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# UTILIZATION OF LANDSAT IMAGERY FOR MAPPING SEAGRASS DISTRIBUTION ON NIRWANA BEACH PADANG CITY

Helsa Permata Sari[1], Dian Adhetya Arief[2], Febriandi[2], Triyatno[2]

[1]Student of the D3 Remote Sensing Technology Study Program, Universitas Negeri Padang, [2]Lecturer Study Program D3 Remote Sensing Technology, Universitas Negeri Padang
e-mail: helsapermatasari@gmail.com

**ABSTRACT**: Mapping the distribution of seagrass beds at Nirwana Beach in Padang City aims to see changes in seagrass meadow area that occurred within a period of five years, namely from 2017 to 2022.The image used is Landsat 8 Imagery, The method used to detect seagrass beds is the Lyzenga algorithm, this method is used to obtain object information below the surface of the water, Because the information obtained from the initial image is still mixed with other information such as water depth, turbidity, and water table movement. The two channels used in detecting this aquatic bottom information are the blue band and the green *band* which have wavelengths corresponding to the ratio of attenuation coefficients required by *the logarithmic formula of lyzenga*. The interpretation results show a decrease in seagrass area within five years, namely from 2017 to 2022 by 6.96 ha. The Lyzenga Algorithm method is the most suitable method for detecting seagrass beds at Nirwana Beach in Padang City.

*Keywords: Seagrass Meadow, Landsat, Lyzenga algorithm.*

## 1. INTRODUCTION

Seagrass beds are one of the shallow marine ecosystems in the waters as a recycler of nitrate and phosphate nutrients and are able to provide various microhabitats for various kinds of marine life (Latuconsina &; Ambo-rappe, 2013). Likewise, Pratiwi said, 2010 seagrass meadows are one of the marine resources that are potential enough to be utilized, ecologically seagrass meadows become an important function in coastal areas. Seagrasses can form underwater ecosystems that are vital to all continents except Antarctica.

One of the locations of seagrass beds that can be found in the waters of West Sumatra is in the city of Padang, one of which is on Nirwana Beach. Referring to data released by the West Sumatra Environmental Agency in SLHD West Sumatra Province in 2012, the percentage of seagrass damage in Padang City reached 33.65%. (DLH, 2012). Coupled with the development of the marine tourism sector in Padang City, which has been suspended since 2014. This damage occurs due to human activities, such as coastal development, seaweed farming, land reclamation, deforestation, overfishing, and garbage.

Remote sensing technology can be used to map the distribution of seagrass beds, remote sensing can be a good enough alternative to overcome the problem of measuring the distribution area of seagrass beds. The ability of this technology to collect data in large and hard-to-reach study areas directly in a short time helps in the provision of information.

## 2. METHOD

### 2.1 Research

This form of research uses a form of research by taking a spatial approach. The spatial approach is an approach that examines a series of similarities from different geosphere phenomena in space, this approach is a typical approach in geography, because it is the study of the diversity of the earth's ultimate space by discussing each spatial aspect.

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2.2 Time and Location of Research

This research was conducted in the odd semester of the 2021/2022 academic year, as for the details of the implementation time from July to January. The location of this research is on Nirwana Beach which is in part of the waters of Teluk Bayur, the land area is in Bungus Teluk Kabung District and Lubuk Begalung District.

2.3 Research Tools and Materials

2.3.1 Research Tools

The tools used in the study are presented in the table below as follows:

Table.1 Research Tools

| No | Research Tools | Information |
|---|---|---|
| 1. | Laptop | Analisis data |
| 2. | Thursera | Documenttasi eightgan |
| 3. | Kamera *Underwater* | Documenttasi eightgan |
| 4. | GPS *(Gl o bal Positioning System)* | Penen t uan koordinat sampel untuk mengkonf i rm asi objek result anali sis |
| 5.. | Tool tulis | Documenttasi eightgan |

2.3.2 Material

The research materials used in this study are presented in table 5 below

Table 2. Research Materials

| No. | Material | Source |
|---|---|---|
| 1. | Citra Satelit *Landsat* 8 | USGS |
| 2. | Citra Satelit *Landsat* 8 | USGS |
| 3. | Peta Administrasi Kota Padang | Bappeda |
| 4. | Field Data | Field Survey |

2.4 Data Analysis Techniques

2.4.1 Pre Data Processing

The pre-processing stage of data is the stage carried out before the data processing process which begins with:

a. Radiometric Correction

The purpose of this radiometric correction is to convert the Digital Number (DN) value into a Reflectance value and eliminate the atmospheric effect on the reflectance value of the image.

