# Assessment of Factors Influencing Poaching and Impact on Conservation of Nyungwe National Park: A Case Study of Cyato and Rangiro Sectors



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A Dissertation submitted in fulfillment of the Award of Masters Degree in Biodiversity Conservation and Natural Resources Management by the University of Rwanda, College of Science and Technology

Supervisor: Prof.Donat NSABIMANA

June, 2022

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**DECLARATION**

I declare that this dissertation contains my own work except where specifically acknowledged, and it has been passed through the anti-plagiarism system and found to be complaints and this is the approved final version of the thesis:

Jules Cesar DUSHIMIMANA

Reg. No: 216149401

Signature………………….

Date………../…………../…………

This research project has been submitted with my approval as University supervisor.

Signature………………….

Date………../…………../…………

Ass. Prof. Donat NSABIMANA

## DEDICATION

**This dissertation is dedicated to**

My lovely wife Ms. Feliculla MUKABATSINDA

My parent, Brother & sister and friends

## ACKNOWLEDGMENTS

**ABSTRACT**

Poaching continue to be reported by Nyungwe National Park Managers as a challenge to its conservation. This work aimed to assess the relationship between poverty and poaching, community proximity to the park and poaching, main actors involved in poaching related activities and to assess perceptions of local communities on the negative impact of poaching to the conservation of Nyungwe National Park. Primary data were collected using a checklist of questionnaire and secondary data collected by reviewing ranger based monitoring (RBM) data from 2013-2017 associated with their socio-economic data obtained from Districts reports. Data were analyzed using descriptive and analytical statistics and were then processed by using Statistical Package for Social Sciences (SPSS). Although the analysis of all arrested poachers from 2013 to September 2017 showed at 68.3% that poachers are poor and confirmed by the findings from our interviewees in    this study at 75.7% that poverty is the major factors influencing continuous poaching, poaching should be considered as a complex problem because other factors such as community proximity to the park, cultural related issues, commercial poaching and indirect involvement of females were also assessed. Findings from this study have shown that the more community live to the proximity of the park, the more the probability of being involved in poaching is high as more than 60% of arrested poachers were living less than 2km from the edge of Nyungwe National Park. It was also found that people aged between 18 and 40 years are highly involved in poaching related activities but there was also evidence that females are indirectly involved in poaching. At 41%, communities have demonstrated their level of understanding that poaching has caused animal extinction, continuous decline in animal species and anthropogenic fires, with the impact of reducing tourism revenues in NNP. Local communities have proposed some actions that should be undertaken by park managers to reduce continuous poaching such as providing many temporal jobs to the communities adjacent to the edge of the park.

**KEY WORDS***: Community Conservation, Poachers, Nyungwe National Park, Continuous poaching

## LIST OF SYMBOLS AND ACRONYMS

AMC: Akagera Management Company

a.s.l : Above Sea Level

NGO: Non-Governmental Organization

NISR: National Institute of Statistics of Rwanda

NNP: Nyungwe National Park

RBM: Ranger Based Monitoring

RDB: Rwanda Development Board

SPSS: Statistical Package for Social Sciences

Sq Km: Square Kilometer

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# 1. INTRODUCTION

In developing countries, communities living at the vicinity of protected areas have been depending on forest resources for livelihood since the beginning of human existence, as source of cultural items, food, and other forest resources for their livelihood (Crawford, 2012; Munanura et al., 2014). In Rwanda, particularly around Nyungwe National Park (NNP), the increase in number of population has caused land scarcity and consequently caused increased dependence to resources from the forest (Masozera, 2002; Plumptre et al., 2002). A study conducted in Zimbabwe on the empirical regularities in the poverty-environment relationship of rural households has demonstrated that poor households with little income from agriculture may be more dependent on forest (Cavendish, 2000). Similarly, Masozera (2002) indicated that community dependency to NNP is driven by factors such as agricultural activities, access to outside markets and demonstrated that livelihood of younger households and larger families around NNP are more dependent on forest resources.

The Belgian colonial administration has given Nyungwe the status of a forest reserve in 1933, but communities around that forest were not forbidden to utilize it, and thus mining, fire wood cutting, honey collection, poaching of animals, vegetation encroachment and agriculture activities continued in Nyungwe (Fimbel et al., 1994 cited by Plumptre et al., 2002).

Gonzales and Zuniga (2014) have observed that mining in NNP has affected the composition of the Park by clearing the natural trees, removing top soil and organic litter and has led to the modification of water streams with the impact on the nutrient cycling process and forest re-growth in the last 20 years. Between 1958 and 1979 vegetation encroachment followed by agriculture have reduced the initial surface area of NNP from 1141 km$^2$ to 971 km$^2$ ( Masozera, 2002). Firewood and honey collection have caused occurrence of anthropogenic fire that affected about 12% of the whole forest between 1997 and 2003 (Kaplin, 2013). This was influenced by the fact that Nyungwe is located in one of the most densely populated area of Rwanda with an average population density

of 400 people per km$^2$ (Kaplin, 2013). Local communities living around NNP live under subsistence agriculture and particularly those from Cyato and Rangiro Sectors who are in a very remote area where the soil is poorly productive and population has difficulty to access the market (Masozera, 2002). The poor soil leads to poor agriculture production and consequently a high food shortage (Halwart, 2008; Crawford 2012). The National Institute of Statistics of Rwanda (NISR) has documented that about 48.4% of the community in the south western part of Rwanda where NNP is located live under poverty (NISR, 2012) and consequently, these communities find themselves heavily reliant on the natural resources within their proximity seeking for multiples sources of income.

A study conducted in Falgore game reserve in Kano in Nigeria has identified forest resources particularly poaching to be the most dominant forest-dependency in this landscape (Suleiman et al., 2017). In most African countries and Asia, poaching is known to be a serious problem (Library of Congress, 2013). In the recent years, poachers have mainly focused on big animals but currently hunting for illegal bush meat is becoming a larger industry (Library of Congress, 2013). Annually, a lot of animals such as primates, antelope, elephants etc., are killed for bush meat and have led to extinction of many populations of animal species. Many countries have put in place laws that prohibit poaching but their enforcement is still difficult (Library of Congress, 2013). In some countries such as Botswana, Central Africa, Kenya, Mozambique, South Africa, and Tanzania, hunting is allowed to pursuant customary rights or it is legal to hunt in places designated as controlled hunting areas when you possess a hunting license (Library of Congress, 2013)

NNP managers are still reporting poaching as a major threat to biodiversity at a very high intensity (RBM, 2017). The annual reports from NNP managers have revealed that while Rwanda Development Board and the Wildlife Conservation Society tried to invest in socio economic development projects to the Community living in Cyato and Rangiro Sectors, many illegal activities are still encountered in that landscape (Mulindahabi et al., 2010). According to the ranger based monitoring done by Park staff from 2006, more than 227 park illegal users versus 200 in 2016 and about 157 until March 2017 were

arrested (RBM, 2017). Poaching adversely affected vulnerable species such as duikers, bush pigs, while buffalos and elephants were poached at extinction (RBM, 2017). Chimpanzees are being trapped by snares set by poachers inside the Park (Moore et al., 2018). However, despite a third of NNP staffs originate from Rangiro and Cyato sectors; Rangiro is reported to be among the first 4 sectors threatening Nyungwe National Park (RBM, 2017).

