

THE SPATIAL PATTERN OF THE AVAILABILITY AND NEEDS RATIO OF RICE IN LEBAK REGENCY, BANTEN PROVINCE

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ABSTRACT: Rice is a staple food for a population of Lebak Regency, Banten Province. The needs of rice in the Lebak Regency are increasing along with the increase in population. The problem of availability of rice for each village in the Lebak Regency does not meet the population needs of each village. The purpose of this study is to analyze: (1) Spatial differences of the ratio of the availability and requirements of rice; (2) The correlation between physical factors (elevation, slope, drought, forest area) and non-physical (population density, distance from the center of district capital of Lebak Regency) to the ratio of the availability and needs of rice. The analytical method used in this study is spatial analysis and statistical analysis (Pearson product-moment). The results and discussion showed: (1) Spatially, there are differences in the region ratio of the availability and needs of rice. The deficit region was located in the north, close to the district capital; (2) The correlation between physical and non-physical factors with the ratio of availability and needs of rice is not significant at the significance level (α) = 0.05, which means that the surplus area of rice is not always in the same physical and non-physical area. The conclusion of this research that's the deficit and surplus area of rice is not always in the same physical and non-physical area.

Keywords: Spatial, Rice surplus, and deficit, Physical and non-physical factors

1. INTRODUCTION

Food is the most basic need for human beings and as a top priority in development. Rice is a staple food for most Indonesian people. Rice consumption in Indonesia is increasing every year, along with the increasing population of Indonesia. The very high dependence of the Indonesian people on rice will be a problem if the availability of rice cannot be fulfilled, thus disrupting national food security. Rice consumption in Indonesia was 96.32 kg /capita/year. Although it has decreased from the previous year, it still far exceeds the average level of world rice consumption, which is 60 kg /capita/year. The decrease in rice consumption caused by government policies regarding the shifting of staple foods, from local foods such as corn and tubers to the national staple food. Conditions of food dependence on one type of staple food product which makes Indonesia food insecure. Therefore, it is necessary to develop another staple food product to replace rice [1]. To support food security, information on the needs and availability of food, especially rice, was crucial.

Lebak Regency's development strategies in agriculture are to improve the status of food security and community economic development [2]. Agricultural production of food crops in Lebak

Regency in 2017 dominated by rice plants consisting of lowland rice and field rice with a production yield of 675,091 tons (93.86%). The increase of food crops, especially rice production, is the focus of the attention of the Lebak Regency farmers. In 2017, rice production decreased by 3.34% from the previous year due to an outbreak of disease that attacks rice plants in several districts. Production of 2014: 474,224 tons; production of 2015: 607,220 tons; production of 2016: 698,463 ton; production of 2017: 675,091 ton [3]. The Lebak Regency Government hopes that rice production can meet the needs of its population. The population of Lebak Regency in 2017 was 1,288,103 people and a population density of four people per hectare [4]. The normative cereal requirement per person/day is 300 grams, which means that the cereal needs of the Lebak Regency population are 300 times the population (Food Insecurity Atlas (FIA) in [5,6].

2. METHODOLOGY

2.1 Research Framework

The variables used to achieve the research objectives are: 1) The Ratio of the availability and needs of rice; 2) Physical factors include: (1) Elevation; (2) Slope; (3) Drought; (4) Forest area; and, 3) Non-physical factors include: (1) Population density; (2) The distance of the village

from the district capital. The research framework saw in Fig. 1.

2.2. Data Collection

The types and sources of data collected: 1) spatial data includes: (1) elevation; (2) slope; (3) drought; (4) forest area; (4) distance of the village from the center of the district capital; 2) socioeconomic data includes (1) rice production; (2) population density. Physical data were obtained from maps and images of Landsat 8, while socioeconomic data collected by the Statistics Agency.

