

# Identification and conversion rate of rice field in Semarang year 2000-2019

Rossi Prabowo<sup>1,\*</sup>, Aziz Nur Bambang<sup>2</sup>, Sudarno<sup>2</sup>, and Agus Rachmad Nurlette<sup>3</sup>

<sup>1</sup>Agribusiness Department, Wahid Hasyim University, Semarang, Indonesia

<sup>2</sup>Doctoral Program of Environmental Sciences, School of Postgraduate Studies, Diponegoro University

<sup>3</sup>Food Security Service of East Sram Regency, Indonesia

**Abstract.** The development of population will be followed by efforts to fulfill facilities and infrastructure also development efforts and the impact is land conversion. Land which often get conversion is rice field, so it causes shrinkage of rice field land. This study aims to determine the extent and shrinkage rate of rice field in Semarang. The method used in this study was imagery satellite in 2000-2019 and calculated with ArcGIS 10.6.1. The results showed that in Semarang there are rice fields shrinkage about 2,368 hectares (Ha) from 2000 to 2019 or 50,81% of shrinkage rate.

**Keywords:** rice field conversion, rate conversion, rice field shrinkage

## 1 Introduction

Population growth will have an impact on fulfillment the needs of human life, some of the needs are residential, places for economic activity such as factories, shops, markets and others. Efforts to fulfill those needs are carried out by converting agricultural land, mainly from agricultural land to non-agricultural land. Conversion of agricultural land generally occurs and regrettable if the converted land is productive such as rice field.

Agricultural land conversion causes shrinkage of agricultural land which is still productive, the shrinkage of agricultural land in Java has been very massive and uncontrol. Every year more than 80 thousand hectares of agricultural land is lost and converted. It is estimated that in 2025 the area of agricultural land in Indonesia will be two million hectares left. In Central Java from 2000 to 2010 was noted that there were rice fields conversion around 14,830 hectares (Ha) (1.483 Ha/year or 4.12 Ha/day) [9]. The conversion of rice fields into residential and buildings in Gunungpati sub-district, Semarang from 1994 to 2010 around 384.40 Ha [2].

Semarang is one of big city with the most development in Central Java, because it is the central of government, commerce, education, services and it is the capital of Central Java Province. The development and economy of Semarang increases and becomes an attraction

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\* Corresponding author: [rossi28081982@gmail.com](mailto:rossi28081982@gmail.com)

of urbanization for people in suburb. The Increase of population and effort of fulfillment for community daily needs also the increase development activities certainly have potential occurrence of conversion from agricultural become non-agricultural.

Agricultural land has social, economic and environmental benefits. Socially, agricultural land is the existence farmer community, economically, the width of agricultural land is certainly related to the amount of production and income. While in terms of environment, agricultural activities is in balance with the principles of environmental preservation [4].

Agricultural land conversion has some negative impacts, such as, the reduce of productive agricultural land, the decrease of agricultural products, the decrease of job opportunities and income for farmers [8]. In addition, the conversion of agricultural land into non-agricultural land also will give bad effect to social and cultural aspects of farmer, farmer's family economy and environmental quality decrease caused by uncontrol conversion. In Semarang there was a conversion around 60.63 Ha of rice field during 2000-2009 and predicted in 2076 rice fields in Semarang would be lost [3]. The main study of agricultural land conversion includes changes pattern, spatial patterns (distribution) and conversion rate (intensity), this is certainly important to study considering agricultural land conversion in Semarang is getting out of control from year to year. The aims in this study are: a). Knowing the distribution of rice fields in 2000-2019. b). Knowing the intensity/conversion rate of agricultural land in 2000-2019.

## 1.1 RESEARCH METHODS

This research was conducted in the city of Semarang, especially in areas that experienced conversion of agricultural land to non-agricultural land in the form of settlements. The selection of the area is based on a map of land use change / conversion that occurred in Semarang City. The design of this research is exploratory descriptive, namely research on a condition by making descriptions and descriptions systematically, factually and accurately about the facts, the nature and studying the relationships between observed phenomena (Nazir, 2005).

