

Contribution To The Study Of Urban Growth And The Evolution Of The Environmental Situation. Case Of The City Of Bukavu, South Kivu, Democratic Republic Of Congo

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Abstract – This study focuses on the town of Bukavu in South Kivu in the Democratic Republic of Congo and aims to contribute to the analysis of the impacts of urbanization on the environmental situation in the city of Bukavu. The methodology consisted of the housekeeping survey, interview and field observation. The results show that the environmental situation in the city of Bukavu has deteriorated over time with the resurgence of catastrophic events such as: erosion, landslides, subsidence, floods, and this is due in part to anarchic construction and unsuitable sites and the loss of vegetation cover due to the small size of the plots yet the population knows the role of trees in a plot. The main cause of this environmental degradation is undoubtedly the resurgence of insecurity that prevailed in the territories of South Kivu province, thus causing a massive displacement of the inhabitants of these rural areas to the city. The promiscuity of the houses also has significant consequences for the harmony between the inhabitants and as a result, the results of the statistical analysis reveal that belonging to a municipality predisposes to the consequences of the promiscuity of houses (p-value = 0.009). This study is essential and shows the need to make urban planning a priority whether in the city of Bukavu or in the likely extensions to relieve congestion in this saturated city to reduce vulnerability to environmental risks.

Keywords – Analysis, Urban Growth, Environment, Urbanization, Rural Exodus, Degradation.

I. INTRODUCTION

Man influences all the planet's ecosystems through the exploitation of natural resources and the occupation of space, among others through agriculture and urbanization. This has manifested itself in a particular way since the beginning of the 20th century. These pressures are causing profound landscape changes that have a negative impact on the ecological quality of the environment [1]. Habitat fragmentation and human extinction are considered to be the main cause of widespread biodiversity decline [2]. By modifying landscape structures, degrading ecological continuity and isolating natural habitats, urban sprawl raises concerns and questions at the level of the various actors in the city. Thus, the study of its environmental impacts has become a focus for urban ecology [3]. A global study of urban expansion in 50 cities found a strong negative correlation between urban development and forests, cropland and pasture, aquatic ecosystems, etc. [4]. It is worth noting that urban sprawl is a defining feature of contemporary cities, but the current challenge is to control the spatial growth of cities in developing countries [4]. While developed countries have struggled to cope with the negative externalities of sprawl, the problem is even more acute in developing countries, which are less technically, legislatively, financially, socially and politically equipped [5]. The population explosion and mobility are obviously at the root of the brutal urban growth in developing countries. The total population of sub-Saharan Africa has tripled since 1960, while the population of cities has increased tenfold [6]. The 2016 UN HABITAT report entitled "For a Better Urban Future" reveals that the DRC is experiencing rapid urbanization, with exceptional rates (more than 40% in 2014 compared to 26.4% for the previous decade and almost the same rates for future projections, in 2024 and 2034). This report highlights the urban challenges that are crystallizing around the acceleration of rural exodus, largely due to conflict and insecurity in many parts of the country. Urbanization is correlated with general environmental problems, such as combating climate change, reducing the risk of disasters, combating urban air pollution, etc. The city of Bukavu is no exception to this reality of urbanization in the DRC. In the city of Bukavu, anarchic urbanization has significantly increased the vulnerability of soils to landslides, floods, collapse of houses, etc., house fires as a result of their promiscuity are also recurrent and many other hazards such as air pollution, rivers and Lake Kivu by the discharge of solid and liquid household and industrial waste discharged into these ecosystems. Like other countries where urbanization is poorly controlled and planned [7], the impact of urban sprawl in the city of Bukavu is often severe on spatial growth. Thus, there is encroachment on agricultural land, which has a negative impact on periurban agriculture, which is nevertheless essential for the survival of the inhabitants of the city, and it also causes the degradation of vegetation, resulting in the resurgence of soil erosion. On the other hand, the intensification of urban spaces has led to the disruption of urban climatology, the health consequences of which are well known [8]. There is therefore a need to think about improving environmental conditions in the city of Bukavu taking into account the concept of a "sustainable city" which highlights urban ecology and its components including: urban agriculture, water (remediation, infiltration, etc.), waste management, as well as biodiversity and nature in the city [9]. This sustainable city should also be "resilient" and take climate change into account and adapt to it. To our knowledge, much work has focused on the natural hazards on the city of Bukavu by referring to specific cases and specific municipalities, but a study that comprehensively highlights the impacts of urbanization on the precarious environmental conditions in that city. It is in this sense that this article aims to contribute to the analysis of the impacts of urbanization on the environmental situation on the entire extent of the city of Bukavu.

