

Assessing the Impact of Urban Growth on the Forest Degradation in Musanze District

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Abstract— As the days are passing there are changes in development in many districts of the country where the urbanization is growing in term of expansion every day. This expansion is due to the population pressure where the population need to satisfy their needs and trying to accommodate themselves with all those acts the forests are damaged by population through constructions and by cooking and which leads to forest degradation. It is in this context that the present study was conducted in order to assess the impact of urban growth on the forest degradation in Musanze. The study had the Specific objectives which were the analyzing of the trend of forest degradation; the assessment of urban growth status; and to establish the relationship between urban growth and forest degradation. The researcher used data (orthophoto) from Rwanda Land Management and Use Authority of the period 2009-2019. The Arc GIS, total station TS06, Differential GPS, have been used for accomplishing this research. Results show that forests lost at rate of 3.3 % every year due to the heavy urban growth which is not monitored and this implicate that within 30 years there will not be any forest in Musanze district. It is recommended that the district should deliver the education and training courses to local communities; should organize special campaigns about importance of forests to the comminutes and the society, should mobilize the population and other stakeholders to plant many trees in whole city and also make the forestation.

Keywords— Musanze district, Urban growth, Forest degradation, City development.

I. INTRODUCTION

The human population grew at unprecedented rate during the last two decades globally as well as in the Asia-Pacific region. The region accounts for more than half of the world's population. During the last 25 years, the population of the region grew by more than a billion (2.45 billion in 1980 to 3.6 billion in 2005), and is likely to reach to 4.2 billion by 2020. However, population growth changed its character and form in the twentieth century with the advancement of technology and medical facilities. This has resulted in major demographic transitions, such as changes in rates of births and deaths, age composition and rural population growth rate. The impact of demographic changes on forests and the environment is often discussed in terms of biological carrying capacity, i.e. the maximum number of individuals that a resource can sustain (Schaffartzik, et al., 2014). However, many factors influence carrying capacity, such as economic development, socio-political processes, and trade, technology, and consumption preferences. Many studies have already shown that demographic changes in conjunction with the other factors have affected natural resources in general and forests in particular (Misselhorn, 2005). Forests provide an array of goods and services critical to economic development and human well-being. The demands of a growing population on forests are increasing in both magnitude and variety. However, the impacts of demographic changes are not widely understood beyond the very broad and superficial relationship that population growth increases demand for goods and services provided by forests. In this context, a thematic study on the impact of predicted demographic changes on forests and forestry has been conducted as part of the Asia Pacific Forestry Sector Outlook Study II (APFSOS II). Some of the important demographic factors that could affect forests and forestry by 2019 include population size and growth, population distribution and population structure (Corvalan, et al., 2005).

As the days are passing there are changes in development in many districts of the country where the urbanization is growing in term of expansion every day and every time. This expansion is due to the population pressure where the population need to satisfy their needs and trying to accommodate themselves with all those acts the forests are damaged by population through

constructions and by cooking and which leads to forest degradation. The present study was conducted in order to assess the impact of urban growth on the forest degradation in Musanze.

II. MATERIALS AND METHODS

2.1 Description of the study area

The study was conducted in Northern Province in the district of Musanze. Musanze District was selected as a site according to its relatively convenient location and rapid infrastructure development and rapid urban growth due to large number of population coming in town to search for job and to extend their business. Its ecological importance to biodiversity associated with the forests located within its boundaries is also a good aspect for this study. Musanze district covers a planned area of 530 km² according to the recent approved master Plan and elaborated for implementation in 2014. The district comprises seven (15) Sectors including Busogo, Cyuve, Gacaca, Gashaki, Gataraga, Kimonyi, Kinigi, Muhoza, Muko, Musanze, Nkotsi, Nyange, Remera, Rwaza and Shingiro. The livelihood of the city depends on the environment and natural resources such as forests, water, land, air, plants and animals.

