Mapping Potential Area of Sustainable Food Agriculture Area in Somba Opu Sub-District, Gowa Regency

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Abstract. Population growth in Indonesia which is increasing causes the need for land to be used as a residential space or housing space [5]. The rapid growth of urbanization at the present time has made a significant change in the function of land on agricultural lands and forests that have been transformed into urban areas or developed lands [10]. The land that is often turned into residential land is agricultural land, such as paddy fields [12].

One of the regions in Indonesia that have changed the function of paddy fields into settlements is Somba Opu Sub-District, Gowa Regency. Somba Opu Sub-District is recorded to have the highest level of population density which is 4,632 people / km² in Gowa Regency [1]. This is because Somba Opu Sub-District is directly adjacent to Makassar City in the North [1]. In addressing the problem of changes in the function of agricultural land in Gowa Regency, the Government of Gowa Regency certainly must immediately take an action to protect agricultural lands, especially paddy fields. One of the efforts to overcome the change of agricultural land into non-agriculture is to make a policy regarding Sustainable

1. Introduction
The increasing population growth in Indonesia, increases the need for land to be used as a residential space or housing space [5]. The rapid growth of urbanization at the present time has made a significant change in the function of land on agricultural lands and forests that have been transformed into urban areas or developed lands [10]. The land that is often turned into residential land is agricultural land, such as paddy fields [12].

One of the regions in Indonesia that have changed the function of paddy fields into settlements is Somba Opu Sub-district, Gowa Regency. Somba Opu Sub-District is recorded to have the highest level of population density which is 4,632 people / km² in Gowa Regency [1]. This is because Somba Opu Sub-District is directly adjacent to Makassar City in the North [1]. In addressing the problem of changes in the function of agricultural land in Gowa Regency, the Government of Gowa Regency certainly must immediately take an action to protect agricultural lands, especially paddy fields. One of the efforts to overcome the change of agricultural land into non-agriculture is to make a policy regarding Sustainable
Food Agricultural Land, which is listed in the Law of the Republic of Indonesia No. 41 of 2009 concerning the Protection of Sustainable Food Agriculture Land.

According to the International Fund for Agricultural Development, the agricultural sector in Indonesia has an important role because most of Indonesia's Gross Domestic Product (GDP) comes from the agricultural sector [14]. Sustainable agriculture and land management aim to utilize natural goods and services while producing good results in ways that are economically, environmentally, and socially profitable, conserving resources for years to come and generations to come [14]. The Sustainable Food Agricultural Land is a field of agricultural land that is determined to be protected and developed consistently in order to produce staple food for national food independence, resilience, and sovereignty [8]. Sustainable food agriculture land is made to guarantee or maintain adequate fulfillment of food and the availability of rice. The availability of rice in sufficient and sustainable quantities is influenced by the production of rice produced, which is a unity of productivity and area of wetland [2].

Gowa Regency Government has already made it through [4] and has also determined a large area for food crop agriculture allotment, namely part of the allotment of agricultural food crops wetlands (33,201 ha) which is technically irrigated as agricultural land for sustainable food crops. However, in [4], Gowa Regency, South Sulawesi Province has not yet specified the distribution of Sustainable Food Agricultural Land (LP2B). Based on this background, this study aims to analyze the distribution of potential areas as Sustainable Food Agricultural Areas in Somba Opu Sub-District, Gowa Regency and analyze the influence of farmers' income with potential areas as Sustainable Food Agricultural Land in Somba Opu Sub-District, Gowa Regency.

2. Methods
This research covers all irrigated and non-irrigated paddy fields in the Somba Opu Sub-District, Gowa Regency. Somba Opu Sub-District is the capital of the Gowa Regency, South Sulawesi. Somba Opu Sub-District is located at 5° 12′ 5″ South Latitude and 119° 27′ 15″ East Longitude. Its area is around 28.09 km² with the height of the area 25 meters above sea level. Most of the area lies in the lowlands. Somba Opu Sub-District has been recorded as the highest level of population density which is 4,632 people / km² [1].

2.1. Material
In this study, secondary data and primary data are used. The secondary data in this study are soil texture, river/irrigation system, road network, slope, land use, and paddy field areas. The primary data in this study are the crop system of paddy fields, rice production of paddy fields, and farmer income. Primary data were collected by conducting observations, interviews, questionnaires, and documentation. Determining the number of respondents, this study uses the Slovin formula. In the calculation of the Slovin method, it is necessary to digitize the data of paddy fields in the study area and determine the level of error used. Based on the digitized rice field data in Somba Opu Sub-District, the number of paddy fields obtained is 15 areas and the margin of error (e) is 30%, so the number of respondents in this study is 6 respondents.

\[ n = \frac{N}{N.e^2 + 1} \]

Where
\( n \) = sample size
\( N \) = population size
\( e \) = margin of error

Figure 1. Slovin’s Formula

2.2. Method
The method used in this study is the overlay analysis method. The data to be overlaid is the suitability of paddy fields with primary data obtained at the time of the interview. The results of the overlay will
be processed and conclusions are drawn to answer research questions regarding the spread of sustainable food agriculture and its relationship with farmers’ income in the Somba Opu Sub-District, Gowa.

