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UTILIZATION OF SENTINEL-2A IMAGERY FOR MAPPING THE DISTRIBUTION OF MANGROVE FORESTS IN THE MANDEH AREA, WEST SUMATERA PROVINCE

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ABSTRACT: Mangroves are a part of the coastal ecosystem, mangroves play an important role in coastal ecosystems where the presence of mangroves can prevent abrasion. This study aims to identify the distribution of mangroves in the Mandeh Area using Sentinel 2A Imagery data assisted by geospatial technology tools. The methods used in this research are Normalized Difference Vegetation Index (NDVI), overlay, and maximum likelihood guided classification, these three methods are a combination of techniques from remote sensing and geographic information systems. The results of the study show that in 2015 the total area of mangrove land was 437 ha, in 2020 the area of mangrove forest with the most extensive mangrove forest density was a high density of (227 ha/ 68%).
Keywords: Mangroves, Land Cover, Remote Sensing

1. INTRODUCTION

The coastal and marine areas of Indonesia are known for their richness and diversity of natural resources, both resources that can be recovered (such as fisheries, mangrove forests, and coral reefs) and resources that cannot be recovered (such as oil and gas and minerals or other mining materials). (Dahuri et al., 2001). Indonesia has the most extensive mangrove forests in the world (22.6% of the world's total mangrove area). However, the mangrove forest area is decreasing from year to year (FAO, 2007). Mangrove forest degradation in Indonesia is caused by various factors, including the conversion of mangrove forests various activity construction, wharf building, area agriculture, and plantations, as well as oil and gas exploration activities (Kordi, 2012).

Problems that occur in mangrove vegetation in Indonesia in general is an area of mangroves that experiences a continuous trend of decline from year to year. According to FAO data (2007) until 2005, Indonesia had lost around 40% of its total area of mangrove vegetation. This is due to population growth which continues to increase so that some mangrove vegetation is destroyed and used as a place to live. Another reason is that the exploitation of mangrove ecosystems is carried out continuously both for timber needs and for land use change mangrove be ponds. This reduction in mangrove areas certainly requires attention because the role of this ecosystem is very important for humans, especially those living in coastal areas.

Mangrove forest areas are generally found along the coast of Indonesia and live and grow in locations that have a relationship with tidal influences inundate the river flow along the coast (Tarigan, 2008). Coastal areas are transitional areas between terrestrial and marine ecosystems that are interdependent on one another (Antomi Y, 2017). The physical functions of mangrove forests include: controlling the rise in the boundary between the groundwater level and sea level towards the mainland (intrusion), acting as a buffer zone, spurring land expansion, and protecting the coastline to avoid erosion or abrasion.

One location of mangrove forests can be found in the waters of West Sumatra, namely in the Mandeh area. According to the Maritime Affairs and Fisheries Service of Pesisir Selatan district (2011), Pesisir Selatan Regency is the largest mangrove forest in West Sumatra. The Mandeh area has a mangrove forest area of ±896.73 ha which can be developed as an ecotourism area. Currently, the Mandeh area has been focused on by the Government as a tourist destination in Indonesia. However, the condition of the mangrove forest in the Mandeh area has suffered a lot of damage. This damage is caused by land conversion and conversion of mangrove ecosystems into harbors and construction of roads and other activities, using interpretation techniques in remote sensing is an effective step in observing changes in environmental conditions such as observing changes in mangroves, land cover, and other dynamic phenomena. on the surface of the earth because users can get information by using satellite imagery to observe changes in environmental conditions. One of the most frequently used image data nowadays is sentinel-2A imagery.

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Utilization of Sentinel-2A imagery in this study to identify mangrove forests, Sentinel-2A imagery has a resolution of 10 meters compared to image resolution Other mediums such as Landsat and Sentinel Image Mode 2A have a better quality level because they can identify objects with a size of 10m*10m. Sentinel-2A image data is easy to obtain and is useful for observing environmental phenomena on the earth's surface more clearly, such as observing the condition of land cover due to human activities.

Increased development activities in mangrove areas will have an impact on the existence mangrove ecosystem which can reduce its functions and benefits (Wibowo and Handayani, 2006). Damage to the mangrove ecosystem unmanageable will be causing losses to other aspects such as reduced coastal areas, reduced abundance of fish, and loss of biodiversity. Vegetation density will be very influential in the degradation of mangrove forest areas which is shown significantly by decreasing mangrove forest area. Mangrove forest degradation results in changes in coastal ecosystems, extinction of certain types of flora, fauna, and biota, decreased biodiversity, and habitat damage that extends to the mainland (Saparinto, 2007).

Remote sensing is a science that is used to obtain information about objects, areas, or symptoms, through data obtained using tools, without direct contact with the objects, areas or symptoms to be studied (Lillesand and Kiefer, 1990). Remote sensing is carried out by measuring the value of electromagnetic waves reflected (reflection) and emission (emission) from the observed object. Objects on the surface of the earth will reflect electromagnetic wave energy, which will then be captured and recorded by sensors (Bakara, 2014).