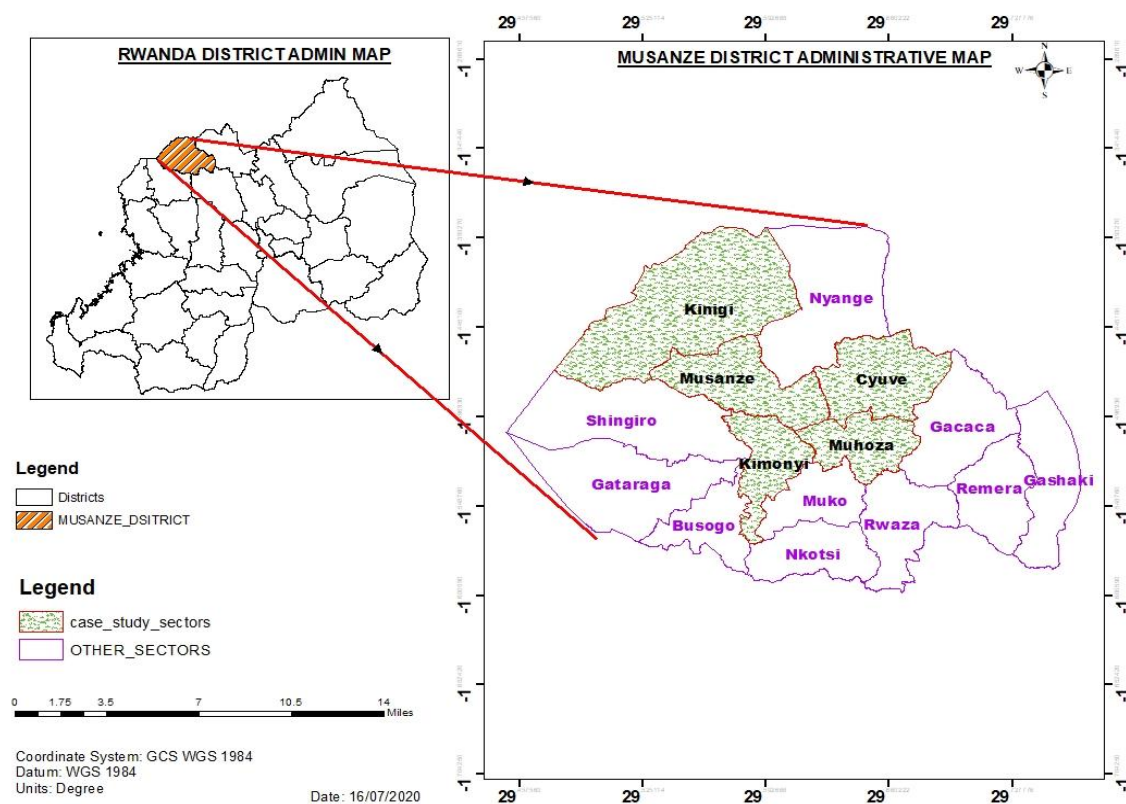


FIGURE 1: Map of the study area

2.2 Data collection and data processing Methods

Data collection is constituted by the primary data and the secondary data; where by the orthophotos have been given by the Rwanda Land Management and Use Authority, those orthophotos showed the housing and land use from the year of 2009. The orthophotos are the ones which contain the information of the forests in 2009 and it shows how the forests were in 2009. The orthophotos of Musanze district have been added to ArcGIS and the shape file of Musanze administrative boundary has been added to the ArcGIS. The sectors on Musanze district have been labeled in ArcGIS in order to know the location of sector of case study and to see the forests in each sector of case study in order to choose randomly two forests to be digitalized. After the choosing of the forests to be analyzed, they have been digitalized and the data have been projected to ITRF 2005 and after that, they have been exported to shape file. After the exporting, the areas of forests in are identified in the table of content and check the attribute table of the forests in order to know the areas of the digitalized forests. After the projection of the forests of 2008 the topographic survey has been conducted by setting out the control points with the differential global positioning system (DGPS) and from those control points, the total station took place by being oriented to the reference made by the differential global positioning system and after the survey of the forest has been done by taking all

points required for having the enough information in order to know how the forest were in 2018. The topographical survey has been done in all selected sectors for case study and with this topographical survey the points taken with total station has been saved in scv comma delimited in excel and after all the points have been added to Arc GIS and then after the points have been digitalized and projected to ITRF 2005 in order to get the shape file of forests in 2019 and after this the areas of forests in 2018 have been find in the attribute table of the forests in 2019 in the table of content, the two forests in each sector of the case study will be chosen randomly and will be surveyed accordingly. All those data are the one, which are used in this research.

During this research project, the following software's have been used, Arc GIS has been used for the production of the maps and for the analysis of the geospatial data. The total station TS06 and its accessories have been used to know the actual topographic situation of the forests of Musanze district in 2019. Differential GPS has been used for setting the control survey of the forest in 2018 and it has been used for doing the boundary survey of the forests. MS WORD has been to write the research report. MS EXCEL has been used to make the tables, diagrams and the charts in analyzing this research report.

III. RESULTS AND DISCUSSION

3.1 The trends of forest degradation

The trends of the forest degradation is characterized by the loss of the areas of the forests in Musanze districts

TABLE 1
THE FOREST DEGRADATION

Sector name	Forest 2009(m ²)	Forest 2014(m ²)	Forest 2019(m ²)
Cyuve	82844.708	56,845.638	19,322.47
Kimonyi	124,154.72	83,153.12	62,982.97
Muhoza	74,733.31	70221.45	65,820.89
Musanze	166,463	103,601.31	79,640.94
Kinigi	275,843.86	261,229.91	257,455.38
Total	724,039.594	575,051.428	485,222.643

The table1 shows the forest degradation from 2009 to 2019 where the forests have been lost especially in Cyuve, Kimonyi, Muhoza, Musanze and Kinigi sectors, the areas occupied by the forests have loss from 82844 m², 124154 m², 74733 m², 166463 m² and 275843.86 m² to 19322 m², 62982 m², 65820 m², 79640 m², and 257 455 m² respectively to Cyuve, Kimonyi, Muhoza, Musanze and Kinigi sectors. The table 2 shows clearly, how the forests in Musanze district are being lost slowly by slowly with the years.

