Analysis of Density and Changes in Mangrove Vegetation on Cup Island, Tangerang Regency, Banten Province, Based on GIS

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Abstract

This research is based on the role of multifunctional mangrove ecosystems. Mangrove ecosystems play an important role for the sustainability of marine and terrestrial life and also for human socio-economic needs. This research was also conducted due to the lack of analysis and information related to the density of mangrove ecosystems on Cup Island. The analysis in this study utilizes Geographic Information System (GIS) technology with NDVI (Normalized Difference Vegetation Indexi) vegetation index. The result of the analysis carried out is that there was a decrease in mangrove area on Cup Island from 2018-2021 by 14.94 ha and increased again in 2022 covering an area of 1.35 ha with a sparse density of 2.52 ha, a medium density of 2.7 ha and a dense area of 5.4 ha. This change occurs due to abrasion factors that occur continuously, fires to deforestation activities that cause reduction and damage to the distribution and density of mangroves on Cangkir Island, Kronjo District, Tangerang Regency, Banten.

Keywords: Geographic Information System, Mangrove, NDVI.

A. INTRODUCTION

Indonesia is nicknamed as a maritime country because the country's area is 70% including ocean. Lasabuda (2013) said that Indonesia has 5.9 million km2 of sea and a coastline of 95,161 km2, therefore in Indonesia there are many coastal discoveries or what can be called the meeting between land and sea waters. In this area there is one ecosystem called the mangrove ecosystem. Mangroves have many functions, both ecological functions and economic functions.

Mangrove ecosystems are forests referred to as brackish forests or mangrove forests which are one of the characteristics found in tropical areas (Hafizul &; Thamrin, 2019). Indonesia itself is dubbed as a country that has the largest mangrove forest in the world, about 27%.

A good mangrove ecosystem is a mangrove that has a medium to dense density (Rosalia, 2022). The higher the vegetation density, the better the function of the mangrove ecosystem. The function of mangrove ecosystems is as a provider of nutrients for food sources of living things in it. There are also social and physical functions, the social functions of this ecosystem are for tourism purposes, medicine and as raw materials for making crafts. While its physical function is as an abrasion barrier, for retaining mud soil and much more (Kustanti, 2011).

Banten Province is a part of Indonesia that is found coastal areas and small islands in between. Banten Province has a coastal area and small islands covering an area of 12,672.59 km2. Tanggerang Regency is part of Banten Province, Tanggerang Regency has

decreased mangrove vegetation area. In 1996 the mangrove vegetation of Tanggerang Regency covered an area of 487.5 Ha, currently only covering an area of 182.14 Ha. The decrease in mangrove vegetation area is due to the conversion of mangrove land into pond and settlement areas. Mangrove ecosystems have many functions, three of which are biological functions, economic functions and also physical functions (Kordi, 2012). Because of this function, there is a lot of overexploitation carried out by humans for their own benefit.

The Mug Island area is an area in Tanggerang Regency that has mangrove forest resources. This area is located in Konjo District, which is about 25 km from the Tanggerang City area. Maangrove forest areas are scattered on the beach, and are in the rehabilitation phase delivered by the head of the Pulau Cangkir mangrove community. With the exploitation that was previously carried out and is currently trying to be rehabilitated, the mangrove vegetation on Mug Island changes its density from time to time.

Changes in mangrove vegetation density can be observed through Marine Information System (GIS) technology by utilizing remote sensing satellites. This remote sensing technique is based on the use of electromagnetic waves. Imagery is produced by establishing a relationship between the *flux* received from satellite-borne sensors with the physical properties of each observed object on the surface of the earth. This image is used to see the density of mangrove vegetation. The results of image analysis carried out multitemporally with the knowledge of experts, this stage can be measured and observed in detail.

Based on the above statement, research is needed to determine changes in mangrove density levels, especially in the Mug Island area, Tangerang Regency, Banten. The absence of research related to changes in mangrove vegetation on Mug Island has made the lack of information, data, or references regarding mangrove density in the Mug Island Area in the last 5 years. The use of GIS technology, namely remote scanning as a method used in this study because it has many advantages by reaching a wide area, more effectively and faster.

