Abstract: Langkat Regency has the largest mangrove forest in North Sumatra. Lubuk Kertang Langkat Village from 2014 to 2018 there has been an increase in the area of mangrove forest by 69.3 Ha. By collecting data on the pattern of mangrove distribution zones in the mangrove area, it will reduce changes in the area of the mangrove area, so that the possibility of distribution of mangroves in the Langkat Regency area is known. Remote sensing using Citra Landsat 8 is part of the way to determine the distribution of mangroves. The purpose of this study was to examine the distribution of mangrove zones in the Langkat area using Citra Landsat 8. The research results found that there were 18 types of mangrove plants in Langkat district, namely Avicennia marina, Nypa fruticans, Sonneratia alba, Rizophora apiculata, Avicennia officinalis, Avicennia rumphiana, Aegiceras corniculatum, Rizophora rumphiana, Aegiceras hydropyliacea, Scyphiphora hydropyliacea, Avicenniam marina, Scyphiphora hydropyliacea, Soneratia alba, Aigeceras corniculatum, Lumnitzera littorea, Rhizophora apiculata, Rhizophora mucronata. The type of mangrove plant that is first is Rhizophora where this plant has the highest species density value of all existing mangrove species, which is equal to 900 Ind/400m. Rhizophora is a type of mangrove plant that has a fruit length of 1.9 cm, an average of 52 cm, and a fruit weight of 56 gr. The pattern of distribution of mangrove plants in groups is based on the tendency of mangrove species to inhabit their preferred environment.

Keywords: Citra Lansat 8; Mangrove Distribution Zone; Spatial Analysis

Introduction

In coastal places, the transition between land and water has created diverse ecosystems that are highly productive and can provide enormous economic value to humans. As a result of increasing coastal pressure, management problems arise due to use conflicts caused by diverse interests in coastal areas. Remote sensing has long used vegetation indices to track temporal changes related to vegetation (Shahrokhinia & Ahmadi, 2019). Many alternative vegetation indices have been developed in recent years for various purposes (Lasaiba & Saud, 2022).

Landsat satellite data is used to classify land cover using remote sensing. According to the latest data, information collected using remote sensing is considered to be superior to information provided through government agencies. Satellite data used in remote sensing is probably the most recently recorded data (Gumma et al., 2011).

The use of Landsat 8 satellites to calculate the index value of the number of normalized vegetation differences (NDVI) using infrared calculations (Mancino et al., 2020). Comparing near-infrared (NIR) data, namely by calculating the NDVI and red values. The Normalized Difference Vegetation Index value is NDVI, NIR is Landsat 8 band 5 imagery, and Red is Landsat 8 band 4 imagery (Ali & Pour, 2014). By setting the value of vegetation canopy density using NDVI calculation results, the analytical approach uses Geographic Information Systems (GIS) (Aboelnour & Engel, 2018). The NDVI class is categorized into five categories, namely very dense vegetation, dense vegetation,
moderately dense vegetation, sparse vegetation, and very sparse vegetation.

Landsat 8 satellite imagery is part of enhancing the image which has many electromagnetic wave channels (Adiri et al., 2020). Visual identification (using Landsat satellite imagery with supervised categorization) can help accurately describe the physical conditions and things in a particular area (Phiri & Morgenroth, 2017). Furthermore, Landsat satellite imagery can be used to identify places that may experience ground motion.

The main characteristics of remote sensing of mangrove plants are: The optical characteristics of chlorophyll absorb the red light spectrum while reflecting the infrared spectrum brightly (Tran et al., 2022). Mangroves contain green leaf material (chlorophyll) and grow near the coast (Castellanos-Basto et al., 2021). Phytoplankton chlorophyll in saltwater can be distinguished from mangrove chlorophyll, and mangrove vegetation can be identified from the surrounding area, the infrared spectrum cannot be absorbed because mangrove chlorophyll has water properties (Rahmadi et al., 2020).

