REPORT

Baseline study on the level of public awareness on Biodiversity conservation around protected areas in Rwanda

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LIST OF ACRONYMS AND ABBREVIATIONS

AHS	**Agriculture Household Survey**
ANP	Akagera National Park
CBD	Convention on Biological Diversity
COVID-19	Coronavirus Disease 2019 Pandemic
CSOs	Civil Society Organisations
EoLG	Employee of Local Government
GMNP	Gishwati-Mukura National Park
KBA	Key Biodiversity Areas
Km	Kilometer
Km²	Square Kilometer
NBSAP	National Biodiversity Strategies and Action Plan
NGO	Non-Governmental Organisation
NNP	Nyungwe National Park
ORTPN	Rwanda Office of Tourism and National parks
PA	Protected Area
REMA	Rwanda Environment Management Authority
VNP	Volcanoes National Park

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EXECUTIVE SUMMARY

Over the last decades, the Government of Rwanda together with environmental stakeholders worked tirelessly to engage local communities in sustainable protection and management of protected areas. To achieve that, many public awareness programs were implemented to raise knowledge and skills, inspire positive attitudes and behavior, and motivate community members to become conservation partners. However, there is a gap in understanding the holistic impact of these awareness programs. Hence, this study was undertaken with the aim to assess the level of awareness, attitude and community participation in supporting biodiversity conservation around protected areas in Rwanda. The two-stage sampling method was used; the first was to select sample cells around five protected areas (ANP, GMNP, NNP, Rugezi wetland and VNP), where 66 of 123 cells were selected. In the second stage, 2,160 respondents were selected from the selected cells i.e. 432 respondents per protected area. Data were collected using a systematic questionnaire developed in CTO Software, and descriptive data analysis and statistical tests were performed by using STATA.

The level of awareness, attitude and community participation in supporting biodiversity conservation is generally low at all protected areas, but relatively higher at the VNP (10.185%) and lower at Rugezi wetland and NNP (6.713% each). It varies with gender, age segments, level of education, leadership position, and professional categories of respondents; higher in men (10.877%) than women (4.310%), higher among people aged 34-49 years old (10.847%) and lower among people above 65 years old (19.980%), higher among university graduates (40.909%) and lower among the people who have no formal education (3.255%), higher among the employees of the local government and teachers (50%, each), and lower among farmers and church leaders (6.216%, 0.00% respectively).

Future awareness activities should prioritize the use of more inclusive means of communication; such as considering the use of Kinyarwanda and interpersonal communication approaches. The message should be technically and scientifically relevant to bridge the gap of skills and knowledge transfer for

inspiring community's commitment and participation in addressing conservation issues at local levels. Moreover, the awareness raising campaigns/programs contents should be tailored to a specific group and the conservation stakeholders should use interactive communication methods rather than push and pull methods. Conservation stakeholders conducting public awareness on biodiversity conservation should refer to National Strategies and priorities to plan programs, projects, activities, and portfolios as well as setting clear goals for successful public awareness in Rwanda with tangible and measurable Key Performance Indicators.

TABLE OF CONTENTS

..... 1

LIST OF ACRONYMS AND ABBREVIATIONS I

ACKNOWLEDGEMENT II

EXECUTIVE SUMMARY III

TABLE OF CONTENTS V

LIST OF FIGURES AND TABLES VI

LIST OF ANNEXES VII

1. GENERAL INTRODUCTION 1

2. METHODOLOGY 3

2.1. STUDY AREA DESCRIPTION 3

2.2. RESEARCH TECHNIQUES 6

2.3. CONSTRUCTION OF INDICATORS 7

3. RESULTS 10

3.1. SOCIO-DEMOGRAPHIC INFORMATION OF RESPONDENTS 10

3.2. GENERAL PERCEPTIONS OF RESPONDENTS TOWARDS BIODIVERSITY AND ITS CONSERVATION ... 11

3.2.1. Biodiversity Awareness *12*

3.2.2. Role of Protected Areas *13*

3.3. STAKEHOLDERS' CONTRIBUTIONS IN THE PROTECTION OF PAS 14

3.4. RESULTS PRESENTATIONS IN RELATION TO PUBLIC AWARENESS INDICATORS 15

4. CONCLUSION 20

5. RECOMMENDATIONS 22

5. ANNEXES ..... A

ANNEX 1: QUESTIONNAIRE ..... A

ANNEX 2: TARGET CELLS AROUND PROTECTED AREAS ..... E

ANNEX 3: MAPS OF TARGET CELLS AROUND PROTECTED AREAS ..... H

LIST OF FIGURES AND TABLES

Figure 1: Study Area 5

Table 1: *Socio-demographic characteristics of respondents (%)* 10
Table 2: *Awareness on the term Biodiversity (%)* 12
Table 3: *Knowledge on human threats to biodiversity (%)* 12
Table 4: *Awareness on the role of Pas (%)* 13
Table 5: *Awareness on free access to PAs (%)* 13
Table 6: *Respondents participation in conservation (%)* 14
Table 7: *Motivation in conservation (%)* 15
Table 8: *Communication channels and utilized languages in public awareness (%)* 15
Table 9: *Public awareness indicators scored by protected areas (%)* 16
Table 10: *Public awareness indicators scored against gender (%)* 17
Table 11: *Public awareness indicators scored against age of respondents (%)* 17
Table 12: *Public awareness indicators scored against the level education of respondents (%)* 18
Table 13: *Public awareness indicators scored against professional categories of respondents (%)* 18
Table 14: *Public awareness indicators scored against the leadership positions of respondents (%)* 19

LIST OF ANNEXES

Annex 1: *Questionnaire* ..... *a*
Annex 2: *List of target Cells around Protected Areas* ..... *e*
Annex 3: *Maps of Target cells around Protected Areas* ..... *h*

1. GENERAL INTRODUCTION

Rwanda ratified the Convention on Biological Diversity (CBD) on 18th March 1995. The Aichi target 1 of the CBD stresses on the important role of member countries in raising communities' awareness on the values of biodiversity and steps they can take to conserve and use it sustainably. In that context, the Government of Rwanda developed strategies and action plans to attain the convention's targets. The revised National Biodiversity Strategy and Action Plan of Rwanda (NBSAP) clearly indicates the commitment towards biodiversity conservation and emphasizes on the importance of information transfer in achieving the sustainable use of biodiversity. This is achieved through developing appropriate skills, knowledge, attitudes, and best practices that forms the basis of public awareness to influence the local communities for undertaking actions of each element of biodiversity conservation. Such actions consequently become the inputs for the improvement of conservation initiatives that benefit both people and Nature.

In Rwanda, many public awareness activities have been conducted over the last decades, especially around protected areas. Public, civil, and private institutions contributed a lot in mainstreaming biodiversity conservation among local communities. However, there is a gap in assessing the impact of these activities at individual, institutional and country levels mainly in areas adjacent to protected areas. This poses challenges in planning, implementation, monitoring, and evaluation of public awareness programmes, project, and activities around protected areas. There is an urgent need of establishing the baseline data to help conservation stakeholders and practitioners to set achievable, measurable, and realistic targets in their portfolio, programmes, and projects from the design to implementation through monitoring. Thus, in 2019, with financial support from the Royal Belgian Institute of Natural Sciences, Nature Rwanda has developed seven main indicators that can help to assess the level of awareness, attitude, and community participation in supporting biodiversity conservation in Rwanda. In

2020, the Royal Belgian Institute of Natural Sciences supported Nature Rwanda to assess the level of awareness, attitude, and community participation in supporting biodiversity conservation around protected areas in Rwanda in order to establish the baseline using indicators developed in 2019.

2. METHODOLOGY

2.1. Study area Description

This study was conducted in the communities adjacent to the five protected areas in Rwanda namely, Akagera National Park (ANP), Gishwati-Mukura National Park (GMNP), Nyungwe National Park (NNP), Rugezi wetland and Volcanoes National Park (VNP). All these protected areas are among the seven declared Important Birds and Biodiversity Areas (IBAs) in Rwanda by Birdlife International[1], while VNP, GMNP, and NNP are also classified as key biodiversity areas (KBAs). The VNP and GMNP are biosphere reserves[2] and Rugezi wetland is the only RAMSAR site[3] in Rwanda.

