

**CHANGES IN LAND COVER AND TOTAL AREA OF MANGROVE DAMAGE
FOR 10 YEARS FROM 2012 TO 2022 IN BUNATI VILLAGE, ANGSA
DISTRICT, TANAH BUMBU REGENCY****Ira Puspita Dewi¹, Nursalam², Siti Fatimah³**^{1,2,3}Marine Science Study Program, Faculty of Fisheries and Marine Science, Lambung
Mangkurat University**ABSTRAK**

Mangrove is a forest that grows on the coast, generally found in protected estuaries, river banks, and lagoons in subtropical and tropical regions. Mangroves describe ecosystems and plant families that can adapt to an environment influenced by tides. The condition of the mangroves in Bunati Village is quite apprehensive due to the conversion of mangrove land to other land uses such as oil palm plantations, industrial mining excavations, and others, seen from Google Earth images for 2013 and 2022, causing mangrove land cover in Bunati Village to decrease. Therefore it is necessary to analyze changes in land cover and the total area of mangrove damage for ten years from 2012 to 2022 in Bunati Village, Angsana District, Tanah Bumbu Regency, South Kalimantan Province. This study uses Sentinel 2 Satellite Image data for 2022, SPOT 7 for 2017, and SPOT 4 for 2012. The data analysis carried out is overlay. Changes in land cover in 2012 and 2022 in Bunati Village, namely mangrove land remaining to become mangroves covering an area of 73.48 hectares with a percentage of 39.88%, mangroves to non-mangrove 108.99 hectares with a percentage of 59.00%, mangroves to waters 2.05 hectares with a percentage of 1.12%, non-mangrove to mangrove 29.84 hectares with a percentage of 2.81%, non-mangrove to remain non-mangrove 1029.27 hectares with a percentage of 97.02%, non-mangrove to waters 1.79 hectares with a percentage 0.17%, waters turned into mangroves 6.67 hectares with a percentage of 47.14%, waters turned non-mangrove 5.43 hectares with a percentage of 38.35%, and waters turned into waters 2.21 hectares with a percentage of 14.51%. The total area of mangroves that have suffered damage or shrinkage is 74.74 hectares.

Keywords: compensation area, mangrove, rehabilitation, Bunati.

INTRODUCTION

Bunati Village is one of the villages that has a mangrove area along the riverbanks and the coast. The condition of mangrove cover in the region has mostly decreased, as seen from Google Earth imagery for 2013 and 2022. Based on observations through satellite imagery, it is known that the main cause of the reduction in mangrove cover area is land conversion to other land covers. Through the information obtained from this research, it is hoped that it can be considered by both the relevant authorities and the local community in managing the mangrove area of Bunati Village.

THEORETICAL FRAMEWORK

Mangrove is a forest that grows on the coast, generally found in protected estuaries, river banks, and lagoons in subtropical and tropical regions. Mangroves describe ecosystems and plant families that can adapt to tidal-affected environments (Maiti & Chodhury, 2013).

According to Barbier et al. (2011), mangroves are very productive ecosystems, living between land and sea, which function as habitats for various biota and provide enormous human resources locally and globally. However, despite their abundant resources, most mangroves have recently experienced high levels of damage due to land conversion to aquaculture, timber harvesting, and clearing for housing and urban development (Walters, 2004).

Mangrove ecosystems in coastal areas often receive various threats. One of these threats results from human activities that carry out destructive uses near mangrove areas. In addition, natural factors such as global warming and natural disasters also threaten the existence of mangroves. (Schadu et al., 2012). Lack of understanding of the benefits and functions of mangroves affects mangrove damage. This creates a direct ecological impact that threatens coastal biota's habitat in the mangrove area.

The condition of the mangroves in Bunati Village is quite apprehensive due to the conversion of mangrove land to other land uses such as oil palm plantations, industrial mining excavations, and others, seen from Google Earth images for 2013 and 2022, causing mangrove land cover in Bunati Village to decrease. Research on the analysis of the area of compensation for mangrove rehabilitation areas has been carried out by Winarno et al. (2016) also conducted research using the grid line method (squared transect) and Habitat Equivalency Analysis (HEA) to produce the level of mangrove damage and the area of compensation areas that need to be rehabilitated along with the estimated value damage claim. Based on previous research, reviewing it as a form of applying the methods used in different places is necessary. Therefore it is required to analyze the compensation for mangrove rehabilitation areas in Bunati Village, Angsana District, Tanah Bumbu Regency, South Kalimantan Province.

