Population Growth in the Upper Garang Watershed Semarang Regency, Central Java Province, Indonesia

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Population Growth in the Upper Garang Watershed Semarang Regency, Central Java Province, Indonesia

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Abstract. More and more people in the world, with increasingly complex needs, all need space to live, water is the most important need. Some residents choose residential areas near water sources, water catchment areas are reduced, land use changes occur, so most watersheds experience degradation. This study aims to examine population growth in the Upper Garang Watershed of Semarang Regency. The population is all villages in the Upper Garang Watershed. Sampling was carried out with a purposive area sample, in the first segment of the upper Garang river area, and included in the Semarang district. The research variable is population growth. Data analyzed has been carried out in a quantitative descriptive way, using exponential population growth formula, overlay, and presented in the frequency table, and figure. The results showed that the villages in the Upper Garang Watershed experienced population growth including high, 2.49 percent each year during the period 2010-2016. Population growth rates in each village vary widely, ranging from low to very high, ranging from low to very very high, from 0.10 to 8.18 percent. Villages that have high population growth rates are followed by house growth and non-agricultural land use changes, this is because some villages are the center of new activities, such as the development of industrial centers, freeway access (TOL), and public facilities.

1. Introduction

The population increases in all regions of the earth's surface, in 2017 the world's population reaches 7,536 billion [1]. The number of population with a lot of distribution is unequal, in Asia the population reaches 59.63 percent and 40.37 percent are in other regions. The large population is not always followed by high population growth, due to the highest population growth in Africa. Indonesia, the population ranks fourth after China, India, the United States.

The rate of population growth in Indonesia is still high, in 2010 the population of 237.6 million people in the period 2000-2010 growth rate of 1.49 percent. In 2015 the population was 255.18 million with a growth rate of 1.43 percent [2]. Java is always ranked first in population and population growth, meaning that Java is still the choice of residence. A high population increase will lead to problems because each population needs the needs of natural resources whose existence is increasingly limited.

Development is one of the things that must be done by all people where they are, both in developed and developing countries and for modern and traditional people. Development becomes a necessity with the aim of improving life expectancy. Development is carried out in all regions and in all fields. In urban and rural areas, and in the watershed, because every population needs water for survival.

Watershed in it occur complex or complicated in ecosystems. In addition, watersheds also contain multipurpose and multi conflict requests or needs or multiple use and conflicting demands. On one

side of the watershed must be conserved carrying capacity, on the one hand, there have been extraordinary changes, especially changes in land use. One important component that determines the quality of watersheds is the diversity of vegetation [3].

Watershed ecosystems in the tropics [4], in general, are the composition of several natural and artificial sub-ecosystems, including forests in the upstream, savanna, wetland, estuary, and mangrove parts in the upper reaches, as well as some artificial sub-ecosystems such as plantation forests and settlements. Watershed ecosystem, classified into upstream, middle and downstream regions. The upstream watershed is characterized by a conservation area, a function of protecting the entire watershed [5].

Watershed land use changes are largely due to the increasing number of people who need land for various purposes, both for agriculture and non-agriculture. How population growth in the Upper Garang Watershed in Semarang Regency is still interesting to study in this paper. The Upper Garang Watershed is part of the Garang watershed which is a buffer zone for the region which covers three administrative regions, namely Semarang City, Kendal Regency, and Semarang Regency. Garang watershed is one of the critical watersheds and is a priority to be addressed [6]. Garang watershed is one of the first priority watersheds, requiring more intensive management [7].

Watershed management [8] concerning watershed management is carried out in a coordinated manner by various agencies across sectors and across administrative regions, and the parties, given the watershed does not know the limits. On the other hand, watershed problems still occur and there are still critical watersheds. Most of the Garang watershed area is an upstream watershed area whose management will directly affect the area located below it [9]. Most watershed studies are related to physical conditions, studies on population are still small. Many watershed studies have been carried out, such as those carried out in the watershed Garang [10], in the Madiun watershed [11] and the Peusangon Aceh watershed [12], all three of which focused on studying physical aspects. This paper analyzes population growth in the Upper Garang Watershed that enters Semarang Regency.

The growth rate is a change in population that occurs at any time in an area when compared to the previous year and expressed in percent. Understanding the previous time can be in one year or period of time more than one year, usually not more than 10 years [2]. The watershed is a land area which is a unity with the river and its tributaries, which functions to accommodate store, and transport water from rainfall to the lake or to sea naturally, the boundary on land is topographic and boundary separator in the sea until waters are still affected by land activities [8]

2. Research Methode

The study was carried out in the Semarang Regency Upper Garang Watersheds. Site selection is based on the location of the Upper Garang watershed in Semarang Regency. The Garang watershed is part of one of the watersheds in Central Java Province which is a priority (Figure 1).