Before Nyungwe become a National Park, this forest provided most of the Community's incomes. Among other forest products, poaching of bush meat was an important cultural tradition and was mainly for providing some incomes for local hunters (Masozera, 2002). After Nyungwe was gazetted as a National Park in 2005, law enforcement has stopped illegal activities and resulted in the loss of local financial means that local communities used to get from Nyungwe. After Nyungwe gazettement as National Park, different initiatives like tourism revenues sharing and compensation fund were introduced by RDB and its partners to reduce the conflict, however poaching remained a problem to conservation of NNP (Kaplin, 2013). Community awareness campaign and sensitization events on the value of wildlife and the importance of NNP were introduced to support other existing conservation efforts with different financial supports but poaching remain a crucial problem that need to be understood and attention for the sustainability of any development project in this landscape and particularly the conservation of NNP.

Nevertheless, Cyato -Rangiro landscape has a big number of staff working in conservation and tourism department of RDB at NNP and represent one third of all staff working in the Park and many development projects were implemented to that area, including construction of schools, temporal job provision, but the level of poaching is still high in comparison to other areas surrounding the Park. During 2016, about 13659 snares were identified around all Park and have caused death to 450 animals and 138 hectares experienced anthropogenic fires (RBM, 2016). However, the cause of a high level of continuous poaching remains poorly understood.

After 2005, main research in Nyungwe has focused on the revenue sharing program, ecology, forest restoration, socio-economic aspect and human impact, but less attention has been devoted to factors influencing poaching while it is always reported to be the most dominant threat to biological diversity in NNP (Hanson et al., 2011).

This research will fill that gap by assessing major factors that influence poaching and its impact on the conservation of NNP with the following specific objectives: (i) to assess the relationship between poverty and poaching, (ii) to assess the relationship between poaching and community proximity to the park, (iii) to assess the main actors in poaching and (iv) to assess the perceptions of the local community on the impact of poaching on conservation of Nyungwe National Park.

This study will respond to following questions: (1) to what extent does poverty and community proximity to Nyungwe National Park influence poaching? (2) Why do some people employed by Nyungwe National Park or its partners also have family members participating in poaching? (3) Does people in this area poach for meat consumption, for commercial purposes or for cultural practices? And is there a market for meats from wild animals? (4) Why people are still poaching? And what can be done by park managers and local authorities to stop illegal poaching in this area?

## 2. MATERIALS AND METHODS

### 2.1. Study Area

Nyungwe National Park is the largest tropical mountain rain forest remaining in Central and East Africa and covers an area of 1019 sq km (Plumptre et al., 2002). It is located in the South -Western part of Rwanda with the altitude ranging between 1600 m and 2950 m a.s.l. Contiguous to Kibira National Park, Nyungwe lies between latitude of $2^0$15'and $2^0$55'South, and between 29º00'and 29º30'longitude East, and the annual rainfall ranges between 1600-2200mm per year (Weber, 1989 cited by Plumptre, et al., 2002). Primary data used in this study were collected    in two local sectors landscape neighboring NNP: Cyato and Rangiro, Nyamasheke District in the Western part of NNP (Fig. 1), whereby secondary data analyzed occupied all sectors surrounding the Park.
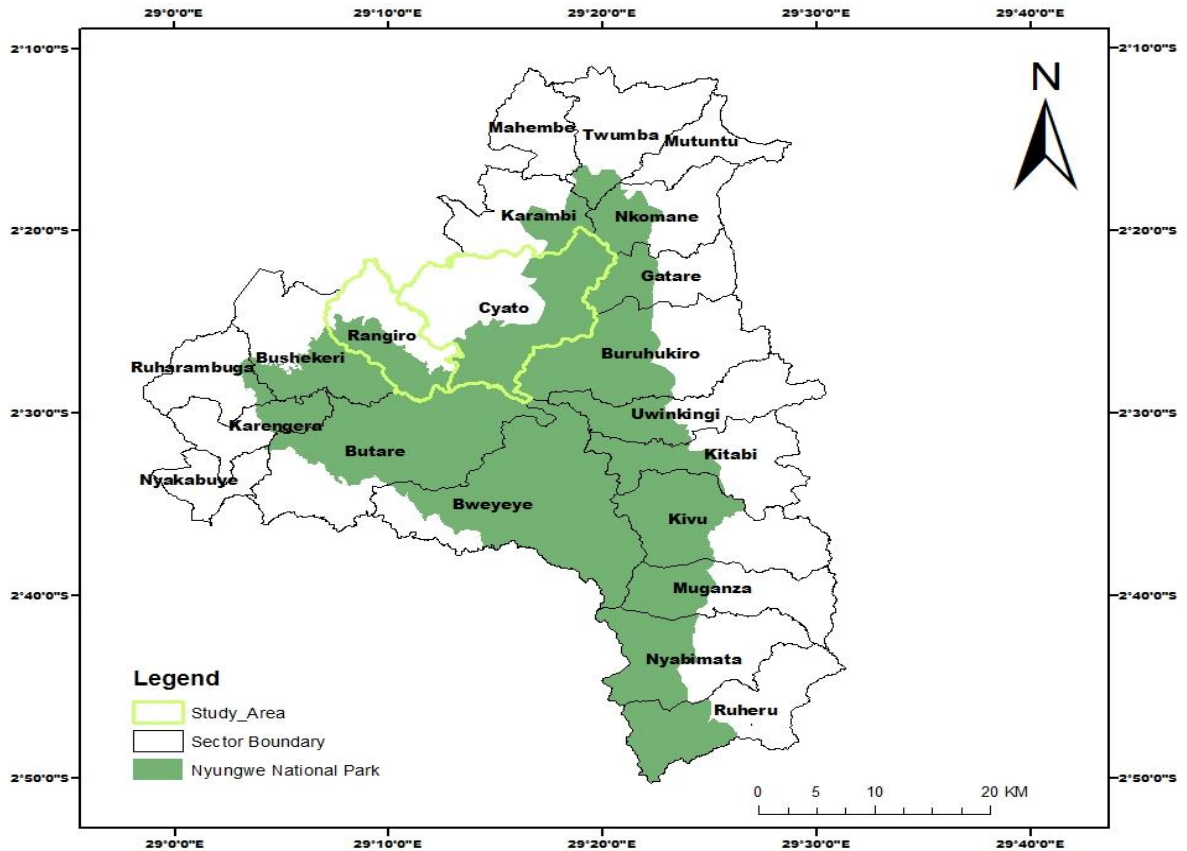


**Figure 1. Map of sectors surrounding NNP and their intersection in the Park.**

The two Sectors were selected based on their level of poaching. In the last five years, from 2013 to September 2017, among 123 poachers arrested in Nyungwe, 17 of them which represent 14% were from these sectors and some of them were arrested more than once. A higher percentage of communities living in these two sectors live in poverty that can be observed through different indicators of life such as low level of education, a big number of family members in most of the households and non-access on basic infrastructures (Plumptre et al., 2004). In comparison to other sectors neighboring Nyungwe where you can find some income generating activities such as tea factories and other companies that can provide job opportunities, agriculture is seen to be the only source of income in this landscape. Mostly their farming is based on perennial crops such as bananas, beans, and sweet potatoes.