The Volcanoes National Park (VNP) is situated in the North of Rwanda bordering the Democratic Republic of Congo and Uganda, and covers approximately 160 km^2 of medium and high altitudes towards the south of the Virunga-Volcanoes chain. It is rich in biodiversity and is home to Albertine Rift Endemic and Endangered Eastern Mountain gorillas (*Gorilla beringei beringei*), Golden monkey (*Cercopithecus mitis kandti*). The VNP inhabits a high number of Albertine Rift endemic fauna and flora species. It has 115 mammals' species, 187 bird species, 27 reptile and amphibian species, and 33 arthropod species. It has 13 orchid species protected by CITES, and 3 endangered reptile species. It also has 245 plant species, 17 of which are threatened as per IUCN red list[4].

The Akagera National Park (ANP) covers an area of 1,122 km^2 and is situated in the eastern province of Rwanda on the border with Tanzania. The ANP includes savannas intersected by strips of forests and important wetlands of the Akagera River, and its depression dotted with lakes and floating swamps. The ANP has an

[1] Kanyamibwa, S. (1995) Revue de littérature relative à l'identification des zones importantes pour la conservation des oiseaux en Afrique tropicale francophone. Birdlife International
[2] https://en.unesco.org/biosphere/africa
[3] https://www.ramsar.org/wetland/rwanda
[4] https://en.unesco.org/biosphere/africa/volcans

important diversity of birds (525 species known) and more than 50 species of large mammals typical of East African savannahs as well as more than 900 species of plants[5] [6]. Key large mammals include African elephant (*Loxodonta africana*), African buffalo (*Syncerus caffer*), Giraffe (*Giraffa camelopardalis*), Hippopotamus (*Hippopotamus amphibious*) and Eland (*Taurotragus oryx*)[7]

The Nyungwe National Park (NNP) is located in the south-west of Rwanda along the Congo-Nile divide. It covers a total area of 1,019 km², falls within the Albertine Rift and is contiguous with the Kibira National Park across the international border in Burundi. It is the oldest rainforest in Africa and it is a home to Endangered Eastern chimpanzees (*Pan troglodytes schweinfurthii*). This park is a biodiversity hotspot which hosts a high diversity of flora and fauna. Its biodiversity comprises thirteen primate species (20% of all primate species in Africa), 275 bird, 85 mammal, 32 amphibian, 38 reptile and 1068 plant species. Furthermore, there are 47 flowering plant species endemics to this forest (e.g. *Impatiens nyungwensis, Afromomum wuertii, Diaphananthe delepierreana, Ypsilopus liae*, etc.) and 280 species endemic to the Albertine Rift[8] .

The Gishwati Mukura National Park (GMNP) is located in the western province and falls along the Congo-Nile Divide. It is made of two separate Natural forests (Gishwati Natural forest and Mukura National Forest and was declared a National Park in 2016, and it covers an area of 34 km². Gishwati is home to a group of 20 Eastern chimpanzees (*Pan trodlodytes schweinfurthii*) which live alongside golden monkeys, L'Hoest's and Blue Monkeys. Birds are well represented too, 232 species have been seen at Gishwati and 163 at Mukura, among them Albertine Rift

[5] Kanyamibwa, S. (1998). Impact of war on conservation: Rwandan environment and wildlife in agony. *Biodiversity & Conservation*, *7*(11), 1399-1406.
[6] Vande Weghe, J. P., & vAnDe WeGHe, G. (2011). Birds in Rwanda: an atlas and handbook. *Rwanda Development Board, Kigali*.
[7] Rwanda: State of Environment and Outlook Report 2015. Rwanda Environment Management Authority, P.O. Box 7436 Kigali, Rwanda
[8] Rwanda: State of Environment and Outlook Report 2015. Rwanda Environment Management Authority, P.O. Box 7436 Kigali, Rwanda

Endemic species and forest specialists. The vegetation on the reserve includes three species of bryophytes (*Porella abyssinica*, *Leptoscyphus expansus* and *Cololejeunea parva*) that occur exclusively in the Giswati Forest[9]. This Park is unique to be the home of Endangered Eastern chimpanzees and Golden Monkey at the same time[10].

Rugezi wetland is a high-altitude wetland located in an inundated valley in the north of Rwanda, to the East of Lake Burera and close to the Uganda border[11]. This site is important for Endangered Grey Crowned Cranes, and Albertine Rift Endemic and Endangered Grauer's swamp warbler[12] [13].

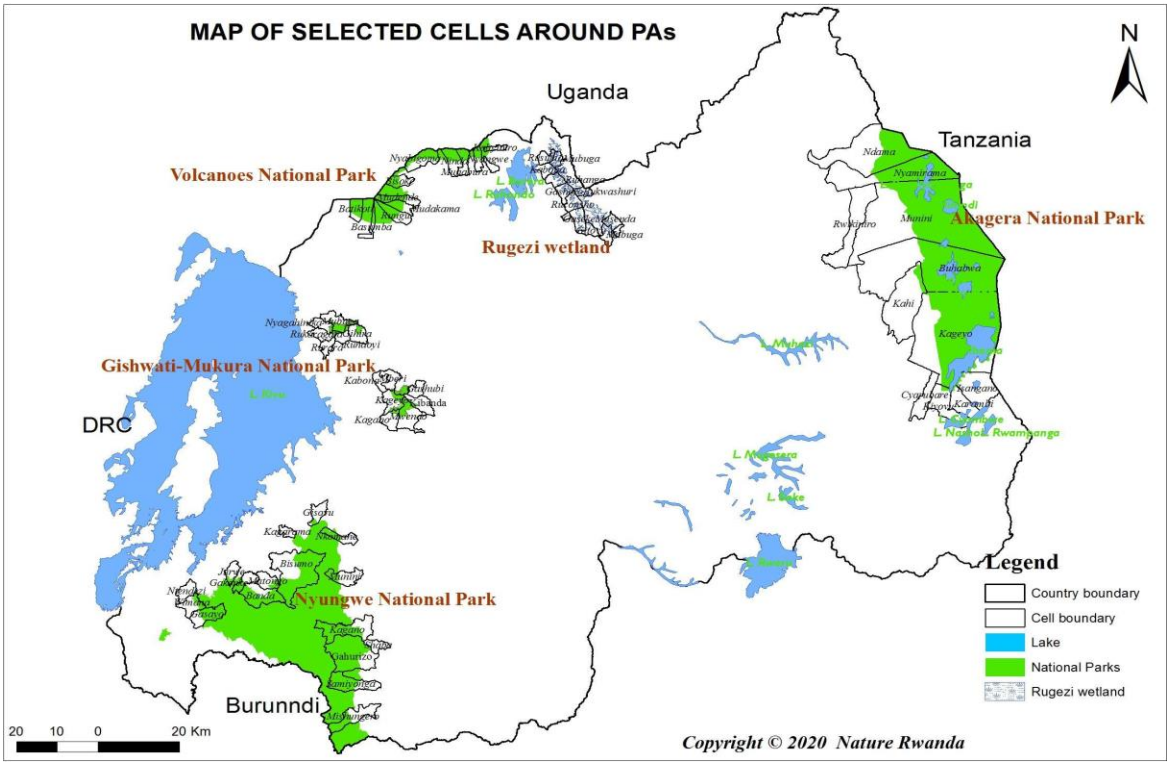


***Figure 1**: Study Area*

[9] https://en.unesco.org/biosphere/africa/gishwati-mukura-landscape
[10] https://www.visitrwanda.com/destinations/gishwati-mukura-national-park/
[11] Fishpool, L. D., & Evans, M. I. (Eds.). (2001). Important Bird Areas in Africa and associated islands: Priority sites for conservation. Cambridge: BirdLife International.
[12] REMA (2011) - Atlas of Rwanda's Changing Environment: Implications for Climate Change Resilience" Rwanda Environment Management Authority P.O. Box 7436 Kigali, Rwanda
[13] https://www.visitrwanda.com/destinations/rugezi%20wetland/

2.2. Research techniques

Both qualitative and quantitative methods have been used during data collection. Close-ended questionnaire was used to collect quantitative data from community members. The mixed open and close-ended questionnaire was used to collect qualitative data from different conservation stakeholders working around protected areas. All questionnaires were prepared based on suitable indicators developed by Nature Rwanda in the project type 1. Quantitative data were collected by using survey CTO software installed on smartphones of data collectors. A team of 6 data collectors has collected the data around all the five PAs, and sub-teams of three were supposed to collect data from two separate cells simultaneously. Qualitative data were collected through desk review and by using Google forms.