METHOD

Time and Place

The research was carried out from May 2022 to March 2023, covering research preparation, data collection, analysis, and report preparation. Data collection occurred in Bunati Village, Angsana District, Tanah Bumbu Regency, South Kalimantan Province. Data analysis occurred at the Bioecology Laboratory, Marine Science Study Program, Faculty of Fisheries and Marine Science, Lambung Mangkurat University, Banjarbaru.

Tools and Materials

The tools used in this study were ArcGIS 10.8, and Microsoft Office, while the materials used in this study were Sentinel 2 Imagery in 2022, SPOT Image 7 in 2017, and SPOT Image 4 in 2012.

Data Acquisition Method

The data used in this study is secondary data obtained from various sources that are relevant to this research. The data collected are Sentinel 2 Imagery in 2022, SPOT Image 7 in 2017, and SPOT Image 4 in 2012. Sentinel Imagery 2 was obtained from <http://earthexplorer.usgs.gov>. The 2017 SPOT 7 and 2012 SPOT 4 images were obtained from the Data and Information Center of the National Aeronautics and Space Agency (LAPAN) under the auspices of the National Research and Innovation Agency (BRIN).

Data Analysis

Image analysis used in this research is spatial overlay analysis using ArcGIS 10.8 software. The overlay is an analysis method combining several spatial elements into a new one. The overlay can be interpreted as a spatial operation combining different geographic layers to obtain further information (Larasati et al., 2017).

DISCUSSION

Mangrove Land Cover Area

Land cover in Bunati Village consists of three types of land cover, namely mangrove, non-mangrove, and water cover. Mangrove land cover consists of mangrove vegetation. The non-mangrove land cover comprises settlements, gardens, industrial areas, and others. The aquatic land cover consists of river and sea waters. Mangrove land cover is marked with the M code, non-mangrove land cover is marked with the NM code, and aquatic land cover or waters is marked with the P-code. Analysis of changes in the area of mangrove land cover in this study was carried out in 3 years of observation, namely 2012, 2017, and 2022. Based on the results, an analysis of the land cover area of the mangrove ecosystem from 2012 to 2022 shows that the area of the mangrove ecosystem in Bunati Village has decreased by 74.74 hectares. **Table 1** shows that the area of mangrove land cover in 2012 was 184.73 hectares, non-mangrove areas were 1,060.84 hectares, and waters were 14.16 hectares. A clear visualization of mangrove land cover in 2012 can be seen in **Figure 1**.

Table 1. Mangrove land cover area in 2012

No	Land Cover	Area (ha)
1	Mangrove (M)	184,73
2	Non-Mangrove (NM)	1.060,84
3	Waters (P)	14,16
Total		1.259,73

(Source: Analysis Results, 2022)

