Land Use Changes Of Paddy Fields In Karangmalang Subdistrict, Sragen Regency In 2014 And 2024

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Abstract.

Population growth has led to an increased demand for housing needs and public facilities, ultimately placing pressure on land availability. This condition causes some agricultural land to convert into non-agricultural land. This study aims to determine the changes of paddy fields that occurred in Karangmalang Subdistrict, Sragen Regency in 2014 and 2024. To obtain image data, the researchers used image interpretation and digitalization techniques on Landsat 8 images in 2014 and Sentinel-2 L2A images in 2024, followed by an overlay process on the 2014 and 2024 land use maps to determine changes in the use of paddy fields in Karangmalang Subdistrict in 2014 & 2024. The results of this study found that the use of paddy fields in Karangmalang Subdistrict between 2014 to 2024 showed a decrease in area from 2964.19 ha to 2864.08 ha, or a decrease of about 100.10 ha.

Keywords: *Land Use; Land Function Change and Paddy Fields.*

I. INTRODUCTION

Indonesia is known as one of the agricultural countries in Southeast Asia region and has tropical climate characteristics. This geographical condition makes Indonesia have high soil fertility, so it is very potential to be utilized in agricultural activities. The total harvested area of paddy fields in Indonesia in 2023 reached 10.19 million ha [1]. Paddy fields are an important component in the agricultural system that functions not only as a provider of food needs, but also as a life support for millions of farmers and has a significant role in maintaining economic stability [2].Along with population growth, the demand for housing, infrastructure, and public facilities has also increased, thereby exerting pressure on land availability, and spatial planning [3]. These issues can be addressed through changes in the function, management, and ownership aspect of land. Generally, agricultural land is converted into modern industrial areas, residential areas, and other forms of land use [5] (Gulthom, 2022).

Karangmalang Subdistrict is one of the Subdistricts in Sragen Regency, it is bordered by Kedawung Subdistrict to the south. Sragen Subdistrict to the north. Ngrampal Subdistrict to the east, and Masaran Subdistrict to the west. It has an area of 46.01 km^2 consisting of 8 villages and 2 Subdistricts.The total population of Karangmalang Subdistrict in 2014 is 65.333 people while in 2024 there were 73.838 people. The population increase by around 8.505 people (BPS Kecamatan Karangmalang tahun 2014 dan 2024). The increase in population encourages the development of facilities to fulfill the needs of the community. The development of facilities in Karangmalang Subdistrict includes the construction of residential areas, hospitals, and other develop land.According to the Directorate of Land Management in [4] (Hasanah et,.al , 2021), one of the steps needed to overcome the problems of managing agricultural land resources, especially related to land conversion, is to periodically identify and map land use. The utilization of Geographic Information System (GIS)in the study of land use change makes it impossible to determine the land area, the amount of land change, and the distribution of land change. This study aims to determine the changes of paddy fields that occurred in Karangmalang Subdistrict, Sragen Regency in 2014 & 2024.

II. METHODS

The research was located in Karangmalang Subdistrict, Sragen Regency which consists of 2 Villages and 8 Subdistricts.