2.4.2 Processing

a. Cropping

The purpose of cropping is to limit the area of the researcher so that it is not too wide and focus on the area to be studied.

b. Water Pool Correction (Lyzenga Algorithm)

Image analysis is a process carried out after the initial processing of images. This image analysis uses the lyzenga logarithm method, namely the Depth Invariant Index (DII), which in processing is intended to obtain object information below the water surface, because the information obtained from the initial image is still mixed with other information such as water depth, turbidity, and water level movement.

c. Convert Raster to Vector and Cut Polygon

Data conversion is done to convert raster data into polygon data so that seagrass area can be calculated using geometry calculation tools. Cut polygons are used to cut the results of classes of shallow sea objects in the Nirvana Beach Area.

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## 3. RESULTS AND DISCUSSION

### 3.1 Research Results

3.1.1 Mapping the distribution of seagrass beds in 2017 and 2022 on Nirwana Beach using the Lyzenga Algorithm method.

Based on the first objective in this study, namely to map the distribution of seagrass beds on Nirwana Beach, Lubuk Begalung District, Padang City using Landsat 8 Imagery. In the process of mapping the distribution of seagrass beds using the Lyzenga Algorithm method, it will go through the main data processing stage, namely image sharpening which is commonly called pansharpening, the process pan sharpening uses panchromatic bands, these bands produce new images that are colorful and have high spatial resolution. Then enter the Lyzenga Algorithm calculation formula which will produce several classes including the Seagrass class.

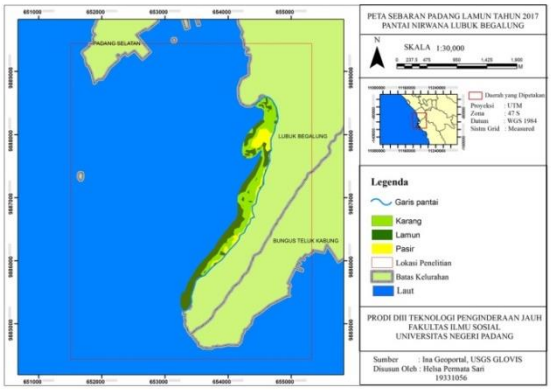


Figure 1. Seagrass Distribution in 2017

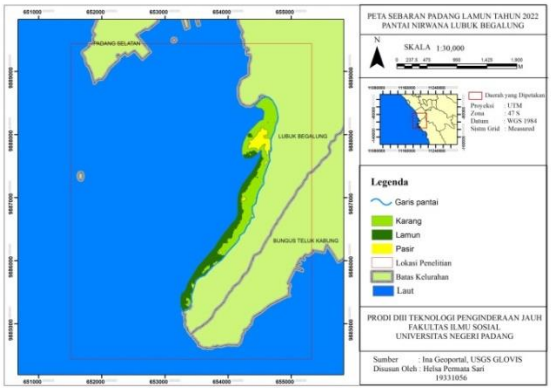


Figure 2. Seagrass Distribution in 2022

Figure 1 and figure 2 are the results of seagrass distribution in 2017 and 2022 in the Nirwana Beach Area, Padang City, the results of seagrass distribution were obtained from processing landsat 8 image data using the Lyzenga Algorithm Formula. In this study, researchers provided three classification classes on shallow sea water objects, including seagrass beds marked with dark green, coral reefs marked with light green, and sand marked yellow. On the map of the distribution of seagrass beds, it can be seen that seagrass beds are found on the southern coast of Nirvana. The condition of seagrass meadows has been reduced, namely from 37.79 ha in 2017 and 30.82 ha in 2022.

