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# Mangrove Health Index in Martajasah Mangrove Ecotourism, Bangkalan Regency, East Java, Indonesia

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**Abstract:** Mangrove areas need to be considered from the condition of distribution and density of mangrove forests for future mangrove forest management planning, especially on Madura Island, especially Martajasah mangrove ecotourism. The purpose of this study is to determine the type of mangrove, canopy cover, and mangrove health index. The method used in this study is observation, which is to know the general overview of the research to be carried out. The selection of the research location was determined by the stratified random sampling method. The canopy cover on the mangrove was measured using the Hemispherical Photography method using the front camera of the OPPO Reno 6 phone with a camera resolution of 8 megapixels with a 180° angle of view at the point of taking the photo. The results of this study found 7 types of mangroves, including Sonneratia alba, Sonneratia caseolaris, Rhizophora apiculata, Rhizophora mucronata, Avicennia alba, Avicennia marina, and Lumnitzera racemosa. The percentage of canopy cover obtained an average score of 63.44% or in the solid category. This indicates that the mangrove ecosystem found in Martajasah mangrove ecotourism is in a good category. The Mangrove Health Index in Martajasah Mangrove Ecotourism is included in normal (33-66%).

**Keywords:** *canopy cover; ecosystem; mangrove; mangrove health index; Martajasah*

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## Introduction

Indonesia has the largest mangrove ecosystem in the world with around 23% of the total number of mangroves in the world. The area of mangroves in Indonesia amounted to 5,209,543.16 ha in 2010 but decreased forest area to 3,361,216 ha in 2019. This value shows that the country of Indonesia has experienced a significant decline in mangrove ecosystems. Based on Murdiyarso et al. (2015), the threat of the highest rate of degradation of mangrove ecosystems reaches 52,000 ha/year. Threats to mangrove ecosystems are caused by land use transfer, waste pollution, illegal logging, overexploitation, and increased abrasion with a speed value of 1,950 hectares per year (Cahyaningsih et al., 2022).

A mangrove forest is a community of tropical coastal vegetation dominated by several types of mangrove plants that can adapt to tidal areas. Mangroves as brackish forests or mangroves are plants that grow in brackish areas on alluvial soils in estuary areas around river mouths. Mangrove ecosystems have an important role, namely as a habitat where they live, shelter, spawn and find food that supports the growth of marine life (Yanto et al., 2016). Mangrove ecosystems have high productivity compared to other ecosystems and become a very important ecological link for living things. The health and environmental quality of mangroves are needed to know whether mangroves have a good status or not, as well as analyze the environmental impact of surrounding activities.

Optimization of mangrove ecosystem functions in an area is highly dependent on the health conditions of mangrove communities. Healthy mangroves can have a good impact on the surrounding environment. Studies on the health of mangrove ecosystems have been developed in Indonesia and have been implemented in the CTI COREMAP Program with a hemispheric photo approach and supported by community data in 30 Indonesian mangrove locations (Nurdiansah & Dharmawan, 2018). Anthropogenic interventions will be detectable from canopy cover in the community.

The Martajasah area is a religious tourist spot, namely the Syaichona Moch Cholil Bangkalan Mosque. In addition, there is also Martajasah mangrove ecotourism which has a mangrove forest area of about 14.6 Ha. This study aims to analyze the mangrove health index (Mangrove Health Index) in mangrove ecotourism Martajasah Kabupaten Bangkalan. Martajesah mangrove ecotourism, Bangkalan Regency is a case study location in this study because it is an area that has religious tourist attractions, so it is necessary to know the health condition of the mangrove community to become a tourist attraction.

## Research Methods

This research was conducted on the ecotourism of Martajasah Mangrove, Bangkalan Regency, East Java, Indonesia. The study was conducted for 3 weeks from October 12 to October 29. The sampling location is divided into 10 stations. The station consists of 3 plots or 3 points. The method carried out in this study is observation, which is knowing the general information of the research to be carried out.