Although agriculture is the main activity in these two sectors, food production is insufficient because their farms are poorly productive so that there is no surplus for sales after harvesting period. These two sectors are also located in a very remote area where communities living there

Get to markets after travelling long distances with the impact of having very high prices for non agricultural items (Masozera, 2002; NISR, 2012).

## 2.2. Sampling Procedure

Multistage sampling techniques were used for this study. The first stage was exploratory evaluation of ranger based monitoring data of poachers arrested by park staff from 2013 to 2017. The second stage was to retrieve data of arrested poacher from Cyato and Rangiro sectors in comparison to the number of poachers from other sectors. After this stage, field data were collected by conducting an interview to 300 inhabitants from the two sectors (Table 1). Slovene's formula was followed to avoid biased sample size.

**Table 1. Sample Flame and Sample size**

| s/no | Sector | Cells | Village | Sample flame | Sample size |
|------|--------|-------|---------|--------------|-------------|
| | | | Hangali | 198 | 48 |
| 1 | Cyato | Bisumo | Kayo | 137 | 34 |
| | | | Ntsinduka | 132 | 33 |
| | | Rugali | Gashihe | 169 | 42 |
| | | | Gasumo | 148 | 38 |
| 2 | Rangiro | Banda | Uwakagano | 144 | 36 |
| | | | Rwasa | 99 | 25 |
| | | Gakenke | Kamatsira | 181 | 44 |
| Total | 2 | 4 | 8 | 1208 | 300 |

$n = N/1+ (e^2) N$

Where n is the sample size to be estimated; N is the total population in each village in the study area; e is the significance level (0.05).

## 2.3. Data Collection

During this study both primary and secondary data were collected. Secondary data include social-economic categories of arrested poachers from 2013 up to 2017, their demography, and their frequency in the forest. Primary data was collected from the sample households of different categories of people including ex-poachers through interviews using a structured questionnaire guided by a checklist of questionnaires. The data was collected in October 2017. The questions  asked  included but were not limited to what extent does community proximity to Nyungwe National Park influence continuous poaching, what extent does poverty influence continuous poaching by comparing the arrested poachers and their social-economic categories, what are the main actors involved in the continuous poaching, value of bush meat  consumed and sold by the households, various sources of households income and what are the impact of poaching on the conservation of Nyungwe National Park. Then other questions related to

the demography and socio-economic conditions of the respondents like sex, age, household size, and social category also were considered (Appendix 1).

The questionnaire was administrated by the interviewer and where possible both males and females were given equal chances as responsible respondent but where not possible eldest child were interviewed on the behalf of the parents. Gender balance in terms of participants was respected in order to ensure that all sex and age class are represented.

## 2.4. Data Analysis

The data were collected, summarized and computerized using Microsoft Excel as the questions was prepared on the questionnaire. The data were then presented in the form of descriptive, statistical tables and percentages. Statistical tools such as Statistical Package for Social Science (SPSS) and Microsoft Excel to analyze the qualitative data and their interpretation and discussions were carried out in a manner that they answer the research questions and in the relation to the objective of the study.

## 3. RESULTS

### 3.1. Demographic Characteristics of Respondents

Four categories of people were interviewed in order to get accurate data as presented in Table 2. Respondents were asked whether are some people who still entering in Nyungwe forest. Their answers are summarized in Figure 2 and indicate that the largest respondents (63%) indicated that people are no longer going in the Park.

**Table 2. Category of Respondents and their frequencies**

| Category of respondents | Frequency | Percent |
|---|---|---|
| Ex-poacher | 47 | 15.7 |
| Park staff | 6 | 2.0 |
| Local leader | 20 | 6.7 |
| Local community | 227 | 75.7 |
| Total | 300 | 100.0 |
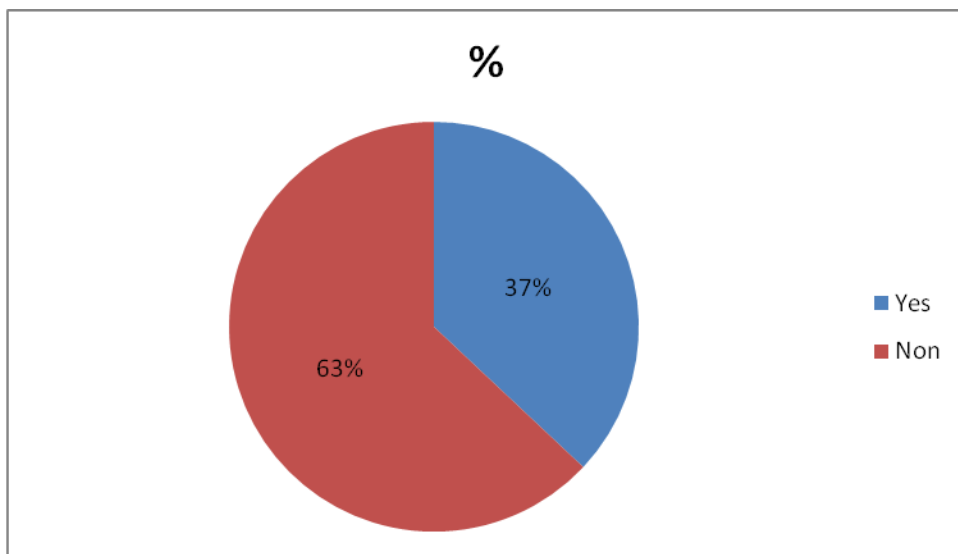


