

## Spatial Analysis of Limboto Lake

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### Abstract

Remote sensing satellite imagery data can be used to monitor the condition of the lake, especially the lake area at certain times, especially the extent of Lake Limboto. The purpose of this research is to know the area of Limboto Lake using Landsat-OLI 2015 satellite image data. The research method used is image data processing which includes image cutting, image reinforcement, RGB color composite (R = NIR + SWIR, G = NIR, B = NIR-Red), and the image classification is done by digitizing directly on the screen (on screening digitizing) by considering the presence of water vegetation. Furthermore, data analysis is done by calculating the extent of Lake Limboto on the image of classification results. The results showed that the area of Lake Limboto in 2015 was 2,943 hectares.

Keywords: spatial analysis; lake; Limboto Lake.

### Introduction

The waters of the lake is one form of freshwater ecosystems that exist on the surface of the earth. In general, the lake is a common groundwater that has an important function for development and human life. Lake Limboto is one of the lakes that has abundant natural resource potential and is located in Gorontalo Province. This lake is located in lowland areas with varying heights ranging from 5-10 meters above sea level (Prawiradisastra, 2001).

Today the breadth and depth of Lake Limboto has undergone a very significant change. In 1932 the average depth of Lake Limboto was 30 meters with an area of 7,000 hectares (ha), and In 1961 the average depth of the lake was reduced to 10 meters and the area became 4,250 ha. While the year 1990-2008 the depth of Lake Limboto an average of 2.5 meters with an area of 3000 ha (Akuba, et al, 2009).

Monitoring the environment of Lake Limboto needs to be observed early because it has been degraded (declining quality), which is mostly caused by land conversion, such as conversion of forest land into agricultural land and other land use. The land changes can be mapped well using remote sensing technology. According Kartika, et al (2012) that remote sensing technology has several advantages,

namely: in terms of wide area coverage; Its continuous information (not just at certain points but thorough throughout the observed area); Can be obtained periodically; And operating costs are relatively cheap. Especially for monitoring, remote sensing data can be obtained periodically because it has multi-temporal properties, which means that data in the same region within a certain time period will be recorded, the time period depends on the satellite.

The above description provides an interpretation that the effort to obtain information about the lake area is considered important to do in terms of determining policies for more effective management of Lake Limboto management. This research utilizes remote sensing data to see the extent of Limboto Lake using Landscape Image of Landat Operational Land Imager (OLI) in 2015. This research is expected to be useful for society and policy makers can be input and information in planning of Limboto Lake arrangement. And for the researchers can be input for research related.

### Research Methodology

This research was conducted at Lake Limboto Gorontalo Province. Map of research location can be seen in Figure 1.

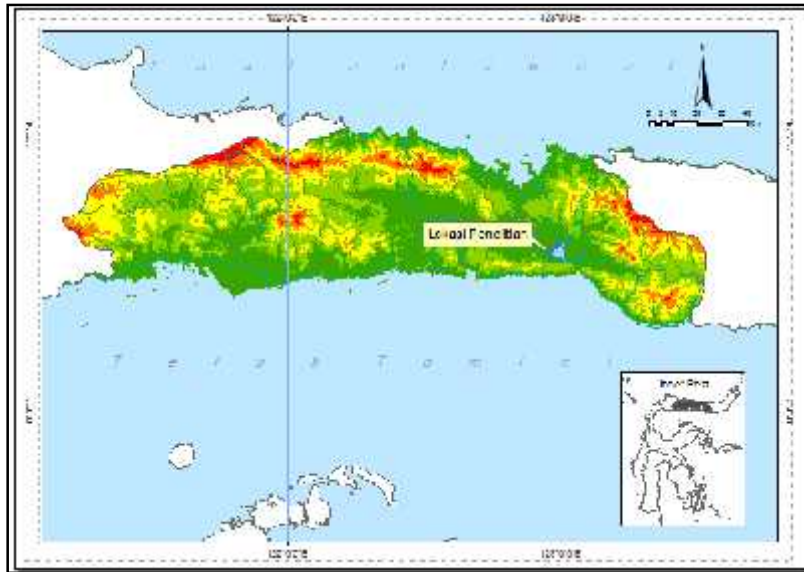


Figure 1 Map of research site

The tools and materials used in this research are Landsat Image Operational land imager (OLI) acquisition March 25, 2015, Computer / laptop, software integrated land and water information system (ILWIS) version 3.6, ArcGis software package version 9.3.1, and Canon brand printer.