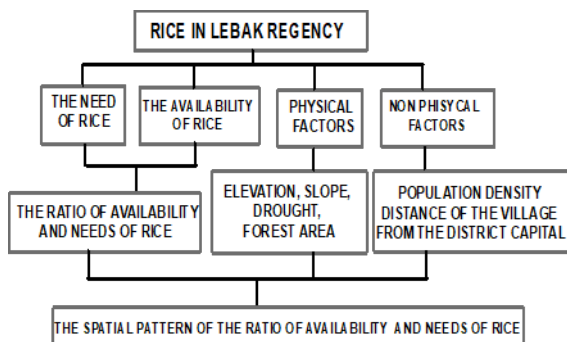


Fig 1. Research framework

2.3. Data Processing

Data processing performed by (a) classification of physical and non-physical data; (b) processing spatial and tabular data with Geographic Information System (GIS) technology and remote sensing [7,8,9]; (c) calculate the ratio of the availability and needs of rice with the with Eq. (1).

$$I = \text{Rice Production} \quad (1)$$

$$\frac{T \text{ population} * C \text{ normative} * 365}{}$$

2.4. Data Analysis

The analytical method used in this study is spatial analysis and statistical analysis. Spatial analysis with map overlaid method, during statistical analysis with Pearson product-moment method. The correlated variable is elevation. Slope, drought, forest area, population density, distance from the district capital to the ratio of the availability and needs of rice. Pearson product-moment formula with Eq. (2) [10].

$$r_{xy} = \frac{n \sum_{i=1}^n X_i Y_i - (\sum_{i=1}^n X_i)(\sum_{i=1}^n Y_i)}{\sqrt{n \sum_{i=1}^n X_i^2 - (\sum_{i=1}^n X_i)^2} \sqrt{n \sum_{i=1}^n Y_i^2 - (\sum_{i=1}^n Y_i)^2}} \quad (2)$$

Correlation of quantitative data processed by the SPSS (Statistical Product and Service Solutions) program, the correlation coefficient (r)

is obtained from the SPSS output and interpreted according to theory.

3. RESULTS AND DISCUSSIONS

3.1 The Ratio of Availability and Needs of Rice

The ratio of the availability and needs of rice can be used to measure the ability of a village to provide rice to meet the needs of the villagers. If the availability of rice is higher than the needs of the population, the village is considered a surplus of rice. If the availability of rice is lower than the population's demand for rice, the area is regarded as a deficit of rice. The spatial pattern of the availability and needs ratio of rice in Lebak Regency shows that villages classified as a deficiency were 34 villages (9.9 %), located in Rangkasbitung District. This condition can see from the amount of rice production in the village is low, and the population is large. Rangkasbitung District is the capital of the Lebak Regency, having relatively small agricultural activities compared to other villages in Lebak Regency.

Based on figure 2, Lebak Regency dominated by a surplus of rice areas covering 311 villages or 90.1 % of all villages in the Lebak Regency. The condition of this village has high food production, and the area of rice agriculture relatively fulfilled the village. The deficit of rice area in the north, such as Rangkasbitung Timur, Rangkasbitung Barat, Muara Ujung Timur, Jati Mulya, Cimangeunteung, Muara Ujung Barat, Cijoro Lebak, and Narimbang villages are an area whose population activities tend to be non-agricultural, while the deficit area in the south, such as Sawarna village is a coastal tourism area. A central deficit of rice areas, such as Kanekes village, is home for Baduy tribes who have a different culture than other villages in Lebak Regency.

3.2 The Correlation Between Physical Factors To The Availability And Needs Ratio of Rice

3.2.1 The correlation between elevation to the availability and needs the ratio of rice

Lebak Regency dominated which an altitude of <500 meters mean sea level, which is an area of 266,295 ha (80.6%) (see Fig.3). It scattered pattern in the northern part (Villages of Maja, Rangkasbitung, Kalanganyar, and Cimarga Districts) and southern coast (village of Malingping, Wanasalam, Panggarangan, Ciligrang, and Bayah Districts) and some areas in the west (villages of Banjarsari, Cileles, and Gunungkencana District), the central region (villages of Cirinten, Gunungkencana, Cijaku, and Cigemblong Districts).