### *Data Retrieval Methods*

The determination of the research location was determined by the stratified random sampling method. This method is applied by determining random observation plots based on mangrove growth or mangrove zoning (Pietersz et al., 2022). This method was chosen because it has advantages such as less time, effort, and costs spent with the coverage of areas that have represented the condition of mangrove canopy cover in Martajasah Village (Purnama et al., 2020). The determination of the research station point is carried out by direct observation in the field during the preliminary survey (ground check). Based on the

results of the preliminary survey, the research station was determined based on the dominance of certain species that could represent the mangrove ecosystem in Martajasah Village. Canopy cover on mangroves was measured using the Hemispherical Photography method using the front camera of OPPO Reno 6 Mobile Phone with a camera resolution of 8 megapixels with a 180° viewing angle at a photo-taking point.

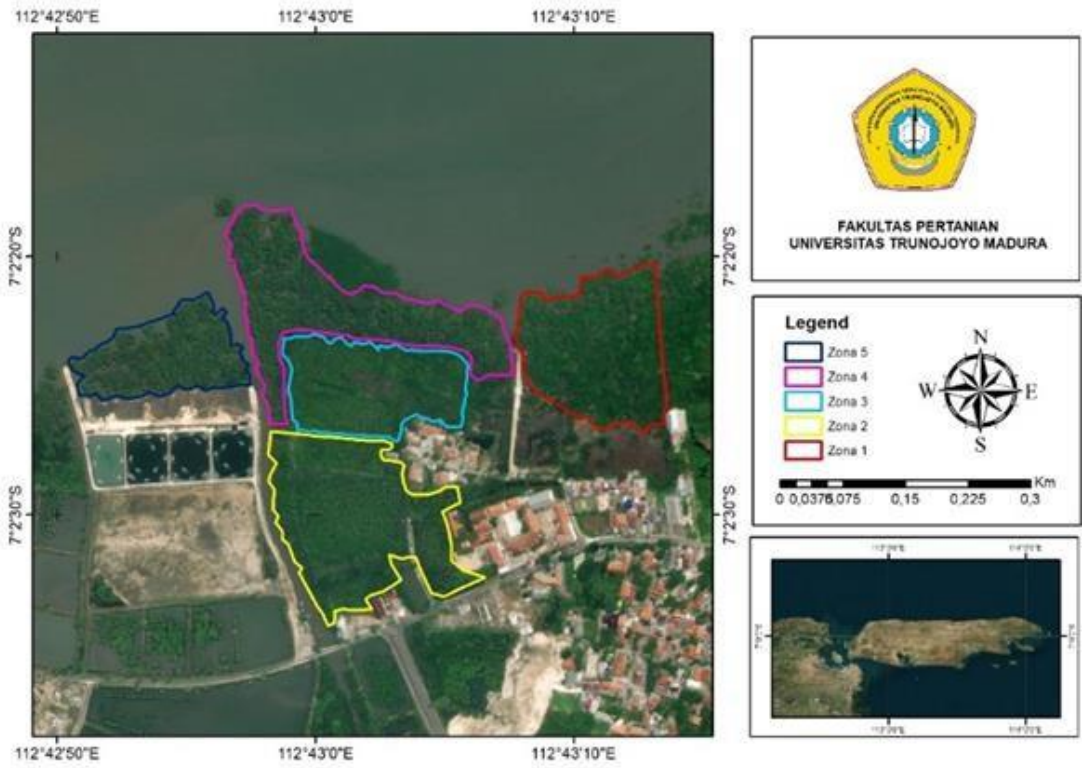



**Figure 1. Map of The Research Site**

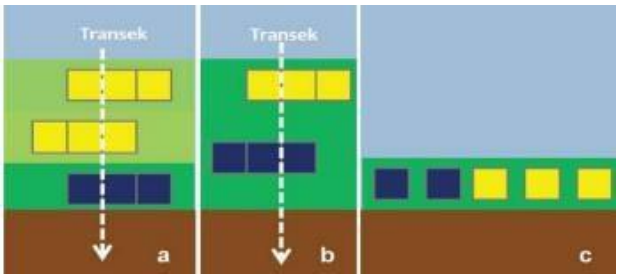



**Figure 2. Illustration of Permanent Plot Determination (Yellow and Blue Boxes) for Mangrove Community Monitoring. Description: a) Mangroves with Three Different Stratification/Zones; b) Mangrove Vegetation with Clear Stratification and or without Clear Stratification; and c) Mangrove Vegetation with a Thickness of 50-100 meters. The Yellow Plot is the Minimum Number of Plots that must be Created. Dark Blue Plots as Additional Plots, if there is still Time and Energy Available.**

