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## **Land Used Change on Rice Field in Serang City, Banten Province, Indonesia**

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### **Abstract**

Serang changed administratively in very short time from just sub district town to be capital city of Banten Province in 2000, and to be autonomous city in 2007. The region development is also changed from rural development with agriculture oriented to be urban development with industries and trade oriented. This means that the existing technical irrigated rice fields will be converted to non-agricultural land. This research aims to study the land used change of rice fields in Serang City from 1993 to 2016, divided into three time intervals are 1993-2000, 2000-2007, and 2007-2016. Land used change is analyzed by overly method between land use map at  $t_0$  and  $t_1$ . The result shows that the biggest land use change is from rice field to settlement and agro forest. The annual land use change in the time interval of 1993-2000 is biggest (265.14 Ha) than 2000-2007 (90.43 Ha) and 2007-2016 (91.67 Ha).

**Keywords:** Land Use Change; Serang City; Rice Fields.

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## **1. Introduction**

Serang has changed administratively in a short time. At first, Serang was just a sub district town. In 2000, through Indonesian Law No. 23 of 2000 about the establishment of Banten Province, Serang was designated as the capital of Banten Province. In 2007, through Indonesian Law No. 32 of 2007 about Serang City, Serang was designated as an autonomous city with administrative areas covering Serang Sub-District, Kasemen Sub-District, Walantaka Sub-district, Curug Sub-District, Cipocok Jaya Sub-district and Taktakan Sub-District. The change of status to autonomous city has been followed by the determination of Spatial Plan of Serang City 2010-2030 through Serang City Regulation No. 6 of 2011 about Spatial Planning of Serang City 2010-2030.

Change of the status of the city gives consequences to the rapid growth of the city. The author in [1] explains that urban growth is an increase of built land in a city. The process is very complex and driven by the interaction of various factors [2]. The dominant factors of urban growth are population growth and economic growth [3]. Population growth of the cities tends to be high because of the movement of people from rural areas or other areas into the city [4]. Urban economic growth is driven by factors: improving the quality of human resources, improving infrastructure, innovation, economic agglomeration, and proximity to the markets.

The increase of urban area is due to the development of urban infrastructure and the construction of settlements as a result of the increasing of urban population. In the period of 2001-2006 when Serang was still part of Serang District, the population growth was just average 1.3% per year [5, 6]. In the period of 2008 - 2016 after Serang became an autonomous city, the population increased from 493,232 in 2008 to 643,205 in 2015 or increased by 25% or an average of 3.5% per year [7, 8]. The increase of population leads to an increase of the rate of conversion of agricultural land into constructed land, especially for settlements. The author [9] states that the conversion of paddy fields in Java is mostly for housing construction needs (74.96%), while outside of Java is for public facilities (43.59%). The author [10] explain that the land use change of wet land to settlement is driven by the low income of paddy farming, and the tendency of land owners to work in non-agricultural sector. Land prices and accessibility also affect paddy fields conversion [11]. According to author [12] paddy fields have problems due to the productivity that near the leveling of. The high of land rent value for non-agricultural use by 1: 500 for the industry and 1: 622 for residential make rice fields very susceptible to conversion to non-agricultural use. The conversion of agricultural land generally occurs in the area near the city center and the city entrance area.

Although administratively Serang has been changed to be a city, but Serang still has an extensive technical irrigated rice fields and a large number of farm households. According to the data from Pusdatin Kementan about Rice Field Audit Results of 2010, and the result of sincronization with BPN data, Serang city has 8,138 ha of technical irrigated rice field. In line with the opinion of author [12], these paddy fields will be highly vulnerable to conversion. This is also shown from the declining of the number of farm households in Serang city. The number of farm households in 2003 was 30,702 families, in 2013 fell to 19,107 families or decreased by 11,057 families [13].

The author in [14] mentioned that paddy fields have high economic, social, and environmental benefits. Most of

the benefits are communal, meaning that if there is a conversion of paddy fields, the losses incurred will be more felt by the crowd than only by the owner. The author in [15] describes the economic, social and environmental impacts of changes in agricultural land use. Among the major socio-economic impacts are reduced availability of land for food production, and reduced open land with all environmental benefits to local people. The dominant environmental impacts are water disturbance, air quality, loss of vegetation and wildlife.

This research aims to study the land use change of the rice field in Serang city before Serang becomes the capital of Banten province, after becoming the capital of Banten province, and after becoming an autonomous city.

