage the mangrove ecotourism area of Lakkang Village in a professional way. Mangrove ecotourism development mainly requires management institutions or divisions that can carry out tourism management, consisting of management institutions and stakeholders, such as the communities, business groups, and other government institutions. Mangrove tourism managers are expected to cooperate with local governments in coordinating the implementation and development of mangrove tourism involving the community and other stakeholders. Tourism managers will implement and oversee ecotourism and conservation policies, while local governments can direct the policies for developing mangrove tourism businesses that involve communities, entrepreneurs, and other government units [10].

IV. CONCLUSION

1. The bioecological potential of mangroves in Lakkang Village for feasibility in ecotourism development is that there are three species of mangroves, namely *Rhizophora mucronata*, *Avicennia alba*, and *Nypa*.
2. The mangrove tourism suitability index in Lakkang Village is in the moderate category with a carrying capacity of 209 people/day.
3. The development directions to support the feasibility of mangrove ecotourism in Lakkang Village are maintaining the existence of the mangrove ecosystem, planting mangroves to increase their thickness, involving local communities, forming natural tourism networks, providing supporting facilities and infrastructure, and forming a management unit.

REFERENCES

[1] A. Tuwo, Pengelolaan Ekowisata Pesisir dan Laut : Pendekatan Ekologi, Sosial Ekonomi, Kelembagaan, dan Sarana Wilayah, Surabaya: Brilian Internasional, 2011.

[2] Rini, Strategi Pengembangan Ekowisata Mangrove dengan Pendekatan Kapasitas Adaptif di Lantebung Kota Makassar, Bogor: IPB, 2018.

[3] M. Ali, A. Rasyid and A. Armasyah, "Strategi Pengembangan Kelurahan Lakkang sebagai Kawasan Ekowisata di Kota Makassar," in *Temu Ilmiah IPLBI*, Semarang, 2018.

[4] C. Kusmana, I. Setyobudiandi, S. Hariyadi and A. Sembiring, Sampling dan Analisis Bioekologi Sumber Daya Hayati Pesisir dan Laut, Bogor: IPB Press, 2015.

[5] A. Bahar, Kajian Kesesuaian Daya Dukung Ekosistem Mangrove Untuk Pengembangan Ekowisata di Gugus Pulau Tanakeke Kabupaten Takalar Sulawesi Selatan, Bogor: IPB, 2014.

[6] F. Yulianda, "Ekowisata Bahari sebagai Alternatif Pemanfaatan SUmber Daya Pesisir Berbasis Konservasi," in *Seminar SAINS*, Jakarta, 2007.

[7] Phadrmrod, B. Phadermrod, R. Chowder and G. Wills, "Importance Performance Analysis Based SWOT Analysis," *International Journal of Information Management,* vol. 4, no. 1, 2016.

[8] A. Ghorbani, V. Raufirad, P. Rafiaani and H. Azadi, "Ecotourism Sustainable Development Strategies Using SWOT and QSPM Model : A Case Study of Kaiji Namazkar Wetland, South Khorasan, Iran.," *Tourism Management Perspectives,* vol. 16, no. 1, pp. 290-297, 2015.

[9] F. Rangkuti, Teknik Membedah Kasus Bisnis Analisis SWOT, Jakarta: PT. Gramedia Pusaka Utama, 1997.

[10] F. Yulianda, Ekowisata Perairan Suatu Konsep Kesesuaian dan Daya Dukung Wisata Bahari dan Wisata Air Tawar, Bogor: IPB Press, 2019.

AUTHORS

First Author – Takbir Dg Sijaya, MSC, Hasanuddin University, muhtakbirmkssr90@gmail.com
Second Author – Chair Rani, PROF, Hasanuddin University, erickch_rani@yahoo.com
Third Author – Ahmad Bahar, DR, Hasanuddin University, amb2270@yahoo.com

Correspondence Author – Takbir Dg Sijaya, MSC, Hasanuddin University, muhtakbirmkssr90@gmail.com