### *Field Data Retrieval*

According to Wayan et al. (2014) field data collection is carried out using several stages, namely:

1. In each plot, 10x10 m2 was measured the diameter of the mangrove tree trunk (diameter > 4 cm or trunk circumference > 16 cm) (Ashton & McIntosh, 2002) using a meter on variations in the location of measurements based on English and Decree of the Minister of Environment of the Republic of Indonesia No. 201 of 2004 concerning Standard Criteria and Guidelines for Determining Mangrove Damage in Wayan et al. (2014) shown in Figure 3.
2. Measurements were made on all trees located on each plot.
3. Type identification is carried out based on reference (Noor et al., 2007),
4. If there is doubt in the identification of the case, it is necessary to photograph the plant parts, namely roots, stems, leaves, flowering, and fruit and take samples for further identification in the laboratory with the help of literature or with the help of mangrove identification experts.
5. Each data obtained is recorded in a data sheet that has been prepared on waterproof paper. Recording of measurement data is carried out based on the datasheet made.
6. The calculation of the percentage of canopy cover can be known using the Excel application.

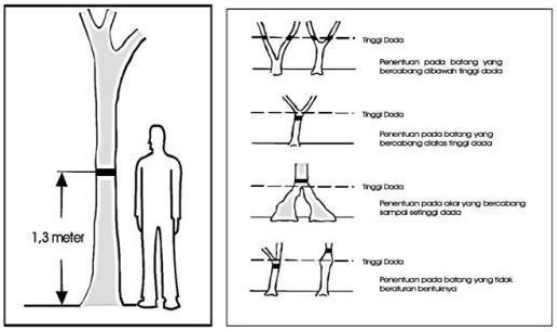



**Figure 3. The Position of Measuring the Circumference of Mangrove Tree Trunks in Several Types of Trunks, which are Influenced by Root and Branching Systems (Decree of the Minister of Environment of the Republic of Indonesia No. 201 of 2004 concerning Standard Criteria and Guidelines for Determining Mangrove Damage).**

### *Canopy Cover Data Capture*

Canopy cover on mangroves was measured using the Hemispherical Photography method using the front camera of OPPO Reno 6 Mobile Phone with a camera resolution of 8 megapixels with a 180° viewing angle at a photo-taking point. Technical implementation is as follows (Purnama et al., 2020).

1. Each 10x10 m2 point is divided into four small dots (quadrants) measuring 5x5 m3
2. The point at which the photo is taken, placed between small dots, should be between one tree and another. And avoid shooting right next to the trunk of one tree.
3. For Each zoning, at least 12 points are taken, where every 10 x 10 m2 point is taken 4 shooting points (Figure 5).

4. The position of the camera is aligned with the height of the researcher's chest / the photo-taking team and perpendicular / facing straight to the sky.
5. Record the photo number on the datasheet form to simplify and speed up the data analysis process.
6. Avoid double shooting at each point to prevent confusion in data analysis.

**Figure 4. Illustration of Hemispherical Photography Method for Measuring Mangrove Cover**

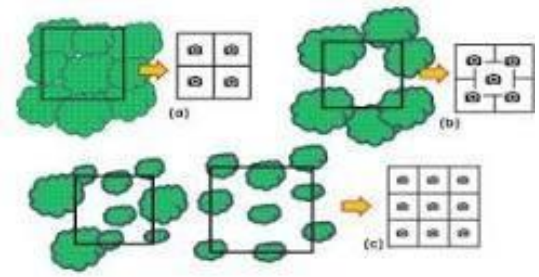


**Figure 5. Points and Number of Photos Based on Mangrove Forest Conditions**

### *Important Value Index (INP)*

INP calculations show that species predominate at the study site. The index of importance values (INP) is the result of the sum of the relative density values of the type (RDi), the relative frequency value of the type (RFi), and the relative closing value of the type (RCi).