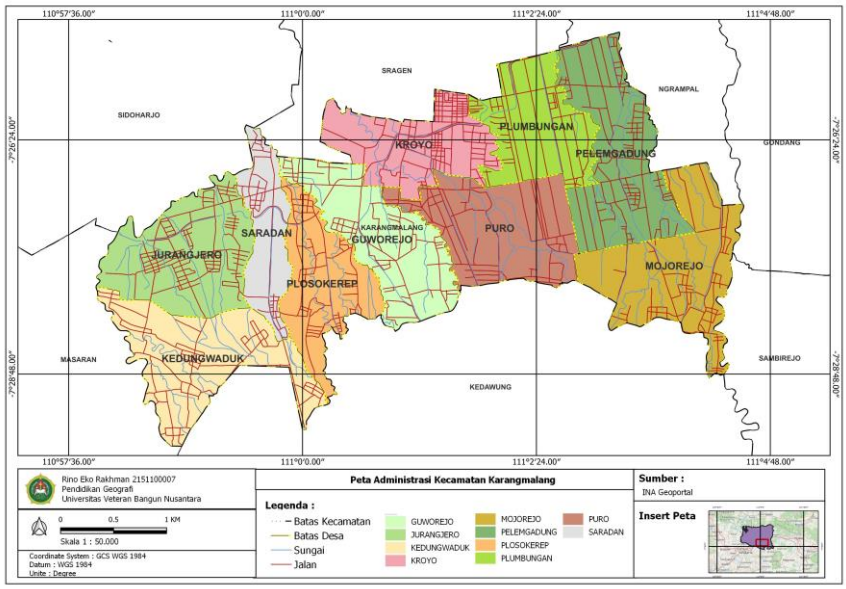

Fig 1. Administrative Map of Karangmalang Subdistrict

The research method used is qualitative method and complex area approach. The data used is Landsat-8 image data in 2024, Sentinel-2 L2A image that has gone through the Composite process and Shapefile of Karangmalang Subdistrict administration. Data analysis techniques used interpretation techniques to identify land use, then digitalized using Quantum GIS (QGIS). To find out the changes of paddy field, an overlay process was carried out the 2014 and 2024 land use maps.

III. RESULT AND DISCUSSION

The land use map is obtained from the results of digitalization by adjusting the interpretation results of each image, namely Landsat 8 image in 2014 and Sentinel-2 L2A image in 2024. According to this process, 7 land use classifications can be identified, including paddy fields, residential areas, fields, urban forests, plantations, reservoirs, and retention ponds.

Land Use in 2014

In 2014 the dominant land use in Karangmalang Subdistrict was paddy fields covering 2964.19 ha of the total area. The next largest land use was residential land with an area of 1589.61 ha. Followed by plantation land with an area of 17.22 ha, reservoirs with an area of 16.13 ha, urban forest with an area of 15.48 ha, fields with an area of 12.12 ha, and retention ponds with 3.24 ha. Land use in 2014 can be seen in Figure 2.

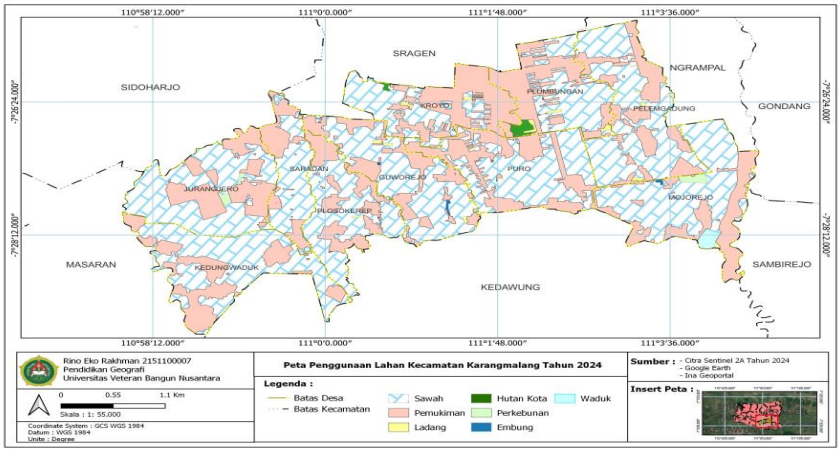

Fig 2. Land use map 2014

In the 2014 the largest area of paddy field in Pelemgadung Village with an area of 386.03 ha. The most extensive residential land use is found in Kroyo Village with an area of 191.47 ha. The most extensive field land use was in Plumbungan Village with an area of 2.56 ha. The most extensive plantation land use was located in Mojorejo Village with an area of 9.54 ha. The largest urban forest is located in Plumbungan Village with an area of 12.93 ha. The most extensive reservoir is located in Mojorejo Village with an area of 14.92 ha. Other land uses such as retention ponds can be found in several villages, with the largest area located in Guworejo Village at 2,02 ha.

Land use in 2024

The dominating land use in Karangmalang Subdistrict in 2024 is still paddy field with an area of 2864.09 ha. The next largest land use is residential land with an area of 1678.43 ha. For land use of cultivated fields with an area of 23.40 ha, plantation land with an area 17.22 ha. Reservoir with an area of 16.13 ha, urban forest occupying 15.48 ha, and retention pond with a total area of 3.24 ha. Land use in 2024 can be seen in Figure 3..

