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LAND COVER CHANGE MANGROVE ECOSYSTEM IN THE COASTAL AREA OF BUNGUS TELUK KABUNG PADANG CITY

*Lamis Tharra Fadhilah[1], Eni Kamal[1], Muzzneena Ahmad Mustapha[2], and Aprizon Putra[1 3]

*[1]Postgraduate Program, Water Resources, Coastal and Marine, University of Bung Hatta
[2]Center for Earth and Environment Science, University Kebangsaan Malaysia
[3]Department of Geography, Universitas Negeri Padang
Email: tharradila25@gmail.com
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ABSTRACT: The mangrove ecosystem is an ecosystem that grows above the brackish marshes that are located on coastlines and influenced by the tides of the sea water. The conditions of the mangrove ecosystem continue to experience widespread decline and change in density especially on the coastal area of Bungus Teluk Kabung. The study was conducted in June – August 2019. The purpose of this research is the major analysis of the rate of change of mangrove land cover, analysis of perception/community opinion about the conditions and efforts made by the Government of the mangrove and analysis of the condition of the mangrove ecosystem. The method used is a quantitative approach to descriptive. The result is a mangrove land cover of 2009 covering an area of 80.71 ha while the year 2019 is 60.35 ha, the rate of change (-25,23%/10 year), the change in mangrove area with a change rate of-100% found in the location of Teluk Sirih where the year 2009 (8, 82ha), and the year 2019 (0 ha). The change occurred due to the construction of the PLTU of Teluk Sirih. With the increase of mangrove ecosystem in the area of Pertamina Jetty because of the rehabilitation of local government. Its expansion in the year 2009 (3.06 ha) became the year 2019 (3.96 ha) with the addition of 0.90 ha and the rate of change of 29.41%. NDVI values of 2009 in 0.60 with normal vegetation density conditions and the year 2019 NDVI values in 0.42 with good vegetation density conditions.

Keywords: Landsat image, GIS, Mangrove Forest, NDVI, change, Bungus - Padang

1. INTRODUCTION

Mangrove forest or better known as "Mangrove" is defined as a community that lives in humid areas, muddy and influenced by ups and downs of [1-6] defines the Mangrove forest as a combined system of land and aquatic components that encapsulate plants and animals.

One of the Mangrove areas in Indonesia that is indicative of damage is West Sumatera region. The reduced area of Mangrove forests in Indonesia is estimated at 1.1% per year. Based on the development of data on the last Mangrove forest [6-7], the area of Mangrove Forest in 1982 approximately 4.25 million hectares, and in 1993, the area of Mangrove Forest lived 3.7 million hectares. But the realization seems to have not followed the feeling of recognised so that it is not able to treat mangrove forests in a wise and prudent. The evidence, after nearly a decade of public forest concept was socialized in Indonesia, the results still can not withstand the rate of forest damage. The function of Mangrove ecosystems in tropical areas has an important role for coastal ecosystem productivity. According to [8], Mangrove serves as a barrier to coastal erosion, expanding land into the ocean and organic waste processors, spawning places of shrimp, and potentially as an educational and recreational area. Nevertheless, the condition of the ecosystem is very sensitive to interference from the outside, especially from pollution activities, conversion of Mangrove forests into non-forest areas such as settlements, ponds and the exploitation of Mangrove results is excessive. When looking at the development of Mangrove conditions in Indonesia which relatively decreased both broad and function, it can be said that the management of this ecosystem still has not been done continuously. Mangrove species that are found in Indonesia, among others, is a type of api-api (*Avicennia sp*), Mangrove (*Rhizophora sp*), Tanjang (*Bruguiera sp*) and Bogem or Pedada (*Sonneratia sp*), is the main Mangrove plant that is widely encountered. The type of Mangrove is the Mangrove group that captures, withholds deposits and stabilizes the land of its habitat [9].

GIS technology integrates common database operations, such as query and statistical analysis, with unique visualization and analysis capabilities that are owned by the mapping. This capability distinguishes GIS from other information systems which makes it useful for various circles to explain events, plan strategies, and predict what is

happening [10, 17]. With the existence of GIS (geographic Information System) technology can be known how to change the rate of cover of Mangrove forest land, efforts undertaken by the Government and society and mangrove forest conditions at the research site in the sungai pinang region Bungus Teluk Kabung sub-district.

2. METHODS

Research conducted in June – August 2019, the location of research is divided into several places, namely, 1) Cindakir, 2) Dermaga Pertamina, 3)Teluk Kabung, 4) Teluk Kaluang, 5) Teluk Pandan and 6) Teluk Sirih. The selection of research site deliberately because of consideration of the location has undergone land change.