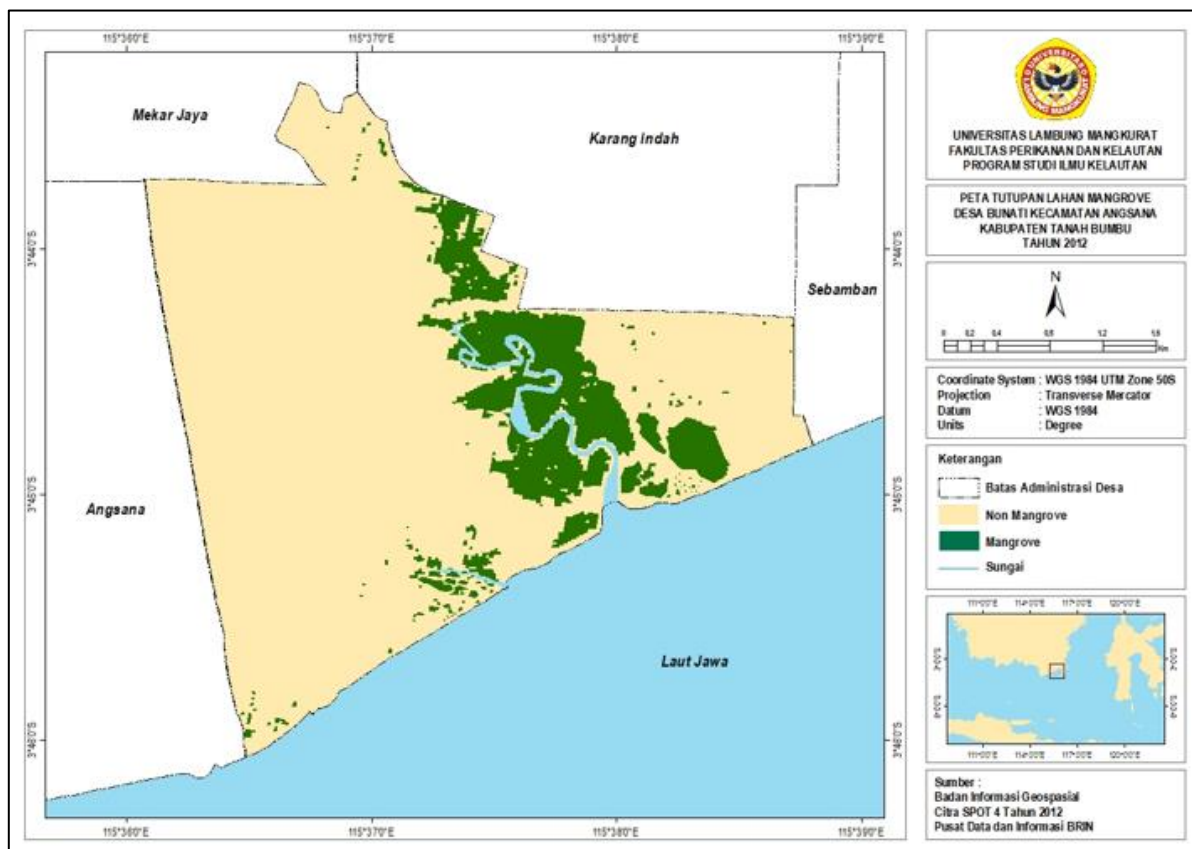


Figure 1. Mangrove land cover area in 2012
(Source: Analysis Results, 2022)

Table 2 shows that the area of mangrove land cover in 2017 was 169.88 hectares, with non-mangrove areas covering 1083.45 hectares and waters covering 6.40 hectares. A clear visualization of mangrove land cover in 2017 can be seen in **Figure 2**.

Table 2. Mangrove land cover area in 2017

No	Land Cover	Area (ha)
1	Mangrove (M)	169,88
2	Non-Mangrove (NM)	1.083,45
3	Waters (P)	6,40
Total		1.259,73

(Source: Analysis Results, 2022)

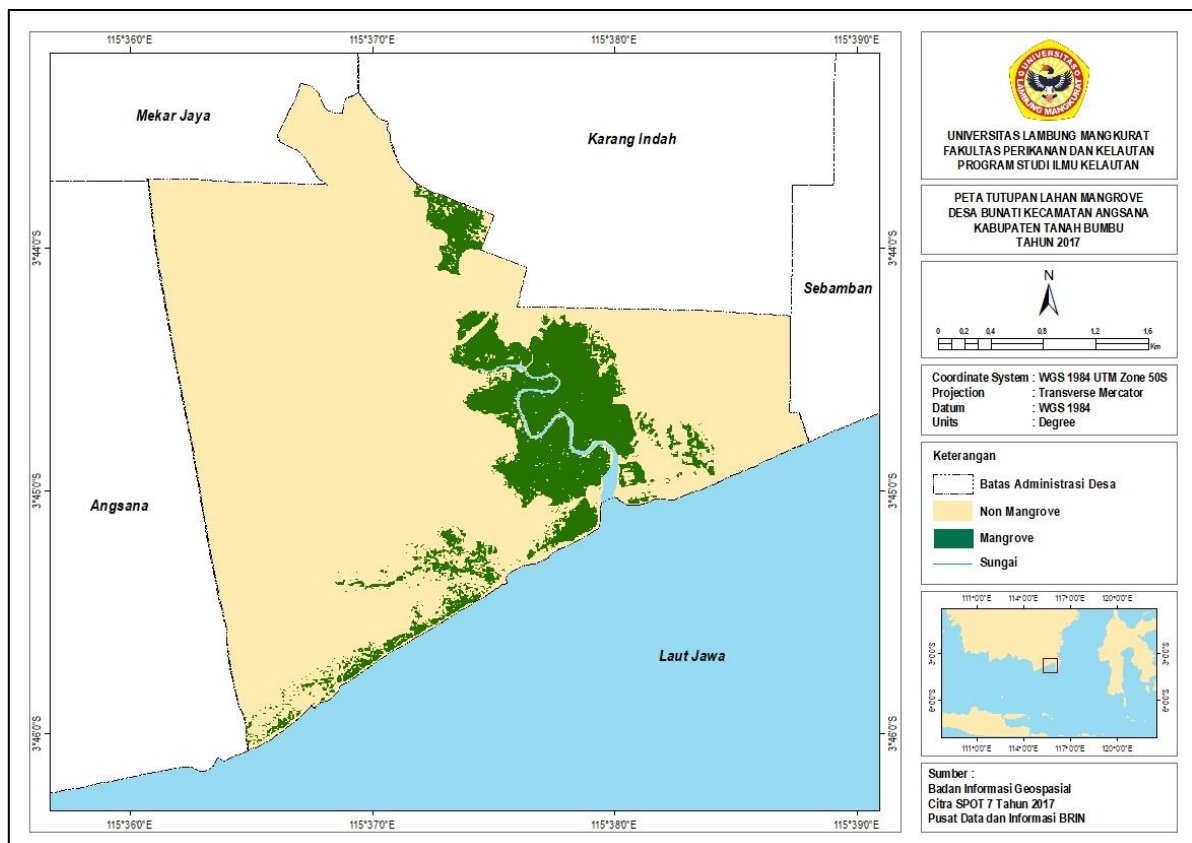


Figure 2. Mangrove land cover area in 2017

(Source: Analysis Results, 2022)

