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LAND COVER CLASSIFICATION WITH OBIA METHOD (OBJECT BASED IMAGE ANALYSIS) IN PADANGWEST DISTRICT, PADANG CITY

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Abstract: High population growth has an impact on the development of a region. Therefore, the need for the latest information regarding land cover obtained through data processing using remote sensing techniques. This land cover monitoring utilizes object-based SPOT 7 satellite imagery data (OBIA) in West Padang District, Padang City. This research was conducted with the aim of knowing the level of accuracy of the OBIA method in land cover classification on SPOT 7 Imagery. The OBIA method consists of two stages, namely segmentation and classification with the Train Maximum Likelihood Classifier algorithm. In this study, there were 10 land cover classifications and resulted in an overall accuracy of 95% and a kappa accuracy of 94%.

Keywords: OBIA, Land Cover, SPOT 7.

1. INTRODUCTION

Indonesia is a country that has the largest population with high population growth. This affects the level of demand for land. One factor that affects land cover is population growth (Bintarto, 2006). Higher population growth will affect land cover because everyone will use the land according to their needs.

Land cover is an important factor in environmental studies and natural resource management (Abdullah et al, 2019). Land cover information is important for regional development planning and monitoring to ensure optimal land use. One method that is often used to obtain land cover information is remote sensing. Processing of satellite image data is in the form of a classification that produces a land cover map.

The OBIA (Object Based Image Analysis) method is a technique for extracting information from more precise remote sensing data. OBIA does not only depend on the spectral value but also the spatial aspects of theobject (Wibowo Tunjung and Suharyadi, 2012). OBIA with specifications whose analysis process is based on spectral and spatial appearance is considered capable of accommodating images with object appearance from low to high spatial resolution images.

The OBIA classification can be used in this study, because Padang Barat District is in the Central Business District (CBD) area. This area is a business and commercial center that is passed by one of the main roads. This condition requires the latest information on land cover which can be obtained from OBIA. This study aimsto determine the level of accuracy of the OBIA method in land cover classification on SPOT 7 Imagery in WestPadang District, Padang City.

2. RESEARCH METHOD

The type of research used is descriptive analysis method with a quantitative approach. This quantitative descriptive approach was completed with research variables in the form of land cover maps of West Padang District, then the data will be analyzed and tested for accuracy using the existing formula, namely Kappa analysis with OBIA classification. The descriptive research method used in the quantitative approach aims to describe or explain a situation that is currently happening in the form of numbers so that it further strengthens the analysis in making a conclusion. The results obtained from the research calculations are then presented in writing. The research flowchart is shown in Figure 1.

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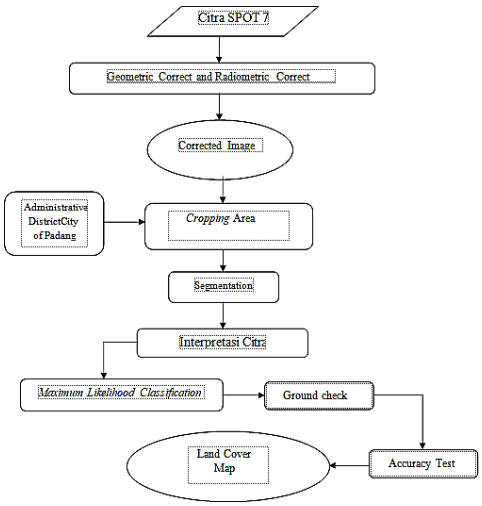

Figure 1. Research Flowchart

2.1 Identification of Land Cover in SPOT 7 Imagery

Identifying land cover in SPOT 7 imagery can utilize a combination of bands 1-2-3 (True Color) to facilitate interpretation because it produces object colors according to the colors seen by the ordinary human eye. Types of land cover can be analyzed by interpreting the resulting image based on its interpretation elements (hue/color, size, shape, texture, pattern, height, shadow, site, association) and determining the land cover class refers to the land cover class according to SNI-7645 of 2010.

2.2 Image Classification

2.2.1 Maximum Likelihood Classification

The Maximum Likelihood Classification evaluates quantitatively the variance and correlation of the category's spectral response patterns when classifying unknown pixels. The process of image classification using the maximum likelihood classification method is carried out using training samples or regions of interest (ROI) that have been made, and then running with the maximum likelihood classification tools.

2.2.2 OBIA (Object Based Image Analysis)

The OBIA method is a classification process that does not only consider spectral aspects but spatial aspects of objects (Wibowo Tunjung and Suharyadi, 2012). The OBIA method has two stages, namely the first stage of segment formation and the second stage of class assignment. Segmentation produces an object shape from a set of pixels that have the same spectral value (homogeneous).

