

Analysis of Agricultural Land Area Availability to Attain the Food Sovereignty in West Java Province of Indonesia

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Abstract. The high growth of population in West Java Province of Indonesia is the main problem in the development of food security. This condition suggests the importance of food compliance to attain the food sovereignty in West Java province. This study applies the descriptive and comparative methods to proceed all secondary data from various institutions. The purpose of this study is (1) to analyze the fulfillment of food agricultural area of the existed agricultural potential, (2) to analyze the needs of the food agricultural land area to attain the food compliance of West Java province's residents in the period of 2020-2045. The result of the study shows potential of agricultural land in West Java amounted to 1,266,280.86 hectares, which corresponds to the allotment of paddy fields, dry land farming, mix dry land agriculture, plantation and community forests. The need of paddy rice production to fulfill the food consumption of the population of West Java in 2020, 2025, 2030 and 2045 is 7,876,828 tons, 8,329,519 tons, 8,787,642 tons and 9,446,716 tons with a population of 49,211,248 persons, 52,039,478 persons, 54,901,649 persons and 59,019,273 persons. The broad needs of paddy fields in West Java province in 2030 and 2045 in order to meet the food requirement are 1,417,362 hectares and 1,226,846 hectares.

1. Introduction

National Long Term Development of 2005-2025 is a continuation of previous development to achieve development goals as stated in the Preamble of the Constitution of the Republic of Indonesia Year 1945. Therefore, in the next 20 years, it is very important and urgent for Indonesia to do the realignment in management of natural resources, human resources, and institutional environment so that the Indonesian people are able to catch up and have a similar position as well as strong competitiveness in the international community.

The agricultural development program is one of the program that always been encouraged by the Indonesian government considering to the unrestricted population increase in Indonesia. One way to improve food security in Indonesia in order not to import foodstuffs from abroad is by revitalizing the agricultural sector. Revitalization of agriculture and rural areas, broadly aimed at increasing the role of agriculture in the national economy, create quality jobs in rural areas, particularly the employment of non-farm, which is characterized by reduced the numbers of opened and half-opened unemployment status and improve the welfare of farmers, fishermen and rural communities, as reflected in the increase of personal income and productivity of workers in the agricultural sector [1].

The purpose of future agricultural development of Indonesia is to implement the sustainable agricultural systems to be able to maintain productivity as well as environmentally friendly. On Green



Revolution I, agricultural development is aimed only to increase productivity without considering the impact on the environment, while on the current Green Revolution II, agricultural development is emphasized on productivity and environmentally friendly so it is expected that the implementation of the organic material usage on The Green Revolution II is able to achieve the food self-sufficiency. The recent government's focus is to achieve self-sufficient in food but on the other hand, farmers only focus on rice plants so that the task of the government is to give an understanding of this agricultural development plan. No single country can reach the take-off stage towards sustainable economic development driven by industry and services based on modern science and technology without any prior stage of development with the achievement of reliable agricultural sector [2]. Reliable agricultural sector is a prerequisite for the development of industry and services sectors. The designers of Indonesia's development in the early New Order aware of it, so the long-term development are designed in stages. The first stage of the development emphasized on the development of agriculture and industries producing agricultural tools. The second stage of the development emphasized on manufacturing industry supporting agriculture (agro-industry) which would gradually be transferred to the development of machinery and metal industries. With such a design, the Indonesia's economic structure transformation process will run harmoniously and balanced so that it grew fast, equitable and resilient to face the internal and external shocks.

Addressing the needs of food and nutrition of the population can be achieved through increase in production and food availability, pricing policies and food supplies, food industry, food industry oversight, and community participation [3]. In addition, the increase of production and food availability is influenced by the land area availability, land productivity, cropping index, food prices, and production facilities [4].

West Java is well-known as an area that plays an important role in agricultural production in Indonesia. Nearly 23 percent of the 29.3 thousand square kilometres of land in West Java are allocated to rice production. In addition, agricultural products in West Java accounted for 15 percent of all agricultural products from Indonesia.

