ANALYSIS OF STAKEHOLDERS AND COMMUNITY PARTICIPATION IN PROMOTING URBAN FOREST ECOSYSTEM IN MUSANZE, RWANDA

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ABSTRACT

Accelerated urbanization is blamed to have major negative implications on environment with particular impacts on urban forests. Growing conditions of urban forests are often in conflict with human needs and management attitudes. This study analyzed the involvement of stakeholders and community participation in promoting urban forest in Musanze City. We measured the prioritization of city residents regarding some public development initiatives including urban forestry, and we assessed the willingness and participation of city residents regarding urban forestry. The sample size of the study was made by 100 people. Both interview and questionnaire were used to collect data. The statistical package for social sciences was used for statistical analysis, and ArcMap and administrative entities shapefiles were used to map the study area. Results showed 47.14 m^2 area is covered by urban forest per capita in the study area and an average of 1.61 trees per domestic garden. Analysis showed that the main stakeholders in urban forest promotion are forest extension officers who provide advices and skills regarding urban forestry to a large percentage of city residents (64%). The level of preference and prioritization of city residents regarding urban trees was measured and 88.0% of respondents showed a positive will to plant and care a tree. However, except tree planting done by 37.0% of respondents from August 2017 to July 2018, other forestry activities are not well considered by city residents. More delivering education to local communities will increase the awareness regarding the benefits of urban forests, essential for making progress towards sustainable cities in Rwanda.

Key words: Stakeholders, Urban forest ecosystem, Musanze Secondary City, Rwanda.

1 Introduction

Today, more than half of the world's population lives in urban areas and the figure is estimated to exceed 70 per cent by 2050 (UN, 2013). Accelerated urbanization is blamed to have major negative implications on urban and worldwide environment. The strong linkages between urban quality of life and how cities use and manage natural resources is essential in having integrated approaches to sustainable urban development (Sida, 2016). The Sustainable Development Goals (SDGs) proposed for ecosystems (SDG 15) have targets to sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss. This will facilitate the achievement of Sustainable Development Goal 11 "Make cities inclusive, safe, resilient and sustainable".

Cecil Konijnendijk (2006), defined Urban forestry as the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits that trees provide to society. The Urban forests are the backbone of the green infrastructure, bridging rural and urban areas and ameliorating a city's environmental footprint (FAO, 2016). However, in developing areas, they face a number of challenges and their growing conditions are often in conflict with human needs and management attitudes (Georgia Forestry Commission, 2001).Urban forestry is a multi-level, multi-stakeholder and multi-disciplinary field that recognizes local government as a significant and often the central player (Lawrence et al., 2013). "Building partnerships and alliances among stakeholder groups is essential in urban greening – not only as a way of mobilizing resources but also because it creates good will, community spirit and a greater understanding of the benefits and costs of urban forests" (FAO, 2016,). In order to achieve inclusive city governance, it is necessary to consider the types and roles of different players who can assume responsibilities in an inclusive Urban and Peri-urban Forestry governance program and the attitude and willingness of the community and its stakeholders to be engaged in governance programs (FAO, 2016).

In Rwanda, the development of cities is very recent and the rate of urbanization stands at about 18%. Although, this rate is among the lowest in the world, the annual growth rate of the urban population of 4.5% far exceeds the worldwide average of 1.8% (MININFRA, 2013). Considerable internal migration is increasingly resulting in negative impacts on

urban environment. The Government has promised to plant two million hectares of trees by 2020 in response to the Bonn Challenge: a global aspiration to restore 150 million hectares of the world's deforested and degraded lands by 2020 and 350 million hectares by 2030. According to the National Forest Policy (2010), communities are expected to carry out activities such as: creation of woodlots on their land, adoption and implementation of agroforestry technologies, working with forest extensionists, working closely with NGOs to increase forest cover, and participate in forest conservation and protection.

This study analyzed the involvement of stakeholders and community participation in promoting urban forest ecosystem in the study area with the following specific objectives: 1) To analyze the involvement of different stakeholders in the promotion of urban forest ecosystem, 2) to measure the city residents' prioritization regarding some public community development initiatives including urban forestry, and 3) to assess the willingness and participation of city residents regarding urban forestry in Musanze city.