B. METHODS

In this study, an exploratory descriptive research method was used which was carried out with data collection activities, analysis and interpretation whose purpose was to be described (Suryabrata, 1987). This method is not only in data collection activities, but includes analysis and discussion of the results of data analysis. While the field validation method used is the Line transect method.

C. RESULT AND DISCUSSION

Landsat 8 imagery is one of the image data that is very easily accessible and data download can be done for free. This image is quite perfect when juxtaposed with other images because landsat 8 images have as many as eleven bands and two sensor instruments including OLI (*Onboard Operational Land Imager)* and TIRS (*Thermal Infrared Sensor).* The existence of this landsat image was created to correct the shortcomings contained in previous images (in landsat images 1-7). Therefore, landsat imagery has a more complex

data structure.

The results of data processing that has been carried out within 5 years. Starting from 2018 to 2022, it can be seen in figure 4.1 to figure 4.5 which is presented using a scale of 1:30,000.

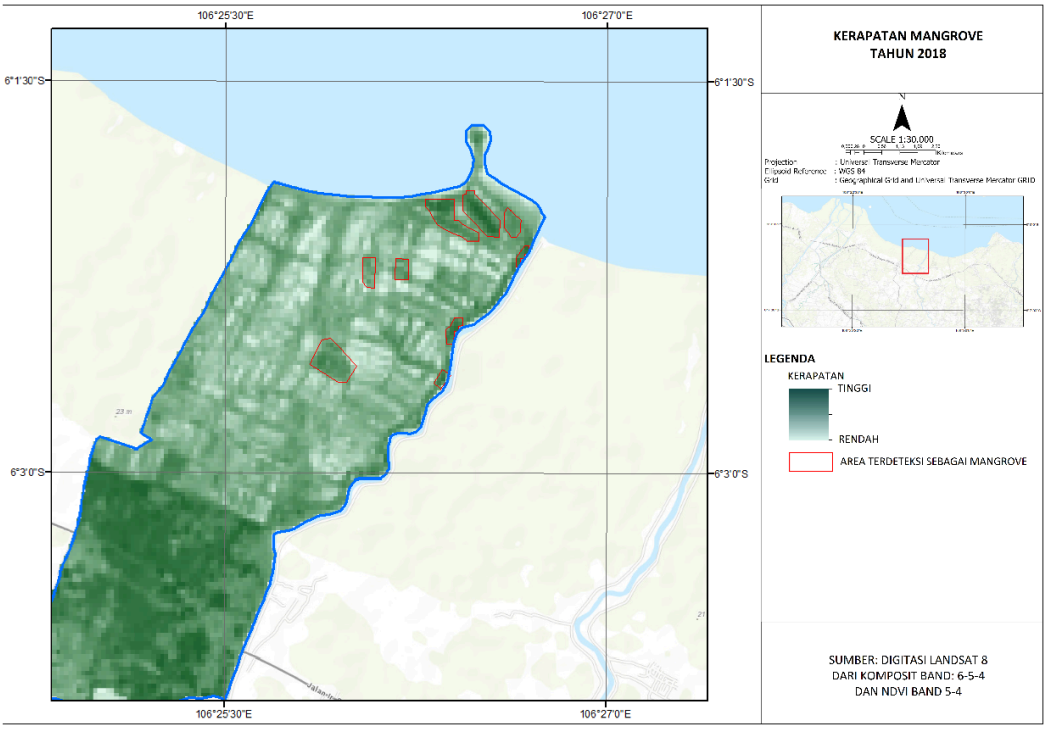

Figure 1. Map of Mangrove Density of Pulau Mug in 2018
(Source: Research document 2023)

The distribution of mangroves on Mug Island in 2018 was spread at several points marked with red marks. As seen on the map, mangrove land is also spread not only in coastal areas but also around dams in the Kronjo District Area.