The research method used is image data processing which includes image cropping in study area, image reinforcement. RGB color composite (R =

NIR + SWIR, G = NIR, B = NIR-Red) in image data (Trisakti, 2012) and image classification by digitizing directly on the screen. The final stage of data analysis is done by calculating the lake area on the image of the classification results.

#### Result and Discussion

##### Image cropping

The image cropping is shown in Figure 2 below.

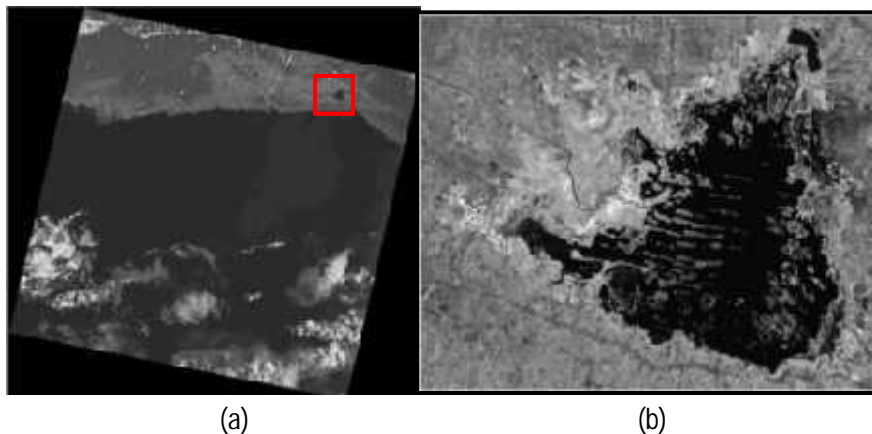


Figure 2 Images, (a) Landsat full scene, (b) Cropped image as the study site

Figure 2 shows that prior to the cropping, the study area appears not to focus on the image (Figure 2a). However, after the image cutting, obtained regional of interest (ROI) as the study area (Figure 2b).

##### Image sharpening

The results of image reinforcement are shown in Figure 3.

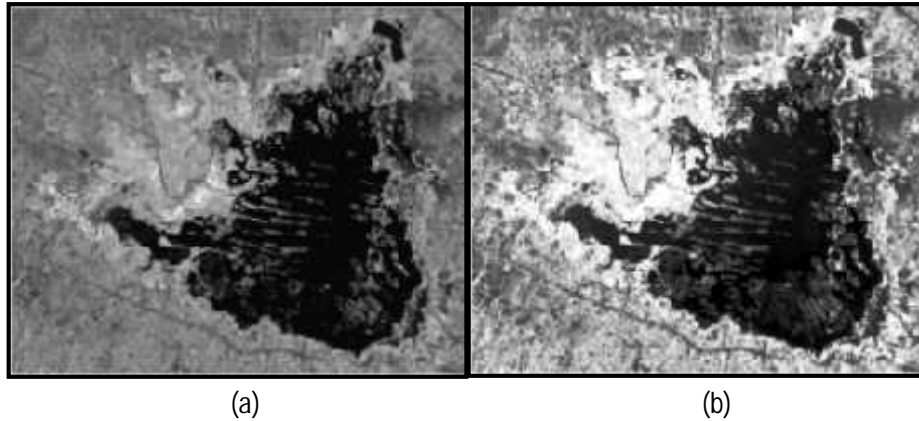


Figure 3 Results of image reinforcement, (a) Before, (b) After

According to Figure 3, it can be seen that prior to the shading of the image the feature hue appears darker (Figure 3a), but after the image reinforcement, the feature hue is seen increasingly clear (especially brighter) especially on the water vegetation object (Figure 3b).