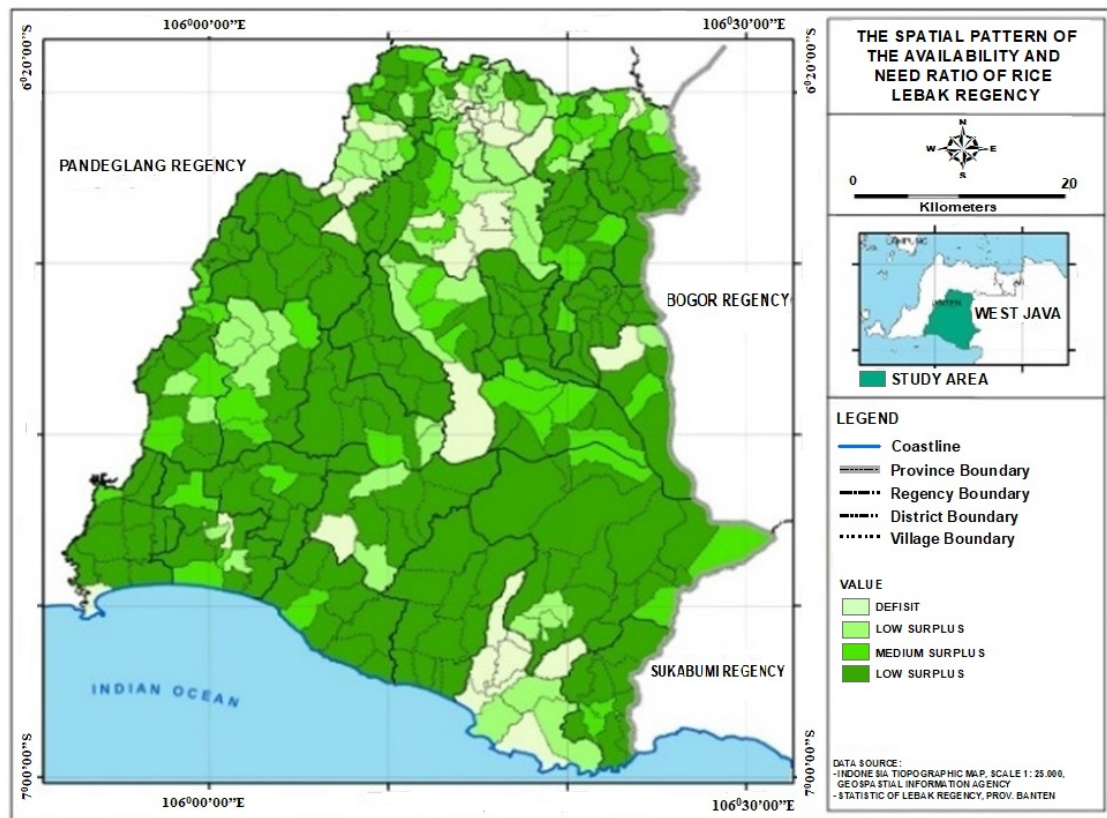


Fig 2. The spatial pattern of the availability and needs ratio of rice in Lebak Regency

