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STUDY OF CHANGES IN USE OF PADDY FIELDS 2013–2023 ON FOOD SUFFICIENCY IN KABUPATEN BEKASI BASED ON GEOGRAPHIC INFORMATION SYSTEMS

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Abstract: Kabupaten Bekasi has significant potential for rice field cultivation. Currently, Kabupaten Bekasi is experiencing significant industrial development. This industrial development has increased the demand for land, resulting in the conversion of rice fields in Kabupaten Bekasi to non-rice uses such as housing, industry, and offices. The increasing conversion of rice fields can have an impact on food sufficiency in the region. Therefore, a study on the transformation of rice fields into food sufficiency in Kabupaten Bekasi is necessary. This study aims to determine the relationship between the conversion of rice fields to non-rice fields and food sufficiency in Kabupaten Bekasi. This study uses a quantitative descriptive method with the help of Geographic Information System (GIS) techniques. GIS is used to overlay rice field data from 2013 and 2023 so that changes in the use of rice fields can be further analyzed. The results of this study show that the conversion of rice fields that occurred in Kabupaten Bekasi from 2013 to 2023 was 11,963.22 ha. The highest area of rice field conversion occurred in Cikarang Pusat District, which was 2,036.16 ha. During 2013-2023, the percentage of area converted from rice fields to settlements was 75.31%. Based on the results of the calculation of food sufficiency per sub-district, Cikarang Pusat District experienced a fairly high decline in food sufficiency; namely, in 2013 it experienced a surplus of 5,128.67 tons, changing to a deficit of 2,797.80 tons in 2023. Additionally, the calculation of food sufficiency in Kabupaten Bekasi showed a deficit of 66,752.51 tons in 2013, which increased to a deficit of 136,386.31 tons in 2023.

Keywords: land use change, paddy fields, food sufficiency, kabupaten bekasi

INTRODUCTION

Indonesia is known as an agricultural country that has a wealth of natural resources and fertile agricultural land. Most of the Indonesian population works as farmers, and the agricultural sector is one of the main pillars of the national economy. Large areas of land play an important role in human life because they support agriculture, which is a source of income for the community. Therefore, if Indonesia can optimally develop its agricultural potential, the agricultural sector plays a strategic role in achieving national development goals (Ikhwanto, 2019).

An important sector in supporting the achievement of Indonesia's economic goals is the agricultural sector. The agricultural sector has generated Indonesia's Gross Domestic Product (GDP) of 12.40%, based on data from the Central Statistics Agency in 2022. As an agricultural country, the agricultural sector is the main livelihood of the Indonesian people, especially in Bekasi Regency; as many as more than 50% of the Indonesian people work in the agricultural sector (Saptono, 2024). Kabupaten Bekasi has extensive agricultural land and is a source of global food supply, especially for

developing countries. However, massive changes in rice fields can threaten sustainable food production and food sufficiency; therefore rice cultivation in Kabupaten Bekasi plays a vital role in achieving sustainable development goals. especially related to the fulfillment of the goals of the Sustainable Development Goals (SDGs), namely efforts to end hunger and improve the quality of healthy and prosperous life in Kabupaten Bekasi.

Several previous studies have shown that the conversion of rice fields to non-rice fields continues to occur. The research includes studies conducted by The Last Supper (2024) that focus on the rate of rice field conversion, as well as analyses of current and future rice availability scenarios. Furthermore, research conducted by Nirbono (2022) is about the analysis of factors affecting the conversion of rice fields in Kabupaten Bekasi. Therefore, the purpose of the study is to update and complete data in previous studies related to changes in the use of rice fields and analysis related to food sufficiency (availability and food needs) in a period of 10 years in Bekasi Regency. This time is used so that it can be studied in detail by utilizing Landsat 8 Satellite Imagery Data and Geographic Information Systems (GIS) Techniques.

Landsat 8 satellite imagery has two sensors, namely the Onboard Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS), with a total of 11 channels (bands) (Landsat 8 | Landsat Science, 2021). Bands 1-9 are on the OLI sensor, and bands 10-11 are on the TIRS sensor. Both sensors can detect and depict land use changes over decades accurately, using historical data from Landsat (Landsat 8 | Landsat Science, 2021). The phenomenon of changes in rice field usage occurs from time to time, so this observation process requires multi-decade data analysis to obtain a detailed picture of the dynamics of actual changes in rice fields in Kabupaten Bekasi. Landsat 8 imagery data is a product of the remote sensing process that is freely available with excellent spatial resolution and multi-temporal (multi-decade) resolution, so it is often utilized for studies of land use changes.

Kabupaten Bekasi is one of the buffer areas of the capital city of Jakarta. This condition certainly has an impact and pressure on land changes. The increasing development activities that occur in the capital city of Jakarta will increase the need for development land towards the buffer area, so that the need for land in the buffer area will increase and encourage land changes. The use of rice fields in Kabupaten Bekasi will continue to be pressured and become a target for the process of land use change due to the increasing development activities and regional development that continue to occur. If rice fields in Kabupaten Bekasi continue to decrease, the availability and sufficiency of food will be disrupted.

Based on the explanation that has been given, the author chose to conduct research with a topic entitled "Study of Changes in Paddy Field Use in 2013-2023 on Food Sufficiency in Kabupaten Bekasi Based on Geographic Information Systems." This research aims to provide useful information through maps, tables, and graphs that can help create public policies for protecting sustainable food agricultural land (paddy fields) in Kabupaten Bekasi. With these data, the author also hopes that the Bekasi Regency Government can determine strategic steps in realizing food security, which includes food availability, food independence, and sustainable food affordability, starting from the local, regional, and national levels.

LITERATURE REVIEW

1. *Changes in the use of Paddy Fields***,** The increasing intensity of rice fields being converted into non-rice fields every year can be influenced by the increasing population factor and is in line with the

rapid development activities. The high demand for land due to development activities results in significant and ongoing changes in land use. The primary focus of land use changes is agricultural land, which covers a large area; for instance, rice fields are being converted into housing, industrial sites, and other developments to satisfy the needs of various stakeholders (Haris et al., 2018). The magnitude of changes in the use of rice fields that continue to occur can be influenced by the low income factor obtained by farmers, the large amount of capital spent, and the relatively long harvest time, so that many farmers sell their rice fields to be converted into non-rice fields (Prasada & Rosa, 2018).

