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Mapping of the Function Conversion of Agricultural Land Into Settlements in Sidodadi Village Wonomulyo District Polewali Mandar District 2005-2022

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ABSTRACT

Changes in agricultural land use are uncontrolled, influenced by population growth. Along with the advancement and development of human life, the pressing need for land has resulted in the increasing threat to existing agricultural land or the existence of available land so that agricultural land changes function to meet the needs of the community. This study aims to map the conversion of agricultural land into residential land. The type of research used in this study is quantitative research. The object of this study is Sidodadi Village, while the target of this study is agricultural land that has been converted into residential land. The data collection techniques that will be used in this study are observation, documentation, and the analysis activity stage. The data analysis techniques used in this study are image analysis, land use change analysis, descriptive analysis, and land conversion rate analysis. The results of the study showed that agricultural land in 2005 was 127.67 Ha and residential land was 63.24 Ha. The area of conversion of agricultural land to residential land in 2005-2010 always experienced an increase in area every year, in 2005 to 2010 it was 3.35 Ha, in 2010 to 2015 it was 7.88 Ha and in 2015 to 2022 it was 15.44 Ha, the total overall from 2005 to 2022 was 27.68 Ha. Factors that influence land conversion are high demand for housing, strategic land location, community economic factors, high population growth, and unfulfilled or inadequate infrastructure

INTRODUCTION

The agricultural sector is a sector with the livelihood of the population in Indonesia where Indonesians depend on this sector because Indonesia is known as an agrarian country. For farmers, agricultural activities can be carried out with the important role of existing natural resources, namely land. Agricultural land is a measured area in hectares or where land is cultivated. Everyone's food needs are generated from the dependence of agriculture on existing land where it almost occurs in all agricultural activities (Ahaliki, 2016). Currently, changes in agricultural land use are uncontrollable, influenced by population growth (Muhammad, 2019). Along with the advancement and development of human life, the insistence on the need for land results in the increasingly threatened existing agricultural land or the existence of available land so that agricultural land changes function to meet the needs of people's lives. The growing economic structure accompanied by an increasing population has resulted in an increasing need for land (Abdullah, 2018). The need for interests such as land results in efforts in fulfillment in the form of a tendency for land conversion to occur which arises because of this. This is a good change for infrastructure such as housing, buildings, highways, industry, offices and tourist attractions, while the availability and extent remain.

The development of geographic information systems (GIS) has been rapid, especially in terms of speed, storage capacity, and computing systems. GIS plays an important role in urban and regional planning, mapping, natural resource management, and disaster mitigation. It is widely used today in decision-making, analysis, and planning (Rianthy, 2018). Based on this, Geospatial Information System is also another name for Geographic Information System, which is an information system whose use is carried out in analyzing spatial information or data, revising, storing, compiling data, while the characteristics of spatial data are described in attributes. Spatial data has components including time and spatial relationships, attribute

data, and geographic location/position (Andio,2017).

Thus GIS is a computerized land system on mapping which includes a set of procedures related to the process of storing, processing, and presenting data which in people's lives has benefits, namely applications in the fields of hydrology, forestry, agriculture, and so on. The state of the earth's surface can be visualized with the use of spatial and graphical data (Hasriyanti, 2014). There is a reference that is owned, namely on the map there are coordinates, satellite images and aerial photographs. Meanwhile, statistical data is data to obtain attribute data, but it can also be obtained from other information and records from surveys related to geographic information systems. Not only that, decision makers in applying spatial databases and conducting analysis can through information provided from geographic information systems (Putu, 2016).

Attribute data or object text is combined with spatial or graphical data where geographically on earth is linked (*georeferenced*) and data merging can be done, conducting data analysis and organizing data so that the output that will be generated can be a reference to problems related to geography in terms of decision making (Puspita, 2017). Geographic Information Systems are very important in the context of technological innovation due to their ability to integrate a number of fields of technology and science to be more useful and large. Data can be integrated through the capabilities of GIS and usually use methods that geographers use and new ways are offered in analyzing large amounts of data in databases, manipulating, modeling, mapping, and the results are distributed in various visual forms such as graphs and images (Tania, 2019).