II. MATERIAL AND METHODS

The town of Bukavu, the capital of the DRC's South Kivu province, is located at the southwestern end of Lake Kivu, which borders it against the highlands of the Kivu mountain range. It is bounded to the north by Lake Kivu, to the west by the Nyamuhinga River which forms its border with Kabare territory, to the south by the Mudusa grouping in Kabare territory and to the east by the Ruzizi River. The city is separated from Rwanda by Lake Kivu as well as by the Ruzizi River [10] cited by Lina in 2016. According to reference [11] it has an area of 63 km², of which 43 km² is land and 20 km² occupied by the lake.

The town of Bukavu (Figure 1), the capital of South Kivu province, has existed for a hundred years and includes 3 municipalities, including the municipality of Bagira consisting of 3 districts (Nyakavogo, Lumumba and Kassha; the kadutu municipality which comprises 7 districts (Nkafu, Nyakaliba, Kajangu, Cimpunda, Mosala, Nyamugo and Kasali) and that of Ibanda composed of 4 districts (Ndendere, Panzi, Cahi and Nyalmba) [12].

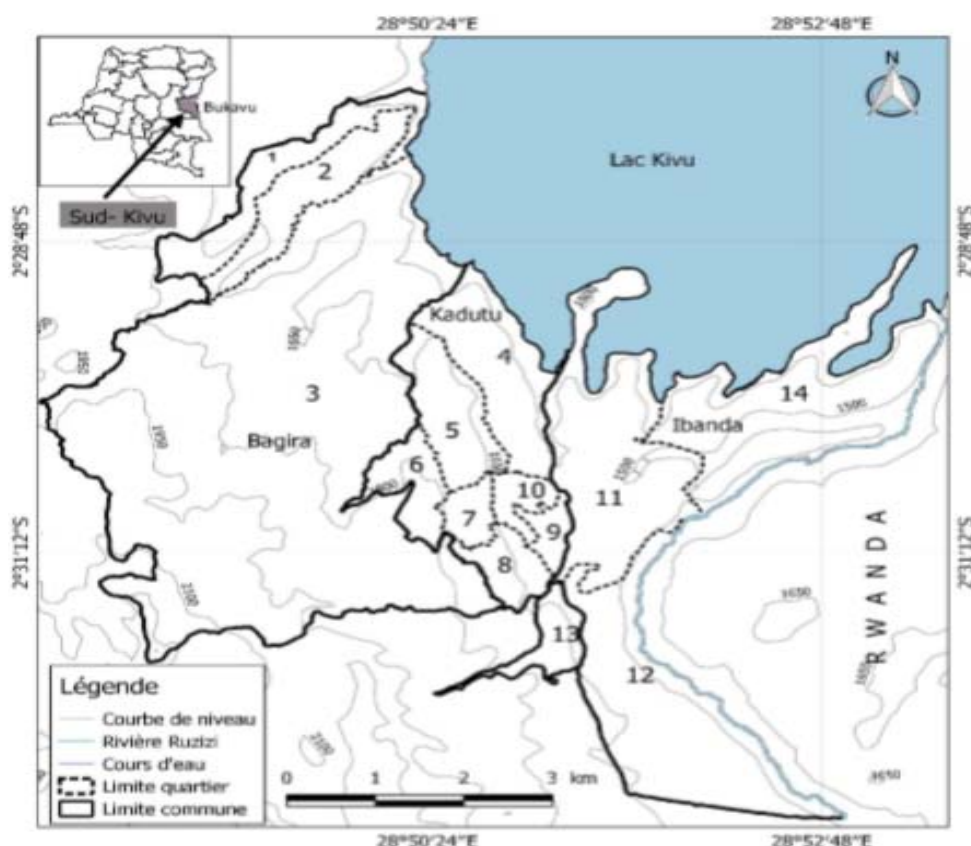


Figure 1: Location of the city of Bukavu and delimitation of the municipalities and districts that make up it. District names. 1: Nyakavogo, 2: Lumumba, 3: Kasha, 4: Nkafu, 5: Nyakaliba, 6: Kajangu, 7: Cimpunda, 8: Mosala, 9: Nyamugo, 10: Kasali, 11: Ndendere, 12: Panzi, 13: Cahi, 14: Nyalukemba [12].