**Figure 2. Illustration of whether people still go in Nyungwe**

## 3.2. Relationship between Poverty and Poaching

To understand at what extent does poverty and community proximity to NNP influence poaching, several questions were asked and respondents point of views are summarized in Figure 3. Majority of the respondents (51.4%) strongly agreed that communities in this landscape poach because they are poor and 24.3% only agreed this statement.
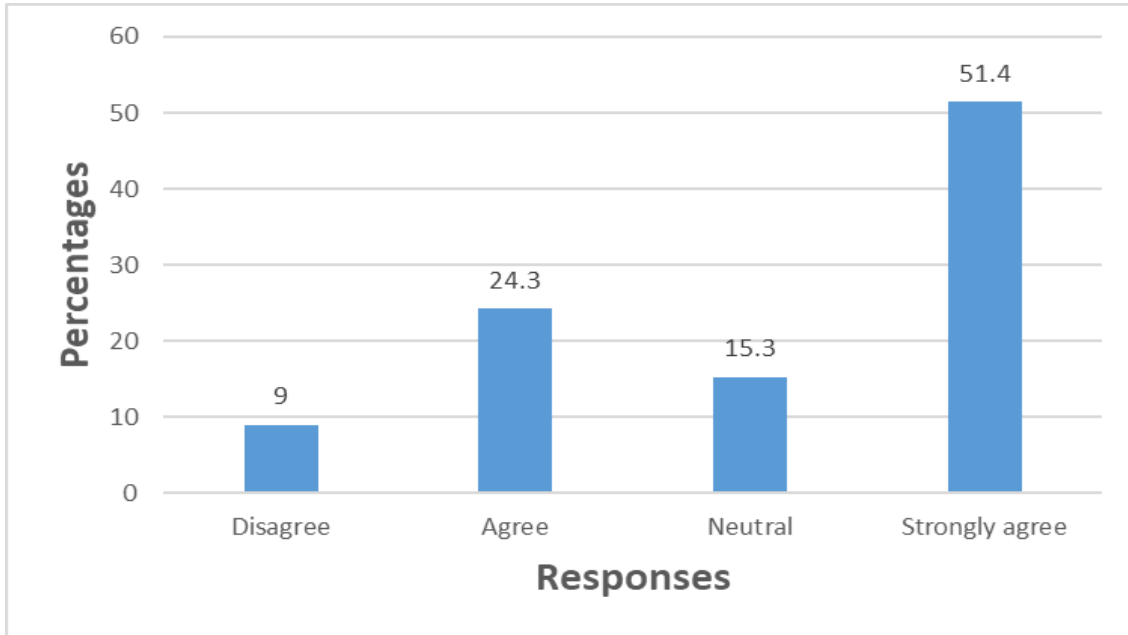


Figure 3. A figure of the statement that people poach because they are poor.

## 3.3. Poaching and Social Economic Categories

Extraction of list of arrested poachers from all sectors bordering the park from the ranger based monitoring data from 2013 to 2017, in combination with their social economic categories from Districts database give a summary presented in Table 3.

Table 3. Social economic categories of arrested poacher from 2013 to 2017.

| Social category | Frequency | Percent |
|---|---|---|
| Missed category | 16 | 13.0 |
| First category | 45 | 36.6 |
| Second category | 39 | 31.7 |
| Third category | 23 | 18.7 |
| Total | 123 | 100.0 |

Table 3 indicate that poverty has influence on poaching because many number of arrested poachers are found in the first and second social categories with a total of 68.3% of all arrested poachers.   Table 4 present the number of household members for arrested poachers.

Then the result presented in Table 4 indicates our findings on size of household and poaching.

Table 4. Number of household members in relation to poaching.

| Number of household member for arrested poacher | Frequency | Percent |
|---|---|---|
| single person | 3 | 2.4 |
| Two persons | 6 | 4.8 |
| Three persons | 14 | 11.4 |
| Four persons | 16 | 13 |
| Five persons | 16 | 13 |
| Six persons | 30 | 24.4 |
| Seven persons | 16 | 13 |
| eight persons | 14 | 11.4 |
| Nine persons | 8 | 6.5 |
| Total | 123 | 100.0 |

To understand whether poaching is commercial based and or it is for meat consumption, community were asked if the meat obtained from poaching is consumed at home or it is taken to the market. Their responses are summarized in Table 5.

Table 5. A table illustrating whether community poach for meat consumption

| Poach only for meat consumption | Frequency | Percent |
|---|---|---|
| Disagree | 8 | 7.2 |
| Neutral | 24 | 21.6 |
| Agree | 51 | 45.9 |
| Strongly agree | 28 | 25.2 |
| Total | 111 | 100.0 |

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Even if there was no public market where meat from NNP is sold, there is evidence that sometimes meat is sold because 27% of the respondents strongly agreed that community poach

For commercial purposes (Figure 4).
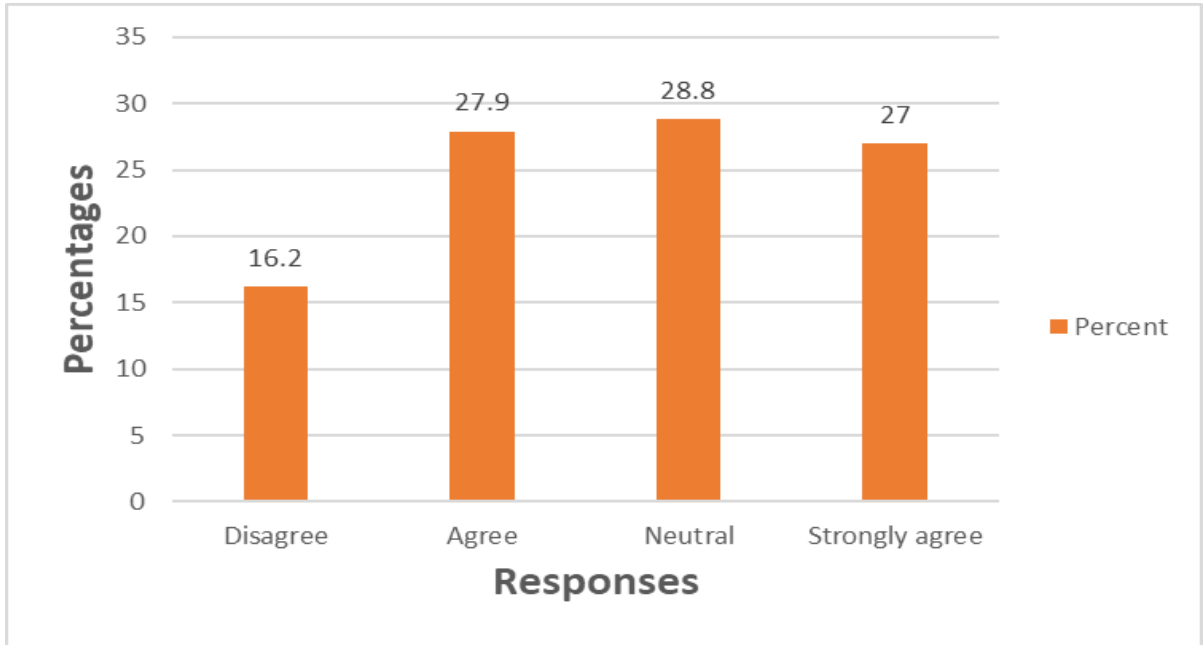


Figure 4**.** A Figure illustrating whether communities poach for commercial purpose.