Based on BPS Indonesia data from 2010-2012, the area of rice fields in Indonesia is 24,225 ha. On the other hand, there is a change in the function of agricultural land due to population growth, which has an impact on the need for housing. Earth is one of the most important bases of human life. The role of the earth is to be a place

where humans can continue their life and existence. The increasing use of land by the community, such as housing, employment, provision of public transportation and other facilities causes the availability of land to decrease. Rice fields are converted into residential areas in Indonesia, which has a significant impact on food availability to meet Indonesia's food needs. The worst impact of agricultural land conversion occurred in 2018, when Indonesia imported 500,000 tons of rice to meet national food needs from Thailand and Vietnam. Another consequence of land restructuring is the loss of livelihood of most agricultural workers (Fitrian, 2020). There are three systems associated with the structure of the city, namely basic processes related to air and water, environmental systems related to abiotic and biotic conditions that go through a scientific process to generate them where plant life is the focus of the process, land development systems with a focus on meeting human needs through changing the adjustment space in the system arrangement so that existing activities can be accommodated (Hasriyanti, 2014).

Polewali Mandar Regency is the largest rice-producing area in West Sulawesi Province with a rice field area of 16,375 hectares based on 2020 data from BPS West Sulawesi Province. However, at that time Polewali Mandar had a reduced agricultural land area of 100 hectares per year and declining yields. This is due to the change in the function of agricultural land to other land use functions, which is quite large (Dedi, 2018). The research that has been conducted is located in West Sulawesi Province, precisely in Polewali Mandar Regency in Wonomulyo District in Sidodadi Village. Sidodadi Village is the center of government or the capital of Wonomulyo District with an administrative area of 220.84 Ha, the topography of Sidodadi Village tends to be flat with an altitude between 2 to 5 meters above sea level. The distance between Ward Sidodadi and the Regency Capital is 18 km. Administratively divided into 5 neighborhoods: neighborhood 1, neighborhood 2, neighborhood 3, neighborhood 4, and neighborhood 5. Astronomically, Ward Sidodadi is located between 3°23'52" - 3°24'33" LS and 119°12'59" - 119°12'30" East. Geographically, it is located in an area with administrative boundaries, namely the south bordering Sidera Village, the east

bordering Tumpiling Village, the west bordering Ugi Baru Village, and the north bordering Sugihwaras Village.

Rapid population growth is the most important factor in land development because people need land to live and survive, so that many land functions change into residential areas (Arisa, 2018). For the last 10 years, there has been rapid population growth in Sidodadi Village, Wonomulyo Subdistrict. According to data from BPS Wonomulyo Subdistrict, the population increased by 1,752 people from 2010 to 2020. This population explosion phenomenon has an impact on the demand for housing in Sidodadi Village, causing land conversion in Sidodadi Village. Conservation is the protection and maintenance of something in order to prevent its destruction and damage by preserving it regularly. An area is always related to conservation activities, while the definition of an area is an area with the main function of cultivation and protection (Hasriyanti, 2022)

METHODS

The type of research used in this study is quantitative research. Quantitative research can be interpreted as a research method based on the philosophy of positivism, where the acquisition of information through quantitative research is in accordance with the formulation of a problem (Alek, 2018). This type of quantitative research aims to use numerical studies to ascertain and then obtain further information about the rate of change of the earth (Andi, 2021). A descriptive approach was also used in this study. Descriptive research aims to describe in detail the rate of land conversion (Ati, 2016). Descriptive explanation is also used in this research (Hasriyanti, 2016). Descriptive research aims to describe in detail about the rate of land conversion.