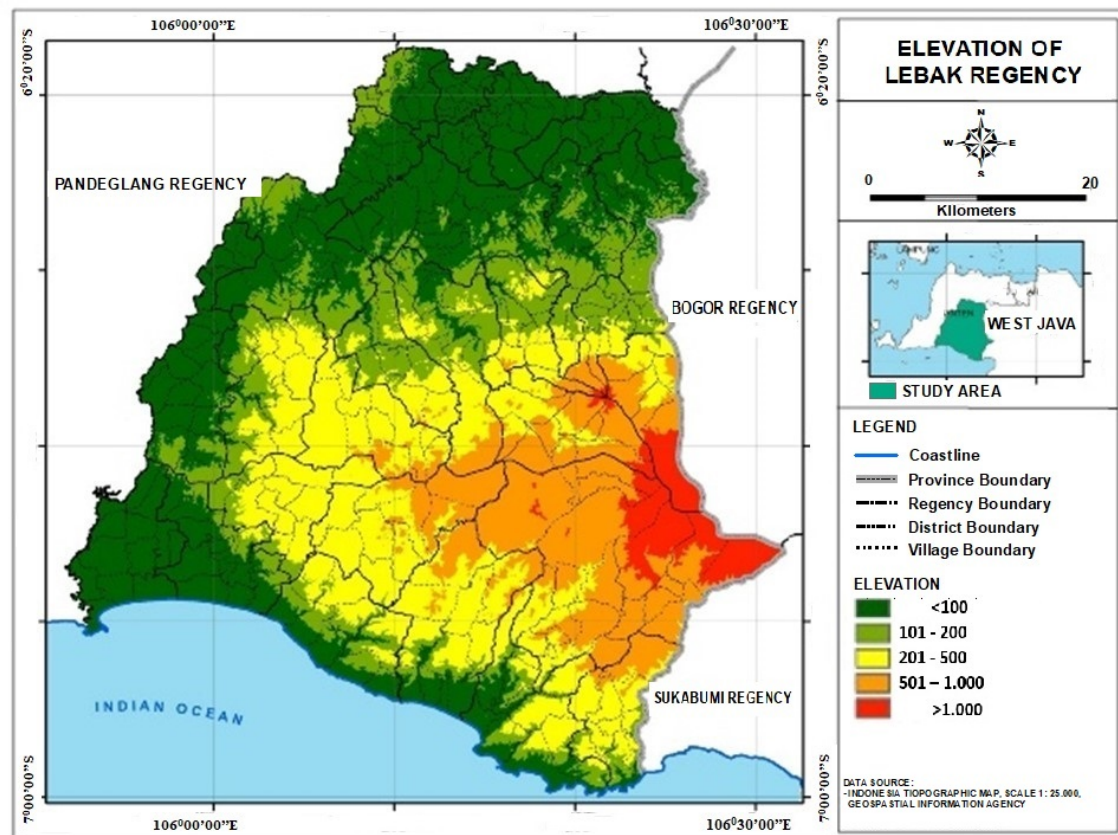


Fig 3. The Elevation of Lebak Regency

A small portion of the Lebak Regency has an altitude of more than 1,000 meters mean sea level, with an area of 12,376 hectares or 3.74% of the total area. The altitude region is part of the Mount Halimun National Park with the peak of Mount Halimun [11]. Correlated through a map overlay between elevation to the availability and needs the ratio of rice, it appears that a high ratio (surplus of rice) is not always at low altitude while the low

3.2.2 The correlation between slope to the availability and needs the ratio of rice

Lebak Regency is dominated by < 15 % slope, which is 221,869 ha (67.11%) (see Fig. 4). The area was spreading in the north and south, which are around the village of Rangkasbitung, Banjarsari, Wanasalam, and Malingping Districts. While the slope area > 15% covering an area of 108,717 ha (32.89%), dominates the eastern regions, such as the villages of Cibeber, Lebakgedong, and Cilonggrang Districts [11]. Map overlay between the slope and the availability and needs a ratio of rice used to explain their relationships. It appears that the high ratio is not always in the lowland. The low ratio is not always in the highlands. The results of the Pearson product-moment statistical analysis show the correlation coefficient $r = -0.079$, which is no significant correlation between slope and the availability and needs ratio at the real level ($\alpha = 0.05$).

3.2.3 The correlation between drought to the availability and needs the ratio of rice

Drought is a natural phenomenon characterized by significantly reduced water availability over a period occurring over a large area [11]. Drought occurs due to the deviation of weather conditions. It is mean the lower rainfall or below normal conditions that occur in a region, it would be a drought. As a natural disaster, drought has the potential to harm human life, including property and property setup measurements [12, 13, 14]. In general, the definition of drought is the availability of water far below the water requirement for the necessities of life, agriculture, economic, and environmental activities. The occurrence of drought in a region can be an obstacle to increasing food production in the area [15,16]. The region of drought is determined using the Brightness, Greenness, and Wetness index [17]. This value can reflect the state of vegetation and soil, these three indices have been studied and used in agricultural, forest, ecological and landscape studies [18,19]

ratio (deficit of rice) is not always in the highlands. The supported by the results of the Pearson product-moment statistical analysis, which shows there is no significant correlation between the ratio with elevation at the significance level ($\alpha = 0.05$). The correlation coefficient $r = -0.026$, revealing a negative correlation between the two variables. The correlation indicates that as one tends to increase, the other tends to decrease.