2. 1. Household survey

A survey questionnaire consisting mainly of semi-open questions was submitted to the target population in the three municipalities of the city of Bukavu. Household characteristics such as: household standings according to municipalities guided the selection of our sample. Thus, the target population was diverse in terms of age, education, gender, occupation, marital status, household size, etc. The sample included parents, lessors or tenants, or their children aged at least 20 years of age who were able to provide reliable information but who had lived in the area for at least two years. The data were collected on the field from March to April 2020. The raid on the field was conditioned by permission from the municipal authorities to carry out the investigation in peace. The fact sheet was provided to the respondent in order to retrieve it within 20 minutes or, if necessary, the resident was interviewed directly. In addition to the survey questionnaire, field observation allowed us to assess the environmental situation in the city. We also used interviews for people who can't read or write, but also for the services responsible for urbanization and environmental management in the city. The advantage of the interview was that it avoided unanswered questions. The sample consisted of 150 households for the whole city, due to 50 households per municipality. Figure 2 provides a summary of the distribution of the sample.

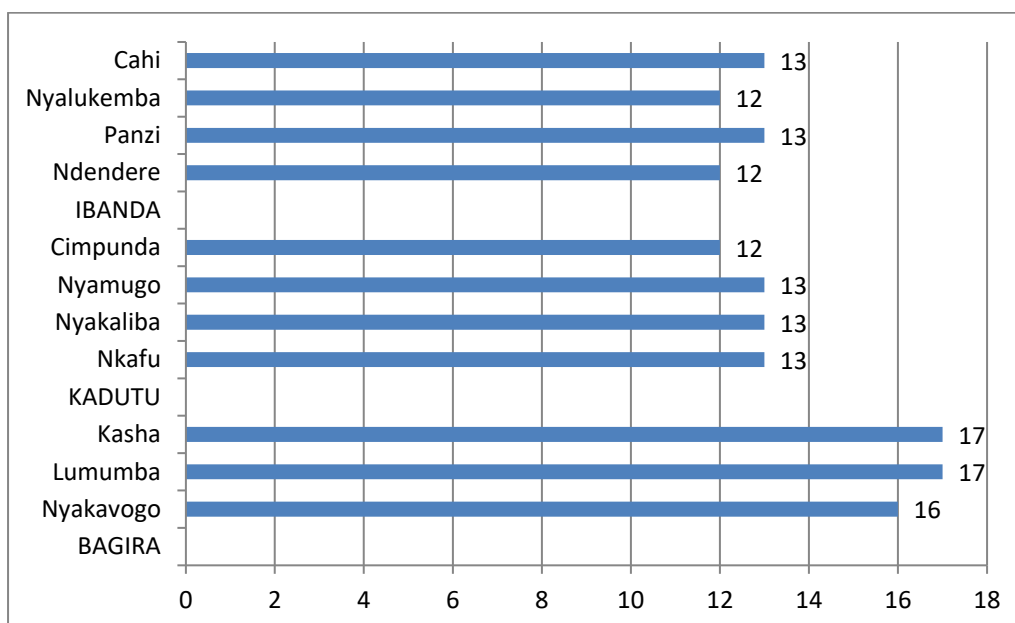


Figure 2. Dividing the sample by municipality and then by districts: the names in capital letters represent the municipalities and those in lower cases represent the districts.

2.2. Data processing and analysis

The survey sheets were compiled, then the data were exploited and stored in the SPSS Version 16 software and the Excel spreadsheet was used to present the results in the form of tables and graphs. For each aspect of the respondents' analysis of the data, proportions are determined by the calculation of percentages as follows:

$\% = \text{Fo} \times 100/\text{Ft}$, where Fo = observed frequency and Ft = total frequency of sample.

Cross-analysis of certain variables was carried out using SPSS version 16 software to identify possible dependencies between these variables. For this purpose, Pearson's Chi² test was applied to establish a dependency relationship between the municipality and the consequences of the promiscuity of the houses in the city of Bukavu.

III. RESULTS

3.1. Household characteristics

Table 1. Gender and age of respondents per municipality

Gender of respondents (%)			Age of respondents (%)				
Municipality	Male	Female	20-30 years	31-40 years	41-50 years	51-60 years	More than 60 years
Kadutu	58	42	18	14	18	40	10
Ibanda	56	44	10	8	30	32	20
Bagira	64	36	12	24	26	20	18
Average	59.3	40.7	13.3	15.3	26.7	30.7	16

According to this table, it appears that 59.3% of respondents are men compared to 40.7% of women. In terms of the age of the respondents, 73.4% of those sampled are between 41 and 60 years of age or more than 60 years of sex combined, but with a high

percentage 30.7%, of those aged 51 to 60 years, followed by 26.7% of those aged 41 to 50 years and 16% of those over 60 years, 15.3% are people aged 31 to 40 years and the lowest rate is 13.3% that concerns people aged 20 to 30 years. The 73.4% rate could be explained by the fact that it is people aged 41 to over 60 years who are supposed to have experienced so many events.