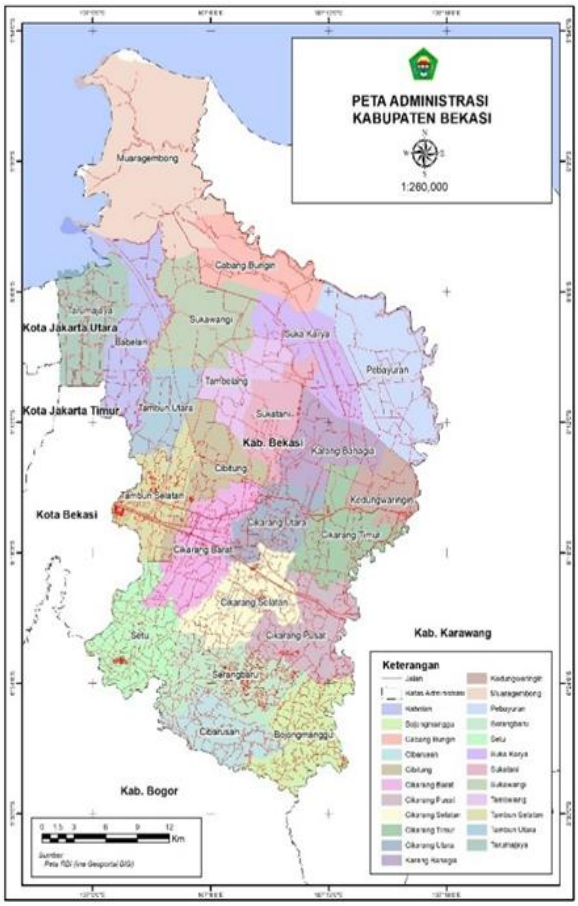
2. *Food Sufficiency,* Humans have a basic need for food. The demand for food is increasing in line with population growth, so there needs to be an effort to ensure food availability every year (Nurpita et al., 2018). The rice commodity sector continues to dominate the Indonesian population's food needs (Santosa, 2017).

3. *Geographic Information System (GIS),* Implementation of geographical in-formation systems (GIS) can facilitate the process of observing changes in rice fields each year (Lindari & Subadiyasa, 2018). The purpose of GIS is to collect, store, and examine phenomena and objects with geographical locations. GIS has a computer-based system with four main functions: input, data management (storing and retrieving data), data analysis and manipulation, and output (Luhukay et al., 2019).

RESEARCH METHODS

This research was conducted from October 2023 to January 2024. The location of this research was conducted in the Kabupaten Bekasi Administrative Area, which is located between coordinates 6º 10' 53" - 6º 30' 6" LS and 106º 48' 28" - 107º 27' 29" BT, with an area of 126,471.33 ha. Based on geographical location, to the north it borders the Java Sea, to the south it borders Kabupaten Bogor, to the east it borders Kabupaten Karawang, and to the west it borders Bekasi City and DKI Jakarta (see Figure 1).

Figure 1. Administrative Map of Kabupaten Bekasi



Source: RBI Map (Ina-Geoportal BIG)

This study uses a descriptive quantitative method by utilizing Geographic Information Systems through the overlay method.

In this study, the tools and materials used included secondary data in the form of Landsat 8 satellite imagery and BPS data related to the population from 2013 and 2023. As well as the tools used were ArcGIS 10.8 software and a laptop to process the data. In this study, the period used to determine changes in rice fields is from 2013 to 2023. This study conducts a land change analysis over a period of 10 years. Therefore, the technical analysis is carried out based on a comparison through an overlay of land use data for rice fields in two time periods between 2013 and 2023 with the help of ArcGIS 10.8 software. The use of rice fields is produced through the process of interpreting Landsat 8 satellite imagery in 2013 and 2023; the image data is obtained through the Earth Explorer-USGS page. After the download stage, the 2013-2023 image data is processed in the ArcGIS 10.8 application.

This study uses a quantitative method to calculate the rate of rice field conversion and to determine the rate of rice field conversion in Kabupaten Bekasi over a 10-year period, namely 2013 and 2023, and also to calculate the amount of rice availability and the amount of rice needed for the population in 2013 and 2023. A descriptive approach is used to explain the relationship between the conversion of rice fields to food sufficiency through the level of rice availability and rice consumption needs in Kabupaten Bekasi. Geographic Information Systems (GIS) are able to monitor land changes that occur dynamically so that they can be used to interpret land use in 2013 and 2023. The use of this method is expected to provide scientific contributions in the fields of geography, agricultural studies, and regional planning.

According to (Nurrahma et al., 2024) and (Butomo et al., 2020), the rate of land use change can be determined by performing partial calculations, namely by analyzing changes in each type of land separately. The formulas used include the following.

$$\mathbf{V} = \frac{L_t - L_{t-1}}{L_t} \times \mathbf{100\%}$$

information:

V = Percentage of land conversion rate (%)

Lt =Total land area at present/year t (ha)

Lt_{-1} =Total land area in the previous year (ha)

Furthermore, to calculate food sufficiency in Kabupaten Bekasi, a comparison is made between the amount of rice available and the required rice consumption. To calculate the availability of rice, it is calculated from the rice production obtained from the area of rice fields in Kabupaten Bekasi; in this study, the rice productivity used as the average per year is 6.5 tons/ha. Based on data from the Kabupaten Bekasi BPS in 2023. In producing the amount of rice production, this study also uses the assumption that each hectare of rice fields has the same productivity. Then, to calculate the production and availability of rice per year, it can be done using the following formula.

$$\mathbf{Rnet = (P \times (1-(S+F+W))) \times C}$$

Information :

Rnet : Net rice production (tons/year)

P : GKG/rice production (tons/year)

S : Rice for seed (0.9%)

F : Rice for feed (0.44%)

W : Scattered rice (5.4%)

C : Rice changesto rice (62.74%)