2 Materials and Methods

Site description

The site is located in Musanze District and was selected according to its relatively convenient location, rapid infrastructure development, and its ecological importance to biodiversity as a fertile plain. The city comprises seven sectors including Muhoza, Cyuve, Kimonyi and Musanze; and parts of Shingiro, Gataraga and Muko (MININFRA, 2016). Muhoza is the most populated Sector with 51,878 residents followed by Cyuve with 39,091 residents and Musanze with 31,864 residents. They represent 14.1%, 10.6% and 8.7% of the total District population respectively (IKI, 2016). The livelihood of the city depends on the environment and natural resources such as water, land, air, plants and animals (IKI, 2016). The site is located in north-western region of Rwanda which has a moderate and humid climate due to its high altitude and abundant rainfall, with annual rainfall maxima of 2000 mm, and altitude between 2000 and 3000 m. There is plenty rainfall throughout the year with two heavy rain seasons; the longest being from February to June with a peak in April while the shortest is from September to December with a peak in November (Kiyiapi and Hitimana, 2006).
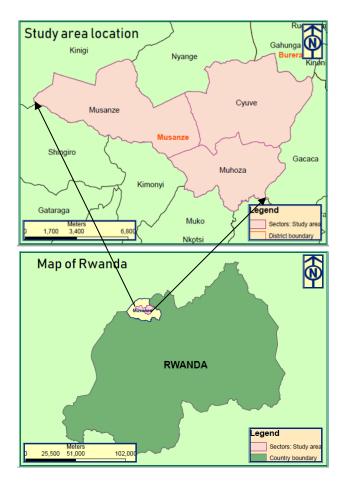
Figure 1: District map showing selected Sectors for sampling. *Source: Field survey, 2018.*

Research Design

The study used the exploratory research design. Descriptive survey design was also used to determine the current situation of city population and other stakeholders regarding urban forestry.

Study Population and Sample size

In this study, only three sectors namely Muhoza, Cyuve, and Musanze were selected to constitute the sample area. The number of households in these Sectors is 28,424,

equivalent to 60.7% of all households located in seven sectors composing the city. The sample size of the study was determined using the formula of Yamane (Israel, 2013).

$n = \frac{N}{1+N(e)^2}$, Where n = Sample size, N= Study population which is the total number of households in Muhoza, Cyuve, and Musanze Sectors and e = margin of error which was 10% meaning that the confidence level was 90%.

Hence, $n = \frac{28,424}{1+28,424\,(0.1)^2} = 99.\,64\sim100$

Other respondents from Institutions which are key players in the forestry sector in the study area were also considered in this study.

Sampling framework

In this study, purposive sampling method was used to select three Sectors that constituted the sample area from seven of the city area. These three sectors are the most populated, localized in the center of the city (IKI, 2016), where accelerated urbanization is increasingly causing drastically changes to urban environment (Nsanzimfura and Nyandwi, 2017; KURADUSENGE and MANIRAGABA, 2018). Stratified sampling technique was used to determine the number of households to be interviewed in each Sector.

The following formula was used: $ni = \frac{Ni \times n}{N}$

Where ni= the sample size proportion to be determined, Ni= the population proportion in the stratum, n = the sample size, N= the total population.

Table 1: Proportion of population in each Sector

Sector	Number of households	The proportion of population (city residents) interviewed per Sector
Muhoza	12,091	43
Cyuve	8,962	31
Musanze	7,371	26
Total	**28,424**	**100**

Data collection

We conducted interview on 100 city residents which, only, constituted the sample size.

Questionnaire was administered to the staffs in charge of forest management at Rwanda Agriculture Board and Musanze district

Both an interview and questionnaire were used to collect primary data. In order to guide individual respondents, schedule was filled in by interviewer who was conducting data collection. The questionnaire was administered to respondents in government institutions (Musanze District and RAB/Northern Agriculture Zone Division) involved in the management of urban forest ecosystem for data gathering. Secondary data were collected using a desk study through documentation of relevant reports, national policies, government development programs, and other published research works relevant to the study.