Table 2. Household size and marital status of respondents

Household size of respondents %					Marital status of respondents %			
Municipality	1-5 pers	6-10 pers	11-15 pers	More than 15pers	Married	Single	Divorced	Widower
Kadutu	28	32	24	16	60	28	2	10
Ibanda	32	42	14	12	58	30	4	8
Bagira	22	44	24	10	72	12	4	12
Average	27.3	39.3	20.7	12.7	63.3	23.3	3.3	10

The majority of the households surveyed are 6 to 10 people 39.3%, followed by 27.3% of households with a size of 1 to 5 people, 20.7% having 11 to 15 people and a small number of households with more than 15 people 12.7% of the households surveyed. Regarding the marital status of the respondents, 63.3% are married compared to 23.3% of single, 10% of widows or widowers and the low rate being that of divorced with 3.3%.

Table 3. Profession and level of education of respondents

Profession of respondents (%)						Level of education of respondents (%)			
Municipality	Agr	Trad	Offic	Techn	Stud	None	Primary	Secondary	University
Kadutu	12	36	18	22	16	16	22	38	24
Ibanda	6	32	28	24	14	12	24	38	26
Bagira	12	30	20	20	10	14	18	44	24
Average	10	32.7	22	22	13.3	14	21.3	40	24.7

*Agr : Agriculture *Trad : Trade *Offic : Official *Techn : Technical *Stud : Student

The average percentage of all three municipalities for the profession gives the highest rate of 32.7% of traders, followed respectively by 22% of respondents who do the jobs (which include masons, seamstresses, carpenters, plumbers, shoemakers, etc.) and 22% of civil servants in the civil service and the private sector salaried, students 13.3%, and the lowest rate being farmers and breeders 10% who correspond mainly to the respondents from the rural peripheries of the municipalities investigated. Regarding the level of education, the majority of respondents have a secondary education level 40%, followed by university executives 24.7%, those at the primary level 21.3% and a low rate of people who have not been to school 14%

Table 4. Arrival period in the city of those surveyed

Date d'arrivée des personnes enquêtées dans la ville de Bukavu (%)					
Commune	Avant 1980	1980-1990	1991- 2000	2001-2010	2011- 2018
Kadutu	10	16	22	30	22
Ibanda	12	22	20	26	20
Bagira	8	18	22	28	24

Moyenne	10	18.7	21.3	28	22
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From this table, it appears that 28% of those surveyed arrived in Bukavu between 2001 and 2010, 22% arrived between 2011 and 2018, 21.3% arrived between 1991 and 2000, 18.7% arrived between 1980 and 1990 and finally, 10% of those surveyed arrived before 1980.

Table 5. Territory of origin of the surveyed

Territories of origin of the respondents (%)									
Municipality	Walungu	Kabare	Kalehe	Idjwi	Mwenga	shabunda	Uvira	Fizi	Other
Kadutu	12	16	10	12	14	10	12	8	8
Ibanda	16	12	10	10	12	12	12	10	6
Bagira	12	18	16	12	10	10	8	8	4
Average	13.3	15.3	12	11.3	12	10.7	10.7	8.7	6

Compared to the territories of origin of the respondents, Kabare has the highest rate with 15.3%, followed by Walungu with 13.3%, Kalehe and Mwenga having 12% each, Idjwi 11.3%, Shabunda and Uvira 10.7% each, Fizi 8.7% and finally respondents from other corners have the lowest rate of 6%. These people came either from other provinces or from abroad etc.

Table 6. Causes of displacement of respondents to the city

Causes of displacement of respondents from villages to the city (%)				
Municipality	Insecurity	changing service and looking for employment	studies	willingness to live in the city forthe search for well-being
Kadutu	36	18	16	30
Ibanda	32	20	22	26
Bagira	46	14	18	22
Average	38	17.3	18.7	26

Among the causes of displacement of respondents from the territories to the city are insecurity which breaks the record with 38%, the willingness to live in the city for the search for well-being 26%, the reason for studies comes in third place with 18.7% and the lowest rate is that of people changing service and looking for employment 17.3%. The reason for insecurity cited by the respondents meets the statements of the planning authorities who said in an interview that insecurity in the territories is the primary cause of displacement of populations to the city.

