Typology and Peri-Urban Development of Yogyakarta City and Surrounding Areas based on Physical, Social, and Economic Aspects

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Abstract

The emergence of peri-urban areas as a transition zone between villages and cities has been influenced by the increasing flow of urbanization. Peri-urban is a dynamically developing suburban area with a mix of rural and urban characteristics. This mixture of characters can be classified from land use patterns, demographic characteristics, economy, and availability of public infrastructure services. On the other hand, the impact of urbanization in urban areas provides positive things through economic growth that supports the sustainability of people in urban areas. The city of Yogyakarta is a growth center in the Special Region of Yogyakarta consisting of 14 sub-districts with significant operations in the trade and service sector. The rapid growth of the city of Yogyakarta has triggered the development of the surrounding area which is directly adjacent to several sub-districts in Sleman Regency. This study aims to examine the typology and development of Yogyakarta City and its surroundings in 2015-2019 with the research area of 20 sub-districts in Yogyakarta City and parts of Sleman Regency. The peri-urban zone typological study employs descriptive geographic analysis, overlays, and scoring. Based on a series of analysis, there were developments and changes in the peri-urban typology in Yogyakarta area and its environs from 2015 to 2019, which were turned into urban areas in terms of physical, social, and economic factors.

Keywords: Yogyakarta; Urban Nature; Urbanization; Peri- Urban Zone

INTRODUCTION

The rapid development of big cities in Indonesia has become a magnet for residents to find work and live there which is often called as urbanization. Urbanization is triggered by the inequality of facility development, especially between rural and urban areas. The extension of urban activities and the utilization of space to the outskirts of the city are influenced by rapid development and rising population. The peri-urban area is an area that is outside the administrative boundaries of the city which is marked by the process of increasing the area of built land. As a result, the peri-urban area can be regarded as a suburban area or a peri-urban area, which is a dynamic area that will continue to undergo development, including physical development, resulting in a shift from rural to urban appearance [1].

The peri-urban area, especially that of developing countries, is characterized by a mixture of urban and rural land uses and fragmented landscapes, resulting from fluid, dynamic and interconnected socioeconomic process [2]. This shift in appearance is classified according to land use patterns, demographic characteristics, economy, and availability of public infrastructure services. The central idea is that peri-urban areas distinguish themselves globally. Issues like rapid growth, and mixed physical, environmental, economic and social strains emerge in these areas in a variety of ways, but they also display clear commonalities as well [3].

The city of Yogyakarta as the capital of DIY Province acts as a National Activity Center (PKN) according to the Yogyakarta Special Region Province Spatial Plan for 2019 – 2039 [4] . The potential for the development of the city of Yogyakarta as a growth center has an impact on the dynamics of the surrounding area. Between 2015 and 2019, the population increased by 4.66 percent, from 412,704 to 431,939 people [5]. Furthermore, Yogyakarta City has a relatively high population density, with 13,154 persons per square kilometer in 2019. Thus, the increasing growth and development of the city of Yogyakarta can trigger developments that go beyond administrative boundaries to surrounding areas such as Sleman Regency which indicates regional expansion, Yogyakarta to the surrounding area. This city's ever-expanding development has eventually resulted in the emergence of new growth centers outside of Yogyakarta, especially growth centers in areas of Sleman Regency such as Depok, Ngaglik, Gamping, Ngemplak, and Mlati sub-districts with changes in physical, social and economic characteristics in the suburbs from rural ones to the city.

The city's rapid growth is a critical issue that must be addressed. Urbanization dynamics can have both beneficial and harmful consequences. The negative impact is the emergence of spatial, social, and economic issues. Development inequality, high land conversion, environmental deterioration, and inequality in the supply of service facilities are all characteristics of spatial aspect concerns. Less access to social infrastructure as well economic issues such as income inequality are causing social and economic challenges [6].

This study aims to examine the typology and peri-urban development of Yogyakarta City and its surroundings based on physical, social and economic aspects in 2015-2019. This study of developments and dynamics in peri-urban areas is expected to assist formulating directions for regional development through synchronization of the city center area with its peri-urban areas through inter-regional policies or inter-regional coordination and cooperation forums.