## 2. Research Method

The research area is Serang City of Banten Province, covering Serang sub-district, Kasemen, Cipocok Jaya, Walantaka, Curug, and Taktakan. Astronomically, Serang City lies between 5°99' - 6°22' South Latitude and 106° 07' - 106°25' East Longitude with an area of 266,74 km<sup>2</sup> (Figure 1). This research was conducted for 17 months starting from August 2015 until February 2017. The data used consisted of Land Sat Image 1993, 2000, 2007, and 2016, and Serang City Map. Land sat image obtained from LAPAN, and Serang city map obtained from the City Planning Office of Serang City. Land use maps obtained through visual interpretation of the land sat image. The class of land use is divided into 9 classes of usage. Land use changes of rice fields were analyzed at 3 time intervals are 1993-2000, 2000-2007, and 2007-2016. The analysis of land use change 1993-2000 is to see land use change before Serang became the capital city of Banten province. The analysis of land use change in 2000-2007 to see land use change after Serang became the capital city of Banten Province, and the analysis of land use change in 2007-2016 is to see land use change after Serang became an autonomous city. Analysis of land use change is done by overlay between land use map in the time t<sub>0</sub> and land use map in the time t<sub>1</sub>. The direction of land use change was analyzed by cross tabulation between land use on t<sub>0</sub> and land use on t<sub>1</sub>.

The annual land use change of rice field in the each time interval was analyze by adapting the formula that developed by [16] Aldwaik and Pontius Jr. (2012) as bellow :

$$I = \frac{I_{t_0-t_1}}{t}$$

where,

$I$ : Annual Intensity of land use change of rice field in the time interval of t<sub>0-t1</sub>

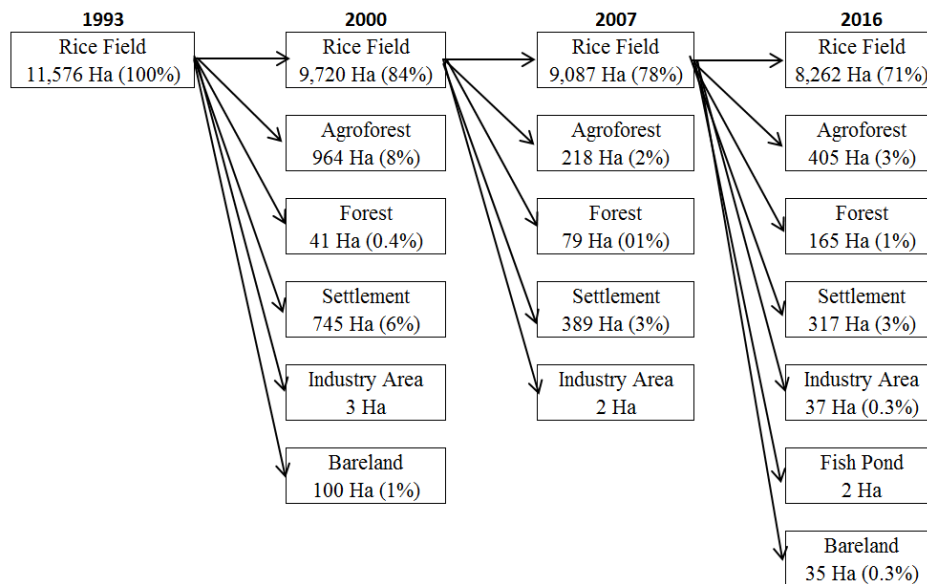
$I_{t_0-t_1}$  : Intensity of land use change of rice field in the time interval of t<sub>0-t1</sub>

t : Time interval

## 3. Result and Discussion

Rice fields in Serang City reduced continuously from 1993 to 2016. Figure 1 show the land use change of rice