Remote sensing systems have four basic components that is; objects, energy sources, transmission paths, and sensors. Fourth these components work together to measure and record information from the observed object. The energy source functions as a medium to transmit information from the target to the sensor, while the sensor is a tool that functions to collect and record electromagnetic waves emitted or reflected by objects. The data is then sent to the receiving station to then be processed into a ready-to-use format in the form of an image. The image is then interpreted to obtain information about the object being observed. There are three main groups of objects on the earth's surface that can be detected by sensors, namely: water, soil, and vegetation. Each of these objects has electromagnetic energy with different wavelengths. These characteristics are often used in remote sensing systems can recognize objects on the surface of the earth (Gunawan, 2014).

2. THE METHODS

This research is a quantitative research, research-quantitative aim to analyze remote sensing spatial data and geographic information systems (Bintarto, 1982). According to Sugiyono (2013), quantitative research methods can be interpreted as methods based on the philosophy of positivism, used to research certain populations or samples, sampling techniques are generally carried out randomly, data collection uses research instruments, data analysis is quantitative/statistical with the aim to test the hypothesis has been set. This study uses a descriptive approach with the aim to describe the research object or research results.

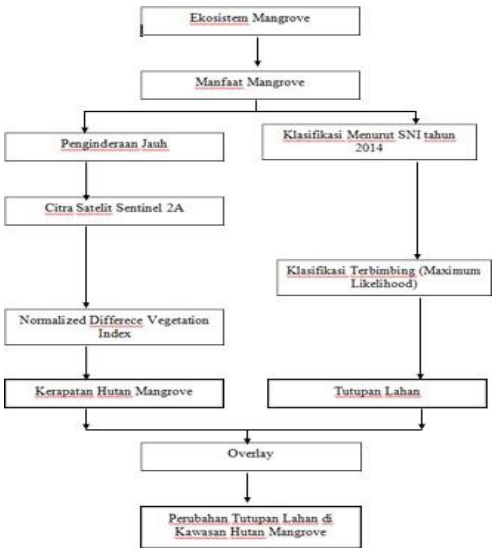

Fig.1 Method

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3. RESULTS AND DISCUSSION

3.1 Mangrove Forest Density in the Mandeh Area in 2015

Based on the results of data analysis in 2015, the condition of the mangrove forest area with the most extensive density is high mangrove density and sparse to moderate mangrove density, only slightly in the Mandeh area. The following table shows the area of mangrove forests in the Mandeh area in 2015.

Table. 1. Area of Mangrove Forest Density in the Mandeh Area in 2015.

No	Mangrove Forest Density	Area (Ha)	%
1	Sparse Density	14	3
2	Medium Density	64	14
3	High Density	359	82
	Total	437	100

Source: Data Analytics 2021

a) Mangrove forest density in 2020

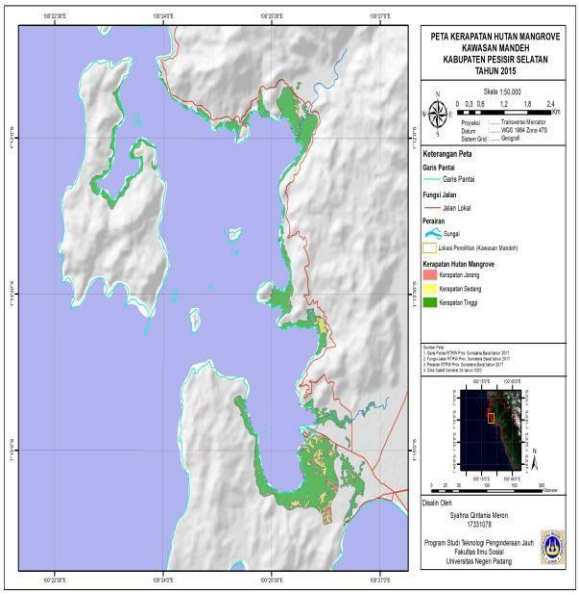

Fig. 2 Mangrove forest density in 2020 Map

b) Mangrove forest density in 2020

Based on analysis using the NDVI method and assisted using geospatial technology The research results showed that the density of mangrove forests in the Mandeh area in 2020 is still dominant with high-density conditions. This is proven based on the results of data analysis on the area of mangrove forests shown in the following table.