Statistical Treatment of Data

The data were analyzed using descriptive statistics including mean, frequencies, and percentages to bring out the extent at which knowledge and skills about the management of urban forest ecosystem are disseminated to city residents by different stakeholders, the level of prioritization of city residents regarding some public community development initiatives including urban forestry, and the willingness and participation of city residents in urban forestry in Musanze city. Using the statistical package for social sciences [SPSS] version

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16.0, data collected from different interviewees were arranged and then analyzed.

3 Results

Stakeholder's involvement in urban forestry

In this study, potential stakeholders providing advices on urban forestry practices in Musanze city were determined based on the scores obtained from respondents. Each interviewee was asked to state from which stakeholder he or she gets advice. The results are presented in the Table 2. Respondents were also asked to state if they have ever been in contact with forest staff. The analysis of the study shows that out of 100 city residents interviewed only 77.0 percent have been in contact with forestry staff and 23.0 percent have not.

Table 2: City residents receiving advices on urban forestry practices from Stakeholders

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Fellow urban resident	6	6.0	6.0	6.0
Researchers	3	3.0	3.0	9.0
Extension officers	64	64.0	64.0	73.0
Private communities	1	1.0	1.0	74.0
NGOs personnel	2	2.0	2.0	76.0
Local media	14	14.0	14.0	90.0
Others	2	2.0	2.0	92.0
None	8	8.0	8.0	100.0
Total	100	100.0	100.0	

Perception and prioritization of urban population regarding urban forestry

In order to get the perception of city resident on the abundance of urban trees, respondents were asked to choose only one from three answers proposed on the following question: "Do you think trees in this area are: 1) Very few, 2) Too many, 3) Just right". Their perception is presented in the table 3.

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Table 3: Perception of city residents toward urban trees availability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very few	50	50.0	50.0	50.0
	Too many	14	14.0	14.0	64.0
	Just right	36	36.0	36.0	100.0
	Total	100	100.0	100.0	

Table 4: City residents' preference regarding relaxation location.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under a tree	80	80.0	80.0	80.0
	Near a building	19	19.0	19.0	99.0
	In the open	1	1.0	1.0	100.0
	Total	100	100.0	100.0	

The results (table 4) show that the majority (80.0%) of respondents prefer to relax under a tree. Near a building score was ranked on the second place with 19.0 percent, followed by in open area ranked with 1.0 percent of all respondents.

Table 5: City residents' prioritization regarding some public community development

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Drains	11	11.0	11.0	11.0
	Tree Planting	60	60.0	60.0	71.0
	Roads	20	20.0	20.0	91.0
	Alley paving	9	9.0	9.0	100.0
	Total	100	100.0	100.0	

The results (table 5) show that tree planting was the most preferred community development initiative (60.0%) while alley paving was the least (9.0%).

Willingness of city residents and adoption of urban forestry at household level

When all city residents involved in the interview were asked if they can plant and care for a tree, each respondent expressed his/her willingness toward this attitude. The frequency distribution and percentages are presented in the table 6.

Table 6: Willingness to plant and care for a tree

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	88	88.0	88.0	88.0
	Not	12	12.0	12.0	100.0
	Total	100	100.0	100.0	

The results (table 6) showed that the largest percentage (88.0%) of respondents stated that they can plant and care for a tree whereas 12.0% showed no interest regarding this forestry attitude.

Regarding forest activities done by city residents in last twelve months, each respondent was asked to state which is the main forestry activity he/she have done from August 2017 to July 2018. Activities such as planting a new tree, weeding, pruning, thinning, and other related activities were presented to the respondent. The results are presented in the table 7.

Table 7: Forest activities done by city residents from August 2017 to July 2018

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tree planting	37	37.0	37.0	37.0
	Weeding	16	16.0	16.0	53.0
	Pruning	8	8.0	8.0	61.0
	Thinning	3	3.0	3.0	64.0
	Other activity	3	3.0	3.0	67.0
	No activity done	33	33.0	33.0	100.0
	Total	100	100.0	100.0	

(Source: Primary data, August 2018)

Analysis (table 7) of collected data shows that only 37.0 percent of all respondents have planted trees. This is the largest percentage followed by 33.0 percent of respondents who did zero activity related to forestry. Weeding was done by 16.0 percent of respondents,

pruning by 8.0 percent, thinning by 3.0 percent, and other related activities were done by 3.0 percent of all respondents.

