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## CHANGES IN LAND USE OF MANGROVES IN THE NORTHERN REGION OF MEDAN CITY

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### ABSTRACT

The Mangrove Ecosystem is an important green open space for the city of Medan. Some of the consequences of the damage to the mangrove ecosystem are, coastal areas are more susceptible to abrasion, water quality declines, reduced green open space for water catchment areas, drought, lack of oxygen levels, and reduced population of dependent animals. on mangrove forest populations such as crabs, shrimp, and so on. Mangrove land use in the northern area of Medan City continues to change to other land uses, this study aims to examine changes in mangrove land use that occur in the northern area of Medan City. The method used in this study is quantitative, the research was conducted through a survey of mangrove land use changes that occurred and processing data with Geographic Information Systems. From this study, it is known that the land use changes of mangroves that occur in the Northern Region of Medan City are dominated by pond land use.

**KEYWORDS:** Mangrove, Land Use Change, Medan City.

### 1. INTRODUCTION

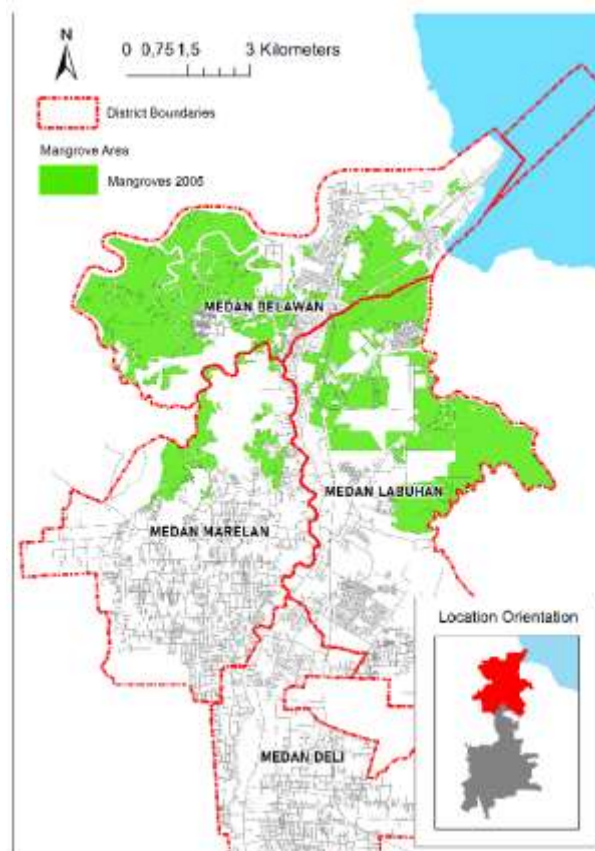
The use of land and natural resources is important in development. Therefore, many researchers and scientists have analyzed and studied land use efficiency (Cintina, V., & Pukite, V. 2018). Scientific interest and interest in land use change have a long history as there has never been a case where communities have used their land and resources without causing any harm (Briassoulis, H. (2019). Land development is necessary for the progress of mankind, but its impact has resulted in the degradation of ecosystem services and affects not only locally and regionally, but globally. Human behavior towards land use must be examined and fully understood to achieve better land management (Mitsuda, Y., & Ito, S. A, 2011). The position of Medan City which is on the east coast of Sumatra Island has a mangrove area located in the Northern Region of Medan City, namely in Medan Belawan District, Medan Labuhan District, and Medan Marelan District. A mangrove area is an area where

vegetation grows between land and sea or coastal areas where the tides occur. Mangrove area functions as a barrier to natural sea waves and prevent coastal abrasion (Panjaitan, J. S. S, 2015). Environmental damage is influenced by human activities or development that does not pay attention to environmental conservation principles. Many space utilizations do not pay attention to their capabilities and exceed their carrying capacity (Rosyidie, A, 2013). Most of the world's mangrove forests are scattered in the tropics, including in Indonesia. Of the total mangroves in the world, Indonesia has the largest mangrove area (4.26 million ha), followed by Brazil (1.34 million ha), Australia (1.15 million ha), and Nigeria (1.05 million ha). The area of mangroves in Indonesia is about 23% of the world's total mangroves. Currently, mangroves have been degraded due to various causes and problems they face. Degraded mangrove forests will disrupt the balance of the mangrove ecosystem so that its natural functions are disrupted. This situation is quite worrying considering that the mangrove ecosystem is an ecosystem that has various functions and benefits, including physical, biological, and economic or production functions (Panjaitan, J. S. S., Djayus, Y., & Harahap, Z. A., 2015). Based on data from aerial photographs of the city of Medan (Dinas PKPR Medan). In the past twelve years, there has been a reduction in the mangrove area of 1,164.68 hectares. In 2005 the mangrove area in the northern area of Medan City was 2,812.06 hectares and there was a change in the area of the mangrove area so that in 2017 the use of mangrove land was only 1,647.38 hectares. The dynamics of land use change in mangroves in big cities in Indonesia and changes in land use are influenced by various factors. Therefore, this study will examine changes in mangrove land use and identify the factors that influence changes in mangrove land use in the northern area of Medan City.