METHOD

This study employs quantitative research methods. Data was collected through field observations and document review. The typology and development of the peri-urban zone were analyzed through descriptive spatial methods, processing using GIS through overlay techniques, and scoring methods. The results of the analysis are presented in the form of maps of each classification and typology of the peri-urban zone. The peri-urban zone typology is classified according to Singh and Yunus theory, which includes primary peri urban, secondary peri urban, and rural peri urban. The following table shows the criteria and scoring for peri-urban locations :

Table 1 Peri-Urban Area Classification Criteria and Scoring Method

No	Aspects	Variable	Typology Characteristics						Criteria Source
			Primary Peri-Urban	Score	Secondary Peri-Urban	Score	Rural Urban	Score	
1	Physical	Percentage of agricultural land use	Land Use Agriculture< 25%	3	Agriculture Land Use > 25% - 50%	2	>75% to with 100% agricultural land	1	[1]
		Percentage of Residential Land Use	Percentage of land settlement >60-100%	3	Percentage of land settlement 30-60%	2	Percentage of land settlement <30%	1	[1]
2	Social	Population density	High Population density	3	Average Population density	2	Low Population density	1	[7][8]
		Population growth rate	> 1.55	3	1.55	2	< 1.55	1	[9]
3	Economic	Proportion of livelihoods in agriculture	20% - 40% of the population live in the agricultural sector	3	40% - 60% of the population live in the agricultural sector	2	>60% of the population is engaged in agriculture	1	[10]

RESULT AND DISCUSSION

Physical Development of Yogyakarta City and Its Surroundings

The growth of the physical characteristics of a place is inextricably linked to urban development. The peculiarity of the peri-urban area's growth, which includes both urban features such as high density and various activities, as well as the unique nature of the countryside, is still present with agricultural sector characteristics [7]. With limited land, urban expansion eventually stimulates external development. External development will push for land conversion in the immediate vicinity, which was formerly dominated by rural areas. Yogyakarta, as the center city with 14 sub-districts, has an impact on the physical development of the surrounding area.

On a physical aspect, the peri-urban area of Yogyakarta City and its environs are classified using Yunus' zoning typology. The peri-urban zone will be classified using agricultural and residential land use variables. There were a total of 20 sub-districts observed in the city of Yogyakarta and the surrounding area.

Agricultural Land Use Conditions and Classification

The area of agricultural land in Yogyakarta and its environs was 7627.62 ha in 2015 and 6370.10 ha in 2019, meaning a decline of 12.57 percent. The city of Yogyakarta has the least amount of agricultural land, with 53 hectares (0.01 percent) of the total land area in 2019 [5]. It is divided into five sub-districts: Mantrijeron, Mergangsang, Umbulharjo, Kotagede, and Tegalrejo. The following is the area of agricultural land

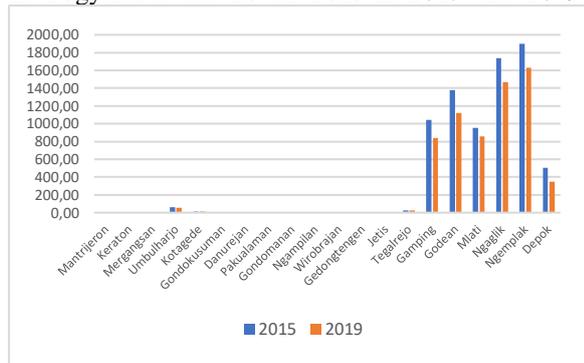in Yogyakarta and its environs in 2015 and 2019 :

Figure 1 Agricultural Land Area of Yogyakarta City
and its surroundings in 2015 and 2019

Yogyakarta's rapid expansion has a physical impact, especially a shift of land functions, including agriculture. From 2015 to 2019, the area of agricultural land in Yogyakarta City fell by 13.20 percent. The spread of Yogyakarta development to the surrounding areas was accompanied by a reduction in agricultural land and an increase in built-up land. Classification and typology of agricultural land use is divided into three indicators as follows :

Table 2 Criteria for Classification of Agricultural Land
Use Variables

PUA Zone	Criteria
Primary Peri-Urban	>0% - 25% agricultural land
Secondary Peri-Urban	>25% - 50% agricultural land
Rural Peri-Urban	>50% agricultural land