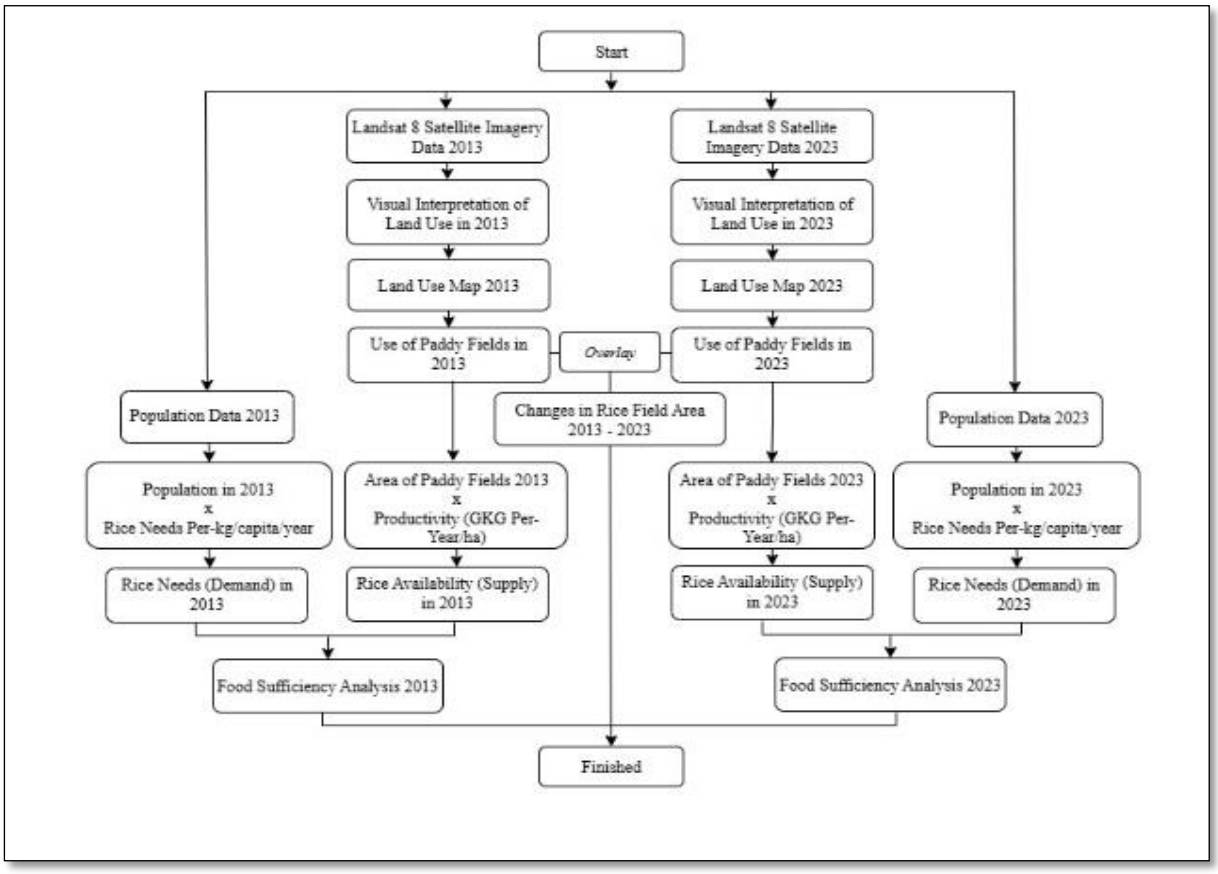
The figure of 62.74% is the conversion figure set by BPS for Dry Milled Paddy (GKG) to rice. This net rice production is then interpreted as the availability of rice (Dewinta & Warlina, 2017). Next, to calculate rice consumption requirements, the following formula can be used.

$$\textbf{Rice Consumption Needs} = \text{Population Count} \times \frac{113{,}48}{(\text{Kg, Capita, Year})}$$

The Central Statistics Agency (BPS) has set the average per capita rice consumption per year at 113.48 kg. This means that each individual consumes 113.48 kg of rice in one year (Haris et al., 2018). This study also assumes that each resident consumes the same amount of rice.

It is assumed that all rice produced in the area is fully consumed for local rice consumption needs. A region is considered to have a rice surplus if the amount of rice available is greater than the needs of the local population. Conversely, a region is said to have a rice shortage if the amount of rice available is less than the needs of the population in the region (Santosa, 2017). The assumptions used in this study are, of course, still general and can affect the accuracy of the research results, but they can provide an estimate of the availability (supply) and demand for rice in Kabupaten Bekasi. This estimate is calculated based on the availability of rice (productivity per year/ha) and the need for rice per kg/capita/year. The researcher hopes that this calculation can show how much food is available in the Kabupaten Bekasi area by comparing how much rice can be produced (based on the size of rice fields) with how much rice people need (calculated by multiplying the amount of rice needed per person by the total population). For more details, see the research flowchart in Figure 2

Figure 2. Research Flow Chart



Source: Research Flowchart, 2024-2025

RESULTS AND DISCUSSION

Geographic Information System is used to facilitate the data processing process and interpret satellite imagery, resulting in land use in 2013 and 2023. From the image interpretation data, the data is then analyzed to produce changes in rice field usage in Kabupaten Bekasi over a period of 10 years. Analysis of changes in rice field land can be obtained using comparative techniques by overlaying data on rice field usage from 2013 and 2023. The analysis of land changes and land use in Kabupaten Bekasi is categorized into 7 types: mangrove forests, mixed plantations, settlements, rice fields, rivers/lakes, ponds, and open land (see Figure 8).

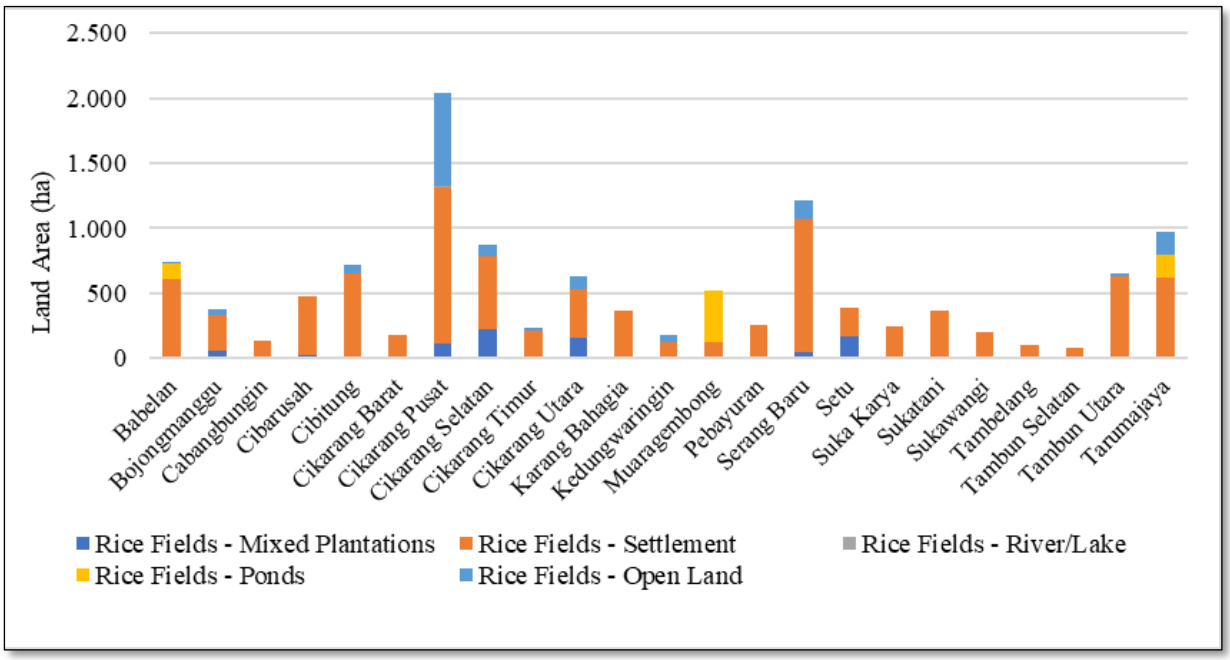
Table 1. Land Use Changes 2013-2023

No	Land Use (PL)	Area of PL 2013 (ha)	Area of PL 2023 (ha)	Change (ha)
1	Mangrove Forest	249.35	482.39	233.04
2	Mixed Plantation	10,747.73	9,210.19	-1,537.55
3	Settlement	30,990.76	42,697.21	11,706.45
4	Ricefield	72,024.76	60,061.53	-11,963.22
5	River/Lake	1,101.06	1,097.20	-3.87
6	Pond	10,940.64	11,355.25	414.61
7	Open Land	417.02	1,567.56	1,150.54