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Table. 2. Density of Mangrove Forest in the Mandeh Area in 2020

No	Mangrove Forest Density	Wide(Ha)	%Bdidyes
1	Density Seldom	22	6
2	Density	83	24
3	Currently Density Tall	227	68
	Total	333	100

Source: Data Analytics 2021

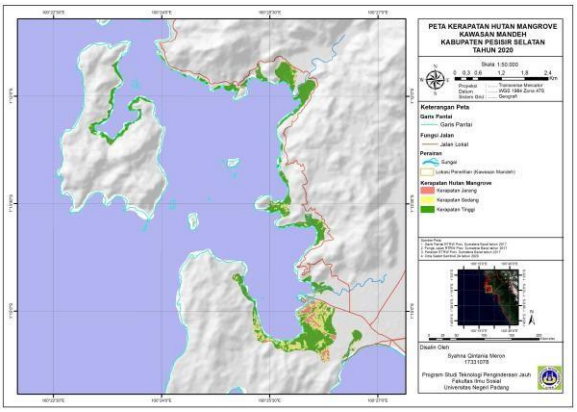

Fig 2. Mangrove Forest

c) Changes in Mangrove Forest Area in the Mandeh Area from 2015 to 2020

Based on the results of the overlay analysis, find the area of mangrove land that has changed from 2015 to 2015 In 2020, this mangrove land change will be converted to another land with a different area of land change. Most of the land with a high density of mangroves has been converted, reaching an area of 89 ha of mangrove land which has changed over a period of 5 years. The following table shows the area of mangrove land that has changed. 16. Changing Mangrove Land Area in the Mandeh Area from 2015 to 2020.

Table 3 Changes in Mangrove Forest Area in the Mandeh Area from 2015 to 2020

No	Mangrove Forest Density	Wide(Ha)	**%QK**
1	Sparse Density	4	4
2	Medium Density	12	11
3	High Density	89	85
	total	105	10

Source: Data Analytics 2021.

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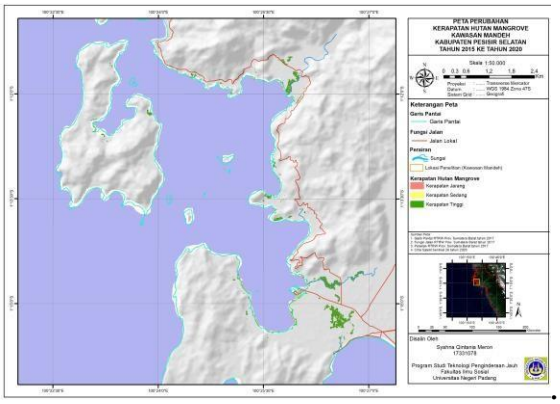

Fig.3 Changes in Mangrove Forest Area in the Mandeh Area from 2015 to 2020

d) Land Cover Change

Based on the guided classification using the maximum likelihood method, the results of the land cover map in the Mandeh area in 2015 showed 10 land classes at the study site, namely settlements, plantations, rivers, mangroves, open land, forest, scrub, ponds, and paddy fields. The following shows the area of land cover in 2015 as follows:

Tabel. 4. Land Cover Area in the Mandeh Supervision in 2015

No	Land Cover	Area (Ha) 2015	(%) 2015
1	Forest	1,482	30
2	Mangrove forest	475	10
3	Open field	11	0
4	Plantation	1873	38
5	Settlement	57	1
6	Ricefield	52	1
7	Shrubs	944	19
8	River	10	0
9	Pond	29	1

Source: Data Analytics 2021

4. CONCLUSION

The results of this study produce a conclusion based on the problem formulation which has exposed before, as for results conclusions that can be drawn as follows:

1. Mangrove Density in the Mandeh Area is divided into The 3 classes are sparse density, medium density, and high density. In 2015 the total area of mangrove land was 437 ha with details of sparse density areas covering 14 ha or 3% of the total mangrove forest area in 2015, medium density areas covering 63 ha or 14% of the total mangrove forest area, and areas with high density covering an area of 359 ha / 82% of the total area of mangrove forests. in 2020 the area of mangrove forest with the most extensive mangrove forest density is high density (227 ha/ 68%), medium mangrove density (83 ha/ 24%), and sparse mangrove density (22 ha/ 6%). Density This mangrove is influenced by land conditions, water conditions, and coastal morphology, and is influenced by human activities in changing the mangrove land itself.
2. Within 5 years as much as ±105 ha of mangrove land has changed with different levels of density change, density rarely changes for an area (4 ha 4%) of the total area of change, medium density changes for an area of (12 ha 11%) and high-density change area of 89 ha / 85%. This change in mangrove forests occurs due to several factors, namely economic factors and land conversion factors in the Mandeh Area itself, the most common factor that occurs is the conversion of mangrove land which is converted into mangrove land built, initially, the mangrove land was cleared or stockpiled to

be used as housing

3. There are 8 land covers in the Mandeh Area that have changed, the largest land cover has changed in the last 5 years. land that underwent a change, namely forest, open land, shrubs, and paddy fields which were converted to plantations covering an area of 104 ha, the total area of change, was shrubs were converted to the residential land area of 3 ha, mangrove forest was converted to settlement area of 2 ha, plantation land was converted to the land open area of 1 ha and plantation land converted into ponds of 5 ha To see an overview of land cover areas and areas of land cover change in the Mandeh Area from 2015 to 2020.

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