2.3. Environmental characteristics

The results of the environmental characteristics of the households surveyed are presented in the tables below.

Table 7. Presence of Unsalted plots or no and the consequences of the absence of urban planning standards

Presence of Unsalted plots or no (%)			Consequences of the absence of urban planning standards (%)	
Municipality	Yes	No	Plot conflicts	occupation of unsuitable construction areas
Kadutu	56	44	38	62
Ibanda	40	60	34	66
Bagira	34	66	44	56
Average	43.3	56.7	38.7	61.3

The legal status of the plot shows that more than half of the households surveyed occupy unsalted plots 56.7% compared to 43.3% of land plots. The proliferation of unquestured plots is justified by the virtual absence of urban planning services in the land transaction, the buyer and seller concluding the contract without associating the authorized services since in most cases they are unsuitable spaces for construction. With regard to the consequences of the absence of urban planning standards, 61.3% are attributed to the occupation of unsuitable construction areas by the population and 38.7% of respondents face conflicts related to either plot boundaries or the management of waste and rainwater and wastewater.

Table 8. Causes of environmental degradation in the city

Causes of environmental degradation in the city (%)		
Municipality	Lack of appropriate land use policies	rural exodus
Kadutu	70	30
Ibanda	50	50
Bagira	64	36
Average	61.3	38.7

The results of this table indicate that the primary cause of environmental degradation in the city of Bukavu is the lack of appropriate land use policies 61.3% and rural exodus accounts for only 38.7%, which means that rural exodus is not a problem in itself if there is rigorous urban planning because in the new sites, there is a total absence of the state, which means that the population is the sole master in the occupation and use of the land.

Table 9. Environmental problems and their causes in the city of Bukavu

Environmental problems (%)					Causes of problems (%)		
Municipality	DSRT	WSAP	WELS	DCP	PCD	LWRDC	LPDSS
Kadutu	20	16	44	20	30	42	28
Ibanda	28	22	38	12	46	32	22
Bagira	32	26	30	12	36	38	26
Average	26.7	21.3	37.3	14.7	37.3	37.3	25.3

*DSRT : Disruption of seasons and rising temperatures

*PCD : Plant Cover Destruction

*WSAP : water, soil and air pollution

*LWRDC : Lack of wastewater and rain drainagechannels

*WELS : Water erosion, landslides

*LPDSS : Lack of public dumps and sanitation service

*DCP : Destruction of crops by parasites

*PCD : Plant Cover Destruction

Environmental problems in the city of Bukavu are water erosions coupled with landslides with the rate of 37.3%, seasonal disturbance and rising temperatures 26.7%, water, soil and air pollution accounting for 21.3%, and pest destruction 14.7%. In fact, the majority of rural people are from rural areas who are interested in agriculture. In terms of the causes of these problems, the destruction of vegetation cover and the lack of sewage and rain channels each account for 37.3% and the lack of public landfills and sanitation services accounts for 25.3%. The lack of public dumps, sewage and rain channels cause pollution, while the destruction of vegetation causes water erosion, landslides, seasonal disturbance and rising temperatures.

Table 10. Consequences of vegetation degradation and period during degradation of this vegetation has increased in the city of Bukavu

Consequences of the decrease in vegetation (%)					Period when vegetation degradation increased (%)			
Municipality	GW	LEF	DAP B	SL	1980- 1990	1991- 2000	2001- 2010	2011-2018
Kadutu	14	40	26	20	12	26	46	16
Ibanda	24	34	28	14	18	26	36	20
Bagira	22	48	20	10	10	28	44	18
Average	20	40.7	24.7	14.6	13.3	26.7	42	18

*GW : Global Warming

*DAPB : Disappearance of animal and plant biodiversity

*LEF : Landslides, Erosions and Floods

*SD : Soil degradation

In view of the results of this table, the scores of the consequences of the decrease in vegetation are as follows : 40.7% are attributed to landslides, erosions and floods; 24.7% to the loss of animal and plant biodiversity, 20% to global warming and a low rate of 14.6% attributed to soil degradation. The loss of animal and plant biodiversity is justified by the rarity of certain species that were observed in the city and its peripheries such as animals and plant species. Some plant species with medicinal properties have even disappeared. Soil degradation is a consequence decried by farmers who have seen their arable land significantly lose their fertility. Regarding the period when vegetation degradation increased, 68.7% of respondents said that this period would correspond to the years 1991 to 2010 with a high rate of 42% between 2001 and 2010 and 26.7% between 1991 and 2000, 18% estimate this period between 2011 and 2018 and a low rate of 13.3% being observed between 1980 and 1990. The high score from 1991 to 2010 would correspond to the massive displacement of people from villages to the city following the growing insecurity in all the territories of South Kivu province since the arrival of Rwandan refugees in eastern DRC in 1994, the war of the Alliance of Democratic Forces for the Liberation of Congo (ADFL) in 1997 until the successive rebellions in this part of the country.

