Distribution Mapping of Rice, Corn, and Soybean Production Based on Geographic Information Systems in Pandeglang Regency

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Abstract. This study aimed to present the data on the mapping of the distribution of rice, corn and soybean production, based on the geographic information system. The method used in this research was the survey method. The research location was in Pandeglang Regency with the consideration that Pandeglang Regency is one of the areas in Banten Province with variety of potential natural resources, especially the abundant and valuable agricultural crop production. Data were collected in July 2020-September 2020 and analyzed descriptively. The results showed that the average production was very high for rice (39713.61-62309.88); Corn (240.50-988.47); and soybeans (2524.50-5004.45) while the average production was very low for rice (6967.11-13783.74); Corn (13095.92-32175.48); and Soybean (00.00-166.30) which means that the production yield was very low in several sub-districts in Pandeglang Regency which need attention in this case related to land suitability evaluation.

1. Introduction

Pandeglang Regency is one of the districts located in Banten Province with a geographic location between 6°21' - 7°10' South Latitude and 104°48' - 106°11' East Longitude with an area of 2,747 km² or 29.98 percent of the total area of the Province. Banten. Pandeglang Regency is known to have a variety of potential natural resources that are abundant and have high selling value in the market which makes the economy in Banten Province not less competitive with other provinces in Indonesia, one of it is the potential for developing the agricultural crop production.

Rice, corn, and soybeans (abbreviated as pajale in Indonesian) are food crops that are expected to become world food, especially with the government policy of the President of the Republic of Indonesia, Ir. Joko Widodo regarding the special efforts for food which hopes that the agricultural food crop sector can meet food for the people of Indonesia [1]. Based on data from BPS Banten Province [2] in 2018 in Pandeglang Regency, the production of rice plants was 449,695 tons, corn 222,374 tons, and soybeans 14,115 tons. Based on these data, Pandeglang Regency is the center of rice, corn, and soybean production in Banten Province. From some data and information that has been presented and published regarding the production of rice, corn and soybeans, it is still published through the book Banten Province in Figures and website. However, the provision of information in the form of maps has not been carried out. According to Tiranda [3] submitting and presenting data in the form of maps will be
able to help in the process of observing (monitoring) the distribution patterns of food crop production more easily and can be used as evaluation material for related parties (government in general).

Efforts to optimize the provision of information regarding the production of rice, corn, and soybeans in Banten Province are deemed necessary based on geographic information systems. According to Chrisman [4], GIS is a system consisting of hardware, software, data, people (brainware), organizations and institutions that are used to collect, store, analyze, and disseminate information about areas on the earth's surface.

Based on the description, it is deemed necessary to present data on the distribution mapping of rice, maize and soybean production based on a geographic information system. The results of this study are expected to be used as an information system to determine the distribution of rice, corn and soybean production in Pandeglang Regency, Banten Province.

2. Methods
The research was conducted from June to September 2020 in Pandeglang Regency, Banten Province. The stages in the implementation of this research are as follows:

2.1. Preliminary studies
Informations those used on this study were collected on theories, study results, and other relevant informations related to the potential problems of mapping food crops, including literature reviews, small-scale research studies, report preparations, and consideration of applicable values in research locations in Pandeglang Regency.

2.2. Initial Analysis
Developing the initial analysis included preparing an implementation model of the mapping system for the availability of rice, corn, and soybean production for each region along with the required spatial and non-spatial data.

2.3. Mapping
Mapping of production areas for rice, corn, and soybeans was carried out by digitizing all the points related to the analysis of the factors that affect the potential availability, access, utilization, and potential stability of food crops. The results of mapping and digitizing the area of availability of rice, corn, and soybean production in the Pandeglang Regency area according to the description in the second cycle, a system planning was carried out using ArcGIS technology. The variables observed in this research activity were related to the availability of rice, corn, and soybean plants in Pandeglang Regency. The research model method used in this research was descriptive research method with survey. Descriptive research according Data analysis was carried out based on predetermined research objectives including quantitative and qualitative analysis methods. Quantitative analysis analyzed data relating to the production aspects of the availability of rice, corn, and soybean in Pandeglang Regency, while the qualitative analysis focused more on technical aspects and policies for developing the potential of rice, corn and soybean plants. All the data then analyzed using spatial analysis process software GIS (ArcGIS 10).

3. Results and Discussion
The great potential of agriculture in Pandeglang Regency should be responded to with programs or policies that support the strengthening of agricultural sector as a mainstay sector. Providing guidance, counseling and supervision to farmers and farm laborers so that agricultural products can increase in both quantity and quality.

The food plant group in Pandeglang Regency covers all economic activities that produce food commodities. Commodities produced by food crop activities include rice, secondary crops (corn, soybean, peanuts, green beans, sweet potatoes, cassava, other crops, such as taro, ganyong, irut, gembili, and others) and other serelia plants (sorghum / cantel, millet, barley, wheat, and others). Based on 2019
BPS data, it is explained that the Production of Food Plants in Pandeglang Regency (ton) is as follows in Figure 1 below:

![Production of Food Plants in Pandeglang Regency](image)

**Figure 1. Production of Food Plants in Pandeglang Regency**

All of the commodities above are included in the seasonal crop category, with the form of production at harvest time or other forms of raw production which are still included in the scope of agricultural business fields. Production results in food crop agricultural commodities include: rice in the form of milled dry grain, corn in the form of dry shells, and cassava in the form of wet tubers.

