

# Agricultural Resources Analysis: Urban Area's Food Sufficiency in South Sulawesi Province

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## ABSTRACT

This study aims to analyze the problem of food sufficiency in urban areas of South Sulawesi Province using secondary data from the Central Statistics Agency of South Sulawesi Province in 2015-2019. The method used is quantitative descriptive analysis to determine the food adequacy of cities in South Sulawesi Province, seen from the comparison of rice needs and rice availability. The population and land use change are the 2 main factors that affect food sufficiency in South Sulawesi Province. The largest accumulated population in South Sulawesi Province is in Makassar City which is 1.521.091 people, Parepare City is 144.446 people, and Palopo City is 181.395 people in 2019 which causes an increase in the amount of food needs and a decrease in agricultural land so that food sufficiency in the three regions urban areas are not met. The conversion factor occurs mainly in food-agricultural land which is turned into built-up land, especially residential and office land. The area of agricultural land has increased by 8 hectares from 2015-2019. Agriculture is dominated by non-food crops farming. Food agriculture area only reaches 20 percent of the total agricultural land area, thus affecting the availability of rice in urban areas. The supply of rice needs in urban areas to meet food sufficiency is supported and obtained from food agricultural products in rural areas in South Sulawesi Province with a high dominance of food agricultural land.

**Keywords:** Food sufficiency, Land conversion, Urban area, South Sulawesi

## 1. INTRODUCTION

The world's food needs from year to year continue to increase along with population growth. According to the FAO, food consumption from 1961-2013 showed an increase. The highest consumption was shown in rice and wheat commodities which reached 500 kcal/person/day. The need for rice, especially in Indonesia, is also very large. According to an article in Indonesia Investment, Indonesia is one of the countries with the greatest demand for rice in the world, which is 150 kilograms of rice per person per year in 2017. The availability of rice in 2017 in Indonesia was only 81.380.000 tons, according to the Ministry of Agriculture of the Republic of Indonesia. Based on the amount of rice availability, although it is increasing every year, due to the increasing population,

in 2017 the Indonesian population reached 262 million people. However, the demand for rice is greater than the availability of rice. This condition can lead to the problem of food sufficiency.

Agricultural activities require large enough land to support products that can meet a large number of residents. However, the increasing population has resulted in the need for land for infrastructure and settlements to increase. Many agricultural lands are converted as a built-up land, therefore the agriculture activities begin to decrease due to the lack of land for agriculture. Based on this, it causes an impact on decreasing rice production, so that the available rice cannot meet the needs of the increasing population. These conditions can cause an area or country to experience

food insufficiency. Food sufficiency is defined as the access for all people at all times to enough food for a food, health and active life. [4]. Food sufficiency for a country is a very strategic thing because it supports people's lives in a nation. [7] Food sufficiency is highest in urban areas. That can happen because, in urban areas, rice farming land has been gently reduced, replaced by built-up land for settlements and economic infrastructure.

South Sulawesi Province, the fourth province that is the primary producer of rice in Indonesia with a significant contribution of 7,22% during 2011-2015 [5] in the urban area experienced a deficit in rice availability. Most rice production in South Sulawesi Province carries out in rural areas where agricultural land is still available.

Based on these conditions and the importance of rice needs for the population, an analysis of food sufficiency in urban areas in South Sulawesi Province, namely Makassar City and Pare-Pare City, is needed to determine the condition of food sufficiency in the city. The analysis results can be used to formulate plans for handling and prevention in the event of food sufficiency. So, food sufficiency analysis is very important to do. Therefore, the food needs in urban areas can be met even though they do not carry out rice farming activities.

**2. METHOD**

Agricultural resource analysis uses secondary data to make land balances and food sufficiency calculations obtained through the website Central Bureau of Statistics of South Sulawesi Province. The data used for the land balance is in the form of land-use area data in 2015 and 2019 while for the calculation of food sufficiency using data on total rice production and population in 2015-2019.

**2.1. Food Sufficiency Value Analysis**

Food sufficiency analysis serves to identify districts/cities in South Sulawesi Province that have food sufficiency or not based on the comparison of rice demand and rice availability.

The formula for calculating rice availability based on [2] is:

$$R_{net} = P \times [1 - (S + F + W)] \times C$$

Note :

R<sub>net</sub> : Net Production Rice (ton/year)

P : Total Rice Production (ton)

S : Rice for Seeds (0,9 %)

F : Rice for Feed (0,44 %)

W : Scattered Rice (5,4 %)

C : Conversion Paddy to Rice (62,74 %)

Net production of rice shows the availability of rice in an area. The conversion of milled dry grain to rice is set at 62,74% by BPS where every 100 kg of dry milled unhulled rice produces 62,74 kg of rice. The rice availability is calculated based on the amount of domestic rice production produced to sufficient the needs of the community without considering the rice entering or leaving the study area. While the formula rice demand is:

$$Rice\ Needs = Total\ Population \times 113,48\ kg/capita/year$$

Where the value of rice needs per individual is 113.48 kg/capita/year which shows that each resident consumes 113,48 kg of rice every year.