Review from ranger based monitoring data from law enforcement department of NNP collected from 2013 to September 2017 indicate that some people still go in Nyungwe for poaching while their relatives are employed by RDB or NGOs partnering with the RDB in conservation related activities. As described in Table 6, the findings from our survey in the community have also shown that people still go in the park while their relatives work in conservation activities.

**Table 6.** A table illustrating whether community poach while their relative's works for the Park.

| Poaching while their parents or relatives work for the Park | Frequency | Percent |
|---|---|---|
| Disagree | 10 | 9.0 |
| Neutral | 34 | 30.6 |
| Agree | 58 | 52.3 |
| Strongly agree | 9 | 8.1 |
| Total | 111 | 100.0 |

## 3.4. Relationship between Community Proximity to Park and Poaching

During this study, there was a need to understand whether community poaches as influenced by their proximity to the park. Respondents indicated that poaching by local community is motivated by proximity to the park as the highest number of poachers had their household located at less than 1km of the park (Figure 5).
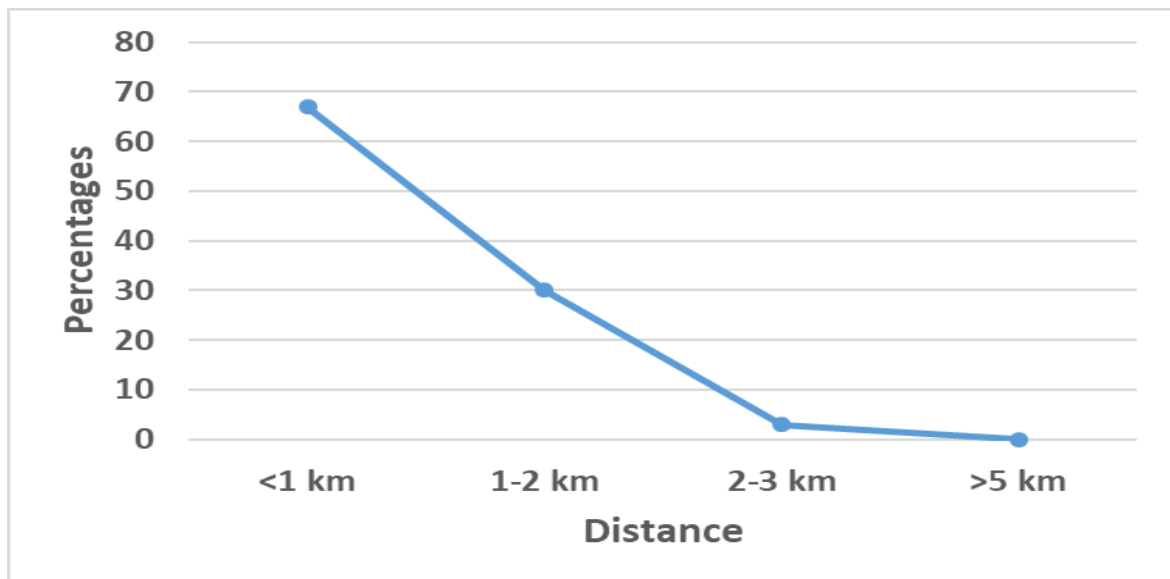


**Figure 5.** Illustrating whether community proximity to the park influence poaching.

## 3.5. Main Actors Involved in Poaching

The findings from this study show that adult people (18-40 years) are most involved in poaching with 58.3% (Figure 6).

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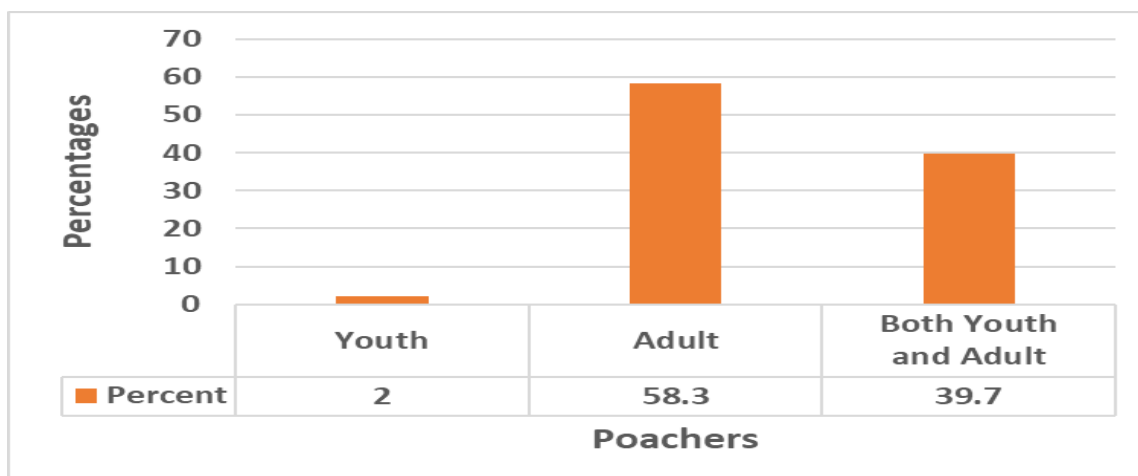
**Figure 6.** A figure illustrating actors mainly involved in poaching.

## 3.6. Perceptions of local community on the impact of poaching on conservation of Nyungwe National Park.

Despite a high level of poaching in the landscape of Cyato and Rangiro sectors, the communities understand that poaching has negative impacts on the conservation of NNP causing extinction of some animal species and continuous death of other animals at a high extent 42% and 34.3% respectively). Community also suggested that poaching cause anthropogenic fires, which consequently kill tree species and may cause decrease in tourism revenues (Table 7)

**Table 7.** A table illustrating perceptions of local communities on the impact of poaching.

| Impacts of poaching | Frequency | Percent |
|---|---|---|
| Decrease tourism revenue | 5 | 1.7 |
| Cause fire in park | 27 | 9.0 |
| Animal extinct | 126 | 42.0 |
| Trees cutting | 39 | 13.0 |
| Animal killing | 103 | 34.3 |
| Total | 300 | 100.0 |

In addition to their level of understanding of the impact of continuous poaching, communities from Cyato and Rangiro sectors have proposed some actions that can be undertaken by park managers and their partners to reduce continuous poaching and its impact on the conservation of Nyungwe National Park (Table 8). Those activities include mainly provision of temporal jobs (46%) and forming cooperatives for ex-poachers (32.7%).