The population of this study is all agricultural land in Semarang in 2000-2019. The method of collecting sample is saturated sampling, which the sample is rice fields in Semarang year 2000 and 2019.

Data analysis used is analysis of rice field conversion distribution and field conversion rate analysis. Partial shrinkage rate of land can be explained as follows

$$V = (L_t - L_{(t-1)}) / L_{(t-1)} \times 100\% \quad (1)$$

Where:

V = Land shrinkage rate (%)

L<sub>t</sub> = Land area of t-year (ha)

L<sub>t-1</sub> = Land area of the year before t (ha)

## 3 Results and discussion

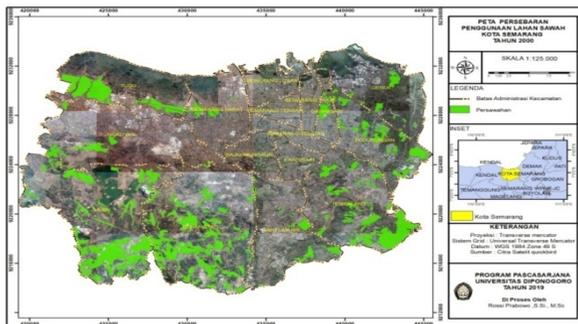
### 3.1 Distribution of rice fields in Semarang period 2000-2019

Total area of rice fields in Semarang in 2000 was 4661.29 Ha, or around 12.04% of Semarang total area 37,300 Ha. Distribution of rice fields in Semarang year 2000 spread in 10 of 16 sub-districts. Mijen is a sub-district which has the widest rice field in 2000 with 1228.72 Ha or 3.29% of Semarang total area, while the sub-district which has the narrowest/smallest rice field is Gayamsari with 72.62 Ha or 0.19% of Semarang total area.

**Table 1.** Rice Field Area and Conversation Rate in Each Sub-district in Semarang Year

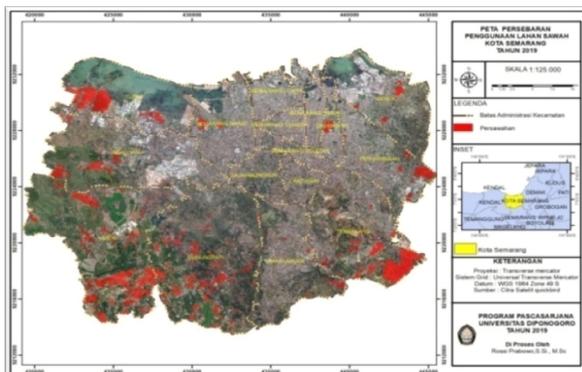
Sub-district	Rice Field Area (Ha)		Difference in rice field (Ha)	Conversion rate %
	2000	2019		
Banyumanik	166.02	47.64	-118.38	71.30
Candisari	0	0	0	0
Gajahmungkur	0	0	0	0
Gayamsari	72.62	35.33	-37.29	51.35
Genuk	98.4	53.03	-45.37	46.11
Gunungpati	1170.41	402.74	-767.67	65.59
Mijen	1228.72	662.08	-566.64	46.12
Ngaliyan	205.69	147.61	-58.08	28.24
Pedurungan	331.72	118.48	-213.24	64.28
Semarang barat	76.54	38.92	-37.62	49.15
Semarang selatan	0	0	0	0
Semarang tengah	0	0	0	0
Semarang timur	0	0	0	0
Semarang utara	0	0	0	0
Tembalang	794.1	463.61	-330.49	41.62
Tugu	517.07	323.47	-193.6	37.44
<b>Jumlah</b>	4661.29	2292.91	-2368.38	50.81

Some other sub-districts which have rice fields in Semarang are Banyumanik 166.02 Ha, Genuk 98.04 Ha, Gunungpati 1170.41 Ha, Ngaliyan 205.69 Ha, Pedurungan 331.72 Ha, West Semarang 76.54 Ha, Tembalang 794.01 Ha and the last is Tugu 517.07 Ha. While sub-districts in Semarang which do not have rice fields are Candisari, Gajahmungkur, Central Semarang, South Semarang, North Semarang and East Semarang.