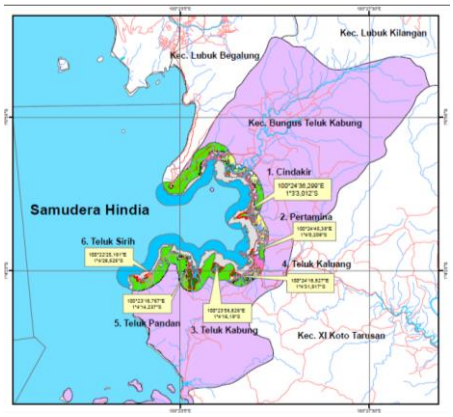

Fig 1. Location research of Bungus Teluk kabung

The analyst used in conducting this research in the form of land cover area calculation, calculation of land cover change and NDVI (Normalized Difference Vegetation Index) to see the condition of land cover ecosystem at the research site [11-12]. As well as an interview with the surrounding community to know the opinions of activities or changes in the mangrove ecosystem at some point of research location in Bungus, Teluk kabung sub-district.

Land cover extension Calculation

$$\mathbf{L} = \sum \mathbf{p} \times \boldsymbol{r} \times \mathbf{0,0001}$$

Description:
L = Area (ha)
$\sum \mathbf{p}$ = number of pixels
r = Landsat Special resolution 30×30 m
0,0001 = Conversion of m2 into (ha) [3, 12]

Calculation of land cover extension Change

$$\mathbf{V} = \frac{\boldsymbol{N2} - \boldsymbol{N1}}{\boldsymbol{N1}} \times \mathbf{100\%}$$

Description:
V = Change rate (%)
N1 = first year area (ha)
N2 = n-year size (ha) [13]

Mangrove Ecosystem conditions

$$\mathbf{NDVI} = \frac{\mathbf{NIR} - \mathbf{Red}}{\mathbf{NIR} + \mathbf{Red}}$$

Description :
NIR = *Nerar – Infrared* (infrared canal)
Red = Red (red canal) [3, 12]

3. RESULTS AND DISCUSSION

3.1 Analysis of LANDSAT satellite imagery for comparison of land cover

The results of the overlay of Landsat 5 TM 2009 and Landsat 8 OLI 2019, can be calculated change of land cover as well as mangrove area at the research site at some observation sample point. Here are the pictures of the result of land cover change 2009 – 2019.

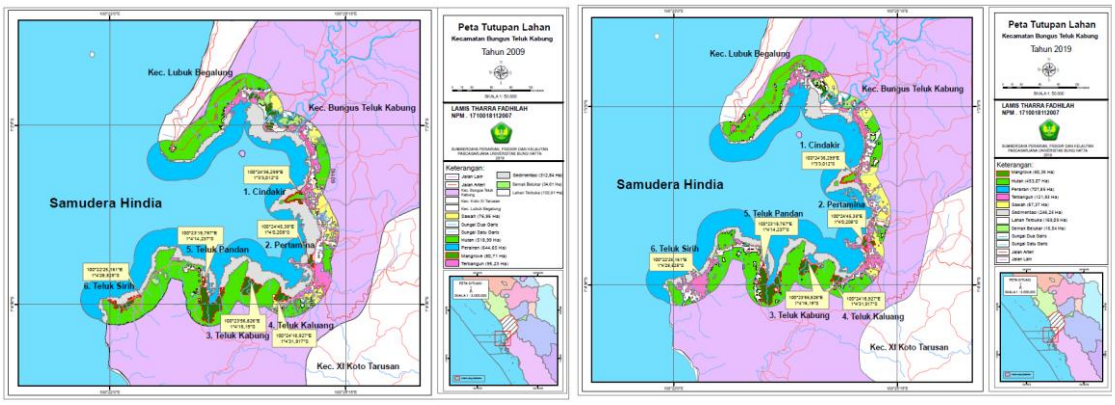

Fig 2. Land cover in 2009 and 2019

Table 1. Land cover in 2009-2019

No	LAND	Area (Ha) 2009	Area (Ha) 2019	Change (Ha)	Change rate (%)
1	Shrub	34,61	16,54	-18,07	-52
2	Forest	518,99	453,07	-65,91	-13
3	Emplacement	102,91	169,09	66,18	64
4	Mangrove	80,71	60,35	-20,37	-25
5	Water	644,65	707,85	63,19	10
6	Field	76,95	87,37	10,42	14
7	Sedimentation	312,84	246,25	-66,59	-21
8	Settlement	95,23	121,93	26,69	28
	Total	1.866,89	1.862,44	-4,45	4