Type frequency (F) is the chance of finding the i-th type in the plot created. The formula used for this analysis is as follows (Badan Standardisasi Nasional, 2011)

$$\text{Frequency} = \frac{\sum \textit{Number of filled tiles of a type}}{\text{Number of all tiles}} \quad (1)$$

The relative frequency of the type (FR) is the ratio between the frequency of the type to – i (Fi) and the number of frequencies for all types (∑F). The formula used for this analysis is as follows (Badan Standardisasi Nasional, 2011).

$$\textit{Relative Frequency} = \frac{\text{Frequency of a breed}}{\text{Frequency of all types}} \times 100\% \quad (2)$$

Specific density (K) is the number of stands of the i-th type in a unit area. The formula used to determine the density of mangrove species is as follows (Badan Standardisasi Nasional, 2011).

$$\text{Density (trunk/ha)} = \frac{\sum \text{Number of individuals of a breed}}{\text{Area of the entire plot}} \quad (3)$$

Relative Density (KR) is the ratio between the number of stands of the i-th type (Ni) and the total number of stands of all types (∑n). The formula used for this analysis is as follows (Badan Standardisasi Nasional, 2011).

$$\text{Relative Density} = \frac{\text{The density of a type}}{\sum \text{Density of all types}} \times 100\% \quad (4)$$

Dominance (D) is the area of closure of the type to – i in a unit area. The formula used for this analysis is as follows (Badan Standardisasi Nasional, 2011).

$$\text{Dominance } (m^2/ha) = \frac{\text{Area of the base plane area of a type } (\frac{1}{4}\pi d^2)}{\text{Area of the entire plot}} \quad (5)$$

Relative Dominance (DR) is the ratio between the dominance of a type and the amount of dominance for all types (∑D). The formula used for this analysis is as follows (Badan Standardisasi Nasional, 2011).

$$\text{Relative Dominance} = \frac{\sum \text{Dominance of a breed}}{\sum \text{Dominance of the whole breed}} \times 100\% \quad (6)$$

The Important Value Index (INP) is the sum of relative density (KR), relative frequency (FR), and relative dominance (DR) values. The formula used for this analysis is as follows (Badan Standardisasi Nasional, 2011).

$$INP = KR + FR + DR \quad (7)$$

The importance value of a breed ranges from 0% - 300%. This important value illustrates the influence or role of a type of mangrove plant in the mangrove community.

### *Canopy Cover Percentage*

The stages of Canopy Cover Percentage analysis are as follows (Dharmawan et al., 2020) :

1. Show ImageJ on Windows 7 64-bit programs.
2. In ImageJ software. Open the image/photo from the shooting on location
3. Convert photos to 8-bit.
4. Separating sky and mangrove cover with adjusted thresholds.
5. Significant separation of sky pixel digital values and mangrove cover.
6. Counting the number of pixels valued at 255 as an interpretation of mangrove cover.

7. The percentage of mangrove cover is a comparison of the number of pixels valued at 255 (mangrove cover) with the total number of pixels.

Mangroves are analyzed for quality according to the Decree of the State Minister of Environment Number: 201 of 2004, the standard criteria for mangrove damage are determined based on mangrove density. the percentage of canopy cover is calculated using the formula (Hendrawan et al., 2018):

$$\% \, Mangrove \, Cover = P225/ \Sigma P \, x \, 100\% \quad (8)$$

Information:
P255: Number of pixels valued at 255
ΣP : the sum of all pixels.

**Table 1. Standard Criteria for Mangrove Damage**

| Criterion | | Covering (%) | Density (tree/Ha) |
|---|---|---|---|
| Good | Very Dense | >70 | ≥1500 |
| | Dense | >50-<70 | ≥1000 - < 1500 |
| Broken | Low Dense | >50 | <1000 |

*Source: Cahyaningsih et al., 2022*

### *Mangrove Health Index*

Here's the formula for calculating mangrove health:

$$\textbf{MHI}\ (\%) = [(\boldsymbol{Sc} + \boldsymbol{SD} + \boldsymbol{SNsp})\ /3]^{*}10 \quad (9)$$

Information:
MHI: Mangrove health index
Sc: Canopy cover Percentage Score (%)
SD: Trunk diameter score (sapling + tree) (cm)
Nsp: Number of piles per area

**Table 2. Standard Criteria for Mangrove Health Index**

| Health | Category |
|---|---|
| <33.33% | Poor |
| 33.33-66.67% | Moderate |
| >66.67% | Excellent |

## Results And Discussions

### *Types of Mangroves in Martajasah Mangrove Ecotourism*

Based on the identification of mangroves found in the research location there are 7 types found in Martajasah Mangrove Ecotourism including, Sonneratia alba, Sonneratia caseolaris, Rhizophora apiculata, Rhizophora mucronata, Avicennia alba, Avicennia marina, and Lumnitzera racemosa. According to Tidore et al. (2021) stated that the growth of mangrove vegetation ecosystems generally follows a zoning pattern closely related to environmental factors such as substrate type (mud, sand, or peat), openness to wave blows, salinity, and tidal influences.