3.1.2 Calculating changes in seagrass area in 2017 and 2022 at Nirwana Beach, Padang City using landsat imagery 8 Padang

Based on the interpretation of Landsat 8 imagery in 2017, the area of seagrass beds in the Nirwana Beach Area is 37.79 ha. These seagrass beds are scattered along the coast of Nirwana and several surrounding islands. Meanwhile, the results of the interpretation of Landsat 8 2022 imagery show that the area of

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seagrass beds in the Nirwana Beach Area is 30.82 ha. This is one indication that there has been a reduction in the area of seagrass beds by 6.96 ha as can be seen in Figure 3 below:

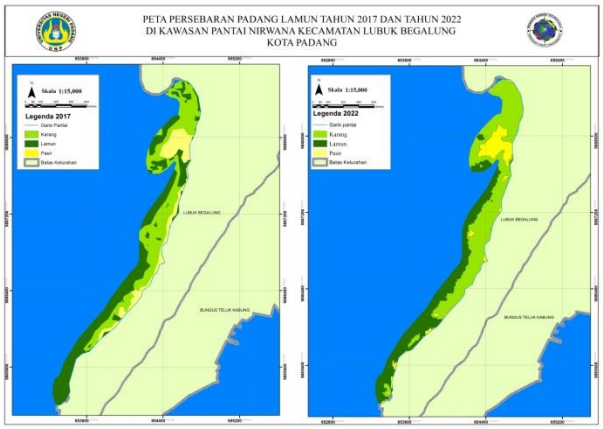


Figure 3. Map of Seagrass Meadow Changes in 2017 and 2022

3.1.3 Accuracy Test

The data in this study was obtained from Pt Pelindo II with the number of data samples used 22 samples, this sampling is based on the Fitzpatrick-Lins theory in Aris Kurniadi 2014 that the formula for estimating the number of samples so that the samples taken in the study represent the population are as follows:

$$N = 4.P.Q / E^2$$

Information:

N = number of samples

P = expected accuracy

Q = difference between 100 and p

E = error received

$$N = \frac{(4 \times 85 \times 15)}{15^2}$$

N = 5100/225= 22

Table 3. Accuracy Test

| Klasifikasi | Lapangan data | | | Total | Producer's Accuracy |
|---|---|---|---|---|---|
| | Lamun | Terumbu Compose | Sand | | |
| Lamun | 6 | 2 | 0 | 8 | 85,71% |
| Terumbu karang | 1 | 6 | 0 | 7 | 75% |
| Sand | 0 | 0 | 7 | 7 | 100% |
| Total | 7 | 8 | 7 | 22 | |
| User's Accuracy | 75% | 85,71% | 100% | | |

Interpretation Correctness Rate = Number of True Points X100%

Number of points surveyed = 19 x 100% = 86.36%

The results of the calculation of table 1 show that the level of correctness of the interpretation that has been carried out is 86.36%. Based on the policy stipulated in Geospatial Information Agency Regulation No. 15 of 2014 where the minimum accuracy value is 85% so that it can be ensured that the image interpretation

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results of 86.36% have met the requirements. There are errors that occur in the category of seagrass beds and coral reefs, this occurs because there are errors in the classification process (Maksum et al, 2016).

Table 4. Accuracy Test Results

| Ex. a s Objek Perairan Laut Shallow | Weight |
|---|---|
| Lamun | 7 |
| Terumbu karang | 8 |
| Sand | 7 |
| Total | 22 |

Source: Field Data and Analysis Data

3.2 Discussion

Based on the results of the study, a map of the distribution of seagrass beds has been obtained in 2017 and 2022 in the Nirwana Beach Area of Padang City. Many seagrass beds are found in the southern part of Nirvana Beach. Seagrass distribution maps were obtained by utilizing landsat 8 image data processed using the Lyzenga Algorithm method. This method is very commonly used to obtain information on objects below the surface of the water, this method of processing uses blue and green bands in identifying seagrass beds. This band is used because it has the best wave range for detecting the presence of substrate in shallow ocean waters. Seagrass beds are widespread in the nirvana beach area because this area predominantly has a sandy substrate that can ensure the supply of nutrients to seagrass plants (Haji, 2019).

In this study, researchers provided three classes of classification of shallow marine objects including seagrass beds, coral reefs, and sand. In 2017, seagrass beds were identified as many as 37.97 ha, while in 2022 seagrass beds were identified as many as 30.82 ha. It can be seen in table 12 that there has been a reduction in seagrass beds in 2017 and 2022 by 6.96 ha. Environmental factors that directly affect the survival of seagrass are sanility, brightness, temperature, depth of waters (Minister of Environment, 2004). While anthropological factors are due to human activities.