field in Serang City during 1993 until 2016. In general, land use change of Serang City during 1993 to 2016 presented in Figure 2. In 1993, Serang City has 11576 Ha of rice fields. In the period of 1993 - 2000, when Serang was still a part of Serang Sub District, 1856 Ha (16%) of rice fields changed to be agro forest (964 Ha), forest (41 Ha), settlement (745 Ha), industry area (3 Ha), and to be bare land (100 Ha). In the period 2000-2007, after Serang becoming the capital city of Banten Province, 633 Ha (5%) of rice fields changed to agro forest (218 Ha), forest (79 Ha), settlement (389 Ha), and to be industry area (2 Ha). In the period 2007-2016, after Serang was being declared to be an autonomous city in 2007, the conversion of rice fields was going up to be 825 Ha (7%). The rice fields was converted to be agro forest (405 Ha), forest (165 Ha), settlement (317 Ha), industry area (37 Ha), fish pond (2 Ha), and to be bare land (35 Ha). The annual change of rice fields in the period of 1993-2000 is 265.14 Ha, in 2000-2007 is 90.43 Ha, and in 2007-2016 is 91.67 Ha. Overall, during the period of 1993-2016 (23 years) the rice fields in Serang City decreased by 29% from 11576 Ha in 1993 to be 8262 Ha in 2016. This means that every year the rice fields in Serang City decreased about 144 Ha or about 1.3%. The biggest rice field conversion is to be settlement and agro forest. The growth of agro forests in Serang City (Figure 3) due to the high demand of wood for packing materials for industries in the area around Serang City. There are many household scale sawmill industries produce wood for packing material as shown in Figure 4. The high demand of settlement in Serang city is caused by the accumulation of activities in Serang City linked to the role of Serang City as a capital city of Banten province, as government center of Serang district, and as government center of Serang City itself. The workers of industrial estate in the area around Serang City like Keragilan, Ciujung, and Cimande industrial estate are also prefer live in Serang City. It makes the settlement demand in Serang City higher.

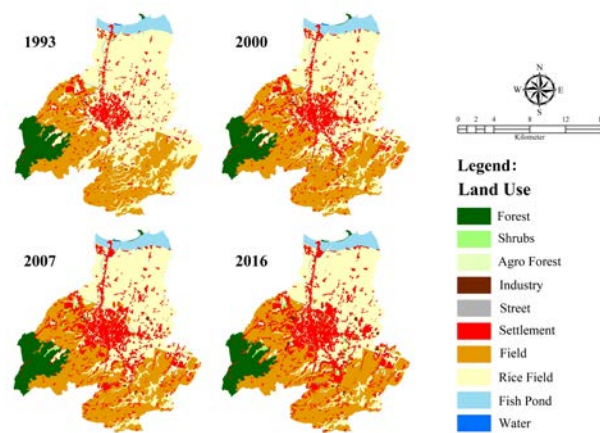


**Figure 1:** Diagram of Land Use Change of The Rice Fields in Serang City From 1993 up to 2016

Land use change of rice fields as shown above indicate that Serang City is being in the period of change from rural with the high potential of irrigated rice fields to be urban with the high growth of settlement. This condition is called as urbanization. Sociologically, urbanization is a process of population moving from rural to urban [17]. The author in [4] state that urbanization is an urbanize process that means there is a change

essentially the physical and socio-economical of the area because of the economic growth. Urbanization would not be prevented because of the higher income in the urban [18].

The author in [19] states that urbanization in the term of urban formation is linked to the opening of employment opportunities, both formal and informal. Employment opportunity is the entrance to the effort to eradicate the people from poverty. Urbanization has helped to alleviate poverty through increasing productivity and added value, employment opportunities, and improving quality of life through better education and health, large scale investment, and better access to infrastructure and services. In terms of employment, in the UK, cities absorb 78% of the workforce. In America, the metropolitan area absorbs 84% of the workforce. The high number of opportunities in the city in terms of providing health services, education, services, and employment make rural areas difficult to compete with urban [20].



**Figure 2:** Land Use Map of Serang City 1993, 2000, 2007, and 2016



**Figure 3:** Agro Forest in Serang City



**Figure 4:** Household Scale Sawmill Industry

The author in [21] in his research in Bali explains that the main driving and attracting factor of migration from rural to urban in Bali is economic factor. The author in [4] explains that urbanization has negative impacts among other reduce open land, increase air pollution due to increase motor vehicle population, increase the potential of natural disasters because some migrants live on riverbanks, increase the traffic jam and destroying urban planning. Urbanization also has an impact on the growth of urban slums. Residents who come from the village into the city, generally do not have skills and sufficient of formal education to be able to work in the

formal sector. They are generally only able to work in the informal sector with low income, so they cannot access habitable housing [22]. The author in [23] suggests the need of a clear Spatial Plan to safeguard the food and environment in the city related to the high rate of urbanization.

#### **4. Conclusion**

Rice field in Serang City reduce continuously from 1993 to 2016. The annual change of rice field in the period of 1993-2000 when Serang still a part of Serang District is highest than the period of 2000-2007 when Serang to be a capital city of Banten Province, dan the period of 2000-2016 after Serang to be an autonomous city. The land use change during 1993-2016 indicate that Serang City is in the condition of change from rural area with wide rice field to be urban with high growth of the population.

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