Two stage sampling method was used to determine the sample from the sample frame. In the first stage, cells around each PA were sorted based on number villages adjacent to the PA per cell, the total number of people aged from 14 years old per cell, and the total number of villages per cell. Cells with the highest size were selected for data collection (See Annex 2). The second stage constituted of selecting respondents in each cell. The sample size was determined based on the formula of Cochran developed in 1963.

$$n = \frac{\frac{Z^2 * p * (1-p)}{e^2}}{1-r} = \frac{n_o}{1-r}$$

Where n is the sample size, p is the proportion of the people who interact with the protected area (p=0.5), (1-p) is the proportion of the people who do not interact with the protected area, e is the acceptable margin error/level of precision required (e=0.05), Z is the value of the standard normal random variable, for this study the value of the standard normal random variable at 95% level of confidence is used, i.e. Z=1.96, and r is the non-response rate, r=10% for this study.

In total, 2160 respondents were selected for study; i.e. 432 respondents from each of the five protected areas (See Annex 2). These respondents were selected in 12 cells (36 respondents per cell) around each of Volcanoes National Park, Gishwati-Mukura National Park and Rugezi wetland. For Nyungwe National Park, 18 cells were selected with 24 respondents since this park has a big number of cells. Whereas at Akagera National Park, only 11 cells are adjacent to the park, therefore 39-40 respondents were selected in order to retain 432 respondents as for other PAs. Since we have a sample size from the population, and a baseline need to be based on the population instead of the sample, we took base on total ratios to reflect the entire population around protected areas by using the formula of Cochran (1963).

$$\hat{Y} = \sum_{i=}^{n} W_{hi} y_i$$

Where:

- $\hat{Y}$ = Total population size in the domain/ strata (PA),
- W_{hi}= sampling weight for the sample households/individuals selected for this survey in the i-th sample cell in stratum h
- y_i = value of variable y (population size) for the ith sample cell in stratum h

Data was entered in Spreadsheet and analyzed using STATA where frequency tables and statistical tests were undertaken to determine the interrelationship between parameters. In addition, data collected from 15 institutions (both governmental institutions and Non-governmental organisations) who conducted public awareness interventions in the local communities around the protected areas in this study were analyzed as well.

2.3. Construction of indicators

Seven indicators were used to assess the level of awareness, attitude and community participation in supporting biodiversity conservation around PAs in Rwanda.

- **KNOWLEDGE INDICATOR-*accurate knowledge on term biodiversity***; was constructed based on knowledge of the term Biodiversity, and the ability to explain what it stands for.

- **KNOWLEDGE INDICATOR-*ability to describe main challenges of biodiversity***; was constructed based on knowledge of the term Biodiversity, ability to mention at least one component of biodiversity, and the ability to give at least one main challenge to biodiversity.

- **KNOWLEDGE INDICATOR-*ability to link biodiversity and livelihood*;** was constructed based on knowledge of the term Biodiversity, ability to mention at least one component of biodiversity, ability to give at least one main challenge to biodiversity, informed that the biodiversity is declining, and/or knowledge of the importance of PAs and why they need a special protection.

- **ATTITUDE INDICATOR-*personal or group commitment to conserve biodiversity***; was developed based on the participation in conservation activities, and whether the motivation was moral or socio-economic.

- **BEHAVIOR INDICATOR-*ability to make positive decisions on sake of biodiversity***; was constructed based on ability to link biodiversity and livelihood (knowledge indicator), commitment to live in harmony with wildlife, and participation in conservation activities.

- **SKILLS INDICATOR-*ability to acknowledge sustainable use of natural resources***; was developed considering the respondents' ability to describe ecosystem goods and services and how they can be utilized in a sustainable and equitable manner.

- **THE OVERALL INDICATOR-*level of awareness, attitude and community participation in supporting biodiversity conservation***; was constructed by only considering respondents who have good knowledge on biodiversity, skills on sustainable use of natural resources, positive behavior and attitude towards conservation, and play active participation in supporting biodiversity conservation, i.e. who positively categorized by each of the six above indicators.

3. RESULTS

This section describes the results from the data collected among communities around five protected areas, and from conservation stakeholder institutions operating around PAs. It is divided into four main sections; the first section is the description of demographic characteristics of respondents, the second section presents the general perceptions of respondents towards biodiversity and its conservation, the third section presents stakeholders' contributions in the protection of PAs, and the fourth section measures the level of awareness, attitude and community participation in supporting biodiversity conservation with respect to PAs, and socio-demographic characteristics of respondents.

3.1. Socio-demographic information of respondents

The table 1 below represents the total number of respondents and their socio-demographic characteristics (gender, age, education level, professional categories, leadership position, and duration of living around a protected area). It also compares these characteristics among the protected areas.

Table 1: Socio-demographic characteristics of respondents (%)

Socio-demographic characteristics	Protected areas					
	VNP	ANP	NNP	GMNP	RW	All
	n=432	n=432	N=432	n=432	n=432	N=2160
Gender						
Male	60.88	57.64	53.70	58.10	54.86	**57.04**
Female	39.12	42.36	46.30	41.90	45.14	**42.96**
Age groups						
14 – 17	7.18	14.81	4.86	6.02	8.80	**8.33**
18 – 33	42.36	41.44	48.15	46.76	52.55	**46.25**
34 – 49	29.40	27.31	29.40	27.31	23.15	**27.31**
50 – 65	14.58	13.19	13.66	15.28	10.42	**13.43**
Above 65	6.48	3.24	3.94	4.63	5.09	**4.68**
Education Level						

No formal	39.58	31.71	30.79	42.13	33.56	**35.56**
Primary	40.74	45.83	50.46	40.74	43.52	**44.26**
Ordinary level	11.57	15.28	10.65	7.64	11.57	**11.34**
Advanced level A2	7.18	6.48	6.71	8.10	10.65	**7.82**
College/University	0.93	0.69	1.39	1.39	0.69	**1.02**
Professional categories						
Farmer	63.43	65.28	72.45	68.29	69.44	**67.78**
Teacher	0.00	0.93	0.23	0.93	1.16	**0.65**
Employee of Local government	0.23	0.69	0.46	0.23	0.23	**0.37**
Student	8.56	16.90	5.32	5.09	7.64	**8.70**
Park ranger	0.23	0.23	0.23	0.00	0.93	**0.32**
Business person	6.02	6.94	4.86	5.32	5.32	**5.69**
Church leaders	0.23	0.00	0.00	0.23	0.00	**0.09**
Other	21.30	9.03	16.44	19.91	15.28	**16. 39**
Leadership position						
Have leadership position	17.36	11.81	13.43	15.05	10.19	**13.56**
Do not have leadership position	82.64	88.19	86.57	84.95	89.81	**86.44**
Years living around the Protected Area						
Less a year	1.16	6.02	1.85	1.16	2.08	**2.45**
1 - 5 years	3.01	18.52	4.86	5.79	5.79	**7.59**
6 - 10 years	3.24	26.62	3.70	6.48	5.09	**9.03**
11 - 15 years	5.09	15.05	3.94	4.63	5.09	**6.76**
16 - 20 years	15.74	12.96	16.20	15.05	14.58	**14.91**
Above 20 years	71.76	20.83	69.44	66.90	67.36	**59.26**

3.2. General perceptions of respondents towards biodiversity and its conservation

This section presents an overview of the perception of respondents about biodiversity conservation around the protected areas. These perception on what biodiversity is and what it stands for, its challenges, human impacts on biodiversity, and acknowledgment of the intrinsic values of protected areas and ecosystem goods and services they provide

3.2.1. Biodiversity Awareness

Respondents were asked if they are aware of the term biodiversity. The majority of respondents (50.37%) had not heard of it, and the (49.63%) had heard the term before (table2).

Table 2: Awareness on the term Biodiversity (%)

	Protected area					
	VNP	ANP	NNP	GMNP	RW	**All**
Heard term biodiversity	n=432	n=432	n=432	n=432	n=432	**n=2160**
Yes	52.55	50.23	50.93	45.37	49.07	**49.63**
No	47.45	49.77	49.07	54.63	50.93	**50.37**
Total	**100.00**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Respondents who knew the term biodiversity were asked what it meant. Only 20.71% of them provided the complete definition of biodiversity i.e. All the living things on the earth, including humans. 63.06% respondents were not accurate for the definition of term biodiversity, while 16.23 % had no idea what biodiversity means. Based on the definition of biodiversity, respondents were asked if human beings can threaten biodiversity 90.40% said yes, 5.80% had no idea and 3.79% said no (table 3).