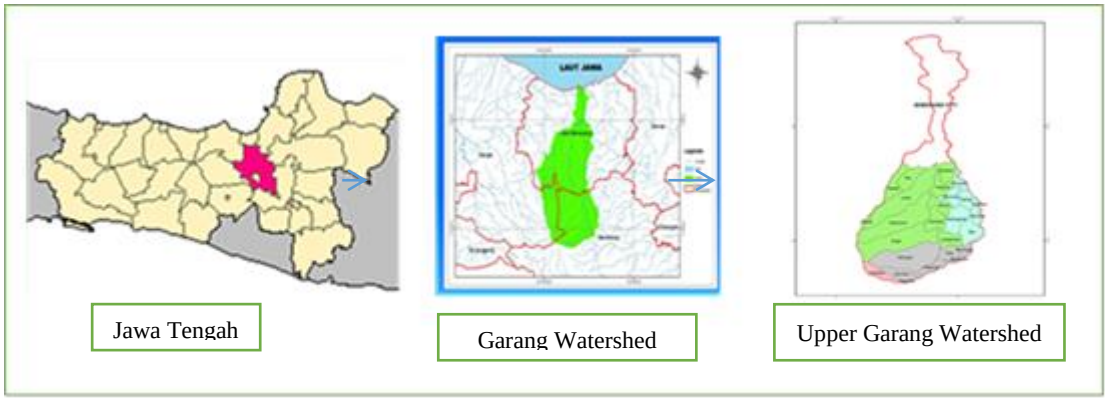

Figure 1: Research Location

The study population was villages in the Upper Garang Watershed of Semarang Regency, numbering 26 villages, all of which became the research sample so that it is population research, all villages located in the upper Garang watershed are analyzed, with the analysis unit used is the village. Sampling was carried out with a purposive area sample, in the first segment of the upper Garang river area, and included in the Semarang district. The area is the upper Garang river flow, covering segments 1, 2, and 3. Segment 1 is located in the district of Semarang. Research variables are population growth, with indicators of population, number of permanent homes, and time periods is 2010 dan 2016. The data used are secondary data from the Central Statistics Agency and the Semarang, namely data on population, data on the number of permanent houses; other than that Regency Regional Development Planning Agency, map administration and maps Upper Garang Watershed. Data was collected by means of documentation, namely documents owned by the two agencies, both in the form of soft and hard coffee.

This study uses several analyzes, namely is descriptive, table analysis, and presented in form figure. Population growth was analyzed by geometric population growth formula, with the formula as follows, [12,13].

$$Pt = P0.e^{rt} \quad (1)$$

Population growth (r), if the value of $r > 0$ means that there is a positive increase or an increase in population from the previous year, and if $r < 0$, it means negative population growth or a decrease in the number of population from the previous year. And if $r = 0$, meaning zero population growth, there will be no change in population from the previous year. The analysis phase is carried out, to find out the villages in the Upper Garang Watershed are carried out by way of stacking or overlaying the map, in the next stage, the villages in the Upper Garang Watershed area are calculated population growth, permanent housing growth, then analyzed descriptively. The results of the analysis of population growth in the Upper Garang Watershed area of Semarang Regency are described with the help of maps, processed using ArcGIS software.

3. Results and Discussion

3.1. General Description of Upper Garang Watershead Semarang Regency

The Garang watershed area includes four sub-watersheds, namely the Upper Garang watershed, the Kreo watershed. Kripik Sub-watershed, and Garang Hilir Sub-watershed. The Upper Garang Watershed covers two administrative regions, namely Semarang Regency and Semarang City. The Upper Garang Watershed is one of the sub-watersheds in Central Java whose territory is in Semarang Regency and Semarang City. The Upper Garang Watershed in Semarang Regency is part of the Upper Garang Watershed which is included in the Semarang Regency. The Upper Garang Watershed is an area that has an important meaning, especially in terms of the protection of the water system function, therefore every activity in the upstream area will have an impact on the downstream area.

Upper Garang Watersheds Semarang Regency, located at $110^0$20’ – $110^0$25’ East Longitude and $07^0$05’ – $07^0$12’ South Latitude. Relatively located among several watershed areas, in the west of the Kreo Sub-watershed in Kendal Regency, in the east Pengkol Sub-watershed in Semarang Regency, in the north of the Upper Garang Watershed in Semarang City, and in the South of Trimo Sub-watershed in Semarang Regency [14].

The Upper Garang Watershed of Semarang Regency is about 8,371 hectares or 39 percent of the Garang watershed area. Administratively, the area is included in four sub-districts, namely Bergas District, Bandungan District, West Ungaran District, and East Ungaran District. The number of villages included in the Upper Garang Watershed in Semarang, all of which cover 26 villages or 59 percent of the total villages in the four sub-districts [15].