The object of this research is Sidodadi Village while the target of this research is Agricultural Land that is converted into settlements. In this research there are several tools that must be prepared such as: Computer, Arcgis 10.8 software, Agisoft software, Phantom 4 drone, stationery, *Global*

Position System (GPS) camera for positioning when making observations (field checks) (Gebrehiwot, 2022). In addition, in this study also prepared some materials to help the course of this research such as spot 4 images in 2005 and 2010, spot 6 images in 2015, and aerial photos in 2022. The observed variables are: Land use, Land conversion, Agricultural land, Settlement land, Land conversion rate.

The data collected in this study consisted of secondary data and primary data. Secondary data is in the form of maps that also describe land use in 2005-2022. While primary data is in the form of data that has changed the use of agricultural land into settlements through field *ground checks*. Data analysis techniques are adjusted to the research objectives. The data analysis techniques used in this research are image analysis, land use change analysis, descriptive analysis, and land use change rate analysis. The data collection techniques that will be used in this research consist of three stages such as: observation, documentation, analysis activity stage. Data that has been entered and collected is analyzed to obtain research objectives. Data analysis techniques are tailored to the research objectives. The data analysis techniques used in the research include: image analysis consisting of (spot image data, aerial photographs, and field *ground checks*), analysis of *land* use change, descriptive analysis, analysis of land function rates. The rate of land conversion can be determined by calculating the rate of partial land conversion. The rate of partial land use change can be explained as follows:

$$V = \frac{Lt - Lt - 1}{Lt - 1} \times 100\%$$

Description:

V : Land conversion rate (%)

Lt : Farmland area in year t (ha)

Lt-1 : Previous year farm size (ha)

The rate of land conversion () can be determined through the difference between the agricultural land area in year t and the agricultural land area in the previous year (t-1), then divided by the land area in the previous year and multiplied by 100%. This can be done in previous years so that the results of the rate of land conversion can be obtained every year. A value of $V < 0$ means that the land area is shrinking.

RESULTS AND DISCUSSION

The distribution and area of conversion of Agricultural Land into settlements from 2005 to 2022 is a change in the function of part or all of the land area from its original function (as planned), to another function. Based on the results of the analysis of the map of conversion of agricultural land to settlements, it is known that the area of conversion of agricultural land from 2005 to 2022 is 27.68 Ha. The following is presented the conversion of agricultural land to settlements from 2005-2022.

The source of land use data for Sidodadi Village in 2005 and 2010 was obtained through processing Spot-4 imagery data in 2005 and 2010. The following table 1 shows the area of agricultural land conversion into settlements.

Table 1. Land Use Change 2005-2010

No.	Category	Change_	Descriptio	Extensive
1	Agriculture	Rice Field - Mixed Garden	No	2.36
2	Agriculture	Rice Field - Rice Field	No	106.90
3	Agriculture	Rice Fields - Settlement	Occur	3.35
4	Public Facilities	Road - Road	No	16.99
5	Public Facilities	Canal - Canal	No	2.93
6	Public Facilities	Market - Market	No	5.62
7	Open Land	Shrubs - Shrubs	No	0.97
8	Public Facilities	City Park - City Park	No	1.62
9	Agriculture	Mixed Garden - Mixed Garden	No	15.05
10	Public Facilities	GAS STATION - GAS STATION	No	0.38
11	Open Land	Vacant / Open Land - Vacant / Open Land	No	0.37
12	Public Facilities	Terminal - Terminal	No	0.87
13	Public Facilities	Mosque - Mosque	No	0.19
14	Settlements	Settlement - Settlement	No	63.24
Total				220.84

Source: Results of Data Analysis Year 2022

Based on Table 1, it is known that the area of agricultural land conversion to settlements from 2005 to 2010 was 3.35 hectares.

