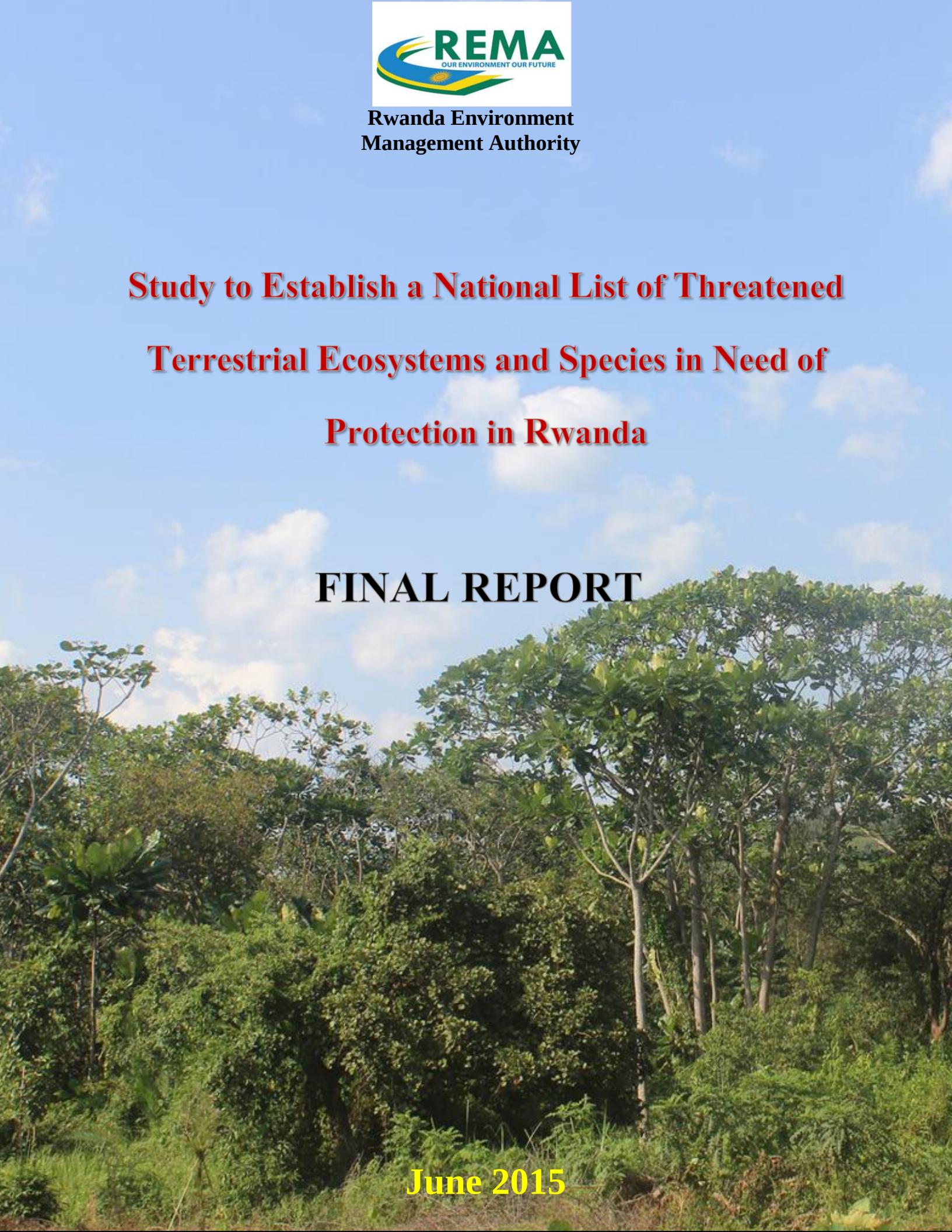

Rwanda Environment
Management Authority

Study to Establish a National List of Threatened Terrestrial Ecosystems and Species in Need of Protection in Rwanda

FINAL REPORT

June 2015

Study to Establish a National List of Threatened Terrestrial Ecosystems and Species in Need of Protection in Rwanda

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Nyagasenyi Natural Forest, photo by the authors

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ACRONYMS AND ABBREVIATIONS

AEWA: The African-Eurasian Migratory Waterbird Agreement

ANP : Akagera National Park

AOO : Area of Occupancy

CITES : Convention on International Trade in Endangered Species of Wild Fauna and Flora

CO : Collapse

CR : Critically Endangered

DD : Data Deficient

EN : Endangered

EOO : Extent of Occurrence

EW : Extinct in the wild

EX : Extinct

FAO : Food and Agriculture Organization

GPS : Global Positioning System

IBAs : Important Bird Areas

IUCN : International Union for Conservation of Nature

LC : Least Concern

NE : Not Evaluated

NNP : Nyungwe National Park

NT : Near Threatened

REMA : Rwanda Environment Management Authority

RNRA : Rwanda Natural Resources Authority

VNP : Volcanoes National Park

VU : Vulnerable

EXECUTIVE SUMMARY

The main objective of this study was to establish a list of threatened terrestrial ecosystems and species of Rwanda. This list serves as a scientific decision making tool for threatened ecosystems and species for conservation in Rwanda.

The established list was obtained based on scientific methodologies for ecosystems and species assessments. Various literature resources were reviewed and field investigations across the country were conducted, coupled with interviews with different stakeholders. Five taxonomic groups were assessed: Plants, Birds, Mammals, Reptiles and Amphibians

A final list of 17 threatened ecosystems was established and classified in different categories as defined by the IUCN. Among them, 3 have classified as Collapse, 10 have the status of Critically Endangered and 4 are classified as Endangered. In addition, a list of threatened species (110 in total) from 5 taxonomic groups was established.

For plant species, 38 plant species were listed as threatened. Among them, 7 are categorized as Critically Endangered, 25 as Endangered, and 6 as Vulnerable. For birds, 26 species were classified as threatened. 11 have the status of Critically Endangered, 9 are Endangered and the status of the remaining 6 is Vulnerable. However, there is another list of 49 bird species for which sufficient data for their assessment was not available. For mammals, 42 mammal's species were listed, among which 6 species are qualified as Critically Endangered, 31 as Endangered species and 5 as Vulnerable species. For herpetofauna group (reptiles and amphibians), 4 species ware qualified for listing: 2 of them are categorized as Critically Endangered and other 2 as Endangered species.

Different threats for both ecosystems and species were identified. They mainly include the lack of proper management in some ecosystems; deforestation; tree cutting for firewood, building material, uncontrolled collection of medicinal plants; fires; agriculture encroachment; poaching…

Based on identified threats, conservation measures for threatened species were suggested and threatened ecosystems categorized according to IUCN Categories of Protected Areas, and list of prohibited activities in each category was established.

CHAPTER 1. INTRODUCTION

As stated by the Convention on Biological Diversity, ecosystems and their biodiversity underpin economic growth, sustainable development and human wellbeing, and biodiversity is the foundation of life on earth. The well-being of the world population in the coming decades will in large part depend on conservation and restoration of ecosystems to maintain and enhance biodiversity and ecosystem services, thereby contributing to sustainable development while reducing environment-related risks. We depend on biodiversity for our security and health and it strongly affects our social relations and gives us freedom and choice. Loss of biodiversity at the ecosystem level, which occurs when distinct habitats, species assemblages, and natural processes are diminished or degraded in quality affect the whole fabric on ecological processes.

Terrestrial ecosystems of tropical forests, apparently the most species-rich terrestrial habitats on earth, are the most widely appreciated, endangered ecosystems; they almost certainly are experiencing the highest rates of species extinction today (Myers, 1988).

Ecosystems can be lost or impoverished in basically two ways. The most obvious kind of loss is quantitative (measured by a decline in areal extent of a discrete ecosystem type). The second kind of loss is qualitative (involves a change or degradation in the structure, function, or composition of an ecosystem) (Noss, 1990). Consequently, habitat loss, degradation and fragmentation constitute the main cause of biotic impoverishment. Hence, modern conservation is strongly oriented toward habitat protection, because protecting and restoring ecosystems serve to protect species.

Rwanda is covered by diversified natural ecosystems from afro-montane in the northern and western regions to lowland forests, savannah woodlands, savannah grasslands in the southern and eastern regions. Other significant ecosystems include volcanic hot springs and old lava flows that mainly occur in the northern and western parts of the country. Rwanda is also rich in large number of inland fresh water lake and wetland ecosystems.

These ecosystems are important water catchments; they control soil erosion, contribute to the favourable micro-climatic conditions and sustain the flow of streams and rivers. They are also biologically important because they host endemic species.

In the perspective of safeguarding the biodiversity of Rwanda, the biodiversity policy aims to "conserve Rwanda's biological diversity, to sustain the integrity, health and productivity of its ecosystems and ecological processes, whilst providing lasting development benefits to the nation through the ecologically sustainable, socially equitable, and economically efficient use of biological resources. Moreover one of the strategic options of the policy is to "Conserve the Diversity of Landscapes, Ecosystems, Habitats, Communities, Populations, Species, and Genes in Rwanda".

Alongside the biodiversity policy, the biodiversity law, in its articles 14, 15 and 16, provides for the publication of respectively, a national list of ecosystems that are threatened and in need of protection, a list of activities prohibited in an ecosystem included on the list referred to under Article 14 of this Law and a list of the species in need of protection.

Although legal and institutional frameworks provide for the high level of protection, natural ecosystems and protected areas are not functioning as originally envisioned. Despite their importance, natural ecosystems, and more particularly terrestrial ecosystems, are facing serious problems of destruction and illegal activities such as poaching, tree cutting for firewood and clearance of land for agriculture, etc. Alien invasive species are increasingly invading protected areas, and some native species have gone extinct or are endangered threatened.

Different studies reveal that human populations and intense land use have grown rapidly in recent decades around many protected areas (Hansen et al., 2007). This pressure leads to huge conversions for agriculture, high demand for natural resources, clearing of primary forest around reserves, etc., and various threats of different magnitude affect not only species considered in isolation but also ecosystems as a whole.

In 2008, Rwanda has published the list of species in need of protection by the Ministerial Order Nº 007/2008 of 15/08/2008 establishing the list of protected animals and plant species. As 5 years have elapsed since the first publication, it is time to review the list and publish it as stipulated in Art.16 of the biodiversity law. Some efforts have been made to map these ecosystems but an inventory and mapping of threatened terrestrial ecosystems is still lacking. Some prior studies (e.g., REMA, 2011), revealed that several remnant forests are distributed across the country but they are facing significant threats. In order to relieve the pressures on these ecosystems as management and conservation of natural ecosystems are concerned, some questions must be addressed: Do these natural ecosystems have a viable size to sustain

the remnant biodiversity they still host? Do they have enough connectivity among them and with the larger National Parks to avoid genetic drift? Does the dominant agriculture matrix allow genes flow from one patch to another? What are the main characteristics of remnant ecosystems, including population sizes of key wildlife and plant species? Do we have viable populations? These are examples of the kinds of questions important to understand the threatened ecosystems and species in Rwanda. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes enabling or facilitating proactive management of the ecosystems, and preventing further degradation and loss of structure, function and composition of threatened ecosystems. For species, some of Rwanda's are already on the IUCN Red list (IUCN, 2011), and they needed to be reassessed so to establish their current status.

It is against this background that REMA has commissioned a study to update the status of threatened terrestrial ecosystems and species in need of protection in Rwanda. Different ecosystems were investigated across the country, and five taxonomic groups assessed: plants, mammals, birds, reptiles and amphibians. Different cartographic maps of the ecosystems were produced including maps for trends detection over the years, and species distribution maps in assessed ecosystems. The final product of this assignment is an updated list of threatened ecosystems and species, their main threats and conservation measures for mitigation.

CHAPTER 2. OBJECTIVES AND METHODOLOGY

2.1. Objectives

The overall objective of the study was to provide a scientific decision making tool for endangered species and ecosystems for conservation in Rwanda.

Specifically, the study aimed to:

- Establish a list of ecosystems that are threatened and in need of protection. Each ecosystem should be assigned to a specific category as specified in Article 14 of the biodiversity law and its location identified.
- Establish a list of activities prohibited in a threatened ecosystem included in the list referred to under Article 14 as stipulated in Article15 of the biodiversity law.
- Establish a list of the species in need of protection and assign each species to a specific category as stipulated in Article 16 of the biodiversity law.

2.3. Scope of the work

This study covered the whole national territory, but a priority was given to protected areas and to other preliminary identified sensitive ecosystems. As far as species' assessment is concerned, five main taxonomic groups were considered: plants, birds, mammals, reptiles and amphibians

2.5. Methodology

2.5.1. Data collection and analysis

In order to achieve the objectives of the study and fulfil the assigned tasks, the collection of data was done from all available information sources. A thorough literature review was done, and different research and academic institutions were consulted, as well as governmental and non-government institutions working in the field of biodiversity.

Field surveys were organized and conducted throughout the whole country to supplement the data obtained from literature review. The type of information to be collected was mostly oriented in a way they can be tested against the IUCN criteria used to assess biodiversity (IUCN, 2000).

Data collected included population sizes, dynamics, structure and distribution of selected species. The red list of species developed by IUCN was considered and served as a basis in this assignment. The conservation measures that are needed for the species were assessed following the IUCN Conservation Actions Classification Scheme (IUCN 2012a). The criteria which were used to assess the species published in the Ministerial order N^{O} 007/2008 of 15/08/2008 establishing the list of protected animal and plant species was also reviewed.

All taxonomic data about the 5 groups was collected. Data on taxa was collected throughout different ecosystems across the country. Semi-structured interviews were also conducted with different stakeholders, including local communities, to get more data about threatened ecosystems and species.

2.5.1.1. Assessment of threatened ecosystems

A baseline list of terrestrial ecosystems was developed and each ecosystem visited for assessment, by particularly referring to the survey conducted in 2011 which aimed to make an inventory of threatened remnant terrestrial ecosystems outside protected areas through Rwanda (REMA, 2011). In this study, a list of 15 remnant terrestrial ecosystems has been produced: Buhanga Natural Forest, Bukora Natural Forest, Ibanda-Makera Natural Forest, Karama Natural Forest, Kumbya Peninsula, Mashyuza Natural Forest, Mukura Natural Forest, Muvumba Gallery Forest, Nyabitukura Natural Forest, Nyagasenyi Natural Forest, Ntendezi Natural Forest, Nyenyeri Natural Forest, Rujambara Natural Forest, Shagasha Natural Forest, Gabiro, Gako and Nasho military domains.

During this study, this list was reviewed and other protected areas were added to this list, as well as any other ecosystem relevant for the study. With reference to the Draft Ministerial Order Determining the Management of Protected State Forests Which Are Not Governed by Special Laws, terrestrial natural ecosystems of at least 10 ha were assessed. The size of 10 ha is based on the fact that the bigger the ecosystem the richer is its biodiversity, and that habitats with spatially heterogeneous abiotic conditions provide a greater variety of potentially suitable niches for species. Some ecosystems have been withdrawn from assessment due to their current status. It's mainly the case of forests which have been converted in ranches such as Bukora, Nyenyeri, Karangazi and Rwimiyaga-Karushunga. Due to limited access, all military domains were also not assessed. Therefore, 17 natural forests were assessed as shown in the following table and map (map in higher resolution is attached).

Table 1: Ecosystems assessed and their locations

Ecosystem	District
1. Akagera National Park	Nyagatare, Gatsibo and Kayonza
2. Busaga Natural Forest	Muhanga
3. Dutake Natural Forest	Karongi
4. Gishwati Natural Forest	Rutsiro and Ngororero (extensively also Rubavu and Nyabihu)
5. Ibanda-Makera Natural Forest	Kirehe
6. Karama Natural Forest	Bugesera
7. Karehe-Gatuntu Forest Complex	Karongi
8. Kibirizi-Muyira Forest	Nyanza
9. Mashoza Natural Forest	Ngoma
10. Mashyuza Natural Forest	Rusizi
11. Mukura Natural Forest	Rutsiro and Ngororero
12. Muvumba Natural Forest	Nyagatare
13. Ndoha Natural Forest	Karongi
14. Nyagasenyi Natural Forest	Kirehe
15. Nyungwe National Park (including Cyamudongo)	Rusizi, Nyamasheke, Nyamagabe, Nyaruguru and Karongi
16. Sanza Natural Forest	Ngororero
17. Volcano National Park (including Buhanga)	Burera, Musanze and Nyabihu

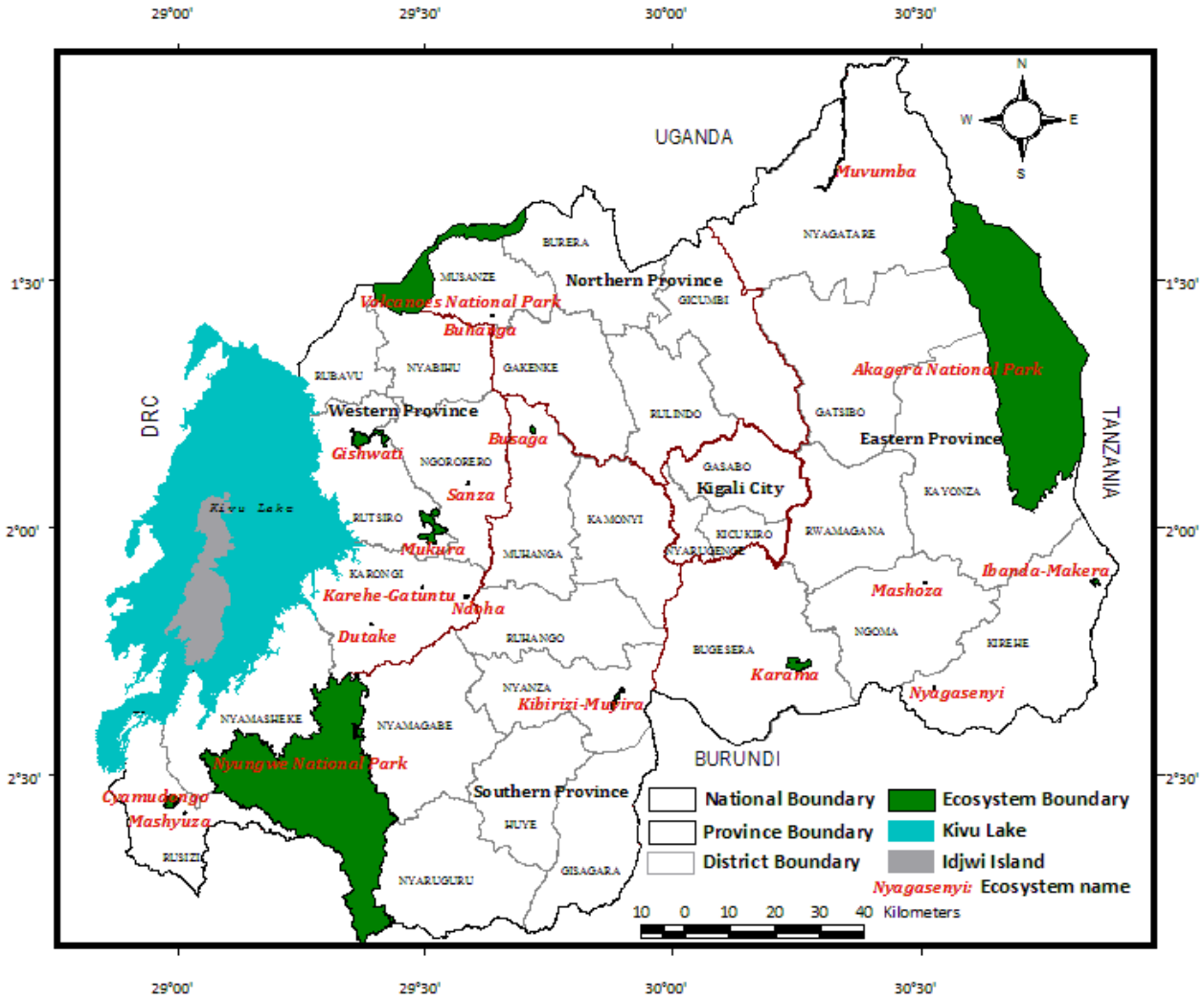


Figure 1: Location of assessed ecosystems

During the assessment, each ecosystem was described based on:

- Associated physical environment and spatial extent,
- Characteristic assemblage of biota and
- Threatening processes.

For risk assessments, IUCN Red List Criteria for Threatened Ecosystems were followed (Keith *et al*., 2013) (Appendix 1). There are five quantitative criteria which are used to determine whether an ecosystem is threatened or not, and if threatened, which category of threat it belongs in (**Critically Endangered (CR); Endangered (EN);** or **Vulnerable (VU**):

- **Criterion A1** current decline in distribution: IUCN recommends conducting the assessment over the 50 years. For this study, we have considered only a period of 30 years given that most data available cover that period of time.
- **Criterion A2** future decline in distribution: We have followed IUCN guidelines for the assessment of risk over the next 50 years, or any 50-year period including the present and the future.
- **Criterion A3** historic decline in distribution: IUCN recommends the assessment since 1750.
- **Criterion B1** extent of occurrence (polygon): This is a convex minimum polygon enclosing all occurrences. During our study, all the ecosystems assessed and which share similar ecological conditions have been considered for a single polygon. Any other similar ecosystem in the country but which was not assessed was not considered depending on their level of degradation (e.g. forests transformed in ranches…) and/or their size (e.g. ecosystems of less than 10 ha, except Mashyuza Natural Forest because of known rare plant species that are found there only). Thus four polygons were created:
    - A polygon enclosing savannah ecosystems of Akagera National Park, Karama and Kibirizi-Muyira Natural Forests.
    - A polygon enclosing mountain forest ecosystems of Nyungwe National Park, and natural forests of Gishwati, Mukura, Busaga, Sanza, Dutake, Ndoha and Karehe-Gatuntu.
    - A polygon enclosing gallery forests of Ibanda-Makera, Mashoza, Muvumba and Nyagasenyi Natural Forests.
    - Volcano National Park (including Buhanga) and Mashyuza were considered as a unique polygon each, given their particular characteristics not shared with any other assessed ecosystem.
- **Criterion B2** area of occupancy (grids): It is equal to the number of 10km x 10km grid cells occupied.
- **Criterion B3** number of locations : It is the number of locations of similar ecosystems (see criterion B1)
- **Criterion C1-3** environmental degradation: It is the extent and relative severity of environmental degradation based on change in an abiotic variable (current decline, future decline and past decline).

