MANGROVE VEGETATION DENSITY MAPPING IN UNTIA MAKASSAR VILLAGE USING SENTINEL 2A SATELLITE IMAGERY

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ABSTRACT

Mangroves are one part of coastal ecosystems, mangroves are very important in coastal ecosystems where, the presence of mangroves can prevent abrasion. This study aims to identify mangrove density in Untia Makassar Village using sentinel 2A satellite imagery. The method used in this study is the Normalized Difference Vegetation Index (NDVI) method, This method is a technique of remote sensing. The results of this study show that in 2022 the mangrove land area is 19.23 ha with the most extensive mangrove density is the normal density with a land area of 13.34 and the lowest mangrove density with a very poor density has a land area of 0.72 ha.

Mangrove ecosystems are meeting areas between terrestrial and marine ecosystems that are dynamic and have the ability to recover quickly if geomorphological and hydrological conditions and habitat composition are not changed (Wardhani, 2011). Mangrove forest is a form of forest ecosystem that is unitary and unique because it is located in tidal areas in coastal areas, beaches and or small islands. Mangrove forests play an important role in stabilizing coastlines and helping reduce the impact of natural disasters such as tsunamis and hurricanes (Nurdin et al., 2015).

Mapping is one of the first steps in a study that can be carried out to observe the condition of mangrove forests which is more effective and efficient in obtaining an overview of the distribution of mangrove forests in an area (Shalihati, 2014). Mapping can be used as an alternative solution for research that requires a fairly long period of time, considering that research on mapping the distribution of mangrove areas can be used to see conditions in the previous year and in the current year (Shalihati, 2014).

The use of remote sensing technology is one method that is widely used to solve and determine the condition of an area using the classification method. Classification is designed to derive thematic information from the results of image classification. It is necessary to assess the accuracy of the information content, so an accuracy test is needed to determine whether the data is used or not (Danoedoro, 2012). One that affects the accuracy of the classification results is the spatial resolution of the image used. High spatial resolution images have an impact on increasing overall accuracy in assessing land cover classification (roots et al., 2016). Remote sensing is a science of obtaining information through analyzing data without having direct contact with objects. Remote sensing can be utilized in monitoring mangrove vegetation based on two important properties, namely mangroves have green leaf matter and mangroves grow in coastal areas (Pnata et al., 2016). Identification of vegetation density can be done by means of digital image interpretation using a vegetation index. The vegetation index is one of the parameters used to analyze the state of vegetation by

measuring the level of greenness (Ardiansyah et al, 2012). The vegetation index used in this study is the Normalized Difference Vegetation Index (NDVI).

Untia is one of the sub-districts that has been used as a tourist village in Makassar City, the Untia sub-district has potential that must be further developed. One of them is the mangrove ecosystem area. The author's reason for taking this title is to find out the condition of the density of mangrove forest ecosystems so that they can be utilized as much as possible, and also to carry out countermeasures for mangrove forest ecosystems that have been damaged.

METHODS OF RESEARCH

This research was conducted on September 26 2022 – November 25 2022 at the Faculty of Marine and Fisheries Sciences, Hasanuddin University, can be seen in Figure 1.
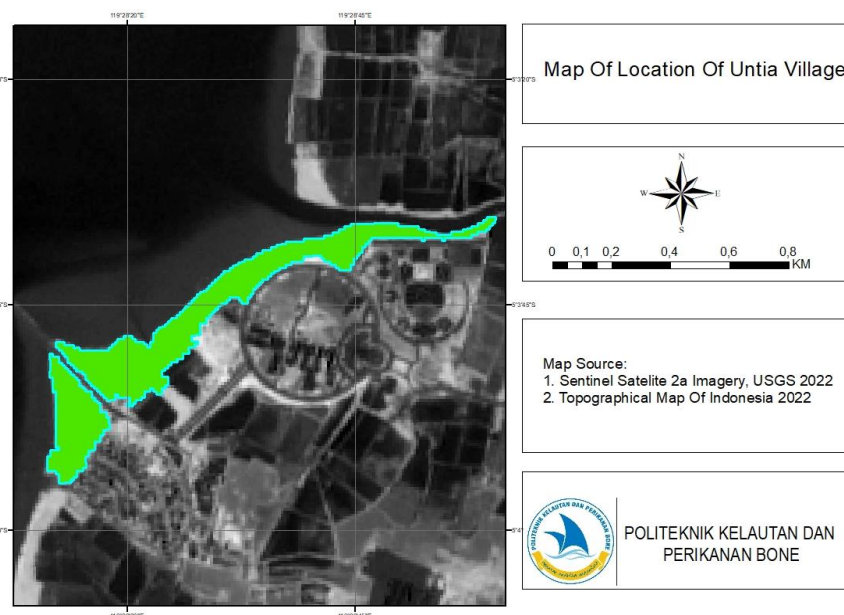