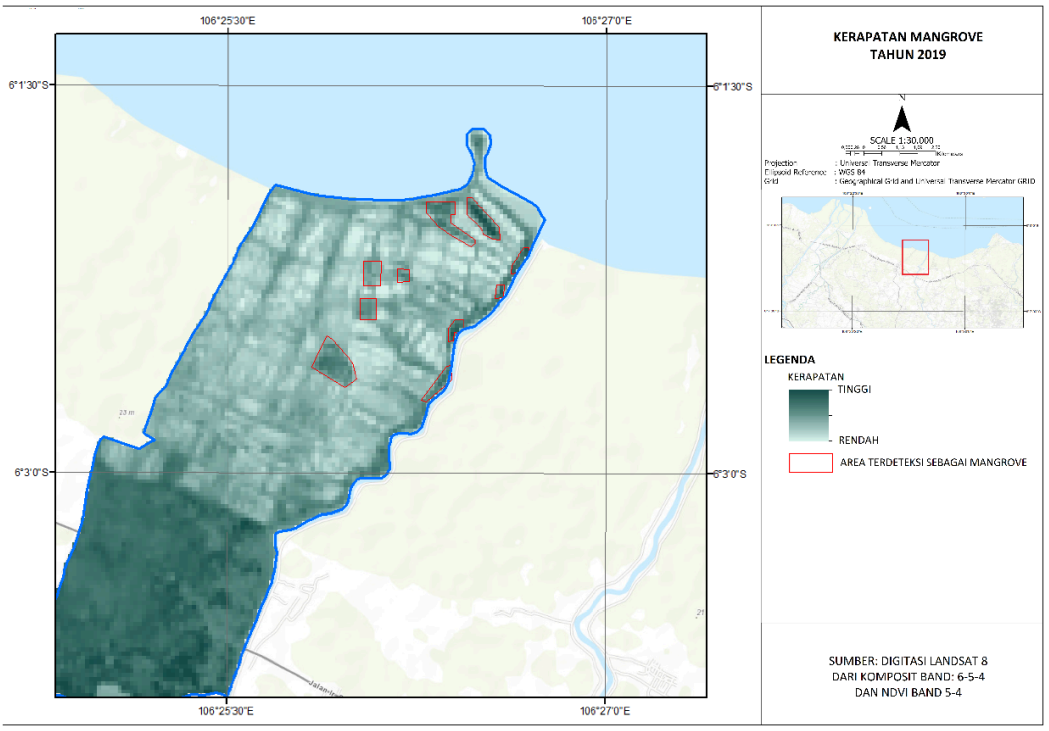

Figure 2. Map of Mangrove Density of Pulau Mug in 2019
(Source: Research document 2023)

Furthermore, through the results of image processing in 2019, it can be seen that there is a reduction in mangrove land around the north coast but the addition of land occurs around the border between Kronjo District and Pagedangan Ilir District. Through the results of the interview with the head of the Mug Island Mangrove community (MAPUCA), this was caused by the occurrence of catastrophic fires around the sellers' shelters around the coast and also the occurrence of abrasion which caused mangroves to decrease. According to the analysis conducted by the community Mangrove Pulau cangkir There are two types of mangroves affected by fire, namely *Avicennia Marina* and *Ryzophora Stylosa*.