3.2 The status of urban growth

Every year the increase of the urban growth is affecting the forests areas.

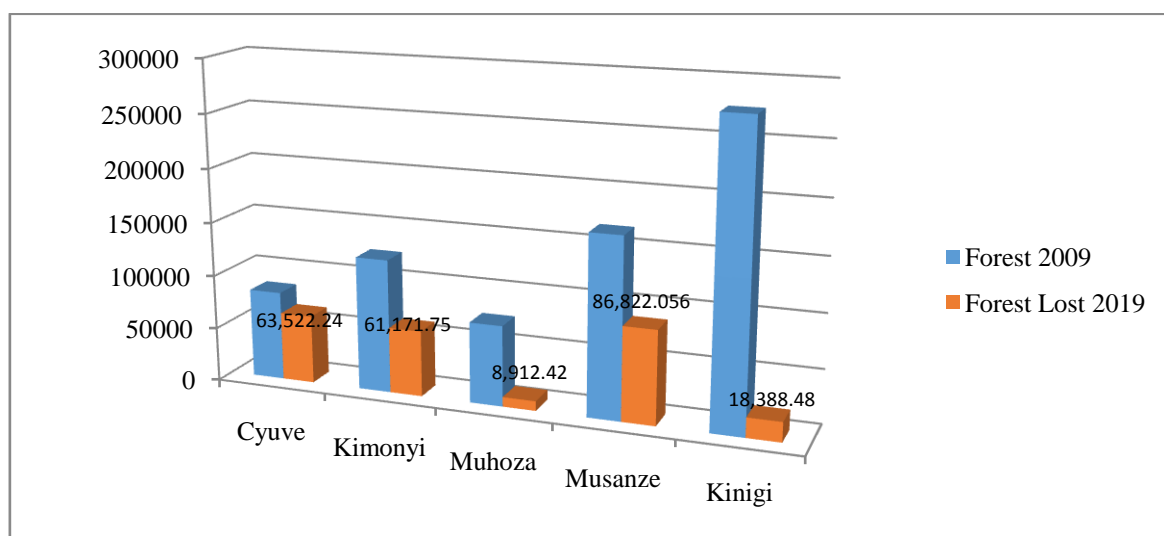


FIGURE 2: The urban growth in Musanze district

The figure 2 shows the areas of the forests in 2009 and it shows also the areas of the forests lost from 2009 to 2019. The very big areas lost have been made on the forests in Cyuve, Kimonyi and Musanze sectors due to the rate of the urban growth. The loss of the forests shows that there is a big increase of people in the all sectors of the case study. The urban growth is expressed in the times of the forest lost. The total area of urban growth from 2009 to 2019 is 238,816.95 m² all five sectors in Musanze city.

3.3 The relationship between the urban growth and the forest degradation

TABLE 2
URBAN GROWTH AND FOREST DEGRADATION RELATIONSHIP

Sector name	Forest 2009 (m ²)	Forest 2019 (m ²)	Forest lost 2009-2019 (m ²) As indicator of urban growth
Cyuve	82,844.708	19,322.47	63,522.24
Kimonyi	124,154.72	62,982.97	61,171.75
Muhoza	74,733.31	65,820.89	8,912.42
Musanze	166,463	79,640.94	86,822.06
Kinigi	275,843.86	257,455.38	18,388.48
TOTAL	724,039.594	485,222.643	238,816.95

The table 2 shows the relationship between urban growth and forest degradation where the urban growth is characterized by areas of forests lost from 2009 to 2019 and the forest degradation is characterized by the areas changes of forest in 2009 and final areas of forests in 2019. As the forest changes by diminishing as there is urban growth.

IV. CONCLUSION AND RECOMMENDATIONS

This study focus was to assess the impact of urban growth on the forest degradation in Musanze district, from 2009-2019. To facilitate and guide the decision making for the urban planners for taking into account the forest degradation, and the good land use planning to sustain urban growth in Musanze District. To provide a useful understanding on how government policies should be implemented for improving the quality of urban life for city residents

The result shows that there are big quantities of forests lost every delay the rate of 3.3 % every year due to the heavy urban growth as it characterized in time of the forest loss which is not monitored and this can implicate that within 30 years there will not be any forest in this city. Recommendation

Based on the results found for this research, several recommendations were formulated to facilitate the better urban planning and land use management:

- Delivering education, training and bridging courses to local communities. The contact of city residents with urban and forest officers is the main source from which urban residents receive advice to avoid the big rate of forests loss,
- To organize special forest campaigns about the good importance of forests to the communities and the society,
- To improve a strong collaboration between city residents and other stakeholders involved in urban planning and development,
- To mobilize the population and other stakeholders to plant many trees in whole city and also make the forestation where the forest has been degraded.

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