3. RESULTS AND DISCUSSION

3.1 Research Results

3.1.1 Image Segmentation

Several parameter combination experiments were carried out to get good segmentation results. The combination of segmentation parameters used in this study are: Spectral detail 18, spatial detail 15, and minimum segment size in pixels 20. This is because the segmentation parameters, the resulting segmentation can already represent the desired object.

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Table 1. Segmentation Parameters

Segmentation	Spectral Detail	Spatial Detail	Minimum Segmen Size	Results
1	18	15	20	
2	20	20	20	
3	15	15	20	

Source: Analysis Results, 2023

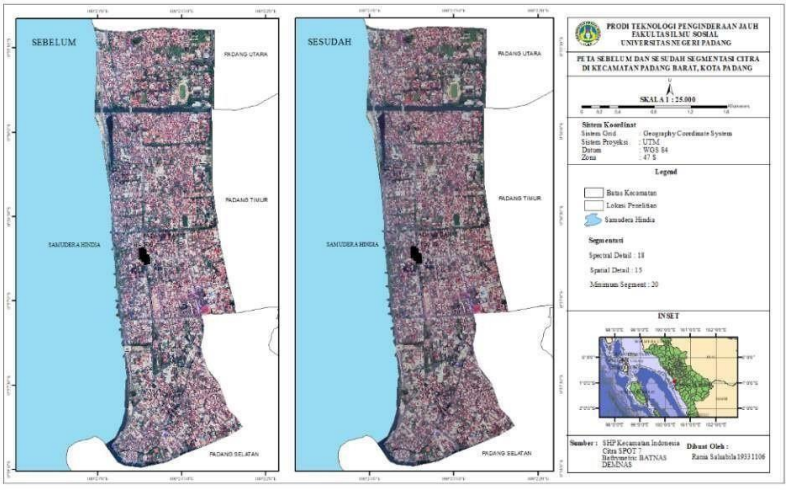

Figure 2. Image Segmentation

3.1.2 OBIA Classification

From the segmentation results that have been carried out, the land cover classification process is continued using the object-based classification method (OBIA) with the Train Maximum Likelihood Classifier algorithm.

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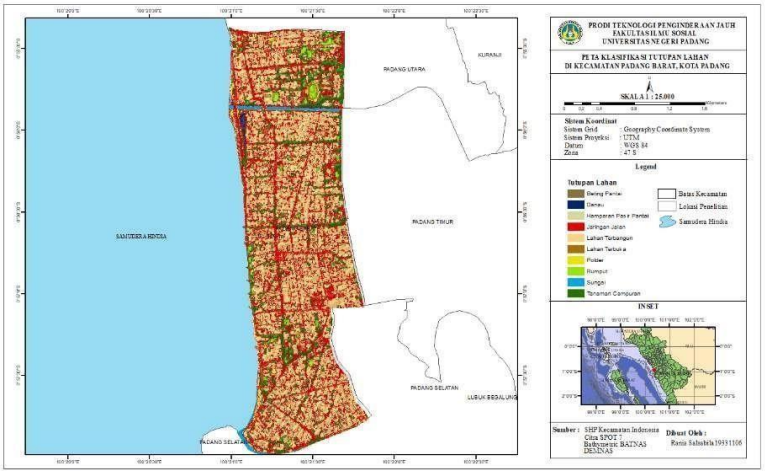

Figure 3. Land Cover Map

Table 2. Land Cover Results for 2021

No	Land Cover	Area (Ha)
1	River	5,83972
2	Lake	4,28026
3	Grass	15,72788
4	Built-up Land	355,82775
5	Road Network	194,31565
6	Mixed Plants	62,31313
7	Open field	3,27642
8	Shoal Shoal	45,55526
9	Sand Beach	5,65641
10	Polder	7,27602
Amount		**700,068499**

Source: Data Processing, 2023

3.1.3 Accuracy Test

Sampling points using random sampling method. The number of points taken on the ground check is 23 points. Determination of the number of samples is determined based on the formula (McCoy 2005).

$$N = \frac{Z^2}{E^2}(p)(q)$$

Information:

