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STUDY OF THE POTENTIAL OF MANGROVE AREAS TO SUPPORT ECOTOURISM IN MANGUNHARJO VILLAGE, TUGU DISTRICT, SEMARANG

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KEYWORDS

Ecoturism; mangrove; Mangunharjo

ABSTRACT

Mangrove ecosystems are one of the potential ecosystems to be developed as ecotourism areas. This study was designed to analyze the suitability of mangrove areas as objects of attraction in ecotourism development in Mangunharjo Village, Tugu District, Semarang City. This study looked at 5 variables, namely mangrove type, mangrove density, biota association, thickness, and tides. Sampling was carried out at 3 stations, 10 plots each. Density data collection is done by counting each individual on each species in a sampling quadrant of 10 x 10 m. Identification of mangroves is carried out by Wetlands. The identification results recorded 8 species of mangrove plants found at the research station. *A. marina* and *R. mucronata* species are most commonly found at each station. Biota found in mangrove areas is quite diverse. The tides in the Mangunharjo area are not too high, so it is an area that is classified as very suitable for ecotourism development. The suitability of the Mangunharjo coastal tourism area for the development of marine ecotourism areas for the three stations in the category is very suitable to match the IKW value of 68.42 - 96.05%.

INTRODUCTION

Semarang City is a coastal city that has a coastline of 13.6 km with a population of 1,814,110 people. As a coastal city, Semarang is a strategic area for various activities such as ports, tourism, fisheries, agriculture, industry, settlements and others (BPS Semarang City, 2019; Sasmito, 2019; Hadi & Mussadun, 2020). Semarang City has sea waters in the north, making Semarang City also famous for its potential marine tourism city. Mangroves that grow can also be used as one of the lungs of the people of Semarang City in accordance with the ecological benefits of mangrove ecosystems (Ulhaq et al., 2022).

Mangrove ecosystems are one of the potential ecosystems to be developed as ecotourism areas. Ecotourism in mangrove ecosystems is seen as synergizing with real forest ecosystem conservation steps. The use of mangrove ecosystems for ecotourism is in line with the changing trend of interest and motivation of tourist visits from mass tourism for leisure to ecotourism with special interest tourism, namely tourist trips with the motivation of visits to do tourism in which there are elements of education and conservation (Latupapua et al., 2019).

Mangunharjo Village has the potential to be used as an object and attraction of ecotourism including diversity of mangrove species with various types of roots such as supporting roots in *Rhizophora sp*., knee roots in *Bruguiera sp*., and peg roots in *Avicennia sp.;* mangrove zoning from the coast to the mainland; diversity of faunal species; and traditional use of mangrove resources by local communities. The potential of the Mangunharjo mangrove ecosystem can be developed for various tourism activities such as fishing, birdwatching, boating down the river, educational tourism, and observation of plant species (Rahmila & Halim, 2018). The purpose of this study was to analyze the suitability of mangrove areas as

objects of attraction in the development of ecotourism in Mangunharjo Village, Tugu District, Semarang City.

RESEARCH METHOD

Materials

This research was conducted in September - October 2022 located in the coastal area of the mangrove ecosystem in Mangunharjo Village, Tugu District, Semarang City (**Fig. 1**). The coastal land area in Semarang City is 9,111.28 Ha (47.6%) and the water area is 10,048.80 Ha (52.4%). The area of mangroves in Tugu District currently reaches 48.2 Ha of the total mangrove area in Semarang City is 96.4 Ha. The land area is dominated by ponds, rice fields, settlements and industries. The equipment to be used in this study includes pH meters, refractometers, salinometers, GPS, roller meters, digital cameras, raffia ropes, iron pegs and plastic bags. The material to be used is the Wetlands and GIS software website.