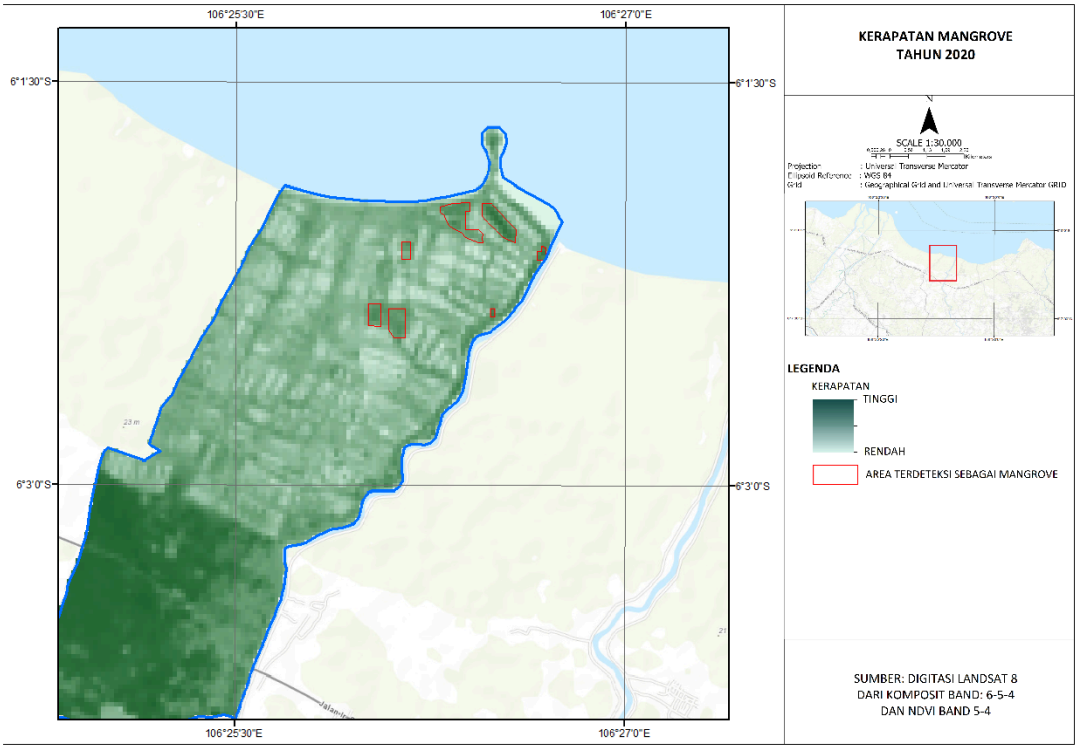

Figure 3. Map of Mangrove Density of Pulau Mug in 2020
(Source: Research document 2023)

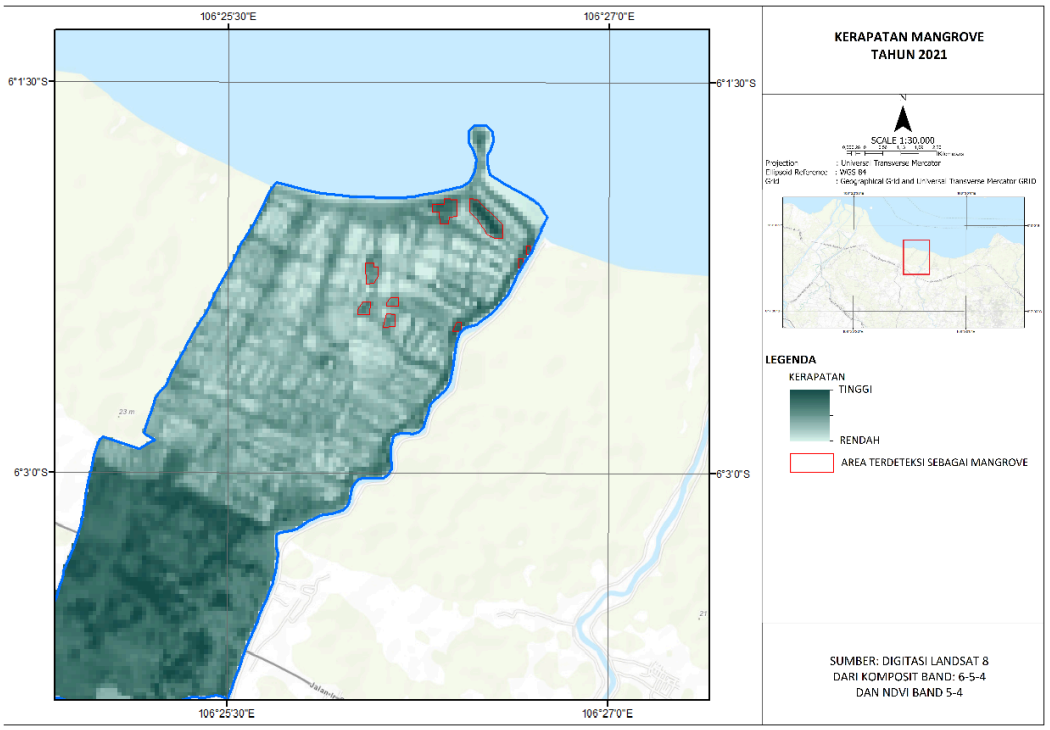

Figure 4. Mangrove Density of Pulau Mug in 2021
(Source: Research document 2023)

The distribution of Mug Island mangroves in 2019-2021 has decreased drastically as can be seen on the map. According to the analysis of the community leader MAPUCA

This is due to the continuous occurrence of abrasion. In addition, mangrove land on Mug Island is also experiencing deforestation. Where, the area around the dam is widely used as food production land (such as rice fields and plantation land) by local residents.