Source : Yunus, 2008

The following is a spatial description of the zones developed in 2015 and 2019 in Yogyakarta and its surrounds based on the classification of agricultural land use characteristics.
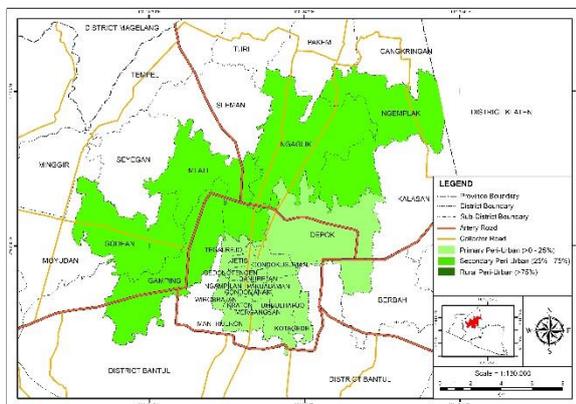

Figure 2 Zone Classification Map Based on
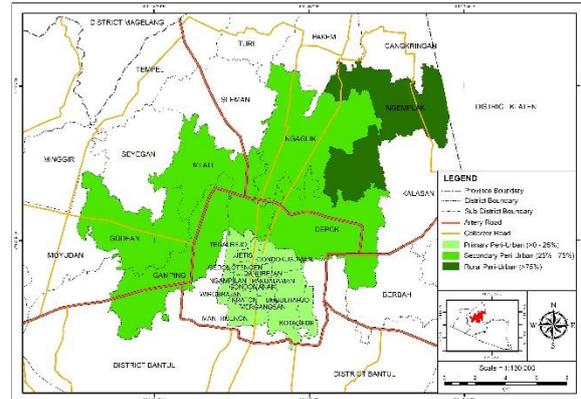Agricultural Land Use in 2015

Figure 3 Zone Classification Map Based on
Agricultural Land Use in 2019

Peri-urban developments can be seen in 2015 and 2019. Primary peri-urban and secondary peri-urban districts dominated the city of Yogyakarta and its environs in 2019. Agricultural land use with a primary peri-urban classification dominated the central city, while a secondary peri-urban classification dominated the suburbs. Yogyakarta's growth as one of Indonesia's major cities had a direct impact on the utilization of agricultural land, as well as the surrounding environment. Changes in the area of agricultural land had an impact on the typology shift of Ngemplak sub-district, which was a rural peri-urban area in 2015 with the dominance of rural characteristics, but then a secondary peri-urban area with urban and rural characteristics influenced each other in 2019 [10].

Conditions and Classification of Residential Land Use

Residential land use in Yogyakarta City had been increasing by 22.04 percent from 2015 to 2019. This situation was impacted by Yogyakarta's rapid population growth, which resulted a rise of residential land in the city and surrounding area. The following graph shows the area of residential land usage in Yogyakarta's urban area in 2015 and 2019:
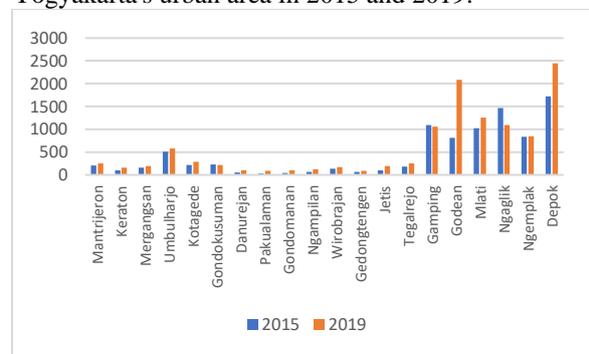

Figure 4 Residential Area of Yogyakarta City and its
surroundings in 2015-2019

Peri-urban typology variables on physical aspects other than agricultural land use can be seen based on residential land use. The classification of residential land use variables is as follow:

Table 3 Criteria for Classification of Residential Land Use

PUA Zone	Criteria
Primary Peri-Urban	>60% - 100% Residential Land
Secondary Peri-Urban	30% - 60% Residential Land
Rural Peri-Urban	<30% Residential Land

The classification of primary peri urban and secondary peri urban determines how residential land is used in Yogyakarta and its environs. In 2015, the primary peri-urban classification with stronger urban characteristics dominated land use for residential areas in Yogyakarta, while the secondary peri-urban classification dominated the surrounding area.

