

# The Impact of Urban Expansion on Agricultural Land in Musanze City

**Erneste Nsangabandi<sup>1, \*</sup>, Angelique Mukantagwabira<sup>2</sup>**

<sup>1</sup>Faculty of Environmental Sciences, University of Lay Adventists of Kigali (UNILAK), Kigali, Rwanda

<sup>2</sup>Department of Project Management, University of Kigali, Kigali, Rwanda

## Abstract

Urbanization in Rwanda is characterized by demographic growth and by migration to urban areas. The increase of many infrastructures in the development is the main aspect which takes the agricultural land in order to get the places for construction [7]; this study was conducted in Musanze city which is located in Northern Province [3]. The data were used were the data covering Musanze, Muhoza, Kimonyi and Cyuve sectors and were analyzed using Arc GIS and Microsoft excel and this helped in generating maps, tables and figures. The results obtained revealed that the area occupied by the infrastructures of urbanization in 2008 was 13.893654 km<sup>2</sup> in all sectors and it has increased up the area of 27.971287 km<sup>2</sup> in 2018 this means that there are big quantities of agricultural land that lost from 96.594 km<sup>2</sup> to 82.514 km<sup>2</sup> and with this loss the agricultural land were caused by the rate of urbanization growth of 1.41 km<sup>2</sup>/year [4]. It is recommended that the district should organize special agriculture campaigns about the good use of land and its effects on agricultural land; it is recommended to improve a strong collaboration between people and its stakeholders [15]; it is also recommended to mobilize the population and other stakeholders to construct the multi-storey buildings instead of many single houses which are occupying many spaces which were reserved for agriculture.

## Keywords

Musanze City, Urban Expansion, Agriculture Land Loss, Agriculture Land

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## 1. Introduction

Urban expansion is mostly among one of the significant and popular processes that have usually affect the human community and human society in general precisely from the centuries to the centuries [8]. The urbanization if it is not properly managed it can pose guiding the development certain or maximize challenges and due to the strong linkage between agriculture and poverty [14], the challenges in the agriculture sector are also drivers of rural poverty [1]. Growing population has an Over recent years, the agricultural sector in Rwanda still faces many challenges through the pressure of the negative effect on land

availability and the expansion of towns and cities [2].

As the days passed there are the changes in the development of the Rwanda's cities and towns, as longer as the cities and towns are expanding and the increases of infrastructures [13] in terms of development were the main aspect which took the agricultural land in order to get the places for construction [5]. The urbanization in Rwanda is characterized by demographic growth and by migration to urban areas, accompanied by the installation of displaced people and returnees after the 1994 genocide against the Tutsi [6]. The urban population has increased from 4.6% in 1978 to 16.5% in 2012 [10]. The Vision 2020 prepares for reaching 35% in 2020. The average urban density surveyed in 2012

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\* Corresponding author

E-mail address: [nserneste@gmail.com](mailto:nserneste@gmail.com) (E. Nsangabandi), [angemukanta@gmail.com](mailto:angemukanta@gmail.com) (A. Mukantagwabira)

with 1,871 inhabitants per square kilometer has more doubled since 2002 [12]. The current annual growth rate of the

urban population is 4.1%. Kigali capital city accommodated about half of the urban population in 2012 [11].