Food sufficiency is calculated based on the difference between rice availability and rice needs [6]. The assumption used is rice availability greater than rice demand, the area is said to be rice surplus. While rice availability is smaller than rice needs, the region has a rice deficit.

$$Food\ Sufficiency = Rice\ Availability - Rice\ Need$$

Based on the calculation results obtained, the value of food sufficiency can be classified as in table 1.

**Table 1.** Classification of Food Sufficiency

Food Sufficiency Value	Classification
≥ 0	The availability of rice can sufficient for food needs (surplus)
< 0	The availability of rice is not sufficient for food needs (deficit)

**2.2. Land Use Balance**

Land use balance is a method to determine changes in land use types calculated based on the difference between the initial reserves of land resources or assets with the amount of land use or liabilities. The land balance method is calculated using equation:

$$\Delta Land\ Area = Passive - Asset$$

Note:

ΔLand area : Land use change in the last year to the initial year (ha)

Passive : Land area in the last year (ha)

Assets : Land area in the beginning year (ha)

### 3. RESULTS AND DISCUSSION

#### 3.1. Food Availability in South Sulawesi

South Sulawesi is one of Indonesia's biggest rice producer provinces, with an agricultural land area of 4.584.076 ha in 2019. However, rice production is higher in rural areas, which makes the availability of rice in urban areas unable to answer the food needs over the last five years, which has led to food sufficiency in the urban areas of South Sulawesi Province. This condition is evidenced by the availability of rice in urban areas, which tends to fluctuate. In Makassar City in 2019, the availability of rice only reached 8.171 tons or less than 0,25% of the total rice production in South Sulawesi Province, while rice consumption required 172.613 tons. The decline in rice availability also occurred in other cities, namely Pare-Pare City, which only reached 3.776 tons (0,11%), and Palopo City with 10.543 tons (0,31%). This happened because of a decrease in the amount of rice production caused by the increasing number of urban residents, therefore that the need for land increased and there was a conversion of agricultural land into non-agricultural land. Another cause of the low number of rice production in urban areas is that most of the paddy or rice fields are only able to be planted once a year and flooding events that hit rice fields in several places. The area with higher building density and low water catchment areas are more likely vulnerable to flooding.

#### 3.2. Food Sufficiency

Food sufficiency in South Sulawesi Province occupies the fifth position in Indonesia with a value of 78,69 after the provinces of Bali, Special Region of Yogyakarta, North Sulawesi, and Central Java. One reason for the high level of food sufficiency is the high level of community participation in the agricultural sector. Almost 40 percent of the population of South Sulawesi work in the agricultural sector, therefore this sector also contributes the highest Gross Regional Domestic Product (GRDP) in South Sulawesi Province. The factors of fertile soil conditions, the optimal temperature for agriculture, and a good irrigation system also influence the growth of rice in South Sulawesi Province.

In general, the majority of districts in South Sulawesi Province are able to meet the local food needs of their respective regions. This happens because almost every district has a high area of agricultural land with the dominance of rice and corn plants. The value of food sufficiency is obtained from the value of rice availability minus the value of rice needs. The condition of food sufficiency will be fulfilled if the calculation result is negative, while the condition is not fulfilled if the calculation result shows a negative value.

The trend of food sufficiency from 2015 to 2019 always shows fluctuations related to unstable increases and decreases. The cause of the increase and decrease in the value of food sufficiency can be caused by two factors, namely the population and rice production in that year. From 2015 to 2019, there was a decrease in food sufficiency by 8.793,48. Although rice production in 2016 increased, there was an increase in the population of 86.071 people in South Sulawesi Province, which caused the demand for rice to increase from the previous year. A significant increase in the value of food sufficiency occurred from 2017 to 2018. This was because rice production in 2018 increased by 2.860.003,5 tons. This increase was very significant, which caused the availability of rice in South Sulawesi Province to also experience a drastic increase. A sharp increase occurred in Bone Regency as the highest agricultural sector producing district in South Sulawesi Province. The high rice production, of course, also has an impact on the economy in South Sulawesi Province. The hard work of farmers and the government in implementing various programs is considered a success because of the increase in rice production that occurs.

