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Abstract. This study aims to determine the level of damage and estimation of rehabilitation value in the Lantebung Mangrove Ecotourism, Makassar City. The sampling technique was carried out using a survey technique with a purposive sampling method. The size of the plots made is 20 m x 50 m with a total of 8 plots. The level of mangrove damage is determined based on land cover and vegetation density. Estimating the value of ecotourism rehabilitation is based on the Regulation of the Director-General of Natural Resources and Ecosystem Conservation P.8/KSDAE/SET/REN.2/10/2017 concerning Standards for Activities and Costs for Conservation of Natural Resources and Ecosystems. The results showed that there were two types of mangrove species, namely *Rhizophora mucronate* and *Avicennia alba*. Lantebung Mangrove Ecotourism has a vegetation cover of 82% with a vegetation density of 1,760 individuals/ha, so that the level of damage to mangroves is in a good category. In general, damage to Lantebung Mangrove Ecotourism is caused by converting mangrove forests into fishponds and settlements. The total cost of mangrove forest rehabilitation is IDR. 350,220,000

1. Introduction

Indonesia is known as a mega-biodiversity country in terms of diversity. With the number of islands reaching 17,508 and a coastline of 81,000 km, causing Indonesia to have a very wide coastal area and will be very potential for regional development if managed properly. The coastal area has a strategic meaning because it is a transitional area between land and sea ecosystems that are affected by changes on land and at sea. Coastal areas have a specific and dynamic character with very rapid biological, chemical and geological changes. The coastal ecosystem consists of coral reefs, mangrove ecosystems, beaches and sand, estuaries, seagrasses which are natural protectors from erosion, flooding, and storms and can play a role in reducing the impact of pollution from land to sea. In addition, coastal areas also provide various environmental services and as human habitation, and for transportation, vacation, or recreation.

Changes that occur in coastal and marine areas are generally influenced by human activities around them. These pressures arise from development activities such as residential development and trading activities because coastal areas are most vulnerable to changes both naturally and physically, resulting in a decrease in environmental quality, one of which is the mangrove ecosystem. Mangrove ecosystems in small islands often face various challenges, including Another is the impact of human activities that make destructive use of the surrounding mangrove ecosystem and natural factors such as global warming and natural disasters. Reducing the area and decreasing the quality of the waters of the mangrove ecosystem is a serious threat to an area whose population is very dependent on the resources in the mangrove ecosystem.

Mangroves have a variety of ecosystem services, such as carbon sequestration and nutrient cycling [1], and provide direct and indirect economic benefits, for example, nearly 80% of fish catches in coastal areas generally depend on the mangrove ecosystem [2]. In addition to the internal value and beauty of mangroves, mangrove ecosystems provide services: act as a CO2 absorber in the atmosphere, support fisheries, buffer zones for seagrass beds and coral reefs against the impact of sedimentation loads from rivers, protect coastal communities from rising sea levels, storms, and tsunamis, providing staple food fiber, wood, chemicals, and medicines for people living near mangrove ecosystems, coastal protection against waves, Carbon storage [3]. Given the great ecological and economic benefits, the reduction of mangrove forest areas due to human activities and climate change is a major concern.

Factors of social conditions and lack of understanding of the functions and benefits of mangroves also affect the damage to mangrove ecosystems. This directly causes ecological impacts that threaten the sustainability of various coastal biota that make mangrove forests their habitat. Therefore, the protection of the mangrove forest area needs to be continuously improved so that the existence and sustainability of the mangrove forest as a protected area are maintained. According to the Decree of the State Minister for the Environment Number 201 of 2004, Mangroves are a group of Dicotyledoneae and/or Monocotyledoneae plants consisting of plant species that have taxonomic relationships to unrelated families but have similar morphological and physiological adaptations to habitats that are influenced by tides. recede. Mangroves are natural resources that have various functions as a habitat for breeding and shelter for marine biological resources and their sustainability must be maintained. Increasing development activities can have an impact on mangrove damage, therefore it is necessary to control efforts. One of the control's efforts to protect mangroves from damage is to know the level of damage based on the standard criteria for damage. This study aims to determine the level of damage and estimation of rehabilitation value in the Lantebung Mangrove Ecotourism, Makassar City.

2. Methods

2.1. Tools and materials

The tools used in this study were Camera, Meter Roll, Raffia Rope, Meter Tape, Stationery, GPS. The material used in this study was mangrove stands.

2.2. Methods

The sampling technique was carried out using a survey technique with a purposive sampling method. The size of the plots made is 20 m x 50 m with a total of 8 plots. Data from the survey was conducted to determine species density, species frequency, species dominance, important value index, and diversity index.