Table 3: Knowledge on human threats to biodiversity (%)

	Protected areas					
	VNP	ANP	NNP	GMNP	Rugezi wetland	All PAs
Humans threaten biodiversity	n=195	n=166	n=189	n=174	n=172	**n=896**
Yes	87.7	88.6	92.6	91.38	91.86	**90.4**
No	4.1	3.01	2.65	3.45	5.81	**3.79**
Don't know	8.21	8.43	4.76	5.17	2.33	**5.8**
	100	**100**	**100**	**100**	**100**	**100**

Also based on the definition of biodiversity, respondents were asked whether they are informed that the biodiversity is declining, 9.71% strongly agree, 60.04% agree, 23.2% not sure, 6.03% disagree while 1.0% strongly disagree

Respondents who said that human beings can threaten biodiversity were also able to list some key threats to biodiversity resulting from anthropogenic activities.

3.2.2. Role of Protected Areas

Respondents were asked whether they think that the nearby PA is important. The table 4 below summarizes responses provided. 94.17% of respondents said that protected areas are important, 3.06% said that they don't know whether PA is important, and 2.78% said that protected areas are not important.

Table 4: Awareness on the role of Pas (%)

PAs are important	Protected areas					All PAs
	VNP	ANP	NNP	GMNP	Rugezi wetland	
	n=432	n=432	n=432	n=432	n=432	**n=2160**
Yes	97.69	94.91	95.83	92.59	89.81	**94.17**
No	0.93	3.01	2.08	2.31	5.56	**2.78**
Do not know	1.39	2.08	2.08	5.09	4.63	**3.06**
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

The respondents who said that protected areas are important were asked to give some key importance of protected areas. Only 32.18% of them mentioned protected areas to be a habitat for biodiversity, 66.77% did not mention habitat for biodiversity in their answers, while 1.05% failed to identify the role of protected areas.

Table 5: Awareness on free access to PAs (%)

	Protected areas					
	VNP	ANP	NNP	GMNP	Rugezi wetland	**All PAs**
Free access on PAs	n=432	n=432	n=432	n=432	n=432	**n=2160**
No	90.51	95.60	93.52	85.65	76.62	**88.38**
Yes	9.49	4.40	6.48	14.35	23.38	**11.62**
	100.00	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

When respondents asked whether they think they should be given free access to the protected area's resources; 11.62% said yes, while 88.38% said No (table 5),

and when asked to give any three species found in the nearby protected area, only 29.03% have given three or more, 70.97% failed.

3.3. Stakeholders' contributions in the protection **of PAs**

In order to know if there is institutional and community partnership in the conservation of PAs, respondents were asked who they think are responsible for the sustainable protection of the PA. 55.33% said that it everyone's concern, 28.18% said the government, 15.98% said the local community, and 0.35% said private sector while only 0.17% mentioned NGOs in their answers. Respondents were asked if they participate in the protection of the nearby protected area. For example; tree planting, reporting wildlife crimes, community mobilization, advocacy, rapid response interventions, education, etc. Table 6 summaries their responses; 85.32% of respondents said they try to do something while 14.68% said that they have never been involved in any conservation activity.

Table 6: Respondents participation in conservation (%)

	Protected Areas					
Participate	VNP	ANP	NNP	GMNP	RW	**All PAs**
Yes	85.88	87.96	82.64	85.88	84.26	**85.32**
No	14.12	12.04	17.36	14.12	15.74	**14.68**
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Respondents who said they had been involved in some conservation activities were asked what motivated them to do so. Reasons are given in table 7 and percentage of respondents selecting each option. The main reasons given were that respondents had a socio-economic motivation (79.11%) i.e., they do everything because it's their source of income, 3.58% had political motivations- because of administrative position they held or are requested by authorities, 17.32% had moral motivations, they wanted to feel that they were doing their bit for the environment and reducing their own impact on biodiversity.

Table 7: Motivation in conservation (%)

	Protected areas					
	VPN	ANP	NNP	GMNP	RW	**All PAs**
Motivation	n=371	n=380	n=357	n=371	n=364	**n=1843**
Socio-economic	68.73	83.16	80.11	77.36	86.26	**79.11**
Political	3.23	2.37	3.64	5.93	2.75	**3.58**
Moral	28.03	14.47	16.25	16.71	10.99	**17.31**
	100.00	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

In order to know the effective communication channels to spread conservation message among the local communities, respondents were asked to list their preferred channels of communication. The majority of respondents (55.09%) said that interpersonal events is the most effective channel of communication for them, followed by audio-visual (43.26%), internet (1.04%), and the least was printed media (0.60%). However, Audio-visual (28.09%) and printed media (25.84%) were reported to be the most utilized communication channels by conservation institutions who work with local communities around protected areas (table 8).

Table 8: Communication channels and utilized languages in public awareness (%)

Communication channel	Language used			**All**
	Kinyarwanda	English	French	
Audio-visual	31.57	25.58	25.03	**28.09**
Printed media	28.95	25.58	12.46	**25.84**
Interpersonal	34.22	16.29	12.46	**23.60**
Internet	5.27	32.56	49.94	**22.47**
Total	**100.00**	**100.00**	**100.00**	**100.00**

3.4. Results presentations in relation to public awareness indicators

Indicators of public awareness on biodiversity conservation were scored by protected areas, and in relation to: the sex, age, education level, profession,

leadership position of the respondents and how long they have been in that place.

Table 9: Public awareness indicators scored by protected areas (%)

Indicators	**Protected Area**					
	VNP	ANP	NNP	GMNP	RW	All parks
Ability to link biodiversity and livelihood	93.519	96.065	95.139	87.037	78.241	**90.000**
Personal or group commitment to conserve biodiversity	85.880	87.963	82.639	85.880	84.259	**85.324**
Ability to make positive decisions on sake of biodiversity	85.648	87.963	82.407	85.648	84.259	**85.185**
Ability to acknowledge sustainable use of natural resources	92.824	80.556	87.963	85.648	71.065	**83.611**
Ability to describe main challenge to biodiversity	43.287	36.574	42.361	39.352	39.120	**40.139**
Accurate knowledge on term biodiversity	12.963	10.185	9.259	10.417	8.102	**10.185**
Level of awareness, attitude and community participation in supporting biodiversity conservation	**10.185**	**9.028**	**6.713**	**7.639**	**6.713**	**8.056**

The Level of awareness, attitude and community participation in supporting biodiversity conservation (the overall indicator) was higher at the Volcanoes National Parks (10.185%), lower at both Nyungwe National Park and Rugezi wetland (6.713%) compared to other protected areas (table 9). Generally, there was a gap of knowledge on the term biodiversity and in describing the main challenges that biodiversity are facing today. However, respondents from VNP were more accurate knowledge on the term Biodiversity (12.963%), and had the ability to describe the main challenges to biodiversity compared to those from other parks. The rest of the indicators were scored high at all protected areas.

Table 10: Public awareness indicators scored against gender (%)

Indicators	Sex		All
	Male	Female	
Ability to link biodiversity and livelihood	92.127	87.177	**90.000**
Personal or group commitment to conserve biodiversity	88.149	81.573	**85.324**
Ability to make positive decisions on sake of biodiversity	87.987	81.466	**85.185**
Ability to acknowledge sustainable use of natural resources	87.581	78.341	**83.611**
Ability to describe main challenge to biodiversity	50.081	26.940	**40.139**
Accurate knowledge on term biodiversity	13.231	6.142	**10.185**
Level of awareness, attitude and community participation in supporting biodiversity conservation	**10.877**	**4.310**	**8.056**

There was a significant statistical difference (Chi2=30.8122, p=0.000, df=1) of the level of awareness, attitude and community participation in supporting biodiversity conservation among females (3.320%) and males (10.877%), and also females have a lower score of all indicators.

