Special Analysis For Predicting Changes In Mangrove Forest

Yumna, Irman Halid

Abstract: This study aims to determine the mangrove forest land cover change and farms based on the interpretation of satellite imagery and predict the extent and determine the area of mangrove rehabilitation based on the rate of change in land cover and land suitability analysis is based on the physical parameters of mangrove forests in the district Ponrang, Luwu. Land suitability classification refers to the Land Suitability Classification Framework Method According to FAO (1976) are divided into three classes, namely suitability Great Fit (Highly Suitable), Self-keeping (Moderately Suitable) and Not Available (Not Suitable). The parameters used in the texture of the soil, slope, salinity, temperature, flow velocity, wave and tidal. Making the land suitability analysis model for the growth and development of mangrove ponds Silvofishery system using weighted overlay (overlaying weighted). The study concluded that the analysis of the changes by using the image data in 1994 and 2002 image shows a reduction in mangrove area of 269.16 ha, whereas farms have additional land area of 587.65 ha. The pace of change by using the image data in 2002 and 2013 image shows an area of 36.28 ha of mangrove reduction and addition of 85.5 ha of pond area. Analysis of the trend of changes in the area of mangroves generate predictions of mangrove area in 2023 or 10 years down the road is 88.1 ha. Based on the analysis of land suitability, the area that includes the appropriate category for the development of Silvofishery pond has an area of 557.86 ha and the area is very appropriate criteria included its range of 1071.98 ha. As for the category Mismatch has an area of 301.67 ha.

Index Terms: Spatial, Prediction, Change, Mangrove, Rehabilitation, Sylvofishery

1 INTRODUCTION

Increased utilization of mangrove forest land causing increasingly desperate state of mangrove forests and endangered. Therefore, in dire need of a system of integrated environmental information, actual, and periodically. Methods of analysis such as identification of damage and changes in coastal ecosystems need to be strengthened with models of Geographic Information Systems (GIS) which can be utilized for planning a response. Research conducted Parvati et.al, (2004)[1] in Space agency (2006) stated that the results of the analysis of broad changes cover / land use remote sensing data with different acquisition date can describe the dynamics of water conditions Segara Anakan. Changes that occur in a span of 25 years, namely, from 1978 to 2003 can be used to predict the conditions that will occur next few years. Management of mangrove forests in the coastal areas became part of Luwu especially in Sub Ponrang not be separated from the dynamics of the changes due to various factors either by man or nature. Therefore, we need an overview and analysis of spatially through a study using remote sensing technology and Geographic Information Systems to be able to predict changes in the area of mangrove ecosystems in District Ponrang, so that later can be used as the data and information to the relevant authorities. Ditch embankment (sylvofishery) is an integrated activity between aquaculture fisheries (fish, shrimp and crab) with the maintenance and preservation efforts of mangrove forests. The purpose of the ditch embankment is to prevent the widespread destruction of mangrove forests / mangrove, and to restore and preserve the brackish water ecosystems and the green line the coast, through the use of land so as to provide maximum benefit to the environment of mangrove ecosystems.

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Implementation of activities in the forest mina area of mangrove forest ecosystems in general is expected to prevent the destruction of the region by the public as it will provide an alternative source of income for people in the area. As for the forest dwellers, can be provided employment as trader to make mina forest area as a tourist area as happened in Blanakan and Cikeong, Bali and South Sulawesi Sinjai. Thus, the area of forest mina can double that maintain and preserve ecosystems and provide employment for the community (Wibowo, K. and T. Hand, 2006)[2]. The purpose of this study was to determine the changes in land cover mangrove forests and farms based on the interpretation of satellite imagery and predict the extent of mangrove forests.