The criteria for land use classification in 2019 showed that the land use for residential areas of Yogyakarta City and its surroundings were dominated by the primary peri-urban zone. The classification of primary peri-urban zones on residential land use began to expand towards suburban areas. The sub-districts that changed their function to become primary urban peripheries in 2019 were Depok District and Godean District. The increasing area of residential land resulted a change in the peri-urban classification of Depok and Godean sub-districts as the area around the city of Yogyakarta. The classification of residential land use variables in the City of Yogyakarta and its surroundings in 2015 and 2019 can be seen in the following figure:
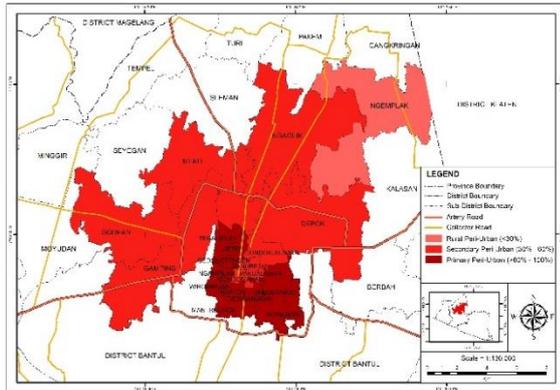

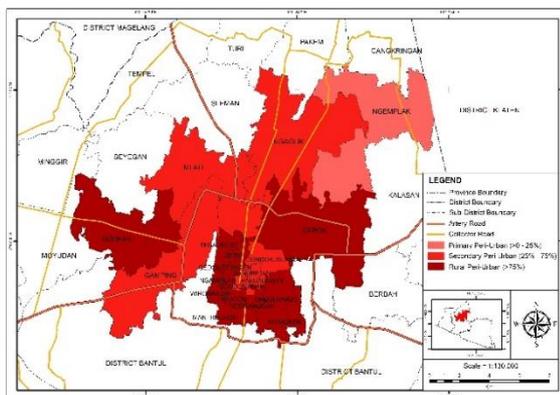Figure 5 Map of Zone Classification Based on Residential Land Use in 2015

Figure 6 Map of Zone Classification Based on Residential Land Use in 2019

Socio-Economic Development of Yogyakarta City and Its Surroundings

The socio-economic development of the core city can have an important influence on the development of the peri-urban area. The development of the city as a center of activity has various impacts on its development (physically, economically and socially) for the surrounding area or peri-urban. The development of peri-urban from physical, social, and economic aspects brings spatial and non-spatial consequences that require monitoring [1].

In 2015 and 2019, the variables of population density, women-to-men ratio, and fraction of farmer households were used to assess the socio-economic growth of Yogyakarta and its environs. The typology used was major peri-urban, while secondary peri-urban, and rural peri-urban typologies were used to classify the Peri-Urban Area (PUA) of Yogyakarta City and its environs.

1. Population Density Classification

According to the BPS City of Yogyakarta and Sleman, the city of Yogyakarta and its surrounding territories had a population of 944,444 in 2015, and 953,374 in 2019 [11]. Ngampilan sub-district had a population density of 19,902 people per square kilometer; Gedongtengen sub-district had a population density of 17,901 people per square kilometer; and Danurejan sub-district had a population density of 16,675 people per square kilometer[5]. The density of Yogyakarta City and its surrounding territories is depicted on the map below.
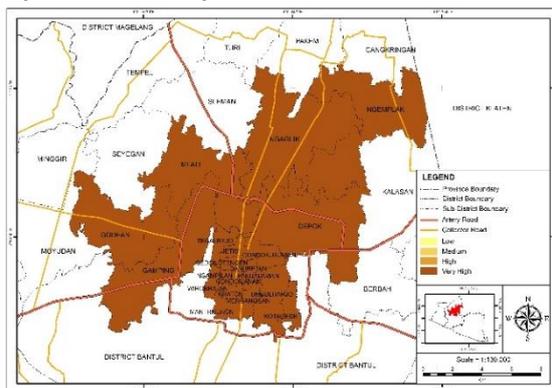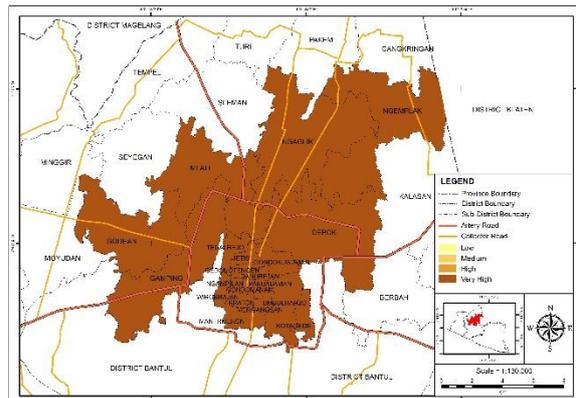