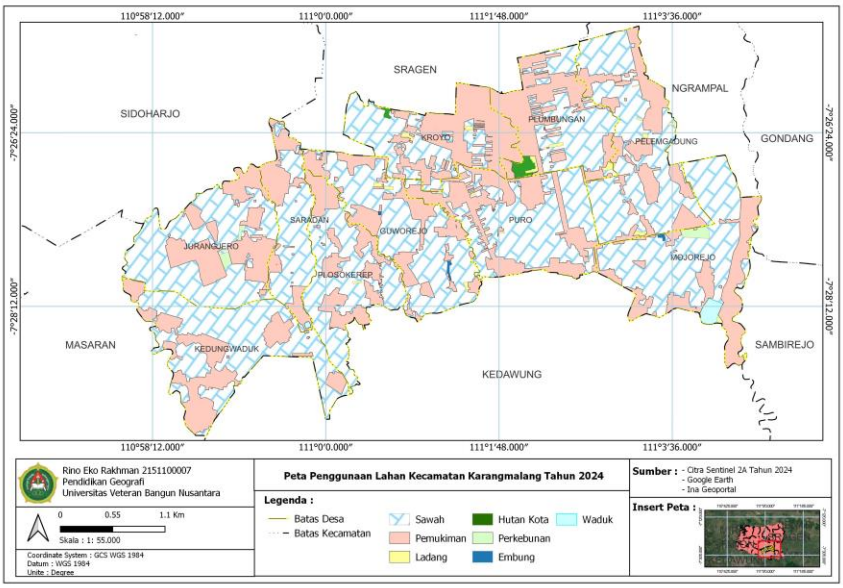

Fig 3. Land use in 2024

In 2024, the village that have the largest area of paddy fields is Pelemgadung Village covering 378.95 ha followed by Mojorejo Village with an area of 365.72 ha. The largest residential land use remained in Kroyo Village encompassing 213.55 ha and Puro Village with 204.36 ha. The most extensive land use for cultivated fields is located in Plumbungan Village, with a total of 7.16 ha. The largest plantation land area was found in Mojorejo Village with an area of 9.54 ha. The most extensive urban forest area was also in Plumbungan Village with an area of 12.93 ha. The largest reservoir was located in Mojorejo Village occupying an area of 14.92 ha. Other types of land use such as retention pond were found in several villages, such as Guworejo and Mojorejo Villages.

Changes of paddy fields

Based on the data analysis conducted by the researchers, it is known that the area of paddy fields in Karangmalang Subdistrict has decreased from 2964.19 ha in 2014 to 2864.08 ha in 2024, a decrease of 100.10 ha. The change in the area of paddy fields occurred in all villages in Karangmalang Subdistrict.

Tabel 1. Changes of Paddy Field

No	Villages	Paddy Fields		Changes (ha)	Percentage
		2014	2024		
1	Kedungwaduk	355.08	354.75	-0.33	-0.1%
2	Jurangjero	340.59	338.17	-2.42	-0.7%
3	Saradan	165.54	161.89	-3.65	-2.2%
4	Plosokerep	250.47	249.82	-0.65	-0.3%
5	Guworejo	336.02	323.97	-12.05	-3.6%
6	Puro	336.86	318.16	-18.7	-5.6%

7	Mojorejo	366.25	365.72	-0.53	-0.1%
8	Pelemgadung	386.03	378.95	-7.08	-1.8%
9	Plumbungan	223.35	192.99	-30.36	-13.6%
10	Kroyo	204.00	179.67	-24.33	-11.9%
	Total	2964.19	2864.09	-100.10	-3.4%

The largest paddy field conversion occurred in Plumbungan Village with a total area of change in paddy fields of 30.36 ha or 13.6% and the smallest paddy field conversion was in Kedungwaduk Village with an area of change 0.33 ha or 0.1%. The largest change of paddy field was paddy field into residential areas which changed by 88.83 ha, and the second largest change was the conversion of paddy fields into cultivated fields which changed by 11.27 ha.

IV. CONCLUSION

The land use change of paddy fields in Karangmalang Subdistrict between 2014 and 2024 showed a decrease in area from 2964.19 ha to 2864.08 ha, or a decrease of about 100,10 ha. The conversion of paddy fields is dominated by residential areas covering 88,83 ha and cultivated fields covering 11,27 ha.

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