2. RESEARCH METHODS

This study includes land cover classification ponds and mangrove period of 1994-2013 and forecast changes in the Year 2023. The tools used in the form of Global Positioning System (GPS), stationery and digital cameras. The analysis of data using ArcGIS 9.3, ERMapper 7:01, and Microsoft Excel. Materials used were Landsat Satellite Image Data 8 in 2013, Landsat 7 ETM + 2002, Landsat Satellite Image and Map TM5 1994 RBI (RBI) BAKOSURTANAL issue.

Data Collection

This phase includes the collection of secondary data, either satellite image data, the data complementary and literature relevant to the research topic.

Preliminary Field Survey

Initial surveys conducted field recognition (field orientation) and the condition of the mangrove ecosystem in the study area. Activities carried out by measuring and recording the coordinates by using the Global Positioning System (GPS).

Cutting Data Image (Cropping)

Cutting the image data is done to minimize coverage of the study area is on land cover Ponrang coastal areas in the district. The data of the scene generally cover a large area most of South Sulawesi. This is done to minimize the file size is used and accelerate processes in data processing using the software

Introduction to Object Land Cover

Separation of an object on the Landsat-ETM + can be done easily by creating a composite channel combinations of colors (Red Green Blue). Interpretation of the coastal land cover typically use a combination of channels 543, which is giving a red color to the channel 5, the color green for channel 4, and blue for channel 3, based on the wavelength and channel function on Landsat ETM + satellite. Channel 4 is very helpful in the identification of plants and strengthening the contrast between the plants with soil and land with water, channel 5 is important to study the appearance of the land, while the channel 3 is an important channel for the separation of vegetation, Amran (2000) in Sham (2004)[3].

Guided Classification (Supervised Classification)

Supervised classification method was guided and controlled largely or entirely by the user in the process of classification. User intervention began training area determination to stage clustering. Supervised classification in this case requires the ability of the user in control of land information for the study area through the implementation of field surveys (Ground Truth).

Field Survey (Ground Truth)

These activities are carried out to determine the training area as a representation of the appearance of each object on the satellite image before classification. Checking in the field using GPS. In the process Determination observation point also considering the ease in reaching the observation area.

Analysis of Mangrove Area of Change and Farming

This analysis is mainly to observe changes in land cover using data which compare two multi-temporal imagery / data classification results, the merger between land cover classification in 1994 to 2002, and 2002 and 2013 will be known changes in land cover. Broad and changes can be calculated from the number of pixels in each group or class multiplied by the size of the pixel. The formula used is:

Area (ha) = (number of pixels) x (30m x 30m spatial resolution) x 0.0001... (1)

Where 1 pixel (spatial resolution) = 30m x 30m and the value of the conversion 0.0001 m2 to ha. The tendency of the land changes that occur in each year is calculated by:

$$\Delta L = \frac{Lt_2 - Lt_1}{\Delta t} \quad \text{.................................. (2)}$$

Where ΔL is the rate of change of broad, LT1 is the area in the early observations (ha) and Lt2 is widespread in the next observation (ha). Δt is the difference between the initial observation period (years) and the end of the observation period (year). The results of the analysis of the changes by using the image data in 1994 and 2002 image is referred to as the rate of change of the first, then the results of the analysis of the changes by using the image data in 2002 and in 2013 the image is referred to as the rate of change is calculated using the equation II 1 and 2.

3. RESULTS AND DISCUSSION

Satellite Image Processing for Coastal Land Cover

The process of object recognition in satellite images using a combination of 543, making the vegetation has the appearance of bright green to dark, while for other objects displayed variegated colors. Mangrove vegetation and other terrestrial vegetation does have almost the same optical properties and are difficult to distinguish, but given the mangroves live on the coast (near the sea) compared to non-mangrove vegetation, it is usually between the two can be separated by a distance into account the influence of sea water. Mangrove area in the district Ponrang into the outer limits of the boundary between the ponds and water, so it is easy to interpret. Identification of coastal land cover done by supervised classification process that produces 5 classes in each image of the 1994, 2002, and 2013. The results of the classification is residential / farm, non-mangrove vegetation, wetland, mangrove, and ponds.