Source: Analyse, 2019

Changes in land cover tend to decrease within 10 years, especially in mangrove ecosystems, in 2009 the total area of mangrove ecosystems was 80.71 ha and in 2019 decreased with an area of 60.35 ha, with an area of about 20.37 ha / 10 years impact on other biota, because with the reduction of mangrove ecosystems whose function is as a barrier to coastal erosion, expanding land into the sea and processing of organic waste and breeding grounds or spawning of a biota has been reduced, the biota will look for a protective place. Figure 3 describe the location of changes in mangrove ecosystems at various points of the study location.

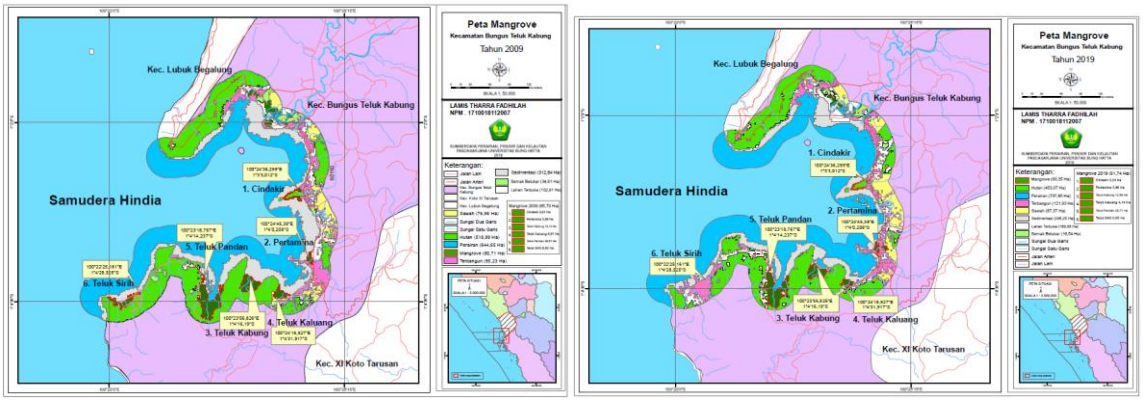

Fig 3. Map of Mangrove 2009 and 2019

Table 2. Area Mangrove Ecosystem 2009 – 2019

No	Location	Coordinate	2009	2019	Change (Ha)	Change rate (%)
1.	Cindakir	100°24’36,299” E, 1°3’3,012” S	3,51	2,24	-1,27	-36
2.	Pertamina	100°24’45,38” E, 1°4’0,208” S	3,06	3,96	0,90	29
3.	Teluk Kabung	100°23’56,826” E, 1°4’16,19” S	14,13	12,69	-1,44	-10
4.	Teluk Kaluang	100°24’18,327” E, 1°4’31,917” S	6,57	4,14	-2,43	-37
5.	Teluk Pandan	100°23’18,767” E, 1°4’14,237” S	29,61	28,71	-0,90	-3
6.	Teluk Sirih	100°22’25,161” E, 1°4’28,525” S	8,82	0,00	-8,82	-100
	Total		65,70	51,74	-13,96	-21

Source : Analyst, 2019

In table 2, explained the wide change of the mangrove nudge ecosystem decreased in the span of 10 years, except in the location of Pertamina which has increased the area of 0.90 ha from 2009 (3.06 ha) to 3.96 ha in 2019, this addition Occurs due to rehabilitation or mangrove planting conducted in Pertamina Jetty area, environmentally friendly assets conducted by the public helped to minimize the occurrence of coastal erosion (beach abrasion). Meanwhile, on the location of Teluk Sirih was reduced to 100% from 2009 (8.82 ha) to the year 2019 (0 ha), due to the development of PLTU (steam power Plant) in Teluk Sirih.

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3.2 Opinion analysis or community perception and effort made by the government

Results from some communities can be concluded that the existence of the mangrove ecosystem in the research is better than the previous year, the existence of activities from various intansi, TNI and Pertamina companies are concerned about the Mangrove ecosystem. According to the community, mangrove or mangrove forest is a forest area of the community and to reduce the beach abrasion at the site of research and society using mangrove land to become cages. In addition to being made in the mangrove land, some people who have mangrove land with private property rights have been certified as it happens in the location along the road, there is a sale of mangrove land and mangrove forest in the tripe.