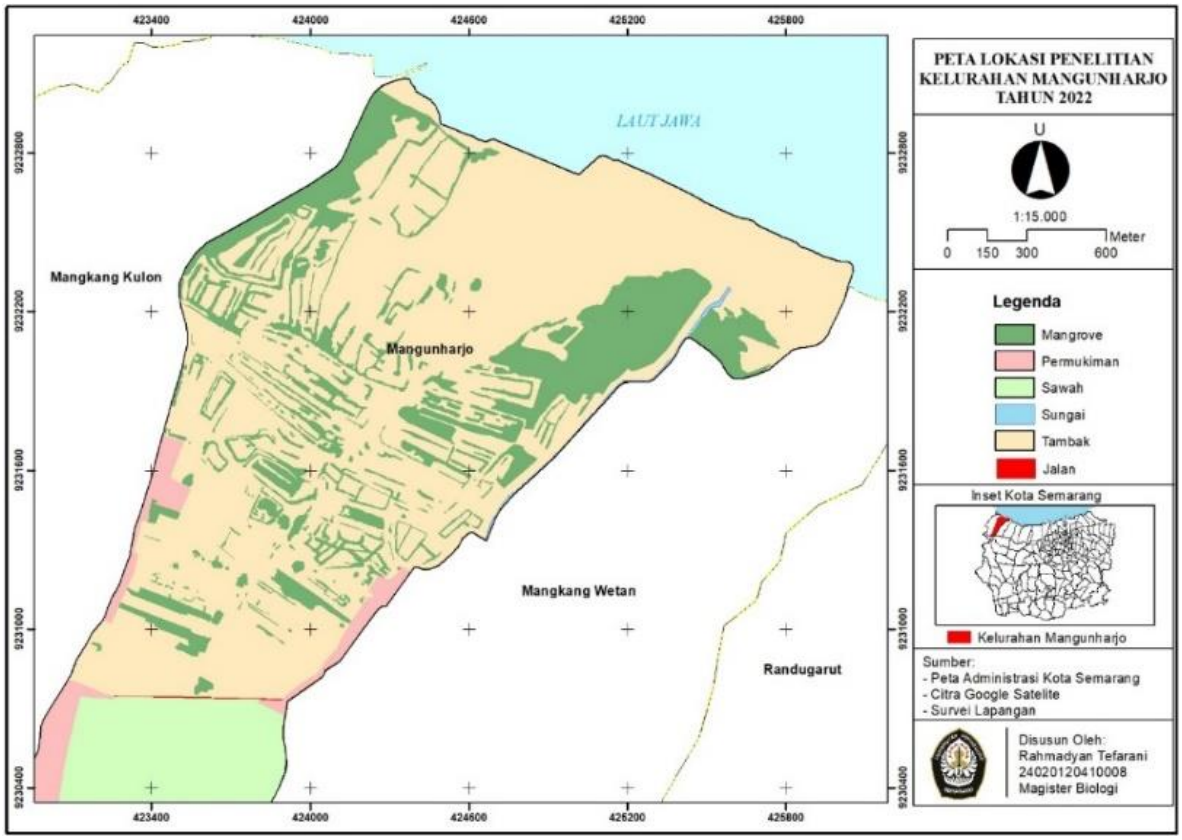

Figure 1. Study area at Mangunharjo Village, Tugu District, Semarang City

Methods

Preliminary Observations

This initial observation phase was carried out in August 2022 in the mangrove area of Mangunharjo Village by conducting a field survey to identify and see firsthand the condition mangrove ecosystem at the research site.

Station Determination

Sampling was carried out at three stations, namely station I in the area close to the beach, station II in the area close to estuaries and rivers and station III in the area close to the mainland.

1) Mangrove thickness calculations were carried out at 3 station points by analyzing Google Earth satellite imagery via arcGIS app.

2) Data collection of mangrove density and type at each observation station there are 10 plots. Mangrove data collection is determined at a location that represents each zone of mangrove area contained in the research site (purposive sampling). Mangrove data were taken from each transect using the quadratic transect method drawn perpendicularly to the coastline. Sample plots of tree category measuring 10 x 10 m with trunk diameter ≥ 10 cm at a height of ≥ 1.5 m, sampling category measuring 5 x 5 m^2 (tree diameter < 10, height > 1.5 m), seedling category measuring 2 x 2 m2 (plant height < 1.5 cm). It then calculated the number of individuals for each species at each mangrove life stage.
3) Biota object data is obtained by making field observations at each observation point. Biota encountered directly and indications of their presence at observation points are observed and recorded. Interviews and literature studies related to biota in the research area were also conducted as a reference for the completeness of the data.
4) Tidal measurements are obtained through literature studies. The data used is the data that best represents the state of the location.