Analysis of changes in land cover and Mangrove Pond

Based on the analysis of change by using the image data in 1994 and 2002 image shows a reduction in mangrove area of 269.16 ha with an average reduction of 33.65 ha / year, while the ponds have additional land area of 587.65 ha with the average rate of change -rata of 73.46 ha / year. The pace of change by using the image data in 2002 and 2013 image shows an area of 36.28 ha of mangrove reduction with an average reduction of 3.3 ha / year. Changes in the area ponds and mangrove significantly occurred in the period 1994 to 2002. This was caused by a change in the pattern of land use by the local community, because at that time the success rate is very high aquaculture. To improve the cultivation, the community, especially fish farmers do to transfer my farm land extending enable mangrove wetland and convert land for new farms.

Predicted Changes in Area of Mangrove

The result of changes in the area of mangrove trend analysis using linear regression analysis with the equation y = -15,30x + 31 040 predictions mangrove area in 2023 or 10 years is 88.1 ha with an average annual change in trend is 8.81 ha . Prediction of the area is built on the assumption that the current mangrove conditions persist and there is no pattern of utilization or natural disturbances that make huge changes to the mangrove condition, for example conversion into a massive pond or a tsunami that make the mangrove area is reduced or even lost.

4. CONCLUSIONS AND RECOMMENDATIONS

Analysis of changes by using the image data in 1994 and 2002 image shows a reduction in mangrove area of 269.16 ha, whereas farms have additional land area of 587.65. The pace of change by using the image data in 2002 and 2013 image shows an area of 36.28 ha of mangrove reduction and addition of 85.5 ha of pond area. Analysis of the trend of changes in the area of mangroves generate predictions of mangrove area in 2023 or 10 years down the road is 88.1 ha.

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Attachment

Table 1. Land cover Coastal District of Ponrang

YEAR 1994			YEAR 2002			YEAR 2013		
No.	class Closure	Area (ha)	No.	class Closure	Area (ha)	No.	class Closure	Area (ha)
1.	Settlement / Gardens	351,27	1.	Settlement / Gardens	252,36	1.	Settlement / Gardens	253,78
2.	vegetation	1254,14	2.	vegetation	1582,78	2.	vegetation	1173,35
3.	field	2572,65	3.	field	2037,83	3.	field	2429,16
4.	embankment	1258,37	4.	embankment	1846,02	4.	embankment	1931,52
5.	mangrove	579,04	5.	Mangrove	309,88	5.	Mangrove	273,6

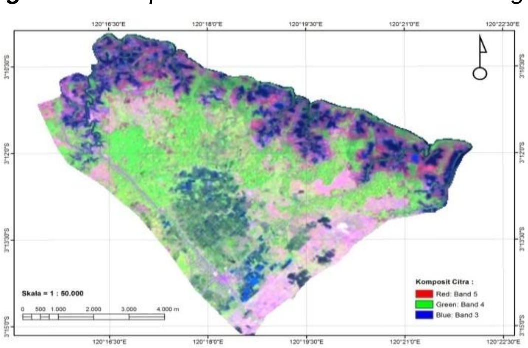
Source: Primary Data, 2013

Table 2. Results of the analysis of changes Area of Farming and Mangrove

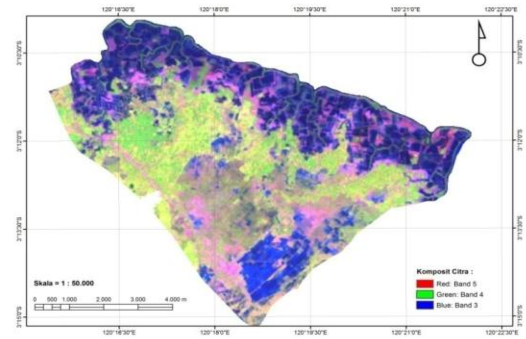
1994		2002		2013	
embankment	1258,37	embankment	1846,02	embankment	1931,52
Mangrove	579,04	Mangrove	309,88	Mangrove	273,6
The rate of change I		The rate of change II			
embankment	587,65	embankment	85,5		
Mangrove	-269,16	Mangrove	-36,28		