Other than rice, West Java, also known as the largest tea producer in Indonesia. More than 70 percent of the national tea production is produced in West Java. This is because the West Java is a plateau area and the climate is suitable for tea plants. Tea plantations scattered in Bandung, Cianjur, Sukabumi, Bogor, Purwakarta, Subang, Garut, Tasikmalaya, Ciamis, Majalengka. In addition, the tea plantation in West Java, especially the Puncak area is often used as a place of recreation. Based on data from the Department of Agriculture in West Java in 2013, agriculture in the Earth Parahyangan produces 12.083 million tons of rice land area of about 2 million hectares of rice paddies and fields. From the 26 districts / cities in West Java which is the central region's largest rice producer generated by the District Indramayu 12 percent, 9 percent Karawang, Subang 8 percent [5].

West Java Province with a population of about 46 million people needs rice consumption at the average of 89.6 per capita per year. The high rate of population growth above the national growth is the pressure on the food supply of the region's own local production. The limited land area is also an important factor affecting the West Java province in improving food availability through production in the region as one of the effort to realize the food self-sufficiency. To find out how much food production potential ability of West Java province and the land area needed to be able to produce food according to the needs of food, it is necessary to do an analysis of the needs of food agricultural area in West Java province to fulfill the food needs.

Based on the above facts, some of the issues that we need to know through this study are (1) how is potential agricultural land in West Java province (2) how the needs of food agricultural area, especially rice field to fulfill the food needs of the population in West Java Province.

The purpose of this research is (1) to analyze the fulfillment of food agricultural area out of the existed potential agricultural area, (2) analyze the needs of the food agricultural area in compliance with food needs of West Java province's residents in the period of 2020-2045. This research is expected to give input to the West Java Provincial Government and other stakeholders in compiling the policy and

regional development program planning that is based on the realization of food sovereignty as well as a consideration in the preparation of the Spatial Plan (RTRW).

2. Research methods

This research was conducted through survey method with descriptive and comparative analysis. Acquisition of data obtained through observation, made by processing the data from the various institutions that consists entirely of secondary data, namely (1) the population data from years 1990 to 2015, (2) the data of farmland availability in the years of 2014-2015, (3) data on potential agricultural land, (4) production data, the productivity of crop in the years of 2014-2015.

To analyze the needs of agricultural land especially paddy land in sustainable food sovereignty requires several stages. The first phase is a review of population growth which further evaluate the needs of rice consumed per year. Phase two is to calculate the necessary amount of grain, which is based on the study results in the first step. Furthermore, phase three is to calculate the total requirement of land for the production of rice needs.

Calculation of land can be described in the equation:

$$h = ((axb) \times 20\% + d) / g$$

a = rice consumption per capita per year

b = total population

c = total of rice demand per year, $c = axb$

d = total of unhulled rice, $d =$

e = total losts (on delivery process, on the rice mill process, etc)

$e = 20\% \times d$

f = total of required unhulled rice

$f = d + e$

g = land productivity

g = 5 ton/hectare per 1 growing session

h = total of required agricultural land

$$h = \frac{\text{total of required unhulled rice}}{\text{total of unhulled production per growing session}} = \frac{f}{g}$$



Figure 1. Map of the West Java Provincial Administration

3. Results and discussion

3.1. General condition

West Java Province is geographically located between 5o50' - 7o50' South Latitude and 104o48' - 108o48' East Longitude. Administratively, West Java region is divided into 27 districts and cities, covering 18 districts of Bogor, Sukabumi, Cianjur, Bandung, Garut, Tasikmalaya, Ciamis, Pangandaran, Kuningan, Cirebon, Majalengka, Sumedang, Indramayu, Subang, Purwakarta, Karawang, Bekasi, West Bandung and 9 cities of Bogor, Sukabumi, Bandung, Cirebon, Bekasi, Depok, Cimahi, Tasikmalaya and Banjar and another 626 districts, 2,671 sub-districts and 3,291 villages.