Table 11: Public awareness indicators scored against age of respondents (%)

Indicators	Age group					All
	14-17	18-33	34-49	50-65	Above 65	
Ability to link biodiversity and livelihood	89.444	89.890	91.356	90.000	84.158	**90.000**
Personal or group commitment to conserve biodiversity	82.222	84.685	88.644	84.483	80.198	**85.324**
Ability to make positive decisions on sake of biodiversity	82.222	84.484	88.644	84.138	80.198	**85.185**
Ability to acknowledge sustainable use of natural resources	76.111	83.483	86.780	85.172	75.248	**83.611**
Ability to describe main challenge to biodiversity	41.667	43.343	42.373	34.483	8.911	**40.139**
Accurate knowledge on term biodiversity	8.333	11.111	12.203	6.552	2.970	**10.185**
Level of awareness, attitude and community participation in supporting biodiversity conservation	**6.667**	**8.208**	**10.847**	**4.828**	**1.980**	**8.056**

There was a significant statistical difference (Chi2= 15.8223, p=0.003, df=4) of the level of awareness, attitude and community participation in supporting

biodiversity conservation; up to 49 years old; older people have higher awareness than young people. Moreover, there was a significant statistical relationship (Chi2= 13.5858, p=0.018, df=5) between the level of awareness and duration by which a person lives around the protected area. People who lived around protected areas for a long period of time have higher awareness compared to new people in the area.

Table 12: Public awareness indicators scored against the level education of respondents (%)

	Education level					
Indicators	No formal	Primary	Ordinal level	Advanced level (A2)	College/ University	**All**
Ability to link biodiversity and livelihood	88.021	89.121	95.102	95.266	100.000	**90.000**
Personal or group commitment to conserve biodiversity	84.245	85.983	85.306	88.166	72.727	**85.324**
Ability to make positive decisions on sake of biodiversity	84.115	85.774	85.306	88.166	72.727	**85.185**
Ability to acknowledge sustainable use of natural resources	79.557	83.996	88.163	91.124	100.000	83.611
Ability to describe main challenge to biodiversity	23.307	40.272	62.857	76.923	86.364	**40.139**
Accurate knowledge on term biodiversity	4.557	7.427	18.367	32.544	63.636	**10.185**
Level of awareness, attitude and community participation in supporting biodiversity conservation	**3.255**	**6.695**	**13.878**	**24.852**	**40.909**	**8.056**

There was a strong and significant statistical relationship (chi2 = 133.9300, p=0.000, df=4) between the level of awareness, attitude and community participation in supporting biodiversity conservation, and the level of education. The higher the education level, the more the level of awareness on biodiversity conservation is.

Table 13: Public awareness indicators scored against professional categories of respondents (%)

	Professional categories								
Indicators	Farmer	Teacher	EoLG	Student	Park ranger	Business person	Church leaders	Others	All
Ability to link biodiversity and livelihood	88.798	100.000	100.000	94.149	100.000	93.496	100.000	90.678	**90.000**

Personal or group commitment to conserve biodiversity	86.544	85.714	87.500	80.851	100.000	83.740	100.000	82.768	**85.324**
Ability to make positive decisions on sake of biodiversity	86.407	85.714	87.500	80.851	100.000	83.740	100.000	82.486	**85.185**
Ability to acknowledge sustainable use of natural resources	82.240	100.000	100.000	79.787	100.000	91.057	50.000	87.571	**83.611**
Ability to describe main challenge to biodiversity	34.495	92.857	87.500	55.851	100.000	46.341	50.000	48.588	**40.139**
Accurate knowledge on term biodiversity	7.582	64.286	62.500	16.489	42.857	15.447	50.000	11.582	**10.185**
Level of awareness, attitude and community participation in supporting biodiversity conservation	**6.216**	**50.000**	**50.000**	**11.170**	**42.857**	**12.195**	**0.000**	**9.322**	**8.056**

There was a strong and significant statistical relationship (chi2 = 136.715, p=0.000, df=7) between the level of awareness, attitude and community participation in supporting biodiversity conservation, and the professional categories. Teachers and employees of the local government have a higher level of awareness, attitude and participation supporting biodiversity conservation and low in farmers and church leaders.

Table 14: Public awareness indicators scored against the leadership positions of respondents (%)

	Leadership		All
Indicators	Yes	No	
Ability to link biodiversity and livelihood	93.857	89.395	**90.000**
Personal or group commitment to conserve biodiversity	87.372	85.003	**85.324**
Ability to make positive decisions on sake of biodiversity	87.372	84.842	**85.185**
Ability to acknowledge sustainable use of natural resources	92.150	82.271	**83.611**
Ability to describe main challenge to biodiversity	64.505	36.315	**40.139**
Accurate knowledge on term biodiversity	23.208	8.141	**10.185**
Level of awareness, attitude and community participation in supporting biodiversity conservation	**19.113**	**6.320**	**8.056**

There was a strong and significant statistical relationship (chi2 = 6.435, p=0.011, df=1) between the level of awareness, attitude and community participation in supporting biodiversity conservation and leadership position.

4. CONCLUSION

The study revealed that the level of awareness, attitude, and community participation in supporting biodiversity conservation is generally low at all protected areas (8.056%). This number represents the respondents who have accurately answered all questions of the survey. In contrast, failing to provide accurate answer even to only one question was a sign that the respondent lacks a certain level of awareness. During the consultation meeting with key stakeholders working around the study area participants had the similar overview, as most of them said that their awareness activities target a certain number of schools, ex-poachers and other community groups whose activities are directly linked to the PA while they represent a small segment of population around protected area. It worth mentioning that this study focused on the general public from cells adjacent to the PAs as defined in the target 1 of the NBSAP 2.

Nevertheless, the level of awareness, attitude, and community participation in supporting biodiversity conservation is relatively higher at Volcanoes National Park compared to other PAs. This small difference can be explained by the fact that there are more conservation institutions operating around VNP compared to other PAs, therefore more awareness activities are conducted at there.

Most of the respondents have not been able to provide accurate answers to questions related to biodiversity, but most of them have been able to answer questions generally related to protected areas. For example; most of respondents said that biodiversity is either or both plants and animals while biodiversity stands for the variety of life on Earth. Representatives of conservation institutions operating around PAs said that during their awareness activities they only focus on key species of the PA, instead of reflecting to all living components of the area.

Different stakeholders are putting much effort in raising biodiversity awareness and community participation in sustainable conservation of protected areas, however, conservation awareness activities conducted don't reflect exactly the

national targets. For example, most of the participants said that their institutions have never referred to NBSAPs during planning, implantation, monitoring and evaluation of their awareness project/activities.

In addition, the communication approaches that are commonly used by conservation institutions are not appropriate to convey the message to the target audience. The most used methods is either push or pull and medium language used is not very appropriate to specific target. For example; the most utilized communication materials are printed and in English, while most of the community members around the PAs have a primary and no-formal level of education.

5. RECOMMENDATIONS

In line with the Aichi target 1 of the CBD and specifically with the revised National Biodiversity Strategy and Action Plan of Rwanda (NBSAP), we recommend the following key points in order to achieve the anticipated results of biodiversity awareness. The following are suggested recommendations that emerged from the data analysis, discussion with subject matter experts and local communities.

i. During planning, implementation, monitoring and evaluation of biodiversity awareness portfolio, programs or projects, conservation stakeholders should refer to the National Goals, Strategies, policies and regulations, and other international conventions that Rwanda has ratified to develop integrated interventions that responding to specific strategic outcomes and intermediate outcomes within those polices and plans.

ii. The focal point of the CBD, Rwanda Environmental Management Authority, other stakeholders who have the primary responsibilities of mainstreaming NBSAPs should invest more time and resources to mainstream the NBSAP document among all conservation stakeholders, and work closely with them in the programs quality assurance to deliver value to local community.

iii. The key indicators to assess the public awareness, attitudes and participation toward biodiversity conservation should be developed and utilized separately with the indicators to assess community development outcomes in awareness raising related projects.