During data collection, each respondent was asked if he/she has any tree in his/ her domestic garden and trees were counted and

verified on the field. The findings of the number of trees per domestic garden in the study area are presented in the table 8.

Table 8: Average number of trees in domestic gardens

	N	Minimum	Maximum	Mean	Std. Deviation
Number of trees per domestic garden Valid N (listwise)	100 100	.00	13.00	1.6100	2.16909

The results of this research show that the number of trees in domestic gardens varies from 0 to 13. Analysis (table 8) shows that

average number of trees per garden in the study area was 1.61.

4 Discussion

Urban forest ecosystem consists of all the trees within urban lands and various ecosystem components that accompany these trees (e.g., soils or understory flora) (USDA, 2016). In this study, urban forest ecosystem consists of forested stands, like in rural areas, but they also contain trees found along streets, in residential lots, in parks, and in other land uses within the city boundaries. The analysis of Stakeholders and Community participation in promoting Urban forest ecosystem in Musanze Secondary City is an important way to integrate the concept of environmental sustainability in urban

development in Rwanda. It is highlighted by Luederitz et al. (2015) that comprehensive stakeholder involvement should be considered as vital tool aimed at strengthening the concept's potential to facilitate meaningful inter- and trans-disciplinary work for ecosystem services research and planning. Recognizing the need for multi-sector collaboration is an important principle of Ecosystem-based Management (Pirot et al., 2005). The results of this study showed the participation of different stakeholders in urban forestry. Among others, there are forest extension officers, local media, fellow urban residents, researchers, NGOs personnel and private

communities. The role of the community was also an important feature in this research and the study analyzed the perception of city residents towards urban forest ecosystem.

By analyzing how different stakeholders are involved in the promotion of urban forest ecosystem, potential stakeholders were determined based on the scores obtained from respondents. The findings showed that forest extension officers from government institutions occupy the first place to provide advices and skills regarding urban forestry to a large percentage of city resident with 64.0%. Regarding the involvement of government institutions in urban forestry, respondents from government institutions stated that their institutions have the following strategies to control the negative pressure of population growth and infrastructure development on urban forest. They have a control over land and land allocation through regular master plan auditing in collaboration with Rwanda Housing Authority and other development sectors to arbitrate the implementation of government policies in equilibrium way. They provide sanctions for those who do not want to comply with the law, and motivate population and residents to use other sources of energy such as biogas digesters, gas stoves, and briquettes. The use of alternative

sources of energy is a strategy to minimize human pressure on forests and is one of the interventions proposed by the government of Rwanda in order to meet the priority 7- Promote sustainable management of the environment and natural resources to transition Rwanda towards a Green Economy- of the National Strategy for Transformation (NST 1, 2017-2024) in urban areas. In respect to how city residents perceive the availability of urban trees in their vicinity, 50.0% of respondents stated that urban trees are very few and showed a need of planting more trees in the study area. The dissatisfaction of city residents about the availability of trees in urban area indicates their need for new urban forests and can be an important information about the presence of free spaces to be planted in their living environment (Blazevska et al., 2012). However, 14.0 percent of respondents stated that trees in their vicinity are too many. This is a important percentage which can be a limiting factor for the improvement of urban forest ecosystem, and can have an implication on residents' participation in promoting urban forest ecosystem as this study revealed a large number (33%) of city residents that did zero forestry activity from August 2017 to July 2018. The remaining 36.0 percent were satisfy with the status quo

neither wanting more trees or want some to be felled. Concerning the preference of city residents regarding relaxation location, the largest percentage (80.0%) of city residents prefers to relax under a tree. Regarding how city residents prioritize some public community development initiatives including urban forestry, the results show that tree planting was the most preferred community development initiative at 60.0% of respondents. This preference may be translated into the need of city residents about more urban trees and the availability of land to be planted in the area. When it comes to the willingness and participation of city residents regarding urban forestry, the finding of this study shows that 88.0% of respondents stated that they can plant and care for the trees. This is a good indicator of the need of city residents about more urban trees in Musanze Secondary City. However, analysis of the main forestry activities done by city residents from August 2017 to July 2018 showed that, except tree planting (done by 37.0% of all respondents), other forestry activities such as weeding, pruning and thinning are not well considered and are done by a low percentage of city residents. They are respectively done by 16.0%, 8.0% and 3.0% of all respondents. These statistics can be a challenging issue for the implementation of National Forest Policy 2010, revised in February 2018, since the Government of Rwanda is calling for the collaboration of the whole population in order to achieve the development of urban forests more than before (National Forest Policy, 2010).