The strategic geographical conditions of West Java are an advantage for the province of West Java as it has a fertile land derived from volcanic deposits and fed by many rivers of Cisadane, Ciliwung, Cikande, Cimanuk and Citanduy. West Java province has a natural condition with the complex geological structure and mountainous region located in the central and southern part and some lowlands in the north. Physiographically, West Java divided into 4 major zone parts, namely: Bogor zone, Bandung zone, the coastal plain of Jakarta and Southern West Java mountainous zone. Having a forestry area with the function of conservation forest, protected forest and production forest, the proportion reached 22.1% of West Java area. Rainfall ranges between 2000-5000 mm/year with a high rainfall intensity level. In 2014, the city of Bandung as the capital of West Java province has the highest rainfall in March, reaching 419 mm, while the lowest rainfall in September is 1.0 mm. The highest rainfall during the year 2015 in April amounted to 322 mm. The average wind speed during the year 2014 amounted to 3 knots with air pressure of 923.7 mb and the relative humidity of 77 percent.

3.2. Population growth in West Java

The population of West Java in 2014 that reach of 46.03 million people, makes West Java to become the largest population province in Indonesia. Consisting of 23.35 million of male and 22.68 million of female, the numbers of sex ratio in West Java is 102.9, which means that there are 102 male population in every 100 female residents. Nearly two-thirds, or 66.5% of the population of West Java live in urban areas, as a result of the influx of industries that drive urbanization. These Conditions will implicate to the availability of agricultural land because of the growing demand for food.

Table 1. Conditions and Prediction of Population in West Java (1990-2045)

No	Year	Total Population (person)
1	1990	29.415.723
2	2000	35.723.473
3	2010	43.053.732
4	2015	46.164.649
5	2020	49.211.248
6	2025	52.039.478
7	2030	54.901.649
8	2045	59.019.273

Description: Population in the year of 2020 until 2045 predicted results with the assumption of the population growth rate of 1.7%.

The average rate of population growth in West Java in 2015 which is 1.7% per year. This represent a decline when compared to the year of 2000, at an average population growth rate of 1.96% and in 2010 by 1.9%. If the trend of population growth of 1.7% is applied to predict the population of western Java area during the period to 2015, the estimated 2020 population of 49,211,248 inhabitants and a population in 2025 amounted to 52,039,478 inhabitants.

3.3. The existed agricultural land and productivity in West Java

The West Java region divided into two groups, the Agricultural Land and Non-Agricultural Land. The characteristic of agricultural land will determine the rise and fall of agricultural production and its diversity. The agricultural land consists of ricefield and non-ricefield (farmland, forests, plantation, pool, etc.). When it compared to the previous year, the rice field area has decreased from 938.06 thousand ha to 936 529 thousand ha [6]. In 2014 the proportion of rice field, non-rice field and non-agricultural land respectively is 26.08 percent, 50.98 percent and 22.94 percent [6].

The crop area of agricultural land, especially paddy in ricefield in 2014 has decreased compared to the year of 2013 which also followed by a decrease in the amount of production. Rice harvested area also decreased by about 2.53 percent and its production down to 3.76 percent and the productivity per hectare fell to 58.82 quintals per hectare.

Paddy rice harvested area decreased by 2.35 percent with a decrease in production by 4.09 percent. The similar condition also occurs in rice fields with crop area decreased by 5.20 percent, but on the other hand the production increased by 2.62 percent. On average, paddy rice fields production per hectare decreased from 60.78 quintals/ha to 59.76 quintals/ha but there is an increase on paddy fields production up to 41.44 quintals/ha to 44.77 quintals/ha, the similarity happens on the production of corn and cassava. Maize production decreased by 4.98 percent while cassava production increased by 5.21 percent and soybeans production increased by 98.19 percent [6].

In 2014, the largest fruits crop production are bananas which amounted to 12,371,712 tons while the largest ornamental plant production is chrysanthemum flower of 209 259 024 stalks, it is increased by 5.78 percent compared to 2013. Meanwhile, the crop production of vegetables in West Java are tomatoes and cabbage that is equal to 3.04687 million tons and 2.96943 million tons which are dominated by Garut as the largest contributor to the District. For the largest crop production of medicinal plants re ginger plants with total production of 22,584,378 kg of which half comes from Cianjur.

Plantation sector until now still has a significant role in the development of the agricultural sector. It can be seen from the increase status of the plantation production plantation in West Java, even though

it is not applicable for all commodities. West Java province has managed plantations by a large state-owned plantation, private plantation and smallholders. The potential commodities are tea, coconut, oil palm, sugarcane and rubber. In 2014, the percentage of the area of smallholder yield is 54.75%, state-owned plantation yield is 26.13% and private plantation yield is by 19.12% yield. The Agricultural productivity (rice) in West Java is 5 tonnes / ha / cropping season.