Spatial analysis is a series of calculation procedures and mathematical logical judgments to find possible connections or patterns that (maybe) include geographical aspects stored in digital data with certain geographical boundaries (Adnyana & As-syakur, 2012). Geographical analysis is part of a geographic information system (GIS), which is a system that can analyze geographic and non-spatial problems and their combinations to provide spatial solutions (Prahasta, 2009). This system is intended to facilitate the analysis of disparate geographic information, such as a way to explore data from a geographical viewpoint to increase understanding and insight (Burrough et al., 2015).

The characteristics of Indonesia's coastal areas vary from region to region. Langkat Regency has the largest mangrove forest in North Sumatra, with an area of 11,709.16 Ha in 2010, and there was a shift in the area of mangrove forest from 1980 to 2010 covering an area of 25,816.01 Ha. in 2005, the mangrove forest in Lubuk Kertang Village was badly damaged, resulting in flooding (Restu & Damanik, 2012). According to Rahmadi's research (2020) in Lubuk Kertang Langkat Village from 2014 to 2018 there has been an increase in the area of mangrove forests by 69.3 Ha. Mangrove 2014-2016 (Rahmadi et al., 2020).

By collecting data on the pattern of mangrove distribution zones in the mangrove area, it will reduce changes in the area of the mangrove area, so that the possibility of distribution of mangroves in the Langkat Regency area is known. Remote sensing using Landsat 8 imagery is part of the way to determine the distribution of mangroves (Chuvieco, 2020). Remote sensing is a technique for identifying, obtaining, and analyzing objects by utilizing sensors at research sites. The purpose of this research is to examine the distribution of mangrove zones in the Langkat area using Landsat 8 imagery.

Method

The location of this research was conducted in Langkat Regency. The satellite used is Landsat 8 imagery acquired in 2015 and adjusted geometrically and radiometrically. The variables of this study include the area, distribution, and density of mangrove forests in Langkat Regency. The tools and materials used in this research are maps of mangrove forest research locations; Landsat 8 image data; GPS, meter, camera, stationary, boat and pen. The software used in digital mapping to make maps of its distribution area include Ermapper 6.4, ArcGIS 10, and ENVI 4.6 software.

![Landsat 8 Image Flow Diagram]
Result and Discussion

Mangroves survive in locations with steep slopes, big waves, and strong currents because they prevent the deposition of silt, which is necessary for life and growth. Mangroves are dicot plants that thrive in brackish water environments. Mangrove environments are often found where river mouths meet the ocean. This site was later designated as land protection against large sea waves. The global mangrove area is estimated at 15,429,000 hectares, with 25% covering the coastlines of the Caribbean islands and 75% covering other coastal areas such as South America and Asia. According to a 1999 estimate, the area of mangrove forests in Indonesia was around 8.60 million hectares, of which 5.30 million hectares were damaged.

The most common types of mangroves found in Indonesia include api-api mangroves (Avicennia sp.), (Rhizophora sp.), tancang (Bruguiera sp.), and bogem or pedada (Sonneratia sp.). One example of the Langkat district is Lubuk Kertang. Lubuk Kertang is the coastal village of Brandon Barat, Langkat Regency. It is the largest village among other villages and sub-districts, with an area of 34% of the total area of the sub-district, which is 3,026 Ha. In 2010, the mangrove forest area was 1200 Ha. With good forest conditions around 235 Ha (19.58%), moderate conditions around 225 Ha (18.75%) (Hafni, 2016).

From the observations made by researchers, there were about 18 species of mangrove vegetation including Avicennia marina, Nypa fruticans, Sonneratia alba, Rizophora apiculate, Avicennia rumphiana, Scyphiphora hydrophyliacea, Lumnitzera littorea, Aegiceras corniculum, Avicennia officinalis, Rizophora rumphiana, Aigeceras hydrophyliacea, Scyphiphora hydrophyliacea, Sonneratia alba, Aigeceras corniculum, Rhizophora apiculate, Avicenniam marina, Rhizophora mucronata.