**Fig. 1.** Map of Rice Field Distribution in Semarang year 2000.

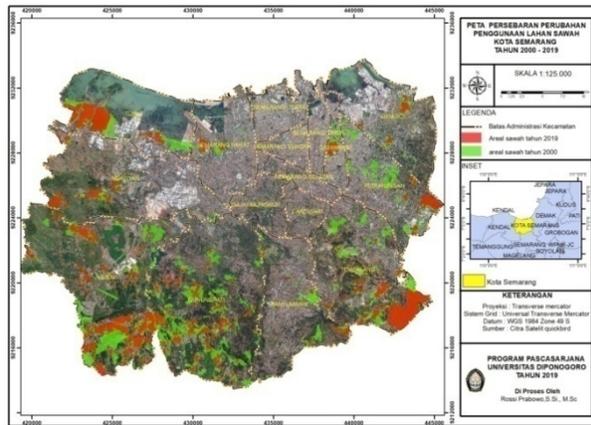
Rice fields condition in Semarang in 2019 already change in function. Total area of rice fields in Semarang 2019 was 2292.91 Ha, or around 6.14% of total area Semarang is 37300 Ha. That area is spread in several Semarang sub-districts, but it is still the same as in 2000, there are several sub-districts that do not have rice fields, namely Candisari, Gajahmungkur, Central Semarang, South Semarang, North Semarang and East Semarang. In 2019, Mijen still has the widest rice field around 662.08 Ha or 1.77% of Semarang total area, while sub-district which has the narrowest/smallest land area is still the same, Gayamsari 35.33 Ha or 0.09% of Semarang total area. Distribution and area of rice fields in Semarang are Banyumanik 47.64 Ha, Genuk 53.03 Ha, Gunungpati 402.74 Ha, Ngaliyan 147.61 Ha, Pedurungan 118.48 Ha, Semarang Barat 38,92 Ha, Tembalang 463.61 Ha and the last is Tugu 323.47 Ha. The total of sub-districts that have rice fields are 10 (ten) sub-districts, while the sub-districts that do not have rice fields are 6 (six) sub-districts.



**Fig. 2.** Map of Rice Field Distribution in Semarang year 2019.

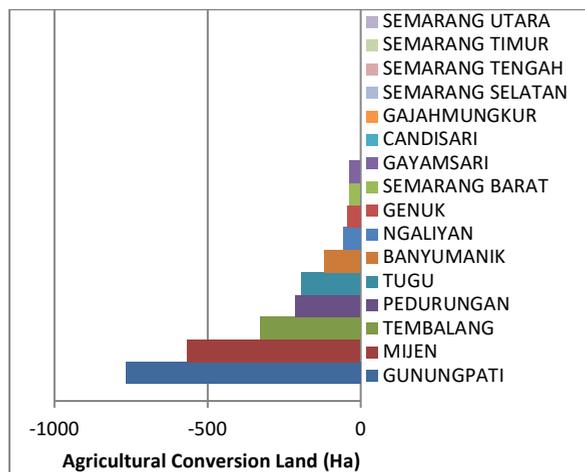
### 3.2 Conversion Rate of Rice Fields in Semarang period 2000-2019.

Rice fields from 2000 to 2019 in the most sub-districts in Semarang get significant conversion, the effect is rice fields area in Semarang has decreased.