**Table 8.** Illustration of community perception on action to be done by park managers to stop continuous poaching.

| Action to be done by park managers to stop continuous poaching | Frequency | Percent |
|---|---|---|
| Strengthening Education and community outreach program | 27 | 9.0 |
| Providing many temporary job to communities around NNP | 138 | 46.0 |
| Integration of local authorities in conservation | 2 | 0.7 |
| Punishment for poachers | 6 | 2.0 |
| Form cooperatives for ex-poacher | 98 | 32.7 |
| Provide small domestics to community around NNP | 29 | 9.7 |
| Total | 300 | 100.0 |

## 4. DISCUSSION

The finding of this study were analyzed, discussed and interpreted in relation to the objectives of the study by comparing primary data collected on field and secondary data from ranger based monitoring and social economic categories of arrested poachers using district reports. During this study arrested poachers from 2013 to 2017 were 123 in 23 sectors surrounding NNP among which 17 of them representing about 14% of all arrests were from Cyato-Rangiro sectors in the western part of Nyungwe National Park (Moore et al. 2018).

This number of poachers may look less significant, but if associated with the number of snares removed during these periods it gives a view on the number of animals that may have been killed without the removal of those snares. In comparison of poaching status in Akagera National Park managed by Akagera Management Company (AMC) where four years ago nearly 2000 snares were confiscated and 200 poachers arrested and by September 2017 the number have fallen to zero (AMC, 2017), this shows how poaching in Nyungwe need to be address too. During our study, poachers were distributed in most of the villages bordering the park in our study area but mostly two villages from Banda cell had a higher number of arrested poachers.

In this study, these poachers were directly associated with their age, sex, social economic categories to understand whether there is a linkage between poaching and poverty parameters. The analysis for social economic categories of arrested poachers from districts data and ranger based monitoring (RBM, 2017) revealed that a high number of them were in the first and second social economic categories, both categories representing poor families while only a very low number of arrested poachers were in the 3rd category with advanced living condition (Table 3). Similarly, to the findings of Masozera (2002), this may be attributed to the fact that Cyato and Rangiro sectors are located into a very remote area where communities live under subsistence agriculture with no other source of income as documented by NISR (2012) that households that have a heavy reliance on farm wages to generate their income have by far the highest levels of poverty followed by those working in agriculture. There was no big difference between the results from RBM data and those from our interviewees, because a higher number of our respondents have strongly agreed that community in Cyato-Rangiro sectors poach because they are poor

(Figure 3) and this was evidenced by Duff et al. (2013) that there is a direct or indirect linkage between poverty and poaching in Sub-Saharan Africa, as a result of subsistence agriculture without any other income generating activities. Mostly bush meat is somehow taken as one of income generating activities similarly to what were found in Ghana (Obour et al.2016). As previously documented by Masozere (2002) and Plumptre et al (2004), our findings also indicated that households with high number of members are also highly participating in continuous poaching, and this may be due to the fact that the more a high number in household the more a high need in food demand. Therefore, increase in population growth is likely to stimulate poaching in NNP (Population reference bureau 2013; Jacob et al. 2015).

Although a higher number of respondents in our study said that, there was no known market of poached meat and even if poaching for only meat consumption may pose a very little impact to the conservation of biodiversity as compared to the large scale commercial oriented poaching there is a probability that a hidden market exists. This tremendous existence of market for poached meat in NNP is justified by the fact that some of our respondents suggested that females participate in poaching by selling meat poached by their husbands (Appendix 2) and similar results were found in Greece (Bell et al., 2005).

However, our findings have also shown that the more people are very close to the edge of the park the more the probability to be involved in poaching increases. This means that there is a relationship between poaching and the community proximity to the park. In most of the cases a higher percentage of our respondents (Figure 5) were ranging between 1 to 2 km close to the edge of the forest which confirmed the ranger based monitoring data, where also a higher number of arrested poachers were living in less than 2 km away from the edge of the park. As demonstrated by Lotter et al. (2016), it may therefore, require an increase in park staff to be able to reduce continuous poaching because the whole park is surrounded by communities.

Although there was no female arrested in Nyungwe National Park for the last five years doing poaching related activities, the results from our study revealed evidence that a certain number of females are indirectly involved in poaching activities as they pack food

for their husband when going in the forest, females also sale meat poached by their husband and they cook that meat. This kind of involvement is not highly considered but once discouraged it may reduce a number of people going in Nyungwe for poaching.

Other zone of attention in our study was to explore whether there are no community members participating in poaching while their relatives are employed by the national park or its partners. Well known cases were reviewed in the ranger based monitoring and were proved by a number of our respondents (Table 6). Our respondents said that the reason behind this is that some of these communities don't find direct benefit from the income of their relatives working in the national park. The finding from this study in comparison to the RBM data from 2013 to September 2017 have also shown that adult people (Figure 6) are the main actors in poaching. This may be explained by the fact that people at the age between 18 and 40 are still strong enough to walk long distances in the forest and to fight against park ranger willing to arrest them.

Beyond a focus on factors influencing poaching we wanted to understand if at least communities in Cyato-Rangiro sectors know the impact of poaching on the conservation of NNP. A high number of the respondents demonstrated that poaching has caused animal to extinct (Table 7) similarly to what was found by Henry et al. (2012) and has caused animals population decline (Arevalo et al., 2016), whereby others know that poaching causes anthropogenic fire associated with loss of different trees species (Dobson et al. 2005) and they also mentioned that poaching may results in reduction of tourism revenues in the park (Obour et al., 2016).

However, a high number of respondents in our study suggested that offering more temporary job to communities surrounding the park, creating more cooperative of ex-poachers, provision of domestic animals and involvement of local authorities at the villages level in conservation activities will be a viable solution to stop continuous poaching in NNP ( Shane 2014). This can be clearly understood because in other areas surrounding NNP, there is availability of some income generating activities such as tea plantations, hotels and lodges, which provide alternatives to the communities around NNP. But also, our respondents suggested that enforcement of punishment for arrested poachers (Mahesh, 2005 and Shamin,2016) can also reduce continuous poaching.

## 5. CONCLUSIONS AND RECOMMENDATIONS

This study explored the major factors influencing continuous poaching in Cyato-Rangiro Sectors and the impact on the conservation of Nyungwe National Park. Our analysis identified different factors such as poverty, community proximity to the park, cultural issues, meats consumption and marketing. Although poaching is not only influenced by one factor, all factors are interconnected and are centered to poverty and thus was seen as the major factor influencing continuous poaching.

We would therefore recommend that whoever comes with a project in Cyato-Rangiro sectors should focus mainly on poorest community members and all projects should be providing enough temporal jobs. Strengthening education and outreach program in Cyato- Rangiro should be among the Park's priorities. Local authorities should be directly involved in most of the park operations because they are key persons to know and advise all people directly or indirectly involved in poaching. There should be a deep study that analyzes all parameters of poverty to clearly reconfirm that poverty is the major factors influencing continuous poaching.