Table 11. Knowledge of the presence of sites unsuitable for construction and presence of wooded sites

Presence of sites unsuitable for construction (%)			Presence of wooded sites (%)	
Municipality	Yes	No	Yes	No
Kadutu	32	68	54	46
Ibanda	54	46	36	64
Bagira	74	26	44	56
Average	53.3	46.7	44.7	55.3

In terms of the presence of unsuitable sites for construction, 53.3% of respondents recognized the presence of unsuitable sites for construction, compared to 46.7% who did not recognize the presence of these unsuitable sites. Through interviews with the planning authorities in the city of Bukavu, many sites have been deemed unsuitable for construction by the master plan of land use, urban planning and habitat inherited from the settlers, but surprisingly, all these sites constitute dwellings in the eyes and in the interest of the political-administrative authorities. Regarding the presence of wooded sites, more than half of the respondents did not recognize the presence of wooded sites in their districts and 44.7% of respondents acknowledged the presence of these sites. Those who have acknowledged the presence of these sites have shown that these sites are mainly in the concessions of churches, schools and some sites of state institutions that have escaped the plundering by the ill-intentioned authorities. The Head of the Office of Nature Conservation at the Provincial Coordination of Environment and Sustainable Development has shown that as part of its reforestation programme, the Coordination has initiated so many campaigns to reforest unsuitable sites for construction but these efforts are still in vain because a little after we observe subdivisions on these sites.

Table 12. Knowledge of the existence of both public and private organizations of protection of the environment in Bukavu

Existence of organisations involved in environmental protection (%)		
Municipality	Yes	No
Kadutu	38	62
Ibanda	44	56
Bagira	36	64
Average	39.3	60.7

When it comes to the existence of organisations involved in environmental protection, 60.7% do not recognize any organisation in this area and only 39.3% meet them. Those who have claimed the presence of these organizations are mostly in the municipality of Ibanda, where we observe household waste collection associations, sanitation services, the town hall, etc. or in poorly-off districts where civil protection most often intervenes in cases such as fires, floods, landslides, etc.

Table 13. The presence of trees in the plot and the influence of occupancy status plot on the presence of a tree in the plot

Presence of trees in the plot (%)			Influence of occupancy status plot on the presence of a tree in the plot (%)				
Municipality	Yes	No	Ren	SP	CF	BNH	ACT
Kadutu	30	70	16	36	8	32	8
Ibanda	32	68	20	32	20	22	6
Bagira	36	64	12	30	12	36	10
Average	32.7	67.3	16	32.7	13.3	30	8

*Ren : Renter * SP : smallness of the plots * CF : concrete floor

* BNH : Building New Houses * ACT : accidents caused by trees

According to our observations in the households surveyed, 67.3% of the plots have no trees compared to 32.7% with some tree samples. This led to question to the occupants of the plots as to why or there were no trees in their plots. For these reasons, the smallness of the plots is the overriding reason 32.7%, followed by the construction of new houses on the undiluted space of the plot 30%, the fact of being a tenant 16%, the concrete nature of the soil 12% and finally 8% fear the risk of accident caused by falling trees or demolition of houses by tree roots regardless of the extent of the plot.

Table 14. Relationship between belonging to a municipality and the consequences of promiscuity of houses in the city of Bukavu

Municipality		Kadutu	Ibanda	Bagira	Totaux
Promiscuity of houses					
Size	House fires and other disasters	22	11	14	47
% total		44 %	22 %	28 %	31.3 %
Size	Conflicts related to waste, wastewater and rain management	21	16	17	54
% total		42 %	32%	34%	36 %
Size	Landslide risks	7	23	19	49
% total		14 %	46 %	38%	32.7 %
Total		50	50	50	150
		100%	100%	100%	100%
Chi ² of Pearson : 13, 395, dl = 4, p= 0,009					

From the relationship between belonging to a municipality and the consequences of the promiscuity of houses, it appears that Ibanda records the high rate of households facing the risks associated with landslides 46%, Bagira 38% and Kadutu 14% all making the cumulative of 32.7%. The municipality of Kadutu registers 44% of households facing house fires and followed by Bagira 28% and Ibanda 22% the cumulative giving 31.3%. Kadutu registers 42% of households facing conflicts related to waste, wastewater and rain management, Bagira 34% and Ibanda 32% giving a cumulative 36%. There is a relationship between belonging to a municipality and the consequences of the promiscuity of the houses since the p value is less than 0. 05.