## **2. METHODOLOGY**

### **2.1. Study Area**

The study area is the northern area of Medan City with an area of approximately 10,206.27 hectares consisting of three sub-districts, namely Medan Belawan District, Medan Labuhan District, and Medan Marelan District, geographically the area is located between 3o 40' – 3o 48' latitude. North and 98o 36' – 98o 44' East Longitude. In the northern area of Medan City, there is mangrove vegetation, based on data in 2005 the area of mangrove vegetation was 2,812.06 hectares. For more details, see the figure of the research area as follows.



**Figure 1: Distribution of Mangrove Vegetation in 2005**

Source: author's processing, 2022

## 2.2. Land Use Data

Research Thought, in 2005, the area with the type of mangrove land use in the northern region of Medan City was quite significant. By utilizing remote sensing data and making observations, this study seeks to evaluate changes in mangrove land use and identify events of mangrove land use change that occurred in the northern region of Medan City. The data used in this study, particularly in evaluating land use change, uses large-scale aerial photographs obtained from relevant agencies. Aerial photo data were obtained from 2005 to 2017. To validate the data through field surveys. The aerial photo data obtained were interpreted and analyzed using a geographic information system application, through this approach identified changes in mangrove land use in the northern region of Medan City.

## 2.3. Mangrove Vegetation Area

Mangrove areas are unique ecosystems in coastal areas and are influenced by tides, formed due to protection from waves, freshwater input from rivers, sedimentation, and tidal water flows. Mangrove areas have ecological and economic benefits and functions for coastal communities, whether they realize it or not, and have very strategic functions ecologically, socially, and economically. There is a variety of mangrove vegetation whose habitat structure is divided into four zones, namely in open

areas, central areas, areas that have brackish to almost freshwater rivers, and areas towards the mainland that have fresh water. In general, the dominant types of mangrove vegetation found in the northern area of Medan are Api-Api (*Avicennia alba*), Nipah (*Nypa fruticans*), and Mangrove (*Rhizophora*).

#### 2.4. Benefits of Mangrove Vegetation Area

Mangroves have various benefits for human life and the surrounding environment. For coastal communities, the use of mangroves for various purposes has been carried out for a long time. Mangrove forests have many functions, in addition to benefits that are directly felt by the community and even become a source of economic livelihoods such as wood and trees, fish, crabs, etc. as well as indirect benefits as a barrier to abrasion and a place for fish to spawn and spawn (Sofian, A., Harahab, N., & Marsoedi, M., 2012). Mangroves are Capable of absorbing carbon. The greater the biomass, the greater the potential for carbon absorption (Iswandar, M., Dewiyanti, I., & Kurnianda, V., 2017). The mangrove area is also a place of activity for various types of birds, one of which is the small egret (*Egretta garzetta*) (Ahadi, R., 2018). The mangrove ecosystem has an effect on reducing the incidence of malaria (Abdul Qohar, I., Bakri, S., & Wardani, D. W. S., 2017). In addition, mangroves have an important role as a barrier to shoreline erosion, mangrove plants in the mangrove ecosystem help the coast to accelerate and reduce the effects of flood waves. Mangroves can also maintain water quality by extracting nutrients from potentially eutrophic situations and increasing the availability of limited salt and anaerobic sediments to detoxify pollutants.

### 3. RESULT AND DISCUSSION

#### 3.1. Mangrove Land Use Change in Medan Belawan District

Based on the results of the analysis in Medan Belawan District, there are 244.51 hectares of mangrove land use that have changed. The most extensive changes occurred in Belawan Sicanang Village, namely mangroves which were converted into ponds covering an area of 134.66 hectares. To more clearly know the use of mangrove land that has changed, see the table below and the area that has changed can be seen in Figure 2.