The low and moderate drought areas located in the middle and east, which are relatively high. Whereas, high drought level areas were generally in the lowlands. The moderate level of drought is the largest area (45%) in Lebak Regency, and the narrowest area (15%) is very high in the regional classification (see Fig. 5). Areas of very high drought dominate villages in the Sub-districts of Wanasalam, Malingping, and Maja, whereas low drought level areas dominate villages of Cibeber, Bayah, Cilongrang, Cirinten, and Sobang Districts. Based on spatial analysis with map overlay shows that low ratios are not always at high levels of drought. Likewise, high ratios are not always low drought levels. The results of the Pearson product-moment statistical analysis show the correlation coefficient $r = -0.066$, which is no significant correlation between the ratio and slope at the real level ($\alpha = 0.05$).

3.2.4 The correlation between forest area to the availability and needs ratio of rice

Forest area based on land use map in Lebak Regency (see Fig. 6). Forest area in Lebak Regency is 73,317.19 ha or 22.18%, and the largest is in villages of Cibeber District (16,967.90 ha). Forest spatially tends to dominate villages in the south, such as villages of Cibeber District, Cigemblong, Cihara, Cijaku, Cilongrang, Cipanas, Cirinten, Lebakgedong, Malingping, Panggarangan, and Sobang Districts whereas areas without forests tend to be in northern villages relatively close to the regency capital, such as villages in Rangkasbitung, Maja, Kalangnganyar, Warunggunung, Cibadak, Curugbitung, Cimarga, Cileles, and Muncang Districts. Correlated through map overlays between ratios and forest areas, it appears that high ratios are not always in low forest areas. While the low ratio is not still in the high forest area, this is supported by the results of the Pearson product-moment statistical analysis which shows that there is no significant correlation between the ratio and forest area at the real level ($\alpha = 0.05$ and the correlation coefficient $r = 0.043$).