Table 3 shows that the area of mangrove land cover in 2022 is 109.99 hectares, non-mangrove is 1,142.69 hectares, and waters are 6.05 hectares. Based on observations of satellite imagery, it is known that the decline in the area of mangrove land cover in Bunati Village is largely due to land conversion to other uses such as oil palm plantations, mining excavations, and coal stockpiles. This aligns with Onrizal's statement (2002) that there are three main causes of mangrove damage: the conversion of mangrove areas that do not pay attention to environmental factors, pollution, and excessive logging. A clear visualization of mangrove land cover in 2022 can be seen in **Figure 3**.

Table 3. Mangrove land cover area in 2022

No	Land Cover	Area (ha)
1	Mangrove (M)	109,99
2	Non-Mangrove (NM)	1.143,69

No	Land Cover	Area (ha)
3	Waters (P)	6,05
	Total	1.259,73

(Source: Analysis Results, 2022)

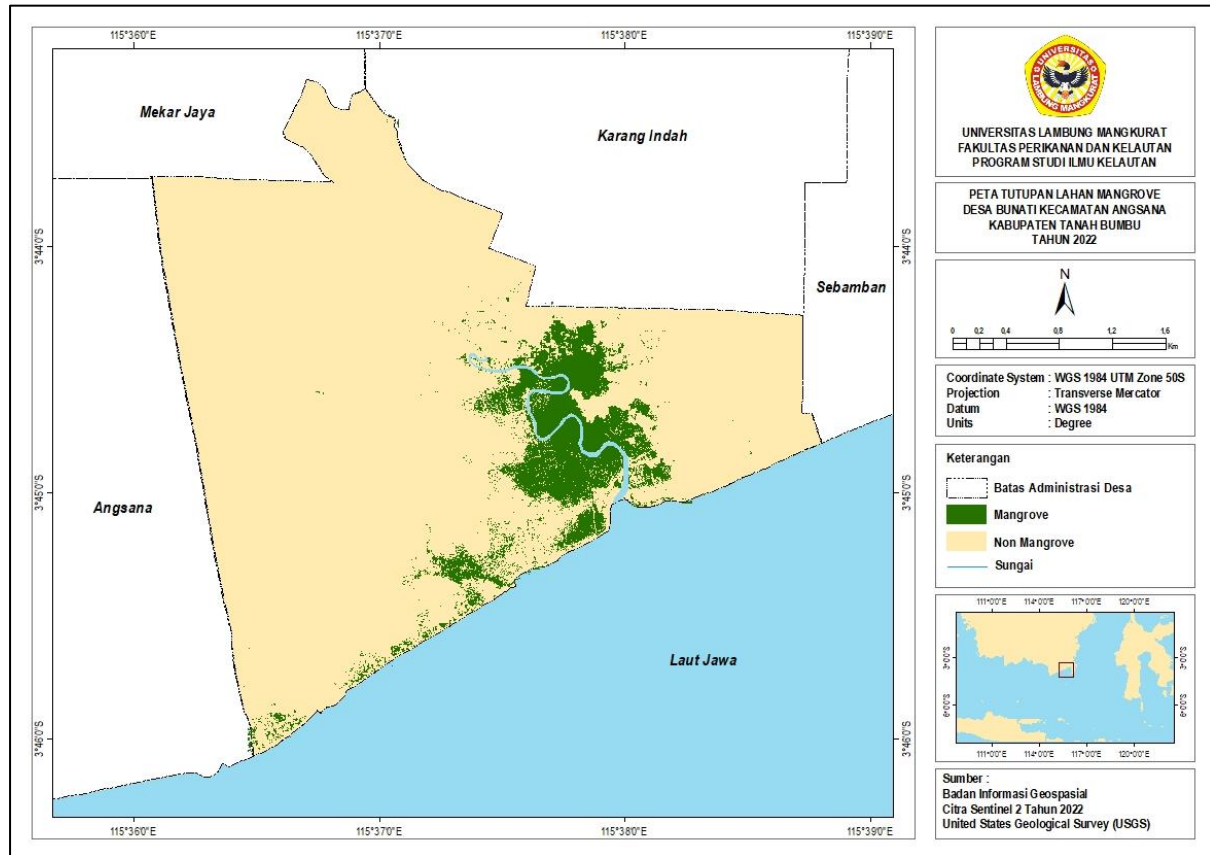


Figure 3. Mangrove land cover area in 2022
(Source: Analysis Results, 2022)

