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An Overview : Ecotourism Suitability Analysis In Several Indonesian Mangrove Areas

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Abstract— This article review is intended to discuss mangrove ecosystem resources as an effort to improve ecotourism areas. Mangrove ecosystems are ecosystems that have high productivity of organic matter which makes them an ecological chain for the life of biota in the waters. Mangrove ecosystems also contribute to environmental, economic and social benefits, such as protection from rising sea levels, rising waves and erosion. One of the efforts to conserve the mangrove area is the development of ecotourism in the area so as to maintain the sustainability of the mangrove ecosystem in a sustainable manner. The study of mangrove ecosystem resources to increase ecotourism potential can be analyzed by knowing the structure and vegetation of the mangrove area and analyzing the suitability of tourism based on a predetermined index.

Keywords - Mangrove Vegetation, Ecotourism, Tourism Suitability Index

I. INTRODUCTION

Mangrove ecosystems are found along tropical and sub-tropical coasts [1]. They are ecosystems that have high biodiversity and productivity that provide ecological services, which are high and play an important role in many ways such as preventing coastal erosion, regulating nutrients, decomposing carbon emissions, providing habitat for many species, regulating global climate and storing carbon so that this ecosystem is considered one of theleading ecosystems [2][3][4][5]. Indonesia is one of the countries thathas high biodiversity in the world. Indonesia is an archipelago with the largest mangrove ecosystem in the world. The mangrove ecosystem in Indonesia is around 3,244,018 ha with diverse mangrove conditions, there are 30.7% mangroves in good condition,27.4% mangroves with moderate damage and 41,4% mangroves with severe damage [6][7].

One of the efforts to conserve mangrove forests is the development of mangrove ecotourism areas. Mangroveforests in Indonesia have been widely degraded and damaged due to human activities such as reclamation, logging and mining in mangrove forest areas [8] so that to save mangrove forests it is necessary to seek conservation of these mangrove forests. mangrove ecotourism alsoprovides opportunities to improve the economy of the surrounding community suchas the use of mangrove forests to catch fish, shellfish, crabs and provide ecotourism activities such as bird watching and others [9].

II. MATERIAL AND METHODS

The method used in writing this journal review is a literature study. Journal searches were conducted through the website https://scholar.google.co.id/ with the keywords used were "Mangrove Ecosystem Studies as an effort to improve the management of ecotourism areas". The criteria for articles taken are as follows: 1) Full text, 2) Research located in Indonesia 3) Indonesian language.

III. RESULT AND DISCUSSION

The purpose of this article review is to find out location of mangrove areas that have the most potential to become ecotourism areas in Indonesia The method that is widely used is the vegetation sampling method of the mangrove ecosystem, and the sampling method on the fauna contained in the area. data analysis carried out in the form of vegetation analysis, Fauna diversity analysis and tourism suitability analysis. Mangroves are important habitats for terrestrial, marine, and aquatic species and are a source of food, medicine, fuel, and building materials for native communities [8]. Ecotourism activities in mangrove ecosystems

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are a conservation effort that aims to minimize and repair damage Ecotourism activities in mangrove ecosystems are a conservation effort that aims to minimize and repair damage to mangrove ecosystems. [10] Ecotourism is a way of utilizing natural resources to fulfill the human desire for pleasure. Ecotourism is responsible for traveling to unspoiled places by preserving nature and supporting community welfare.

The process of analyzing the suitability of mangrove area ecotourism generally uses data from mangrove thickness, mangerove density, mangrove species, biota, and tidal data. the results of the analysis are adjusted to the mangrove ecotourism suitability matrix and doing calculated the mangrove suitability mangrove with using formula from tourism suitability index. Research related to the suitability of mangrove areas as ecotourism areas has been carried out by several researchers listed in Table 1.

TABLE I. RESEARCH RESULT RELATED TO THE SUITABILITY OF MANGROVE ECOTOURISM AREAS

Location	The kind of data collected	Mangrove Thickness (m)	Mangrove Density (Ind/100 m^2)	Mangrove Species	Biota	Tidal (m)	ESI	Category Suitability	Reference
Payo Village, West Halmahera Regency., Indonesia	**Primer data :** Mangrove vegetation, Biota analysis, Area characterictic, Accessibility	197 m	6 ind/100 m^2	8	7 Bird 2 Reptile 5 Fish 1 shirmp 4 Crab 4 Mollusca	0.50 m	73.86 %	Suitable (S2)	[10]
Hamadi Beach, Jayapura City, Indonesia	**Primer Data :** Mangrove density analysis, mangrove species identification, biota identification	587.89 m	16 ind/100 m^2	10	6 Fish 2 Reptil 3 Crab 7 Mollusca 1 bivalvia 5 bird	1,6 m	96.05 %	Very Suitable (S1)	[11]
Tanjung Batu, Sekotong Tengah, Indonesia	**Primer Data :** Mangrove vegetation	197.12 m	42 ind/100 m^2	3	Fish Reptil Shrimp Mollusca bird	1.24	1.97	Suitable (S2)	[12]
Lantebung, Makasar, Indonesia	**Primer data:** Mangrove vegetation and biota diversity	144.5 m	22 ind/100 m^2	7	2 Fish 3 Shrimp 8 Mollusca 2 Reptile 5 Bird	0.8 m	66,67%	Suitable (S2)	[13]
Pasar Banggi, Jawa Tengah , Indonesia	**Primer data:** Mangrove vegetation, biota diversity **Secondary data:** Tides, Mangrove area	121,942 m	38 ind/100 m^2	15	22 Bird Insekta Muloska Ikan kepiting	0.6 m	74,36 %	Suitable (S2)	[14]
Siahoni Village, Maluku, Indonesia	**Primer data:** Mangrove vegetation, Biota diversity, interview **Secondary data:** Tides	150 m	99,30 ind/m^2	7	5 bird 4 Fish 2 Crustacea 2 Mollusca 1 reptil	-	69%	Suitable (S2)	[15]
Kuala Langsa, Aceh, Indonesia	**Primer Data:** Mangrove vegetation, tides, biota diversity **Secondary data:** Tides, geography data.	145,66 m	7,11 ind/m^2	6	1 fish 2 crustacea 2 mollusca 1 mamalia	1,44 m	60%	Suitable (S2)	[16]
Teluk Pangpang, Banyuwangi, Indonesia	**Primer Data:** Mangrove vegetation, Biota diversity **Secondary data:** Mangrove thicknes (ArGIS 10.1)	-	18 Ind/100 m^2	9	11 Bird 3 Fish 7 Crustacea 2 Mollusca 1 Reptil	0.02 m	-	Suitable (S2)	[17]
Pasar Banggi, Kembang, Indoneisa	**Primer Data:** Mangrove vegetation, biota diversity. **Secondary Data:** Mangrove Thicknes, Tides.	139 m	62 ind/100 m^2	3	Fish Bird Mollusca Reptil Crustacea	0.53 m	59%	Suitable (S2)	[18]
Aeramo, Nusa Tenggara	**Primer Data:** Mangrove Vegetation, Biota Diversity	202 m	10,67 ind/ 100 m^2	2	Fish Crustacea Mollusca	1,45 m	1,95%	Not Suitable	[19]