**Table 1: Changes in Mangrove Land Use in Medan Belawan District**

Village	Land Use	Area	
		(Hectares)	%
Bagan Deli	Industry	16,97	6,94
	Road	4,49	1,83
	Other Specials	8,06	3,30

	Housing Area	1,60	0,66
	Public Service Facilities	0,32	0,13
	Fishpond	0,03	0,01
	<b>Sub Total</b>	<b>31,46</b>	<b>12,87</b>
<b>Belawan Bahari</b>	Industry	4,40	1,80
	Bush	0,44	0,18
	Fishpond	26,75	10,94
	<b>Sub Total</b>	<b>31,59</b>	<b>12,92</b>
<b>Belawan I</b>	Blue Open Space	0,69	0,28
	Industry	1,82	0,75
	<b>Sub Total</b>	<b>2,51</b>	<b>1,03</b>
<b>Belawan II</b>	Road	0,89	0,36
	Housing Area	1,65	0,68
	<b>Sub Total</b>	<b>4,36</b>	<b>1,78</b>
<b>Belawan Sicanang</b>	Industry	8,14	3,33
	Road	0,98	0,40
	Other Specials	9,35	3,82
	Pertanian	10,15	4,15
	Housing Area	11,37	4,65
	Blue Open Space	1,31	0,54

Public Service Facilities	0,35	0,14
Bush	0,09	0,04
Fishpond	134,66	55,07
<b>Sub Total</b>	<b>176,41</b>	<b>72,15</b>
<b>Total</b>	<b>244,51</b>	<b>100,00</b>

Source: Analysis Results, 202

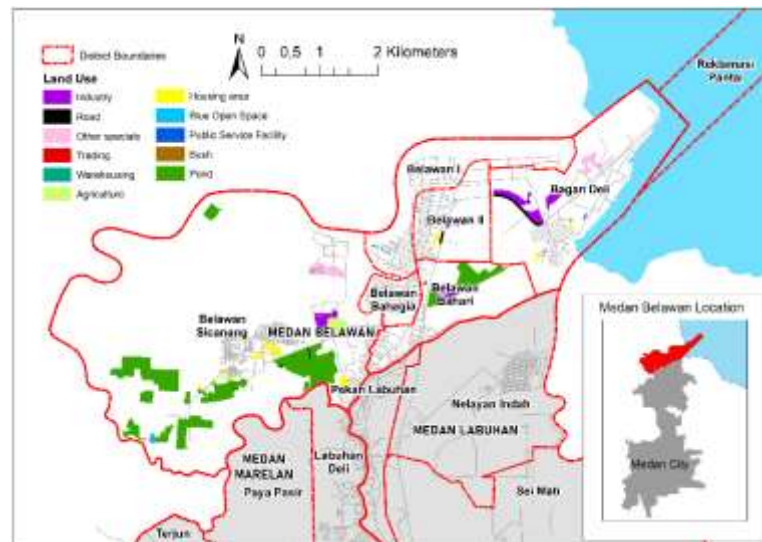
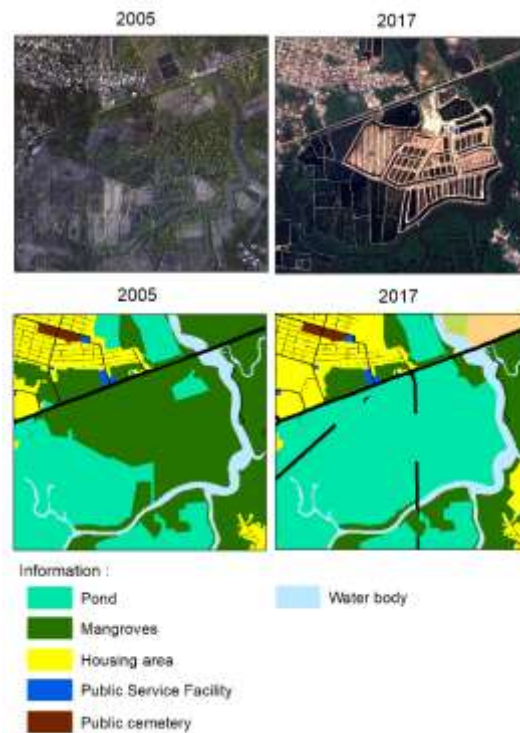