Its location in the upper part of the Garang watershed, so that it becomes a priority for environmental conservation. Meanwhile, the sub-watershed area of the Upper Garang Watershed in Semarang Regency is the center of industrial areas, such as the plastic seed industry, printing industry,

car body industry, food industry, cloth washing industry, etc.), government centers (office facilities) and population activity centers (hotels, restaurant, markets, shops, hospitals) [15,16]. In addition, there are several villages where activities for taking water for refill drinking water [16], and there are some villages have the potential of natural tourism to become tourist villages [17].

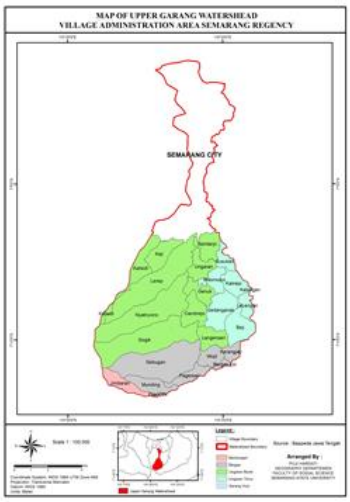

Figure 2. Map of Upper Garang Watershead Semarang Regency

The Upper Garang Watershed in Semarang Regency is managed as one with watershed management, starting from the provincial government central government, city/district government, State-owned Public Agency, and NGOs and the community. The form of community participation has begun to appear, with village funds in each village, but the rate of population growth > 1 percent still occurs in almost all regions.

3.2. Population growth in the Upper Garang Watershed Area in Semarang Regency

Population growth in the Upper Garang Watershed area of Semarang Regency is very dynamic over time. Upper Garang Watershed, Semarang Regency, covers most of the East Ungaran Sub-district, all of the West Ungaran Sub-district, a small part of the Bergas Sub-district and Bandungan Sub-district. In these four sub-districts, the number of people from year to year is increasing. The highest population growth rate in Bergas Sub-district, which reached 3.19 percent, and the lowest in Bandungan Sub-district, 1.21 percent (Table 1).

Table 1. Population in the Upper Garang Watershed of Semarang Regency

Sub-District	Population		Population Growth (%)
	2010	2016	
Bergas	64,241	82,412	3.19
Bandungan	52,712	56,667	1.21
Ungaran Barat	74,481	83,875	1.99
Ungaran Timur	68,686	80,089	2.59

Source: Central Bureau of Statistic 2017.

Villages in the four sub-districts (Bergas, Bandungan, Ungaran Barat, Ungaran Timur) (Table 1), are not all included in the area of the Semarang Upper Garang Watershed. Several villages that are included in the Semarang Upper Garang Watershed, some villages included in the Upper Garang

Watershed in Semarang Regency are 26 villages from 44 villages in the sub-region of the Upper Garang Watershed, whose locations are spatially dispersed.

In general, in the sub-watershed area of Upper Garang Watershed, Semarang Regency, the population growth rate was high including in 2010-2016, the population growth rate was 2.49 percent. each village has a varied and very diverse population. In the upper Garang Watershed, the village that has the most population is Lerep Village, 10,950 people, while the village with the least population is Keji Village, with a population of 2,521 [5]. Lerep Village and Keji Village are two villages whose location is directly adjacent to the City of Ungaran, the capital of Semarang Regency.

Table 2. Population Growth in the Upper Garang Watershed of Semarang Regency in 2010-2016

Villages	Population Growth (%)
Beji	1.32
Leyangan	7.03
Kalongan	3.12
Susukan	3.86
Kalirejo	1.96
Sidomulyo	2.41
Gedanganak	1.52
Gogik	1.02
Langensari	2.62
Candirejo	8.18
Nyatnyono	1.82
Genuk	2.87
Ungaran	0.14
Bandarjo	0.10
Lerep	1.55
Keji	1.64
Kalisidi	1.63
Branjang	1.29
Munding	0.87
Pagersari	1.36
Gebugan	1.26
Wujil	2.81
Bergas Lor	3.23
Karangjati	4.55
Jimbaran	1.71
Pankopen	1.40
Sub Watershed Garang Hulu (26 Villages)	2.49

Source: Central Bureau of Statistic 2017.

Villages that have the most population are not always followed by high population growth. During this period, namely in 2010-2016, the villages that had the highest population growth were Leyangan Village, reaching 7.03 percent and Candirejo Village reaching 8.13 percent (Table 2). Villages that fall into the category of very high and unusually high population growth reached 23.08 percent of the number of villages in the Upper Garang Watershed of Semarang Regency, which number 44 villages. While villages with a low population growth rate of only 11.54 percent. Villages

with very high and very high population growth rates are the central location of activities, densely populated residential centers, and industrial centers.