Mangrove Land Cover Change

Based on **Table 4**, it is known that changes in land cover in Bunati Village in 2012 and 2017, namely mangrove land remained to become mangroves with an area of 115.84 hectares with a percentage of 62.71%, mangroves became non-mangrove 67.66 hectares with a percentage of 36.63%, mangroves into waters 1.47 hectares with a percentage of 0.66%, non-mangrove into mangroves 46.59 hectares with a percentage of 4.39%, non-mangrove remains non-mangrove 1013.24 hectares with a percentage of 95.51%, non-mangrove into waters 1.01 hectares with a percentage of 0.10%, waters turned into mangroves 7.54 hectares with a percentage of 53.25%, waters turned into non-mangrove 2.65 hectares with a percentage of 18.71%, and waters turned into waters 3.97 hectares with a percentage of 28.04 %. A clear visualization of changes in mangrove land cover in 2012 and 2017 can be seen in Figure 4.

Table 4. Changes in land cover in 2012 and 2017

No	2012		2017		Percentage (%)
	Land Cover	Area (ha)	Land Cover	Area (ha)	
1	Mangrove	184,73	Mangrove	115,85	62,71
2	Mangrove		Non-Mangrove	67,66	36,63
3	Mangrove		Waters	1,22	0,66
Total					100

No	2012		2017		Percentage (%)
	Land Cover	Area (ha)	Land Cover	Area (ha)	
1	Non-Mangrove	1.060,84	Mangrove	46,59	4,39
2	Non-Mangrove		Non-Mangrove	1.013,24	95,51
3	Non-Mangrove		Waters	1,01	0,10
Total					100
1	Waters	14,16	Mangrove	7,54	53,25
2	Waters		Non-Mangrove	2,65	18,71
3	Waters		Waters	3,97	28,04
Total					100

(Source: Analysis Results, 2022)