- **Criterion D1-3** disruption of biotic processes : It is the extent and relative severity of disruption of biotic processes and interactions based on change in biotic variable (current decline, future decline and past decline)
- **Criterion E** quantitative risk estimate: It is the quantitative analysis that estimates the probability of ecosystem collapse.

Each ecosystem was assessed using all criteria for which data are available, and a set of thresholds within criteria (thresholds such as amount of decline in geographical distribution or degree of degradation that must be reached in order to qualify for a corresponding category). Overall threat status was the highest level of risk returned by any of the criteria. The quantitative categories of risk correspond to those of the IUCN (IUCN, 2012c; IUCN, 2014).

Besides threatened categories (CR, EN and VU) under each criterion, an ecosystem could be classified as:

Least Concern (LC) for an ecosystem that unambiguously meets none of the threatened category,

Data Deficient (DD) where too few data exist to apply any criterion,

Not Evaluated (NE) for an ecosystem that has not yet been assessed,

Collapsed (CO) assigned to an ecosystem that has collapsed throughout its distribution, the analogue of the **Extinct (EX)** category for species.

2.5.1.2. Determination of prohibited activities in threatened ecosystems

According to five IUCN categories of protected areas (Dudley, 2008), each assessed ecosystem was assigned a proposed category. Given that the basic role of protected areas is to separate elements of biodiversity from processes that threaten their existence in the wild, different harmful activities were suggested (IUCN, 1992).

IUCN categories of protected areas:

- **Category I: Strict nature reserve and wilderness areas:** Areas designed to protect natural organisms and natural processes in an undisturbed state in order to have

representative examples of biological diversity for scientific study, education, environmental monitoring, and maintenance of genetic variation.

- **Category II: National Parks: A**reas of outstanding scenic and natural beauty of national or international importance that are maintained for scientific, educational, and recreational use.
- **Category III: National monuments and landmarks:** Areas designed to protect and preserve nationally significant natural features because of their special interest or unique characteristics.
- **Category IV: Managed wildlife sanctuaries and nature reserves:** Areas preserved to assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment where these require specific human manipulation for their perpetuation.
- **Category V: Protected landscapes and seascapes:** Areas designed to maintain nationally significant natural landscapes which are characteristic of the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal life style and economic activity of these areas.
- **Category VI: Managed-resource protected areas:** These areas allow for the sustained production of natural resources, including water, wildlife, grazing for livestock, timber, tourism, and fishing; in a manner that insures the preservation of some aspects of biological diversity. These areas are often large and may include both modern and traditional use of natural resources.

2.5.1.3. Assessment of threatened species

Five taxonomic groups are under consideration for this study: plants, birds, mammals, reptiles and amphibians. For all groups, the assessment of their status in order to establish a list of threatened species was based on IUCN criteria (IUCN, 2012c; IUCN, 2014). Details on IUCN threatened categories (Critically Endangered, Endangered and Vulnerable) (IUCN, 2014) are found in appendix 2.

Classification criteria are as follows:

EXTINCT (EX)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate

times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

NEAR THREATENED (NT)

A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

For each taxonomic group, detailed methodologies and approaches for data collection and analysis are developed below.

a. Assessment of threatened plant species

The existing list of threatened plant species was updated by using different documentations. Literature, previous lists such as the 2008 list and RNRA list for plant were used to establish a baseline list considering plant species with a clear conservation benefit such as endemism; restricted geographic distribution; overexploitation, etc. Rapid floristic inventory through natural ecosystems investigation was conducted. Stratified-random sampling method was used during floristic and vegetation survey. This allowed the determination of floristic composition and plant community structure.

The cover-abundance value of inventoried plant species was recorded with reference to phytosociological methods and techniques (Braun-Blanquet, 1932). Species identification was done immediately on the field, or later on with support of different monographs and National Herbarium records.

The collected data were analyzed using assessment criteria of IUCN. The five IUCN criteria (A-E) were used to evaluate if a plant species belongs in a threatened category (CR, EN and VU) (IUCN, 2014). Criterion A assesses species based on the population reduction, criterion B bases on geographical range in the form of extent of occurrence and area of occupancy, Criterion C considers population size and decline(number of mature individuals) while criterion D focuses on very small or restricted population (number of mature individuals) and E quantitative analysis. To respond to these, gathering data were based on the general observation, current knowledge about population trends, range, and recent, current or projected threats. The conclusion was taken considering the criteria resulting in the highest threatened category.

b. Assessment of threatened bird species

During the assessment on bird's status, we compiled the existing information on birds of Rwanda from public, research and academic institutions, national and international organizations dealing with biodiversity issues. Publications on birds and the information from the potential persons including tourist's guides, park managers, members of Rwanda Birding Club

and local birders were considered as an important source of information on the status of the species and their habitat.

Using the information from documentation review and Ministerial order of 2008 establishing the lists of protected animals and plant species, a list of priority bird species to be assessed on the field was established.

The desk and internet based researches were supplemented by the rapid assessment of different sites mainly IBAs, National Parks, forest reserves and remnant forests throughout the country. A line transect was set in each visited site and information collected with direct observations of the presence of the species and the habitat status. Many species were detected while travelling to and from survey sites, or outside standard survey times or survey sites. Birds were identified opportunistically either by their call or by their appearance. The direct threats on species and their habitat were assessed through the direct observation and questionnaire addressed to local communities and leaders.

The prioritized bird species were assessed and categorized within IUCN categories basing on the habitat status, estimated population, threats and species occurrence throughout the country. Four criteria were considered:

c. Assessment of threatened mammals

This study has been concluded based on field studies carried out the forests and parks of Rwanda. General information population size, status of the habitat and fluctuation in the animal population were resembled. The field information was supported by literature findings and the ground truth was carried out to verify the findings in the literature (including technical reports, papers, and books), the main data related to the population size and possible trends was gathered in literature, further information was gathered from park managers and researchers.

In addition, questionnaire has been used to collect information on the past and current status of the species of interest, where possible books have been used to make sure the species pointed out by the interviewee is the right one.

Species distribution was assessed by providing information on geographic range, the current population's abundance, and absence/presence, ecological requirements such as habitat preferences, adaptation and major threats (Sutherland 2000).

During field work surveys, non-invasive methods for the rapid assessment of mammalian richness and geographic distribution (combination of the techniques including droppings, footprint, and direct observation) were used where the information on large mammals is not available or poorly documented. Repeatedly walk transects located along existing trails in the forest was used to collected information on the presence/absence, existing threats on the habitat and past threats (Plumptre 1991; Sutherland 2000). Animal footprints, direct observations and indirect observation such as vocalizations and faeces/droppings was recorded, photographed, and identified when possible (Sutherland 2000; White and Edwards 2000). Photographs collected in the field were further analyzed and the corresponding species identified according to field guides.

Field books (e.g. The Kingdom Field Guide to African Mammals) including pictures of the species was used to help assessors to quickly recognize each of the species of interest. The presence of small mammals was collected by observing burrows and faeces, and specific species presence in the site was checked in field books with local people, researchers and conservationists in the sites.

For each species assessed, the information including species classification, geographic range (including a distribution map), red list category and criteria, population information, habitat preferences and threats to the habitat as gathered (Sutherland 2000).

d. Assessment of threatened Reptiles and amphibians

We have sampled the herpetofauna by walking trails at each survey site and searching for reptiles and amphibians along the trails (Southerland 2000). Special attention was given to creeks, downed logs, cavities, and other favourable habitats, to discover as many species of amphibians and reptiles as possible. In addition we were looking and listening for small movements, and listening for calls while exploring the variety of habitat types (Heyer et al. 1994). An interview was used to address different informants to enrich collected information from the field. Field books (A Field Guide to the Reptiles of East African region and Central Africa Reptiles checklist, A Field Guide to the Amphibians of East African region) including pictures of the species was used to help interviewees to quickly recognize each of the species of interest.

2.5.2. Mapping

Integrated cartographically sound thematic maps of threatened terrestrial ecosystems of Rwanda as well as spatial distribution of identified threatened species have been produced. The extent of occurrence was calculated using ArcGIS 10.2. This was performed by applying the minimum convex polygon that covers the recorded locations. In addition, the area of concurrency was calculated by superimposing 10km x 10km grid cells over convex polygons. Maps showing the derived extent of occurrence and area of occupancy were produced in the raster format.

Shapefiles (in shape of point) showing the general distribution of the identified species were delivered. The spatial coverage at different years of the ecosystems to be assessed derived from remotely sensed data of 30 years ago, as most Landsat images from different providers date from 30 years ago. The imagery used was Landsat Thematic Mapper (TM) of 30mx30m spatial resolution. Images were used to locate and quantify different ecosystems. Other sources of data included topographic map of Rwanda of 1989, and the Orthophotos of 2008 collected by Rwanda Natural Resources Authority. Data analysis included geometric correction of the Landsat images, rectification, classification, enhancement, and information extraction. The image rectification and geometric correction was done by projecting images using UTM zone 35 S, Projected Coordinate System WGS84, GCS_WSG_1984 and D_WGS 1984. The enhancement was done by increasing the apparent distinction between the features to improve the visual interpretability of the image.

Landsat images were classified according to FAO classification scheme (FAO, 1997). The classification method is the Maximum likelihood classifier, which is one of the most widely used in the classification of satellite imagery (Vorovencii, 2005). Software used in image processing is ERDAS IMAGINE 9.2, whereas ArcGIS Desktop version 10.2 was applied for spatial analysis when quantifying different ecosystems for 30 years. Change detection analysis concern changes which have occurred during last past 30 years to quantify the temporal and spatial dynamics of different ecosystems. Overlay analysis operations was performed to measure the degree of change in areas coverage at different years, for each ecosystem under the assessment. Such operations allowed the estimation of the land cover change over 30 years in terms of ecosystem degradation.

In addition, GPS coordinates were collected during the field visit to delineate the boundaries of ecosystems of low spatial coverage and allow those ecosystems' mapping. Captured and saved coordinates for ecosystems were downloaded and integrated in ArcMap interface as point features. The next step consisted of digitizing process, to create the polygons representing the boundaries of delineated ecosystems, using the same spatial referencing system in order to allow further integration and analysis with spatial coverage of large ecosystems, generated through image classification. The DEM was combined with the vector layers (ecosystem boundaries) to calculate the total areas (in Hectares) for each ecosystem, using spatial analysis function of Arc Map.

2.5.3. Survey tool for interviews

Focus group discussions and guided consultations were conducted with key stakeholders who are involved in the management of biodiversity and natural resources in general, including community groups, leaders, park managers... Individual interviews with key stakeholders were organized with the help of an interview guideline (appendix 6). Local communities were mainly interviewed about the negative impacts of human activities on species and their habitat and other different issues related to ecosystems and biodiversity in general. For each taxonomic group, a provisional list of species subject to assessment was suggested, and it constituted a baseline for the semi-structured interviews.

CHAPTER 3. TERRESTRIAL THREATENED ECOSYSTEMS

3.1. Listing of threatened ecosystems

3.1.1. Akagera National Park

3.1.1.1. Ecosystem description

Abiotic environment and distribution

ANP is located in the East of Rwanda, in the districts of Nyagatare, Gatsibo and Kayonza bordering the north-western Tanzania and the south-western Uganda, at an altitude varying between 1250 and 1825 m. ANP was established in 1934 with an original size of 245,000 ha. In 1957 Umutara hunting area of 30,000 ha was added. In 1997, a considerable part of the park was de-gazetted to accommodate Rwandans returning from exile (Munyaneza, 2012). Currently, the park covers an area of 112,185 hectares. ANP is a savannah landscape of tangled acacia woodland interspersed with open grassland. In the west, the topography of the park is characterized by rolling sandstone hills, quatzites, schists and granites cut in places by deep, narrow valleys. In the east, flood-plains are predominant, as well as swamps that follow the meandering course of the Akagera River that flows along the eastern boundary and feeds into a labyrinth of lakes of which the largest is Lake Ihema (Figure 2).

Figure 2. Main features of ANP: Savannah landscape (above left and right); Lakes (below left and right)

Characteristic native biota

ANP still has an 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 (Kanyamibwa 1998:13, Vande weghe & Vande weghe 2011). Akagera hosts many ornithological features with several breeding residents, migrants, wetland and open water birds as well as endemics of sub-Saharan Africa. The rare and elusive shoebill (*Balaeniceps rex*) shares the papyrus with other rarities such as the exquisite papyrus gonolek (*Laniarius mufumbiri*) and countless other water birds that inhabit the wetlands in large numbers. Nine of the 11 bird species endemic to the Lake Victoria Basin that occur in Rwanda are present in Akagera (Kanyamibwa 2001). Key large mammals include African elephant (*Loxodonta Africana)*, African buffalo (*Syncerus caffer*), Giraffe (*Giraffa camelopardalis)*, Hippopotamus (*Hippopotamus amphibious*) and Eland (*Taurotragus oryx).* The vegetation of ANP comprises mainly savannah species in the western part of the park dominated mostly by xerophytic plants.

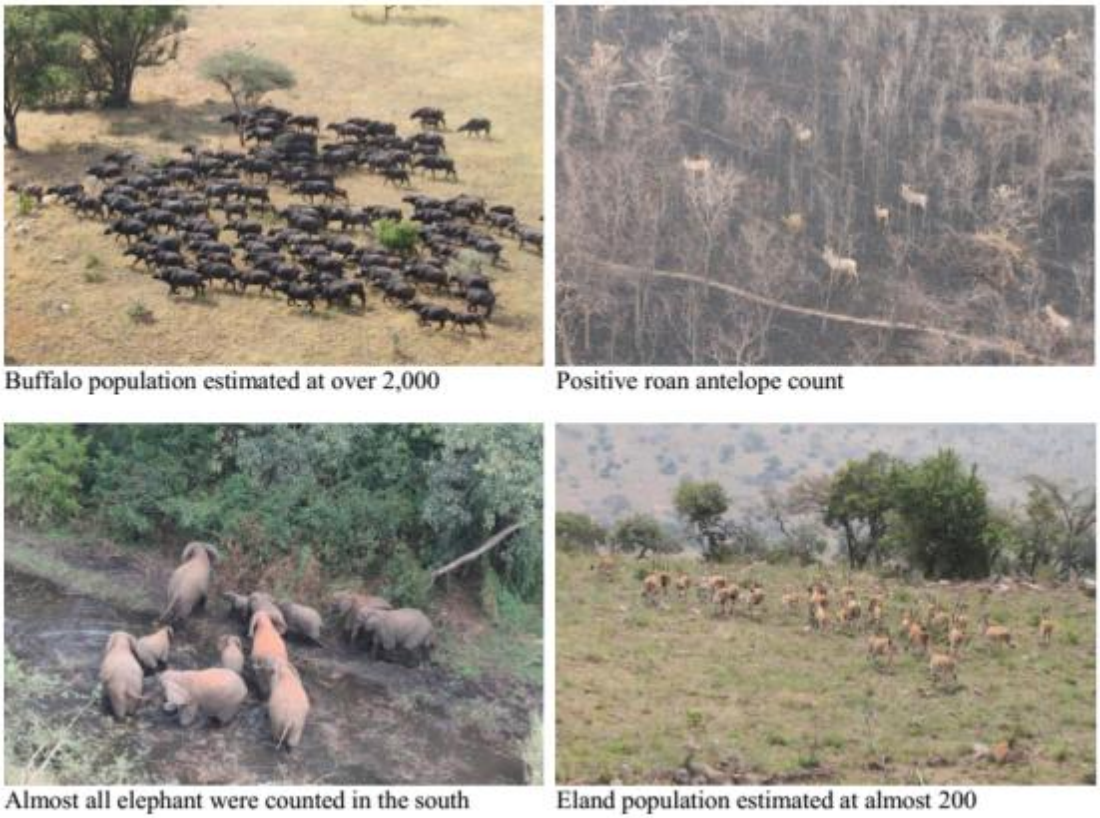


Figure 3: ANP biodiversity

Source: Akagera National Park - Aerial Census, 2013.

Threatening processes

The main threats to the persistence of this ecosystem are related to anthropogenic activities. In fact, losses in biodiversity have been estimated at more than 60% of the park area that was converted into farmland, 50-80% of large mammals and 13% of birds (Kanyamibwa 1998, Plumptre et al., 2001, Chemonics International 2008). Key cases include the extinction of black rhino and lions. It is estimated that the population of black rhino exceeded 50 in the late 1970s. However wide-scale poaching in the early 1980s wiped out the Akagera population almost entirely and the last confirmed sighting of a black rhino in Akagera was in 2007. This is the same case for lions whose population has been wiped out mostly through poisonings by cattle herders seeking to protect their livestock. The largest decline in wildlife occurred in 1990s attributable to direct killing by humans. Heavy grazing pressure, agricultural encroachment, charcoal production, the felling of trees for fuel wood and construction, and deliberately set fires have seriously fragmented the ecosystem (Figure 4). Current threats include poaching, illegal fishing and harvesting of Sandalwood (*Osyris lanceolata*) and invasive species of *Lantana camara, Opuntia ficus-indica*…

Figure 4: Burning in the ANP (towards Gishami)

3.1.1.2. Risk assessment

Criterion A

Current decline

In the past 30 years, ANP has lost 58% of its size (Figure 5). Based on this criterion, the status of ANP is therefore **Endangered.**

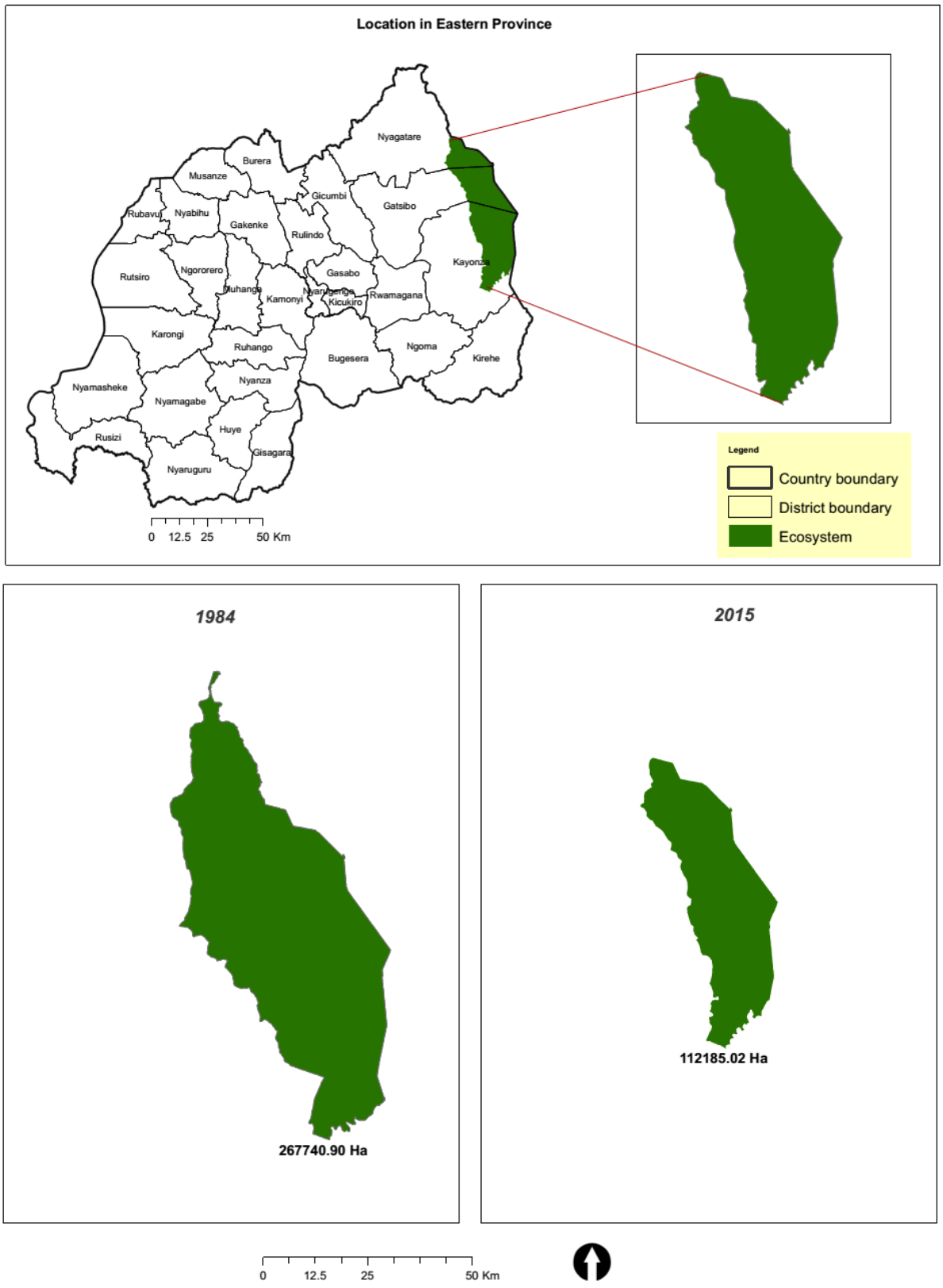


Figure 5: Changes in geographic distribution of ANP

Future decline

Based on protection measure including the new management of the park, law enforcement strategies and the electric fencing surrounding the park, there will evidently be no declines in the park's extent. The status of ANP is therefore **Least Concern** under this criterion.