Mangroves are the main carrying capacity to support life activities in coastal areas play an important role in maintaining the balance of biological cycles in their environment and have high economic value (Ramadhan et al., 2022). Mangroves found in Martajasah ecotourism with data collection are divided into three plots in one station with an area of 10x10m per plot. At station 1 there are 21 trees, 37 stakes, and 67 seedlings. Station 2 has 14 trees, 18 saplings, and 71 seedlings. Station 3 has 17 trees, 33 saplings, and 71 seedlings. Station 4 has 24 trees, 36 stakes, and 152 seedlings. Station 5 has 23 trees, 34 stakes, and 112 seedlings. Station 6 has 32 trees, 35 stakes, and 28 seedlings. Station 7 has 25 trees and 9 stakes. Station 8 has 19 trees, 12 stakes, and 18 seedlings. Station 9 has 12 trees, 15 saplings, and 7 seedlings. Station 10 has 16 trees and 10 stakes. The types of mangroves found are Sonneratia alba, Sonneratia caseolaris, Rhizophora apiculata, Rhizophora mucronata, Avicennia alba, Avicennia marina, Lumnitzera racemosa.

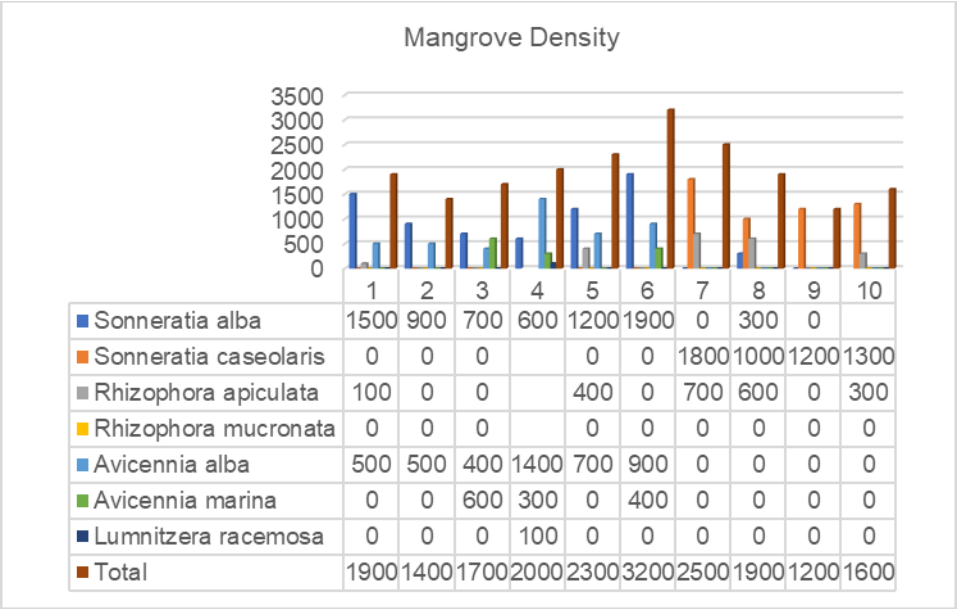
The types of mangroves in Martajasah ecotourism at each station experience differences or different types. According to Poedjirahajoe et al. (2011) factors have a significant effect on the composition of mangrove ecosystems. Even complex changes in habitat quality can result in shifts in the types of vegetation that make it up. In addition, because of human activities where the existence of mangrove forests are used as a place of settlement, aquaculture, tourist attractions, and excessive tree cutting to be used for personal interests. Likewise, in Martajasah ecotourism, there are still many around it used as residential areas, tourist facilities, and aquaculture, this is due to the division of land ownership.

### *Mangrove Type Density*

Based on the density graph, the highest total density value at station 6 with a value of 3200 ind/ha shows that the condition of mangroves is very dense. The lowest total density value is at station 9 with a value of 1200 ind/ha but the condition of mangroves is still in the solid category. Mangrove density is obtained in data processing which refers to the decree of the Minister of Environment no.201 of 2004 concerning Criteria for Mangrove damage. Each station obtained a value that was included in the very dense category with a density value of ≥1500. According to found at each station and the low density due to the lack of trees and the distance between trees from one another is relatively tenuous caused by the incompatibility of the type of substrate with the type of mangrove, the closure of mangroves by plastic waste carried by tidal flows so that mangrove growth is not good.