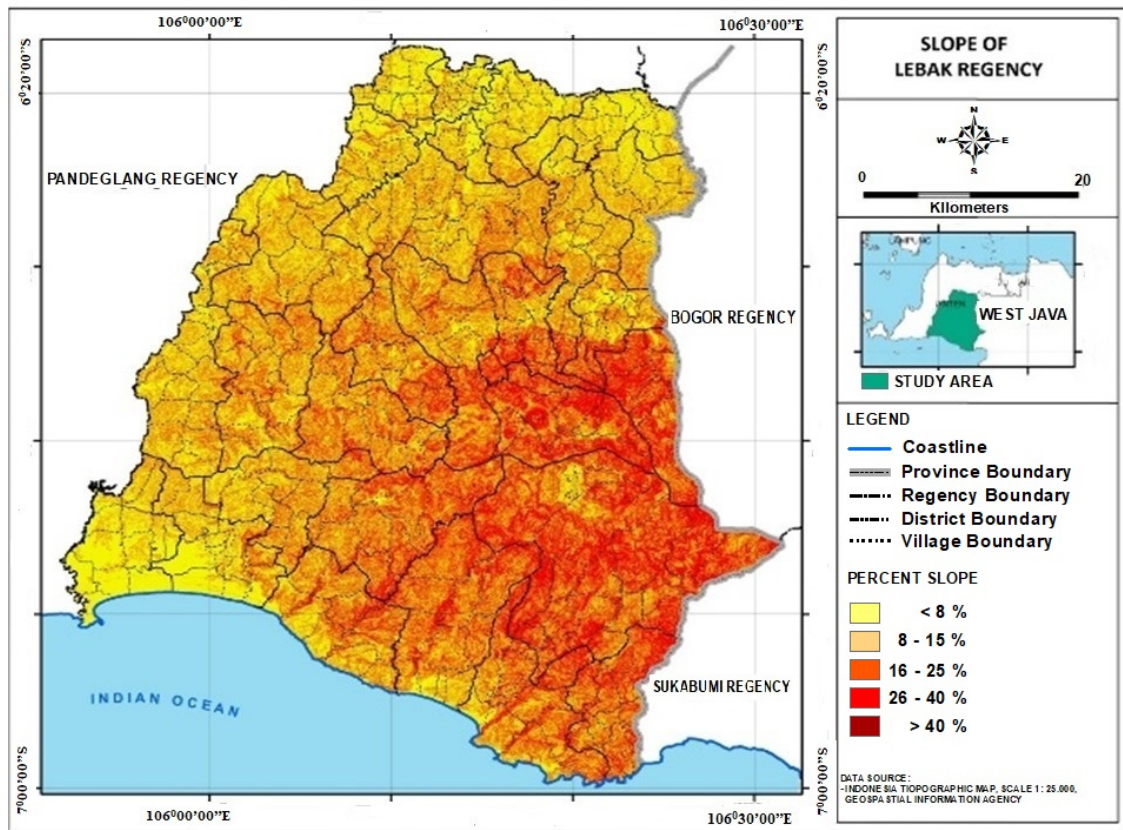


Fig 4. The Slope of Lebak Regency

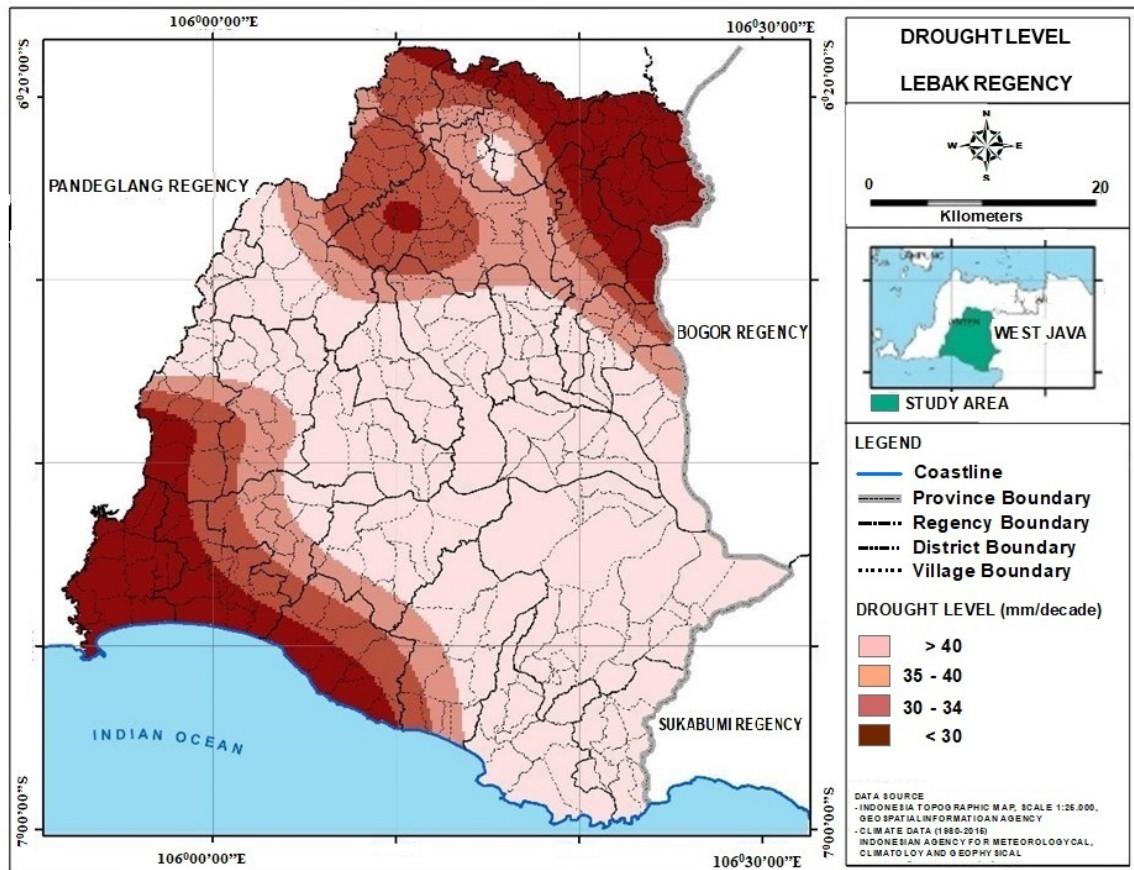


Fig 5. The Drought Level of Lebak Regency

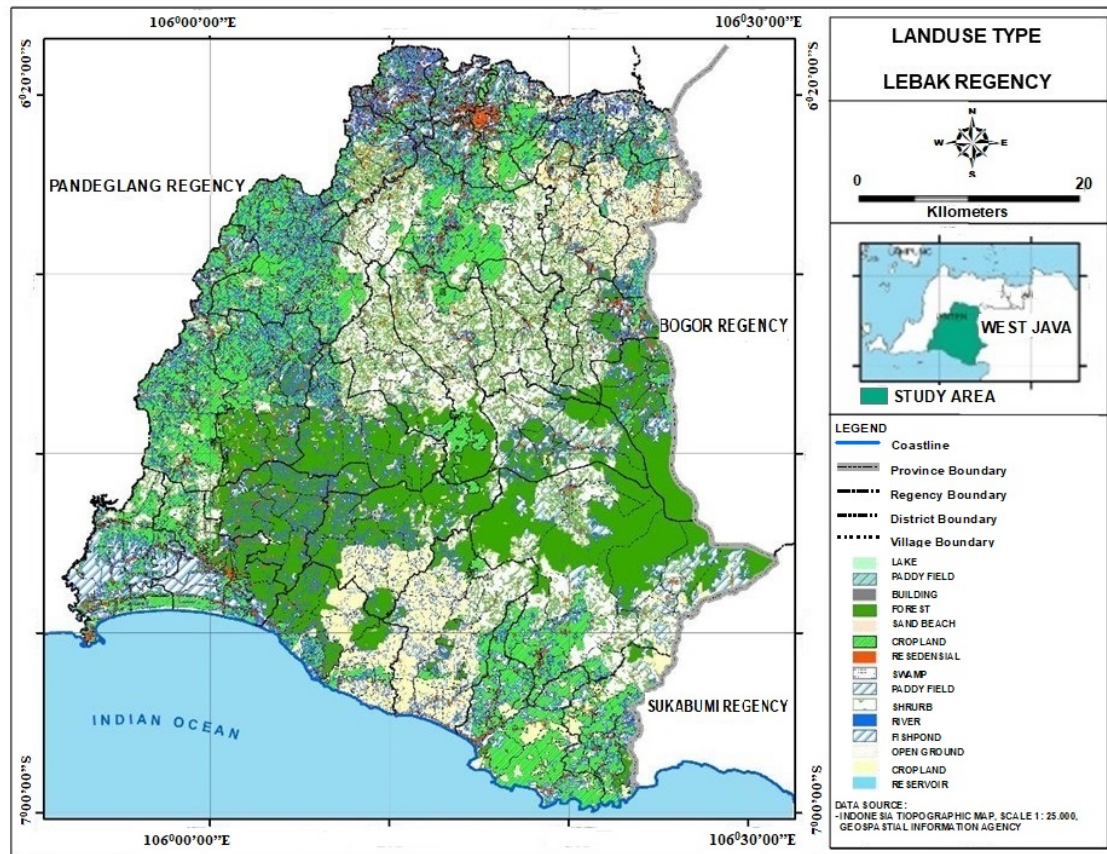


Fig 6. The Forest Area according to Land Use of Lebak Regency

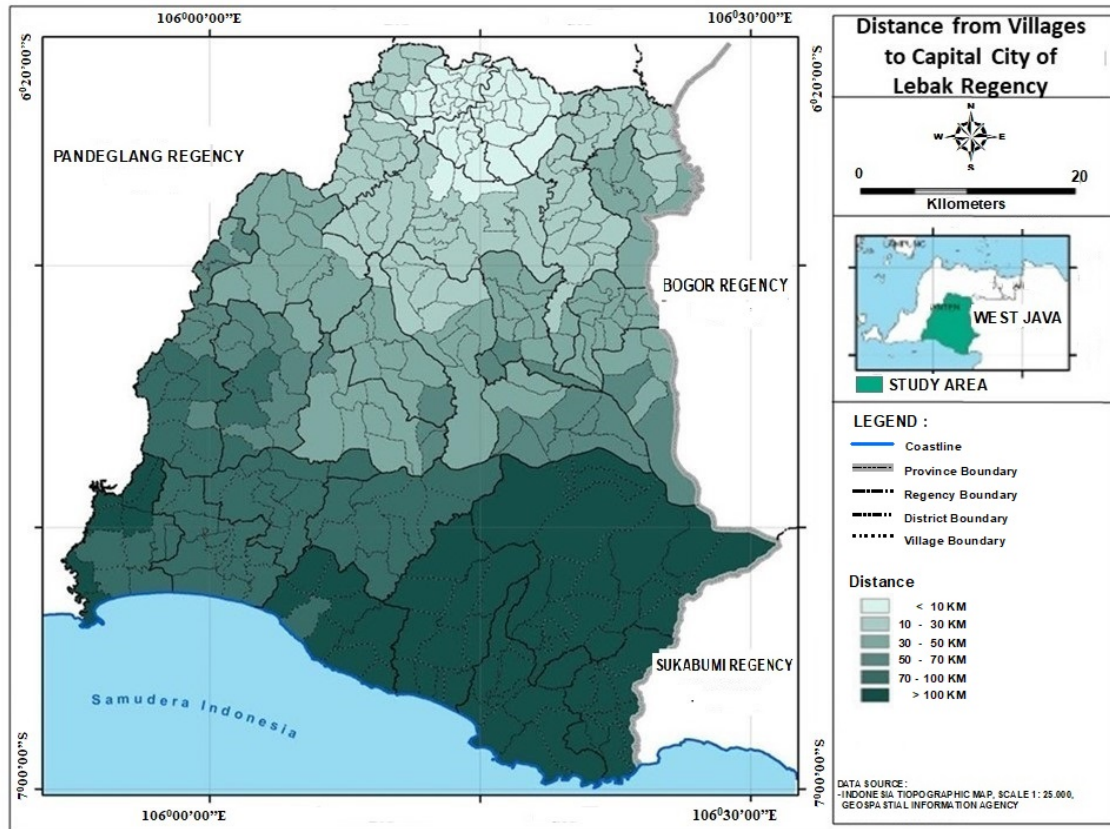


Fig 7. The Distance from Villages to Capital City of Lebak Regency

3.3. The Correlation Non-Physical Factors to The Availability And Needs Ratio of Rice

3.3.1. The correlation between population density to the availability and needs a ratio of rice

The high population densities are located in the villages of the northern sub-districts, while low population densities found in villages of the southern sub-districts, which are relatively far from the regency capital. Low population density figures indicate the availability of land for agricultural activities is relatively more full compared to villages that have high population densities [20]. Correlated through the ratio map overlay with population density, it