For example; Constructing a community water spring from tourism revenues, doesn't indicate that the users have good knowledge, skills, commitment and participation in biodiversity conservation of the PA.

iv. Conservation stakeholders should use mainly interactive communication method over push and pull communication methods to engage local communities in ways that allow them gain both explicit and tacit knowledge for sustainable conservation of biodiversity.

v. Conservation stakeholders have to develop contents that are tailored to a specific population segments and use strictly in Kinyarwanda as a medium to ensure that the message reaches to the targeted audience at large and decoded.

vi. The local government and should play an active part in raising public awareness of biodiversity conservation among the local communities, as this exercise is not something conservation institutions can succeed in alone.

vii. The development partners have to work with conservation stakeholders in co-designing tailored conservation programs using gender lenses and other inclusion lenses to holistically address conservation challenges around and beyond PAs.

viii. The development partners and the government should deploy enough financial resources to continue to support biodiversity conservation awareness programs, projects/activities around PAs focusing gaps identified within this report

5. ANNEXES

Annex 1: Questionnaire

General information of respondents

1. Name of the interviewee ……
2. Age
   a. 14-17 years
   b. 18-33 years
   c. 34-49years
   d. 50-65 years
   e. Above 65 years
3. National ID ……
4. Telephone ……
   a. Sex
   b. Male
   c. Female
5. Village ……
6. Cell……
7. Sector ……
8. District ……
9. Education level
   a. No formal
   b. Primary
   c. Ordinal level
   d. Advanced level (A2
   e. College/University
   f. Other
10. Profession
    a. Farmer
    b. Teacher
    c. Local leader
    d. Student
    e. Park ranger
    f. Conservation professional
    g. Business person
    h. Church personnel
    i. Others
11. a. Do you have a leadership position?
    i. Yes
    ii. No

11.b. If yes, where?

i. Government
ii. Church
iii. Women group
iv. Youth group

v. Cooperative
vi. School
vii. NGO

12. What is the name of the nearby protected area?
    a. VNP
    b. ANP
    c. NNP
    d. GMNP
    e. Rugezi wetland

13. How long have you living around this protected area?
    a. Less a year
    b. 1-5 years
    c. 6-10 years
    d. 11-15 years
    e. 16-20 years
    f. Above 20 years

14. a. Have you heard the term biodiversity?
    i. Yes
    ii. No

14. b. If Yes, where?

i. Awareness-raising campaign
ii. News
iii. School
iv. Videos
v. Brochures
vi. Social media
vii. T-shirts
viii. Dedicated websites
ix. Other

15. From your point of view, what biodiversity stands for?
    a. Animals
    b. Plants
    c. Both plants and animals
    d. All living things
    e. Don't' know

16. From the list below, choose what you think are the main challenges for Biodiversity
    a. Forest fire
    b. Hunting
    c. Poaching
    d. Agriculture encroachment
    e. Illegal mining
    f. Grazing

g. Population explosion
h. Climate change
i. Don't know

17. Biodiversity is declining at local and global levels. Do you agree with this statement?
a. Strongly agree
b. Agree
c. Not sure
d. Disagree
e. Strongly disagree

18. a. Do you think that human being poses any threat to the Biodiversity?
i. Yes
ii. No
iii. Don't know

18.b. If YES, how humans can threaten the biodiversity?
i. Poaching
ii. Hunting
iii. Tree cutting
iv. Intentional killings
v. Bush fires
vi. Deforestation
vii. Logging
viii. I don't know

19. Do you think that protected areas are important?
a. Yes
b. No
c. Don't know

19.b. IF YES, Why do you think that Protected areas are important?
i. Source of revenues through tourism
ii. Habitat for biodiversity
iii. Provide a great range of Ecosystem goods and services
iv. Maintain the climate stability
v. I don't know

20. Do you think that people should have a free access to the resources of the protected areas?
    a. Yes
    b. No

21. Give any three species do you know from this forest

a. Gorilla	f. Monkey	k. Zebra
b. Giraffe	g. Plant (any)	l. Bird (any)
c. Lion	h. Chimpanzee	m. Reptile (any)
d. Buffalo	i. Duiker	n. Don't know
e. Elephant	j. Antelope	o. None

22. How can you react in case you find a wild animal eating the crops in your garden?

a. Everyone	d. NGOs
b. Local community	e. Private sector
c. Government	f. None

23. How do you participate in the protection of this protected area?

a. Tree planting	d. Educational/training activities
b. Reporting of any wildlife crime	e. Advocacy
	f. Rapid response interventions
c. Community mobilization	g. None

24. What is your motivation?

a. Socio-Economic	c. Cultural
b. Political	d. Moral

25. What do you think are effective channels of communication for you?

a) Community campaign	e) Movies/songs
b) TV and radio	f) Social media
c) Formal education	g) Preachings
d) Meeting/seminar	h) None

26. Do you have anything to share that can help to improve the coexistence of humans and Nature?

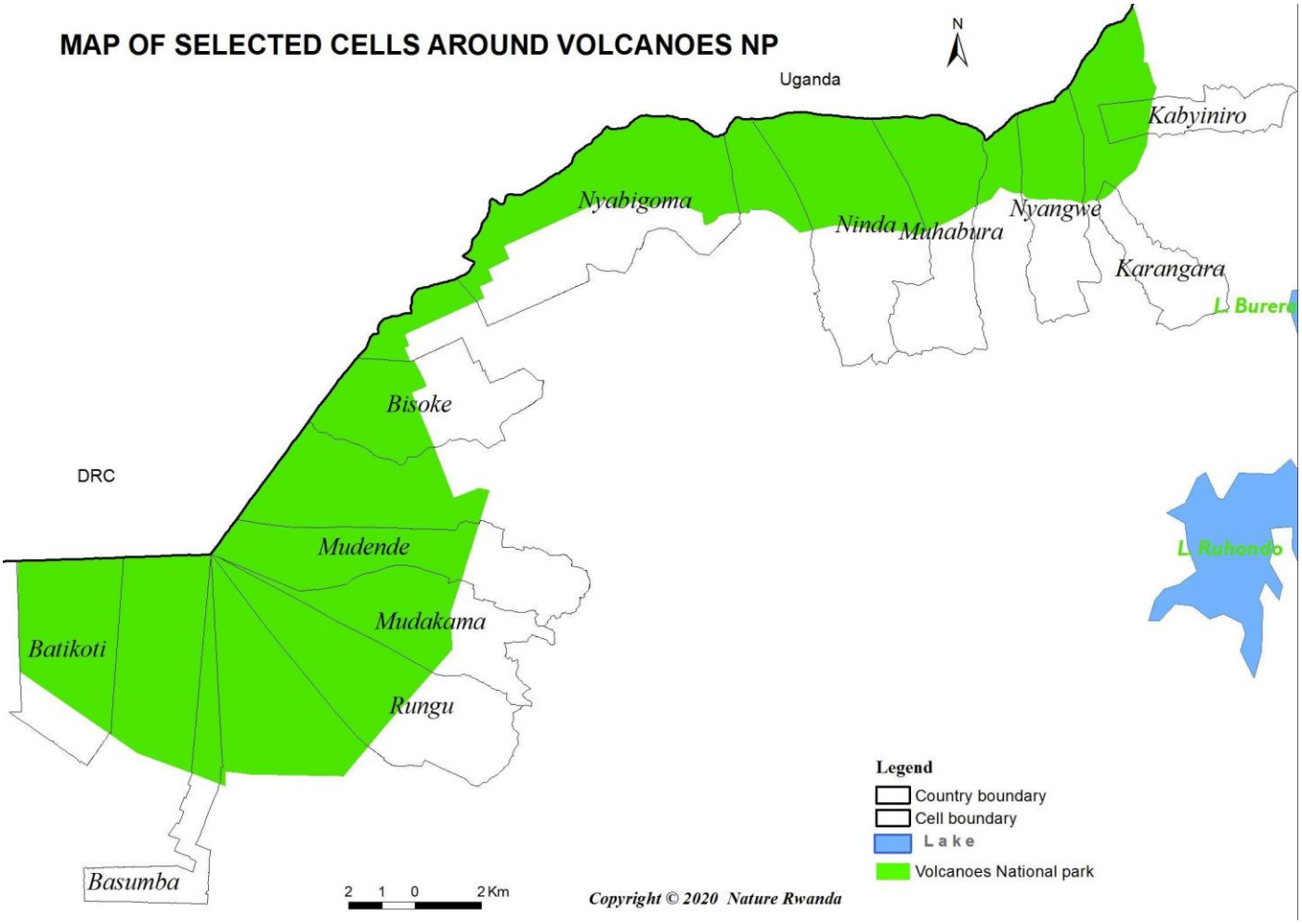
Annex 2: List of target Cells around Protected Areas