Timur, Indonesia					Bird				
Rumadian, Maluku, Indonesia	**Primer Data:** Mangrove Vegetation, Tides biota diversity	200-327 m	11,2 ind /100 m^2	4	Reptil Fish Crustacea Gastropoda Bird	1,40 m	2,1	Sesuai (S2)	[20]

Based on the matrix, it can be seen the weightof each parameter, where the highest weight is on mangrove thickness, mangrove densityand fauna in the area. The weight value represents how important the parameter is tobe considered in the development of ecotourism areas

3.4 Mangrove Thickness

Data collection of mangrove thickness in each study is different, some use manual methods by measuring with raffia, and some use the help of satellite imagery. mangrove thickness is measured from mangroves at the end of the beach, stretching to mangroves that are at the end towards land. Based on the results of the collection of several mangrove locations in Indonesia in the table, it is found that the location with mangroves with high values is in the Hamadi Beach Jayapura City area, next in Aeramo village Nusa Tenggara and Rumadian village Maluku. The thickness of mangroves greatly affects what types of activities will be developed in the mangrove area.

3.3 Mangrove Density

Mangrove density based on the table is measured on an area of 100 m2. Based on Table 1, it is found that the plot area used to measure mangrove vegetation is different in each study, but for ecotourism suitability the data needed is the density of individuals/100m2 based on the table obtained the highest density value in Latupapua's research (2019), with a density value of 99.30 m2 in the Siahoni Maluku mangrove area.

3.3 Mangrove Species

The type of mangrove species greatly influences ecotourism activities, this parameter can increase interest and provide education to the public to know the type of mangrove and know how important mamgrove. based on the Table, it is known that the largest number of mangrove species is what research Setyawan et al. (2015) with a total of 15 species, with the location in Pasar Banggi Village, Central Java, then the largest area has mangrove species is Hamadi Beach, Jayapura City with a total of 10 mangrove pesies, namely from the research of Susi et al. (2018).

3.4 Biota

The existence of biota, apart from determining mangrove health, can also be an educational tourism object that can be asked by the community and of course also supports conservation efforts for mangrove area biota. based on the results of the review obtained several types of biota, namely birds, molluscs, fish, reptile families, crustaceans such as shrimp and crabs, bivalves, and gastropods. Biota can be a bioindicator related to the health of mangrove ecosystems, the more biota found then an ecosystem can be said to be a healthy ecosystem, because it is able to carry out its ecological function as a place to find food, rest and become a habitat for other biota.

3.5 Tides

Tides affect the development of ecotourism areas, one of which affects the arrival time of the community to the mangrove area, and also affects the development of ecotourism facilities, such as tacking heights for mangrove tracking activities. based on the review table, it was found that the average value of the highest tides was in the study. based on the provisions of tides for ecotourism activities, the lower the average value of tides, the better it is to be developed into an ecotourism area. based on Table 1, the lowest average for tides was found in the research of Rodiana et al. (2019) with an average of 0.02 m in Pangpang Bay, Banyuwangi.

3.6 Ecoutourism Suitability Index

Based on the data reviewed and compared at each location, the location with the highest suitability as a mangrove area was found in the research of Susi et al. (2018) at Hamadi Beach, Jayapura City, with an index value of 96.05% with a category of veriy Suitable (S1). next found Location Location with category Suitable (S2) and 1 location with category not suitable in the research of Rahayu et al, (2023) in Aeromo Village, East Nusa Tenggara, Indonesia..research related to the analysis of the suitability of eco-tourism is very important to find out whether the area to be developed into an ecotourism area is qualified or not, Variations in vegetation structure can occur due to human activities, natural disasters. From these results we can find out how to develop the mangrove ecosystem area into an ecotourism area. Whether there should be improvements first or not. Because if no analysis is done first, it is feared that efforts to develop ecotourism with the aim of protecting and preserving are not achieved.

IV. Conclusion

Based on the review, area Hamadi Beach Jayapura City is an area with the highest mangrove ecotourism suitability with value is 96,05% with category very suitable, we get conclusion for ecoutourism development is needed for developing ecosystems because the analysis can provide information related to the condition of the mangrove ecosystem.whether it is in a state of damage, moderate damage or good enough. So that later it can be considered as an ecotourism area.

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