Historic decline

There is no sufficient data to estimate changes in ANP since 1750. Even though, most of the national territory was covered by natural forests in those past years. As the population grew, forests were increasingly cleared for settlements, agriculture and pastoral lands…and this did not only happen ANP region, but elsewhere in the country as well. Thus, the status under this criterion is **Data Deficient**.

Criterion B

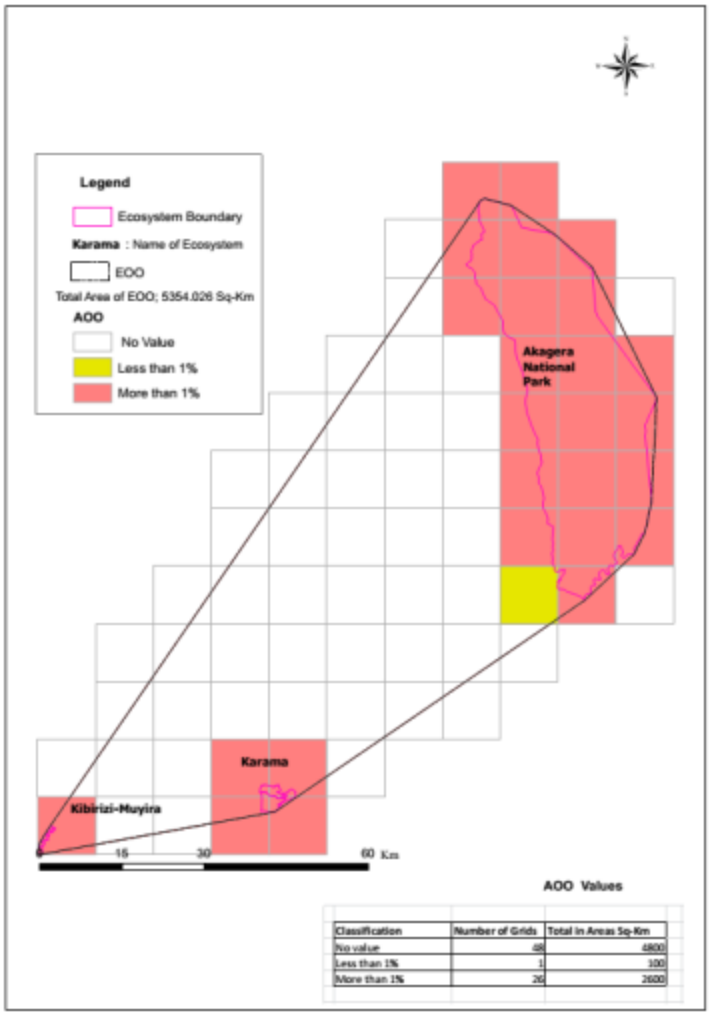


Figure 6: Extent of Occurrence and Area of Occupancy for savanna ecosystems

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar savannah ecosystems has an area of 5,354 km^2. This is less than 20,000 km^2, and thus, the status of ANP is **Endangered** under B1 (Figure 6).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of ANP and similar ecosystems indicates that 26 10kmx10km grid cells have an area of more than $1km^2$. Therefore, the status of ANP is **Vulnerable** under B2 (Figure 6).

Number of locations

Savannah ecosystems are mainly found in the eastern part of the country. Two main ecosystems similar to ANP in terms of vegetation types include

Karama and Kibirizi-Muyira Natural Forests. Others include some few relicts scattered in the East of the country, with high levels of degradation and/or very negligible size. Given that ANP is under official protection as a park, major threatening processes that are capable of causing collapse or making ANP critically endangered within a short time period and operating at some of these locations (e.g. Karama where wood cutting, agriculture encroachment, cattle grazing…are frequent) are unlikely to happen. This ecosystem is therefore listed as **Endangered** under criterion B3.

Criterion C

Current decline

Dry season fires are the main abiotic processes on which rates of environmental degradation can be assessed. Due to inadequate control capacities in fire management, the last 30 years knew some cases, the most recent being the one that happened in 2010, when some 160 km^2 were destroyed followed by huge fires which broke out in ANP, destroying 20% of the land mass in a total period of 30 days in 2012. These fire guts degrade natural environment at an extent estimated at less than 50% but with more than 80% of relative severity. This leads to **Endangered** status for this criterion.

Future decline

In many dry seasons, fire regimes threaten the ANP ecosystem. There are no data that could allow to model fire guts in the next 50-year period including the present and future though, but current threats will likely happen given that control measures are still insufficient although some efforts have increasingly been put together to address the issue. The status is therefore **Data Deficient** under C2.

Historic decline

There are no data for assessing this criterion, which leads to **Data Deficient** status under C3.

Criterion D

Current decline

Disruption of biotic processes and interactions in ANP is mainly linked to invasive species of *Lantana camara* spreading at high rates and *Dichrostachys cinerea* naturally growing in the park by negatively affecting the ecosystem by causing huge loss of plant diversity and affecting ecological habitats to wildlife. The extermination of *Osyris lanceolata* constitutes another threat

to biodiversity, as it happened in many other parts of the country where this species was deracinated for commercial purposes. In the past 30 years, the disappearance of lions contributed to ecological disequilibrium in this park as well. Another factor is related to high exposition of wild animals to ixodid ticks and to tick-borne diseases transmitted by these ones. Although the extent, magnitude and trends of degradation in biotic processes and interactions within the ecosystem are unknown due to insufficient data, but our estimates indicate that around 50% of biological diversity is affected at a high rate of severity (more than 80%). Under criterion D1, the status of the ecosystem is thus **Endangered**.

Future decline

Current control measures ensure a significant positive change as far as biotic processes and interactions are concerned. Assuming that sustained efforts will continue towards the mitigation of the threats in the future, the status of ANP is **Least Concern** for D2.

Historic decline

Not assessed due to lack of data. The status of ANP under D3 is **Data Deficient**.

Criterion E

No modelling of risks has been carried out to estimate ecosystem collapse; hence ANP is **Data Deficient** under criterion E.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**EN**	**VU**	**DD**	**EN**
Subcriterion 2	**LC**	**VU**	**DD**	**LC**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of ANP is estimated as being **Endangered (EN).**

3.1.2. Busaga Natural Forest

3.1.2.1. Ecosystem description

Abiotic environment and distribution

Busaga is a mountain rain forest located in Muhanga District, Rongi Sector. It has an area of 158.86 ha covering one big mountain, at an elevation of 1900-2000m. Busaga is bounded in the North by Sumo stream and the chains of Ndiza mountains in the West (Figure 7).

Figure 7: Overview of Busaga Natural Forest

Characteristic native biota

Surrounded by a buffer zone of *Eucalyptus, Grevillea* and *Alnus* species Busaga has very rich plant diversity. The dominant plant species are: *Macaranga neomilbraedina, Maesa lanceolata, Dombeya torrida, Chrysophyllum gorungosanum, Albizia gummifera, Tabernaemontana stapfiana* and *Myrianthus holstii*. The underwood comprises *Sercostachys scandens, Mimulopsis violacea, Chassalia subochreata, Clutia abyssinica, Psychotria mahonii…* The forest also shelters primates such as *Cercopithecus mitis*.

Threatening processes

Although surrounded by a buffer zone and protected by the authority, agriculture encroachment and clay exploitation constitute a big threat to this forest (Figure 8). In fact, this region is densely populated, and the land per household is very small. This leads to encroaching Busaga forest for various reasons as source of income (agriculture, firewood collection, beekeeping, clay working…). Plantations of eucalyptus constitute another threat to Busaga. This exotic

species is progressively invading the natural vegetation, and many eucalyptus trees have already grown inside the forest.

Figure 8: Major threats to Busaga Natural Forest

3.1.2.2. Risk assessment

Criterion A

Current decline

In the past 30 years, Busaga Natural Forest lost 17% of its size (Figure 9). It is therefore classified as **Least Concern** under this criterion.

Future decline

The insufficiency of current protection measures might lead to increased encroachment. The risk of reduction in geographical distribution can be estimated at least 30 for the next 50 years. The status of Busaga Natural Forest is then **Vulnerable** under A2.

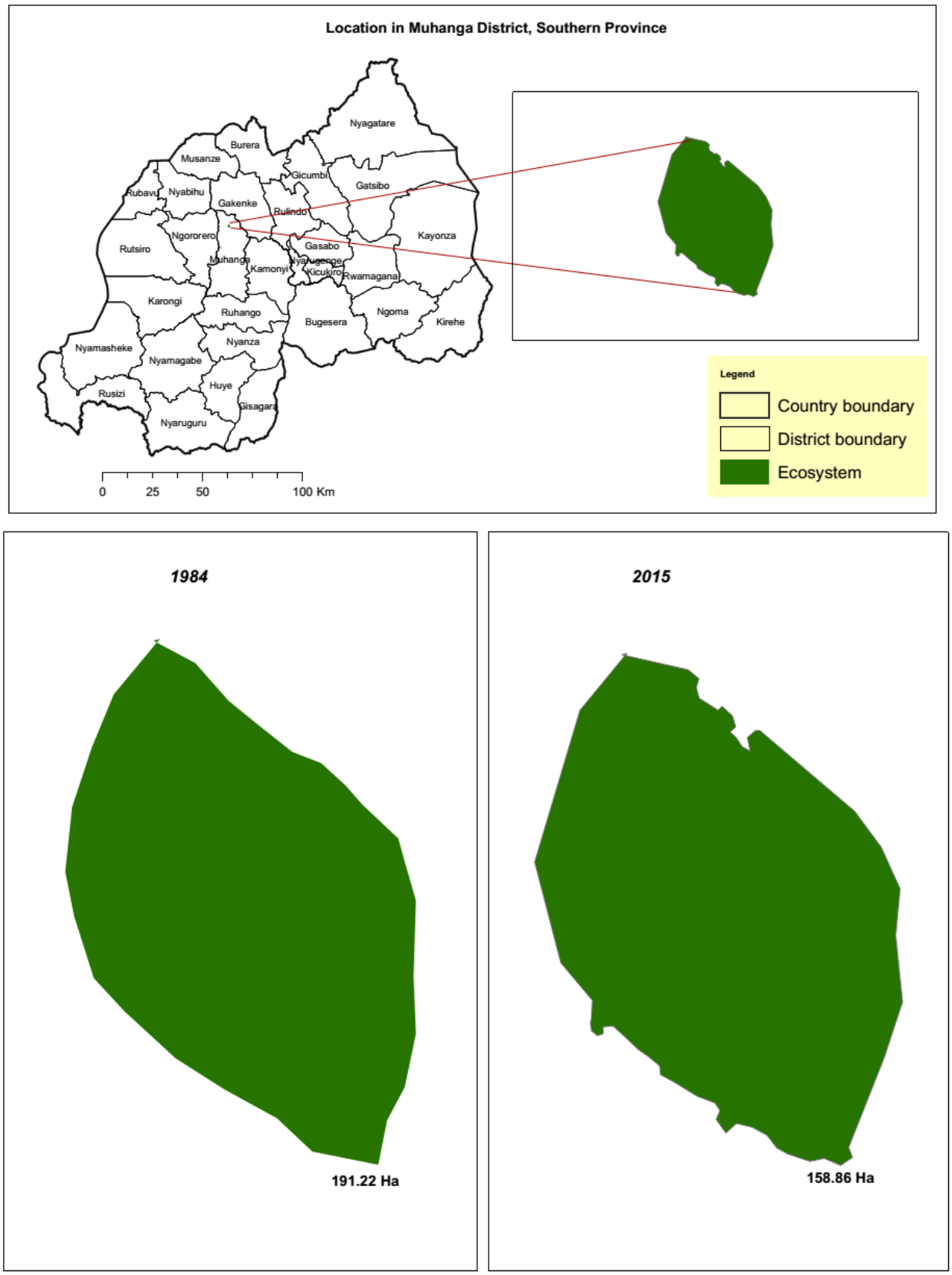


Figure 9: Changes in geographic distribution of Busaga Natural Forest

Historic decline

There is no sufficient data to estimate historical decline for the past 265 years. The status of Busaga is therefore **Data Deficient** under this criterion.

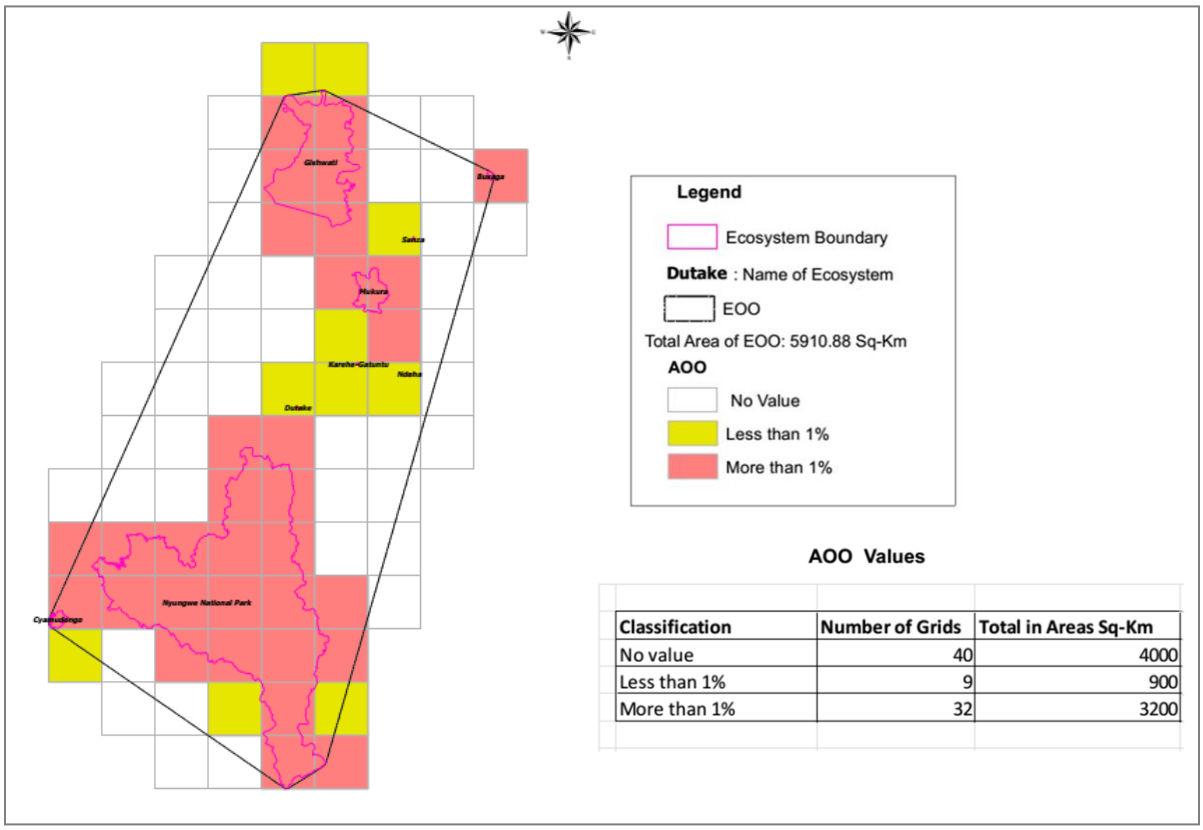
Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems has an area of 5,910.88 km^2.This is less than 20,000 km^2, and thus, the status of Busaga Natural Forest is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Busaga Natural Forest and similar ecosystems indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of Busaga Natural Forest is **Vulnerable** under B2 (Figure 10).



AOO Values

Classification	Number of Grids	Total in Areas Sq-Km
No value	40	4000
Less than 1%	9	900
More than 1%	32	3200

Figure 10: Extent of Occurrence and Area of Occupancy for mountain forests

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems found in the western part of the country. Under this criterion, the status of Busaga Natural Forest is **Endangered**.

Criterion C

Current decline

Agricultural encroachment which tends to convert natural ecosystem into agricultural farms is high, even though currently limited to the edges of the forest. The extent of degradation is estimated to have affected around 30% with high threatening risk estimated at 80%, mainly due to land cover change and erosion risks in cleared areas. The status of this ecosystem is therefore **Vulnerable** under this criterion.

Future decline

Unless strong protection measures are applied, existing factors of environmental degradation are expected to increase at an extent of more than 50% in next 50 years from now, with same high severity (80%). The status of Busaga forest under C2 is therefore **Endangered**.

Historic decline

The lack of sufficient data to assess this criterion leads to **Data Deficient** status.

Criterion D

Current decline

Disruptions in biotic processes and interactions are related to anthropogenic activities and the invasion of introduced eucalyptus. Many trees have already been uprooted in the sites of tiles making following clay extraction. Eucalyptus also gradually replaces natural vegetation. Degradation extent of biotic factors over past 30 years is estimated at 30-50%, with a high severity (>80%). This makes Busaga **Vulnerable** under this criterion.

Future decline

The increase of population pressure and lack of well defined remedial strategies to current threats on biotic variables will cause huge severe losses in the next 50 years at an extent of more than 80%. Therefore, this ecosystem is **Critically Endangered** under D3.

Historic decline

The lack of sufficient data to assess this criterion leads to **Data Deficient** status.

Criterion E

No quantitative analysis conducted to estimate the probability of ecosystem collapse in the future.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**LC**	**EN**	**VU**	**VU**	**DD**	**CR**
Subcriterion 2	**VU**	**VU**	**EN**	**CR**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Busaga Natural Forest is estimated as being **Critically Endangered (CR).**

3.1.3. Dutake Natural Forest

3.1.3.1. Ecosystem description

Abiotic environment and distribution

Dutake Natural Forest is located in Karongi District, at an altitude of 2331m, with an area of 10.76 hectares. Dutake covers both sides of very steep hill whose big part has been exploited for Coltan extraction (Figure 11). The eastern side is bordered by a stream which turns around the hill to the north. Due to an elevated altitude, the climate is very cold and temperatures relatively low compared to many other parts of the country. The forest is very wet with a thick carpet of mosses covering a big part of it.

Figure 11: Overview of Dutake Natural Forest

Characteristic native biota

The forest is surrounded by a buffer zone made of *Pinus patula*. Dominant plant species include many ericacea species on the slopes, *Syzigium guinnense* and *Parinari excelsa.* Other taxonomic groups are poorly represented (birds, mammals…).

Threatening processes

The major threat to Dutake forest is tree felling for construction and fire wood, in particular at the summit of the hill. During field investigations, many freshly cut trees were visible and many clearings and remains of cut trees found. In the past, the extraction of Coltan which started in 1950s has eliminated a significant part of the forest and huge ravines prone to erosion have resulted (Figure 12). Many footpaths crossing the forest increase access encroachment to it. In addition, law enforcement is very low as the forest is under the authority of village authority, whose capacity to control all illegal activities was reported to be not enough.

Figure 12: Major threats to Dutake Natural Forest

3.1.3.2. Risk assessment

Criterion A

Current decline

Based on distribution maps over 30 past years, the forest has lost 60% of its size (Figure 13). Thus, Dutake is classified as **Endangered** under Criterion A1.

Future decline

If protection measures are well established, future decline will likely be less than 30%. However, the pressure from population growth is very high, and the distribution of the forest is expected to significantly reduce up to more than current thresholds in next 50 years. The status of Dutake is therefore **Critically Endangered** under this criterion (Figure 14).

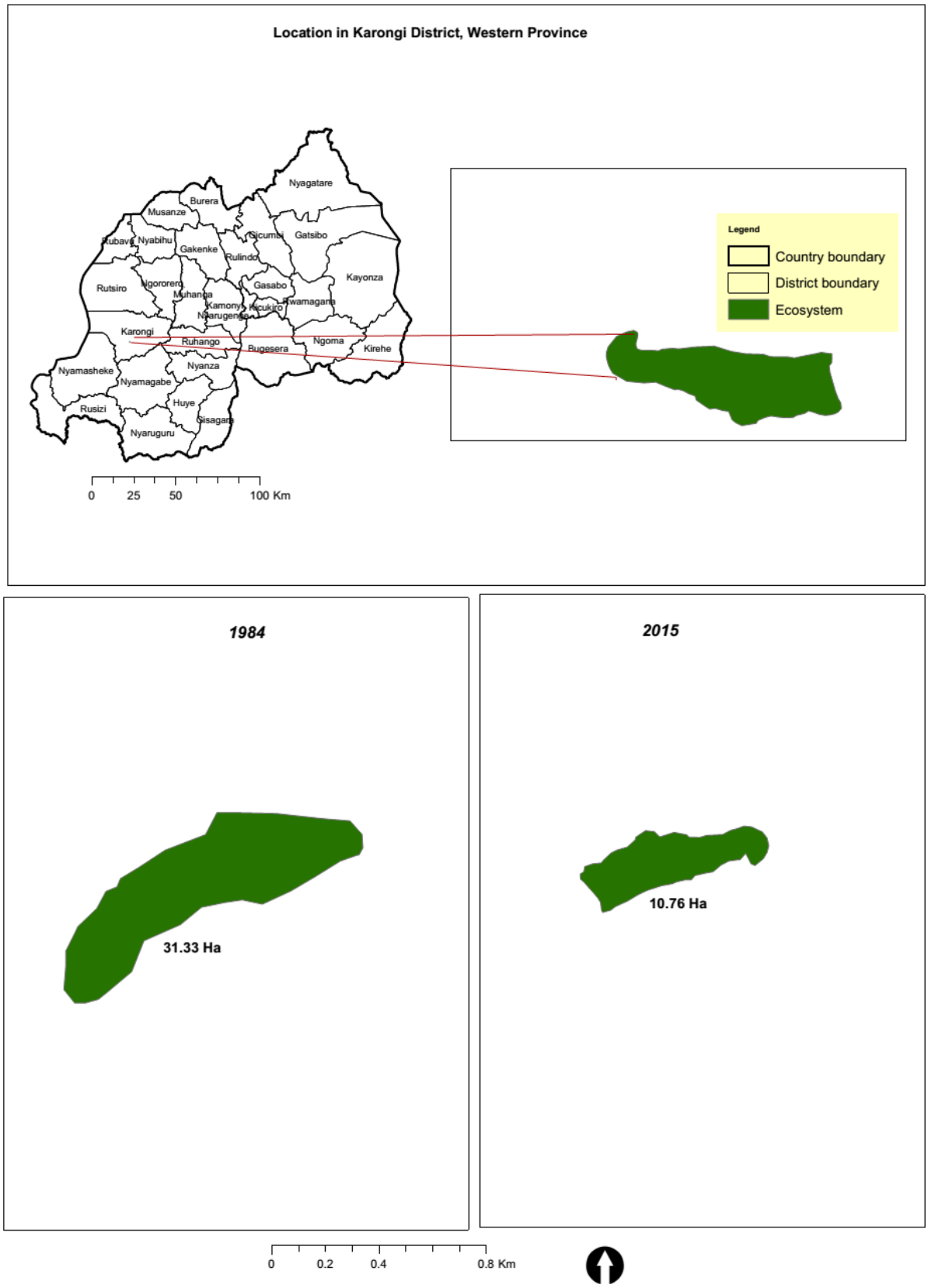


Figure 13: Changes in geographic distribution of Dutake Natural Forest

Figure 14: Intensive agriculture in the surroundings of Dutake Natural Forest

Historic decline

As for other ecosystems, there is no sufficient data to estimate changes in Dutake since 1750. Therefore, the status of Dutake Natural Forest is **Data Deficient** under this criterion.