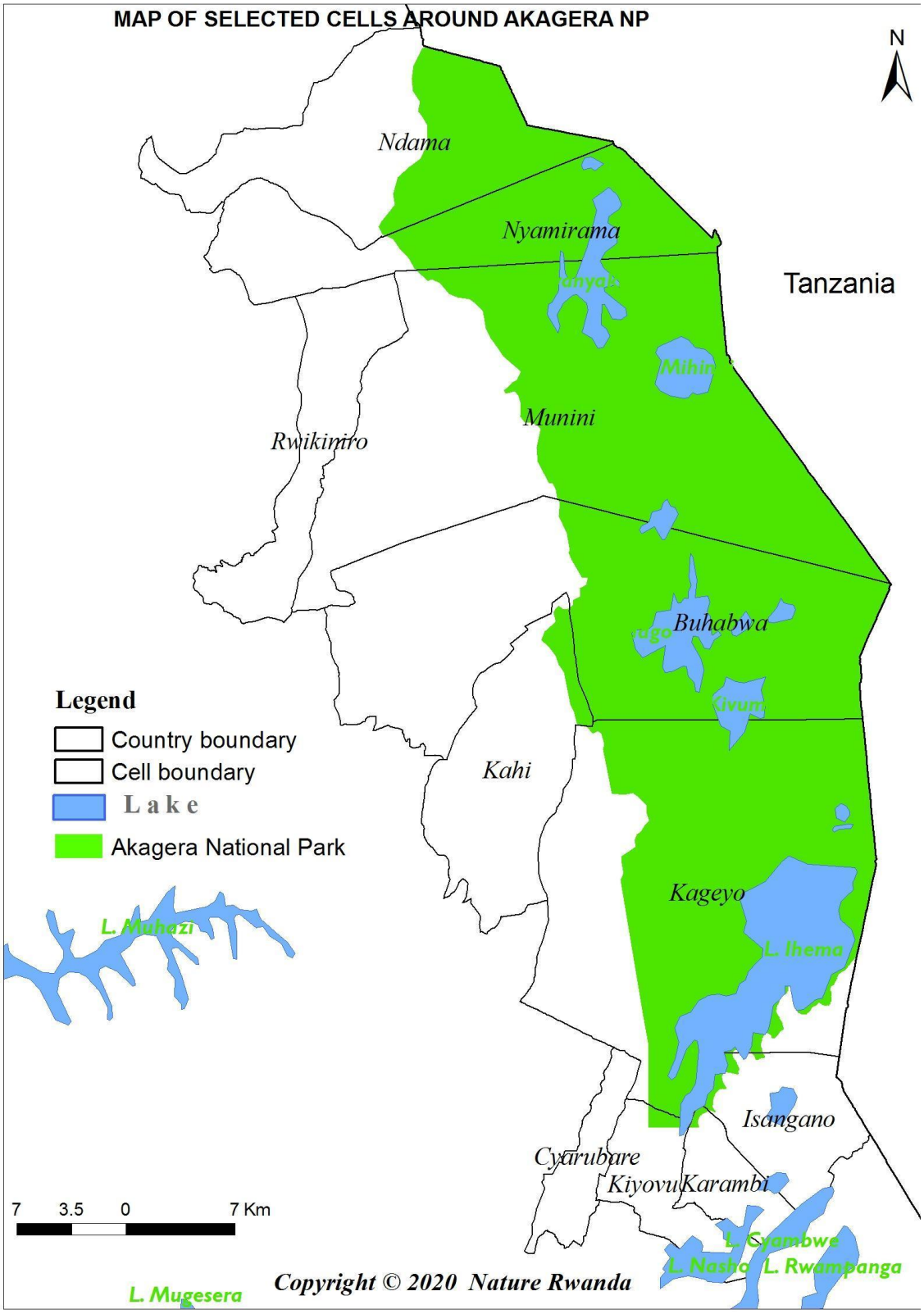
Protected Area	District	Sector	Cell
Akagera National Park	Gatsibo	Rwimbogo	Munini
Akagera National Park	Gatsibo	Rwimbogo	Rwikiniro
Akagera National Park	Kayonza	Gahini	Kahi
Akagera National Park	Kayonza	Kabare	Cyarubare
Akagera National Park	Kayonza	Murundi	Buhabwa
Akagera National Park	Kayonza	Mwiri	Kageyo
Akagera National Park	Kayonza	Ndego	Isangano
Akagera National Park	Kayonza	Ndego	Karambi
Akagera National Park	Kayonza	Ndego	Kiyovu
Akagera National Park	Nyagatare	Karangazi	Nyamirama
Akagera National Park	Nyagatare	Karangazi	Nyamirama
Gishwati-Mukura National Park	Ngororero	Bwira	Gashubi
Gishwati-Mukura National Park	Ngororero	Ndaro	Mwendo
Gishwati-Mukura National Park	Rutsiro	Kigeyo	Nyagahinika
Gishwati-Mukura National Park	Rutsiro	Kigeyo	Rukaragata
Gishwati-Mukura National Park	Rutsiro	Mukura	Kagano
Gishwati-Mukura National Park	Rutsiro	Mukura	Kageyo
Gishwati-Mukura National Park	Rutsiro	Mukura	Mwendo
Gishwati-Mukura National Park	Rutsiro	Mushonyi	Rurara
Gishwati-Mukura National Park	Rutsiro	Nyabirasi	Mubuga
Gishwati-Mukura National Park	Rutsiro	Ruhango	Gihira
Gishwati-Mukura National Park	Rutsiro	Ruhango	Rundoyi
Gishwati-Mukura National Park	Rutsiro	Rusebeya	Mberi
Nyungwe National Park	Karongi	Twumba	Gisovu
Nyungwe National Park	Nyamagabe	Buruhukiro	Munini
Nyungwe National Park	Nyamagabe	Kitabi	Kagano
Nyungwe National Park	Nyamagabe	Kitabi	Shaba
Nyungwe National Park	Nyamagabe	Nkomane	Nkomane
Nyungwe National Park	Nyamagabe	Uwinkingi	Rugorwe

Nyungwe National Park	Nyamasheke	Cyato	Bisumo
Nyungwe National Park	Nyamasheke	Cyato	Mutongo
Nyungwe National Park	Nyamasheke	Karambi	Kagarama
Nyungwe National Park	Nyamasheke	Karengera	Gasayo
Nyungwe National Park	Nyamasheke	Rangiro	Banda
Nyungwe National Park	Nyamasheke	Rangiro	Gakenke
Nyungwe National Park	Nyamasheke	Rangiro	Jurwe
Nyungwe National Park	Nyamasheke	Ruharambuga	Ntendezi
Nyungwe National Park	Nyamasheke	Ruharambuga	Wimana
Nyungwe National Park	Nyaruguru	Kivu	Gahurizo
Nyungwe National Park	Nyaruguru	Muganza	Samiyonga
Nyungwe National Park	Nyaruguru	Nyabimata	Mishungero
Rugezi wetland	Burera	Butaro	Mubuga
Rugezi wetland	Burera	Butaro	Rusumo
Rugezi wetland	Burera	Gatebe	Musenda
Rugezi wetland	Burera	Kivuye	Bukwashuri
Rugezi wetland	Burera	Ruhunde	Gaseke
Rugezi wetland	Burera	Ruhunde	Gitovu
Rugezi wetland	Burera	Rusarabuye	Kabona
Rugezi wetland	Burera	Rusarabuye	Ruhanga
Rugezi wetland	Burera	Rwerere	Gashoro
Rugezi wetland	Burera	Rwerere	Ruconsho
Rugezi wetland	Gicumbi	Miyove	Mubuga
Rugezi wetland	Gicumbi	Nyankenke	Kinishya
Volcanoes National Park	Burera	Cyanika	Kabyiniro
Volcanoes National Park	Burera	Gahunga	Nyangwe
Volcanoes National Park	Burera	Rugarama	Karangara
Volcanoes National Park	Musanze	Gataraga	Mudakama
Volcanoes National Park	Musanze	Gataraga	Rungu
Volcanoes National Park	Musanze	Kinigi	Bisoke
Volcanoes National Park	Musanze	Kinigi	Nyabigoma
Volcanoes National Park	Musanze	Nyange	Muhabura

Volcanoes National Park	Musanze	Nyange	Ninda
Volcanoes National Park	Musanze	Shingiro	Mudende
Volcanoes National Park	Nyabihu	Bigogwe	Basumba
Volcanoes National Park	Nyabihu	Kabatwa	Batikoti