**Fig. 3.** Map of Rice Field Distribution in Semarang year 2000-2019

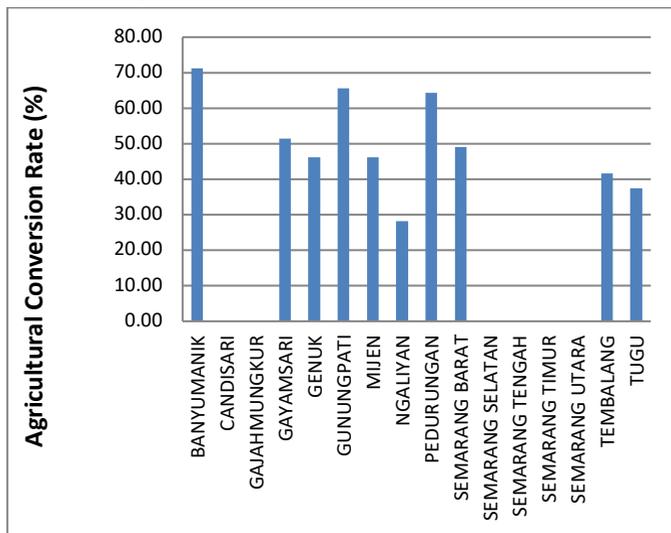
The reduction of rice fields based on interpretation of imagery satellite in 2000 and 2019 was due to the large number of land conversion from rice fields to residential or developed land. Since 2000 up to 2019, the area of rice fields much reduced from 4661.29 Ha to 2292.91 Ha, there was a difference in change, around 2368, 38 Ha.



**Fig. 4.** Rank of Agricultural Conversion Land in Semarang period 2000-2019.

From Figure 4, it is known that Gunungpati is a sub-district which has the most shrinkage area of ricefield from 2000 to 2019 which is 767.67 Ha or the same as 40.4 Ha/Year. The shrinkage area caused by agricultural land conversion in Gunungpati sub-district is due to Gunungpati area become the central of education and residential. That city developments, lands in Gunungpati sub-district is converted from agricultural land becomes non-agricultural land or becomes residential and other buildings [2]. Semarang Mayor Regulation No. 16 year 2012 concerning on Regional Development Work Plan (RKPD) states that Gunungpati Sub-district is include in BWK VIII (Urban Area Dividing Plan) where the main function of that development area is for educational development.

In its development Gunungpati sub-district became a magnet for economic development because there are development of educational facilities, the community change the function of rice fields into business place such as restaurants, boarding houses and residential.



**Fig. 5.** Percentage Diagram of Agricultural Conversion Rate for Each Sub-district in Semarang.

From Figure 5. it is known that Banyumanik sub-district has the highest conversion rate of agricultural land it is 71.30%. In 2000, there were 166.02 hectares of rice fields and in 2019, there were many functions and 47.64 hectares rice fields left. High conversion rate in Banyumanik sub-district occurs because narrow agricultural land is not comparable to the very high demand of land. With total area 4,8000,688 Ha, and population density 6.421 people/Km<sup>2</sup> [1]. Banyumanik sub-district is a residential area and as a trade center. Geographically, Banyumanik sub-district is a strategic hilly area, there are many residential and trade centers, in addition it is also an office area, especially military offices, there is high way access and supermarkets and shopping centers make the land prices is costly. This is encourages farmers or rice field owners to sell or convert the agricultural land to non-agricultural land. That due to big insistence of non-agricultural sector, under the pretext of development, the owner of land become weak party with low bargaining position so the agricultural land certainly convert, to other hand if farmers do not sell their agricultural land, but in their surrounding area has been sold and already built it will certainly be a problem in cultivating land due to the cut off irrigation channels [3]. The phenomenon of agricultural land conversion rate in Semarang will certainly affect to the efforts to realize sustainable agriculture, especially the three sub-districts that getwide land conversion, namely, Gunungpati, Mijen and Tembalang areas intended for food crop agriculture [5]. The highshrinkage of agricultural land area and the rate of agricultural conversion land will certainly reduce productivity value of agricultural product, so government's efforts to realize food sustainable and independence in Indonesia will be more difficult to realized[7].

## 4 Conclusion

1. During 2000-2019 there were 10 sub-districts which still had rice fields in Semarang and 6 sub-districts did not have rice fields. Mijen Sub-district is a sub-district which has the widest rice fields in Semarang in 2019 around 662.08 Ha. The sub-district which gets the most shrinkage of rice fields was Gunungpati sub-district with an area of shrinkage due to land conversion 767.67 Ha in 2000-2019, or 40.4 Ha/year.
2. The sub-district with the highest land conversion rate is Banyumanik sub-district with the agricultural conversion rate is 71.30%.

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