Source: Data analysis results, 2024-2025

Based on Table 1, Land Use Changes in 2013 - 2023 there were changes in land use in Kabupaten Bekasi, including mangrove forests increasing by 233.04 ha, mixed plantations decreasing by 1,537.55 ha, settlements increasing by 11,706.45 ha, rice fields decreasing by 11,965.22 ha, rivers/lakes decreasing by 3.87 ha, ponds increasing by 414.61 ha and open land increasing by 1,150.54 ha.

Figure 3. Diagram of Changes in Paddy Fields to Non-Paddy Fields in 2013-2023 per Sub-District in Kabupaten Bekasi



Source: Data analysis results, 2024-2025

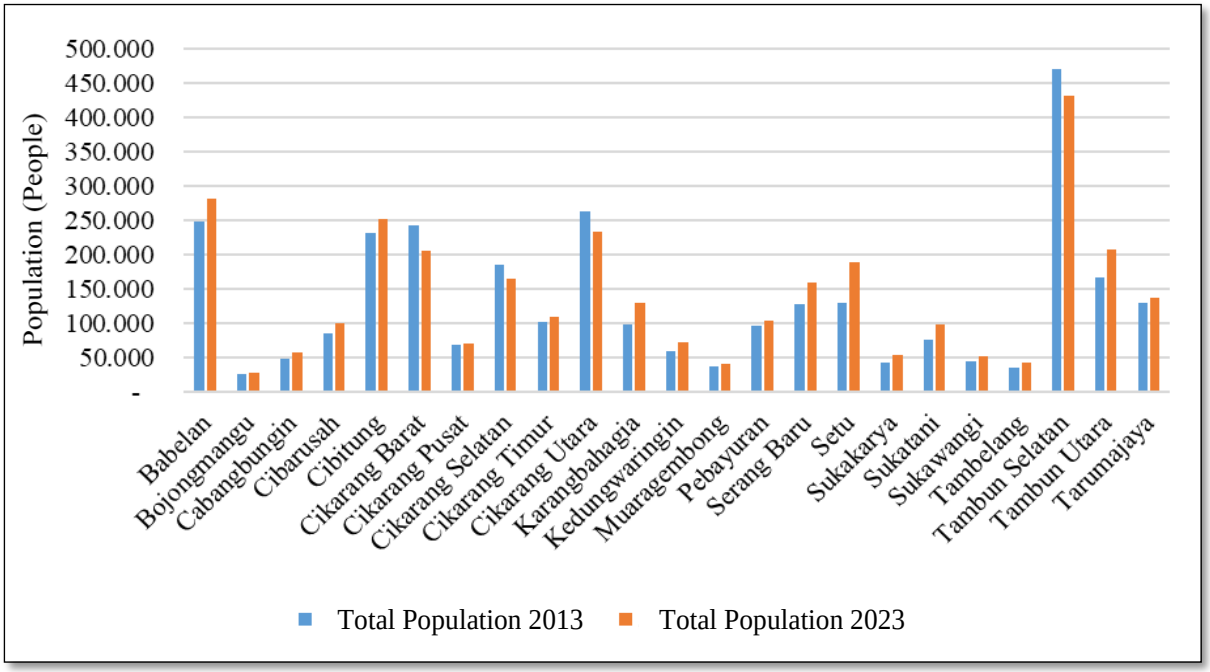
Table 2. Land Use Change Matrix 2013-2023

PL Year 2013	PL Year 2023							Total Area (ha)
	Mangrove Forest	Mixed Plantation	Settlement	Ricefield	River/ Lake	Pond	Open Land	
Mangrove Forest	249.29	0.00	0.00	0.00	0.00	0.06	0.00	249.35
Plantation Mixture	0.00	8,414.45	2,277.11	0.00	0.00	0.00	56.18	10,747.73
Settlement	0.00	0.00	30,990.76	0.00	0.00	0.00	0.00	30,990.76
Ricefield	0.00	787.33	9,009.41	60,061.53	15.35	687.39	1,463.73	72,024.76
River/Lake	0.00	0.00	0.12	0.00	1,078.82	22.13	0.00	1,101.06
Pond	233.10	0.00	58.85	0.00	3.03	10,645.67	0.00	10,940.64
Open Land	0.00	8.41	360.96	0.00	0.00	0.00	47.65	417.02
Total Area (ha)	**482.39**	**9,210.19**	**42,697.21**	**60,061.53**	**1,097.20**	**11,355.25**	**1,567.56**	**126,471.33**

Source: Data analysis results, 2024-2025

Based on Table 2, data on changes in the use of rice fields from 2013 to 2023 are divided into several types of non-rice fields. The changes in rice fields to non-rice fields that occurred were changes in the use of rice fields to mixed plantations covering an area of 787.33 ha, settlements covering an area of 9,009.41 ha, rivers/lakes covering an area of 15.35 ha, ponds covering an area of 687.39 ha, open land covering an area of 1,463.73 ha, and the use of rice fields that did not experience modifications covering an area of 60,061.53 ha. From these data, it can be seen that the total area of rice fields in 2013 was 72,024.76 ha and also the total area of rice fields in 2023 was 60,061.53 ha. These data show that there is a difference in the area of rice fields of 11,963.22 ha. In other words, there was a total area of change in rice fields of 11,963.22 ha that occurred within a period of 10 years.

Figure 4. Population Data Diagram per Sub-District in Bekasi Regency in 2013 and 2023



Data source Central Statistics Agency (BPS) Bekasi Regency 2013 and 2023

The results of the analysis are in Figure 3 and Figure 4. There was a change in the use of rice fields to non-rice fields within 10 years, namely from 2013 to 2023, which occurred in every sub-district in Kabupaten Bekasi. Based on the data obtained, it can be seen that there was a change in rice fields within a period of 10 years. The area with the highest change in the use of rice fields to non-rice fields occurred in Cikarang Pusat District, with a converted area of 2,036.16 ha. In Cikarang Pusat District, the conversion of rice fields into settlements covered an area of 1,198.81 ha.