Figure 2: Changes in Mangrove Land Use in Medan Belawan District

Source: Analysis Results, 2022

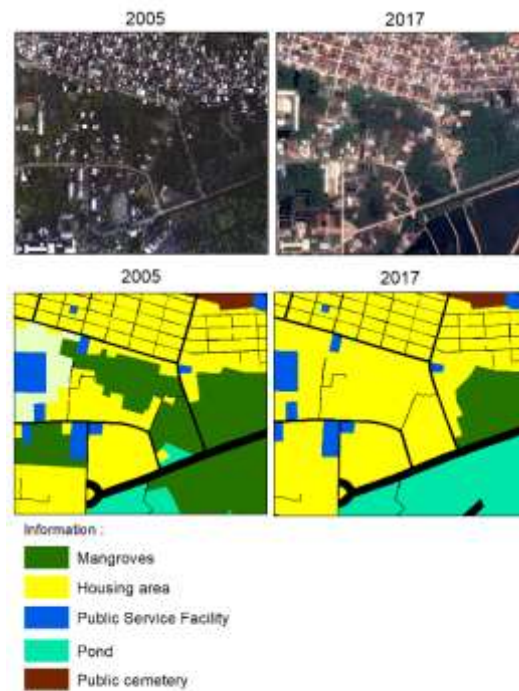
tracing the road to the Pulau sicanang, on the left side of the road, we found land that had been turned into a shrimp and fish pond, from the gate it was written the shrimp and fish farming business "Gajah Mada" and the pond businessman prohibited entry for unauthorized parties. About 300 meters from that location there is a pond area belonging to another entrepreneur. So that the pond area is next to each other, from the results of the identification, the entire pond area has converted the mangrove area of 30 hectares, changes that occur as shown in Figure 3.



**Figure 3: Comparison of Aerial Photos of 2005 and 2017 at Gajah Mada and Surrounding Pond Locations**

**Source: Analysis Results, 2022**

Still in the vicinity of the elephant pond location found the location of mangroves that have been converted into housing, precisely on the tomb road. In the aerial photo in 2005, it is still visible that the green land is vegetated with mangroves, while now it has been turned into housing. The conversion of mangrove land into housing is approximately one hectare, changes that occur as shown in Figure 4.



**Figure 4: Comparison of Aerial Photos of 2005 and 2017 at Jalan Pusara**  
*Source: Analysis Results, 2022*

### 3.2. Mangrove Land Use Change in Medan Labuhan District

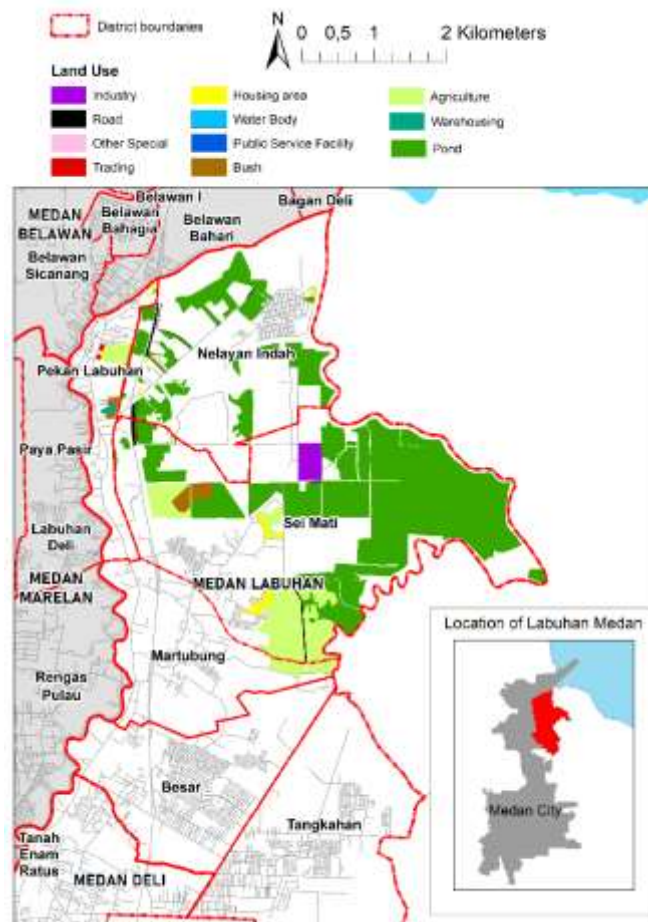
The most extensive changes in mangrove land use in Medan Labuhan Sub-district occurred in Sei Mati Village, the changes that occurred were from mangrove land use to pond land use covering an area of 491.45 hectares. For more details, see the table as follows and the area that has changed can be seen in Figure 5.