#### 3.3. Factors that affect food insufficiency

##### 3.3.1. Population

Population growth in various areas in South Sulawesi Province, especially in urban areas, is the leading cause of the increasing number of rice needs. Sustainable development in line with economic and technological developments has attracted many residents from outside the region to migrate to South Sulawesi Province, especially to urban areas such as Makassar City, Parepare City, and Palopo City. Population migration is carried out to work in urban areas due to the urban predicate as the center of the economy in South Sulawesi, thus opening up very high job opportunities. This very high population increase has resulted in higher rice needs in urban areas. Table 2 show the total population of urban areas, with the total population in Makassar City in 2019 reached 1.521.091 people and is the value of the densest population per Regency/City in South Sulawesi, causing Makassar City to become the city with the highest value of rice needs in the south Sulawesi Province with a rice demand value of 172.613,41 tons/year in 2019. This figure has a very high value of the rice need gap when compared to the value of rice needs in other urban areas in South Sulawesi Province. Rice needs in Pare-Pare City in 2019 only amounted to 16.391,73 tons/year, while the value of rice needs in Palopo City in 2019 was only 20.584,70 tons/year, the data can be seen in table 3.

The gap in rice needs that occurs in urban areas in South Sulawesi Province is caused by the spatial distribution pattern of the population, which is densely concentrated in Makassar City. The population density in

2019 in Makassar City reached a value of 8.686 people/km<sup>2</sup>. The dominance of development in Makassar City, especially in the industrial and informal service sectors, has led to an increase in population migration who work as laborers, resulting in a pattern of land use change and high rice demand in South Sulawesi. Rice needs in the cities of Pare-Pare and Palopo do not show very high numbers like those in Makassar City. This happens because the two cities have high development, but the density and number of residents are still relatively low, therefore the rice needs are not as big as in the City Makassar. The total population of Pare-Pare City in 2019 only reached 144.446 people with a population density of 1.462 people/km<sup>2</sup>. Meanwhile, the population of Palopo city in 2019 only reached 181.395 people with a population density of 746 people/km<sup>2</sup>. This value shows that there is an imbalance in the number and density of population between cities in South Sulawesi Province. This value also indicates that the urban area of South Sulawesi Province has a very high value of population pressure on land, resulting in a decrease in agricultural land and an increase in built-up land, which has an impact on the increasing demand for rice and decreasing regional productivity to produce rice as an effort to meet the needs local rice.

The pattern of rice needs in urban areas of South Sulawesi Province did not experience significant changes from 2015-2019. This shows that the population growth rate in South Sulawesi Province is still relatively low. Population growth in Makassar City, Pare-Pare City, and Palopo City from 2015-2019 only reached a value of 1% per year, therefore that rice needs each year only increased by 1978-2292 Tons/Year for Makassar City and increased demand for rice by 100-100 percent. 450 tons/year for Pare-Pare City and Palopo City. In addition, it can be seen that the development carried out in South Sulawesi Province, especially in urban areas, in terms of economic development, infrastructure, and services, is

not too high every year which causes low fluctuations in the value of rice needs in South Sulawesi.

### 3.3.2. Land Conversion

Land use change in 2015-2019 of South Sulawesi looks different based on regency or city. When seen by three cities of South Sulawesi, such as Makassar, Pare-pare, and Palopo, the trend of land use change during five years looks stable. Land use change at the agricultural or non-agricultural land is not big. However, the total area of the agricultural land is more significant in the three cities. The total area of wet rice fields is not over 20% of the total area of agricultural land. The total area of agriculture in the city, dominated by non-wet rice fields, such as plantations, forests, and fields. Although land-use conversion by three cities of South Sulawesi Province is not significant, the total area of the agricultural land is still smaller than built-up areas.

Based on the total area of the land-use conversion of the agricultural land in urban areas in South Sulawesi Province in 2015-2019, the three cities have significant trends: an increase of agricultural land in five years, especially Palopo City. The increased area of the agricultural land in 2015 was 2.678 ha and increased significantly in 2019 by 10.679 ha. An increase in agricultural land caused by a lot of vacant land has not been used, therefore this land was not able to be categorized as an agricultural land or non-agricultural land. Most of this increase in agricultural land-use comes from non-rice fields, such as community forests. Many products have economic value and can support food sufficiency, such as wood, fruits, latex, and other products by community forest. Optimizing the use of community forest has the opportunity to improve the economy of South Sulawesi Province, which makes the agricultural sector the largest contributor to Gross Domestic Region Product (GDRP), this statement based on [1].