Data Analysis

Data analysis was carried out to calculate the density of mangrove species and the suitability index of mangrove tourism using the following formulas.

The density of mangrove species was calculated using the formula (Masiyah & Sunarni, 2015)

$$Di = \frac{ni}{A} \quad (1)$$

The suitability index of mangrove tourism was calculated using the formula (Yulianda, 2007)

$$IKW = \sum[\frac{Ni}{Nmaks}]\ x\ 100\% \quad (2)$$

RESULT AND DISCUSSION

Mangrove thickness

Measurement of mangrove thickness of the study location using Google Earth imagery perpendicular to the land boundary to the sea boundary. Based on mangrove thickness measurements ranging from 300.90 m – 567.58 m (Fig 2). Based on mangrove thickness measurements, it is known that, the categories at Stations I, II and III are suitable for tourist activities because they are more than 300 m. The thickness of mangroves is very important, especially for mangrove tracking activities and the carrying capacity of areas that can accommodate visitors. The function of mangrove thickness is a breakwater (Rodiana et al., 2019).

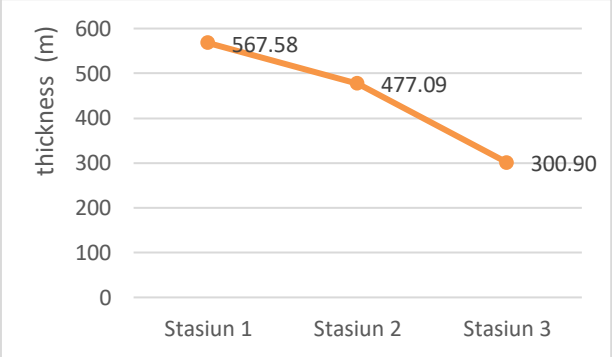

Figure 2. Mangrove thickness Mangunharjo Village, Tugu District, Semarang City

Mangrove density

Based on the calculation of the density value of mangroves in the tree category in Mangunharjo Village (**Table 1**) shows that at Station 1 the species of *A. marina* and *R. mucronata* are most commonly found with density values of 1210 ind/ha and 880 ind/ha, respectively. At stations 2 and 3 *A. marina* species were also found the most with density values of 650 ind/ha and 670 ind/ha respectively. The dominance is caused because people prefer to plant mangroves from *R. mucronata* and *A. marina* species, because the two species are able to adapt in the environment and the fast and easy breeding process makes the two species grow more in the Mangunharjo area. Dominance of *Avicennia sp.* and *Rhizophora sp*. at the observation station indicates that there is a suitability of Mangunharjo mangrove habitat.

Table 1. Density, Frequency and Dominance in the Tree Phase in the Mangunharjo Mangrove Ecosystem

Species	STATION 1						
	D	**K**	**F**	**DR %**	**KR %**	**FR %**	**INP %**
A. alba	1026.75	860	0.7	24.34	23.56	20.59	68.49
A. marina	1402.87	1210	1	33.25	33.15	29.41	95.82
R. apiculata	704.46	600	0.6	16.70	16.44	17.65	50.78
B. gymnorrhiza	1.3	33.33	0.1	0.03	0.91	2.94	3.89
R. stylosa	2.1	66.66	0.2	0.05	1.83	5.88	7.76
R. mucronata	1081.21	880	0.8	25.63	24.11	23.53	73.27
Amount	**4218.687**	**3649.99**	**3.4**	**100**	**100**	**100**	**300**
Species	**STATION 2**						
	D	**K**	**F**	**DR %**	**KR %**	**FR %**	**INP %**
A. alba	638.54	540	0.5	31.29	28.47	17.92	77.68
A. marina	753.82	650	0.8	36.94	34.27	28.67	99.88
R. mucronata	640.76	540	0.5	31.40	28.47	17.92	77.79
A. officinalis	6.03	33.33	0.33	0.30	1.76	11.83	13.88
X.moluccensis	1.51	133.33	0.66	0.07	7.03	23.66	30.76
Amount	**2040.66**	**1896.66**	**2.79**	**100**	**100**	**100**	**300**
Species	**STASIUN 3**						
	D	**K**	**F**	**DR %**	**KR %**	**FR %**	**INP %**
A. marina	768.79	670	0.6	90.75	90.54	66.67	247.96
R. mucronata	78.34	70	0.3	9.25	9.46	33.33	52.04
Jumlah	**847.1338**	**740**	**0.9**	**100**	**100**	**100**	**300**