**Table 2: Changes in Mangrove Land Use in Medan Labuhan District**

Village	Land Use	Area (Hectares)	%
<b>Martubung</b>	Agriculture	15,57	1,90
	<b>Sub Total</b>	<b>15,57</b>	<b>1,90</b>
<b>Nelayan Indah</b>	Road	4,46	0,54
	Housing Area	1,67	0,20
	Public Service Facilities	0,11	0,01



	Bush	2,34	0,29
	Fishpond	128,14	15,62
	<b>Sub Total</b>	<b>136,72</b>	<b>16,66</b>
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	Commerce	1,00	0,12
	Warehousing	1,88	0,23
	Agriculture	8,69	1,06
<b>Pekan Labuhan</b>	Housing Area	1,48	0,18
	Bush	5,08	0,62
	Fishpond	0,20	0,02
	<b>Sub Total</b>	<b>18,33</b>	<b>2,23</b>
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	Industry	16,54	2,02
	Road	4,51	0,55
	Agriculture	114,24	13,92
<b>Kel.Sei Mati</b>	Housing Area	8,93	1,09
	Bush	14,20	1,73
	Fishpond	491,45	59,90
	<b>Sub Total</b>	<b>649,86</b>	<b>79,20</b>
<hr/>			
	<b>Total</b>	<b>820,48</b>	<b>100,00</b>
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**Figure 5: Changes in Mangrove Land Use in Medan Labuhan District**  
**Source: Analysis Results, 2022**

In Sei Mati Sub-district, it was found that mangroves were turned into ponds, the ponds were controlled by companies, one of which was PT ML, which used the land as fish ponds. The location found has converted the use of mangrove land covering an area of approximately 179 hectares, changes that occur as shown in Figure 6.



**Figure 6 : Comparison of Aerial Photos of 2005 and 2017 in PT ML's Pond and Surrounding Areas**

**Source: Analysis Results, 2022**

In addition to mangrove land that was turned into a pond in Sei Mati Village, it was also found that land that used to be mangroves turned into residential land, namely the TKBM complex. This condition occurs on the basketball road. Based on the identification of these changes, 2 hectares of mangrove land have been converted. Conditions in the TKBM Complex are often flooded by water. The condition of the road and drainage looks poor, changes that occur as shown in Figure 7.



**Figure 7:** Comparison of Aerial Photography in 2005 and 2017 at the TKBM Complex  
*Source: Analysis Results, 2022*

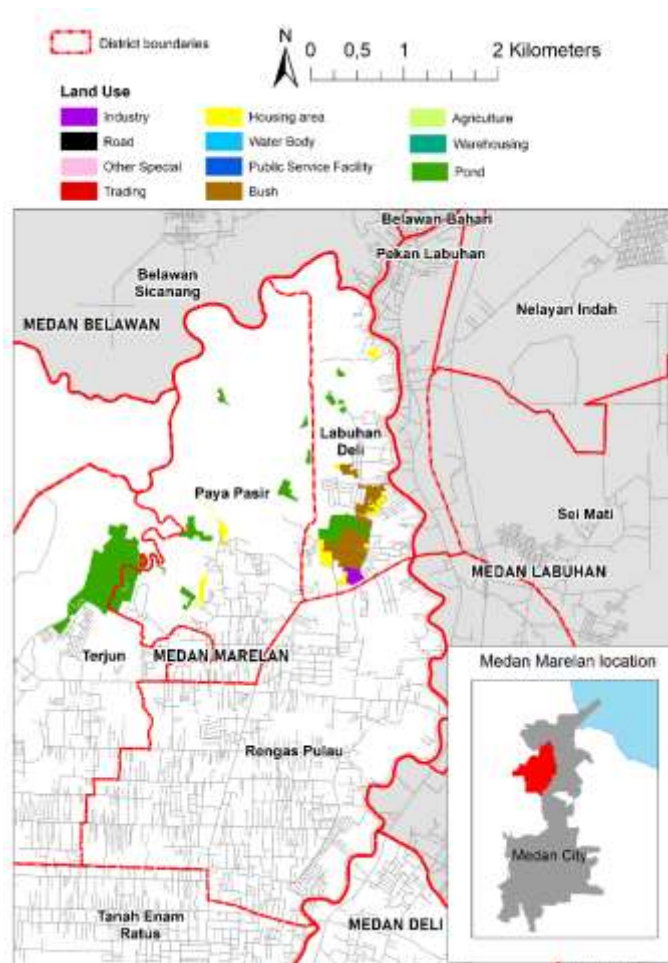
### 3.3. Mangrove Land Use Change in Medan Marelan District

Changes in mangrove land use that occurred in Medan Marelan District were the same as those that occurred in Medan Belawan District and Medan Labuhan District, the use of mangrove land was changed to pond land use, precisely in the District of Falls covering an area of 34.57 hectares. For more details, see the table as follows and the area that has changed can be seen in Figure 8.