2.3. Data analysis

The data collected is then analyzed descriptively, quantitatively, with an analysis unit based on primary data and secondary data. The level of mangrove damage is determined based on land cover and vegetation density. The method used to calculate the level of mangrove damage is guided by the Decree of the State Minister of the Environment Number 201 of 2004 concerning the standard criteria and guidelines for determining mangrove damage. The estimation of the value of ecotourism rehabilitation is based on the Regulation of the Director-General of Natural Resources and Ecosystem Conservation P.8/KSDAE/SET/REN.2/10/2017 concerning Standards for Activities and Costs for Conservation of Natural Resources and Ecosystems.

3. Result and discussion

3.1. Diversity index

Species diversity can be used to express the community structure of high species diversity, indicating that a community has high complexity because species interactions that occur in that community are

very high. A community is said to have high species diversity if the community is composed of many species. On the other hand, a community is said to have low species diversity if the community is composed of a few species and if only a few species are dominant. To estimate species diversity, analysis of the Shannon Index diversity (H') is used.

Table 1. Diversity index of Mangroves.

No.	Species	ni	ni/n	ln ni/n	H'
1	*Rhizophora mucronata*	973	0.69	-0.37	-0.26
2	*Avicennia alba*	435	0.31	-1.17	-0.36
	Total	**1,408**			**0.62**

3.2. Mangrove composition

Species Density (K), Relative Density (KR), Frequency (F), and Relative Frequency (FR) of Mangroves in Lantebung Mangrove Ecotourism can be seen in Table 2, Table 3, and Table 4.

a. Specific Density and Relative Density

Table 2. The density of a species and Relative Density of Mangroves.

No	Species	ni	Plot (ha)	K	KR (%)
1	*Rhizophora mucronata*	973	0.8	1216	69.11
2	*Avicennia alba*	435	0.8	544	30.89
	Total	1,408		1760	100

Based on Table 2, the results of research conducted in Bira Village, Tamalanrea District, it can be seen that the density of Rhizophora mucronata is higher than the density of Avicennia alba, which is 1,216 trees/ha with a percentage of 69.11%, while the density of Avicennia alba is 544 trees. /ha with a percentage of 30.89%.

b. Frequency and Relative Frequency

Table 3. Frequency and Relative Frequency of Mangroves.

No	Species	Pi	F	FR(%)
1	*Rhizophora mucronata*	6	0.75	60
2	*Avicennia alba*	4	0.5	40
	Total		1.25	100

The study results are presented in Table 3, it can be seen that the frequency of Rhizophora mucronata is 0.75, and the relative frequency is 60%, then for the frequency of Avicennia alba is 0.5 and the relative frequency is 40%. From these data, it can be seen that the probability of finding the mangrove species Rhizophora Mucronata in the measuring plot is 0.75, while the probability of finding the mangrove species Avicennia alba is 0.5

c. Dominance and Relative Dominance

Table 4. Dominance and Relative Dominance of Mangroves.

No	Species	Basal area (m)	Plot Area (m)	D	DR
1	*Rhizophora mucronata*	2,726	8000	0.00034	16.1822
2	*Avicennia alba*	14,117	8000	0.00176	83.8178

Total	16,843	0.00211	100

The dominance and relative dominance of mangroves are presented in Table 4, it can be seen that the dominance of Avicennia alba is higher than the dominance of Rhizophora mucronata, namely 0.00176, with a percentage of 83.82%, while the dominance of Rhizophora mucronata is 0.00034 with a percentage of 16.18%.

d. Important value index

Table 5. Mangrove important value index.

No	Species	**KR (%)**	**FR(%)**	**DR(%)**	**IVI**
1	*Rhizophora mucronata*	69.11	60	16.18	145.29
2	*Avicennia alba*	30.89	40	83.82	154.71
	Total	100.00	100.00	100.00	300.00

This important value index provides an overview of the influence or role of a mangrove plant species in the ecosystem and can also be used to determine the dominance of a species in a mangrove community. The important value index presented in Table 5, it can be seen that the IVI of the mangrove species Rhizophora mucronata is lower than that of Avicennia alba, which is 145.29, while the IVI of the mangrove species Avicennia alba is 154.71.