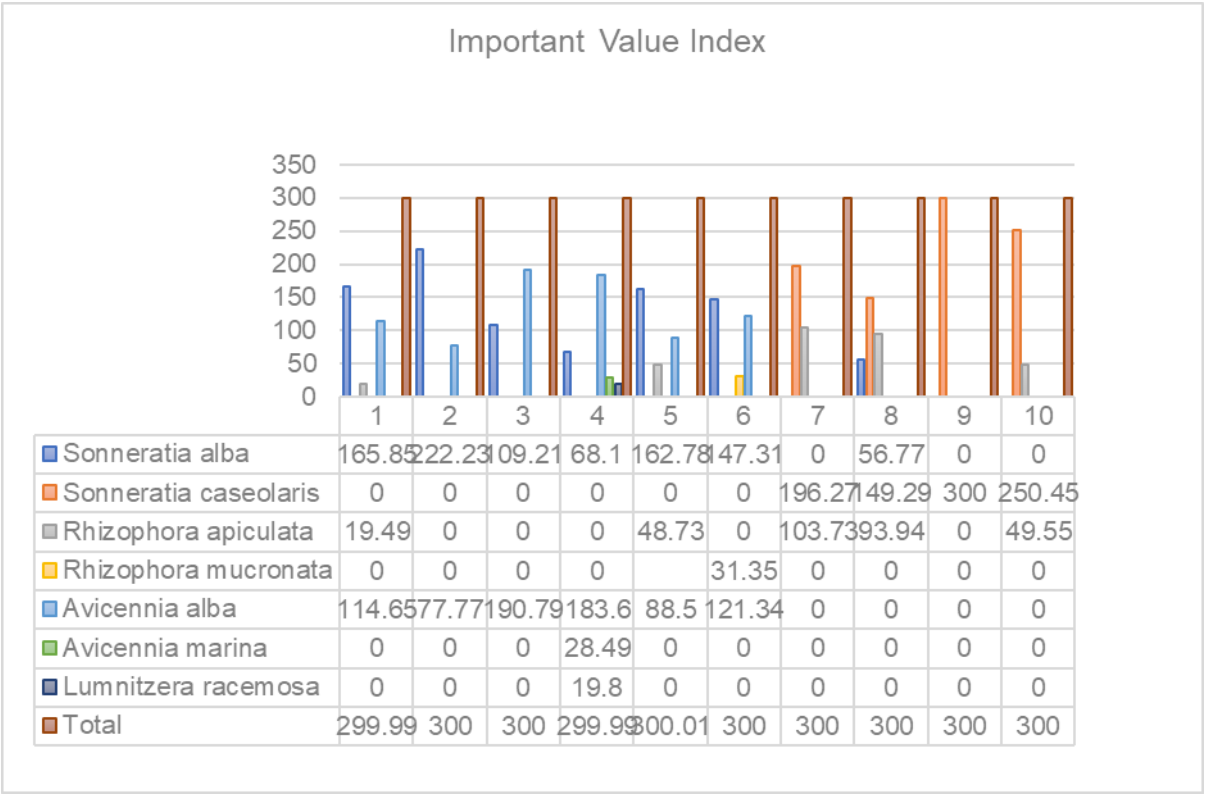
### *Important Value Index*

The type of mangrove that is often found at each station is the type of Sonneratia alba, this is because this area has a fairly good carrying capacity for the growth and development of mangroves such as muddy soil substrate conditions and is influenced by tides (Siregar et al., 2022). According to Agustini et al. (2016) species that have a high importance value index mean that the type is more dominant in a plant community. Furthermore, Rosalina & Rombe (2021) added that species that have a high INP mean that they have a greater cumulative value of mastery in mastering their habitat. Types that have a high INP will be superior in utilizing resources or more able to adapt to the environment.