Figure 7 Population Density Map 2015

Figure 8 Population Density Map 2019

Based on the map above, the density condition of Yogyakarta City is divided into 4 classes with low to very high population density (Class I-IV). The density of Yogyakarta City and its surroundings is classified as very high density.

The development of the city of Yogyakarta as one of the major cities in Indonesia has a direct impact on increasing population density every year, and also has an impact on the area around the city of Yogyakarta..

Population density data shows that Yogyakarta City's population had been rising between 2015 and 2019. This makes population density one of the elements that influences the classification of urban characteristics of a place. According to Singh, there are three factors for determining population density that can be used to define areas:

Table 4 Criteria for Classification of Variables Population Density Level

PUA Zone	Criteria
Primary Peri-Urban	High Density
Secondary Peri-Urban	Average Density
Rural Peri-Urban	Low Density

Based on the classification criteria, the population density variable can be classified spatially related to the peri-urban zone in Yogyakarta City and surrounding areas in 2015 and 2019 as shown in the following figure :
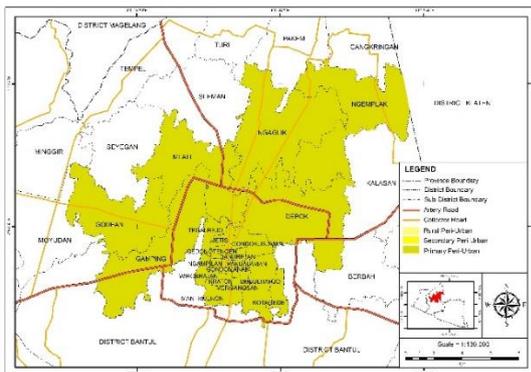

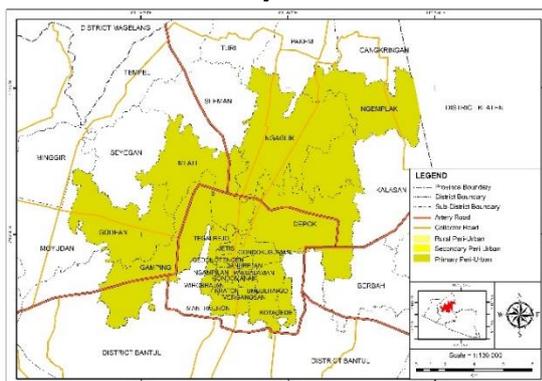Figure 9 Zone Classification Map based on Population Density in 2015

Figure 10 Zone Classification Map based on Population Density in 2019

2. Population Growth Rate

The development of urban areas is influenced by the rate of population growth. The causes of population growth are the number of births (natality), deaths (mortality) and population movement (migration). The higher the rate of population growth, the faster the development of urban areas. The rate of population growth is one of the variables that can be used to assess the typology and function of urban areas. The classification of the population growth rate is as follows:

Table 5 Criteria for Classification of Variables Population Growth Rate

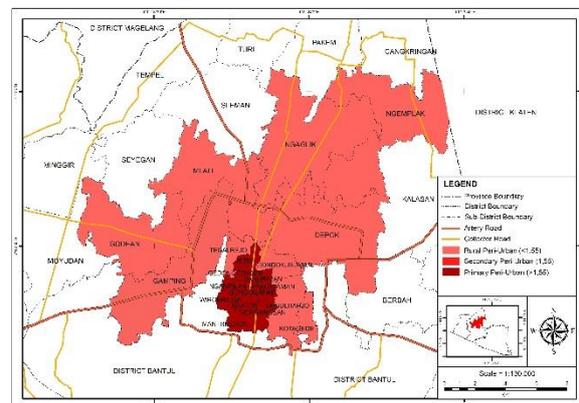| Classification	Growth Rate
Primary Peri-Urban	>1,55
Secondary Peri-Urban	1,55
Rural Peri-Urban	<1,55