Criterion B

Extent of occurrence The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems has an area of 5,919.88 km^2. This is less than 20,000 km^2, and thus, the status of Dutake Natural Forest is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Busaga Natural Forest and similar ecosystems indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of Dutake Natural Forest is **Vulnerable** under B2 (Figure 10).

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems found in the western part of the country. Under this criterion, the status of Dutake Natural Forest is **Endangered**.

Criterion C

Current decline

Erosion constitutes the main abiotic factor that affects the integrity of Dutake forest due to very steep slopes and surrounding quarries. Since the beginning of Coltan extraction in 1950s,

around 30% have been affected with very high relative severity (more than 80%). This leads to **Vulnerable** status.

Future decline

Extraction of Coltan has now stopped. Plantation of *Pinus* as a buffer zone is a good measure to prevent the erosions. Even though there are no sufficient data to model erosions behaviors in the next 50-year period including the present and future, we can assume that the risk will remain at current thresholds of extent and severity The status is therefore **Vulnerable** under C2.

Historic decline

There are no data for assessing this criterion, which leads to **Data Deficient** under C3.

Criterion D

Current decline

In terms of interactions, the increasing population growth constitutes a high potential threat due to agriculture encroachment and needs in wood for fuel, building materials, handcrafts, fire wood. Many paths inside the forest increase edge effect as well. The extent is estimated at 50% with relative severity of 80%. Under criterion D, the status of the ecosystem is thus **Endangered**.

Future decline

As described under criterion A, protection measures should lessen the risks, and limit negative interactions, but the estimates for the future indicate that more than more 50% of extent with relative severity 80% will have been destroyed. The status of Dutake is therefore **Endangered** under D3.

Historic decline

No available data to assess this. Status is **Data deficient** for D3

Criterion E

No modelling of risks has been carried out to estimate ecosystem collapse; hence Dutake Natural Forest is **Data Deficient** under criterion E.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**VU**	**EN**	**CR**	**CR**
Subcriterion 2	**CR**	**VU**	**VU**	**EN**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Dutake Natural Forest is estimated as being **Critically Endangered (CR)**.

3.1.4. Gishwati Natural Forest

3.1.4.1. Ecosystem description

Abiotic environment and distribution

Gishwati Forest Reserve is located in Rutsiro and Ngororero Districts, but its extended area to crosses also Rubavu and Nyabihu Districts of the Western Province of Rwanda. The mean slope is 35% with an elevation ranging between 2000m to 3000m. Gishwati is a highly degraded rainforest characterized by a complex of lithology and landscape diversity from valley floor to mountain summits (Figure 15) and it currently covers an area of 1,439.72 hectares. Gishwati region is a part of the Congo-Nile Divide and Albertine Rift. The characteristics of that relief have an important impact on the local climate which is characterized by cool temperatures and high rainfall.

Figure 15: Mountainous relief of Gishwati Natural Forest

Characteristic native biota

Gishwati is a home to important biodiversity including world-wide recognized species namely eastern chimpanzees (*Pan troglodytes schweinfurthii*); golden monkeys (*Cercopithecus mitis kandti*i); mountain monkeys (*Cercopithecus l'hoesti*); and more than 130 species of birds including 14 that are endemic to the Albertine Rift and two endangered species Martial Eagle (*Polemaetus bellicosus*) and Grey Crowned Crane (*Balearica regulorum*). Many of the plant species have been destroyed but some characteristics of mountain forest species including more than 60 indigenous tree species survived in fragmented patches of the remaining forest such as *Carapa grandiflora*, *Entandrophagrama excelsum*, *Symphonia globulifera*…

Threatening processes

Gishwati Natural Forest has been faced many threats that undermined most of its ecosystem. Since 1980s, forest clearing for large scale cattle ranching projects, pine plantation, cropland and settlement resulted in the loss of a big part of the forest. Consequently the area is plagued with catastrophic flooding, landslides, erosion, decreased water quality, and heavy river siltation, all of which aggravate local poverty. During and after the 1994 Genocide against the Tutsi, there was acute shortage of land to resettle returnees and internally displaced persons. Resettlement of former refugees has sharply contributed to the destruction of Gishwati (Figure 16).

Figure 16: Threats to Gishwati Natural Forest (above left: cleared mountains; above right: cattle ranches; below left: settlements; below right: 2007's floods due to Gishwati deforestation)

3.1.4.2. Risk assessment

Criterion A

Current decline

Based on distribution maps over 30 past years, the forest has lost 93% of its size (Figure 17). Thus, the status of Gishwati is **Critically Endangered** under this criterion.

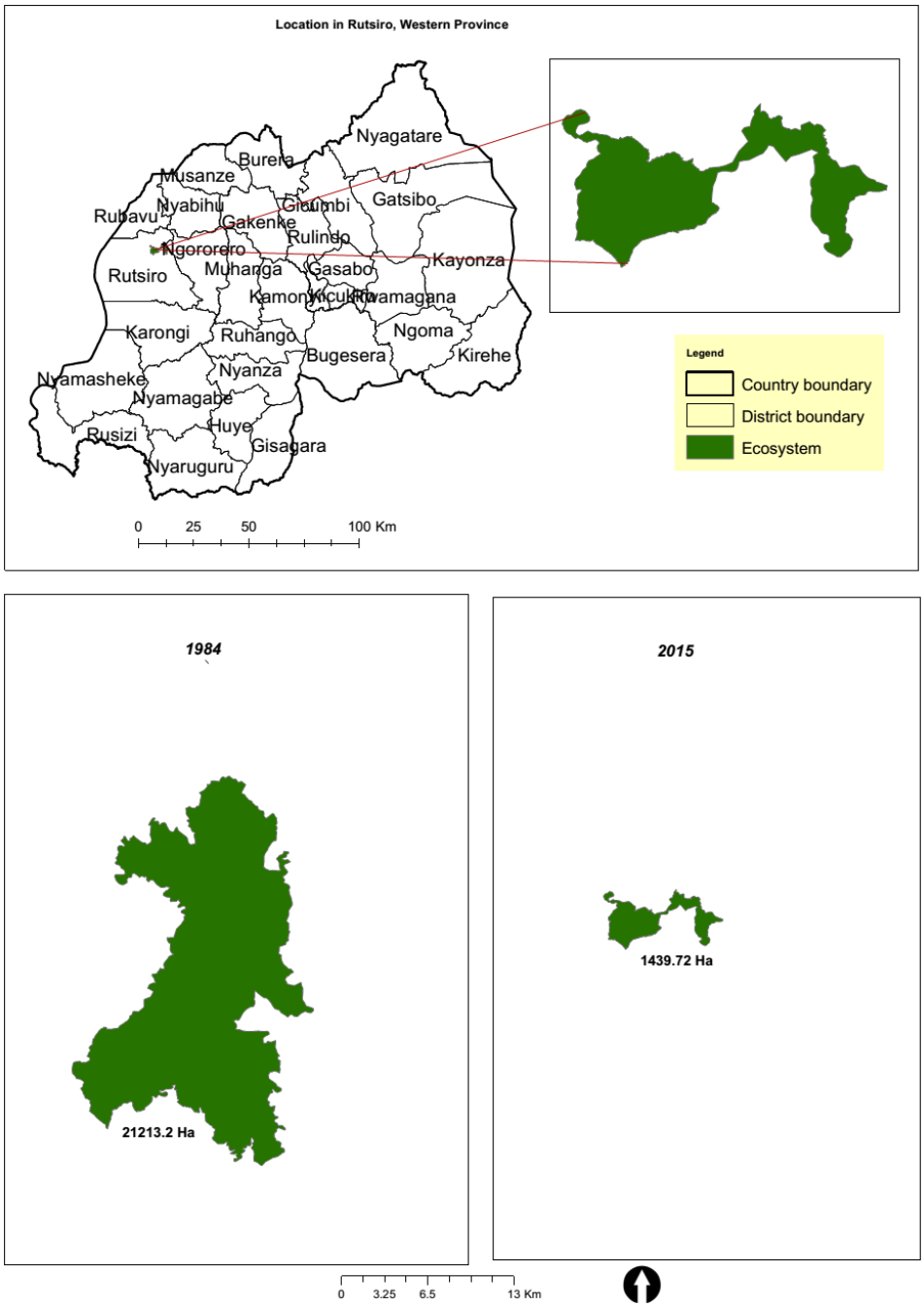


Figure 17: Changes in geographic distribution of Gishwati Natural Forest

Future decline

This forest, together with Mukura Natural Forest, has been suggested to be gazetted as Gishwati-Mukura National Park. Currently, a draft law to get this new park gazetted has reached an advanced stage. After approval of by the Cabinet meeting in 2014, the draft law is being finalized by the Parliament. These conservation efforts for Gishwati restoration indicate that the

threats to its geographic distribution will considerably reduce to at least the level of **Vulnerable** status in next 50 years.

Historic decline

Some estimations state that Gishwati extended 100,000 hectares in the early 1900s. Based on this data, the loss was more than 80%, and thus leading to Critically Endangered status under this criterion. Due to lack of sufficient data cannot allow us to confirm this information, the status of Gishwati Natural Forest is **Data Deficient** under this criterion.

Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems as Gishwati has an area of 5,919.88 km^2. This is less than 20,000 km^2, and thus, the status of Gishwati Natural Forest is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Gishwati Natural Forest and similar ecosystems indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of Gishwati Natural Forest is **Vulnerable** under B2 (Figure 10).

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems found in the western part of the country. Under this criterion, the status of Gishwati Natural Forest is **Endangered**.

Criterion C

Current decline

Clear-cutting the forest has resulted in recurrent landslides and floods. Soil erosions on slopes of the mountains caused serious damages in topography of the forest. Extent of degradation can be estimated at more than 80% with very high severity (>80%). This leads to **Critically Endangered** Status under this criterion.

Future decline

As for criteria A, current conservation measures can ensure the better future for this ecosystem. We estimate that it will take time to fully remediate the disruptions caused by various threats, so that in the next 50 years, current levels of extent and severity will lower to 50%. As an example, 336 hectares added in 2008 have been reforested from late 2009 to early 2010 and the 262 hectares added in 2009 to stabilize steep hillsides in an area called Kinyenkanda that has been plagued by landslides and severe erosion into the Sebeya River, are under natural regeneration. Therefore, the status of Gishwati under this criterion is **Endangered**.

Historic decline

Criterion not assessed due to lack of sufficient data. Gishwati status is therefore **Data Deficient** under this criterion.

Criterion D

Current decline

As described in previous sections, much of biological resources were decimated at very great extents that can be estimated at more than 80% with great severity of more than 80%. Therefore, the status of Gishwati Natural Forest under this criterion is **Critically Endangered**.

Future decline

Current efforts of restoration will hardly reach the original state of biodiversity of Gishwati Natural Forest in 50%. Thus, the status is assumed to remain **Critically Endangered** under D2.

Historic decline

Criterion not assessed due to lack of data. Gishwati Natural Forest status is therefore **Data Deficient** under this criterion.

Criterion E

No modelling of risks has been carried out to estimate ecosystem collapse; hence Gishwati Natural Forest is **Data Deficient** under criterion E.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**CR**	**EN**	**CR**	**CR**	**DD**	**CR**
Subcriterion 2	**VU**	**VU**	**EN**	**CR**		

Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Gishwati Natural Forest is estimated as being **Critically Endangered (CR)**.

3.1.5. Ibanda-Makera Natural Forest

3.1.5.1. Ecosystem description

Abiotic environment and distribution

Ibanda-Makera Natural Forest Complex is located in Kirehe District. The two forests, Ibanda and Makera constitute a complex made of a gallery forest of Ibanda located in the South and contiguous to the Akagera wetland in the East (Figure 18). Another forest is Makera located in the North on a hill of woodland and savannah vegetation. Ibanda-Makera covers an area of 168.88 hectares. A stream called Nyampongoroma crosses the forest and is source to water used by many local people.

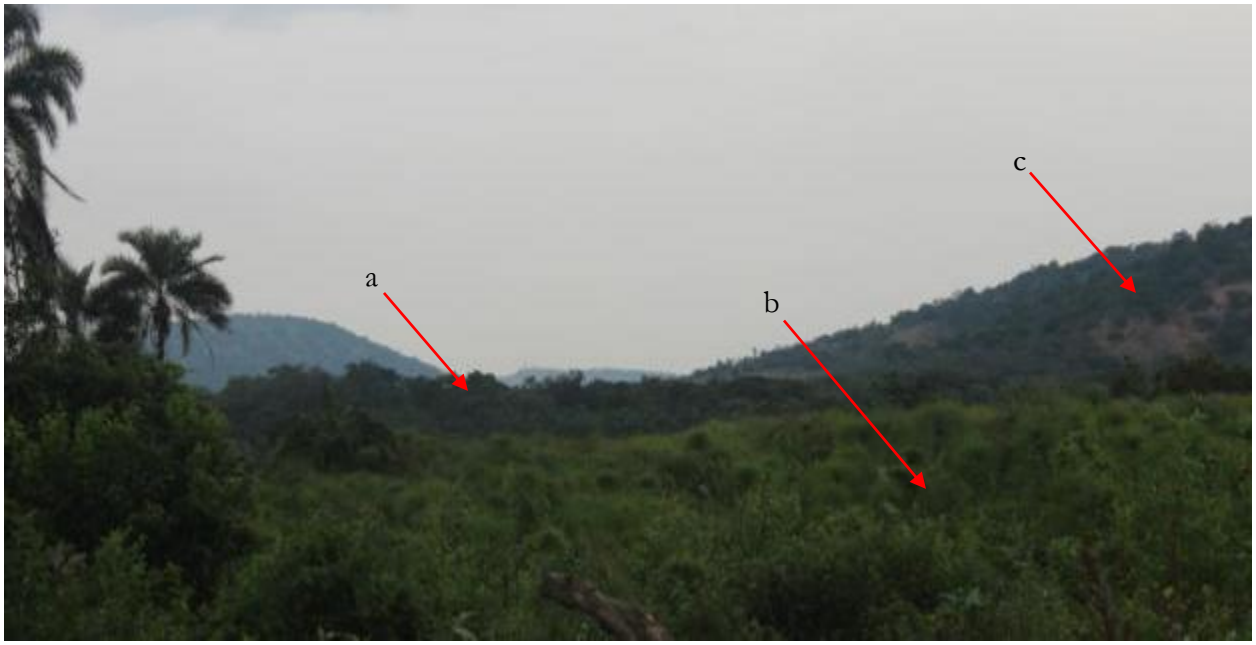


Figure 18: a. Ibanda forest; b. Akagera wetland; c. Makera forest

Characteristic native biota

Due to its varied ecological structure, Ibanda-Makera forest hosts diverse plant species. Ibanda is rich in riparian forest species dominated by *Albizia gummifera*, *Grewia bicolor*, *Blighia unijugata*, *Ficus thonningii*, *Ficus valis-choudae*, *Phoenix reclinata* and *Acacia polyacantha*

mostly used for bee keeping. Makera is dominated by *Teclea nobilis*, *Bridellia micrantha*, *Rhus vulgaris* and *Dovyalis macrocalyx*. The forest is also rich in baboons and bushpigs.

Threatening processes

The forest is heavily fragmented and encroached due to high human pressure. There is no delimitation between the forest and the agricultural fields. Encroachment to the forest leads to tree cutting to free more land for cultivation. Illegal tree cutting for firewood, building materials and other purposes is high. Many footpaths cross the forest and high human presence inside the forest increases the levels of threats to biodiversity (Figure 19).

Figure 19: Threatening processes in Ibanda-Makera Natural Forest

3.1.5.2. Risk assessment

Criterion A

Current decline

Since 30 years ago, Ibanda-Makera has lost 88% of its size (Figure 20). Makera side was mostly affected due to settlements of the population. The status of this ecosystem is thus **Critically Endangered** under criterion A1.

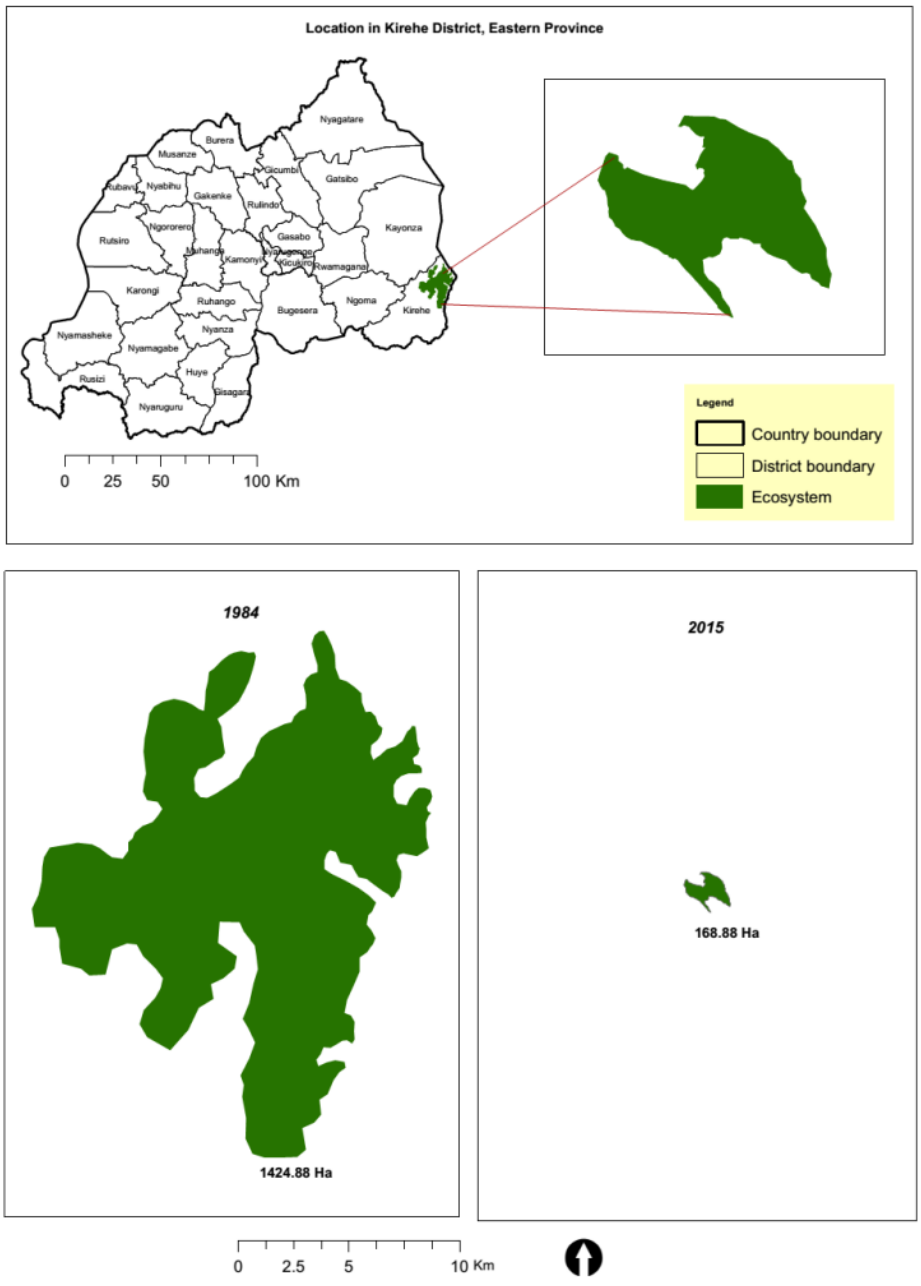


Figure 20: Changes in geographic distribution of Ibanda-Makera Natural Forest

Future decline

If declines continue at the current rate, the distribution may be expected to keep current extent of 80% in the next 50 years. The status of the ecosystem is therefore **Critically Endangered** under criteria A2.