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sonneratia alba | 1500 | 900 | 700 | 600 | 1200 | 1900 | 0 | 300 | 0 | |
| Sonneratia caseolaris | 0 | 0 | 0 | | 0 | 0 | 1800 | 1000 | 1200 | 1300 |
| Rhizophora apiculata | 100 | 0 | 0 | | 400 | 0 | 700 | 600 | 0 | 300 |
| Rhizophora mucronata | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Avicennia alba | 500 | 500 | 400 | 1400 | 700 | 900 | 0 | 0 | 0 | 0 |
| Avicennia marina | 0 | 0 | 600 | 300 | 0 | 400 | 0 | 0 | 0 | 0 |
| Lumnitzera racemosa | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 1900 | 1400 | 1700 | 2000 | 2300 | 3200 | 2500 | 1900 | 1200 | 1600 |

**Figure 6. Mangrove Density Graph**




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sonneratia alba | 165.85 | 222.23 | 109.21 | 68.1 | 162.78 | 47.31 | 0 | 56.77 | 0 | 0 |
| Sonneratia caseolaris | 0 | 0 | 0 | 0 | 0 | 0 | 196.27 | 149.29 | 300 | 250.45 |
| Rhizophora apiculata | 19.49 | 0 | 0 | 0 | 48.73 | 0 | 103.73 | 93.94 | 0 | 49.55 |
| Rhizophora mucronata | 0 | 0 | 0 | 0 | | 31.35 | 0 | 0 | 0 | 0 |
| Avicennia alba | 114.65 | 77.77 | 190.79 | 183.6 | 88.5 | 121.34 | 0 | 0 | 0 | 0 |
| Avicennia marina | 0 | 0 | 0 | 28.49 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lumnitzera racemosa | 0 | 0 | 0 | 19.8 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 299.99 | 300 | 300 | 299.99 | 300.01 | 300 | 300 | 300 | 300 | 300 |

**Figure 7. Important Value Index (INP)**

### *Percentage of Canopy Cover*

**Table 3. Canopy Cover Percentage**

| No | Station | Cover | Category | Average % |
|---|---|---|---|---|
| 1 | BR1 | 71,60± 0,70 | Very Dense | |
| 2 | BR2 | 67,76±2,58 | Dense | |
| 3 | BR3 | 50,04±7,46 | Dense | |
| 4 | BR4 | 68,16±3,69 | Dense | |
| 5 | BR5 | 67,06±1,77 | Dense | 63,44% |
| 6 | BR6 | 71,68±0,58 | Very Dense | |
| 7 | BR7 | 59,60±6,98 | Dense | |
| 8 | BR8 | 64,43±6,75 | Dense | |
| 9 | BR9 | 57,67±4,03 | Dense | |
| 10 | BR10 | 56,43±5,69 | Dense | |

Based on the table above, it can be seen that the canopy cover category at each station with the category is very dense and dense. The canopy cover produced at the station ranged from 71.68±0.58% to 50.04±7.46%. Canopy cover is obtained in data processing which refers to the decree of the Minister of Environment no.201 of 2004 concerning Criteria for Mangrove damage. Each station obtained a value that was included in the solid category with a value of ≥ 75% at each station. Research conducted by Mauludin et al. (2018), getting value the percentage of overall mangrove cover in the Ujung Piring area ranges from 58.15 ± 7.75% - 80.41 ± 4.25%, this is due to this allegedly because the location has a mud substrate and contains very high organic matter which makes this location good for mangrove growth and is dominated by mangrove species Rhizophora apiculata, Ceriops Tagal and Sonneratia alba. The percentage of canopy cover in Martajasah mangrove ecotourism has similarities based on the results and types of mangroves obtained and factors that cause the cover value to reach 71.68±0.58% due to substrates that are suitable for mangrove growth. The type of mangrove that dominates in martajasah ecotourism is Sonneratia alba. According to Purnama et al., (2020) stated that the high and low percent of mangrove cover will affect the survival of mangrove saplings and seedlings, this is because it blocks sunlight that should be obtained by saplings and seedlings for the photosynthesis process. Kuncahyo et al. (2020) added that the environment such as damage by ocean waves, lighting levels, and predation can affect the formation of mangrove canopy cover.