IV. DISCUSSION

The results compared to the arrival period of those surveyed in the city indicate that a large proportion of people arrived in the city between 1990 and 2018, 28% between 2001 and 2010, 22% between 2011 and 2018 and 21.3% between 1990 and 2000. These results relate to the causes of displacement of people living in rural areas to the city in the sense that it was during this period that a cycle of wars was recorded in the villages of South Kivu Province. This meets what the reference [13] pointed out in her thesis that this period corresponds to the genocide in Rwanda in 1994 which dumped refugees in the DRC who dispersed into the forests of Kivu to escape the regular armies of the countries bordering the DRC that invaded and occupied eastern DRC in 1996. Another episode of the wars came with the advent of the ADFL (Alliance of Democratic Forces for the Liberation of Congo) followed by rebellions by both foreign and national armed groups and they proceeded to illegally exploit natural (mineral) resources, thus causing rape, killings etc. This context led to a large-scale rural exodus to the city of Bukavu. The reason for insecurity cited by the respondents meets the statements of the planning authorities who said in an interview that insecurity in the territories is the primary cause of displacement of populations to the city. Regarding the territories of origin of migrants to the city of Bukavu and their host communities, it is noted that migrants occupy the municipalities of the city of Bukavu according to ethnic affinities, these migrants most often settle in places occupied by the tribes of origin, this situation is not only unique to the city of Bukavu because the same observation was made by the reference [14] in Cameroon where the occupation of spaces in urban areas is based on ethnic affinity grouping. With regard to the status of land use, our results show that the majority of the plots in the city of Bukavu and its peripheries are not registered, the plots are acquired from the agreements between two parties whose purchaser and seller materialized by the signature of a piece of paper often countersigned by the leader of avenue or district. This anarchic occupation creates districts without infrastructure or even encroaches on existing infrastructure, such as the erection of houses in public interest infrastructure such as trails that communicate with different avenues, this situation was demonstrated by the reference [15], who came to the same

conclusion that anarchy in the planning sector enjoys the benevolence of local governments who have few means to prohibit them. For the case of this study, this anarchy has resulted in the occupation of unsuitable areas under the 1957 Bukavu Land Development Plan, these spaces include steep slopes, wetlands (Mukukwe), the 10 m of shore of Lake Kivu, sites reserved for cemeteries, along rivers, etc. This was confirmed in the April 2020 interview we did with the Head of the Bureau of Nature Conservation at the Provincial Coordination of Environment and Sustainable Development in Bukavu. Similarly, the cause of environmental degradation is the lack of appropriate land use policies, as our results have shown. This was corroborated by the Chief of the Bureau of Planning and Housing in an interview in April 2020. For him, rural exodus is not a problem in itself if there is rigorous urban planning because in the new sites, there is a total absence of the state and the population is the only master in the occupation of the land. He acknowledged the failure of the state services in charge of urban planning and land use in the occupation of the land because the master plan of urban planning dates back to the colonial period but has been trampled on and no other plan is in place for the control of the occupation of the land. These authorities deplored the confusion in the management of the territory in urban areas, among others the division of land affairs and that of the land registry, which grant the plots in unsuitable sites for construction without the knowledge of the urban planning and housing division. They also show that the inhabitants occupy these spaces where they erect houses in a hurry on Sunday, public holiday and the department of urban planning finds itself powerless to demolish these houses for fear of being taxed the offence of wicked destruction because any demolition requires the prosecution or special authorization of the Provincial Governor against illegal occupation. These procedures are sometimes initiated but never produce any effect and the planning department is unable to carry out its mission independently. The environmental problems observed in the city of Bukavu are largely erosions, landslides and landslides as a result of the rugged sites in the city, reference [16] has highlighted the resurgence of landslides affecting the slopes and natural slopes causing very significant damage to buildings, structures and sometimes causing casualties. This author argues as the causes of landslides; natural events such as heavy rains, erosions, earthquakes or the direct consequences of human activity such as earthworks of construction sites, untimely deforestation. The reference [17] criticizes that entire houses and neighborhoods disappear, vegetation erased, creating natural and man-made calamities combined. This author takes as samples the erosions of Lugohwa and Mosala which show how the city is losing its greenery, its habitat and its beauty of yesteryear; and how quickly it will disappear. It shows that the anthropogenic factors of erosion are the allocation of unsuitable and prohibited plots for construction, which is the irresponsibility of the public authority, which shows shortcomings in the management of urban spaces. The city of Bukavu in general and its peripheries are almost devoid of trees according to the observation we made on the ground. The few traces of woodland that we encounter belong to certain institutions such as university sites, church sites and some sites in the public domain of the state that have escaped looting by ill-intentioned people. Like a survey carried out by landscape entrepreneurs in France on the role of plants in the city, more than nine out of ten French people felt that contact with plants is important or even essential to their daily lives and half of those surveyed felt that the garden is one of the two most important "rooms" of their homes [18]. The inhabitants of our study area know the importance of the tree in their plot, but the smallness of the plot is for many the obstacle to the planting of trees. The reference [19] made the same observation for the city of Kinshasa and found that more than half of the Kinois population knows the role of trees in urban areas such as fruit production, shade and air purification but curiously there is a tree deficiency in this city. This leads us to deduce that the planting of trees in urban areas is possible provided that there is sufficient space but also the involvement of the authorities in charge of land use planning in urban planning. In a study of urban wasteland, The reference [11] makes an observation that green spaces in cities are full of benefits, functions, services and even ecosystem services. He adds that these services are, among other things (health, well-being and social cohesion) linked to biophilia, which is difficult to quantify once monetized. The results of the cross-analysis show that belonging to a municipality is a factor that predisposes to the consequences of promiscuity since the p-value is less than 0.05.