**Table 2.** The population of urban areas of South Sulawesi Province in 2015-2019

Urban City	Total Population (People)				
	2015	2016	2017	2018	2019
Makassar	1.449.401	1.469.601	1.489.011	1.503.664	1.521.091
Pare-Pare	138.699	140.423	142.097	143.075	144.446
Palopo	168.894	172.916	176.907	178.253	181.395

Source: BPS and 2021 data processing

**Table 3.** Rice Needs for urban areas of South Sulawesi Province in 2015-2019

Urban City	Rice Needs (Tons/years)				
	2015	2016	2017	2018	2019
Makassar	164.478,03	166.770,32	168.972,97	170.635,79	172.613,41
Pare-Pare	15.739,56	15.935,20	16.125,17	16.236,15	16.391,73
Palopo	19.166,09	19.622,51	20.075,41	20.228,15	20.584,70

Source: BPS and 2021 data processing

The area of non-agricultural land has decreased in the past five years, but Palopo City has increased. However, non-agricultural land in urban areas is larger than agricultural land. Increase in non-agricultural land due to increasing population and economic development. One of the reasons for the increase in population is the inflow of migration which was high enough during that period. In 2015 the number of in-migration was 771.201 people [3].

The number of migrants who entered in 2015 will affect the increase in population in the following year. The reason migran entered South Sulawesi is because the GDRP in South Sulawesi is quite high and South Sulawesi is one of the provinces with a better economy in eastern Indonesia. This way encourages many migrant workers to enter, so that the need for land for housing is increasing. Therefore, it is necessary to clear land for residential land.

The built-up land is larger than the agricultural land due to the development in urban areas, this development has purpose to increase the economy. In addition, the increase in the number of urban residents is higher than in rural areas, so the need for land for settlements is increasing. The function of the city as the center of economic activity and other activities encourages infrastructure development to support economic activities. Urban areas often rely more on the industrial sector than other economic sectors, so it is unavoidable that more of built-up land than agricultural land. Therefore, the narrow area of agricultural land is the reason for rice production being slightly unable to meet the needs of the larger population in urban areas.

**3.4. How to fulfilled the urban area’s food demand**

Food sufficiency data shown by table 4 of South Sulawesi from 2015 to 2019 and figure 1 shows that areas with negative food sufficiency are dominated by urban areas. The urban area of South Sulawesi, consisting of Palopo City, Makassar City, and Pare-pare City. Urban area food shortages are caused by the dominance of anthropogenic land compared to agricultural land and denser population compared to rural areas. The dominance of anthropogenic land compared to agricultural land resulted in a problem where agricultural productivity cannot cover the population's food needs. The high number of people in urban areas also leads to

high population density and results in an increasing need for resources. Therefore, the value of food sufficiency in urban areas becomes negative.

Food insufficiency tends to easily occur in urban area, especially if there are rural areas that have large enough food source commodities around urban areas. Rural areas will serve as urban buffer areas because of the transactions between two regions for fulfilling urban area's food demand. The transaction of the two regions will not only meet the food needs in urban areas but will also improve the economy of rural areas. It shows that the food availability in urban areas is the result of importing food commodities from the surrounding areas and other areas, therefore of course, the price of food offered in urban areas will be more expensive than in rural areas because there are transportation costs.

Urban areas are characterized by the dominance of service sector jobs, high incomes, rapid growth, high population density, and high unemployment. The urban area is a region that had advanced civilization, great economy, and advanced science, where this had resulted in high population growth, especially from migration factors [8]. High population growth has resulted in tight competition for employment, which make social inequalities in urban areas more visible than rural areas [8]. This shows that even in urban areas, there is a large number of poor people, where the poor will have difficulty in meeting their food needs due to higher urban food prices.

Residents of urban areas have characteristics, where the characteristics are the existence of money capital and natural capital, which is very limited, especially for poor residents [8]. Poor residents that arise because of tight competition for employment experienced the largest impacts from food sufficiency. The money capital they have is limited due to poverty, while natural capital is limited due to dense settlements in urban areas, therefore there is no land that can be used to produce foodstuffs. That should be the focus of the government in coping this problem to do by importing from the surrounding districts. However, when the goods arrive in the city, the price will increase therefore that the poor in urban areas will find it difficult to get food. High food prices, high social inequalities, and limited agricultural land in urban areas make the problem of food insufficiency in urban areas will be more difficult to cope with. The government is expected to establish policies that lead to cheaper food, increase the number of foodstuffs and quality of foodstuffs.