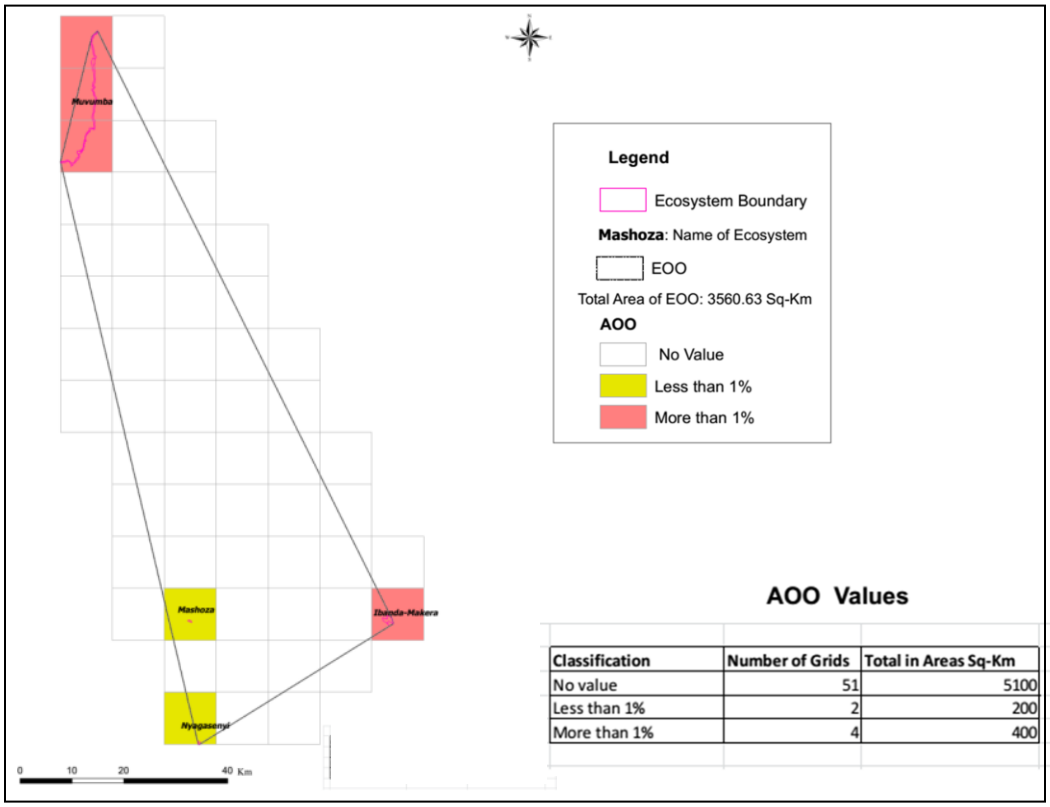
Historic decline

There is no sufficient data to estimate changes in Ibanda-Makera since 1750. Thus, the status under this criterion is **Data Deficient**.

Criterion B

Extent of occurrence

Although there are many gallery forests in the eastern part of the country, but under this study only four have been considered as worthy assessing: Ibanda-Makera, Mashoza, Muvumba and Nyagasenyi. The minimum convex polygon enclosing all occurrences of similar gallery forests as Ibanda-Makera has an area of 3,560.63 km^2. This is less than 20,000 km^2. Therefore, the status of Ibanda-Makera is **Endangered** under this criterion (Figure 21).



Classification	Number of Grids	Total in Areas Sq-Km
No value	51	5100
Less than 1%	2	200
More than 1%	4	400

Figure 21: Extent of Occurrence and Area of Occupancy for gallery forests

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Ibanda-Makera and similar ecosystems indicates that four 10kmx10km grid cell has an area of more than 1km^2. Under this criterion, the status of Ibanda-Makera is **Endangered** (Figure 21).

Number of locations

By considering 4 locations, the status of Ibanda-Makera is **Endangered** under B3.

Criterion C

Current decline

We assume that seasonal flooding by Akagera River may have negative impacts on environment and cause its degradation. Land conversion for agriculture purposes contributes also to natural environmental degradation. With an estimated extent of 30-50% and severity of 50-75%, the status of Ibanda-Makera is in the **Vulnerable** category under this criterion.

Future decline

If current threats are not mitigated, the trends will undoubtedly lead to further degradation and the extent will go beyond current threshold. We assume that the extent will be around 50% and severity increase to 80%. Therefore, the status of Ibanda-Makera is **Endangered** under C2.

Historic decline

There are no sufficient data to assess this criterion. The status of the ecosystem is therefore **Data Deficient** under criterion C3.

Criterion D

Current decline

The reduction in geographic distribution due to anthropogenic factors (agriculture and tree felling mainly) has affected biological diversity in Ibanda-Makera and caused disruptions of biotic processes and interactions at an estimated extent of more than 80%. The disappearance of many species due to destruction of their ecological niches, and the changes in species diversity and richness has caused impacts of more than 80% relative severity. Based on these estimates, the status of the ecosystem is **Critically Endangered** under criterion D1.

Future decline

Although no quantitative projections are currently available, but current disruption or decoupling of biotic interactions is not expected to decrease in the following 50 years. High demography induces sustained encroachment to this natural ecosystem in search of construction plots and agricultural lands. The status of Ibanda-Makera is therefore **Critically Endangered** under this criterion.

Historic decline

Not assessed due to lack of sufficient data. The status of this ecosystem is **Data Deficient** under criterion D3.

Criterion E

No quantitative analysis has been carried out to assess the risk of ecosystem collapse for Ibanda-Makera. The status of the ecosystem is therefore **Data Deficient** under criterion E.

Summary

Criterion	**A**	**B**	**C**	**D**	**E**	**Overall**
Subcriterion 1	**CR**	**EN**	**VU**	**CR**	**DD**	**CR**
Subcriterion 2	**CR**	**EN**	**EN**	**CR**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Ibanda-Makera Natural Forest is estimated as being **Critically Endangered** (CR).

3.1.6. Karama Natural Forest

3.1.6.1. Ecosystem description

Abiotic environment and distribution

Karama natural forest is located in Bugesera District, Gashora Sector at an altitude of 1337 m-1442 m. It is also known as ISAR KARAMA, as it is managed by RAB (Former ISAR). The forest is bordered by Kirimbi and Gaharwa Lakes in the South and in the East (Figure 22). Karama is on a surface area of 1,064.85 hectares. Karama is adjacent to Gako Military Domain, separated by the tarmac road in the West. The climate of Karama is characterized by long seasons of hot summer with relatively high temperatures and low precipitations.

Figure 22: Overview of Karama Natural Forest (above); Surrounding lakes (below)

Characteristic native biota

Karama forest is rich in plant diversity dominated by trees and shrubs characteristic of savannah vegetation. Dominant species include *Rhus natalensis, Grewia similis, Acokanthera schimperi, Vepris nobilis, Afrocanthium lactescens, Olea europea* var*. africana, Euclea schimper, Lannea fulva, Combretum molle*… The region is also renowned to host many snakes.

Threatening processes

Karama is facing many threats due to the population pressure. Agriculture encroachment by surrounding population, firewood collection, charcoal making…lead to degradation of the biodiversity. Another important threat to the ecosystem is the recent process of RAB authority to convert a big are of this natural savannah forest into farming and grazing lands. Illegal exploitation of *Osyris lanceolata* undermines also the integrity of Karama. Currently, it is very rare to find this plant species, while, not long ago, it used to be widespread in this natural habitat

of it. Invasive species are also a threat to natural diversity. *Lantana camara*, *Opuntia ficus-indica*, *Tithonia diversitfolia* are the main invaders (Figure 23).

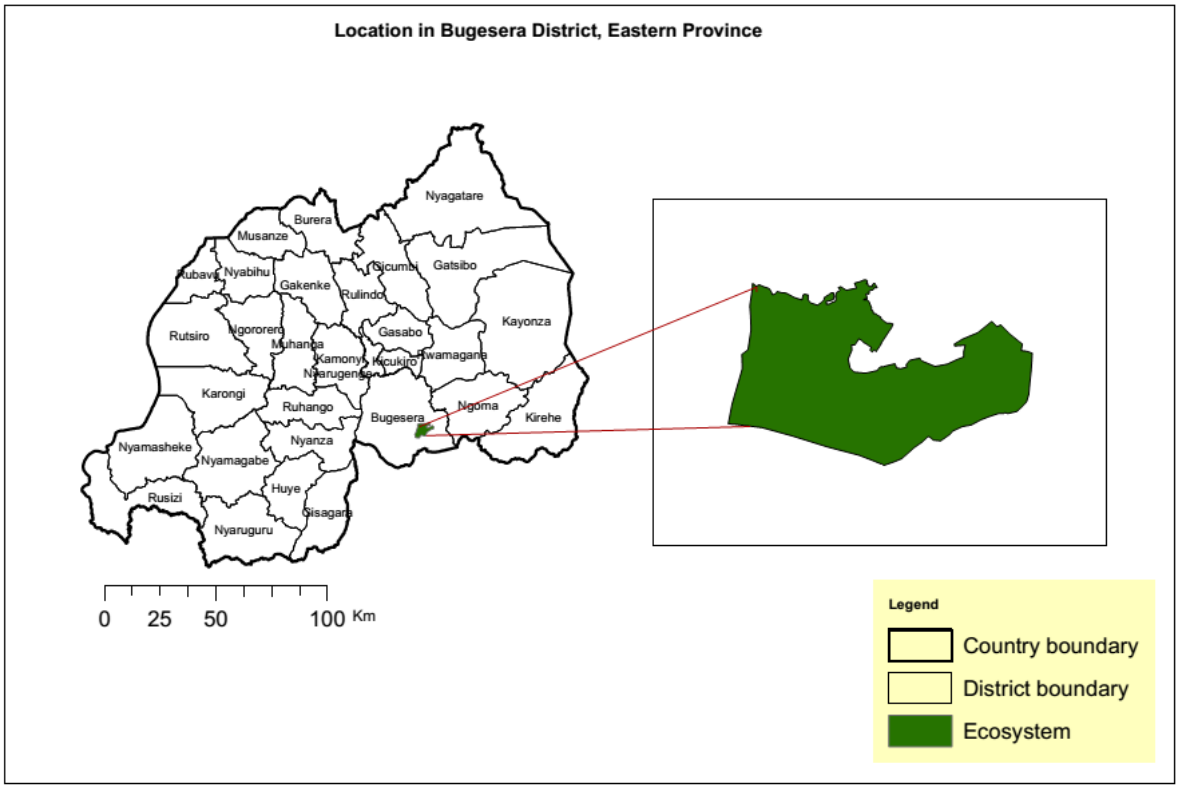
Figure 23: Major threatening processes to Karama Natural Forest

3.1.6.2. Risk assessment

Criterion A

Current decline

People who first installed in the area had to cut the forests to free the lands for habitations and agriculture/pastoral farms, as the region used to be covered by huge savannah forests. Research experiments in agriculture and husbandry contributed also to reduction in geographic distribution of Karama Natural Forest. For the past 30 years, the forest lost 67% of its size (Figure. Thus, Karama is classified as **Endangered** under this criterion.



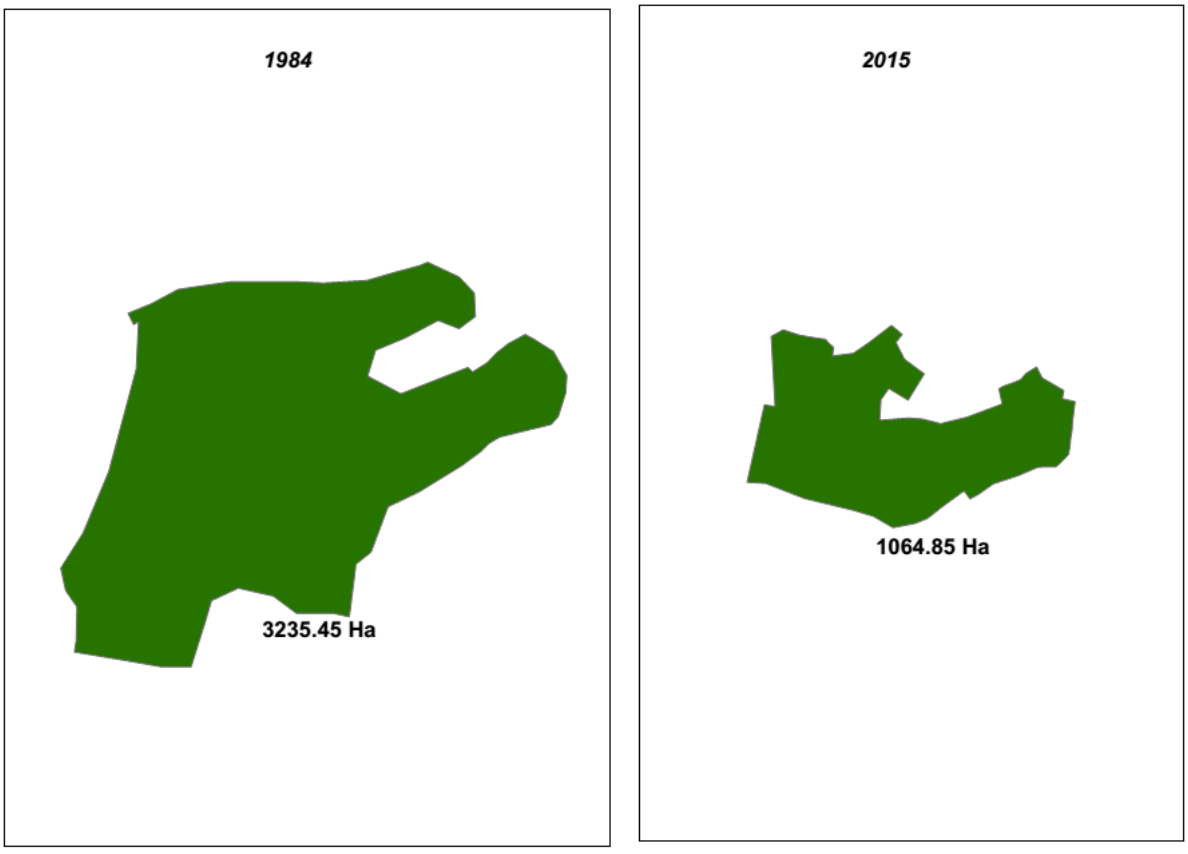


Figure 24: Changes in geographic distribution of Karama Natural Forest

Future decline

In the next 50 years, we assume that the geographic distribution will continue reducing because if current threats are not mitigated. We estimate that the extent of reduction will reach **Critically Endangered** thresholds of 80%.

Historic decline

Not assessed due to lack of data. The status is **Data Deficient**.

Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar savannah ecosystems has an area of 5,354 $km^{2.}$This is less than 20,000 km^2, and thus, the status of Karama Natural Forest is **Endangered** under B1 (Figure 6).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of ANP and similar ecosystems indicates that 26 10kmx10km grid cells have an area of more than $1km^2$. Therefore, the status of Karama Natural Forest is **Vulnerable** under B2 (Figure 6).

Number of locations

By considering all similar occurrences Karama is found in 3 locations. Karama's status is therefore **Endangered** under criterion B3.

Criterion C

Current decline

In addition to agriculture encroachment, conversions of natural forest to agricultural/pastoral farms affect the natural environment of this ecosystem. We can estimate that the extent is about 30 based on observed areas converted. The status of Karama under this criterion is **Vulnerable**.

Future decline

By considering current trends, more negative impacts will increase the extent of degradation for the next 50 years and increase to 30%-50. This leads to a status of **Endangered** under C2.

Historic decline

Not assessed due to lack of data. The status is therefore **Data Deficient**.

Criterion D

Current decline

For the past 30 years, the biotic processes that have negatively affected Karama forest are related to anthropogenic related to population settlement in this area, research activities, invasive species and overexploitation of *Osyris lanceolata*. Based on the disappearance of *Osyris lanceolata* in this area where it used to be widespread and other species affected by various threats, we estimate that the extent and severity are more than 50-70%. The status of Karama is therefore **Endangered** under D1.

Future decline

If current threats are not mitigated, the degradation of biotic resources will continue to increase up to **Critically Endangered** level.

Historic decline

Not assessed due to lack of data. Status is **Data Deficient**.

Criterion E

There has been no quantitative analysis to estimate the probability of ecosystem collapse due to lack of data. Status is therefore **Data Deficient.**

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**EN**	**EN**	**DD**	**CR**
Subcriterion 2	**CR**	**VU**	**VU**	**CR**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Karama Natural Forest is estimated as being **Critically Endangered (CR)**.

3.1.7. Karehe-Gatuntu Natural Forest Complex

3.1.7.1. Ecosystem description

Abiotic environment and distribution

Karehe-Gatuntu natural forest complex is found in Karongi District. t is made of two separate forests separated by a road: Karehe which is bigger is located in the North-West and covers two small hills with a stream crossing between them, and Gatuntu in the South-East (Figure25). The size area of this forest is 19.14 hectares. The soil is very clayey, and many water fountains taking source in the hills.

Figure 25: Overview of Karehe-Gatuntu Natural Forest Complex

Characteristic native biota

The forest is dominated by *Syzygium guineense* at more than 90%. This constitutes a very important biological source of these species, which are used for various purposes, especially in traditional medicine against amoebic infections. Some scattered species of *Polycias fulva*, *Maesa lanceolata*, *Neoboutonia macrocalyx* and *Rhus natalensis*...can also be found.

Threatening processes

The main threat to this forest complex is tree felling and introduced eucalyptus species. Lack of management authority is also a big challenge. During field investigations, the sites of charcoal

burning and signs of many cut trees were found. Cut trees are used as firewood, but in many cases they are cut to free the land for agricultural purposes. In various places, eucalyptus species can be found all around the forest edge, and in other places, where natural vegetation was removed, it was replaced by those eucalyptus trees. The forest lacks any boundary, and agriculture encroachment is very high. Footpaths through the forest indicate also frequent crossings by people (Figure 26).

Figure 26: Major threats to Karehe-Gatuntu Natural Forest Complex

3.1.7.2. Risk assessment

Criterion A

Current decline

Over the past 30 years, the forest has lost 60% of its size (Figure 27). The status of Karehe-Gatuntu is therefore **Endangered** under this criterion.

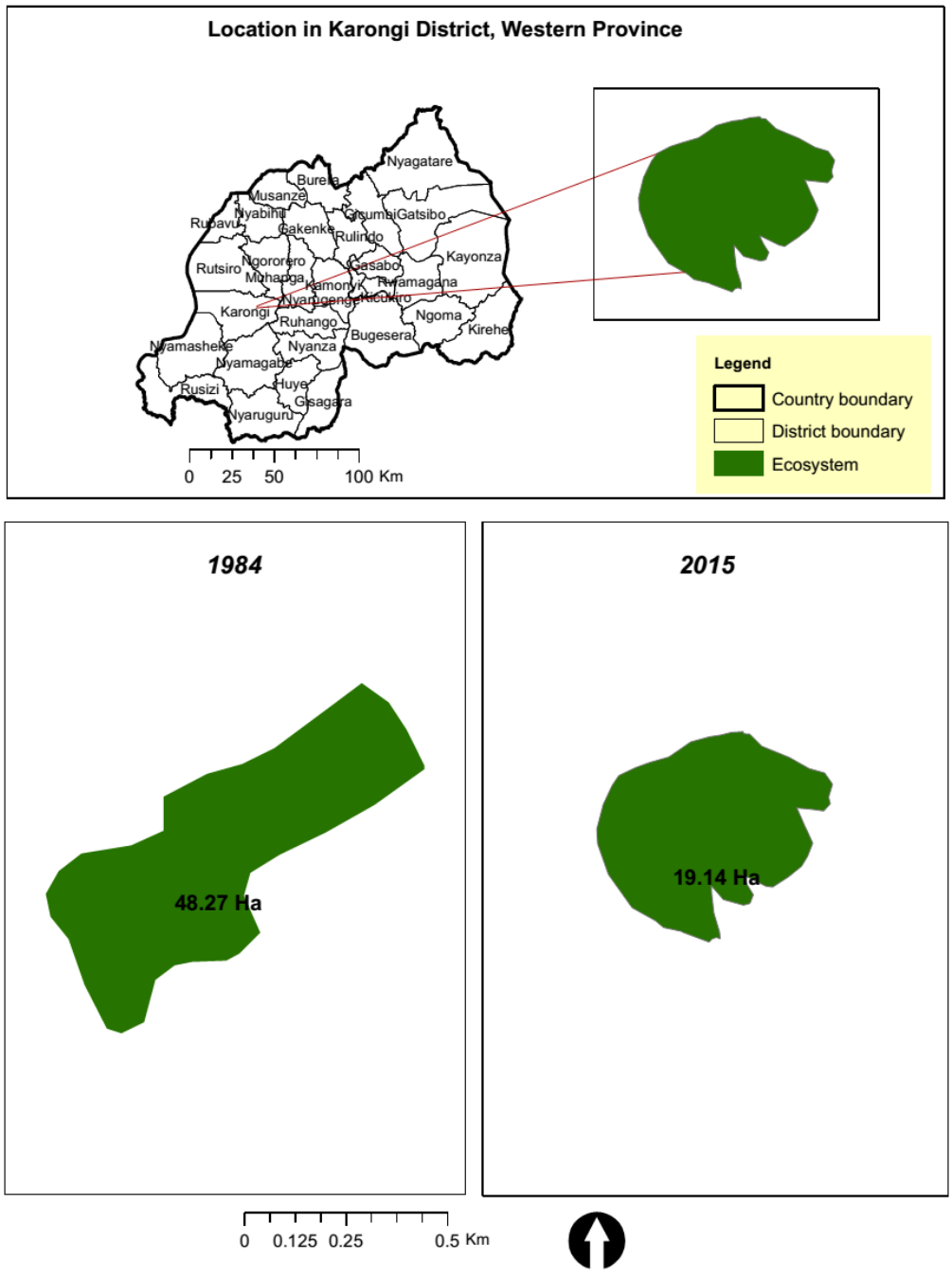


Figure 27: Changes in geographic distribution of Karehe-Gatuntu Natural Forest

Future decline

Current signs of forest degradation show that this ecosystem will face serious threats for the next 50 years including the present and the future, unless serious measures are taken. It is estimated that more than 80% will be lost. Thus, the status of the ecosystem under criterion A2 is **Critically Endangered**.