#### Color composition image

The result of the color composite in the image is presented in Figure 4.

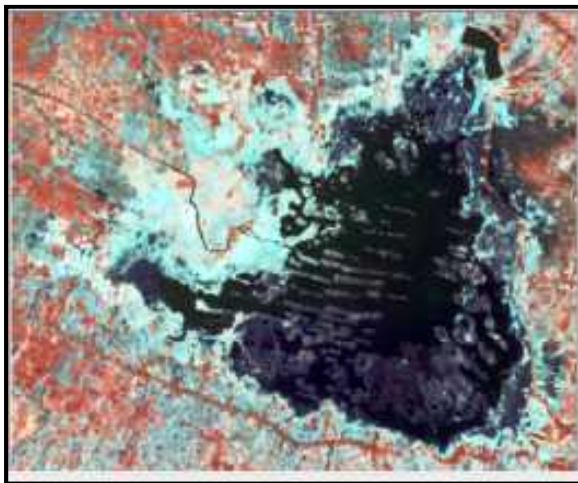


Figure 4 Result of color composite on image of 2015

Based on figure 4 above shows that each object in the composite image of Year 2015 can be clearly distinguished. Water objects in the Year 2015 image are black. While the water vegetation is thick white. Other colors are objects on land such as open land, settlements, roads, and others.

#### Image classification of composite result

The classification results are presented in Figure 5a and 5b..



Figure 5a Color composite on 2015 image result of digitation

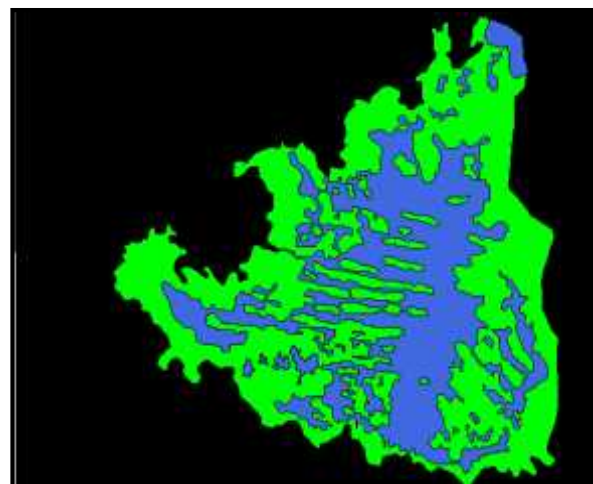


Figure 5b Color composite on 2015 image result of polygonize

The digitizing results are given a green color for the water vegetation class, the blue color for the water body class, and the black color for the land class. After all classes have been digitized (Figure

5a), they are then converted to vector data by plotting raster data into vector data (polygonize) (Figure 5b).

Image interpretation

The results of the Limboto Lake boundary interpretation taking into account the aquatic vegetation of 2015 are shown in Figure 6.