Annex 3: Maps of Target cells around Protected Areas




MAP OF SELECTED CELLS AROUND AKAGERA NP
N
Ndama
Nyamirama
Tanzania
Mihir
Munini
Rwikiniro
Buhabwa
Kivumu
Kahi
Kageyo
L. Ihema
L. Muhazi
Isangano
Cyarubare
Kiyovu
Karambi
L. Cyambwe
L. Nasho
L. Rwampanga
L. Mugesera
Legend
Country boundary
Cell boundary
Lake
Akagera National Park
7 3.5 0 7 Km
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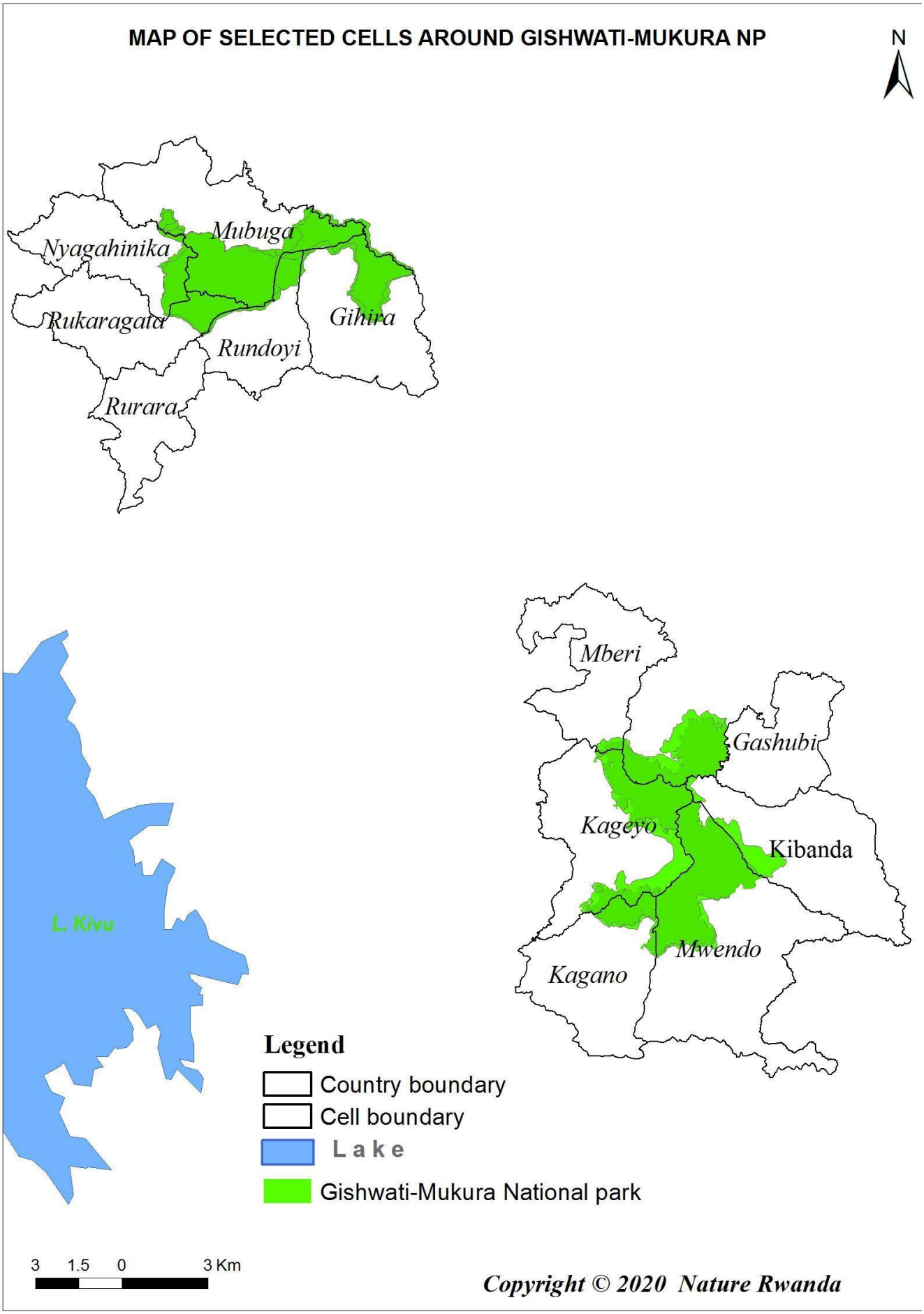

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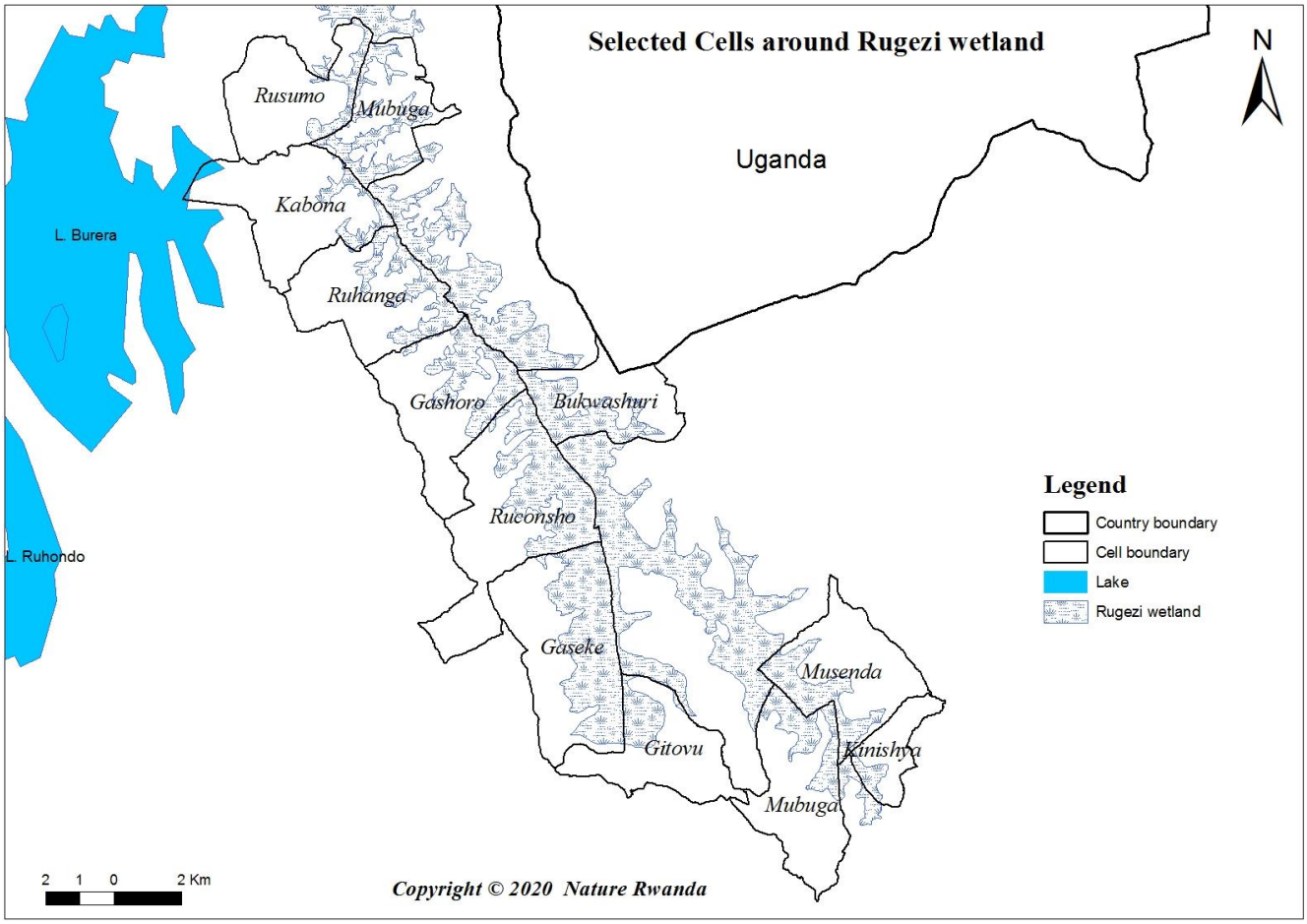
MAP OF SELECTED CELLS AROUND NYUNGWE NP
N
L. Kivu
Gisovu
Kagarama
Nkomane
Jurwe
Gakenke
Mutongo
Bisumo
Munini
Ntendezi
Banda
Wimana
Gasayo
Rugogwe
Kagano
Shaba
Gahurizo
Burundi
Samiyonga
Mishungero
Legend
Country boundary
Cell boundary
Lake
Nyungwe National park
4 2 0 4 Km
Copyright © 2020 Nature Rwanda


Selected Cells around Rugezi wetland
N
Uganda
Rusumo
Mubuga
Kabona
Ruhanga
Gashoro
Bukwashuri
Ruconsho
Gaseke
Musenda
Gitovu
Kinishya
Mubuga
L. Burera
L. Ruhondo
Legend
Country boundary
Cell boundary
Lake
Rugezi wetland
2 1 0 2 Km
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