According to the Green Economy Baseline Survey Report in Rwanda (IKI, 2016, Pg 82), the total area covered by forests in the study area is 570.04ha. The number of total residents is 122833 (NISR, 2012). This indicated 47.14 m^2 of area covered by forest and tree resources per capita. In addition, the results of this study indicate the average of 1.61 trees per domestic garden in the study area. The area covered by urban forests per capita in the study area is much greater than 9 m^2 of green space per city dweller which is recommended by the World Health Organization (Kuchelmeister, 1998; Singh et al., 2010). However, this area is too small compared to the area covered by forests per person estimated in developed cities such as Singapore (58.0 m^2/person) and Phoenix in Arizona (100.0 m^2/person) (FAO, 2018). About 104 m^2/ inhabitant is also estimated in 26 large European cities, 80 m^2/ inhabitant in Greater Paris region, and 228 m^2/inhabitant in 22 largest Dutch cities (Konijnendijk, 2003). According to FAO (2018), urban forests have helped to address urban

challenges by increasing the resilience and liveability of urban environments in 15 different- sized cities of various regions around the world. Thus, other cities should replicate, adapt and scale up green strategies such as urban forestry towards sustainable cities.

5 Conclusion

In this study, the involvement of stakeholders and community participation in promoting urban forest ecosystem in Musanze was examined in three dimensions namely: stakeholder's involvement in urban forestry, prioritization of city residents regarding some development initiatives including urban forestry, and willingness and participation of city residents regarding urban forestry. The contact of city residents with extension forest officers from government institutions is an important way of disseminating knowledge and skills regarding the management of urban forest ecosystem in Musanze Secondary City. It is fortunate that Musanze city, which is under pressure of accelerated infrastructure development and population growth, has, at some extent, forests within its boundaries. Its residents are interested in adopting urban forestry at household level and some of them have already planted trees in their domestic gardens. The majority of city residents showed their perception on the availability of urban trees in their vicinity, and demonstrated the need of planting more trees in the city. Among different community development initiatives presented to respondents, tree planting was the most preferred. Respondents indicated a desire and strong will to plant and care trees. However, their positive attitude towards trees may not be necessarily translate into support for more trees in ones' domestic garden but, fortunately, should be an effective support for policy makers, planners and managers to sustain urban environment in Musanze Secondary City.

6 Recommendations

The analysis revealed the need of city residents about more urban trees in their vicinity due to the low availability of urban trees in their vicinity and their interest of living in a good environment. Thus, the planning of forestry activities should intergrate local communities in order to meet their need in an equilibrium way and facilitate a meaningful forest management. Infrastructure development should be coupled with environmental concern in developing areas such as Musanze Secondary City. As the country continues to urbanize, integrating forests and trees into land use planning and urban development strategies is essential for ameliorating city's

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environmental footprint and making progress towards sustainable cities in Rwanda. Since the percentage of respondents receiving advice from fellow urban resident is still low, mobilization groups among city residents are required in order to facilitate efficient transfer of information and skills regarding forest management. It is recommended for Musanze District that the contact of city residents with forest extension officers should be encouraged and focus on the dissemination of skills and improved technologies regarding the management of urban forest.

Further researches in the domain of urban forest in developing cities are required and should analyze the impact of each development initiative on urban forest ecosystem and come up with strategies facilitating the minimization of the conflict between human needs and forest management attitudes. Assessment of ecosystem services that urban forests are providing in the economy of the city and in the welfare of local residents are also required for increasing awareness regarding the benefits of urban forests in sustainable urban development.

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