This can be influenced by several factors, one of which is an increase in population. The increase in population is mostly the result of urbanization and natural processes. Cikarang Pusat District is the capital city and the center of government of Kabupaten Bekasi. Cikarang Pusat District is located in the Deltamas City area, which is a medium- and large-scale industrial base. In addition, Cikarang Pusat is a center of trade and services. Therefore, the increasing population also increases the rate of settlement development, resulting in a

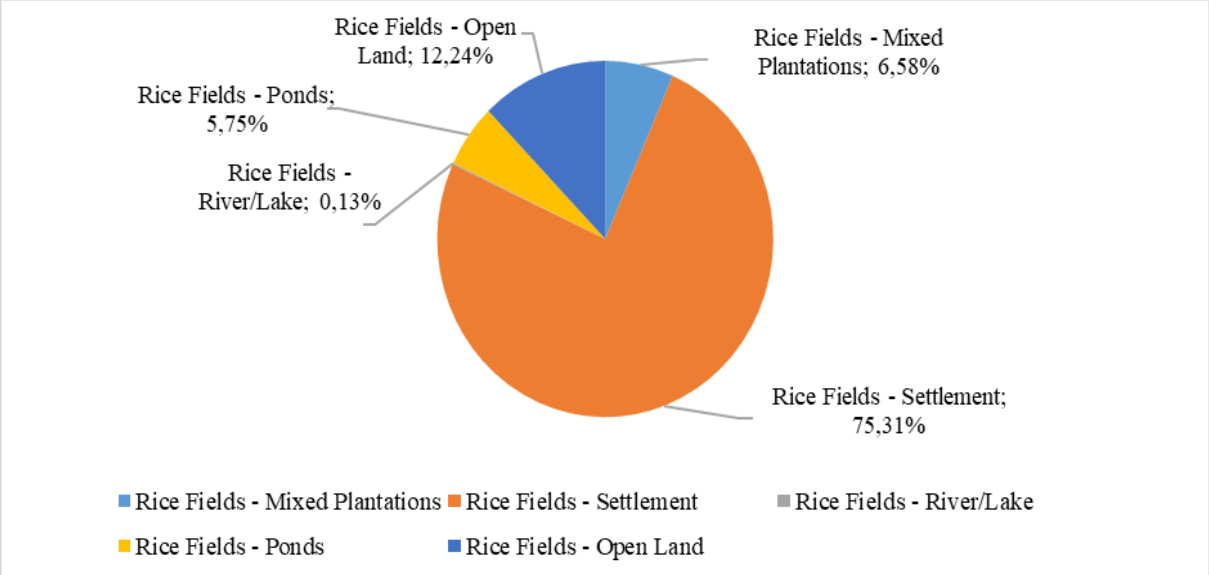
change in the use of rice fields to become quite high settlements (Concerned, 2015).

In Kabupaten Bekasi, there is also an area, Serang Baru District, that has experienced extensive land use changes, with the converted land reaching 1,216.49 ha. The conversion of rice fields into settlements covers an area of 1,021.17 ha. The high level of land conversion that occurred in Serang Baru District is certainly inseparable from the influence of the location, which is directly adjacent to Cikarang Pusat District as the center of government and medium- to large-scale industrial base, in addition to the topographic factor of Serang Baru District being very strategic for residential development and also equipped with easy access for the community to carry out daily mobility. Meanwhile, the least change in rice fields in Kabupaten Bekasi occurred in Tambun Selatan District. This is because the rice fields in Tambun Selatan District are limited in area and followed by a decrease in the population in Tambun Selatan District since 2013.

Changes in the use of rice fields along with the increase in population during 2013-2023 in Kabupaten Bekasi. According to BPS Kabupaten Bekasi data, the population in 2013 was 3,002,112 people (Bekasi, 2019) and the population in 2023 will be 3,214,791 people (Hendri, 2023). In other words, there was an increase in the population of 212,679 people. This is in line with the continued increase in changes in rice fields that occurred in Kabupaten Bekasi. Based on BPS data in 2023, Kabupaten Bekasi had a population of 3,214,791 people. The high rate of population growth in Kabupaten Bekasi is directly related to the increase in the development process in a region. However, the high rate of population growth requires control efforts to ensure the fulfillment of facilities and infrastructure needs.

Without monitoring, population growth will escalate and lead to significant changes in land use. Rapid development in a region has a positive impact, namely providing jobs outside the agricultural sector, but it can have a negative impact on food productivity. The high rate of conversion of rice fields has implications for decreasing the availability of rice for the population, so that it can threaten food sufficiency in a region (Prasada & Rosa, 2018).

Figure 5. Diagram of Percentage of Rice Fields Converted During 2013-2023 in Kabupaten Bekasi



Source: Data analysis results, 2024-2025

Figure 5 explains the percentage of changes in rice fields to settlements, open land, ponds, rivers/lakes, and mixed plantations. The data produced shows a high level of change in rice fields dominated by settlements of 75.31%, or an area of 9,009.41 ha, in a period of 10 years, namely from 2013 to 2023. Furthermore, changes in the use of rice fields to open land are 12.24%, or an area of 1,463.73 ha; the conversion of this land is prepared as land for regional development.