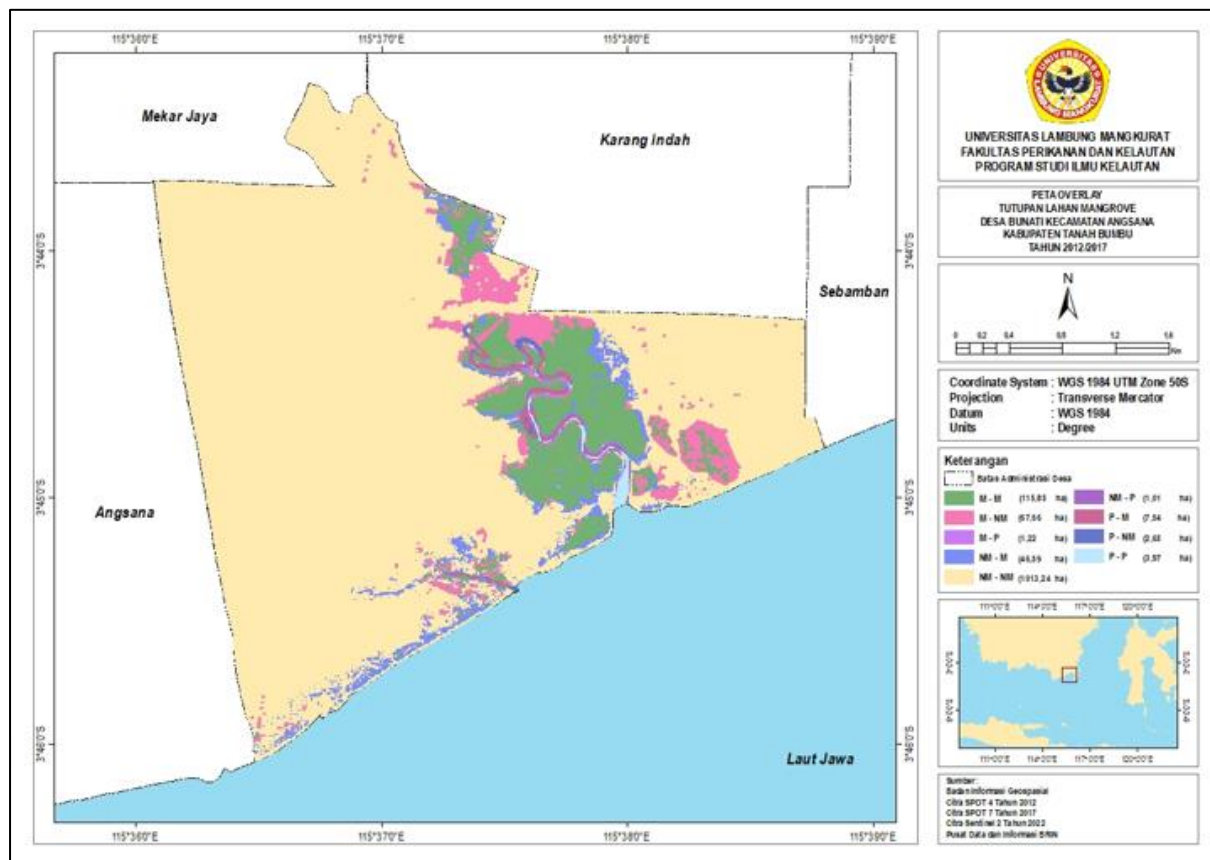


Figure 4. Changes in land cover in 2012 and 2017

(Source: Analysis Results, 2022)

Based on **Table 5**, it is known that changes in land cover in 2017 and 2022 in Bunati Village, namely mangrove land remain to become mangroves with an area of 89.86 hectares with a percentage of 52.90%, mangroves to non-mangrove 78.37 hectares with a percentage of 46.13%, mangroves into waters 1.65 hectares with a percentage of 0.97%, non-mangrove into mangroves 19.22 hectares with a percentage of 1.77%, non-mangrove remains non-mangrove 1063.25 hectares with a percentage of 98.14%, non-mangrove into waters 0.98 hectares with a percentage of 0.09%, waters turned into mangroves 1.39 hectares with a percentage of 21.72%, non-mangrove waters 1.14 hectares with a percentage of 17.81%, and waters turned into waters 3.87 hectares with a percentage of 60,47 %. A clear visualization of changes in mangrove land cover in 2017 and 2022 can be seen in **Figure 5**.

Table 5. Changes in land cover in 2017 and 2022

No	2017		2022		Percentage (%)
	Land Cover	Area (ha)	Land Cover	Area (ha)	
1	Mangrove	169,88	Mangrove	89,86	52,90
2	Mangrove		Non-Mangrove	78,37	46,13
3	Mangrove		Waters	1,65	0,97
Total					100
1	Non-Mangrove	1.083,45	Mangrove	19,22	1,77
2	Non-Mangrove		Non-Mangrove	1.063,25	98,14
3	Non-Mangrove		Waters	0,98	0,09
Total					100
1	Waters	6,40	Mangrove	1,39	21,72
2	Waters		Non-Mangrove	1,14	17,81
3	Waters		Waters	3,87	60,47
Total					100

(Source: Analysis Results, 2022)