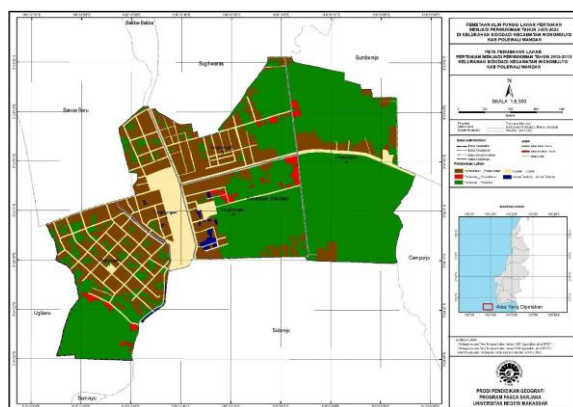


Figure 1. Land Change Map 2005-2010

Based on the land change map of Kelurahan Sidodadi from 2005 to 2010, it is known that the conversion of agricultural land into settlements is located in Neighborhood 3.

Distribution and extent of agricultural land conversion to settlements in 2010-2015. The source

of land use data of Sidodadi Village in 2010 and 2015 was obtained through data processing of Image Spot 4 in 2010 and Image Spot 6 in 2015. The following table presents the area of agricultural land conversion to settlements in

Table 2. Land Use Change in 2010-2015

No.	Changes	Category	Description	Area
1	Road - Road	Public Facilities	No Change	16.99
2	Canal - Canal	Public Facilities	No Change	2.93
3	Mixed Garden – Mixed Garden	Agriculture-Agriculture	No Change	16.73
4	Mixed Garden - Vacant / Open Land	Agriculture-Open Land/Vacant	Changes Occur	0.69
5	Mosque - Mosque	Public Facilities	No Change	0.19
6	Market - Market	Public Facilities	No Change	5.62
7	Settlement - Settlement	Settlements	No Change	66.58
8	Rice Fields - Settlement	Agriculture- Settlement	Changes Occur	7.88
9	Rice Field - Rice Field	Agriculture Agriculture Agriculture-Open Land/Vacant	No Change	96.57
10	Rice Fields - Shrubs	Agriculture-Open Land/Vacant	Changes Occur	0.69
11	Rice Fields - Vacant / Open Land	Agriculture-Open Land/Vacant	Changes Occur	1.76
12	Shrubs - Shrubs	Open/empty land-Open/empty land	No Change	0.79
13	Shrubs - Vacant / Open Land	Open/empty land Open/empty land	No Change	0.18
14	GAS STATION - GAS STATION	Public Facilities	No Change	0.38
15	City Park - City Park	Public Facilities	No Change	1.62
16	Vacant / Open Land – Vacant / Open Land	Open/empty land- Open/empty land	No Change	0.37
17	Terminal - Terminal	Public Facilities	No Change	0.87
Total				220.84

Source: Results of Data Analysis Year 2022

Based on table 2 above, it is known that the area of conversion of agricultural land into settlements from 2010 to 2015 is 7.88 hectares. In

addition to the conversion of agricultural land into residential land, agricultural land was converted into vacant land covering an area of 2.54 hectares.

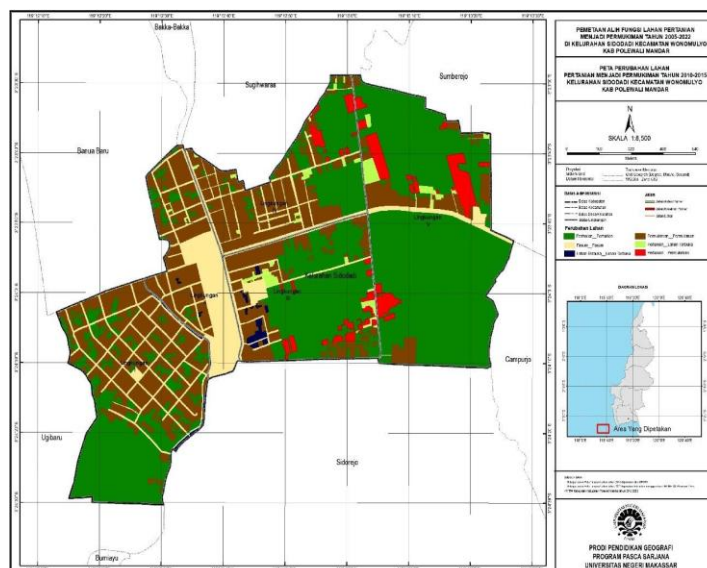


Figure 2. Land Change Map 2010-2015

Based on the map above, the land change of Sidodadi Village from 2010 to 2015 shows that the conversion of agricultural land into settlements located in neighborhoods 1, 3, 4, and 5.

