

## Canopy Density of Mangrove Distribution in Mangrove Center Graha Indah (MCGI) North Balikpapan District of Balikpapan City, East Kalimantan Province, Indonesia

Eddy Elminsyah Jaya<sup>1</sup>, Maryunani<sup>2</sup>, Amin Setyo Leksono<sup>3</sup>, Idiannor Mahyudin<sup>4</sup>

<sup>1</sup> Postgraduated Student of environmental and development studies Brawijaya University, Malang,, Indonesia

<sup>2</sup> Professor in Economics and Bussines, Brawijaya University, Malang, Indonesia

<sup>3</sup> Professor in Mathematic and Sciences, Brawijaya University, Malang, Indonesia

<sup>4</sup> Professor In Fisheries Economics, Lambung Mangkurat University, Banjarbaru, Indonesia

Corresponding Author : Eddy Elminsyah Jaya Email: eddyjaya@gmail.com

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**Abstract:** One of the mangrove forest in Indonesia is in the province of East Kalimantan, precisely in Graha Indah Village, North Balikpapan District, Balikpapan City so it is called Mangrove Center Graha Indah (MCGI) the which is a mangrove growing environment. This mangrove forest has a total area of about 150 hectares with one of the features it has is the location right on the edge of existence residential area and within 1 (one) kilometer from the center of Balikpapan city. Mangrove forests at this location is very potential as a protector with beautiful panoramic coastline that is ideal for the development of eco-tourism, fish farming waters and other benefits such as breeding fish for fishermen residing in coastal areas. Sustainable management of mangrove forest in Mangrove Center Graha Indah of Balikpapan City required a study on the strategy management policy based on the status of sustainability and sensitive indicators that influence it. In this regard, in the National Strategy Mangrove Ecosystem Management explained that the focus is on a mangrove management policy synergies in the main dimensions items, namely the management of the ecological, economic and social, institutional and legislation. The results of the analysis of the sustainability status of mangrove forest management can then be used as the basis for building a management policy scenarios based on existing conditions. Therefore, the expected results of this study can provide a picture of the existing condition and scenarios Also managing to do in supporting the implementation of sustainable development. The purpose of this study was to Determine and analyze the mangrove canopy density distribution in the Mangrove Center Graha Indah (MCGI) Balikpapan. The mangrove forest in Mangrove Center Graha Indah (MCGI) Balikpapan has dense canopy density area of 1.546.900m<sup>2</sup> (48.41%); medium canopy density area of 573 400m<sup>2</sup> (17.94%), and sparse canopy density area of 1.075 200m<sup>2</sup> (33.65%). Based on the distribution, mangrove forests with sparse canopy density spread throughout the delta area. In the middle of the delta, mostly mangrove forests have those kind of canopy density. The existence of mangrove forest with medium canopy density was more prevalent on the edge of the delta area, especially in the delta branching of the southern part. Mean while, the existence of mangrove forest with dense canopy density is found only in a small portion edge of the delta in the south and the edge of the branching streams with a smaller area.

**Keywords:** Mangrove Center Graha Indah (MCGI), Mangrove Forest Management, canopy density

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### I. Introduction

One of the natural ecosystems which are considered important as part of coastal resources is a mangrove forest ecosystem. Mangrove forests are often referred to brackish since as being in the brackish area and its resistant to salinity. Mangroves grow in the mouth of a river or estuary which is the final destination for organic particles or silt carried from upstream area due to erosion. The fertility of this area is also determined by the tides that transport nutrients.

The mangrove forest is the green line of the beach area which has the function of ecological and socio-economic. Based on identification in 1997-2000 of potential extensive mangrove habitat in Indonesia ±8,6 million ha comprising 3.8 million ha in forest area and 4.8 million ha outside the region. At this time 1.7 million ha or 44.73% of the mangrove forests that are in the forest area and 4.2 million ha or 87.50% of the mangrove forests that are outside the forest area are in a damaged condition. Those damages are generally caused by human activity in the utilization of natural resources which does not pay attention to coastal areas of sustainability, such as cutting for firewood excessively or change function for the benefit of other land uses such as farms, residential, industrial and mining (Regulation of Forestry Minister Number 03/MENHUT-V /2004).