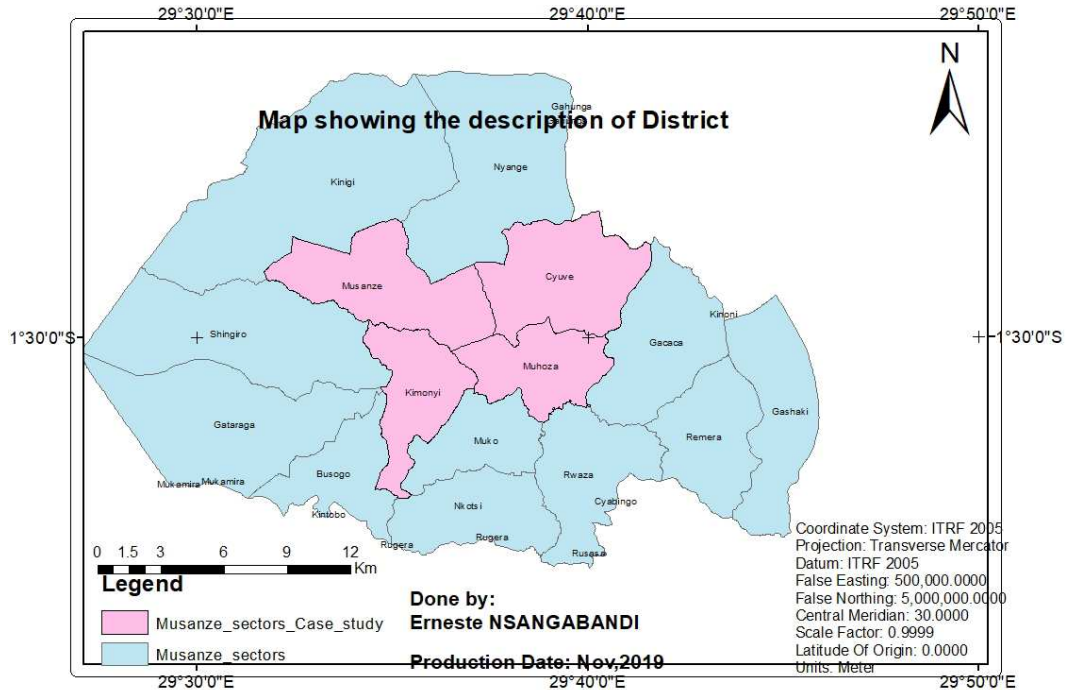


Figure 1. Map showing the sectors selected for case study and showing the selected district in the Northern Province.

## 2. Materials and Methods

### 2.1. The Study Area Description

Musanze city is located in the Northern Province on the high altitude in Rwanda of 1892 m and it has the area of 530.38 km<sup>2</sup>. It is located on the latitude of 1°29' 29" South and on the longitude is 29°35'54" East. The figure 1 shows also that Musanze sector is located North-North of the district, Muhoza sector is located North- south of the district; Cyuve sector is located North- east of the district and Kimonyi sector is located on the North-West of the district.

### 2.2. Data Processing and Software

This research project were using several software's where Arcgis has been used for the production of the maps and for the analysis of the spatial data [9]; Google Earth pro has been used for getting imageries taken by of Musanze district in 2018; MS WORD has been used to write the research report and finally MS EXCEL has been used to make the tables, diagrams and the charts in analyzing this research report.

In this process the different technics were used for analyzing and in order to get the data used as results however with the use of the ArcGIS the orthophotos of 2008 were added in Arcgis by focus on the study area and the orthophotos were showing the land occupied by houses which showed that the land housing were the urbanization in 2008 and the remaining land area was served as agriculture land. To have

the primary data the geospatial data of orthophotos was digitalized by focusing on the land housed by infrastructures after digitalization the digitalized area was calculated in the attribute table and it was recorded as statistical data using Microsoft excel.

Also for the Google map pro, it was opened and the name of the study area was written and the images showing the land occupied by the houses and others used for agriculture have been taken; these images were added in Arcgis and then they were geo referenced and then they become the spatial data with geospatial reference and projection; these data were digitalized by focusing on the lands occupied by the infrastructures and the remaining were considered as the agricultural land. Here the areas which were digitalized were served as the area of urbanization in 2018 and it were computed in the attribute table from the table of content. The area of agricultural land were got but taking the entire area of the each sector in the study area minus the area occupied by the infrastructures either in 2008 or 2018 these calculations are done in Microsoft excel.

## 3. Results and Discussions

### 3.1. Urban Expansion Status

The table 1 shows the area of expansion of Musanze city was made in very big rate of expanding and is represented by sector to sector.