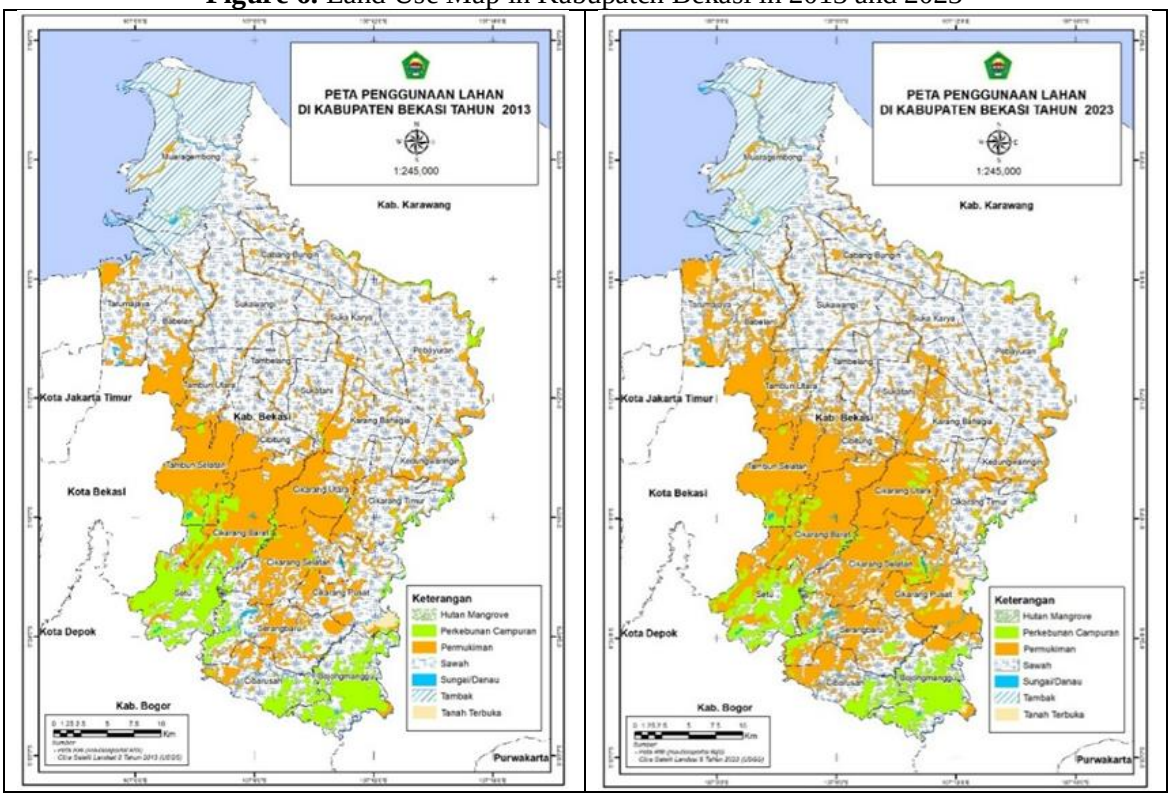
Areas that are close to busy centers will be affected by the development of socio-economic activities from the city center and suppress changes in rice fields to non-rice fields. Conversion of rice fields to mixed plantations is 6.58%, or an area of 787.33 ha, while the conversion of rice fields to ponds is 5.75%, or an area of 687.39 ha. And there was a slight conversion of rice fields into rivers/lakes of 0.13%, or an area of 15.35 ha. If the rate of rice field conversion in Kabupaten Bekasi is calculated for 10 years, the rate of rice field conversion can be obtained as 16.61% for 10 years.

Regarding the protection of wetland agriculture (rice fields) in Kabupaten Bekasi, this has been regulated in Bekasi Regency Regional Regulation Number 12 of 2011 Concerning the Bekasi Regency Spatial Planning Plan for 2011–2031. The regulation stipulates that sustainable food agricultural land is 35,244 ha and is spread across 12 sub-districts. However, on the other hand, the phenomenon of rice field conversion continues to occur even in sub-districts that are the target for sustainable agricultural land protection as stated in the Kabupaten Bekasi RTRW Regional Regulation. Although the condition of the remaining rice field area in 2023 is still far from the value of the area targeted for protection, in reality there are still deviations in land use that result in a reduction in the area of rice fields in Kabupaten Bekasi. Therefore, the regional government needs to increase supervision controlled by the RTRW regulations that have been set so that the phenomenon of converting rice fields to non-rice fields can be avoided. Another challenge for the Kabupaten Bekasi regional government is to accelerate the process of drafting regional regulations on Sustainable Food Agricultural Land Protection (LP2B) as mandated in Law of the Republic of Indonesia Number 41 of 2009 concerning Protection of Sustainable Food Agricultural Land. It is hoped that the regional regulation can protect and maintain sustainable agricultural land. The regional government also needs to overcome obstacles related to the availability of more accurate spatial data on rice field agricultural land to support the process of drafting the Regional Regulation on LP2B in Kabupaten Bekasi.

The lack of implementation and support of regional regulations that are able to protect the fate of farmers, as a result, the conversion of rice fields cannot be avoided and causes a shift in the type of work, and begins to leave the agricultural sector because it is considered no longer profitable. Farmers' rice fields are starting to be offered at high prices by property developers, and the results are used for new business capital (Haviz et al., 2021).

The reduced condition of rice fields can affect the fulfillment of food needs for residents in Bekasi Regency. Based on the formula mentioned in the method, it produces a value of 113.48 kg/capita/year, which is the standard value of rice consumption needs per capita. This value shows that the need for rice consumption for each resident is 113.48 kg of rice per year. If the rice output in the area is insufficient to satisfy the population's demand for rice consumption, the area is facing a deficit and has failed to meet the food requirements of its citizens. If rice production surpasses the population's consumption demand, the area enjoys a surplus and can satisfy the food requirements of its citizens.

Figure 6. Land Use Map in Kabupaten Bekasi in 2013 and 2023



Source: *RBI Map (Ina-Geoportal BIG), Landsat 8 Satellite Imagery 2013 and 2023*

Figure 7. Land Use Change Map in Kabupaten Bekasi 2013-2023

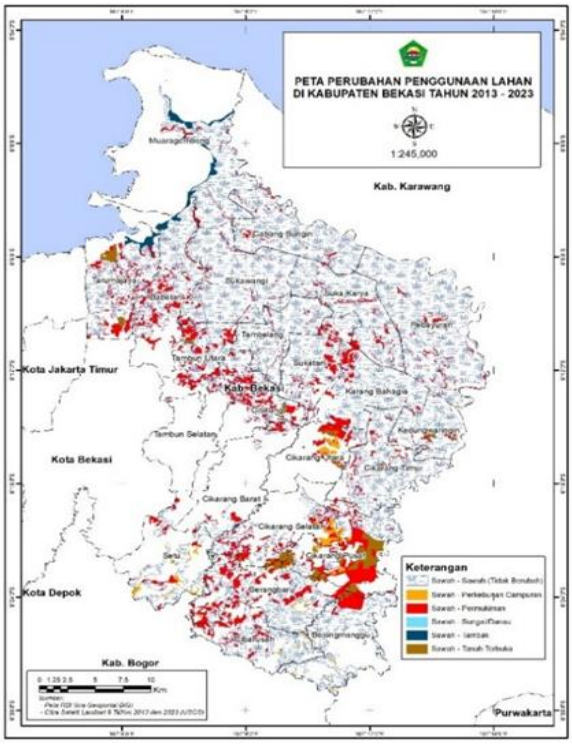
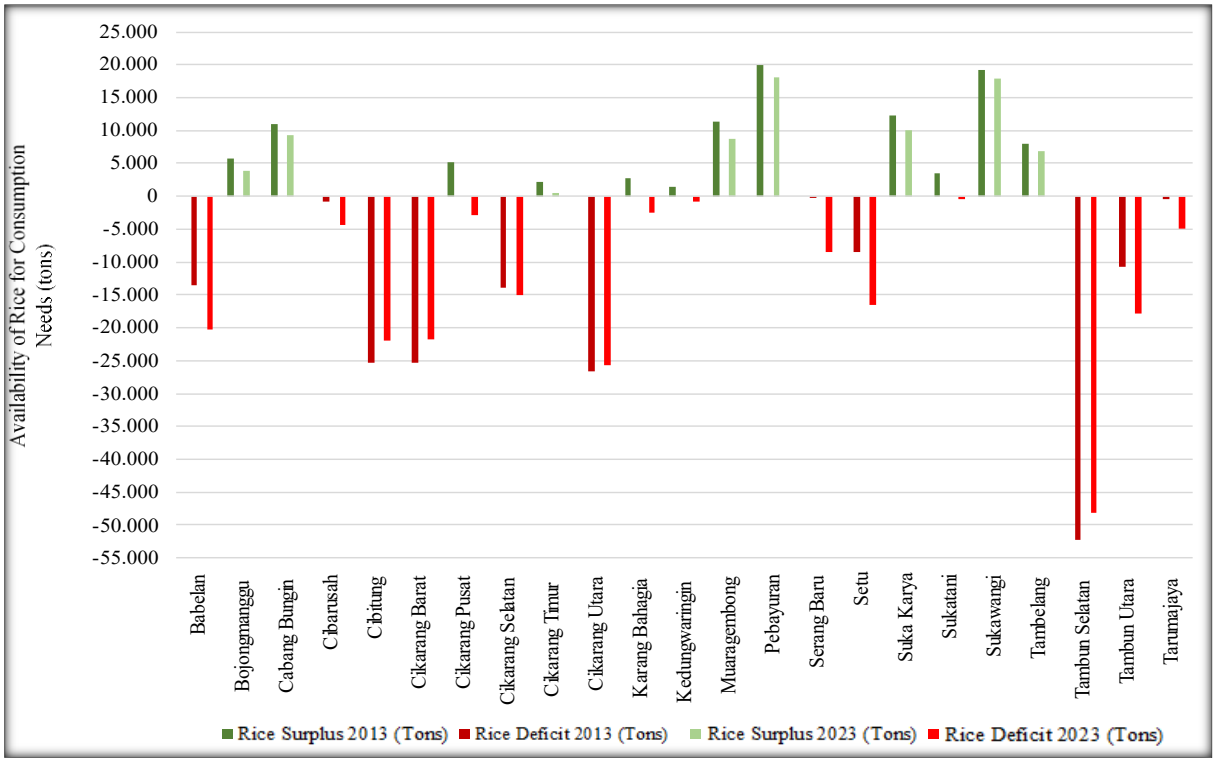