**Table 4.** Food Sufficiency in Urban Areas

Urban City	Food Sufficiency Value				
	2015	2016	2017	2018	2019
Makassar	-155686.58	-158068.93	-160181.52	-161150.64	-164441.47
Pare Pare	-12958.05	-13210.39	-13343.66	-11760.39	-12615.51
Palopo	-10194.55	-10714.33	-11120.54	-8358.37	-10040.74

Source: BPS, data processing 2021

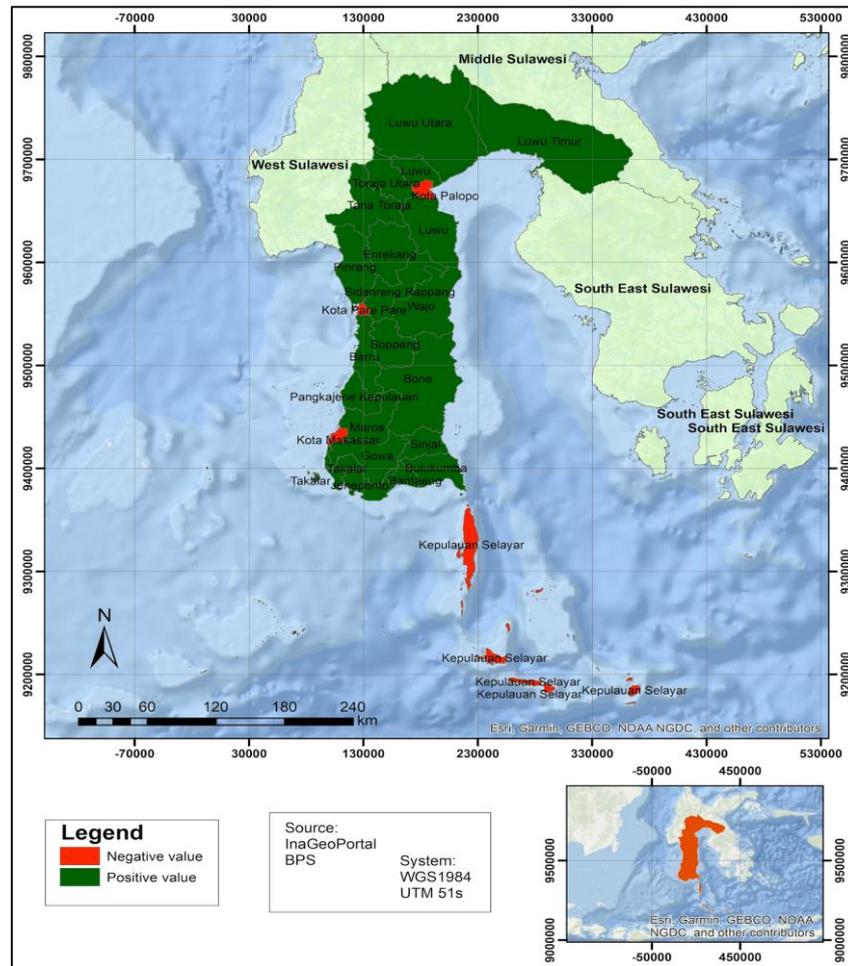


Figure 1. Food Sufficiency Map of South Sulawesi Province

#### 4. CONCLUSION

The value of food sufficiency in Makassar, Pare-Pare, and Palopo shows negative values, causing food insufficiency. The population increase is the cause of the increase of food needs in South Sulawesi Province and has an impact on food insufficiency in the province. Makassar city has the most populous population compared to Pare-Pare and Palopo in 2019, which reached 1.503.664 people, so the food needs of Makassar city are the highest. The value of food needs in Makassar reached 172.613,41 tons / year in 2019, while Pare-Pare 16.391,73 tons / year and Palopo City 20.584,70 tons/year. Land conversion and the narrowness of rice fields that only amount to 20% of the total area of agricultural land will affect rice production, therefore that makes a direct impact on the availability of rice in urban areas that are inadequate. The government tries to import food resources from rural areas to fulfill food needs in urban areas. In addition, the government must establish policies that lead to cheap food, a good quantity of foodstuffs, and good quality of foodstuffs, therefore the poor will get their food easily.

#### AUTHOR'S CONTRIBUTION

All authors had contribution for designing the research and calculating data based on method. But each author also had their own contribution, as follows:

- Raka Adi Bagaskara analyses the solution of urban area's food sufficiency and tidying up the paper.
- Alfanni Nurul Kumalasari collects and analyses data about land conversion in urban areas.
- Arsita Rahma Devainsaini was writing introduction and collecting literature about food sufficiency.
- Azhar Firman Ghani was collecting and analyse population data.
- Erlangga Jati Dewantara was analyse and collecting rice availability data.
- Nisa Karimah was analyse and collecting food sufficiency data.
- Tri Utami Setyawati was writing method and collecting literature about food sufficiency.

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