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**APPENDIX**

**Apendix 1. RESEACH QUESTIONAIRE**

**RESEARCH PROJECT DESCRIPTION**

I am DUSHIMIMANA Jules Cesar a master's student at University of Rwanda. The research project that I am asking you to participate in today will allow the park managers to know the major factors that influence continuous poaching in Nyungwe National Park (NNP) and the perception of the local community on the impact of poaching to the conservation of NNP. You have been randomly selected from the community to be a respondent. Privacy is key principle to this survey. No information you provided will be attributed to you. There is no wrong answer; most importantly candidate and honest answer are the most useful for the completion of this stud. The result from this study can be shared with you if you would like too. Any question to this survey contact DUSHIMIMANA Jules Cesar at 0788629410 or juduce@gmail.com, julescesar.dushimimana@rdb.rw then Prof. Donat NSABIMANA at 0788741619 or D.NSABIMANA@ur.ac.rwI.

GENERAL INFORMATION ABOUT THE RESPONDENT

a) Address of the respondent……………….

b) Category of the respondent (ex-poacher, park staff, local leader, local community etc)…………………….

c) Sex: Male    or Female ………………..

d) Age: ‹18   , 18-40, ›40

e) How far is your home from Nyungwe National Park…………………..

f) What is your social category (icyiciro cy'ubudehe)…………………….

g) How many are you in your household...........................

      II.RESOURCES USE

7.      Do people in this area still go in Nyungwe National Park? If not go to the question 2 bellow. If yes go to the question 3.

8.      If no, why they don't go there?

    a) Fear of rangers

    b) Fear of animals

    c) Too far for them

    d) Other, specify

9.      If yes, Please indicate your level of agreement with the statement bellow.

| No | Statement | Strongly agree | Agree | Neutral | Disagree |
|----|-----------|----------------|-------|---------|----------|
| 1 | Local community from this area are still going in Nyungwe for poaching | | | | |
| 2 | Local community in this area poach because they are poor | | | | |
| 3 | Local community in this area poach as motivated by their proximity to Nyungwe National Park | | | | |
| 4 | some local community poach in Nyungwe while their parent or relatives work for Nyungwe National Park | | | | |
| 5 | Local community poach only for meat consumption | | | | |
| 6 | Poaching in this area is cultural based | | | | |
| 7 | Local community poach for commercial purpose | | | | |

III.ANSWER IN DETAILS

I) what makes people having their relatives working in the park also participate in poaching?

…………………………………………………………………………………………………

ii) Is there a market for bush meat poached in Nyungwe National Park? If yes where is that market?

…………………………………………………………………………………………………

iii) What do you think can be done by Nyungwe National Park managers for the community around              here              to              stop              poaching?

………………………………………………………………………………………………

iv)  Do you know any impact caused by poaching on the conservation of Nyungwe National Park? …………………………………………………………………………………………

v) Who do you think are the main actors involved in poaching in this area?

………………………………………………………………………………………………

vi) Are females also involved in poaching in this area? If yes how are they involved? If not why they are not involved

……………………………………………………………………………………………

Thank you for your fruitful participation!!

**APENDIS 2. Other related data (information)**

**Reason they don't go in park**

|  | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Valid | 111 | 37.0 | 37.0 | 37.0 |
| Fear of rangers | 68 | 22.7 | 22.7 | 59.7 |
| Fear of animals | 1 | .3 | .3 | 60.0 |
| Fear of punishment | 10 | 3.3 | 3.3 | 63.3 |
| knows importance of environment | 110 | 36.7 | 36.7 | 100.0 |
| Total | 300 | 100.0 | 100.0 | |

**Existance of market for poached meat**

|  |  | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 8 | 2.7 | 2.7 | 2.7 |
|  | Non | 275 | 91.7 | 91.7 | 94.3 |
|  | neutral | 17 | 5.7 | 5.7 | 100.0 |
|  | Total | 300 | 100.0 | 100.0 | |

**Location of market for poahed meat**

|       |               | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|---------------|-----------|---------|---------------|--------------------|
| Valid | Hidden market | 8         | 2.7     | 2.7           | 2.7                |
|       | No market     | 275       | 91.7    | 91.7          | 94.3               |
|       | Neutral       | 17        | 5.7     | 5.7           | 100.0              |
|       | Total         | 300       | 100.0   | 100.0         |                    |

**Females involved in poaching activity**

|       |       | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-------|-----------|---------|---------------|--------------------|
| Valid | Yes   | 146       | 48.7    | 48.7          | 48.7               |
|       | Non   | 154       | 51.3    | 51.3          | 100.0              |
|       | Total | 300       | 100.0   | 100.0         |                    |

**How females involved in poaching activity**

|       |                                    | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|------------------------------------|-----------|---------|---------------|--------------------|
| Valid |                                    | 159       | 53.0    | 53.0          | 53.0               |
|       | Food packaging to their husband    | 65        | 21.7    | 21.7          | 74.7               |
|       | They sale poached meat             | 61        | 20.3    | 20.3          | 95.0               |
|       | Poached meat cooking               | 15        | 5.0     | 5.0           | 100.0              |
|       | Total                              | 300       | 100.0   | 100.0         |                    |

**Sectors of arrested poachers**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Buruhukiro | 7 | 5.7 | 5.7 | 5.7 |
| | Burukukiro | 1 | .8 | .8 | 6.5 |
| | Burundais (KIBITOKI) | 1 | .8 | .8 | 7.3 |
| | Burundi | 1 | .8 | .8 | 8.1 |
| | Butare | 18 | 14.6 | 14.6 | 22.8 |
| | Bweyeye | 32 | 26.0 | 26.0 | 48.8 |
| | Cyato | 3 | 2.4 | 2.4 | 51.2 |
| | Gatare | 5 | 4.1 | 4.1 | 55.3 |
| | Karambi | 3 | 2.4 | 2.4 | 57.7 |
| | Karengera | 9 | 7.3 | 7.3 | 65.0 |
| | Kitabi | 9 | 7.3 | 7.3 | 72.4 |
| | Kivu | 5 | 4.1 | 4.1 | 76.4 |
| | Muganza | 6 | 4.9 | 4.9 | 81.3 |
| | Nkomane | 2 | 1.6 | 1.6 | 82.9 |
| | Nyakabuye | 1 | .8 | .8 | 83.7 |
| | Rangiro | 12 | 9.8 | 9.8 | 93.5 |
| | Rwambogo | 1 | .8 | .8 | 94.3 |
| | Tare | 1 | .8 | .8 | 95.1 |
| | Uwinkingi | 6 | 4.9 | 4.9 | 100.0 |
| | Total | 123 | 100.0 | 100.0 | |