Figure 1 – Research Locations

In fieldwork II, the author made a mapping of mangrove vegetation density with the method used, namely the Normalized Difference Vegetation Index (NDVI) method.

At this time remote sensing has been widely used to map resources. In this case monitoring the vegetation index value using high spatial resolution with images that have the bands needed in determining the vegetation index calculation algorithm (Philiani et al., 2016).

In determining an accurate vegetation index, the Normalized Difference Vegetation Index (NDVI) method can be used to determine the density of mangrove vegetation areas and the extent of mangrove forests. This research was carried out by preparing sentinel-2A satellite imagery data which will be used starting with downloading the data and cropping the image in the study area. Then processing the image data using vegetation index analysis (NDVI) to determine the level of vegetation density. The formula for calculating the NDVI classification (Sinaga et al, 2018). are as follows:

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

Where: NDVI - Normalized Difference Vegetation Index; NIR - Near Infrared Band Channel; RED - Red Wave Band Channel.

On sentinel 2A satellite imagery is calculated by the following formula:

$$NDVI = \frac{Band\ 8 - Band\ 4}{Band\ 8 + Band\ 4}$$

The results of this algorithm will be used for the next stage, namely converting images in raster format to vector format using ArcGis 10.5 software. The stages of image processing and analysis include the following stages:
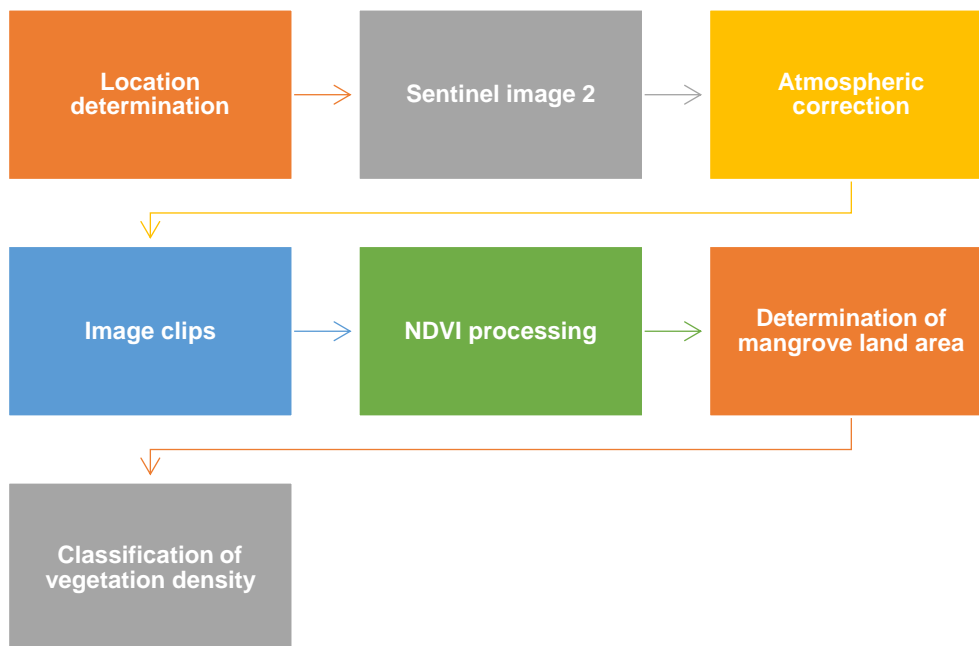

