The phenomenon of urban fringe settlements in the south-north region of Malang City

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Abstract. The City of Malang grows annually along with the implementation of its spatial policy. One of the policies that stimulates movement into the city is the development of land for settlements. Limited land and high demands have led to the expansion of settlements towards the urban fringe of Malang City, especially for the south-north region. The purpose of this study was to identify the characteristics of settlements in the north-south regions of Malang City. The variables studied consisted of patterns and types of settlement, land use and land cover, land prices, housing density, and the population. The five aspects of the settlement were studied using the descriptive statistical analysis methods and spatial mapping. The results of descriptive statistical analysis show that there are different characteristics of settlements in the north-south regions of Malang City. The difference can be seen in the four aspects, such as land use and land cover, land prices, housing density, and population. Meanwhile, based on the results of spatial mapping analysis, the different characteristics occurs due to the availability of road access and proximity to city-regional-scale facilities.

1. Introduction

Major cities in Indonesia are growing and developing not only due to the city's residents themselves, but also by many immigrants who helped build the city [1]. Physically, the development of a city can be characterized by an increase in population density, buildings density, and built-up areas, especially the settlements that tend to be wider, as well as more complete city facilities that support the city's social and economic activities [2].

Population activity and land conversion lead to changes in urban structure, with the emergence of new settlements in the urban fringe [3]. This area is influenced by the character of a city (both physically and non-physically), while, on the other hand, it still also has the character of a village [4]. A special characteristic of this suburb raises a lot of attention. Most of the attention focused on various problems caused by the process of urban expansion to the suburbs, which result in physical changes, such as land use, demographics, ecological balance, and socio-economic conditions [5]. The high expansion towards the urban fringe is due to the economic sector and city-scale services, which then have a significant impact on the availability of accessibility, thus stimulating an increase in the population [6]. Population growth and limited availability of land in the city center make the urban fringe an option to live in [7].

Malang is the second-largest city in East Java, which clearly shows the dynamic development of the city. Throughout 10 years (2004–2014), land use trend shows that 45% of the non-built areas
turned into built-up areas, accompanied by an increase in the average population of 1.25% [8]. The affected areas are the urban fringe of Malang City, such as Kedungkandang, Blimbing, and parts of Lowokwaru District. This urban fringe was transformed into built-up areas with a focus of land use through residential development. Continuous development without control is feared to affect the structure and pattern of space in the urban fringe of Malang City, which then affects the sustainability of the environment. Therefore, this study aimed to recognize the urban fringe phenomenon in Malang City, especially for the development of settlements, thus possibly minimizing the negative impacts in the future.

2. Methods
The research method is a science that learns how to make observations with the right thinking, conducted in an integrated way through stages to find, analyze, and conclude data [9].

2.1. Selected Location
The Municipal Regulation Number 4 of 2011 on the Malang City Spatial Plan (RTRW) recognised the division of Malang City service areas (hereinafter referred to as the BWP) into 6 parts, namely East Malang BWP, Southeast Malang BWP, North Malang BWP, Northeast Malang BWP, Central Malang BWP, and West Malang BWP.

Based on the results of the land use deviation of land-use change against the spatial plan, it can be seen that there are significant changes in the northern and southern areas of Malang City. Changes in the 2 areas are supported by the settlement development policy due to the availability of land and the plan to place a new activity center.

Until 2030, the southern region will function as the center of government, city-scale public services, and large industries. Meanwhile, the northern region functions as a center for the development of education and trade in services on a city to regional scale. All of these functions cause a fairly large pull in these 2 areas where the tendency for residential development as a generation center occurs in the northern and southern regions (Figure 1).