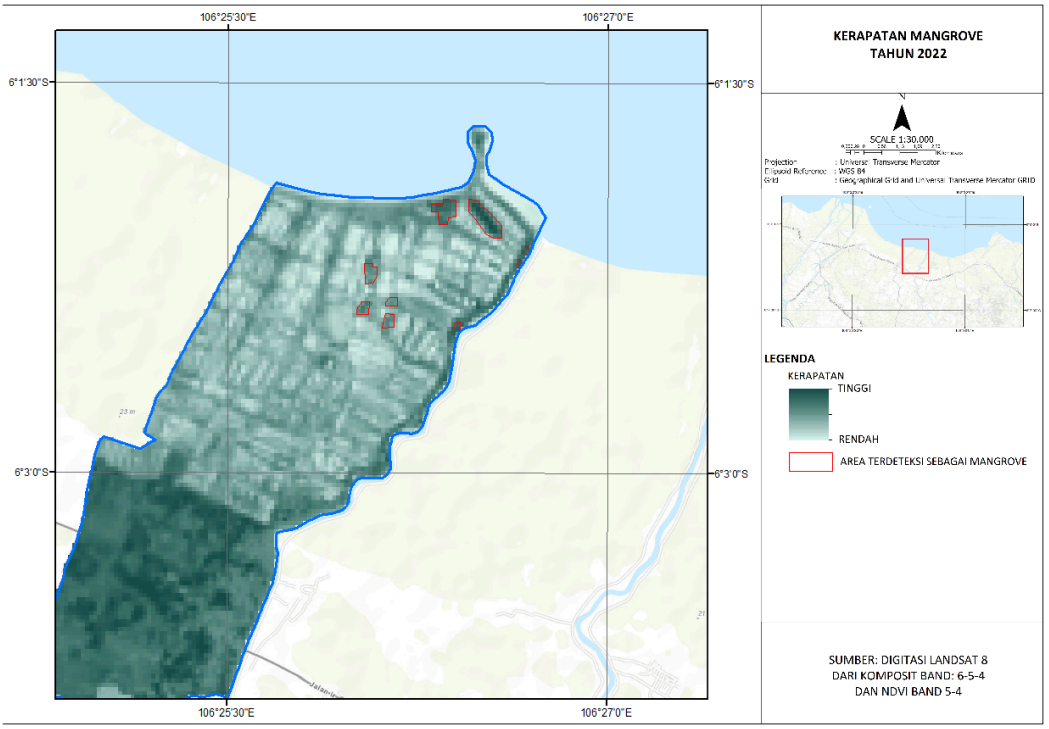

Figure 5. Cup Island Mangrove Density in 2022
(Source: Research document 2023)

In 2022, the mangrove land of Pulau Mug has increased again due to the movement of the MAPUCA community to preserve it. Even until now many companies have collaborated and donated mangrove seedlings and began to be planted around the coast of Mug Island, Kronjo District.