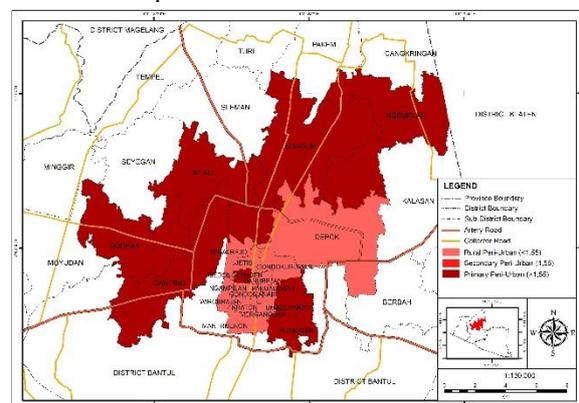Figure 11 Zone Classification Map based on Population Growth Rate in 2015

Figure 12 Zone Classification Map based on Population Growth Rate in 2019

Areas categorised as rural peri urban dominated zone classification based on population growth rate in 2015. Danurejan District, Gondomanan District, Keraton District, Mantrijeron District, Ngampilan District, Wirobrajan District, Mergangsan District, Pakualaman District, Jetis District, and Gedongtengen District are among the areas having primary urban peri-classification in the city of

Yogyakarta. In 2019, areas with primary peri urban areas expanded, according to the classification map based on population growth rate, particularly in Yogyakarta City, Gamping sub-district, Godean sub-district, Mlati sub-district, Ngaglik sub-district, and Ngemplak sub-district. Some parts of the city of Yogyakarta are classed as rural peri urban due to the prevailing population growth rate.

3. Condition and Classification of Livelihood Population in Agriculture Sector

The economic sector of a community is heavily influenced by people's livelihoods. Changes in activity are brought about by urban growth, which has an impact on people's livelihoods. Urban zones can be determined using the population livelihoods variable in the agriculture sector. Singh's hypothesis is used to classify people's livelihoods in the peri-urban agriculture sector (2011).

Table 6 Criteria for Classification of Farmers' Livelihood Variables

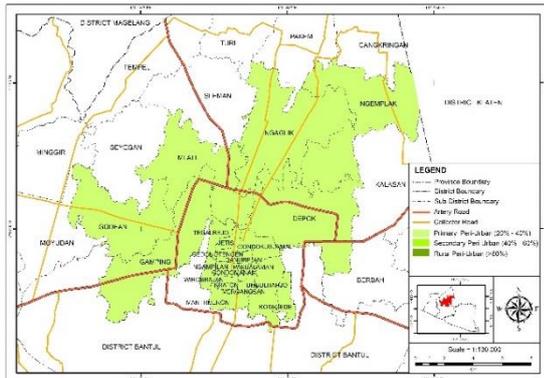| PUA Zone	Criteria
Primary Peri-Urban	20% - 40% residents earning living in agricultural sector
Secondary Peri-Urban	40% - 60% residents earning living in agricultural sector
Rural Peri-Urban	>60% residents earning living in agricultural sector

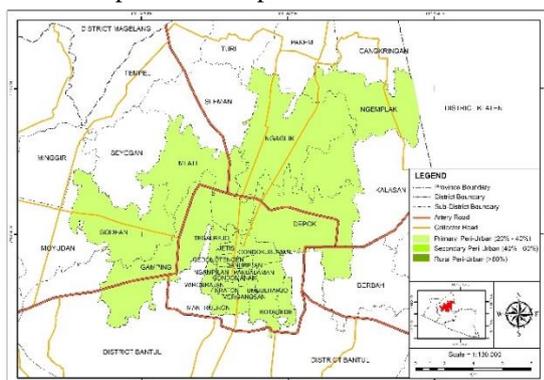Figure 13 Zone Classification Map Based on Proportion of Population Farmers 2015

Figure 14 Zone Classification Map Based on Proportion of Population Farmers 2019

All sub-districts of Yogyakarta and its environs are grouped into the primary peri-urban zone classification based on the fraction of the people who make their living as farmers, as shown on the map above. Yogyakarta and its environs are predominantly urban, with farmers accounting for a small percentage of the population. In both 2015 and 2019, the proportion of farmers in Yogyakarta and its environs was between 20% and 40%.