appears that the high ratio is not always on low population density, whereas the low ratio is not always at high population density. The results supported by Pearson product-moment analysis, which shows that there is no significant correlation between the ratio and population density at the real level (α) = 0.05, and the correlation coefficient $r = -0.102$.

3.3.2. The correlation between the Distance of villages to district capital to the availability and needs ratio of rice

The distance of each village to the district capital varies from <10 km to > 100 km (see Fig. 7). Villages that have a short distance from the regency capital (Rangkasbitung) are 38 villages or 11%, and 124 villages (36%) have a far distance from the regency capital [19]. Based on spatial analysis with map overlay indicates that the high ratio is not always on far distance. Whereas, low ratio areas are not always at a short distance. The hypothesis supported by the results of the Pearson product-moment statistical analysis, which shows there is no significant correlation between the ratio with the distance at the real level (α) = 0.05 and the correlation coefficient $r = 0.019$, revealing by a positive of correlations between the two variables. The result indicates that as one tends to increase, the other tends to increase.

4. CONCLUSION

Based on the results of the analysis and discussion, the researchers concluded that: (1) Spatially, there are differences in the region's ratio of the availability and needs of rice. The deficit region was located in the north, close to the district capital, (2) The correlation between physical (elevation, slope, drought, forest area) and non-physical (population density, distance from the center of district capital of Lebak Regency) to the

ratio of the availability and needs of rice is not significant at the significance level (α) = 0.05, which means that the surplus area of rice is not always in the same physical and non-physical area.

5. ACKNOWLEDGMENT

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