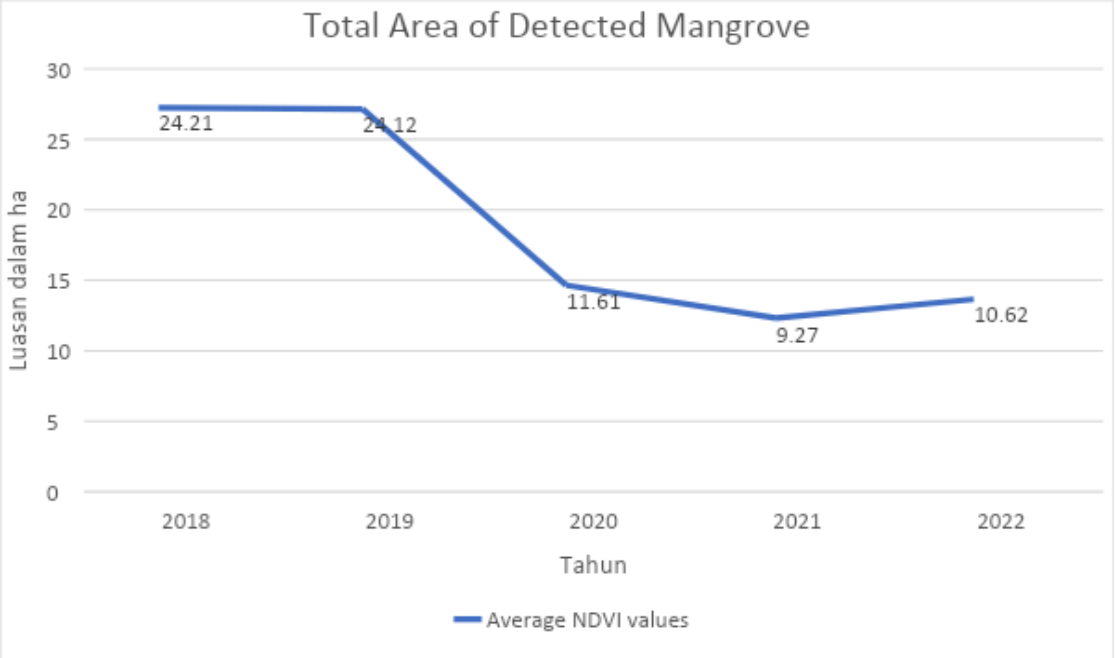

Figure 6. Graph of Mangrove Changes in Cup Island in 2018-2022
(Source: Research document 2023)

The results of changes in mangrove land area in the last 5 years (2018-1022) on Mug Island have changed which can be seen in the data presented in figure 10.

In the period from 2018 to 2021, the area of Mangroves on Mug Island has decreased very drastically, covering an area of 14.94 ha. The biggest thing that causes this decrease in area is the continuous occurrence of abrasion. Based on image analysis, a very large decrease occurred in the middle area and around the northern waters (border area of Kronjo District). And in 2022 the mangrove area has increased again by 1.35 ha.

Based on the data above, there are several factors that cause changes in mangrove land area. Changes in plant populations can occur if they experience damage due to natural factors and also human factors. For example, forest burning, indiscriminate logging and others are described in Onrizal, 2005 *in* Ario, R., *et al* (2017). Based on this study, the factors that cause mangrove land change are as follows:

1. Natural Factors

According to the results of interviews that have been conducted, the coast of Mug Island is an area that often occurs abrasion. The speed of high abrasion events and also the sloping position of the coast are factors in the occurrence of tidal floods and high seawater intrusion as a cause of natural damage to mangrove lands (Maulani, *et al*., 2021). In addition, wave factors, strong wind conditions, disruption of parasitic plants and pests are also natural factors that affect mangrove growth.

2. Human Factor

The cause of the reduction of mangrove land on Mug Island is not only caused by environmental factors. In addition to environmental factors, mangrove land damage is also caused by socio-economic activities carried out by humans (Toknok, *et al.,* 2014). The increasing population density is one of the factors. Humans increasingly need a place to live, a place for work purposes (changing functions as rice fields, livestock, ponds and so on), the increasing amount of household waste that is thrown carelessly so that it pollutes

mangrove land and also the lack of education provided to the community about the importance of mangrove ecosystems.

From the results of the analysis that has been carried out in 2018-2021, mangrove land on Mug Island has decreased very drastically by around 14.94 ha. This is due to lack of attention from the local government and also the community. But in 2022 mangroves are increasing again due to community efforts that pay attention to the preservation of mangrove land and make it a tourist spot that can also be an educational tour about mangrove maintenance from nurseries, care to mangrove planting. Not only that, but the Pulau Mug Mangrove community (MAPUCA) educates the use of mangroves as food and daily necessities (such as soap, oil and many more).

D. CONCLUSION

Referring to the research and results of data analysis carried out, the distribution and extent of mangrove land on Mug Island for the last 5 years from 2018 to 2022 has changed. From 2018 to 2021, it experienced a drastic decrease of up to 14.94 ha. Meanwhile, 2022 rose again to 1.35 ha. Not only the area but also the degree of density is arbitrary. The cause of mangrove changes on Mug Island is influenced by natural factors and human factors. Natural factors are the occurrence of continuous abrasion on the coast and climate change. While the human factor is deforestation carried out, fire disasters from sellers around the coast and for other personal interests.

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