3.4. The potential of available land for agricultural development

The potential land is a result of a referral suitability evaluation of land that can be developed in terms of biophysics, with the consideration of the area of commodities. The potential land based on the interpretation of map of the potential land for farming in West Java in 2014 showed that the potential land to be developed for food especially rice farmland is 1,266,280.86 hectares. The potential of this land area corresponds to 29603.63 ha for plantation, 15923.09 hectares for community forests, 116,854.08 hectares for dryland agriculture, 167,370.60 hectares for mixed dryland farming and 936,529.46 ha for ricefield. The land area is the result of map interpretation with 9380 Ha of shrubs and 3,298 hectares of open land, so that the shrub land and the open land is a potential to be formed as agricultural land that suitable for dry land farming and mixed dryland farming and a new land for ricefield, considering to <8% tilt of the land in slope so it is suitable for food farmland. The potential land spread throughout some districts in West Java, where the suitable land for ricefields are mostly located in the northern part of West Java, while agricultural land, plantations and mixed of plantation and private forest spread across the central and southern part of West Java. The data on the potential land is excluded the existing land area that already exists.

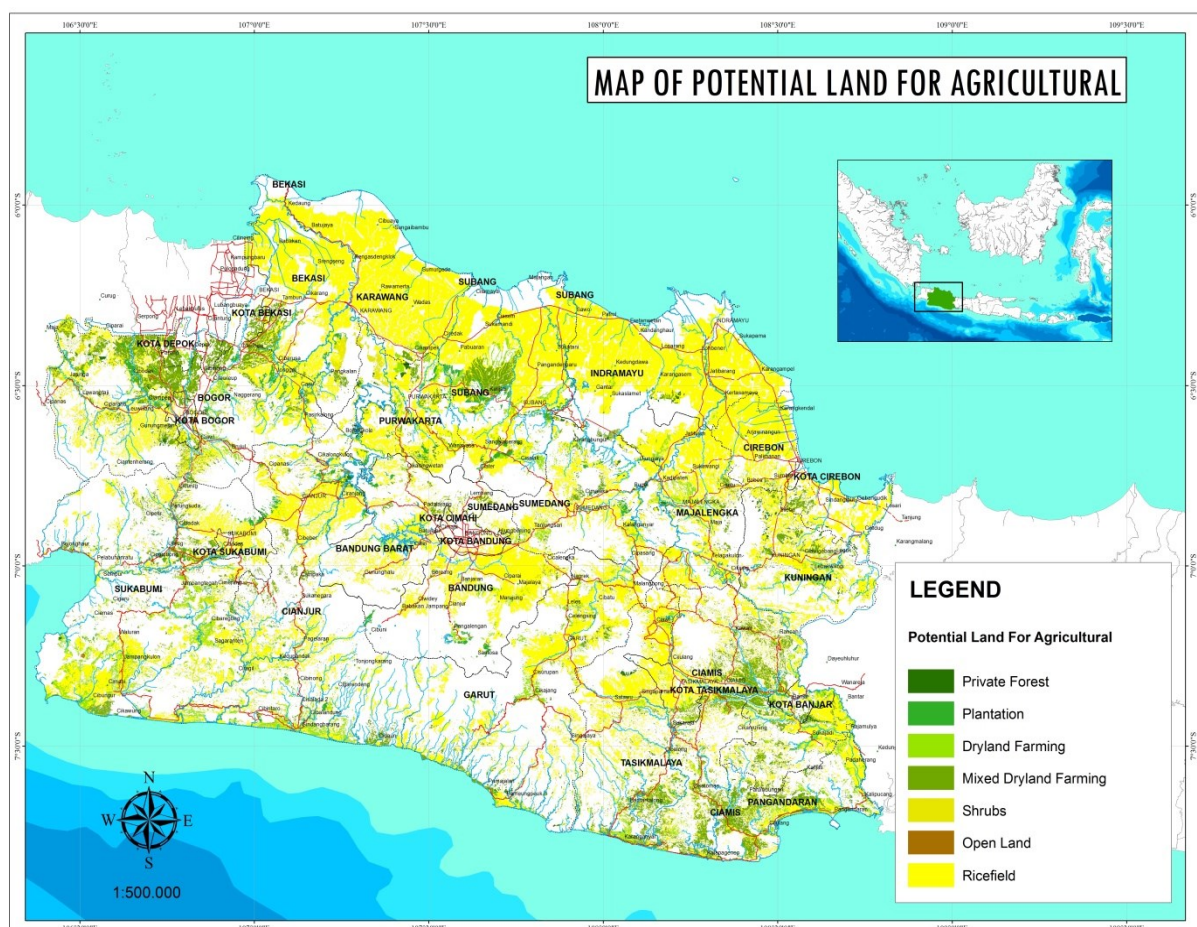


Figure 2. Map of Potential Land for Agricultural in West Java

Table 2. Distribution of Available Potential Land for Agricultural Development

No.	Appropriate Designation	Wide in Hectares
1	Plantation	29.603,63
2	Private Forest	15.923,09
3	Dryland Farming	116.854,08
4	Mixed Dryland Farming	167.370,60
5	Ricefield	936.529,46
Total		1.266.280,86

Source: Interpretation Results of Potential Map for Agricultural Land, 2015.

3.5. *The needs of agricultural land wide*

The needs for paddy fields in West Java province in 2020 with the assumption of rice consumption per capita of 86.7 kg / capita / year and permanent population growth rate of 1.7%, with the increase of productivity to 5.38 tonnes / ha is amounted to 1.465.456 Ha. While the needs of paddy fields in 2025 with the same assumptions but different productivity of 5.77 tons / Ha is amounted to 1,443,591 ha. The amount of required unhulled rice in 2020 is 7,876,828 tonnes and in 2025 is amounted to 8,329,519 tonnes. This fact occurs if the land productivity is increased by 1.5% per year. If the standard acreage of available food agricultural land in 2015 of approximately 1,477,837 hectares can be maintained, so there will be more land available to be used to increase the food crops production other than rice.