Nevertheless, it is important to note that the methodological approach chosen to carry out this study has a number of limitations, including (i) the sample size that does not correspond to the requirements of a sociological study that would require a sample of up to 10-25% of the population, this, of course, is a matter of financial, logistical and temporal constraints, (ii) the reluctance to answer a few personal questions (out of misunderstanding or fear of reprisals from the administrative authorities) , (iii) the difficulties of conducting the household survey and interviews with targeted services due to Covid-19 because this fieldwork coincided with the beginning of containment in our study area.

V. CONCLUSION

This study has shown that the city of Bukavu and its surroundings have experienced anarchic occupation of the soil over time due to the absence of urban planning standards in land use. This anarchic occupation was exacerbated by the advent of repeated wars in almost all the territories of South Kivu. Examples include Laurent Désiré Kabila's war to liberate Congo from the Alliance of Democratic Forces for the Liberation of Congo (ADFL) in 1997, the rebellion of the Congolese Rally for Democracy (CRD) from 1998, the Democratic Forces for the Liberation of Rwanda (DFLR) which occupied all the forests of South Kivu province. All these events of wars have caused increasing insecurity (pillages, rape, mutilation, killings, etc.) in all the territories of the province thus causing the displacement of the population to the city where there is less atrocity. The results of this study confirmed that insecurity in the territories of South Kivu contributed significantly to the anarchic occupation of the soil in the city of Bukavu. The failure to comply with urban planning standards as envisaged by the 1957 land use plan led to the occupation of unsuitable sites for construction, the non-compliance with the size of the plot and the occupation of the plots for the subdivision had negative environmental and social impacts. Environmentally, there are serious consequences for biodiversity and ecological functioning of ecosystems in the city of Bukavu, causing landslides, catastrophic erosion, floods, house collapses, fires, river and lake Kivu pollution, proliferation of epidemics, etc. It should be noted that the city of Bukavu no longer has enough green spaces, yet in time called "Bukavu the Green". This lack of green spaces in turn leads to the disappearance of animal biodiversity. The few green spaces that we encounter are mainly in the sites of academic institutions, ecclesiastical and some sites of state institutions that have escaped the plundering by the ill-intentioned. The absence of trees in households is justified by the fact that the plots are too small to such an extent that the built area occupies the entire plot leaving no space even for an ornamental or fruit tree. Given the imminent danger that the population of the city of Bukavu is in danger of environmental insecurity, it is urgent to rethink the development of this city but also to provide a rigorous development of the probable extensions that are under way to relieve congestion in the already saturated city. This requires a rigorous environmental impact assessment followed by a development plan for these extensions.

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