Sustainable development and environmentally sound is the concept for managing the development of coastal areas to be more organized and not getting chaotic and endanger future generations (Sugandhy and

Hakim, 2007). This concept is necessary to keep the threshold constantly at the rate of utilization of natural ecosystems and the natural resources that exist in it. These thresholds are not absolute because it depends on technological and socio-economic conditions of the use of natural resources, as well as the ability of the biosphere to accept the impact of human activities. Mean while, the Coastal Area Development is the approach of ecosystem to coastal zone management is highly complex, dynamic and has a high vulnerability, because it has a wealth of natural resources and potentially lead to multiple-use conflicts and still open space by the entry into force of the mastery of certain groups. The efforts to preserve the mangrove forests can be done through a Silvo fishery technique and bottom-up approach in rehabilitation. Silvo fishery is the technique of a fish and shrimp aquaculture which combined with made to improve the welfare of forest communities and preserve the mangrove forest ecosystems that maintain their survival. All this time, the implementation of the mangrove ecosystem restoration that has occurred in recent years carried out on orders from above. as habit in any project whose name the plan was always comes from above while the sub ordinate (community) as the spearhead of the project implementers merely carrying out orders or with the popular term with the top-down approach. The implementation of such project is of course less potential to empower communities, whereas ideally the community is exactly what should be actively in volved in efforts to restore the mangrove ecosystem, while the government only as a fund provider, controllers and facilitators related activities. On the other hand people do not feel involved to have(a sense of belong that does not grow) the mangrove forest. People assume that the mangrove forests are government- owned and does not belong to them, so that if people need, they simply take without being monitored by the government or by project implementers (Savitri and Khazali, 1999).

## II. Research Methods

### Location and Time Research

This research was conducted in Januari – April 2015 at Mangrove Center Graha Indah (MCGI) in Graha Indah Village , North Balikpapan District, Balikpapan City, East Kalimantan Province, Indonesia.

### Source and Types of Data

The data used in this study include primary and secondary data. Primary data is the data obtained directly from the research subjects and have not been processed. Primary data in this study are fitted to the analysis significance where for GIS analysis of data in the form of point coordinates the distribution of mangrove land taken through the determination of the coordinate points mangrove forest area using GPS and then downloaded to a computer as to form a map polygon.

## III. Results And Discussion

### Analysis of Mangrove Distribution of Mangrove Center Graha Indah (MCGI) Balikpapan City

The analysis of the distribution of mangrove in this study aimed to find out how the extensive of mangrove forests and the spread to be used as a reference for mangrove management at the Mangrove Center Graha Indah (MCGI) Balikpapan. This activity is supported by the activities of field inspections (ground check) to obtain information about the state of mangroves distribution as a reference in the classification process. The analysis of the mangrove distribution in this study conducted in the year 2015 observation.