4. Typology of the Peri Urban Zone of Yogyakarta City and its surroundings

Based on the characteristics of the peri urban area and the scoring of each variable as well as the mapping of the city of Yogyakarta and its surroundings, the classification of the peri urban zone is carried out using the overlay and weighting methods. Determination of classification is done by making a classification range obtained through calculating class intervals and dividing it into three characteristics. The following table is a classification table for urban peri-urban zones in Yogyakarta Urban Area.

Table 7 Scoring of Peri-Urban Zone Classification of Yogyakarta City and its surroundings

No	Variable	Urban	Peri Urban	Rural Urban
1.	Physical Aspect			
a	Agricultural Land Use	3	2	1
b	Residential Land Use	3	2	1
2.	Social Aspect			
a	Population density	3	2	1
b	Population Growth Rate	3	2	1
3.	Economic Aspect			
a	Proportion of Livelihoods in Agriculture	3	2	1

The scoring of the peri-urban zone classification of Yogyakarta City and its surroundings uses variables based on physical, social and economic aspects. The scoring results will be classified into three classes, namely primary peri-urban zone, secondary peri-urban zone and rural peri urban zone. The following is the score for peri urban zone of Yogyakarta City and its surroundings.

Table 8 Overlay Results of the Total Score Classification of the Peri Urban Zone of Yogyakarta City and its surroundings in 2019

Districts	Agricultural Land Use	Residential Land Use	Population Density	Population Growth Rate	Farmers Population	Total	Classification
Mantrijeron	3	3	3	3	3	15	Primary PU
Keraton	3	3	3	3	3	15	Primary PU
Mergangsan	3	3	3	3	3	15	Primary PU
Umbulharjo	3	3	3	1	3	13	Secondary PU
Kotagede	3	3	3	1	3	13	Secondary PU
Gondokusuman	3	2	3	1	3	12	Secondary PU
Danurejan	3	2	3	3	3	14	Secondary PU
Pakualaman	3	2	3	3	3	14	Secondary PU
Gondomanan	3	2	3	3	3	14	Secondary PU
Ngampilan	3	3	3	3	3	15	Primary PU
Wirobrajan	3	3	3	3	3	15	Primary PU
Gedongtengen	3	3	3	3	3	15	Primary PU
Jetis	3	3	3	3	3	15	Primary PU
Tegalrejo	3	3	3	1	3	13	Secondary PU
Gamping	2	2	3	1	3	11	Secondary PU
Godean	2	3	3	1	3	12	Secondary PU
Mlati	2	2	3	1	3	11	Secondary PU
Ngaglik	2	2	3	1	3	11	Secondary PU
Ngemplak	1	2	3	2	3	11	Secondary PU
Depok	2	3	3	1	3	12	Secondary PU

In the 2019 class interval calculation, the primary peri-urban zone scores >13, secondary peri-urban zones 11-13, and rural peri-urban <11. Based on the process that had been carried out, the zone classification was formed in 2015 consisting of: the primary peri-urban zone having 3 sub-districts, the secondary peri-urban zone having 11 sub-districts, while the rural peri-urban zone having 6 sub-districts. The classification of 2019 consists of: primary peri-urban zones with 7 sub-districts and secondary peri-urban zones with 13 sub-districts. If we look at the number of comparisons in 2015 and 2019, it is known that the number of primary peri-urban zones had increased by 3 sub-districts and the secondary peri-urban area had increased by 6 sub-districts. This occurs as a form of development into a primary peri-urban area. The following is a classification map of the urban peri-urban zone of Yogyakarta City and its surroundings.
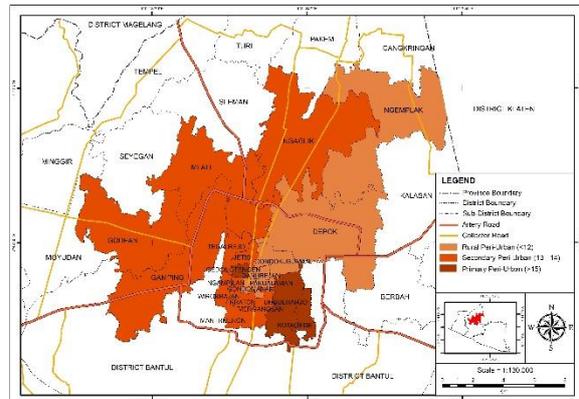