Historic decline

Not assessed due to lack of data. The status is **Data Deficient**.

Criterion B

Extent of occurrence The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems has an area of 5,919.88 $km^{2.}$This is less than 20,000 km^2, and thus, the status of Karehe-Gatuntu Natural Forest is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Busaga Natural Forest and similar ecosystems indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of Karehe-Gatuntu Natural Forest is **Vulnerable** under B2 (Figure 10).

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems found in the western part of the country. Under this criterion, the status of Karehe-Gatuntu Natural Forest is **Endangered**.

Criterion C

Current decline

Current practices of charcoal burning near or inside the forest constitute a threat to abiotic features of the forest. The transformation of soil substrate leads to changes in plant species composition. In the past 30-50 years, local people informed that the two forests of the complex were a single one forest. Road construction and conversions for agricultural purposes affected the natural structure of the ecosystem. The extent is estimated to be around 30% and relative severity of 50%. The status is thus **Vulnerable** under C1.

Future decline

At the current pace, environmental degradation over the next 50 years, or any 50-year period will increase the extent of affected area up to more than 50%, and thus leading to **Endangered** status.

Historic decline

There are no data for assessing this criterion. The status is therefore **Data Deficient** under C3.

Criterion D

Current decline

Changes in biotic processes and interactions are mainly related to substitution of natural vegetation by exotic plantations (eucalyptus) and agricultural crops. The loss of dominant functional species of *Syzygium guineense* reduces ecosystem function and resilience as well as ecological organization of the whole ecosystem. Estimations indicate that the extent of biotic degradation is more than 50% with high relative severity (more than 80%). The status of the ecosystem under criterion D1 is therefore **Endangered**.

Future decline

The lack of protection measures will lead to high degradation of Karehe-Gatuntu forest complex in the future. Based on current situation, estimations of biodiversity loss will unceasingly increase to more than 80% of extent and 80% of severity and thus **Critically Endangering** the ecosystem.

Historic decline

Not assessed due to lack of data. The status is **Data Deficient**.

Criterion E

Not assessed due to lack of data. The status is **Data Deficient**.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**VU**	**EN**	**DD**	**CR**
Subcriterion 2	**CR**	**VU**	**EN**	**CR**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Karehe-Gatuntu Natural Forest Complex is estimated as being **Critically Endangered (CR).**

3.1.8. Kibirizi-Muyira Natural Forest

3.1.8.1. Ecosystem Description

Abiotic environment and distribution

This complex is made of two separate but neighbour relict savannah forests located in Nyanza District, in Kibirizi and Muyira Sectors respectively at an altitude range of 1420-1700m and covering an area of 352 hectares. Kibirizi forest is bigger than Muyira forest being separated by a road and a valley dam. The hills are very steep with rocky soils. In this Mayaga region, arable land is very fertile (Figure 28).

Figure 28: View of Kibirizi (left) and Muyira (right) natural forests

Characteristic native biota

The vegetation is typical of savannah species, with scattered tuffs of bushes dominated by thorny acacias. Other most represented species include *Combretum molle, Lannea…Parinari curatelifolia*, various Rubiaceae species dominated by *Euclea racemosa* and *Pavetta ternifolia*, and the currently highly exploited *Osyris lanceolata*. Animals include mainly the monkeys.

Threatening processes

In past 10 years, people inhabited the near surroundings of the forests. This has caused huge losses in biodiversity richness and great ecosystem degradation. Until today, there is no

demarcation between the forest and peoples farm lands. Agricultural encroachment and tree cutting constitute a big threat to this ecosystem complex. Illegal exploitation of Osyris lanceolata has worsened the situation. Local people informed the researchers that tens of trucks have deported tons of this species which was uprooted and sold to business people. Some rare remnants of *Osyris* shoots have been discovered during the field work, but we were told that any plant found could lead to its ultimate destruction if seen by others. The forests are also threatened by invasive species of *Lantana camara* which cover big spaces around and inside the forest (Figure 29)...

Figure 29: Agriculture encroachment (above-left); shoot of *O.lanceolata* (below-left); eucalyptus and banana plantations near the forest (above-right); coffee plantation inside the forest (middle-right) and invasive *Lantana camara* (below-right).

3.1.8.2. Risk assessment

Criterion A

Current decline

Over past 30 years, this ecosystem lost 22% of its surface area (Figure 30). Therefore, the status of Kibirizi-Muyira is **Least Concern** under A1.

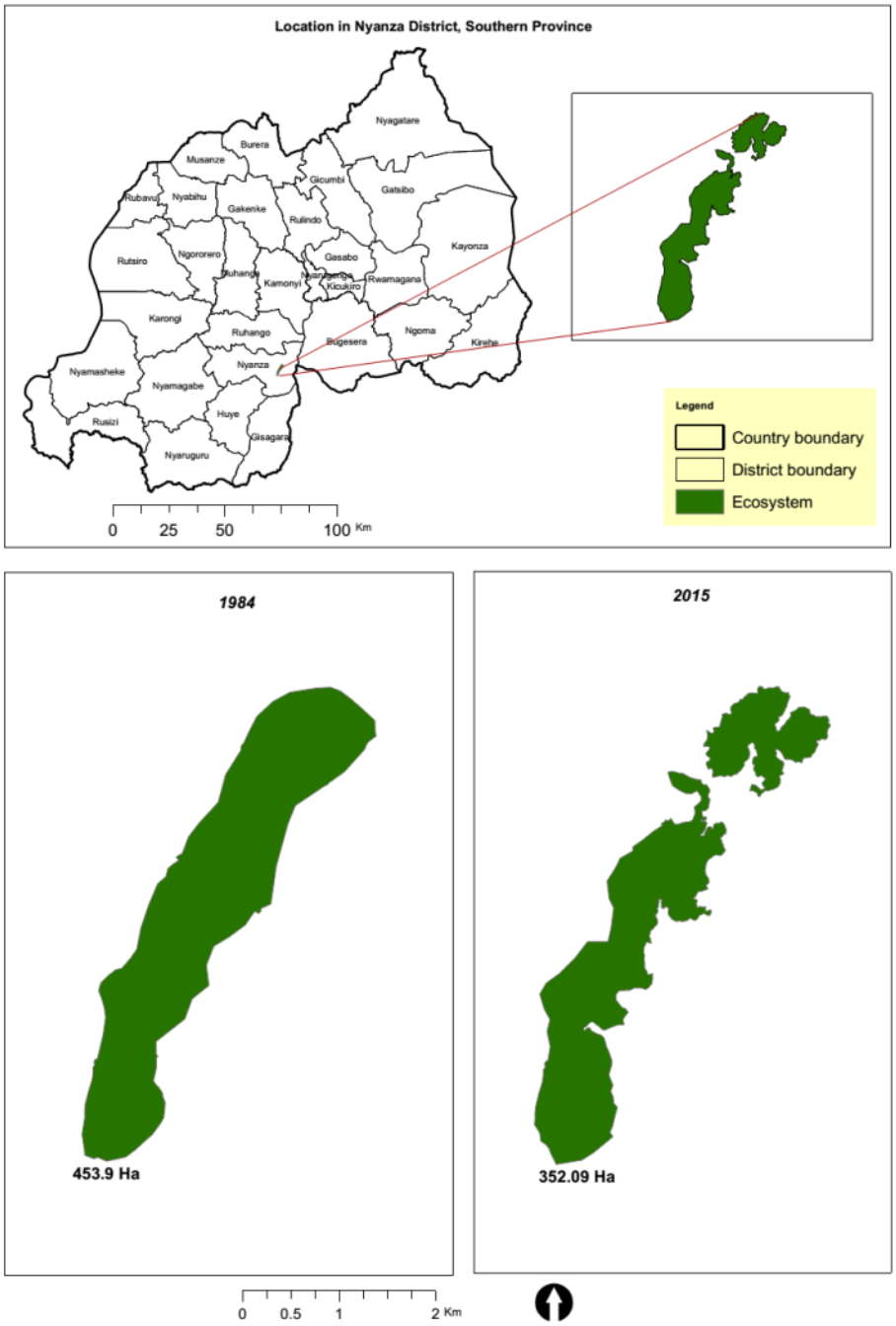


Figure 30: Changes in geographic distribution of Kibirizi-Muyira Natural Forest

Future decline

The population has now moved to agglomerations (known as Imidugudu), and this would contribute in the decline of reduction in the ecosystem distribution in the next 50 years. Given that the threats will subsequently decline, we estimate that the status for Kibirizi-Muyira will remain **Least Concern** for A2.

Historic decline

Not assessed due to lack of data. The status is **Data Deficient**.

Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar savanna ecosystems has an area of 5,354 km^2.This is less than 20,000 km^2, and thus, the status of Kibirizi-Muyira is **Endangered** under B1 (Figure 6).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of ANP and similar ecosystems indicates that 26 10kmx10km grid cells have an area of more than $1km^2$. Therefore, the status of Kibirizi-Muyira is **Vulnerable** under B2 (Figure 6).

Number of locations

By considering all similar occurrences Kibirizi-Muyira is found in 3 locations, and it's status is therefore **Endangered** under criterion B3.

Criterion C

Current decline

Conversions of the natural ecosystem into agricultural farm lands has caused the degradation of the environment at an estimated extent of more than 70% with high severity (>80%). The forest is scarred by many holes as a consequent to deracination of *Osyris lanceolata* whose richness used to be very high in this forest. This leads to **Endangered** status under criterion C1.

Future decline

Continuous threats to the ecosystem's environment will potentially lead more degradation. However, compared to the past, the rate of degradation is expected to reduce in the next 50

years at an extent of 30% with same relative severity though (>80%). The status of Kibirizi-Muyira forest is therefore **Vulnerable** under C2.

Historic decline

Not assessed due to lack of data. The status is therefore **Data Deficient**.

Criterion D

Current decline

For the past 30 years, the biotic processes that have negatively affected Kibirizi-Muyira forest are mostly related to anthropogenic activities. Some areas have been cleared for population settlements, agricultural lands and pastoral farms. Plantations of Eucalyptus also affected the natural vegetation, and the invasive species widespread in the forest have worsened the situation. Uprooting *Osyris lanceolata* did not only affect this species, but also other surrounding species which were first cut to free the space related. The estimated extent of degradation compared to remaining intact area is less than between 50-70% with relative severity of more than 80%. The status of the ecosystem is therefore **Endangered** under this criterion.

Future decline

Current degradation rate of biotic variables is expected to decline in the next 50 years mainly due to relocation of people in Imidugudu. The expected extent will not go over 50% with same relative severity of 80%. Therefore, the status of Kibirizi-Muyira forest under D2 is **Vulnerable.**

Historic decline

Not assessed due to lack of data. Status is **Data Deficient**.

Criterion E

Although no quantitative analysis was done to estimate the probability of ecosystem collapse due to lack of data, but given the size of Kibirizi forest and the major measures taken mainly related to people relocation, its collapse cannot be envisioned. However, the side of Muyira is potential to collapse, but this would be confirmed by further analyses. The status is therefore **Data Deficient.**

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**LC**	**EN**	**EN**	**EN**	**DD**	**EN**
Subcriterion 2	**LC**	**VU**	**VU**	**VU**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Kibirizi-Muyira Natural Forest is estimated as being **Endangered (EN)**.

3.1.9. Mashoza Natural Forest

3.1.9.1. Ecosystem Description

Abiotic environment and distribution

Mashoza, also known as Rujambara or Rugomero or Parike is a natural gallery forest located in Ngoma District, Rurenge Sector. It is a relatively small forest of about 17.78 hectares, situated on a hillside of Mashyoza. In the south, Mashoza is bordered by Mwambu wetland, site of extensive rice plantations (Figure 31).

Figure 31: Overview of Mashoza Natural Forest

Characteristic native biota

Mashoza Natural Forest hosts both mountain plant species like *Pittosporum spathicalyx* and low land species such as *Acacia polyacantha* and *Vangueria volkensii.* The forest hosts a rare

species of *Pterygota mildbraedii* found only there. In terms of animal species, very large populations of monkeys (*Chlorocebus aethiops*) are hosted in Mashoza (estimated at more than 100). Local people informed that this forest hosts a big number of snakes, some of them being very venomous.

Threatening processes

Mashoza is highly degraded due to anthropogenic activities. The surrounding wetland exploited for rice cultivation progressively encroaches on the forest, and in other sides, there are no limits between the fields of various crops and the forest. Additionally, tree cutting for firewood and building materials is like a custom to local population. This degradation has led to many clearings, and as consequence, invasive plant species are widely spread in this ecosystem and have replaced original native species. Main invaders include *Lantana camara*, *Leonotis nepaetifolia, Tithonia diversifolia*, *Ricinus communis*, and *Acanthus pubescens*. Many exotic species are also found in Mashoza (mainly *Grevillea* and *Eucalyptus* species)

Figure 32: Major threats to Mashoza Natural Forest

3.1.9.2. Risk assessment

Criterion A

Current decline

Over past 30 years, this ecosystem lost 51% of its surface area (Figure 33). Therefore, the status of Mashoza is **Endangered** under A1.

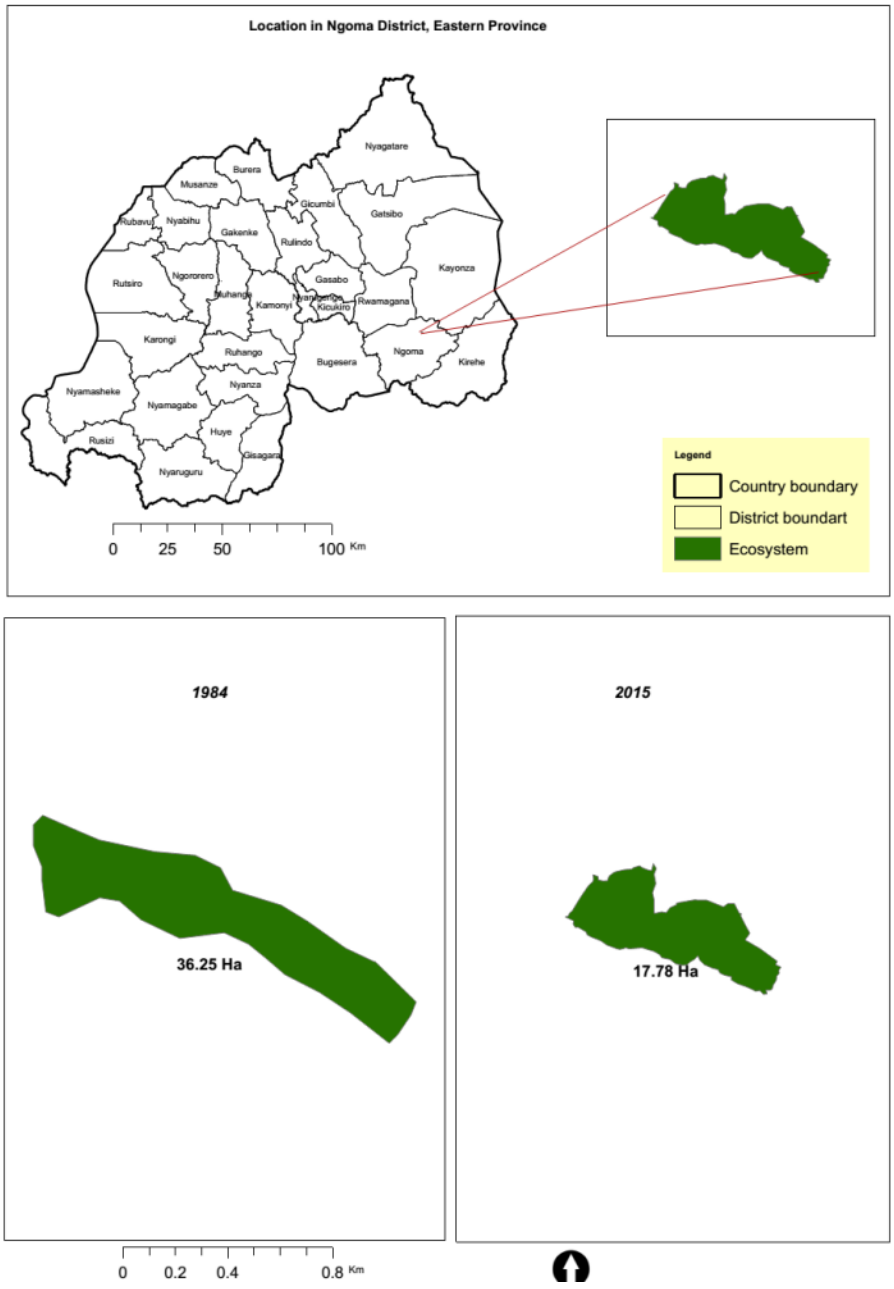


Figure 33: Changes in geographic distribution of Mashoza Natural Forest

Future decline

Mashoza ecosystem is already highly degraded despite its particular species among which some are only found in this forest. Its geographic reduction has reduced at a very big extent, and this is shown by scattered individual trees species of *Pterygota mildbraedii* which survived in farms lands in various places around Mashoza forest. Future more losses in distribution are expected, and these will undoubtedly lead to more reductions beyond current levels. The status of Mashoza is therefore **Critically Endangered** under this criterion.

Historic decline

There is no sufficient data assess this criterion. The status is thus **Data Deficient.**

Criterion B

Extent of occurrence

Mashoza shares similar characteristics with Ibanda-Makera, Muvumba and Nyagasenyi natural forests. The minimum convex polygon enclosing all occurrences of similar gallery forests has an area of 3560.63 km^2.This is less than 20,000 km^2. Therefore, the status of Mashoza is **Endangered** under this criterion (Figure 21).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Mashoza and similar ecosystems indicates that four 10kmx10km grid cell has an area of more than 1km^2. Under this criterion, the status of Mashoza is **Endangered** (Figure 21).

Number of locations

By considering 4 locations, the status of Mashoza Natural Forest is **Endangered** under B3.

Criterion C

Current decline

Agricultural encroachment has affected abiotic features of this forest and its ecosystem services mainly related to erosion control and soil retention. The extent of degradation is estimated to have affected more than 80% with estimated severity of 50%, mainly due to land cover change and erosion risks in cleared areas. The status of this ecosystem is therefore **Endangered** under this criterion.

Future decline

Current environmental degradation is expected to increase and go beyond current threshold (more than 80% of extent and more than 80% of relative severity). This classifies Mashoza under **Critically Endangered** status.

Historic decline

The lack of sufficient data to assess this criterion leads to **Data Deficient** status.

Criterion D

Current decline

Human activities affecting this ecosystem contribute to high disruptions in biotic processes and interactions. Many native species have faced big threats in the past and this continues to take place, many of them being completely removed for agricultural purposes, firewood needs, etc. Invasive species also negatively affect native biota in Mashoza by transforming the vegetation type of this ecosystem. A very high degradation has affected an estimated extent of more than 80%, with a relative severity of more than 80%. This makes Mashoza forest **Critically Endangered** under criterion D1.

Future decline

Based on current trends, the extent of the threats will continue to be at higher levels as today. The status remains **Critically Endangered** under criterion this criterion.

Historic decline

There is no sufficient data to assess this criterion. The status of Mashoza under D3 is therefore **Data Deficient.**

Criterion E

Criterion not assessed due to lack of sufficient data. The status of Mashoza is therefore **Data Deficient** under criterion E.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**EN**	**CR**	**DD**	**CR**
Subcriterion 2	**CR**	**EN**	**CR**	**CR**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Mashoza Natural Forest is estimated as **Critically Endangered (CR)**.

3.1.10. Mashyuza Natural Forest

3.1.10.1. Ecosystem description

Abiotic environment and distribution

Mashyuza Forest is a patch of 6.2 hectares of natural tree and shrub species covering hillside above the extent of the famed Bugarama hot springs (locally known as Amashyuza). It is located in Rusizi District, at an elevation varying between 1150m and 1190m. The biophysical conditions are characterized by two distinct landforms of steeper slope on hillside and flat area covered by a small lake of hot springs (Figure 34. The soil is clayey at the south-western part of the hillside. The remaining parts of the forest cover a stony, sandy and fairly dry black soil. In the northern part of the forest, there is mining quarry site providing the raw materials for the local cement factory, (CIMERWA Ltd). In the west-southern area, there are gardens laid out by CIMERWA Ltd for amenity purposes.

Figure 34: Mashyuza Natural Forest

Characteristic native biota

The biophysical conditions of Mashyuza Natural Forest make it possible to host some rare plant species. In general, dominant species include *Anthocleista schweinfurthii*, *Bridelia micrantha* and *Ficus vallis-choudae*. Two rare species are also found in this place: *Sterculia tragacantha* and *Nymphaea thermarum* which deserves high priority of conservation (Figure 35). The forest is also home to many great lakes bush vipers.

Figure 35: *Sterculia tragacantha* (left); *Nymphaea thermarum* (right)

Threatening processes

The main threat to this forest is related to CIMERWA quarries for materials used in cement production in the upper portion of the hill where the forest is located. Drilling has destroyed much of the nature forest, and this is unfortunately ongoing without conservation perspective. In other sides, the eucalyptus which was planted following the deforestation of the natural forest has invaded a big part of the site (Figure 36).