The source of land use data for Sidodadi Village in 2015 and 2022 was obtained through

data processing of Spot-6 Imagery in 2015 and Aerial Photography using Drones in 2022. The following table presents the area of agricultural land conversion to settlements in

Table 3. Land Use Change 2015-2022

No.	Changes	Category	Description Area
1	GAS STATION - GAS STATION	Public Facilities	No 0.38
2	Terminal - Terminal	Public Facilities	No 0.87
3	Mosque - Mosque	Public Facilities	No 0.19
4	Travel	Public Facilities	No 16.99
5	Canals	Public Facilities	No 2.93
6	Market - Market	Public Facilities	No 5.62
7	City Park - City Park	Public Facilities	No 1.62
8	Vacant / Open Land - Road	Open / Vacant Land Public Facilities	Occur 0.04
9	Shrubs - Shrubs	Open/empty land Open/empty land	No 0.36
10	Shrubs - Vacant / Open Land	Open/empty land-Open/empty land	No 0.84
11	Vacant Land - Vacant / Open Land	Open/empty land-Open/empty land	No 1.98
12	Shrubs - Settlements	Open/empty land- Settlement	Occur 0.28
13	Vacant/Open Land - Settlement	Open/empty land- Settlement	Occur 0.98

14	Settlements	Settlements	No	74.47
		Agriculture-Facilities		
15	Bottom of the road		Occur	0.70
		Agriculture-Facilities		
16	Rice Field-Hospital		Occur	2.16
	Rice Field Agriculture			
	Office	Agriculture-Facilities		
17			Occur	0.52
	Paddy Field- Unoccupied/ Open			
	Land	Agriculture-Open Land		
18			Occur	7.52
	Mixed Garden-Unoccupied	Agriculture-Open Land		
19	/ Open Land		Occur	0.44
	Rice Fields			
	Settlement	Agriculture Settlement		
20			Occur	12.62
	Mixed Garden-Settlement	Agriculture-Settlement		
21			Occur	2.82
	Rice Field-Mixed Plantation	Agriculture-Agriculture		
22			No	4.03
		Agriculture-Agriculture		
23	Rice Paddies		No	69.01
	Mixed Gardens-Mixed			
	Gardens	Agriculture-Agriculture		
24			No	13.46
Total				220.84

Source: Results of Data Analysis Year 2022

Based on table 3 above, it is known that the area of conversion of agricultural land into settlements from 2015 to 2022 is 12.62 hectares. In addition to the conversion of agricultural land into

residential land, agricultural land is converted into vacant land and other public facilities.

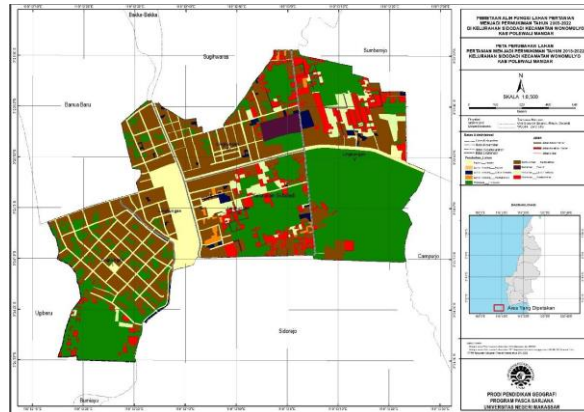


Figure 3. Map of Land Change 2015-2022

Based on the map above, it can be seen that the land change of Sidodadi Village from 2015 to 2022 is known, that the conversion of agricultural land

into settlements is located in neighborhoods 3, 4 and 5.