Figure 2 – The stages of image processing

RESULTS AND DISCUSSION

The vegetation index is an existing algorithm for images as aspects of vegetation density or aspects related to density, for example biomass, chlorophyll concentration and so on. The vegetation index is an algorithm that is applied to images to highlight aspects of vegetation density or aspects related to density, for example, biomass, chlorophyll concentration, and so on. Practically this vegetation index is a mathematical transformation that involves several channels at once, and produces new images that are more representative in presenting vegetation phenomena (Arnanto, 2015). The range of NDVI classification classes resulting from the absorption of solar radiation always ranges from -1 to +1 (Danoedoro, 2012). The bands contained in the Sentinel 2A satellite imagery can be seen in the table below:

Table 1 – Types of image bands

Sentinel -2A	Region image	Resolution
Band 1 – coastal aerosol	0.443	60
Band 2 – Blue	0.49	10
Band 3 – Green	0.56	10
Band 4 – Red	0.665	10
Band 5 – Vegetation Red Edge	0.705	20
Band 6 – Vegetation Red Edge	0.74	20
Band 7 – vegetation Red Edge	0.783	20
Band 8 – NIR	0.842	10
Band 9 – Water Vapour	0.945	60
Band 10 – SWIR – cirrus	1.375	60
Band 11- SWIR	1.61	20
Band 12 – SWIR	2.19	20

The benefit of this sentinel image is to present data in order to meet the needs of several things including vegetation and can be used as basic data that can be applied in various ways (Kawamuna et al., 2017). The bands used in this study are bands 4 and band 8

because these bands have near infrared waves with red waves reflected by vegetation and can be used to identify the density of mangrove plants (Wahrudin et al., 2019).

Mangrove density classification data obtained based on NDVI calculations using ArcGIS. The NDVI calculation used in this processing uses band 4 and band 8 of the sentinel-2A image as shown below:
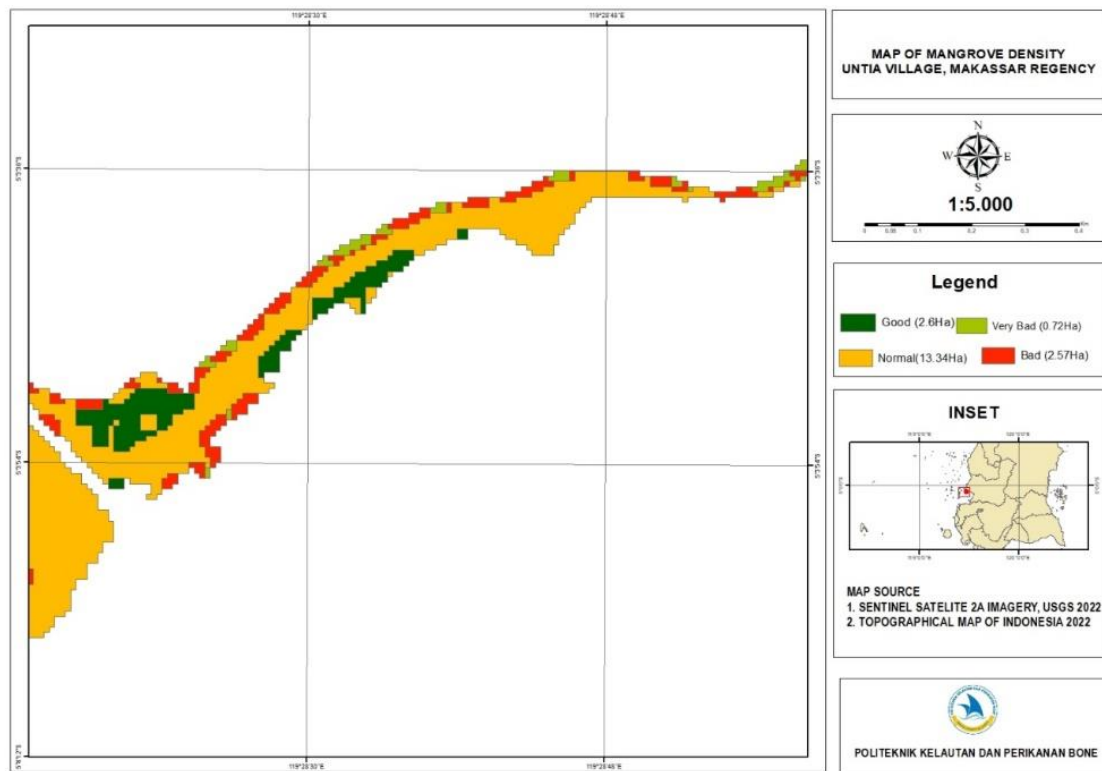