**Table 1.** The urban expansion.

Sector name	General Area (Km <sup>2</sup> )	Urbanization in 2008 (Km <sup>2</sup> )	Urbanization in 2018 (Km <sup>2</sup> )	Growth rate (Km <sup>2</sup> /year)
Cyuve	33.7738	3.100338	10.952493	0.785
Kimonyi	21.5923	0.646753	1.505309	0.086
Muhoza	21.3436	5.98543	9.863119	0.388
Musanze	33.7743	4.161133	5.650366	0.149

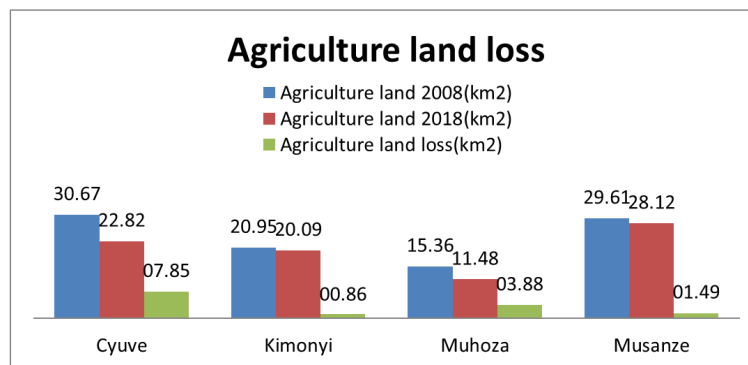
Source: Primary data

The table 1 showed that the urbanization has been expanded all the year from the year 2008 to the year of 2018 there is a big change in times of area of urban expansion where In Cyuve sector the urbanization area has been increased by 7.85 km<sup>2</sup> it meant that every year the urbanization was increased at rate of 0.785 km<sup>2</sup> per year. In Kimonyi sector, the urbanization area has been in Increased by 0.86 km<sup>2</sup> it means that every year the area occupied by building has been increased by 0.086km<sup>2</sup> per year. In Muhoza sector, the area occupied by the infrastructures for urbanization has been Increased by 3.88 km<sup>2</sup> in ten years it means that every year the area occupied by building has been increased by

0.388km<sup>2</sup> per year. And finally, in Musanze sector the urbanization area has been increased by 1.49 km<sup>2</sup> in ten years it meant that every year the urbanization area has been increased by 0.149 km<sup>2</sup> per year. The urbanization area as increased from 13.89 km<sup>2</sup> in 2008 to 27.97 km<sup>2</sup> in 2018 is which showed that rate of urbanization growth is 1.41 km/year.

### 3.2. Agricultural Land Loss and Agricultural Production

The figure 2 showed the increase of urbanization and how much were affecting the agriculture lands.



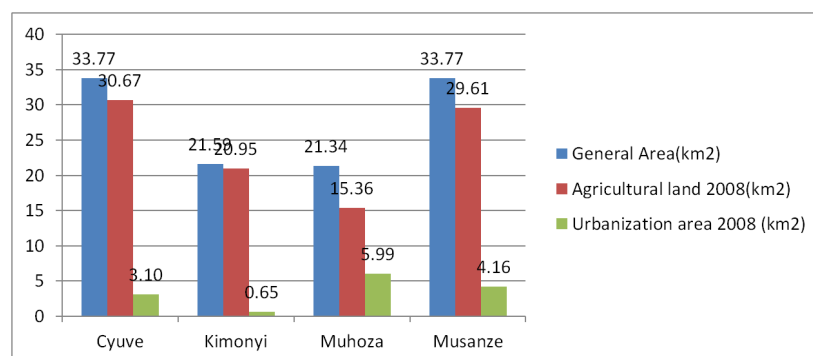
**Figure 2.** The Agriculture land loss (Source: Primary data).