Land use was dominated by forestry, rice fields and large plantations. In 2019 the land according to use was mixed forest of 86,517.33 hectares or around 31% of the land use area in Pandeglang Regency. Meanwhile, 18.24% of the area of land use in Pandeglang Regency with a land area of 50,888.90 hectares consists of shrubs. The area of rice fields 34,391.28 or about 12.32% of the area of land use and land use is 47,893.65 or 17% of the area of land use. From the results of the study, data on land area based on land use is presented in Table 1 below:

| Land use               | Land area (Ha) | Percentage (%) |
|------------------------|----------------|----------------|
| Thick Forest           | 50 888,90      | 18.24          |
| Dense Forest           | 10 099,51      | 3.62           |
| Similar Forest         | 13 778,12      | 4.94           |
| Mixed Garden           | 86 517,33      | 31.01          |
| Field                  | 19 754,73      | 7.08           |
| Inland waters          | 2 202,57       | 0.79           |
| Village                | 5 746,69       | 2.0            |
| Large Plantation       | 5 272,54       | 1.89           |
| Rice Fields            | 34 391,28      | 12.32          |
| River/Lake             | 1 354,27       | 0.4            |
| Ground                 | 1 139,78       | 0.41           |
| Moor/Field             | 47 893,65      | 17.16          |

*Source: Pandeglang in Figures, 2019*
By paying attention to the vast area of rice fields and plantations, it was not surprising that Pandeglang is the center of agriculture in Banten Province. Not only as a center for food crops but also famous for its horticulture. According to Sugartianiningsih, 2012, to increase agricultural production as an effort for food self-sufficient, then wide area is an important factor to consider. The distribution of rice, corn and soybean production in Pandeglang Regency is as follows:

3.1 Rice Plants
Rice plants are short-lived plants annually. Based on data in the field, rice production in Pandeglang Regency was spread throughout the regency, which is presented in Figure 2 below:

Based on Figure 2 above that the production of rice was very high in Mandalawangi District (47304.43 ton/ha) and Cikeusik (62309.88 ton/ha) while very low is in Cigeulis District (13342.56 ton/ha); Cibaliung (6967.11 ton/ha); Cibitung (11235.27 ton/ha); Labuan (8485.40 ton/ha); Cadasari (13754.10 ton/ha); Karangtanjung (11241.83 ton/ha); Koroncong (13783.74 ton/ha); Majasari (10603.00 ton/ha); Pandeglang (10525.26 ton/ha); and Mekarjaya (12756.03 ton/ha).

3.2 Corn Plants
This plant is an annual plant with an age of around 3 months. Based on field data, the production of corn plants in Pandeglang Regency was spread throughout the districts, which is presented in Figure 2 below:
Based on Figure 3 above, the production of corn was very high in Cikeusik District (32175.48 ton/ha); Cibaliung (25928.77 ton/ha); Ciguelis (29131.10 ton/ha); and Panimbang (21967.57 ton/ha) while very low was in Labuan District (524.00 ton/ha); Cikedal (240.50 ton/ha); Menes (294.00 ton/ha); Jiput (402.50 ton/ha); Cimanuk (556.00 ton/ha); Majasari (388.50 ton/ha); Koroncong (988.47 ton/ha); and Pandeglang (324.00 ton/ha).

3.3 Soybean Plants
Soybean is a species of legume, seasonal food crop as source of protein. Based on field data, soybean production in Pandeglang Regency was scattered throughout the districts, which is presented in Figure 3 below:
Based on Figure 4 above, the soybean production was very high in Panimbang (5004.00) while very low was in Sumur District (160.00 ton/ha); Cisata (166.30 ton/ha); Menes (151.10 ton/ha); Labuan (48.00 ton/ha); Pulosari (109.30 ton/ha); Majasari (141.05 ton/ha); Koroncong (146.38 ton/ha); Cadasari (0.00 ton/ha); Koroncong (146.38 ton/ha) and Pandeglang (30.00 ton/ha).

From the results of field observations, the causes of the very low production of rice, corn and soybeans were due to the size of the land area and environmental factors, in this case the unsuitability of land for planting rice, corn, and soybean. So it is necessary to do a follow-up to evaluate the suitability of land in districts with low production of rice, corn, and soybean. This is in accordance with the opinion of Bagus, 2020 that land suitability evaluation is carried out to determine the characteristics / quality of the land so that it can be carried out the development of suitable alternative crop commodities other than oil palm, cocoa and rice. The development of alternative crop commodities on land requires data and information on land potential. Therefore, it is necessary to conduct land suitability class assessment based on physical and chemical characteristics so that the land can be productive and obtain optimal yield/production.

Geographical information systems can be used to map areas based on the production of food crop commodities consisting of rice, corn and soybeans. This information can be used as a reference for regional development based on superior food crop commodities in Pandeglang. Geographical Information Systems or GIS can be used to facilitate spatial or spatial analysis in the decision-making process (Jauhari Agung, 2020). The determination of production areas or agropolitan areas is based on production values without considering the inter-regional linkages. Spatial analysis of production areas can provide a more complete picture of the relationship between one region and other areas around it. Spatial analysis also makes it easier to determine the area to be developed as a production center. The Geographic Information System for Potential Food Plants can make it easier to provide information data and locations of potential Food Plants in West Halmahera Regency (Ambarita Arisandy, 2017).

4. Conclusion
The average production was very high for rice (39713.61-62309.88 ton/ha); Corn (240.50-988.47 ton/ha); and soybeans (2524.50-5004.45 ton/ha) while the average production was very low for rice (6967.11-13783.74 ton/ha); Corn (13095.92-32175.48 ton/ha); and Soybean (0.00-166.30 ton/ha) which means that the production yield was very low in several sub-districts in Pandeglang Regency which need attention in this case related to land suitability evaluation.

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