The reduction of seagrass beds in the research location was caused by community activities around the research area, lack of public knowledge about the function of seagrass meadow ecosystems resulted in community efforts in maintaining the preservation of seagrass beds were very minimal and even considered as nuisance plants so that these plants were ignored or destroyed (Hartati et al., 2012). The accuracy test is carried out by means of a field ground check with a sampling amount of 22 points, from all sampling numbers there are 3 wrong points, this occurs due to errors when classifying shallow sea water objects. At the time of ground check the field, pictures of the location of environmental conditions at coordinate points are taken to be matched with the classification results from the satellite images used. To determine how much the level of image accuracy of groundcheck results can be calculated with the confusion matrix table, the level of correctness of interpretation that has been done is 86.36%.

## 4. CONCLUSION

This study produces conclusions based on the formulation of the problem that has been described before, as follows:

a. Based on the map of the results of research on the distribution of seagrass beds in the Nirwana Beach Area of Padang City, the existence of seagrass meadows is spread along the Nirwana Beach Area, many seagrass meadows are found in the southern part of Nirwana Beach.
b. The area of seagrass cover in the Nirwana Beach Area using the Lyzenga Algorithm method has decreased, namely in 2017 the area of seagrass meadows was detected around 37.79 ha while in 2022 the area of seagrass meadows was only around 30.82, so the reduction of seagrass meadows has decreased by around 6.96 ha in the last 5 years.

## REFERENCES

[1] Abubakar, S., Subur, R., Rina, R., Kadir, M. A., Sabar, M., Darmawaty, D., &; Akbar, N. (2020). Seagrass Potential as Supporting Ecotourism in Sibu Island, Subdistrict North Oba, North Maluku Province. Agrikan: Journal of Fisheries Agribusiness, 13(2), 147-159.
[2] West Sumatra Government Regional Environmental Status Data Book 2012.

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Vol 4 No 1 | June 2023

[3] Dhewani. Nurul M.S, Udhi E.H, Prayudha. B, Indarto H.S (2018). Status of Seagrass Meadows Indonesia 2018. Oceanographic Research Center.
[4] Ernawa, Y. (2015). Detection of changes in seagrass area using Landsat imagery in Baluran Situbondo National Park, East Java (Doctoral dissertation, Universitas Brawijaya).
[5] Hartini, H., &; Lestarini, Y. (2019). Seagrass mapping as a support for ecotourism in East Lombok Regency. Journal of Tropical Biology, 19(1), 17.
[6] Haji, C., &; Frananda, H. Dynamics of Seagrass cover at Nirwana Beach, Padang City for the period 2008-2019.
[7] Ilyas, T. P., Nababan, B., Madduppa, H., &; Kushardono, D. (2020). Seagrass ecosystem mapping with and without water column correction in the waters of Pajenekang Island, South Sulawesi. Journal of Tropical Marine Science and Technology, 12(1), 9-23.
[8] Nugraha, A. H., Ramadhani, P., Karlina, I., Susiana, S., &; Febrianto, T. (2021). Distribution of seagrass types and cover in the waters of Bintan island. JurnalEnggano, 6(2), 323-332.
[9] Rosalina, D., Rombe, K. H., &; Hasnatang, H. (2022). Seagrass Distribution Mapping Using Lyzenga Method Case Study of Kapoposang Island, South Sulawesi Province. Journal of Tropical Oceans, 25(2), 169-178.
[10] Rifqi, C., &; Suparno, S. (2021). Seagrass Damage Status in the Waters of Nirwana Beach, Batu Kalang Beach and Pasumpahan Island in West Sumatra Province (Doctoral dissertation, Hatta University)
[11] Sari, D. P., &; Lubis, M. Z. (2017). Utilization of Landsat 8 imagery to map the distribution of seagrass in the coastal area of Batam Island. Enggano Journal,2(1), 38-45
[12] Setiawan, F., Harahap, S. A., Andriani, Y., &; Hutahaean, A. A. (2012). Seagrass change detection using remote sensing technology and its relation to the ability to store carbon in Banten Bay Waters. Journal of Marine Fisheries, 3(3)
[13] Shah, A. F. (2010). Remote sensing and its application in coastal areas and oceans. Indonesian Journal of Marine Science and Technology,3(1), 18-28.Tangke, U. (2010). Seagrass meadow ecosystems (benefits, functions and rehabilitation). Agrikan: Journal of Fisheries Agribusiness, 3(1), 9-29.
[14] Taryana, D. (2009). Spatial Approach in Geography. Journal of Education Geography, 3(1).