Table 3. Projected Land Needs towards Food Sovereignty

No	Parameter	Year				
		2015	2020	2025	2030	2045
1	Rice Consumption (per capita per year)	86,70	86,70	86,70	86,70	86,70
2	Total Population (person)	46.164.649	49.211.248	52.039.478	54.901.649	59.019.273
3	Total Rice Production per year (ton)	4.002.475	4.266.615	4.511.823	4.759.973	5.116.971
4	Total Unhulled Rice Production (ton)	6.157.654	6.564.023	6.941.266	7.323.035	7.872.263
5	Total Lost (ton)	1.231.531	1.312.805	1.388.253	1.464.607	1.574.453
6	Total required Unhulled Rice (ton)	7.389.185	7,876.828	8.329.519	8.787.642	9.446.716
7	Land Productivity (ton/Ha)	5,00	5,38	5,77	6,20	7,70
8	Required Land (Ha)	1.477.837	1.465.456	1.443.591	1.417.362	1.226.846

The result of predictive analysis for land requirements in 2030 is 1,417,362 hectares and in the year 2045 is amounted to 1,226,846 ha, assuming to a population of West Java rice consumption fixed at 86.70 kg/capita/year. The needs of unhulled rice production in 2030 and 2045 respectively amounted to 8,787,642 tons and 9,446,716 tons. The fulfillment of the food needs of the population of West Java province in 2030 and 2045 would have been different if no policy change towards diversification of food consumption and increase production through intensification [7]. These kinds of land conditions require the attention of the government to block the conversion of land, increase agricultural infrastructure, especially irrigation and increase the productivity of the land itself [8].

4. Conclusion

Potential agricultural land in West Java amounted to 1,266,280.86 hectares, which corresponds to the allotment of paddy fields, dry land farming, mixed dry land agriculture, plantation and community forests. The need for rice grain production to meet the consumption needs of West Java in 2020, 2025, 2030 and 2045 is 7,876,828 tons, 8,329,519 tons, 8,787,642 tons and 9,446,716 tons with a population of 49,211,248 persons, 52,039,478 persons, 54,901,649 and 59,019,273 persons. The needs for paddy land area in West Java province in 2030 and 2045 in order to meet the food needs are 1,417,362 Ha and 1,226,846 Ha.

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