3. Result and Discussion

3.1. The suitability of paddy fields

The suitability of paddy fields in Somba Opu Sub-District is divided into two classes, very suitable class and suitable class. Variables used in determining the suitability of paddy fields in Somba Opu Sub-District are in Table 1. In Somba Opu Sub-District, the average annual rainfall is more than 1500 mm. The slope category in Somba Opu Sub-District according to Badan Informasi Geospasial’s data is divided into two which are, flat (0-3) and moderately steep (16-25). The flat slope (0-3) is found in almost all Somba Opu Sub-Districts, and the moderately steep class (16-25) is only in southeast of the Somba Opu Sub-District or in the Bontoramba Village. The temperature in Somba Opu Sub-District averages around 25 - 29°C each year. The soil texture in Somba Opu Sub-District is also generally divided into two types of textures which are clay and sandy loam.

Table 1. Paddy Fields Suitability

| Land Characteristics       | Suitability Classes |
|----------------------------|---------------------|
|                           | S1                  |
| Temperature (°C)           | 24 - 29             |
| Water Availability         | Irrigation          |
| Rainfall                   | >1500               |
| Soil Texture               | Fine, slightly fine |
| Slope (%)                  | <3                  |
|                           | S2                  |
|                           | 22 - 24             |
|                           | Irrigation          |
|                           | 1500 - 1000         |
|                           | moderate            |
|                           | 3 - 8               |
|                           | S3                  |
|                           | 18 - 22             |
|                           | Irrigation          |
|                           | 1000 - 750          |
|                           | Slightly rough      |
|                           | 8 - 30              |
|                           | N                   |
|                           | < 18                |
|                           | > 35                |
|                           |                    |

Source: [7]

Figure 2. Paddy Fields Suitability
3.2. Crop System of Paddy Fields

Fatoni et al., [3], rice planting patterns on Java Island are influenced by several factors which are, water availability, land conditions, land ownership, and local culture. Same as in Java, the planting pattern in Somba Opu is influenced by several factors, but the most significant factor is water availability, because a sufficient amount of water supply is a condition to reach optimum plants’ production. The expected rains that occur at the right time with the right amount of water will give positive impacts on the agricultural sector [13].

According to interviews with farmers, generally, the paddy fields in Somba Opu Sub-District only do 2 to 3 crop systems a year. The area of paddy fields that do 2 times crop systems a year is around 773 ha. The area of paddy fields that do up to 3 times crop systems a year is around 455 ha. Paddy fields that can do 3 times crop systems a year are irrigated paddy fields, therefore, the water supply is more adequate compared to non-irrigated paddy fields. As for non-irrigated paddy fields, the crop systems cannot be harvested more than 2 times because the water source cannot be sufficient for the needs of lowland rice during the third planting period.

![Crop System of Paddy Fields in Somba Opu Sub-District](image)

**Figure 3. Crop System of Paddy Fields**

3.3. Rice Production Every Crop

Interview result shows that farm laborers in Somba Opu Sub-District use a sack system for every crop. The yield every crop ranges from 30 to 50 sacks for one hectare of paddy field. From interviews with several farm laborers, farmworkers generally produce 35 to 40 kg for each sack per hectare. Therefore, the results of the calculation of rice production in Somba Opu Sub-District is between of 1000 to 5000 kg per crop systems per hectare. This production result is affected by several factors, which are the adequacy of water for a single planting period and the condition of rice during the planting period.

From the survey result, it was found that the area of paddy fields having a yield of >2800 kg per harvest per hectare was around 259 ha and the area of paddy fields having a yield of <2800 kg was around 815 ha. Yields of rice >2800 kg per harvest per hectare are found in irrigated paddy fields with good rice conditions, while paddy fields that have a yield of rice <2800 kg per harvest per hectare are caused by the number of pests that attack during the planting period. Some farmers keep their rice is
biving pesticides or medicines for pests at certain times during the planting period. Overall, the yield of rice production in Somba Opu Sub-District in a year reaches approximately 6,590 tons per year.