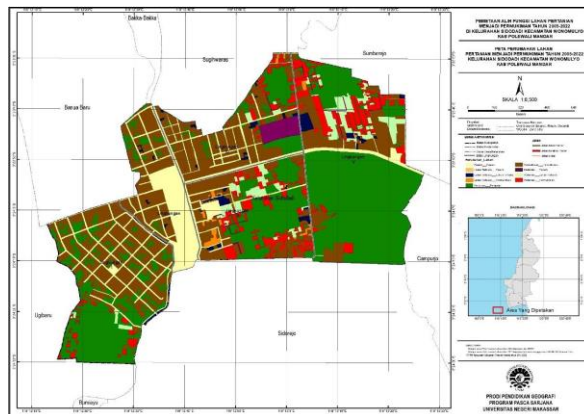
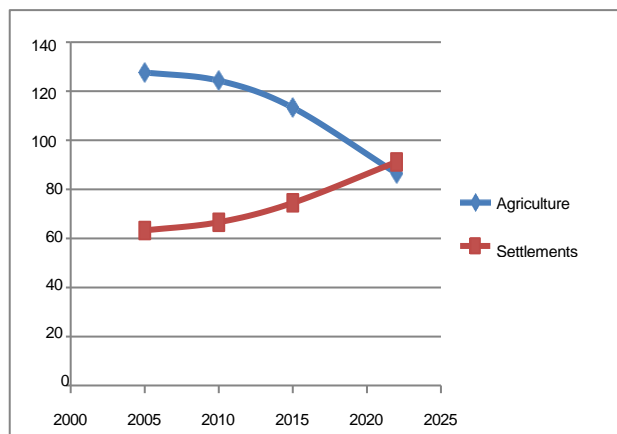


Figure 4. Land Change Map 2005-2022

Based on the map above, it can be seen that the land change of Sidodadi Village from 2005 to 2022 is known, that the conversion of agricultural land into settlements is located in neighborhoods 1, 3,

4 and 5. Rate of conversion of agricultural land to residential use



Source: Results of Data Analysis Year 2022

The rate of land conversion is the ratio of the amount of agricultural land converted to residential land in one year to the area of the previous year and

is expressed in percent (%). The following data presents the rate of land conversion.

Table 4. Rate of Agricultural Land Conversion to Settlement

No.	Year	Area (Ha)		Rate of Agricultural Land Conversion to Settlement (%)
		Agricultural Depreciation	Settlement Growth	
		Agriculture	Settlements	
1	2005	127.67	63.24	0
2	2010	124.32	66.58	3.35
3	2015	113.29	74.47	7.89
4	2022	86.5	91.17	16.70

Source: Results of Data Analysis Year

Based on the results of the data analysis above, it shows that the rate of conversion of agricultural land into settlements that occurred in Sidodadi Village in a span of 5 years was different, as happened in 2005-2010 by 0.03%, in 2010-2015 by 0.09% and in 2015-2022 by 0..

DISCUSSION

Distribution and extent of agricultural land conversion to residential land in 2005-2022. Based on the results of the research that has been conducted and the analysis used on the land use map data of Sidodadi Village in 2005, it is known that the area of agricultural land use in this case rice fields and mixed gardens is 127.67 hectares, then the

area of residential land is 63.24 hectares. The conversion of agricultural land into settlements in Sidodadi Village can be known by determining the area of each land use, so that the area of each conversion of agricultural land into settlements can be known, the agricultural land referred to in this study is mixed garden land and rice fields that are converted into settlements.

From 2005 to 2022, the area of agricultural land conversion to settlements always experienced an increase in area every year. the area of agricultural land conversion to settlements in 2005 to 2010 was 3.35 Ha, the area of agricultural land conversion to settlements in 2010 to 2015 was 7.88 Ha and the area of agricultural land conversion to settlements

in 2015 to 2022 was 15.44 Ha. The overall total area of agricultural land conversion to settlements from 2005 to 2022 was 27.68 Ha.