Figure 36: Threats to Mashyuza Natural Forest: CIMERWA quarry (left); invading eucalyptus (right)

3.1.10.2. Risk assessment

Criterion A

For assessment of criteria A1 and A2, collapse is assumed to occur when the mapped distribution of the ecosystem declines to zero as a consequence of conversion of natural forest due to different degradation factors (the forest lost 93% of its size over past 30 years) (Figure 37). Under future scenarios, considering the current highly degraded and dispatched status, a collapsed state is assumed when there is very negligible or no natural area remaining at all due to environmental degradation mainly related to CIMERWA exploitation (Criterion C) and consequent disruption of biotic processes (Criterion D) with thresholds beyond critically endangered category. In fact, small remaining natural forest is dominated by ferns covering a very big part as a result of deforestation and very few trees are remaining. Even if there are no quantitative analyses conducted to estimate the probability of ecosystem collapse, observations on the field indicate that current and potential threats are very high to cause the collapse of Mashyuza forest (Criterion E). Therefore, the status of Mashyuza Natural Forest under criteria A, C, D and E is **Collapsed.**

Criterion B

Mashyuza was considered as unique in delimitation of extent of occurrence due to its particular ecosystem and ecological characteristics. The estimations of extent of occurrence and the area of occupancy are estimated to go far beyond the thresholds of **Critically Endangered** status under B1 and B2. Its single location classifies it as **Critically Endangered** too under B3.

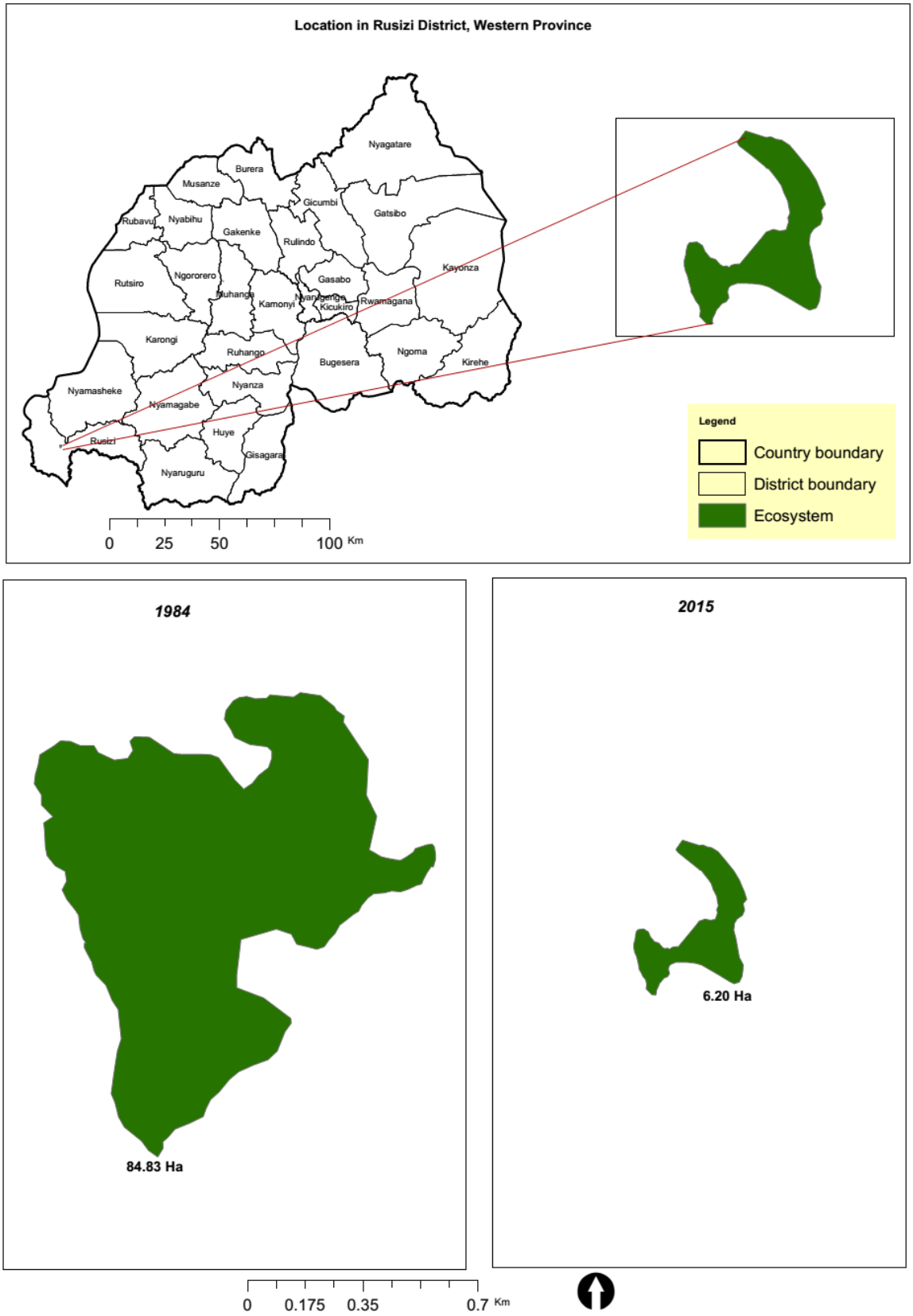


Figure 37: Changes in geographic distribution of Mashyuza Natural Forest

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	CO	CR	CO	CO	CO	CO
Subcriterion 2		CR				
Subcriterion 3		CR				

The overall status of Mashyuza Natural Forest is estimated as being **Collapsed (CO)**.

3.1.11. Mukura Natural Forest

3.1.11.1. Ecosystem description

Abiotic environment and distribution

Mukura Natural Forest is a mountain forest located in Rutsiro and Ngororero Districts. It covers an area of 1,987.74 hectares characterized by steep and abrupt mountains (Figure 38). Altitudinal range of Mukura varies between 2000m to 2700m. The main permanent springs and streams having the source in Mukura Natural Forest are Ntaruko, Ndaba and Rutabanzongera to name a few.

Figure 38: Side view of Mukura Natural Forest

Characteristic native biota

Mukura Forest is a habitat of highly diversified and rich flora. The forest physiognomy can be divided into 4 parts: secondary forest (58.8%), closed forest (27.45%) degraded part with empty spaces left by agriculture (9.8 %) and Wetland /Marshes (1.9 %). Predominant plant species include *Psychotria mahonii, Macaranga kilimanscharica, Psydrax parviflora, Syzygium guineense,, Neoboutonia macrocalyx, Hagenia abyssinica* ….Concerning the fauna, the forest possesses the common mammal species including *Funisciurus pyrrhopus*, *Heliosciurus ruwenzorii*, *Thryonomys swinderianus, Canus mesomeras* and *Herpestes urv*a. In addition, Mukura Forest is home to many bird species endemic to Albertine rift including *Apalis personata, Bradypterus graueri, Cinnyris regia, Tauraco johnstoni, Zoothera tanganjicae, Parus fasciiventer, Colius leucocephalus*, *Francolinus nobilis*, *Macronyx croceus*...

Threatening processes

Subject to intense human pressure over the years in the form of agriculture encroachment, illegal cutting, grazing, beekeeping and more recently amputation of its part for resettlement (150 families were settled in the zone previously occupied by the forest), Mukura has been reduced to a series of small disjointed forest relics in remote valleys and on steep slopes that are difficult to access. During the 1994 genocide against the Tutsi and the associated aftermath such as the resettlement of the returned refugees, Mukura Natural Forest was so much jeopardized. Despite legal distribution of farming land authorized by the Government, agriculture encroachment and livestock grazing in Mukura Forest continue to affect its integrity. A more threatening process in Mukura Natural Forest is illegal mining. Indeed, Mukura forest is renowned to be rich in mines especially Coltan. Despite the effort of the authorities to stop illegal mining, these illegal activities are still experienced (Figure 39).

Figure 39: Threatening processes to Mukura Natural Forest (above: agriculture and grazing; below: mining)

3.1.11.2. Risk assessment

Criterion A

Current decline

Over past 30 years, the size of Mukura Natural Forest reduced of 54.5% (Figure 40). This decrease in geographical distribution leads to **Endangered** status.

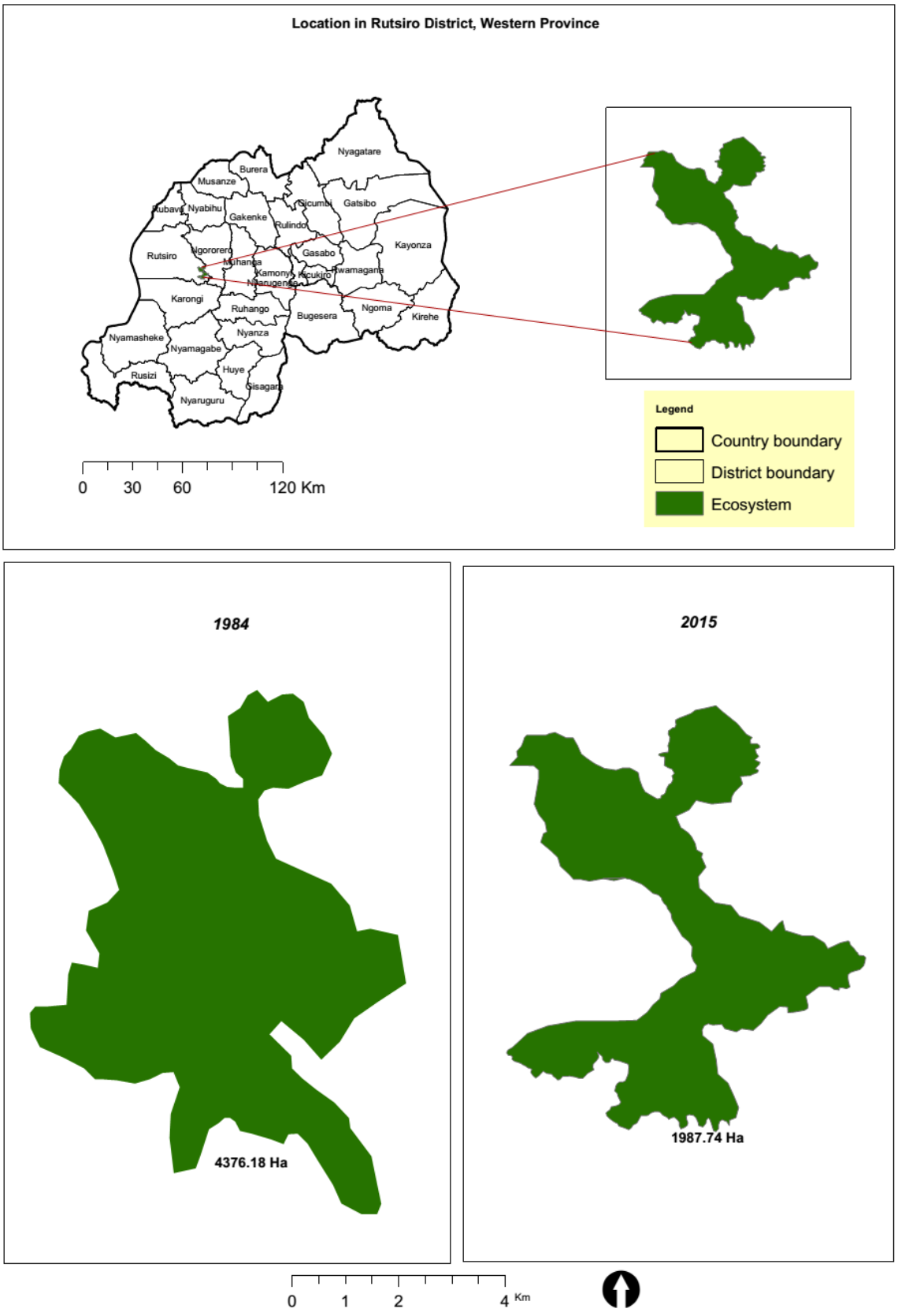


Figure 40: Changes in geographic distribution of Mukura Natural Forest

Future decline

This forest, together with Gishwati Natural Forest, has been suggested to be gazetted as Gishwati-Mukura National Park. Currently, a draft law to get this new park gazetted has reached an advanced stage. After approval of by the Cabinet meeting in 2014, the draft law is being finalized by the Parliament. These conservation efforts for Mukura restoration indicate that the threats to its geographic distribution will considerably reduce to at least the level of **Vulnerable** status in next 50 years.

Historic decline

This criterion was not assessed due to lack of sufficient data. The status is therefore **Data Deficient** under this criterion.

Criterion B

Extent of Occurrence

The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems has an area of 5,919.88 $km^{2.}$This is less than 20,000 km^2, and thus, the status of Mukura Natural Forest is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Busaga Natural Forest and similar ecosystems indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of Mukura Natural Forest is **Vulnerable** under B2 (Figure 10).

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems found in the western part of the country. Under this criterion, the status of Mukura Natural Forest is **Endangered**.

Criterion C

Current decline

The forest has been dug in many places for mining, leaving holes and pits all around the forest. With the disappearance of a big part of the forest, many of water springs have apparently dried out, and landslides and floods have increased as well deporting big amounts of the soil. We estimate the extent of abiotic disruptions at more than 80% with relative severity of more than 80%. The status of Mukura Natural Forest is therefore **Critically Endangered** under C1.

Future decline

New conservation measures which will be put in place as the forest becomes a National Park will ensure the reduction of the threats on abiotic features of Mukura Natural Forest. Although no projections have been made, but based on experience of other protected areas in Rwanda we assume that the decline in next 50 years will be less than 50% even though severity would remain constant (>80). This leads to **Vulnerable** status under this criterion.

Historic decline

Criterion not assessed due to lack of sufficient data. The status Mukura Natural Forest is therefore **Data Deficient** under this criterion.

Criterion D

Current decline

Different threats have undoubtedly negatively impacted Mukura's biodiversity. Massive deforestations have led to disappearance of different species. We estimate that the extent of disruptions is more than 80 and severity of more than 80%. Thus, Mukura Natural Forest is classified as **Critically Endangered** under criterion D1.

Future decline

As explained in previous sections, it is expected that the gazetting this forest as a National Park will contributed to mitigation of existing threats in the next 50 years. We can thus estimate that the extent of biotic disruptions will decrease to less than 50% of extent and less than 80% of severity, which leads to **Vulnerable** status under D2.

Historic decline

Criterion not assessed due to lack of data. Mukura Natural Forest status is therefore **Data Deficient** under this criterion.

Criterion E

No modelling of risks has been carried out to estimate ecosystem collapse. Therefore, Mukura Natural Forest is **Data Deficient** under criterion E.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**CR**	**CR**	**DD**	**CR**
Subcriterion 2	**VU**	**VU**	**VU**	**VU**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Mukura Natural Forest is estimated as being **Critically Endangered (CR)**.

3.1.12. Muvumba Natural Forest

3.1.12.1. Ecosystem description

Abiotic environment and distribution

Muvumba Forest is located in Nyagatare District. It is a gallery forest covering the river banks and flood plain of Muvumba River which takes its source in south-western highlands of Uganda. It is shared between Karama, Gatunda, Tabagwe, Nyagatare, Rwempasha, Musheri and Matimba Sectors.

Characteristic native biota

Apart from predominant *Acacia kirkii*, some accompanying species like *Pavetta ternifolia* and *Dovialis macrocalyx* have been observed during field trip in the region. *Acacia kirkii* is a threatened species only found aboundantly in Muvumba Forest. This forest accommodates also various bird species and the most dominant bird species are *Anastomus lamelligerus* and *Leptoptilos crumenofurus*.

Threatening processes

Muvumba River and its gallery forest face various threats. Increasing population growth in this region has caused high pressure to this forest. Main causes of threats include people's needs in terms of agriculture land, livestock farms, firewood…and recently a wide scale rice farming project taking place in Muvumba valley. During the implementation of rice scheme development, Muvumba River was deviated to allow irrigation of rice crops developed in the river's flood plain. As a result, several derivation branches from the main river channel would be formed and this should cause water reduction and loss in the valley. Without any mitigation measure, there is a big risk that in the near future, water shortage will be a serious problem in the region given that Muvumba is the only important and permanent stream.

Figure 41: Muvumba gallery forest dominated by the threatened *Acacia kirkii* (left) and ongoing rice farming project in Muvumba marshland (right)

3.1.12.2. Risk assessment

Criterion A

Current decline

Over past 30 years, the size of Muvumba forest reduced of 46.5% (Figure 42). This decrease in geographical distribution leads to **Vulnerable** status.

Future decline

Lands distribution in Nyagatare region and ownership of this forest by the district authorities and other government institutions to protect Muvumba, mainly including environmental impact assessments for rice production project has contributed to limiting encroachment threats. This would give hope that the trends in size reduction would sensibly decline in the future, but increasing pressure from population growth escalates the threats that could keep the current extent and severity of the threats in spite of all efforts invested. Therefore, the status of Muvumba under this criterion would be **Vulnerable.**

Historic decline

This criterion was not assessed due to lack of sufficient data. The status is therefore **Data Deficient** under this criterion.

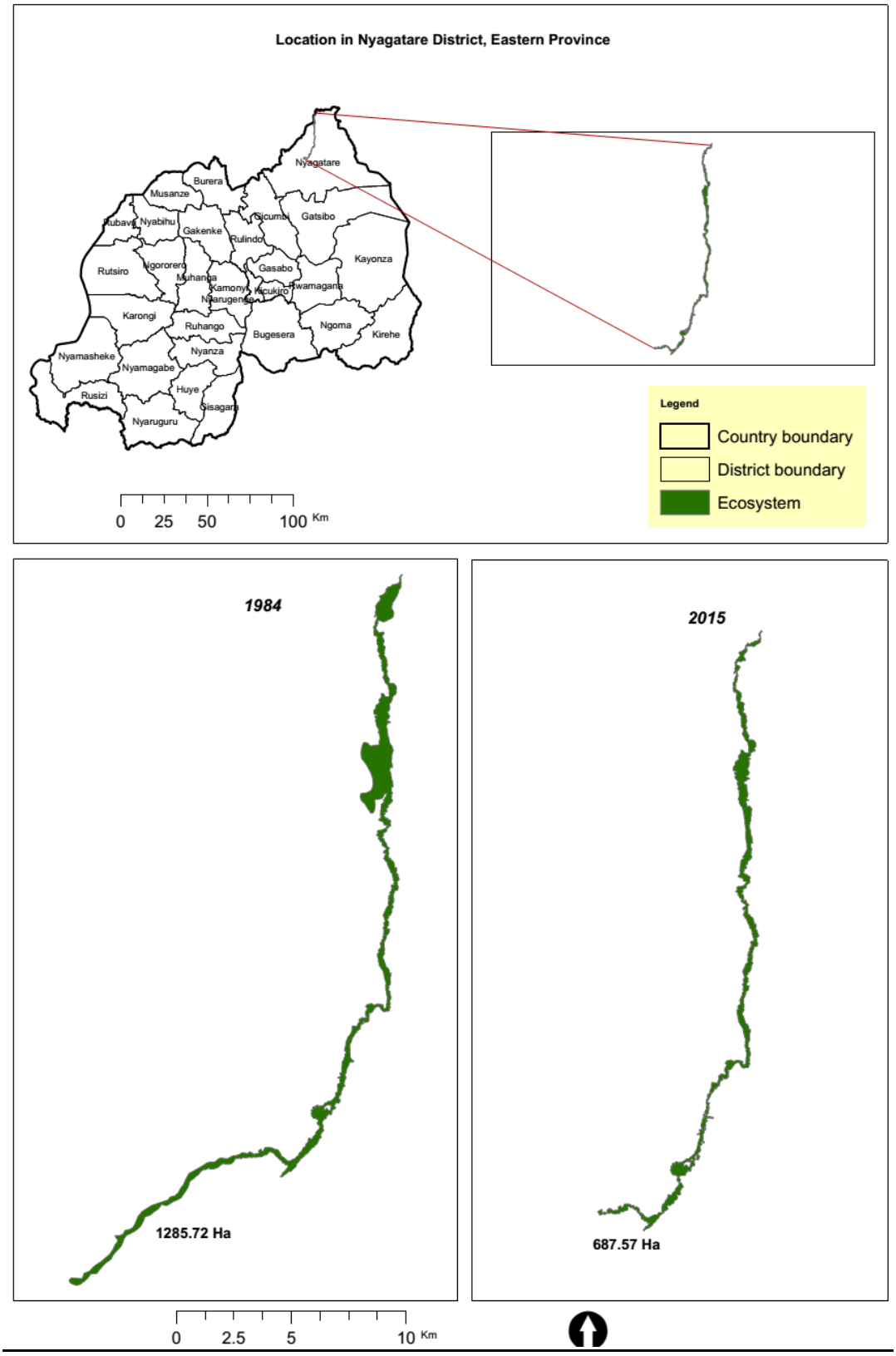


Figure 42: Changes in geographic distribution of Muvumba Gallery Forest

Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar ecosystems of gallery forests has an area of is 3560.63 km^2. This is less than 20,000 km^2, and thus, the status of Muvumba is **Endangered** under B1 (Figure 21).

Area of occupancy

The minimum convex polygon enclosing all occurrences of similar gallery forests as Muvumba has an area of 3560.63 km^2. This is less than 20,000 km^2. Therefore, the status of Muvumba is **Endangered** under this criterion (Figure 21).

Number of locations

By considering 4 locations, the status of Muvumba is **Endangered** under B3.

Criterion C

Current decline

As mentioned above, the deviation of the river for the purposes of irrigations schemes poses a threat to natural environmental features of Muvumba. We estimate the extent of abiotic disruptions at more than 50% with relative severity of more than 80%. The status of Muvumba Forest is therefore **Endangered** under C1.

Future decline

Environmental Impact Assessments provide mitigation measures to protect the river and the associated gallery forest. We assume that if all measures are well established the decline in abiotic disruptions for next 50 years will be less than 50% even though severity would remain constant (>80). This leads to **Vulnerable** status under this criterion.

Historic decline

Criterion not assessed due to lack of sufficient data. The status Muvumba Forest is therefore **Data Deficient** under this criterion.

Criterion D

Current decline

Acacia kirkii, a critically endangered species, faces more threats due to anthropogenic activities. Muvumba is the only place in Rwanda where this species is abundantly found and would be considered as a genetic pool for this species. Some measures to protect the forest has limited the extent and severity of the threats at a certain level, but still the risk is very high. We estimate current extent 50% and severity at 80%. Thus, Muvumba Forest is classified as **Endangered** under criterion D1.