Figure 15 Map of Peri Urban Zone Classification in Yogyakarta Urban Area 2015
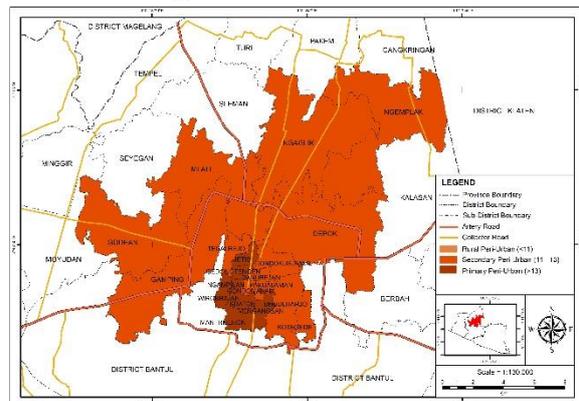

Figure 16 Map of Peri Urban Zone Classification in Yogyakarta Urban Area 2019

In 2015 Yogyakarta Urban Area (YUA) was dominated by the secondary peri-urban and rural peri-urban zones. The classification of primary peri urban zones was only found in Umbulharjo sub-district, Kotagede sub-district and Gedongtengen sub-district. In 2019, the development of YUA was increasingly moving towards urban areas, dominated by secondary peri-urban and primary peri-urban zones. The zone classified as rural peri-urban had shifted to become secondary peri-urban, namely 6 sub-districts consisting of 2 sub-districts in the hinterland of Yogyakarta City (Ngemplak and Depok sub-districts) and 4 sub-districts in Yogyakarta City including Gondokusuman, Danurejan, Pakualaman, and Gondomanan sub-districts.

The growth of primary peri-urban areas and secondary peri-urban zones has the potential to push the rural peri-urban categorisation down. As a result, the Yogyakarta Urban Area (YUA) of people's physical, social, and economic growth was increasingly focused on urban regions. The dominance of agricultural land in 2015 gave a way to the use of built-up land in 2019. The community's socioeconomic activities changed as well; in 2015, there were still a lot of agricultural operations, however in 2019, the activities were more diverse. As a result, the Yogyakarta Urban Area (YUA)'s growth was expanding and allowing for adjustments at a greater urban level.

CONCLUSION

Within a five-year period, the development of Yogyakarta City and its environs reveals a transition in the region's typology, which is becoming increasingly urbanized. It illustrates a transition in typology to secondary and primary peri-urban locations, based on physical, social, and economic factors. Yogyakarta's peri-urban development is influenced by the city's development as a core city. In three sub-districts around Yogyakarta, namely Ngemplak, Depok, and Godean, agricultural and residential land use tend to be peri-urban primary typologies, with variations in typology towards urban regions. This is supported by the decreasing area of agricultural land and the increasing area of residential land. These developments need to be anticipated through a firm policy related to the control of built-up land. Authorities at local levels are entitled to control land development activities so that any new developments can be prohibited [12]. Similar to the physical aspect, developments in the socio-economic aspect based on population density, livelihoods in the agricultural sector, and the rate of population growth also tend to be of the primary peri-urban typology.

In terms of physical, social, and economic dimensions, changes in typology and the expansion of peri-urban Yogyakarta and its environs towards urban regions can provide a variety of opportunities and difficulties. Agricultural land conversion, high population density, and an increase in built-up land, such as settlements, are all things to be concerned about. Recommendations in the form of an integrated regional strategy are required to accommodate the integration of the downtown area with its peri-urban areas, allowing for balanced growth of the peri-urban area's physical, social, and economic characteristics.The urban rural relationship was too complex to simply divide the national policy into urban bias or rural bias and it as difficult to measure the degree of bias. As a consequence policymakers have to periodically adjust their policy priority according to social, economic, and political situation [2].

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