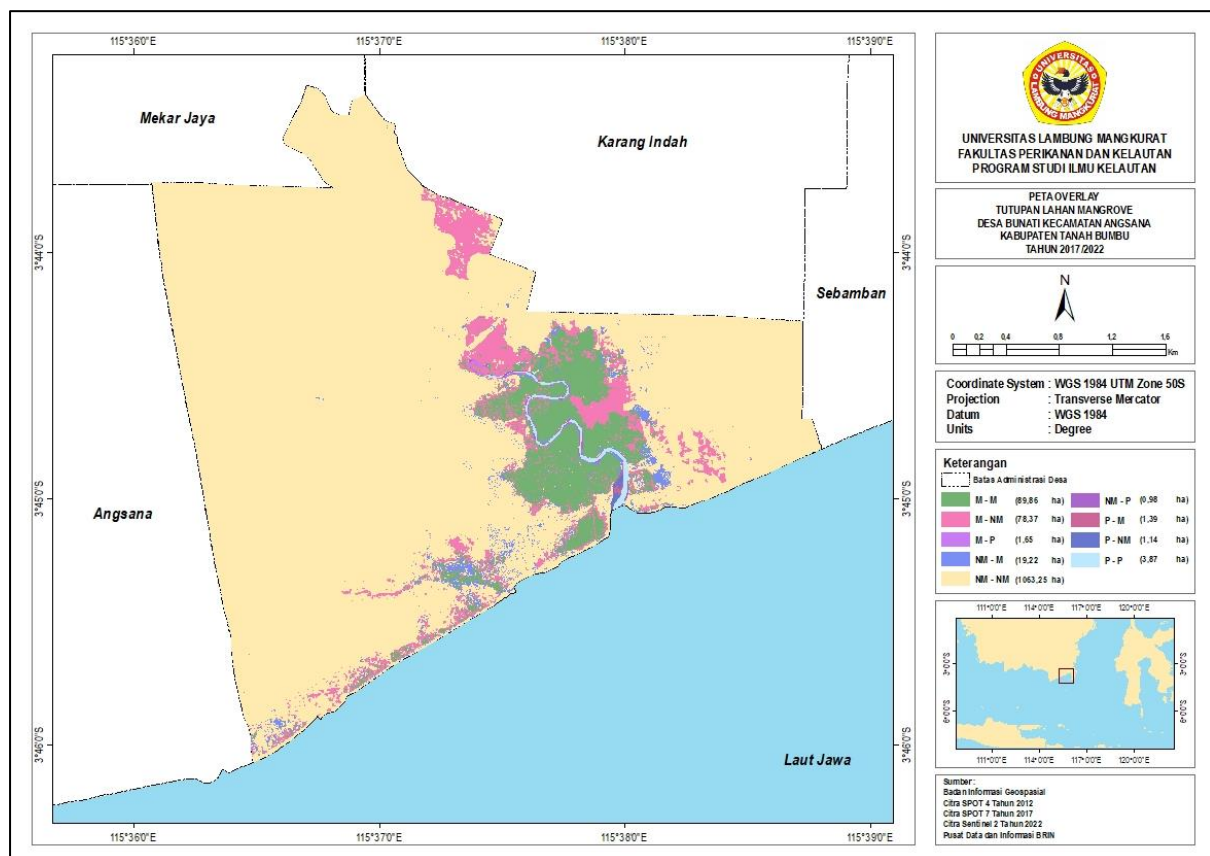


Figure 5. Changes in land cover in 2017 and 2022

(Source: Analysis Results, 2022)

Based on **Table 6**, it is known that changes in land cover in 2012 and 2022 in Bunati Village, namely mangrove land remaining to become mangroves covering an area of 73.48 hectares with a percentage of 39.88%, mangroves to non-mangrove 108.99 hectares with a percentage of 59.00%, mangroves into waters 2.05 hectares with a percentage of 1.12%, non-

mangrove into mangroves 29.84 hectares with a percentage of 2.81%, non-mangrove remains non-mangrove 1029.27 hectares with a percentage of 97.02%, non-mangrove into waters 1.79 hectares with a percentage of 0.17%, waters turned into mangroves 6.67 hectares with a percentage of 47.14%, waters turned into non-mangrove 5.43 hectares with a percentage of 38.35%, and waters turned into waters 2.21 hectares with a percentage of 14,51 %. As already mentioned, based on observations through satellite imagery, it is known that the area of mangrove land cover in Bunati Village has largely decreased due to the conversion of land functions to other uses such as special port areas, mining areas, and oil palm plantations. Most of the change from mangrove land to non-mangrove is designated as a special port area. This aligns with Sukardi's (2010) statement that changes in mangrove land cover occur due to the local community's conversion of land functions into settlements, industry, agriculture, etc. A clear visualization of changes in mangrove land cover in 2012 and 2012 can be seen in **Figure 6**.

Table 6. Changes in land cover in 2012 and 2022

No	2012		2022		Percentage (%)
	Tutupan Lahan	Luas (ha)	Tutupan Lahan	Luas (ha)	
1	Mangrove	184,73	Mangrove	73,48	39,88
2	Mangrove		Non-Mangrove	108,99	59,00
3	Mangrove		Perairan	2,05	1,12
Jumlah					100
1	Non-Mangrove	1.060,84	Mangrove	29,84	2,81
2	Non-Mangrove		Non-Mangrove	1.029,27	97,02
3	Non-Mangrove		Perairan	1,79	0,17
Jumlah					100
1	Perairan	14,16	Mangrove	6,67	47,14
2	Perairan		Non-Mangrove	5,43	38,35
3	Perairan		Perairan	2,21	14,51
Jumlah					100

(Source: Analysis Results, 2022)