Mangrove diversity

Based on the identification results, there were 8 species of mangrove plants found at the research station. Of the 8 species found, only Avicennia alba, Avicennia marina and R. mucronata were found at all research stations. According to Siahaan et al., (2020), the small number of mangrove species is due to the large anthropogenic influence that changes mangrove habitat for other purposes such as land clearing for aquaculture and settlement. Tari and Siregar (2020) added, low diversity indicates that the ecosystem is experiencing pressure or environmental conditions have decreased. The decline in diversity growth is due to environmental pressures that are always changing, as well as the influence of human activities that are in line with the development of development so that there is no harmony in maintaining and preserving green areas, especially coastal areas.

Table 2. Composition of Mangrove Types in Mangunharjo Area

No.	Species of mangrove	Research location		
		Station 1	Station 2	Station 3
1	*Avicennia alba*	+	+	+
2	*Avicennia marina*	+	+	+
7	*Avicennia officinalis*	-	+	-
5	*Bruguiera gymnorrhiza*	+	-	-
6	*Rhizophora stylosa*	+	-	-
3	*Rhizopora apiculata*	+	-	-
4	*Rhizopora mucronata*	+	+	+
8	*Xylocarpus moluccensis*	-	+	-

Biota Association

Biota found in mangrove forests is a unique combination of marine and terrestrial biota. Based on biota found such as fish, birds, reptiles, crab mollusks, and mammals (Table 3), it is included in the good category because these types of biota are typical fauna with mangrove habitats (Samsi et al., 2018). The diversity of biota is the main attraction in the development of ecotourism at the research site. According to Yulianda (2019), the potential of aquatic biota species that have tourist attractions is included in aquatic ecotourism commodity objects. The use of environmental services with the concept of ecotourism is the right effort to maintain the sustainability of these resources.

Table 3. Biota Association of Mangunharjo Village Mangrove Area.

No	Biota	∑ Family	Family of biota association
1	Mammals	3	Mustelidae, Macroglossus, Herpestidae
2	Aves	8	Acanthizidae, Apodidae, Ardeidae, Cisticolidae, Estrildidae, Ploceidae, Phalacrocoracidae, Pycnonotidae.
3	Reptile	4	Ranidae, Bufonidae, Pythonidae, Agamidae, Homalopsidae
4	Pisces	15	Ariidae, Belonidae, Carangidae, Chirocentridae, Cynoglossidae, Engraulidae, Gerreidae, Haemulidae, Lutjanidae, Mugilidae, Scatopagidae, Sciaenidae, Siganidae, Serranidae. Hemiramphidae.
5	Mollusca	6	Ellobiidae, Potamididae, Ampullaridae, Assiminidae, Littorinidae, Thiaridae

Tides

Activities suitable for traveling in coastal areas when not in full tide conditions. Spring tides occur when the Earth, Moon and Sun are in a straight line (Sun and Moon in opposition). At that time, very high tides and very low low tides will be generated, because the combination of attraction from the sun and moon works to reinforce each other. This full tide occurs twice every month, namely during the new moon and full moon. Precisely occurs on the 1st of the new moon and on the 14th of the full moon.