The form of distribution of spatial analysis is now known with three varieties, namely: random, clustered (clustered or aggregated), and uniform (Cressie, 2015). Random Spatial Distribution does not require unique demands and does not depend on few and limited resources (generalist species) created by homogeneous environmental conditions (Barrachina-Munoz et al., 2019; Schabenberger & Gotway, 2017). Meanwhile, the distribution pattern of groups and uniforms can indicate whether or not there is a limiting variable in the environment that determines the existence of a species population at that location (MacArthur, 1984). If a tree species is known to spread in groups, it can be assumed that individuals from the same tree species will be found in the same location (Irni, 2022).

Remote sensing method (Image Representation) is used to collect information about the area spread across the Pangemang Muara Badak bay (Schott, 2007). First, the image data is cropped because a single scan image data usually covers a large area, but the research area is very limited, so the image data is cropped because the data obtained from the scene is not all of the data used. The cropped image is then used to attempt image recovery using geometric and radiometric corrections (Gao et al., 2017; Shorten & Khoshgoftaar, 2019). The purpose of using Edit Transform Limit is to enhance the original data obtained from the uneven surface of the earth, as well as to improve the visual quality and correct each pixel value in the processing process (Sheikh & Bovik, 2006). The image is then sharpened using the Contrast Enhancement technique at 99% or by combining the three Green, Blue, and Red bands in the Edit Transform Limit tool (Somvanshi et al., 2018). From the results of the analysis found mangrove plant species at 3 coordinate points, namely in Table 1.

<table>
<thead>
<tr>
<th>Coordinate Point</th>
<th>Type of Mangrove</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nypa fruticans</td>
</tr>
<tr>
<td></td>
<td>Sonneratia alba</td>
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<tr>
<td></td>
<td>Avicennia rumphiana</td>
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<td></td>
<td>Lumnitzera littorea</td>
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<td></td>
<td>Avicennia officinalis</td>
</tr>
<tr>
<td></td>
<td>Avicennia officinalis</td>
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<tr>
<td></td>
<td>Rizophora apiculata</td>
</tr>
<tr>
<td>0:12:40:46S_117:26:1:52E</td>
<td>Aegiceras corniculum</td>
</tr>
<tr>
<td></td>
<td>Lumnitzera littorea</td>
</tr>
<tr>
<td></td>
<td>Rizophora apiculata</td>
</tr>
<tr>
<td></td>
<td>Scyphiphora hydrophyliacea</td>
</tr>
<tr>
<td>0:12:31:99S_117:25:57:16E</td>
<td>Avicennia marina</td>
</tr>
<tr>
<td></td>
<td>Avicennia officinalis</td>
</tr>
<tr>
<td></td>
<td>Nypa fruticans</td>
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<td></td>
<td>Nypa fruticans</td>
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</tbody>
</table>

From the data above, the type of mangrove plant that ranks first is Rhizophora where this plant has the highest species density value of all existing mangrove species, which is equal to 900 Ind/400m. Rhizophora is a type of mangrove plant that has a fruit length of 1.9 cm, an average of 52 cm, and a fruit weight of 56 gr (Matatula...
et al., 2021). This mangrove variety contains bioactive substances such as triperthenoids, flavonoids, tannins, saponins, and steroids, as well as hydroquinone phenolic compounds, which can be obtained from mangrove fruit extracts (Purwaningsih et al., 2013). Mangroves grow on the shoreline and are most commonly seen near estuary-river boundaries. This mangrove plant has the characteristics of living in groups, has large roots, and produces fruit (Victória et al., 2020).

Conclusion

There are 18 types of mangrove plants in Langkat district, namely Avicennia marina, Nypa fruticans, Sonneratia alba, Rizophora apiculate, Avicennia officinalis, Avicennia rumphiana, Aegiceras corniculatum, Rizophora rumphiana, Aigeceras hydrophyliacea, Scyphiphora hydrophyliacea, Avicenniam marina, Scyphiphora hydrophyliacea, Soneratia alba, Aigeceras corniculatum, Lumnitzera littorea, Rhizophora apiculate, Rhizophora mucronata. The pattern of distribution of mangrove plants in groups is based on the tendency of mangrove species to inhabit their preferred environment.

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Conflicts of Interest
The authors declare no conflict of interest.

References