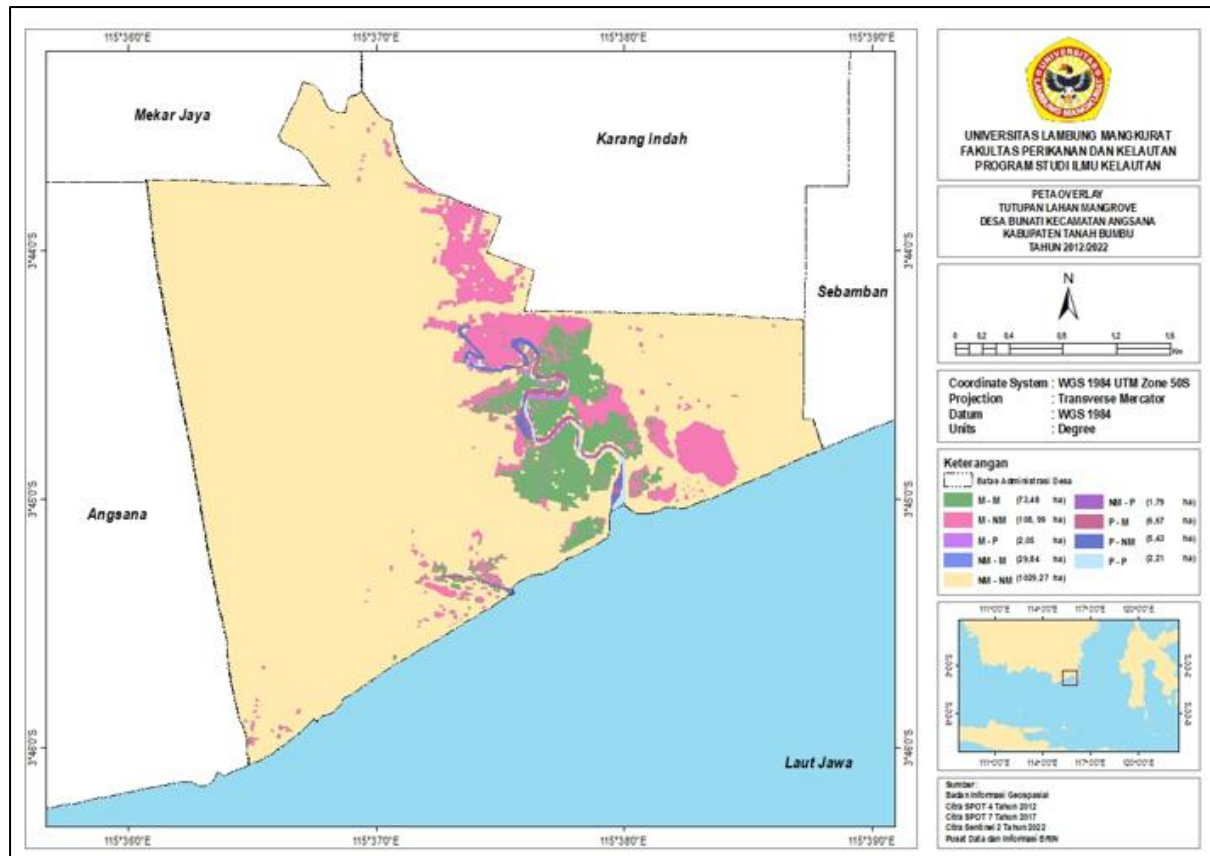


Figure 6. Changes in land cover in 2012 and 2022

(Source: Analysis Results, 2022)

Total Area of Mangrove Damage for 10 Years from 2012 to 2022

Based on the analysis of mangrove land cover, it is known that the area of mangrove land cover in 2012 was 184.73 ha, while the area of mangrove land cover in 2022 was 109.99 ha. Based on these values, it is known that in the span of 10 years from 2012 to 2022, there was damage or shrinkage of the mangrove land cover area of 74.74 ha. The total area of mangrove damage can be seen in **Table 7**. Based on observations of satellite imagery, it is known that the shrinkage of mangrove land cover is largely due to land conversion to other uses such as oil palm plantations, mining excavations, and special port areas. This aligns with Onrizal's statement (2002) that there are three main causes of mangrove damage: the conversion of mangrove areas that do not pay attention to environmental factors, pollution, and excessive logging.

Table 7. The total area of mangrove damage

Mangrove Land Cover 2012 (ha)	Mangrove Land Cover 2022 (ha)	Total Area of Mangrove Damage (ha)
184,73	109,99	74,74

CONCLUSION

Changes in land cover in 2012 and 2022 in Bunati Village, namely mangrove land remaining to become mangroves covering an area of 73.48 hectares with a percentage of 39.88%, mangroves to non-mangrove 108.99 hectares with a percentage of 59.00%, mangroves to waters 2.05 hectares with a percentage of 1.12%, non-mangrove turned into mangrove 29.84 hectares with a percentage of 2.81%, non-mangrove remained non-mangrove 1029.27 hectares with a percentage of 97.02%, non-mangrove became waters 1.79 hectares with a percentage

0.17%, waters turned into mangroves 6.67 hectares with a percentage of 47.14%, waters turned into non-mangrove 5.43 hectares with a percentage of 38.35%, and waters turned into waters 2.21 hectares with a percentage of 14.51%. The total area of mangroves that have suffered damage or shrinkage is 74.74 hectares.

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