Figure 1. (Left) Land use map in 2017 and (right) land use map planning until 2030 [10]

The northern Malang area is included in the North Malang BWP and is directly adjacent to the Malang Regency administrative area. However, only 4 sub-districts, out of a total of 13 sub-districts, are directly adjacent to Malang Regency, with a total area of 968.2 ha. While for the southern region, only 5 of the total 14 sub-districts are directly adjacent to Malang Regency and Batu City, with a total area of 1853.87 ha. This means that only 9 sub-districts—as the outermost part of Malang City—were included in this research (Figure 2).
2.2. Research Variable

The research variable is an attribute or value of a person, object, or activity that has a certain variation determined by the researcher to be studied and concluded [11]. This study formulated several variables as the object of study, which were then formulated based on the analysis in the field.

| Purpose | Variables          | Operational Definition                                      |
|---------|--------------------|-------------------------------------------------------------|
| Identifying the phenomenon of urban fringe settlements in the north-south region of Malang City | Pattern of the settlement [12] | Type of settlement area shape |
|         | Land cover and land use [13] | Land cover: comparison between built up or non-built up to the entire area |
|         | Land use: percentage of maximum-minimum used for activity divided by the total area |
|         | Housing density [13] | The value of the comparison between housing unit and housing area |
|         | Land price [14] | The average of high-low land prices |
|         | Number of population [15] | Population density |
|         | | Ratio of population growth |

2.3. Analysis Methods

A. Descriptive Statistical Analysis of the

Descriptive statistical analysis is a preliminary analysis of research to obtain results that match with an operational definition of the variables. This method analyzed data by describing the data that has been collected as it is without intending to draw conclusions that apply a generalization [11]. In this research, the variables of land cover and land use, housing density, land prices, and the number of the population were processed using this method.

B. Spatial Analysis

Spatial analysis can be defined as the analytical techniques associated with the study of geographic phenomena locations together with their spatial dimensions and their associated attributes [16]. In this research, the variable of settlement pattern was processed using this method. Moreover, the other 5 variables were also described with a map to interpret the distribution of data.

3. Results and Discussion

The urban fringe of Malang City has grown very fast in recent times. The characteristics of the area to the northern and southern have several differences.
3.1. Pattern of the Settlement

Settlements can also be classified based on their shape and type of pattern. The major types that are classified by their shape are: (a) Compacted or Nucleated Settlements; (b) Dispersed Settlements; (c) Linear Pattern. Based on the results of spatial analysis, these two regions have the same classification group. This is because the growth in this area is still sporadic, which depends on the availability of road infrastructure. Therefore, all of the settlements are located along the road. In addition, the southern area is still dominated by agricultural activities, so the location of the community's residence is not far from the garden or area owned. However, the nucleated or compact category is starting to appear in the southern region due to the relatively sloped topography and ease of accessibility (Pandaan–Malang toll road). This is in line with one of the indications of the emergence of this model, which is good transportation links and no restriction to development to all directions [12]. This advantage causes the southern region to be the location of choice for residential area development in this region. In addition, based on the 2011–2031 RTRW of Malang City, the southern area will become a new growth center for Malang City, precisely in the Buring to Arjowinangun Sub-districts. In other word, the development of the nucleated category in this area will increase. As for the southern region with a dispersed model, seen in Buring sub-district, this is related to the character of this pattern, which is located in a mountainous area [17].

This is slightly different for the northern region, in which the most common form of category is compact or nucleated. The northern area of the city of Malang has a fairly large development pull because it is one of the accesses to the tourist city of Batu. In addition, the proximity to the city and regional-scale facilities, such as trade in services and universities, has led to high interest in living in this area. The indications shown in the northern region arise because of the effective public service factor, where the site has connecting points, good transportation networks, and there are no restrictions for development in all directions. The shape seen from these 2 regions can be seen in Figure 3.