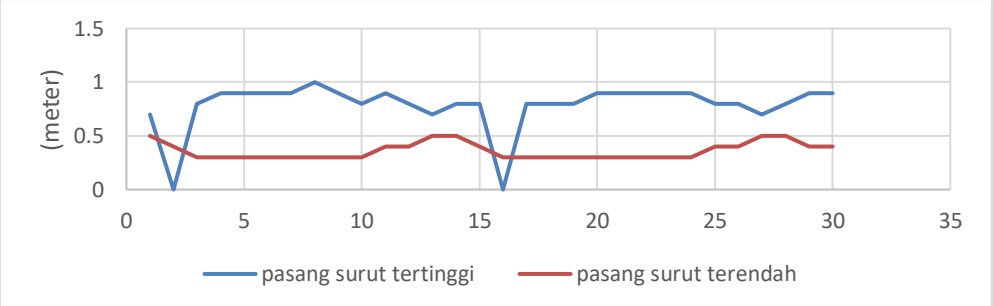

Figure 3. Tides of Mangunharjo Village

Suitability index of mangrove tourism

The result of the suitability of mangrove ecotourism is almost most of the mangrove ecosystem expanse of Mangunharjo Village is classified as very suitable for ecotourism development. The IKW value at station 1 is 96.05%; at station 2 78.94% is included in the category of very suitable for ecotourism development and the IKW value at station 3 of 68.42% is included in the appropriate category (Table 4). According to Nugroho (2019) in his research, the IKW category value is very appropriate because the condition of the vast and dense mangrove ecosystem supported by the presence of beautiful animals and landscapes also adds to the attractiveness of ecotourism. The condition of mangroves is very unique with the potential of natural resources in the form of landscapes, flora, fauna and socio-economic activities can be used as objects and attractions of ecotourism.

Table 4. Percentage of Land Suitability for Mangunharjo Mangrove Ecotourism

No	Parameter	Bobot	Observation Station					
			1		2		3	
			Score	Value	Score	Value	Score	Value
1	Mangrove Thickness	5	4	20	3	15	3	15
2	Mangrove Density	4	4	16	3	12	2	8
3	Mangrove Diversity	4	4	16	3	12	2	8
4	Tides	3	3	9	3	9	3	9
5	Biota	3	4	12	4	12	4	12
	Amount			73		60		52
	Suitabilty (%)			96.05		78.94		68.42
	Category			S1		S1		S2

Based on the results of the assessment at the three locations of research stations, mangrove areas in the Mangunharjo area are eligible to be used as mangrove ecotourism because the calculated parameters have met the requirements and are suitable to be developed as ecotourism attraction objects. The existence of biota objects such as fish diversity that makes the Mangunharjo mangrove area a tourist attraction for fishing activities. Based on observations at the research site, this is supported by local residents who provide boat rental services for fishing or tracking activities. Mangrove conservation through mangrove planting that has been carried out by several parties both from academics and non-academics is no less interesting for visitors at the research site. Community participation in the preservation of mangrove areas in a conservative effort by replanting was recommended by respondents as much as 75.59%.

Reinforced by the statement of Hamzah et al. (2017)that coastal communities also bear a great responsibility because their daily activities and livelihoods are very dependent on existing resource services and the impact of their activities on marine and coastal resources is very high. Ecotourism development will have an impact on the economy of the surrounding community. This is reinforced by economic valuation research conducted by Sari et al. (2021), the economic value of mangrove tourism is included in the high category. Community knowledge and understanding of the economic value of mangrove tourism is needed, so that they can participate. Abib and Appadoo (2021) added that campaigns and education are needed to increase awareness of mangrove ecosystem protection. Rianto et al. (2021)stated that tourism with the concept of ecotourism with a community-based ecotourism model can contribute or positive benefits to community empowerment and can be used as a vehicle or tool to empower

the community, especially for local communities who are economically marginalized or inadequate.

CONCLUSION

Based on the results of the assessment at the three locations of research stations, mangrove areas in the Mangunharjo area are eligible to be used as mangrove ecotourism because the calculated parameters have met the requirements and are suitable to be developed as ecotourism attraction objects. Thus, the suitability of the coastal tourism area of Mangunharjo, Tugu District, Semarang City for the development of marine ecotourism areas in the mangrove category for the three stations in the category is very suitable to be appropriate (68.42 - 96.05%).

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