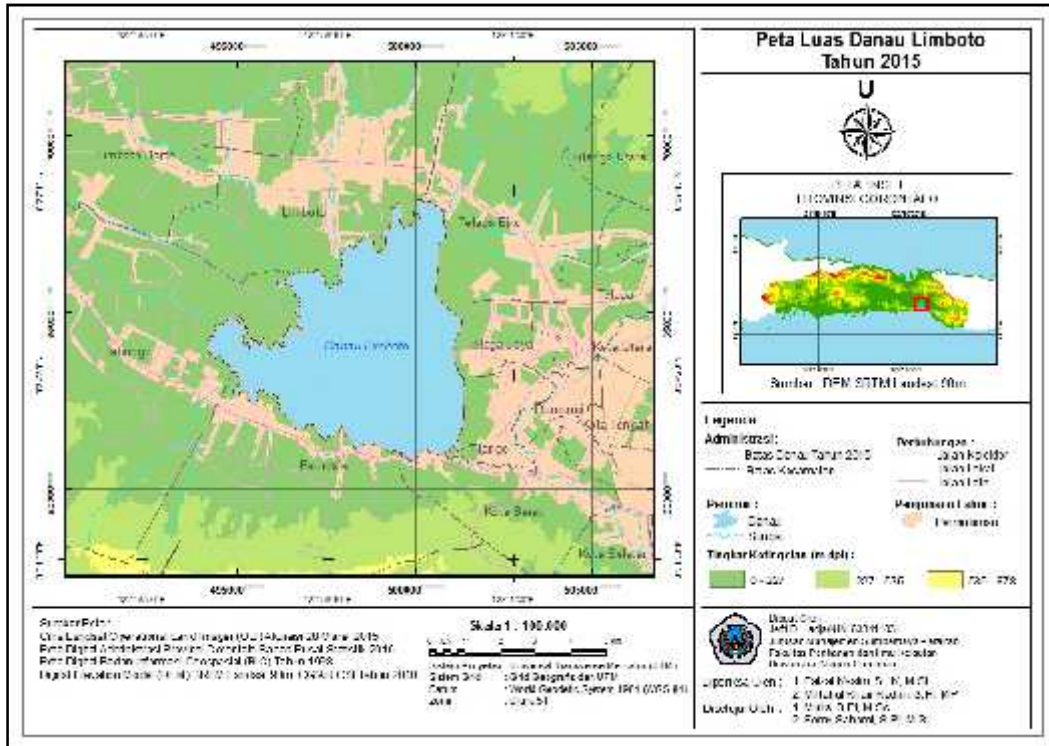


Figure 6 Map of Limboto Lake in the year 2015

Figure 6 shows that the width of the water body is marked by a blue area, while the area of the lake is marked by the red line boundary. Boundary of lake water surface taken by observing the existence of water vegetation (see the result of classification in Figure 5). According to Trisakti (2012) that the water surface of the lake by paying attention to water vegetation means that the water vegetation in the lake is included as part of the lake, so that the water surface of the lake is the total area of lake water visibility and the surface area of water vegetation in

the lake water surface. Based on the results of image analysis can be seen that the area of lake water limboto in 2015 ie 11,321,011 m<sup>2</sup> or 1,132 hectares, while the area of water vegetation is 18,107,126 m<sup>2</sup> or 1,811. If the width of the water body and the total area of water vegetation is summed, it means that the area of Lake Limboto Year 2015 is 2,943 hectares. The water area and the extent of the water vegetation resulting from the image analysis are shown in Figure 7.

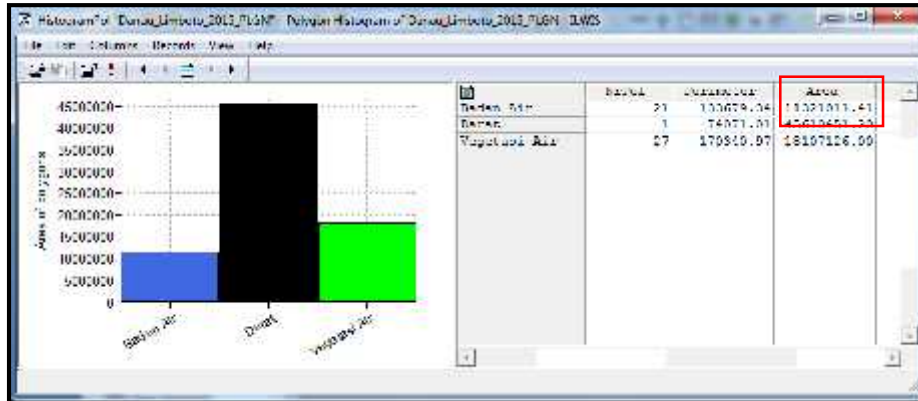


Figure 7 The area of water bodies and the water vegetation resulting from the image analysis

### Conclusion and Suggestion

Based on image data analysis, obtained by Limboto Lake Area in Year 2015 of 2,943 hectares. Spatial information about the extent of the lake is still very rare, especially in Lake Limboto. So this

research needs to be continued and developed using satellite image data that has higher resolution (eg Spot image data or others). This information is very important to formulate a more effective management of Lake Limboto.

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