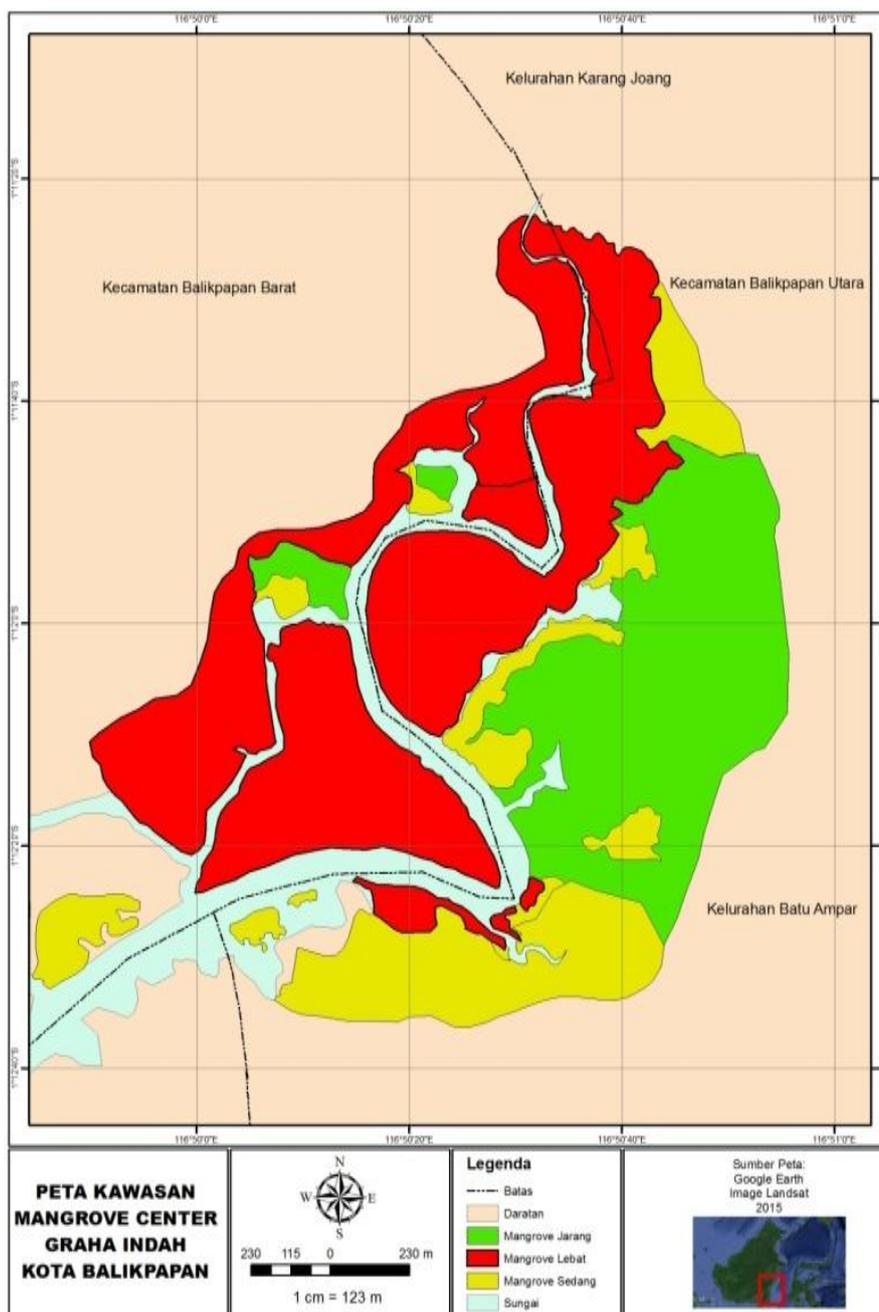
The canopy density analysis used in this study using Normalized Difference Vegetation Index (NDVI). NDVI is a measure of the balance between the energy received by the energy emitted by objects on Earth. When it is applied to the plant community, the index set a value to determine how green an area that can express the amount of vegetation and the presence of health or strength level of growth (Meneses-Tovar, 2011). The assessment of the degree of canopy density distribution of mangrove forests used criteria issued by the Ministry of Forestry , Directorate General of Land Rehabilitation and Social Forestry (2005) as follow.

**Table 1. Level Criteria of Mangrove Forest Canopy Density Based on NDVI Value**

NDVI Value	Level of Mangrove Density Distribution in MCGI
$0,43 \leq NDVI \leq 1,00$	The distribution of the dense canopy density
$0,33 \leq NDVI \leq 0,42$	The distribution of the medium canopy density
$-1,00 \leq NDVI \leq 0,32$	The distribution of the sparse canopy density

Source : Modified from Regulation of the Forestry Minister of Republic of Indonesia (2005).

Visually, the distribution of mangrove forests in Mangrove Center Graha Indah (MCGI) Balikpapan presented in a map so it can be seen the distribution and pattern of its spread. Based on the visual interpretation of remote sensing data is then obtained extensive information of mangrove forests as Figure 1.