### *Mangrove Health Index (MHI)*

**Table 4. Mangrove Health Index**

| Station | Plot | Value | Average % | Category |
|---|---|---|---|---|
| 1 | 1 | 54,735 | | |
| | 2 | 56,707 | 54,227 | Moderate |
| | 3 | 54,393 | | |
| 2 | 1 | 47,659 | | |
| | 2 | 53,913 | 52,207 | Moderate |
| | 3 | 54,133 | | |
| 3 | 1 | 12,741 | | |
| | 2 | 25,779 | 27,038 | Poor |
| | 3 | 35,091 | | |
| 4 | 1 | 34,177 | | |
| | 2 | 37,960 | 36,895 | Moderate |
| | 3 | 38,265 | | |
| 5 | 1 | 39,875 | | |

| | | | | |
|---|---|---|---|---|
| | 2 | 44,945 | 43,427 | Moderate |
| | 3 | 47,585 | | |
| 6 | 1 | 38,622 | | |
| | 2 | 39,390 | 39,703 | Moderate |
| | 3 | 40,680 | | |
| 7 | 1 | 53,600 | | |
| | 2 | 43,967 | 49,526 | Moderate |
| | 3 | 40,516 | | |
| 8 | 1 | 49,290 | | |
| | 2 | 60,910 | 52,270 | Moderate |
| | 3 | 52,610 | | |
| 9 | 1 | 47,159 | | |
| | 2 | 45,977 | 44,309 | Moderate |
| | 3 | 38,866 | | |
| 10 | 1 | 51,530 | | |
| | 2 | 44,400 | 48,177 | Moderate |
| | 3 | 50,589 | | |

In ecotourism, Martajasah mangroves are classified into MHI medium category (moderate) and different at station 3 classified as rare (poor). According to the absence of stake levels, there is no regeneration, while the high value of MHI is influenced by the constituent parameters of MHI found with a high amount, namely the percentage of canopy cover, diameter, and abundance of stakes. Added by Rizky et al. (2019) stated that the health level of mangroves is categorized as good if they are rarely exposed to strong waves and external disturbances, namely animals and humans.

MHI (Mangrove Health Index) analysis is a new approach used to determine the environmental condition and quality of mangrove forest ecosystems. In general, the MHI calculation was developed to assess the health of mangroves at the ecosystem level based on 3 main parameters of mangrove stand structure, namely trunk diameter, crown cover, and density. MHI values can be determined through data collection or using satellite images. Further findings show a strong correlation between these three parameters and vegetation indexes that can be known through satellite image analysis. So that the MHI value can be predicted from several vegetation index values. The results of this study have been able to map the spatial and temporal dynamics of mangrove forest conditions with the MHI approach and analyze the community structure of mangrove forests in the Martajasa Mangrove Ecotourism area. The results of this study can be used as one of the basis for policy-making for the conservation and rehabilitation of mangrove forest ecosystems in the Martajasa Mangrove Ecotourism area.

## Conclusion

The types of mangroves found in Martajasah Mangrove Ecotourism Village, Bangkalan District, Bangkalan Regency were found as many as 7 types, including Sonneratia alba, Sonneratia caseolaris, Rhizophora apiculata, Rhizophora mucronata, Avicennia alba, Avicennia marina, and Lumnitzera racemosa. Which was found at the study site. Based on the percentage of canopy cover, an average value of 63.44% or in the solid category is obtained, this shows that the mangrove ecosystem contained in the Martajasah mangrove ecotourism is in a good category.

Mangrove Health Index obtained an average value at station 1 of 54.227% or in the normal category, station 2 of 52.207% or in the normal category, station 3 of 27.038% or in the rare category, station 4 of 36.895% or in the normal category, station 5 of 43.427% or in the normal category, station 6 of 39.703 or in the normal category, Station 7 is 49,526 or in

the normal category, station 8 is 52,270 or in the normal category, station 9 is 44,309 or in the normal category, station 10 is 48,177 or in the normal category.

To achieve the mangrove health index into the excellent category in Martajasah Mangrove Ecotourism is to maintain environmental conditions in accordance with the requirements of mangrove growing places and have resistance to disturbances such as high waves or large waves that cause abrasion, uncontrolled sedimentation that causes accretion (sediment accumulation), garbage that causes pollution, and others. Mangrove habitat protection is aimed at maintaining and rebuilding environmental conditions to suit the requirements of mangrove growing places and avoid various forms of disturbances. The application of mangrove habitat protection is carried out through the creation and/or improvement of hydrological conditions with several activities, namely the manufacture of breakwaters, Plant Protection from Waste, and Sediment Trap Tools.

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