Furthermore, the distribution of agricultural land conversion to residential land from 2005 to 2022 occurred in environment V covering an area of 12.79 hectares, environment III covering an area of 9.47 hectares, environment IV covering an area of 4.58 hectares and environment I covering an area of 0.84 hectares, and there was no conversion of agricultural land to residential land in environment II. Changes in agricultural land into residential land that occur in environment V and environment III are due to the location of the two environments around the center of economic growth and the government of the Wonomulyo sub-district, thus attracting the interest of housing / property developers, there are three housing development companies in the two environments, namely PT Balanipa residence, Wonomulyo residence, and Bina residence.

The rate of conversion of agricultural land to residential land in 2005-2022. The rate of land conversion is the speed of change in land function expressed in percent (%). The rate of land conversion is known through the calculation of the final year (2022) agricultural land area minus the initial year (2005) agricultural land area divided by the initial year (2005) agricultural land area then multiplied by 100%. The rate of conversion of agricultural land to residential land in this study is divided into three stages namely the rate of conversion of agricultural land to residential land in 2005-2010, the rate of conversion of agricultural land to residential land in 2010-2015, and the rate of conversion of agricultural land to residential land in 2015-2022.

Based on the results of the analysis of the rate of conversion of agricultural land into residential land in 2005-2010 in Sidodadi urban village amounted to 0.03%, then the results of the analysis of the rate of conversion of agricultural land into residential land in 2010-2015 in Sidodadi urban village amounted to 0.09%, then the results of the analysis of the rate of conversion of agricultural

land into residential land in 2010-2015 in Sidodadi urban village amounted to 0.24%, the total rate of change of agricultural land into residential land amounted to 0.36%

Similar research was also conducted by Dedy (2020) in conditions of open options for investors to invest, so land conversion in areas with good infrastructure as well as market centers is unavoidable, this is the driving factor for the increasing rate of land conversion (Belford, 2022). The magnitude of the rate of land conversion in the sidodadi village is influenced by the increase in housing needs due to rapid population growth in the sidodadi village which is one of the centers of economic growth in the polewali mandar district.

The results of this study are relevant to Nasiah's research (2022) which states that the nature of population dynamics, both in quality and quantity, plays a major role in the conversion of agricultural land (paddy fields) to non-agricultural land. The impact is that the potential for food production decreases, so the threat of food shortages is very large (Okolie, 2023). The current symptoms are not only in urban areas, but in rural areas, especially areas around cities and coastal rural areas, the process of converting agricultural land to non-agricultural (paddy fields- resettlement) is happening and will continue to happen (Hasriyanti, 2024).

Changes in land use change occur that the existing residential land is a land use change from agricultural land supported by rapid population growth and increased demand for community needs for land, which results in incompatibility with established plans. In conclusion, changes in land use change occur every year, which is caused by population growth which causes higher land demand.

CONCLUSION

Agricultural land in 2005 was 127.67 hectares and residential land was 63.24 hectares, the area of agricultural land conversion to residential land in 2005-2010 always experienced an increase in area every year, from 2005 to 2010 of 3.35 hectares,

from 2010 to 2015 of 7.88 hectares and from 2015 to 2022 of 15.44 hectares in total from 2005 to 2022 of 27.68 hectares. The distribution of agricultural land conversion in Sidodadi Village into settlements occurs in neighborhoods I, III, IV, and V, among the land conversion that occurs in several neighborhoods, land conversion occurs in neighborhoods III and V because these neighborhoods are located around the center of economic growth. The rate of conversion of agricultural land into residential land in 2005-2010 in Sidodadi Village was 0.03%, then the results of the analysis of the rate of conversion of agricultural land into residential land in 2010-2015 in Sidodadi Village was 0.09%, then the results of the analysis of the rate of conversion of agricultural land into residential land in 2010-2015 in Sidodadi Village was 0.24%, the total rate of change of agricultural land into residential land was 0.36%.

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