N : Number of sample points.
Z : Standard Deviation with a value of 2.
p :Accuracy expected 85%
q : 100 – p.
E: Accepted error 15%

$$N = \frac{2^2}{15^2}(85\ \%)(100\text{-}85\ \%) = 23 \text{ (sample point)}$$

From the results of the ground check that was carried out with a total sample of 23 points, 22 correct values were obtained and 1 point was incorrect. To determine how accurate the level of image accuracy from the ground check results can be calculated as follows:

$$\text{Overall Accuracy} = \frac{Correct\ Number\ of\ Dots}{Number\ of\ Survey\ Points} \times 100\ \%$$

$$= \frac{22}{23} \times 100\ \% \qquad = 95\ \%$$

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Kappa Coeficient (T) = ((TSxTCS)-∑(Colum TotalxRow Total))/(TS^2-∑(Colum TotalxRow Total)) x 100
= (22*23)-(2*2)+(2*2)+(1*1)+(6*7)+(4*4)+(3*3)+(1*1)+(1*1)+(1*1)+(1*1)}/529
{(2*2)+(2*2)+(1*1)+(6*6)+(4*5)+(3*3)+(1*1)+ (1*1)+(1*1)+(1*1)} = 94 %

Tabel 3. Accuracy Assessments Table OBIA year 2021

	SPOT 7										
Classification	River	Lake	Grass	Built-up Land	Road Network	Mixed Plants	Open field	Shoal Shoal	Sand Beach	Polder	Total (Users)
River	2	0	0	0	0	0	0	0	0	0	2
Lake	0	2	0	0	0	0	0	0	0	0	2
Grass	0	0	1	0	0	0	0	0	0	0	1
Built-up Land	0	0	0	6	1	0	0	0	0	0	7
Road Network	0	0	0	0	4	0	0	0	0	0	4
Mixed Plants	0	0	0	0	0	3	0	0	0	0	3
Open field	0	0	0	0	0	0	1	0	0	0	1
Shoal Shoal	0	0	0	0	0	0	0	1	0	0	1
Sand Beach	0	0	0	0	0	0	0	0	1	0	1
Polder	0	0	0	0	0	0	0	0	0	1	1
Total (Producer)	2	2	1	6	5	3	1	1	1	1	23

Source: Data Processing, 2023

3.2 Research Discussion

3.2.1 Image Segmentation

In land cover segmentation research, spectral detail is expressed in terms of hue and color, for example: bodies of water are blue, vegetation is green, and built-up land looks like its original color is reddish. Meanwhile, the results of spatial detail are expressed in terms of size, for example: a body of water is medium in size, vegetation is medium in size, and built-up land is large in size. Meanwhile, from the texture, it can be seen that the body of water has a fine texture, the vegetation has a rough texture, and the built-up land has a relatively coarse texture. Judging from the pattern, for example: water bodies have a linear pattern, vegetation has a grid pattern, and built-up land has a grid pattern.

Segmentation that results in polygon sizes exceeding objects will result in over- segmentation because too many objects can cause classification to become complex. Segmentation whose size is less than the size of the object will cause under segmentation. In this study, objects that experience under-segmentation, that is, there is one point where the segmentation of built-up land is joined to the segmentation of the road network. This may be because the pixel values of the areas in the image are almost the same or even the same.

3.2.2 Classification of OBIA

Land cover classification uses the OBIA method with the Train Maximum Likelihood Classifier algorithm contained in ArcGIS 10.8. Obtained land cover classes of 10 classification classes, namely: rivers, lakes, grass, built-up land, road network, mixed cropping, open land, beach shoals, stretches of beach sand, and polders. The dominant land cover in the OBIA classification in the West Padang District area is built-up land of 355.82775 ha. Land cover with the smallest area is open land of 3.27642 ha.

3.2.3 Accuracy Test

The accuracy test of the classification results was carried out to test the level of accuracy of the maps produced from the digital classification process with test samples from the results of field activities. The method used to calculate classification accuracy uses kappa accuracy with the help of a confusion matrix.

According to Catur (2015), the results of the classification process are acceptable if they have a kappa accuracy value of more than or equal to 85%. The accuracy test of the object-based classification results on SPOT 7 imagery uses a confusion matrix calculation resulting in an overall accuracy of 95% with a kappa coefficient of 94%. Based on the calculation results of the overall accuracy and kappa accuracy obtained, it shows that the results of the object-based land cover classification research are considered correct and acceptable.

4. CONCLUSION

Classification of land cover using SPOT 7 imagery with the OBIA method in West Padang District, Padang City resulted in 10 land cover classifications based on the SNI classification scale of 1:25,000, namely: rivers, lakes, grass, built-up land, road networks, mixed crops, open land, shoals' beaches, stretches of beach sand, and polders. Object-based classification using high-resolution imagery is very effective in classifying land cover in West Padang District, Padang City. The classification results show a fairly high level of accuracy, namely 94%, so that it can be ensured that the OBIA method is able to provide accurate and reliable information about land cover in the area.

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