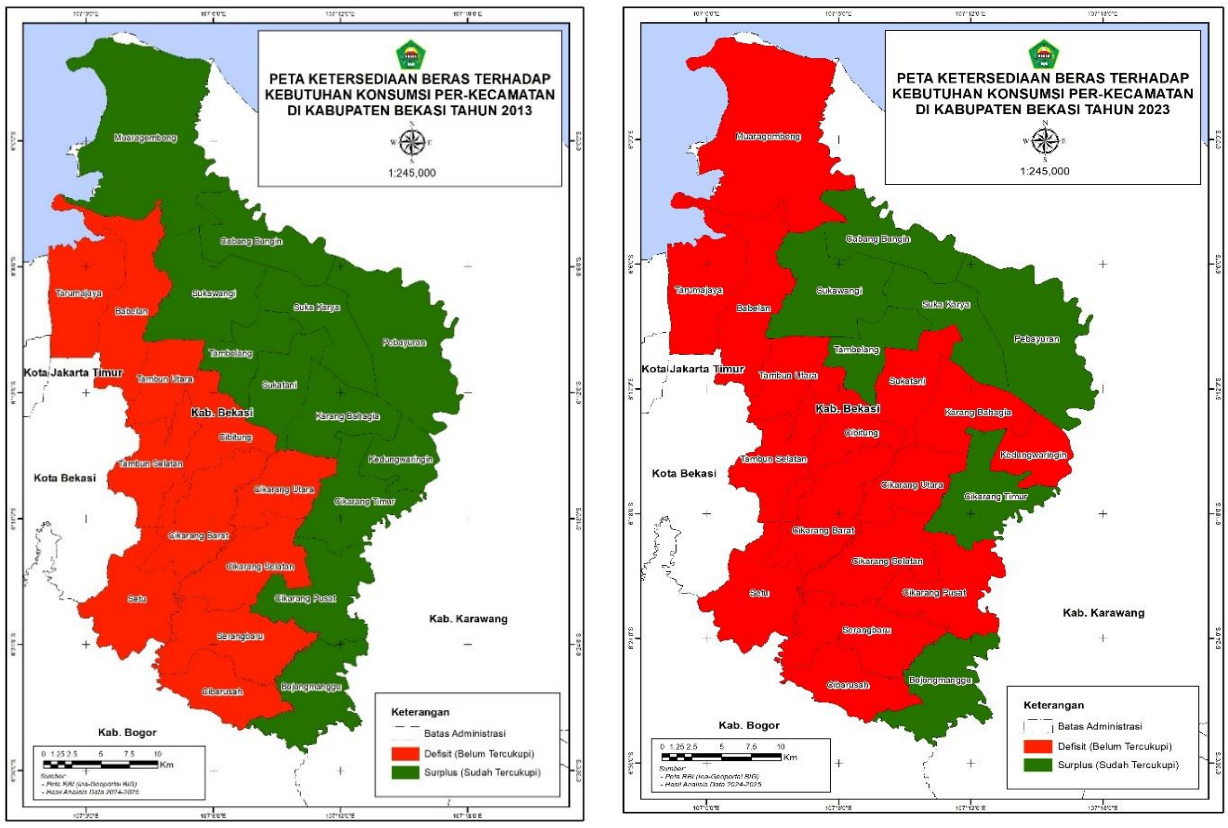
Figure 6 shows a map of rice field land use in 2013 and 2023. Then, from the two maps, an overlay is performed to analyze changes in rice field land. Figure 7 shows the results of the overlay that can show changes in rice field land from 2013 to non-rice field land in 2023. The red color indicates changes in rice field land to settlements (see Figure 7). So that through the land use change map, it can be seen which sub-districts have experienced changes in rice field land to settlements that are quite extensive. Furthermore, data on the area of rice fields and its changes are the basis for calculating the estimated food sufficiency in Kabupaten Bekasi from 2013 to 2023. Before calculating food sufficiency, it is first necessary to calculate the availability of rice using the formula Rnet = (P × (1-(S + F + W))) × C.