Fig 4. Selling Mangrove land in Cindakir

With the effort made by the Government so that the condition of mangrove is maintained is rehabilitate mangrove forest by planting mangrove ecosystem, at some locations in the sub-district Bungus Teluk Kabung, as happened at the location of the pier Pertamina is experiencing an increase in the amount of land area, change the area amount of land because of the activities of planting mangrove based on eco-friendly.

3.3 Condition analyst of Mangrove area at research site

Knowing the mangrove ecosystem at the research site, analyzing using NDVI (Normalized Difference Vegetation Index). The density value of vegetation with the provisions of values in table 3 below.

Table 3. NDVI values with vegetation density

Vegetation density	NDVI values
Excellent	0,72-0,92
Good	0,42-0,72
Normal	0,22-0,42
Bad	0,12-0,22
Very bad	-0,1-0,22

Source: http://endeleo.vgt.vito.be/dataproducts.html

NDVI values derived from the calculation of digital calculators between imagery (band RED-NIR) and NDVI classification in 2009 and 2019 years. The value of NDVI 2009 obtained with the highest value of 0.60 and the lowest-0.87, while in 2019 the high NDVI value of 0.42 and the lowest is-0.92. These vulnerable values entered into good categories in the year 2009 and normal in the year 2019. Changes in mangrove conditions in the year 2009 are seen in Figure 8 and in the year 2019 in Figure 5 below.

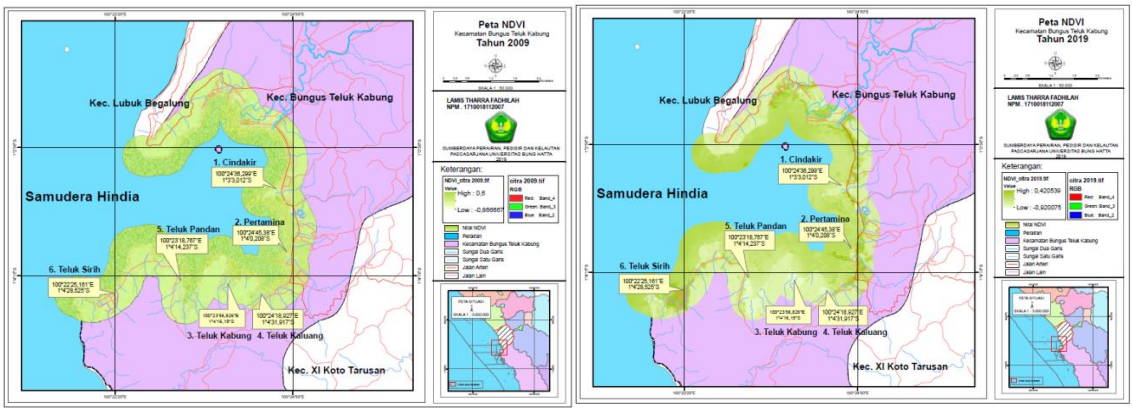

Fig. 5 NDVI Map of 2009 and 2019.

4. CONCLUSIONS

The change of nudge land cover decreased within 10 years, especially in the mangrove ecosystem, in the year 2009 the area of mangrove ecosystem of 80.71 ha and in 2019 decreased with an area of 60, 45 ha, with a change in the area of approximately 20, 37 ha/10 years. On land cover within 10 years there is an increase in area on the open land of 66.18 ha (64.31%) From 2009 (102.91 ha) to (169.09 ha) in 2019. As well as reduced area of sedimentation of 66.59 ha (21.29%) From 2009 to 312.84 ha to 246.25 ha in 2019 at the point of research location. The

Mangrove ecosystem. With the existence of rehabilitation activities from the Government and communities are included in some areas Bungus, the big impact occurred in the jetty area Pertamnia, adding to the area of mangrove if compared in 2009 with an area of 3.06 ha to 3.90 ha in 2019 the addition of mangrove land around 0.90 ha (29.41%). In general, mangrove forests in the area Bungus Teluk Kabung is a forest-owned rights, as for private and land-owned forests that have a certificate of sale of mangrove land and mangrove forest in the tripe in addition, the people also make mangrove land into ponds. The value of NDVI in the year 2009 IE 0.60 with vegetation condition declared good, while in the year 2019 namely with vegetation condition 0.42 declared Normal.

The need for strict action in the activities of logging mangrove trees in Bungus Teluk Sackcloth District and the existence of rehabilitation activities every year and on each coastal region in Bungus teluk kabung District to preserve the sustainability of the mangrove ecosystem. The need for advanced research to know the development of mangrove ecosystem in year.

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