**Table 3: Changes in Mangrove Land Use in Medan Marelan District**

Village	Land Use	Area	
		(Hectares)	%
Labuhan Deli	Industry	2,68	2,69
	Road	0,11	0,11
	Housing Area	7,37	7,39
	Bush	21,69	21,76

	Fishpond	10,87	10,90
	<b>Sub Total</b>	<b>42,71</b>	<b>42,85</b>
<b>Paya Pasir</b>	Housing Area	3,55	3,56
	Fishpond	18,84	18,90
	<b>Sub Total</b>	<b>22,39</b>	<b>22,47</b>
<b>Terjun</b>	Fishpond	34,57	34,68
	<b>Sub Total</b>	<b>34,57</b>	<b>34,68</b>
<b>Total</b>		<b>99,68</b>	<b>100,00</b>



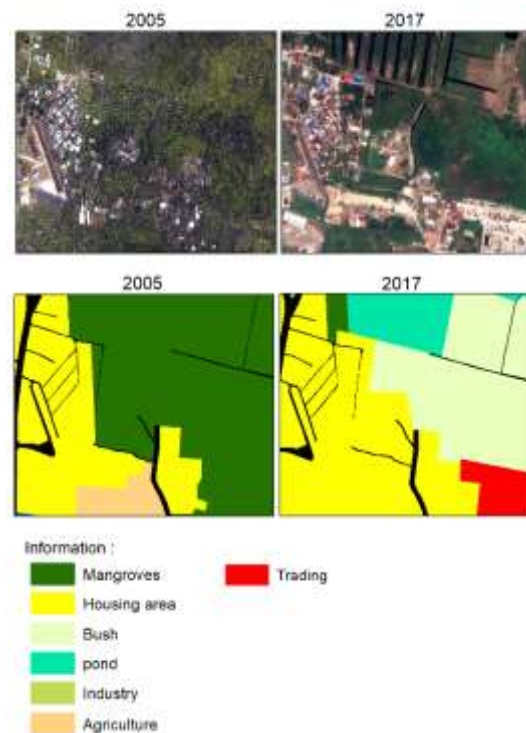
**Figure 8: Changes in Mangrove Land Use in Medan Marelán District**  
**Source: Analysis Results, 2022**

Changes in mangrove land use that occurred in the District of Medan Marelan, especially those that occurred in Labuhan Deli Village, found land that used to be mangrove land and is currently turning into a Toyota Auto 2000 car showroom. The location of this change is Jalan Titi Pahlawan. Based on the identification results, this change has converted the mangrove area to approximately 2 hectares, changes that occur as shown in Figure 9.



**Figure 9: Aerial Photo Comparison of 2005 and 2017 at Toyota Auto 2000 Showroom**  
**Source: Analysis Results, 2022**

In addition to turning it into a showroom, in Labuhan Deli Village, it was found that land that used to be mangroves was turned into residential land use. This condition is located on Jalan Tauci, based on the identification results, the change has converted the mangrove area to approximately 2 hectares, changes that occur as shown in Figure 10.



**Figure 10: Comparison of 2005 and 2017 Aerial Photos on Jalan Tauci**  
**Source: Analysis Results, 2022**

#### 4. CONCLUSIONS

The northern region of Medan City has a unique biodiversity with the existence of a mangrove vegetated area which has a balancing function of environmental conservation for the development of Medan City. However, since 2005 the use of mangrove land in the northern area of Medan City has undergone changes to other functions, such as in the District of Medan Belawan there are 244.51 hectares of mangrove land use that have changed. The most extensive changes occurred in Belawan Sicanang Village, namely mangroves which were converted into ponds covering an area of 134.66 hectares. The most extensive changes in mangrove land use in Medan Labuhan Sub-district occurred in Sei Mati Village, the changes that occurred were from mangrove land use to pond land use covering an area of 491.45 hectares. The change in mangrove land use that occurred in the Medan Marelán sub-district was the same as that which occurred in the Medan Belawan and Medan Labuhan sub-districts, the mangrove land use changed to a pond land use, precisely in the District of Falls covering an area of 34.57 hectares.

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