Villages in Upper Garang Watershed all have positive population growth rates, no villages have negative and zero population growth rates, which means that in all villages there has been an increase in population from 2010 to 2016.

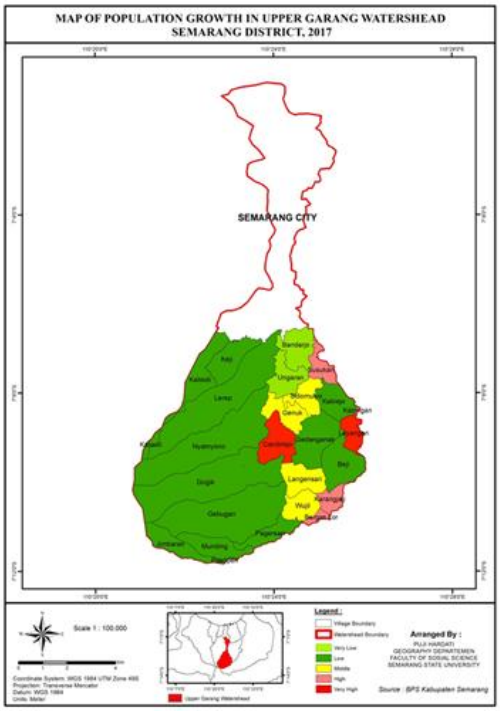

Figure 3. Map Of Population Growth in Upper Garang Watershed 2010-2016

Population growth rates in a region are followed by home growth rate. In Bergas sub-district, which is the highest sub-district with the highest population growth rate among the four sub-districts, has the highest home growth rate, which is 0.76 percent. But in Bandungan sub-district it is not the case, because some villages in the Bandungan sub-district area become tourist centers and many hotels and houses are built (Table 3).

Table 3. The growth of Houses in the Upper Garang Watershed Semarang Regency

Sub-District	Permanent Home Growth (%)
Bergas	0.76
Bandungan	0.72
Ungaran Barat	0.71
Ungaran Timur	0.43

Sumber: Central Bureau of Statistic 2017

In the Upper Garang Watershed, it is a water catchment area, where residents should be able to access water easily, but, there are still some households that use water sources from unprotected water sources [18]. Population growth followed by the growth of permanent houses has not been followed by clean water facilities.

Land use in the Upper Garang Watershed Semarang Regency, varies greatly, generally used for agriculture and non-agriculture. The use of agricultural land which consists of paddy farming and non-rice farming, while the use of non-agricultural land is for buildings, public facilities.

Non-agricultural land use increases or the area of agricultural land is reduced. The rate of growth of non-agricultural land use is most rapid in Bergas District, this is driven by the construction of industrial facilities and permanent housing. Bergas District is one of the industrial development centers in Semarang Regency.

In Bergas Subdistrict, the number of permanent houses from year to year is increasing, the is due to the fact that the Bergas sub-district is the center of large and medium-sized industries, and is followed by the growth of small industries and industrial house. Most of the workforce comes from outside the area, so many workes rent a house, and many boarding houses are built. In addition, there is also an increase in public facilities to support this activity.

Table 4. The growth of non-agricultural lands in the Upper Garang Watershed Semarang Regency

Sub-District	The growth of Non-Agriculture Landuse (%)
Bergas	0.83
Bandungan	0.19
Ungaran Barat	0.48
Ungaran Timur	0.12

Source: Central Bureau of Statistic 2017.

Villages that have high levels of population growth are always followed by the need for land for housing and supporting facilities. The number of permanent houses in areas with a very high population growth rate, in Bergas Sub-district (Table 1), also has the highest rate of permanent housing growth among the four other districts (Table 3), as well as the growth rate of non-agricultural land, use the highest (Table 4).

4. Conclusion

Population growth in the Upper Garang Watershed in Semarang Regency is high. High population growth is always followed by changes in agricultural use of agriculture to non-agriculture. The dominant variables related to changes in land use are buildings, residential settlements, plantations, and more. The Upper Garang Watershed has the potential to become a source of raw water for residents in Semarang Regency, Semarang City, and Kendal Regency.

Areas with rapid population growth are followed by the growth rate of non-agricultural land use and the rate of growth of permanent homes. Bergas Subdistrict is one area that has a population growth rate, as well as the growth of non-agricultural land use and the highest growth rate of houses. This region is the center of industrial growth in Semarang Regency.

Upper Garang Watershed, Semarang Regency, because population growth is high, it must be conserved by increasing vegetation, so that the environmental carrying capacity functions are well maintained to support sustainable livelihoods. Agricultural land conversion to non-agriculture is considered more selective.

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