Source: Primary Data, 2013

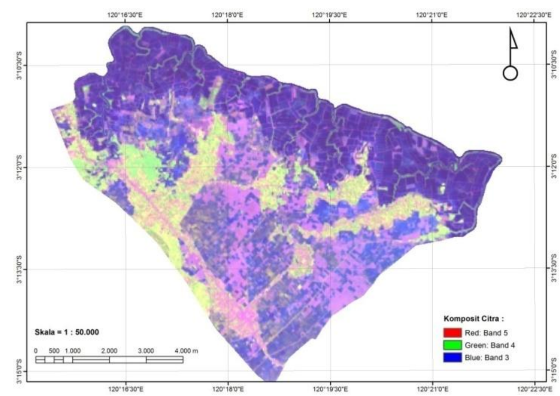
Figure 1. *Composite 543 Landsat Satellite Imagery*



a. Satellite Imagery LandsatTM5 1994 Composites 543

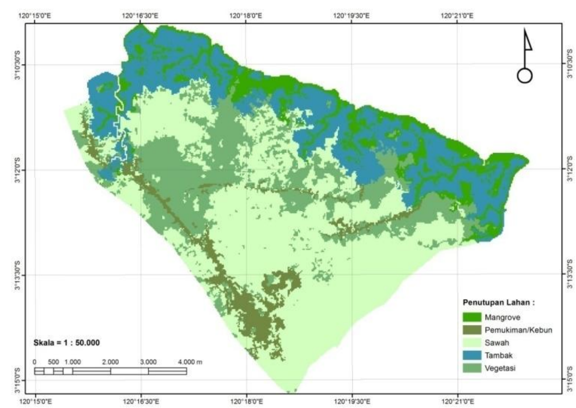


b. Landsat ETM + satellite imagery 7 2002 Composites 543

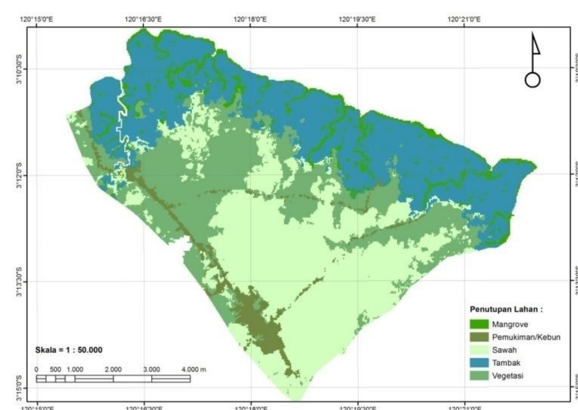


c. Landsat Satellite Image 8 of 2013 Composite 543

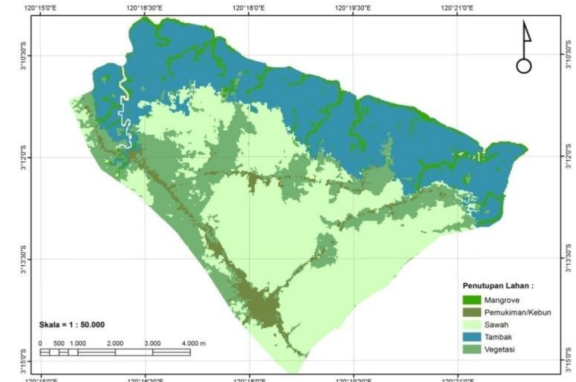
Figure 2. *Results of Satellite Image Classification*



a. Coastal Land Cover Classification Results 1994



b. Coastal Land Cover Classification Results 2002



c. Coastal Land Cover Classification Results 2013