**Illegal activities done by arrested poachers**

|  |  | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Poaching | 10 | 8.1 | 8.1 | 8.1 |
|  | Poaching/Mining | 1 | .8 | .8 | 8.9 |
|  | Snares | 40 | 32.5 | 32.5 | 41.5 |
|  | Mining | 5 | 4.1 | 4.1 | 45.5 |
|  | Snares/ drugs | 1 | .8 | .8 | 46.3 |
|  | Cultivate and Poaching | 2 | 1.6 | 1.6 | 48.0 |
|  | Paoching | 3 | 2.4 | 2.4 | 50.4 |
|  | Poaching | 59 | 48.0 | 48.0 | 98.4 |
|  | Poaching/Mining | 2 | 1.6 | 1.6 | 100.0 |
|  | Total | 123 | 100.0 | 100.0 |  |

**Areas arrested**

|  |  | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Hidden information | 6 | 4.9 | 4.9 | 4.9 |
|  | Bigano | 2 | 1.6 | 1.6 | 6.5 |
|  | Bigwagwa | 1 | .8 | .8 | 7.3 |
|  | Binazi | 2 | 1.6 | 1.6 | 8.9 |
|  | Bisharara | 1 | .8 | .8 | 9.8 |
|  | Bunyovu | 1 | .8 | .8 | 10.6 |
|  | Bushigishigi | 4 | 3.3 | 3.3 | 13.8 |
|  | Bushigo | 2 | 1.6 | 1.6 | 15.4 |
|  | Busimbukiro | 1 | .8 | .8 | 16.3 |
|  | Bwasovu | 1 | .8 | .8 | 17.1 |
|  | Bweyeye | 1 | .8 | .8 | 17.9 |

| | | | | |
|---|---|---|---|---|
| Centre Bweyeye | 1 | .8 | .8 | 18.7 |
| Cyazi | 1 | .8 | .8 | 19.5 |
| Cyimbeho | 1 | .8 | .8 | 20.3 |
| Cyurugeyo | 1 | .8 | .8 | 21.1 |
| Gashinge | 1 | .8 | .8 | 22.0 |
| Gikungu | 1 | .8 | .8 | 22.8 |
| Gipimo | 2 | 1.6 | 1.6 | 24.4 |
| Gishinge | 1 | .8 | .8 | 25.2 |
| Gishugushu | 1 | .8 | .8 | 26.0 |
| Gitemwe | 1 | .8 | .8 | 26.8 |
| Gititi | 2 | 1.6 | 1.6 | 28.5 |
| Gitoki | 2 | 1.6 | 1.6 | 30.1 |
| Kabyirando | 1 | .8 | .8 | 30.9 |
| Kabyiranto | 1 | .8 | .8 | 31.7 |
| Kanyinya | 1 | .8 | .8 | 32.5 |
| Katabuguza | 4 | 3.3 | 3.3 | 35.8 |
| Kayogoro | 1 | .8 | .8 | 36.6 |
| Kibonajoro | 5 | 4.1 | 4.1 | 40.7 |
| Kibumba | 1 | .8 | .8 | 41.5 |
| Kidondori | 1 | .8 | .8 | 42.3 |
| Kimena | 4 | 3.3 | 3.3 | 45.5 |
| Kinzobe | 1 | .8 | .8 | 46.3 |
| Kivobo | 1 | .8 | .8 | 47.2 |
| ku Gashinge | 1 | .8 | .8 | 48.0 |
| Ku gashishi | 2 | 1.6 | 1.6 | 49.6 |
| Ku Kiganza | 1 | .8 | .8 | 50.4 |
| Ku mugano | 1 | .8 | .8 | 51.2 |
| Ku mwumba | 1 | .8 | .8 | 52.0 |
| ku ntango | 2 | 1.6 | 1.6 | 53.7 |
| Kurukubo | 1 | .8 | .8 | 54.5 |
| Misave | 1 | .8 | .8 | 55.3 |
| Mu dutare | 1 | .8 | .8 | 56.1 |

| | | | | |
|---|---|---|---|---|
| Mu Mwumba | 1 | .8 | .8 | 56.9 |
| Mu wankungu | 1 | .8 | .8 | 57.7 |
| Mu Wisege | 1 | .8 | .8 | 58.5 |
| Mubivoka | 1 | .8 | .8 | 59.3 |
| Mubuga | 2 | 1.6 | 1.6 | 61.0 |
| Mucyanya | 4 | 3.3 | 3.3 | 64.2 |
| Mwumba | 1 | .8 | .8 | 65.0 |
| Ngabwe | 1 | .8 | .8 | 65.9 |
| Nyabikongoro | 4 | 3.3 | 3.3 | 69.1 |
| Nyabishwati | 3 | 2.4 | 2.4 | 71.5 |
| Nyamugendwa | 1 | .8 | .8 | 72.4 |
| Nyembuto | 2 | 1.6 | 1.6 | 74.0 |
| Pingura by Army | 3 | 2.4 | 2.4 | 76.4 |
| Rubyiro | 2 | 1.6 | 1.6 | 78.0 |
| Rugazi | 2 | 1.6 | 1.6 | 79.7 |
| Ruhinamavi | 1 | .8 | .8 | 80.5 |
| Ruhindu | 3 | 2.4 | 2.4 | 82.9 |
| Ruhombo | 1 | .8 | .8 | 83.7 |
| Shava | 1 | .8 | .8 | 84.6 |
| Sigira | 2 | 1.6 | 1.6 | 86.2 |
| Tangaro | 2 | 1.6 | 1.6 | 87.8 |
| Uwabapiki | 1 | .8 | .8 | 88.6 |
| Uwagakungu | 2 | 1.6 | 1.6 | 90.2 |
| Uwagashihe | 1 | .8 | .8 | 91.1 |
| Uwamacu | 2 | 1.6 | 1.6 | 92.7 |
| Uwankikabahizi | 3 | 2.4 | 2.4 | 95.1 |
| Uwaruhitamu | 1 | .8 | .8 | 95.9 |
| Uwasekuboko | 2 | 1.6 | 1.6 | 97.6 |
| Uwinkingi | | | | 98.4 |
| | 1 | .8 | .8 | |
| Uwisuri | | | | 100.0 |
| | 2 | 1.6 | 1.6 | |
| Total | 123 | 100.0 | 100.0 | |

**Years correspondence to arrested poachers**

|  |  | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 2013 | 7 | 5.7 | 5.7 | 5.7 |
|  | 2014 | 22 | 17.9 | 17.9 | 23.6 |
|  | 2015 | 25 | 20.3 | 20.3 | 43.9 |
|  | 2016 | 50 | 40.7 | 40.7 | 84.6 |
|  | 2017 | 19 | 15.4 | 15.4 | 100.0 |
|  | Total | 123 | 100.0 | 100.0 |  |