Figure 3. Mangrove density classification data obtained based on NDVI calculations using ArcGIS

The results of the accuracy test obtained with the NDVI method can be seen from Figure 34 above showing that in 2022 the total area of mangrove land is 19.23ha in the Untia Makassar Village, there are 4 classes of mangrove conditions dominated by yellow which means that the resulting NDVI value is normal with a land area 13.34 Ha. Based on the processing of the above data using Sentinel-2, it can be divided into broad categories and mangrove density conditions which are divided into 4 classes, namely good, normal, bad and very bad. The following is presented in the form of a table of areas and mangrove density classification values obtained using the NDVI method in the table below:

Table 2 – Results of NDVI

NDVI value	Criteria	Color	Area (Ha)
0. 56	Good	Green	2.6
0.31	Normal	Yellow	13.34
0.19	Bad	Red	2.57
0.7	Very bad	Lime	0.72

From the table above, the comparison of the area of mangrove density in the Untia Village, Makassar. The good density class is green in area of 2.6 ha with an NDVI classification value of 0.56, the normal density class in yellow has an area of 13.34 ha with an NDVI classification value of 0.31, the bad density class in red has an area of 2.57 ha with a classification value of 0.19 and the density is very bad has an area of 0.72 ha with a

classification value of 0.7. The total area of mangroves in the Untia Makassar Village is 19.23 ha.

Overall the mangrove ecosystem in Untia Village grows thickly with a basic sedimentary structure in the coastal area which is generally sandy and muddy. This makes most of Untia Village grow mangroves with medium density. According to Yulius et al (2018) said that mangrove density is important in showing that existing mangrove ecosystem communities grow in fertile waters.

The decline in the condition of mangrove forests occurs due to anthropogenic or human factors and natural factors. Anthropogenic or human factors are the main factor in the decline of mangrove land (Monfort et al., 2020). Excessive cutting of mangrove land, making ponds that occur in coastal areas results in degradation and loss of mangrove forest area. This is in line with the very rapid increase in population resulting in increased community demand for land. Limited land and increasing population growth have forced people to choose to encroach on forests to meet their needs, such as the establishment of ponds and settlements. This activity is exacerbated by overlapping interests with the development of Special Economic Zones (KEE) in protected forest areas, or overlapping between rehabilitation interests and economic interests (Refliss, 2017).

As for the natural factors that affect the decline in mangrove land, namely natural disasters such as hurricanes or storms which can damage mangroves, such as a prolonged dry climate which can reduce the accumulation of salt levels in mangrove growth (Akram & Hasnidar, 2022). Global warming or high climate can cause sparks so that they can spread to mangrove plants and surrounding vegetation (Khaniea & Wooa, 2015).

CONCLUSION

Based on the analysis of sentinel-2A imagery in 2022 using the NDVI method, Untia Village has a mangrove land area of 19.23 ha and has a density level consisting of 4 classes of mangrove conditions which are dominated by yellow which means that the resulting NDVI value is normal with a land area of 13.34 ha with a value NDVI 0.31, good density is green with an area of 2.6 ha with an NDVI classification value of 0.56, bad density is red with a land area of 2.57 ha with an NDVI value of 0.19 and very bad density has a land area of 0.72 ha with an NDVI classification value 0.7 with a total area of 19.23 ha of mangrove land in Untia Makassar Village.

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