Figure 8. Diagram of Rice Availability Level Against Consumption Needs per District in Kabupaten Bekasi in 2013 and 2023



Source: Data analysis results, 2024-2025

Figure 9. Rice Availability Map for Consumption Needs per Sub-District in Kabupaten Bekasi in 2013 and 2023



(a) **(b)**

Source: RBI Map (Ina-Geoportal BIG), 2024-2025 data analysis results

Figures 8 and 9 show a diagram of the level of rice availability against consumption needs per sub-district in Kabupaten Bekasi for the years 2013 and 2023. Of course, the data looks contrasting regarding food sufficiency in each sub-district; this occurs because of differences in the area of rice fields and population growth rates in the sub-district. The conversion factor of rice fields, along with the dynamics of population growth, can either increase or decrease the population's need for rice. When viewed based on the availability and needs of food in each sub-district, there are 11 sub-districts that experience a food deficit and 12 other sub-districts that experience a food surplus in 2013. In 2023, there is an increase in the number of sub-districts experiencing a food deficit; as many as 16 sub-districts and 7 other sub-districts experience a food surplus. Tambun Selatan District experienced a decrease in the rice deficit rate in 2013 by 52,224.09 tons, while in 2023 the deficit became 48,218.73. The high level of deficit in Tambun Selatan District is because Tambun Selatan has few rice fields but a fairly high population, although the population in Tambun Selatan has decreased recently. Meanwhile, Cikarang Pusat District experienced a rice surplus in 2013 of 5,128.67 tons. However, in 2023 Cikarang Pusat experienced a fairly high rice deficit of 2,797.80 tons. In addition, Serang Baru District experienced a fairly minimal deficit in 2013 of only 168.81 tons; however, it increased quite significantly in 2023, namely, the deficit figure touched 8,421.44 tons. The current phenomenon is that the decreasing amount of available rice fields and the increasing population growth mean that the data obtained will look very contrasting and clearly and strikingly inversely proportional between production (availability) and consumption (needs).

Table 3. Calculation of Total Rice Productivity and Conversion of Net Rice Availability Based on Rice Field Area in 2013 and 2023 in Kabupaten Bekasi

Area of Paddy Fields (ha)		**Rice Productivity (tons)**		**Net Rice Availability (tons)**	
Year 2013	Year 2023	Year 2013	Year 2023	Year 2013	Year 2023
72,024.76	60,061.53	468,160.94	390,399.95	273,927.16	228,428.18

Source: Data analysis results, 2024-2025

Table 4. Calculation of Total Rice Consumption Needs Based on Population in 2013 in Kabupaten Bekasi

Total population (Soul)		**Consumption Needs Population Rice (kg)**		**Consumption Needs Population Rice (tons)**	
Year 2013	Year 2023	Year 2013	Year 2023	Year 2013	Year 2023
3,002,112	3,214,791	340,679,670	364,814,483	340,679.67	364,814.48

Source: Results of BPS data analysis of Bekasi Regency Population in 2013

Table 3 shows the results of the calculation of total productivity and rice availability based on the area of rice fields in 2013 and 2023. Based on the area of rice fields in 2013 with an area of 72,024.76 ha, it produced rice productivity of 468,160.94 tons, then if converted into rice availability, the net rice available was 273,927.16 tons. While the rice fields in 2023, with an area of 60,061.53 ha, produced rice productivity of 390,399.95 tons, if converted into rice availability, the net rice available was 228,428.18 tons.

Then for the calculation of food needs based on the need for rice consumption per capita with a value of 113.48 kg/capita/year in 2013 and 2023 can be seen Based on the calculation in Table 4, it can be seen that the total need for rice consumption per capita/year in 2013 in Kabupaten Bekasi was

340,679,670 kg, or 340,679.67 tons. While the calculation of the need for rice consumption per capita/year in 2023 reached 364,814,483 kg, or 364,814.48 tons. When compared between the availability of net rice and the population's rice consumption needs, it can be said that food sufficiency in Kabupaten Bekasi in 2013 experienced a deficit of 66,752.51 tons and in 2023 experienced a deficit of 136,386.31 tons. In other words, the Bekasi Regency area in 2013 and 2023, with the assumptions determined in this study, shows that it is not yet able to meet food sufficiency for its population.

Based on the calculation results of rice availability and rice consumption needs in 2013-2023, it shows that Kabupaten Bekasi has not been able to meet the food needs of its population. This also shows that the Kabupaten Bekasi area can experience a food crisis if rice fields continue to change into non-rice fields (settlements, open land, etc.) every year.

The increasing population will continue to push for development; this is a necessity that continues to occur to meet the needs of the population for housing. The Kabupaten Bekasi area, which acts as a buffer zone for the City of Jakarta, is unable to withstand the process of urbanization and is also the target of medium-to large-scale industrial areas.

Infrastructure development, including housing and industry, will mechanically use the land that is widely available, namely agricultural land. Of course, the reduction in agricultural land will affect productivity results, especially in rice fields. The decreasing rice production will significantly affect food sufficiency because the demand for rice consumption for residents will continue to increase along with the increasing population. Another factor that triggers the rapid conversion of rice fields is the lack of firmness in implementing policies both at the sub-district and district levels, so that protection of available rice fields cannot be maximized.

This means that if this happens, the Bekasi Regency area can also threaten national food security, so that the realization of the targets listed in the SDGs related to ending hunger and improving the quality of a healthy and prosperous life will be difficult to achieve. Therefore, the government must be able to focus on the problem of changing rice fields so that the productivity of rice can be maintained in stability and availability so that food sufficiency can be met and food security can be realized.

CONCLUSION

Conversion of rice fields that occurred in Kabupaten Bekasi within 10 years, namely 2013-2023, has experienced a reduction in rice fields of 11,963.22 ha. Based on the results of the analysis obtained, the area experiencing the highest conversion of rice fields occurred in Cikarang Pusat District, with a converted area of 2,036.16 ha. The use of rice fields in Cikarang Pusat District was converted into settlements with an area of 1,198.81 ha, and Serang Baru District became the second area experiencing the highest land conversion in Kabupaten Bekasi, namely rice fields converted to non-rice fields reaching 1,216.49 ha and conversion of rice fields to settlements reaching 1,021.17 ha.

The results of the analysis show that the percentage of changes in converted rice fields during 2013-2023 in Kabupaten Bekasi resulted in a conversion value of rice fields into settlements of 75.31%, open land of 12.24%, mixed plantations of 6.58%, ponds of 5.57%, and rivers/lakes of 0.13%. Through the calculation of rice availability against rice needs per sub-district, it is known that Tambun Selatan Sub-district experienced a decrease in rice deficit in 2013 by 52,224.09 tons, while in 2023 the deficit became 48,218.73.

This occurred due to a decrease in population. Cikarang Pusat Sub-district, which previously had a surplus of 5,128.67 tons in 2013, experienced a deficit of 2,797.80 tons in 2023. Meanwhile, Serang Baru Sub-district experienced an increase in rice deficit from 168.81 tons in 2013 to 8,421.44 tons in 2023. Based on the research results obtained, food sufficiency in Kabupaten Bekasi in 2013 experienced a deficit of 66,752.51 tons. The same thing also happened in 2023 which showed that food sufficiency in Bekasi Regency experienced a deficit of 136,386.31 tons. With these results, it can be interpreted that the level of productivity of rice fields in Kabupaten Bekasi is still unable to meet food sufficiency in Kabupaten Bekasi

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