The figure 2 showed how the land has been lost from 2008 to 2018 in each sector. The agricultural land has been lost from 96.594 km<sup>2</sup> in 2008 to 82.514 km<sup>2</sup> in 2018 where in Cyuve sector the agricultural land has been reduced from 30.67 km<sup>2</sup> to 22.82 km<sup>2</sup> it meant that it has been reduced by 7.85 km<sup>2</sup> in 10 years, also it has been lost by 0.86 km<sup>2</sup> in Kimonyi, 3.88 km<sup>2</sup> in Muhoza, and 1.49 km<sup>2</sup> in Musanze sector; finally in Musanze sector the agricultural land has been reduced from 29.61 km<sup>2</sup> in

2008 to 28.12 km<sup>2</sup> in 2018. It meant that the agricultural land has lost in ten year at the rate of 1.41 km<sup>2</sup> per year.

### 3.3. Relationship of Urban Expansion and Agricultural Production

The relationship between urban expansion and agricultural production is made within the interval of 10 years from 2008 to 2018.



**Figure 3.** The relationship between urban expansion and agricultural production in 2008 (source: Primary data).

The figure 3 shows the area of agricultural production in 2008 where it is expressed by the agricultural land and it shows also the area occupied by the urbanization in 2008.

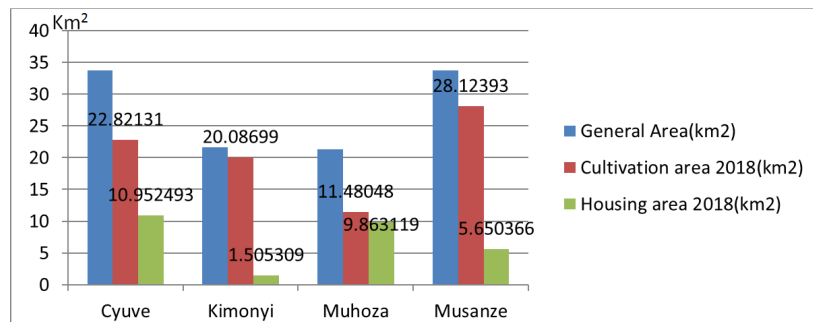


Figure 4. The relationship between urban expansion and agricultural production in 2018 (Primary data).

The figure 4 shows the area of agricultural production in 2018 where it is expressed by the agricultural land and it shows also the area occupied by the urbanization in 2018.

The figures 3 and 4 showed that once the area of urbanization has expanded the agriculture land reduced this meant that as the agricultural land were reduced. The urban expansion and agricultural production one were dependent variable and another were the independent variable.

## 4. Conclusion and Recommendations

### 4.1. Conclusion

This study focus was to assess the impact of urban expansion on agricultural production in Musanze city.

The results showed that there is a big urban expansion where the urbanization area was at 13.89 Km<sup>2</sup> in 2008 and expanded up to 27.97 Km<sup>2</sup> in 2018. This implies that the expansion is affecting the agricultural area and if these expansions are not well managed and controlled within 59 years, the entire area of Musanze, Cyuve, Kimonyi and Muhoza sectors will be occupied by infrastructures. This will probably be resulting from the remaining non-urbanized area (82.514 Km<sup>2</sup> across all four sectors considered) under the annual growth rate of 1.41Km<sup>2</sup> per year.

The results showed also that they are big quantities of agricultural land that lost within 10 years from 96.594 km<sup>2</sup> in 200 to 82.514 km<sup>2</sup> in 2018 and with this loss the agricultural land loss diminishes the quantity of production in Musanze district as the urbanization is increasing the land for cultivation is diminishing.

### 4.2. Recommendation

Governments have a range policy of urban policy and agricultural policy. Practical approaches that could be in most cities include:

Delivering education, training and bridging courses to local communities. The contact of city residents with urban and agriculture officers is the main source from which urban residents receive advice to avoid the big rate of agriculture land loss,

To organize special agriculture campaigns about the good use of land and its effects on agricultural production,

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 construct the multi-storey buildings instead of many single houses which are occupying many spaces which were supposed to be used for agriculture.

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