![Figure 3. Pattern of the settlement comparison of north-south region of Malang City](source: analysis, 2021)

3.2. Land Use and Land Cover

In addition to the settlement pattern, the characters of the northern and southern regions also experience differences in land cover and land use. Land cover is the area of land that is physically visible, such as vegetation, water, or buildings. In Figure 4, it can be seen that the majority of land cover in the southern region is a non-built-up area, comprising 73.4% of the total area. Only Kebonsari sub-district has a larger percentage of built-up area (59.2% of the sub-district’s total area) because Kebonsari sub-district is adjacent to a regional market (Pasar Gadang) and a Type-B Public Transport Terminal.
While in the northern region, most of the land use in the 4 sub-districts comprise mainly built-up areas, about 54.3% of the total area. This happens because the northern area is close to city-scale facilities and access roads connecting to other cities. The distribution of built-up and non-built-up areas in these 2 areas is illustrated in Figure 5.

Based on the data above, land use on the built-up area in the north and south is dominated by residential for all sub-districts. However, the percentage of settlement area in the southern region is relatively smaller when compared to the northern region. The northern region consists of 371.77 ha of residential area while the southern area has 326.90 ha of residential area.

Figure 4. Land cover area’s comparison of north-south region of Malang City
Source: Analysis, 2021

Figure 5. Land cover area’s map of north-south region of Malang City
Source: Analysis, 2021

Figure 6. Land use comparison on non-built-up area of north-south region of Malang City
Source: Analysis, 2021
Regarding the land use of non-built category, there is a difference in both regions (Figure 6). All sub-districts in the south are dominated by the use of field land or about 75.4% of non-built-up area in southern region. Unlike the northern region, the dominance of land use still shows land use for rice fields compared to other uses, or around 48.2% of non-built-up area in the northern region. The spatial distribution of land use in 2021 can be seen in Figure 7.

![Figure 7. Land use maps of north-south region of Malang City](image)

Source: Analysis, 2021

3.3. Building Density
The data for 2021 shows that the number of buildings (houses and facilities) for the southern region is smaller than the northern region. The southern region consists of 19,083 units (18,103 houses + 980 facilities) with a total settlement area of 326.9 ha. Meanwhile, the northern region consists of 19,377 units (17,377 houses + 2,000 facilities) with a total settlements area of 372 ha. The maps in Figure 8 shows that the two regions have almost the same density category, ranging from 40–100 units/ha and are included in the medium-density classification [18]. However, there is 1 sub-district in the northern region that shows a high building density of > 100 units/ha.

![Figure 8. Building Density of north-south region of Malang City](image)

Source: Analysis, 2021

3.4. Land prices
Another measurement tool for regional development is land price. Land price is an assessment of a plot of land by looking at its nominal value. Many aspects affect land prices, one of which is proximity to vital objects around the area. The northern area, which is close to various city-regional-scale facilities and has high accessibility, has a higher land price per m² in all sub-districts compared to the southern area (Figure 9).
3.5. Number of Population

As we know, the number population is directly proportional to the distribution of settlements. Figure 10 shows that the southern region has a smaller number of people per hectare than the northern region. The service factor and access to the centers of activity result in the northern region acting as a magnet for people to live.

The data shows that the highest density is in Tlogomas sub-district (northern region), which is 106 people/ha. This is in line with the results of building density classification indicating that this area is included in the high-density criteria. While in the southern region, the low population density dominates the 4 sub-districts, while only Kebonsari sub-district showing a medium population density classification (Figure 11).

The population growth rate in the 2 regions also shows differences. The southern region has a population growth ratio of above 1.5% for 2020. This number is higher than the growth rate of Malang City, which is 1.25 per year. This shows that there is a significant increase in population every year in the southern region. Population growth can be influenced by demographic factors, such as fertility and migration [19]. Meanwhile, the northern region has a growth rate similar to the growth rate of Malang City, which is around 0.5–1.0.
4. Conclusion
There are different characteristics between the southern and the northern regions of Malang City. The differences are as follows: (a) The land use for settlement area shows that the southern region is smaller than the northern region; (b) Building density shows that only 1 sub-district of the northern region is included in the high building density category; (c) Land price shows that the highest land prices (> Rp4,000,000/m²) is almost entirely found the sub-districts in the northern region; (d) The total population of the northern region has a more diverse densities compared to the southern region. While the settlement pattern varies, the two regions have the same pattern.

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