Source : Data processed, 2015.

**Figure 1. Results of the analysis of the distribution of mangrove in Mangrove Center Graha Indah (MCGI) Balikpapan City**

Visualization of green color is sparse mangrove density classes, yellow is medium grade mangrove density, and red color dense mangrove density class. In detail, the information of density in the mangrove forest canopy in Mangrove Center Graha Indah (MCGI) Balikpapan City in 2015 are presented in Table 2.

**Table 2. Mangrove canopy density in Mangrove Center Graha Indah(MCGI) Balikpapan City 2015**

NDVI Value	Level of Canopy Density	Area (m <sup>2</sup> )	Percentage of Area
0,43 ≤ NDVI ≤ 1,00	The distribution of mangroves in MCGI with dense canopy density	1.546.900	48,41%
0,33 ≤ NDVI ≤ 0,42	The distributionof mangroves in MCGI with medium canopy density	573.400	17,94%
-1,00 ≤ NDVI ≤ 0,32	The distributionof mangroves in MCGI with sparse canopy density	1.075.200	33,65%

Source : Data processed, 2015.

The information about canopy density is one of the things that are important in the management of mangrove in Mangrove Center Graha Indah (MCGI) Balikpapan City. Guidelines for Identification of Critical Land Inventory and Mangrove issued by the Ministry of Forestry explained that canopy density is one of the criteria used to determine the critical level of mangrove land other than land use type and soil resistance to abrasion. The analysis showed that most of the mangrove forests in the Mangrove Center Graha Indah (MCGI) Balikpapan City covers an area of dense canopy density 1.546.900 m<sup>2</sup> or approximately 48.41%, mangrove forests which have a medium canopy density was covering a total area of 573 400 m<sup>2</sup> or about 17.94%. Meanwhile, mangrove forests with sparse canopy density measuring 1.075.200 m<sup>2</sup> or 33.65%. Based on the distribution, mangrove forests with sparse canopy density is spread throughout the delta area. In the middle of the delta, mostly mangrove forests have that kind of canopy density. The existence of mangrove forest with medium density was more prevalent on the edge of the delta area, especially in the southern part of the delta branching. Mangrove forests with medium canopy density was just a bit found in the middle area of the delta, which is around the river (Schaeffer et al, 2008). Meanwhile, the existence of mangrove forest with dense canopy density is found only in a small portion edge of the delta in the south and the edge of the branching streams with a smaller area. The conditions above may indicate that the mangrove forests located on the edge of the delta and directly adjacent to the sea tend to be under natural conditions, especially in the southern part of the delta branching area. Nevertheless, the influence of the power of waves and currents may affect the density so that it has a medium canopy density. Meanwhile, the influence of human activities are more done in the mangroves which is located more towards the ground or in the middle of the delta area.

#### **IV. Conclusions And Suggestion**

##### **Conclusions**

Mangrove forest in Mangrove Center Graha Indah (MCGI) Balikpapan City has an area of dense canopy density of 1.546.900 m<sup>2</sup> (48,41%); medium canopy density are 573.400 m<sup>2</sup> (17,94%), and sparse canopy density of 1.075.200 m<sup>2</sup> (33,65%). Based on the distribution, mangrove forests with sparse canopy density is spread throughout the delta area. In the middle of the delta, mostly mangrove forests have that kind of canopy density. The existence of mangrove forest with medium canopy density was more prevalent on the edge of the delta area, especially in the southern part of the delta branching. Mangrove forests with medium canopy density was just a bit found in the middle area of the delta, which is around the river. Meanwhile, the existence of mangrove forest with dense canopy density is found only in a small portion edge of the delta in the south and the edge of the branching streams with a smaller area.

##### **Suggestions**

This study needs to be followed by more specific research, especially research that are more towards the type of mangrove vegetation that grows in the area, as well as the growth rate of the amount of the average diameter of mangrove in Mangrove Center Graha Indah. Bottom Up approach in the management of mangrove in mangrove center to be optimized by increasing the role of the community in addition to the role of government policies to support the area into a conservation area.

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