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**Figure 4.** Rice Production of Every Crop

3.4. Farmers Income

Farm income consists of income on cash costs and revenues over total costs [9]. Paddy rice farmers in Somba Opu Sub-District have an income of around Rp. 1,250,000 to Rp. 7,813,000 per harvest. This income is obtained from the yield per harvest multiplied by the selling price of rice per kilogram and reduced by expenses during the planting period and the system of sharing the yield with the owners of paddy fields. Generally, from the results of the field survey, farmers in Somba Opu Sub-District are farm laborers who work on other people's paddy fields. The production sharing system for each farmworker varies depending on the agreement with the landowner.

According to [6], the criteria for Sustainable Food Agriculture Land are the points that explain farmers' income. One of them is farm income which is able to meet the minimum living requirements in accordance with those stipulated by the district/city-regional government and the profit ratio with the minimum district/city minimum salary level greater than 1 (one). This means that if the income of farmers at every harvest can be sufficient for their lives, the agricultural land will be included in the Sustainable Food Agricultural Land and exceeds the minimum wage of South Sulawesi Province, which is Rp. 2,860,382 according to the Decree of the Governor of South Sulawesi Number 2877 / X / 2018.

According to the results of the field survey, it was found that the farm laborers in Somba Opu Sub-District generally felt that they had enough income from the harvest every time, even the farm laborers were still able to send their children to school. However, there are also some farm laborers who have side jobs if they are not working on rice fields such as construction jobs. From the results of interviews during the field survey, farmworkers in Somba Opu Sub-District were hoping for help from the government for their agricultural land and many of the farmworkers agreed with the establishment of Sustainable Food Agricultural Land, because it would greatly provide assistance to farm laborers.
3.5. Sustainable Food Agriculture Land Area

Determination of the potential of Sustainable Agricultural Food Land and Sustainable Agricultural Food Reserves Land in Somba Opu Sub-District takes into account the physical conditions and also the social conditions of farmers using rice fields in accordance with Regulation of Ministry of Agriculture No. 79 of 2013. Based on field survey results, it was found that the potential distribution of Sustainable Food Agricultural Land for paddy fields in Somba Opu Sub-District was 214 ha. And the potential distribution of Sustainable Food Agriculture Reserves Land for paddy fields in Somba Opu Sub-District is an area of 854 ha. As seen in Figure 11, the potential distribution of Sustainable Food Agriculture Land for paddy fields in Somba Opu Sub-District is located in the middle of Somba Opu Sub-District or in Tompobalang and Romangpolong Villages.

By the total potential distribution area of Sustainable Food Agriculture Land, the estimated annual rice production is around 6,390 tons. However, these production results have not been able to meet the needs of rice consumption in the Somba Opu Sub-District community. According to the survey results, the annual rice consumption needs of the Somba Opu District community is around 13,717 tons. The calculation of rice consumption is obtained by setting 1.57 kg/person/week multiplied by the population [11]. By determining the potential distribution of Sustainable Food Agricultural Land in Somba Opu Sub-District, food security can be maintained in Somba Opu District and is expected to be considered in determining Sustainable Food Agriculture Land in Gowa Regency. According to Article 48 Paragraph 2 of Regulation of Gowa Regency No. 15 of 2012 Concerning the Spatial Planning of Gowa Regency in 2012-2032 a part of Somba Opu Sub-District entered the area of wetland food crop agriculture with an area of 33,201 ha [4].

However, Article 53 Paragraphs 3 and 4 of Regulation of Gowa Regency No. 15 of 2012 concerning the Spatial Planning of the Gowa Regency in 2012-2032 explain that a portion of the Somba Opu Sub-District is included in the development of the urban settlements [4]. This, of course, requires a review of the regulation of Sustainable Food Farming Land in Gowa Regency so that lands that have the potential to become Sustainable Food Farming lands, such as those in Somba Opu Sub-District, which are not convert into non-agricultural lands, thus, food security will be maintained.
4. Conclusion

Somba Opu Sub-District has 214 ha of Sustainable Food Agricultural Land for potential paddy fields. Sustainable Food Agricultural Land spread in irrigated paddy which meet the criteria and farmers' income that exceeds the minimum salary of South Sulawesi Province is Rp. 2,860,382. The Sustainable Food Agriculture Reserves lands are 854 ha located in paddy fields, which not meet the criteria for Sustainable Food Agriculture Land. In addition to food security, Sustainable Food Farming Land also affects the welfare of farmers because with the establishment of Sustainable Food Farming Land, assistance and programs from the government to protect paddy fields will be increased therefore farmers' welfare is also a concern for the government.

By doing the mapping of the potential area distribution of Sustainable Agricultural Land it is expected to be a considered for establishing policies related to the provision of subsidies or assistance to farm laborers to maintain their paddy fields to see the wishes of farmworkers who still want to work on paddy fields.

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