3.3. The Level of Mangrove Damage

Based on the results of land cover analysis using geographic information system analysis, it is found that Lantebung Mangrove Ecotourism has a vegetation cover of 82%. the total density of mangroves is 1,760 trees/ha. Rhizophora mucronata species of 1,216 trees/ha with a percentage of 69.11% and Avicennia alba mangrove species of 544 trees/ha with a percentage of 30.89%.Based on the criteria for the level of mangrove damage which is guided by the Decree of the State Minister of the Environment Number 201 of 2004 concerning the standard criteria and guidelines for determining mangrove damage, the condition of the mangrove ecosystem in Lantebung ecotourism is in a good category. However, at the study site, mangrove ecosystem disturbances occurred. The damage to the Lantebung mangrove forest is more due to the conversion of mangrove forests into ponds, settlements, and plantations

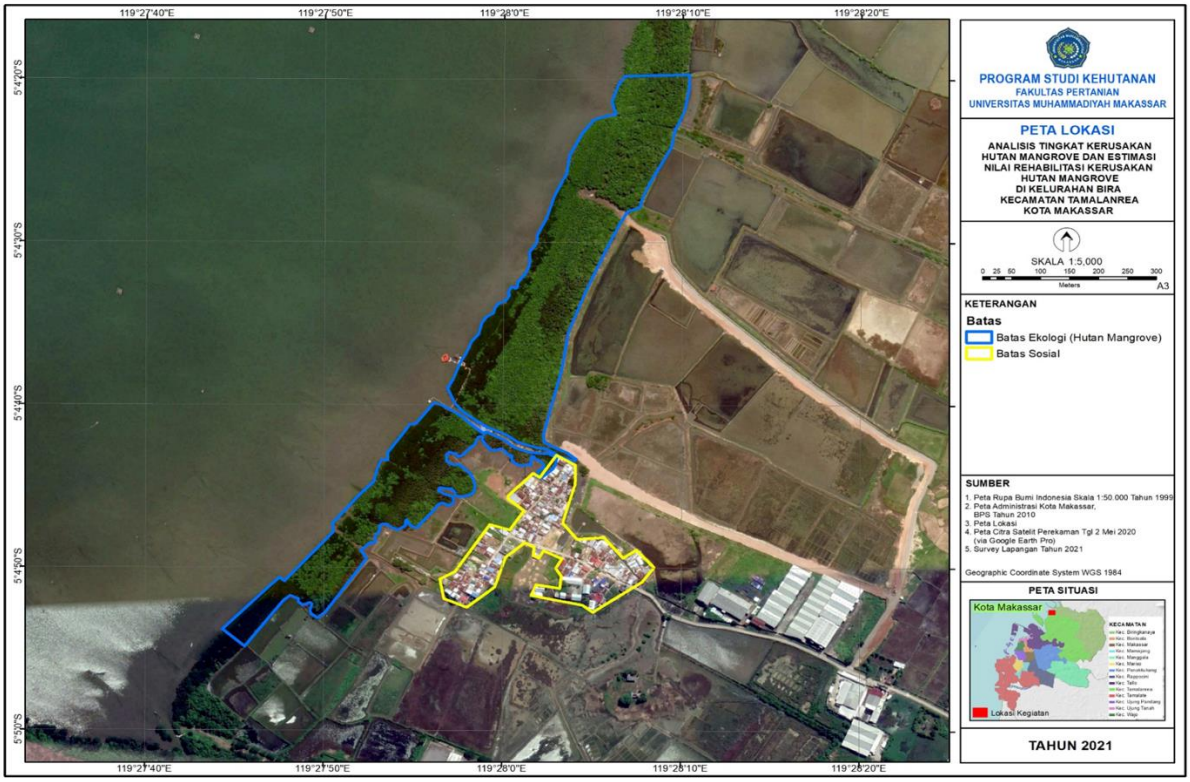

Figure 1. Land cover of Lantebung Mangrove Ecotourism.

3.4. Estimation of Rehabilitation Cost

Based on the rehabilitation costs, which refers to P.8/KSDAE/SET/REN.2/10/2017 concerning Standard Activities and Costs for the Conservation of Natural Resources and Ecosystems in 2018, the rehabilitation costs per hectare are equivalent to IDR. 35,022,000, where the total area to be rehabilitated is 10 Ha, so the rehabilitation value of the Lantebung mangrove forest is IDR. 350,220,000.

4. Conclusions and suggestion

4.1. Conclusions

there were two types of mangrove species, namely *Rhizophora mucronate* and *Avicennia alba*. Lantebung Mangrove Ecotourism has a vegetation cover of 82% with a vegetation density of 1,760 individuals/ha so that the level of damage to mangroves is in a good category. In general, damage to Lantebung Mangrove Ecotourism is caused by the conversion of mangrove forests into fishponds and settlements. The total cost of mangrove forest rehabilitation is IDR. 350,220,000.

4.2. Suggestion

Makassar City government needs to reduce the level of damage to mangrove forests through efforts to prevent and rehabilitate the Lantebung mangrove forest. This effort is needed considering the role of mangroves in coastal ecosystems is very important and it is also necessary to enforce the institutional law of mangrove forests.

References

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