Future decline

Given that the main biotic characteristic of this forest is a critically endangered species, the trends in population pressures and development projects to respond to different needs would not reduce the current levels of extent and severity. We can thus estimate that risks in biotic disruptions would keep the **Endangered** status under D2.

Historic decline

Criterion not assessed due to lack of data. Muvumba Natural Forest status is therefore **Data Deficient** under this criterion.

Criterion E

No modelling of risks has been carried out to estimate ecosystem collapse. Therefore, Muvumba Natural Forest is **Data Deficient** under criterion E.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**VU**	**EN**	**EN**	**EN**	**DD**	**EN**
Subcriterion 2	**VU**	**EN**	**VU**	**EN**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Muvumba Gallery Forest is estimated as being **Endangered (EN)**.

3.1.13. Ndoha Natural Forest

3.1.13.1. Ecosystem description

Abiotic environment and distribution

Ndoha is located in Karongi District at the border of Murundi Sector in the East and Murambi Sector in the West. It is a riparian forest of 28 hectares, located in the flanks of two hills, the biggest part being on the side of Murambi Sector, at an altitude of 1670m. A small stream called Ndoha crosses the forest between the two hills. The slopes of the hills are very steep with rocks in some places and all along the stream. Fragmented patches of the forest are scattered on the hills, surrounded by cultivated lands all around the forest (Figure 43).

Figure 43: Overview of Ndoha Natural Forest

Characteristic native biota

The forest comprises different plant species, and key characteristic species are dominated by *Albizia gummifera*, *Hallea rubrostipulosa*, *Myrianthus holstii*, *Polycias fulva* and *Maesa lanceolata*. Some few mammals are also found in Ndoha, including *Cricetomys gambianus* (isiha). Bird's diversity includes *Necrosyrtes monachus* (Inkongoro).

Threatening processes

Ndoha is much degraded, the main threat being related to agricultural encroachment. People have cleared a big part of the forest for agriculture purpose, and this is an ongoing practice. In fact, local people informed the researchers that there are no restrictions to forest access, since when someone needs a plot to cultivate; they pay a rent to sector officers who guarantee full access for exploitation. This leads to tree felling for agricultural land and other purposes such as fuel wood…The fields of different crops are plenty (sweet potatoes, colocasia, manioc, yam, various vegetables, tomato trees, *Pennisetum purpureum* for cows feeding….). The natural status is also threatened by the presence of many exotic plants. Eucalyptus plantations have replaced a major part of the forest, especially in the eastern part, and different invasive species dominated by *Acanthus pubescens* occupy a big area inside the remnant forest as a consequent to high degradation of the forest. Another threat is related to cow grazing. A well built cow drinking trough was found just close to the stream (Figure 44).

Figure 44: Major threats to Ndoha Natural Forest

3.1.13.2. Risk assessment

Criterion A

Current decline

Ndoha lost 26% of its size over the last 30 years (Figure 45). Its status is thus **Least Concern** under A1.

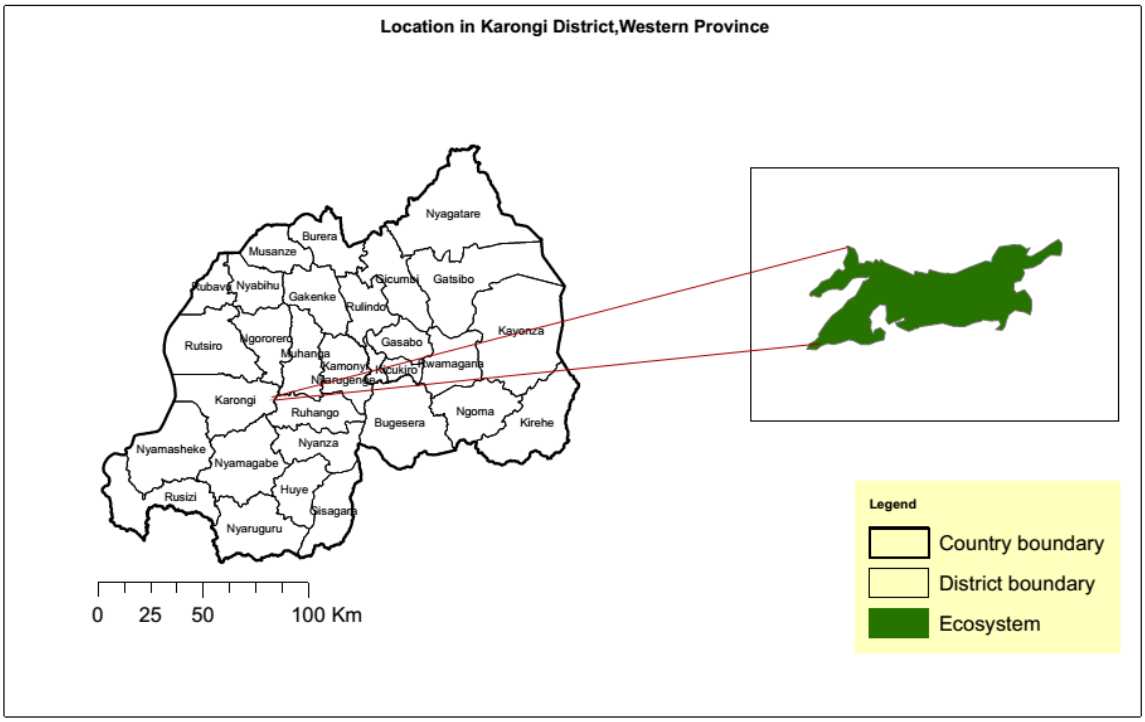


Figure 45: Changes in geographic distribution of Ndoha Natural Forest

Future decline

Current threats will definitely lead to huge losses for the next 50 years. The loss can be estimated at more than 75%. The status under A2 is therefore **Endangered**.

Historic decline

The criterion was not assessed due to lack of sufficient data. The status of Ndoha is thus **Data Deficient** under this criterion.

Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems has an area of 5,919.88 $km^{2.}$This is less than 20,000 km^2, and thus, the status of Ndoha Natural Forest is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of Ndoha Natural Forest and similar ecosystems indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of Ndoha Natural Forest is **Vulnerable** under B2 (Figure 10).

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems found in the western part of the country. Under this criterion, the status of Ndoha Natural Forest is **Endangered**.

Criterion C

A collapsed state is assumed when there is very negligible or no natural area remaining at all due to environmental degradation (Criterion C) and disruption of biotic processes (Criterion D) with thresholds beyond critically endangered category. Even if there are no quantitative analyses conducted to estimate the probability of ecosystem collapse, observations on the field indicate that current and potential threats are very high to cause the collapse of Ndoha forest (Criterion E). Therefore, the status of Ndoha Natural Forest under criteria C, D and E is **Collapsed.**

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	LC	EN	CO	CO	CO	CO
Subcriterion 2	EN	VU	CO	CO		
Subcriterion 3	DD	EN	CO	CO		

The overall status of Ndoha Natural Forest is estimated as being **Collapsed (CO).**

3.1.14. Nyagasenyi Natural Forest

3.1.14.1. Ecosystem description

Abiotic environment and distribution

Nyagasenyi Natural Forest (also known as Bishop Kayinamura forest) is located in Kirehe District. In the Western part, it is associated with a wetland which is connected to Cyunuzi wetland in East and Rwagitugusa wetland in the North. Rugomero stream crosses the forest (Figure 43). Nyagasenyi covers an area of 18.66 hectares.

Figure 46: Overview of Nyagasenyi Natural Forest

Characteristic native biota

Nyagasenyi is dominated by *Anthocleista grandiflora* and *Syzygium cordatum*. The forest contains also various species like *Blighia unijugata, Cordia africana, Acacia polyacantha* and *Hallea rubrostipulata*. It was reported that many *Cercopithecus mitis doggetti* are often found in the forest.

Threatening processes

The forest has been highly degraded due to advanced agricultural encroachment and tree cutting for firewood. People have free access to the forest, and very few stands of tress remain. Consequently, invasive species dominated by *Tithonia diversifolia* and *Acanthus pubescens* have covered a big part of the remaining forest. Agriculture encroachment is another big threat to Nyagasenyi (Figure 47).

Figure 47: Threats to Nyagasenyi Natural Forest: agriculture encroachment (above); invasive species (below)

3.1.14.2. Risk assessment

Criterion A

Current decline

In the past 30 years, Nyagasenyi has lost 58% of its size (Figure 48). Therefore, the status of Nyagasenyi is **Endangered** under this criterion.

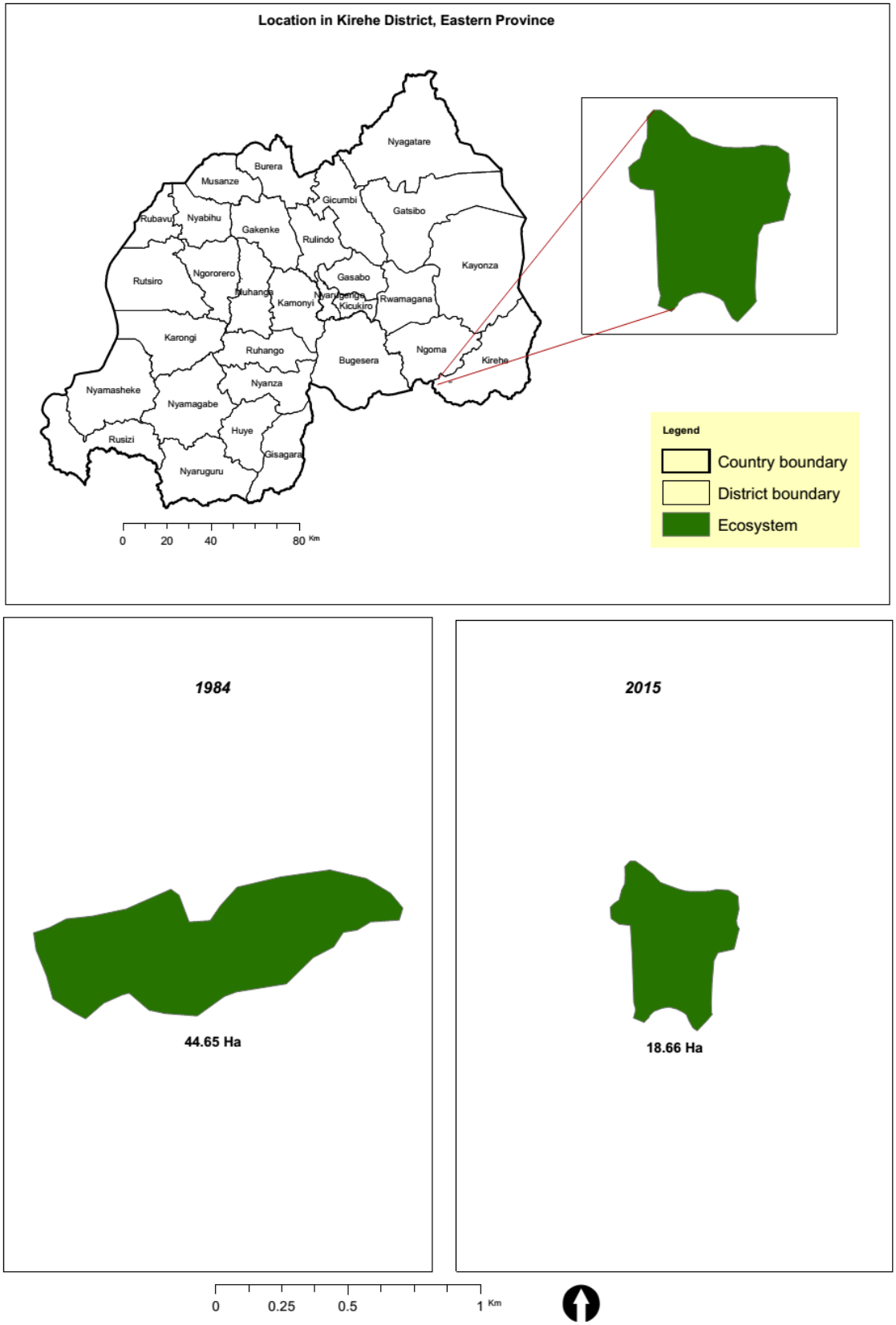


Figure 48: Nyagasenyi decline trends of over past 30 years

Future decline

High agriculture encroachment will undoubtedly lead to more size reduction. Under current population pressure, we estimate that the extent of reduction will be more than 80% for the next 50 years, which leads to **Critically Endangered** status under this criterion.

Historic decline

This criterion was not assessed due insufficient data. The status is therefore **Data Deficient**.

Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar ecosystems of gallery forests has an area of is 3560.63 $km^{2.}$This is less than 20,000 km^2, and thus, the status of Nyagasenyi is **Endangered** under B1 (Figure 21).

Area of occupancy

The minimum convex polygon enclosing all occurrences of similar gallery forests as Nyagasenyi has an area of 3560.63 km^2. This is less than 20,000 km^2. Therefore, the status of Nyagasenyi is **Endangered** under this criterion (Figure 21).

Number of locations

By considering 4 locations, the status of Nyagasenyi is **Endangered** under B3.

Criterion C

Current decline

Environmental degradation due to agriculture is the main cause of disruptions in abiotic factors of this ecosystem. It was reported that the quantity of Rugomero water has diminished over past years, the main cause being forest degradation and agriculture encroachment upstream. Although there have been no data for accurate estimations, but according to direct observations and local populations reports, the extent of environmental degradation can be estimated at 50% with severity of 80%. The status of Nyagasenyi is therefore **Critically Endangered** under this criterion.

Future decline

Unless strong protection measures are applied, existing factors of environmental degradation are expected to increase at an extent of more than 50% in next 50 years from now, with same high severity (80%). The status of Busaga forest under C2 is therefore **Endangered**.

Historic decline

This was not evaluated due to lack of sufficient data. Therefore, the status is **Data Deficient** under this criterion.

Criterion D

Current decline

Huge biotic disruptions have taken place, with many plants species replaced by invasive species as a consequent to agricultural encroachment and tree cutting. Estimated extent of degradation is more than 80% with severity of more than 80%. The status of this ecosystem under D1 is therefore **Critically Endangered**.

Future decline

Continuing degradation of biological resources is linked to lack of management system of the forest. In the next 50 years, this forest will have faced worse threats which can lead to its collapse, unless conservation measures are taken. Therefore, Nyagasenyi will continue being estimated as **Critically Endangered** under D2.

Historic decline

This was not evaluated due to lack of sufficient data. Therefore, the status is **Data Deficient** under this criterion.

Criterion E

This was not evaluated due to lack of sufficient data. Therefore, the status is **Data Deficient** under this criterion.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**CR**	**CR**	**DD**	**CR**
Subcriterion 2	**CR**	**EN**	**EN**	**CR**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of Nyagasenyi Natural Forest is estimated as being **Critically Endangered (CR)**.

3.1.15. Nyungwe National Park

3.1.15.1. Ecosystem description

Abiotic environment and distribution

NNP is an afromontane forest located in the South West of Rwanda. The park touches five districts: Karongi in the North, Nyamasheke in the West, Rusizi in the South-West and Nyamagabe and Nyaruguru in the East. Within these five districts, twenty-three administrative sectors border the Park (Figure 46). NNP covers an area of 101,659 hectares which makes it the largest protected area in Rwanda. NNP comprises the main forest of Nyungwe and isolated forest patch of Cyamudongo. Its altitudinal range varies between 1,600m and 2,950m, with climatic conditions quite typical of a tropical montane forest. NNP is located in a region where several large-scale biogeographical zones meet and the variety of terrestrial biomes provides a great span vegetation types of rainforest, bamboo, grassland, swamps and bogs (such as Kamiranzovu swamp) and microhabitats for a large number of plant and animal species (Sun et al. 1996). NNP is also Rwanda's primary water catchment, sheltering more than 2/3 of all its waters. The Park is contiguous with Kibira National Park in Burundi, and they both form the Nyungwe-Kibira Landscape.

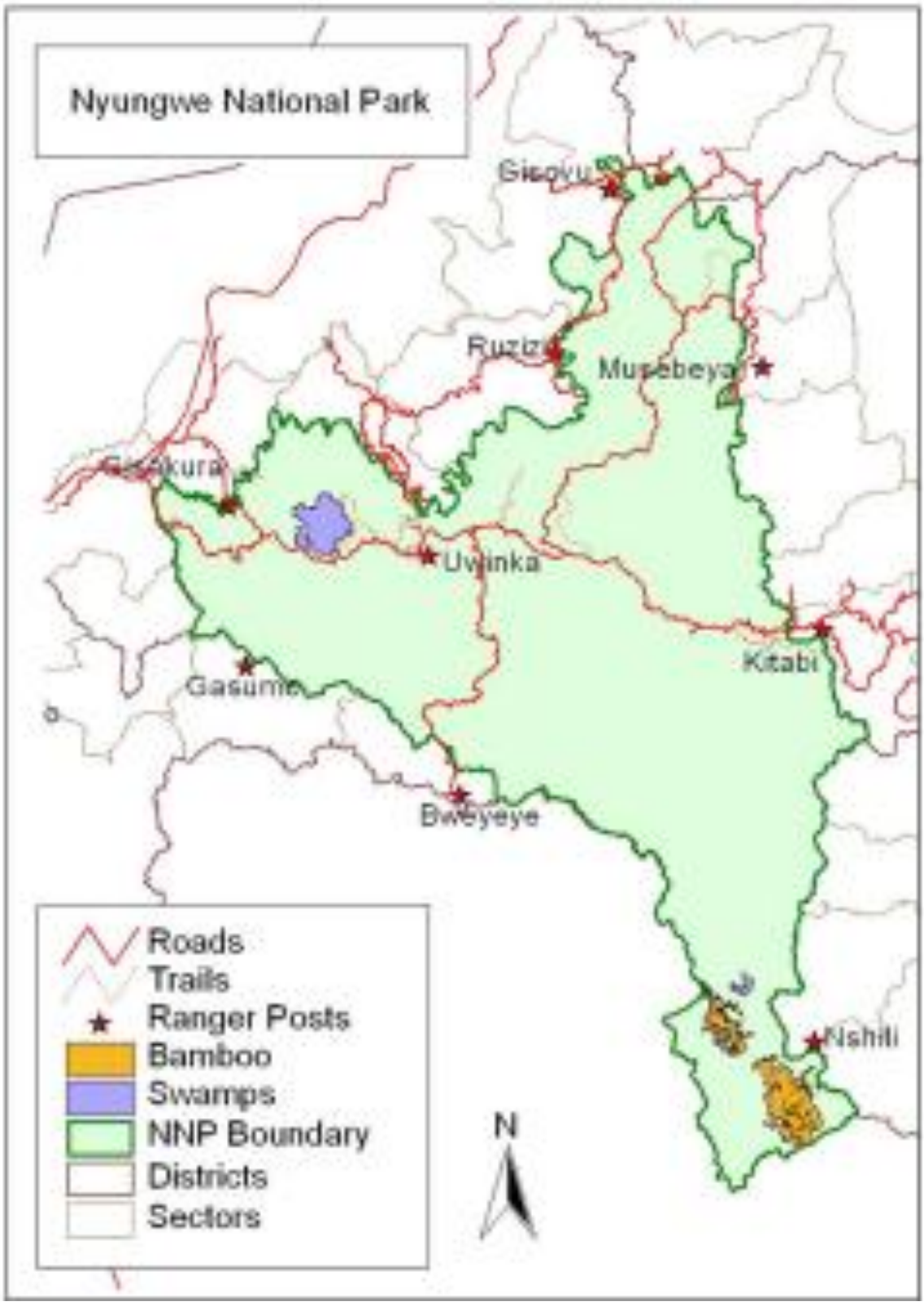


Figure 49: Map of Nyungwe National Park

Source: Adapted from RDB 2012, Nyungwe National Park Management Plan 2012-2021

Characteristic native biota

NNP is a biodiversity hotspot which hosts a high diversity of flora and fauna. NNP biodiversity comprises thirteen primate species (20% of all primate species in Africa), 275 bird, 85 mammal, 32 amphibian, 38 reptiles and 1068 plant species. Furthermore, there are 47 flowering plant species endemic to this forest (e.g. *Impatiens nyungwensis, Afromomum wuertii, Diaphananthe delepierreana, Ypsilopus liae*, etc.) and 280 species endemic to the Albertine Rift. New species are continuously discovered such as Impatiens kagamei (plant) and African glass frog *Hyperolius* (frog) (Fischer & Killmann, 2008). Due to its high biodiversity, NNP has been identified as an area of global conservation importance by World Wildlife Fund as an "ecoregion" (Olson & Dinerstein, 1998; Burgess et al, 2004), by Conservation International as a "biodiversity hotspot" (Brooks et al, 2004) and by Birdlife International as an "endemic bird area" (Stattersfield et al, 1998).

Threatening processes

Being located in one of the most densely populated areas of the country, with high levels of poverty, NNP faces heavy pressure on the natural resources through poaching, illegal mining, habitat loss by fire, tree harvesting for firewood and house construction, livestock grazing…Combined with the lack of alternative income-generating opportunities, these threats contribute to degradation of this forest's ecosystem.. It was reported In the recent survey conducted in 2014, the mean average of all threats encountered per Km per month over the year 2014 was 0.09 threats/Km. The major threat for the year 2014 was poaching (0.84/km), tree cutting (0.19/km), bamboo cutting (0.07/Km), fire places and mining (0.04/km each); beehives (0.02/Km). Other threats were also recorded including agriculture, cattle passing or grazing, bush fires, debarking of trees and medicinal plants collection The neighbouring Kibira National Park in Burundi causes also challenges related to very intensive and permanent mining along the Akaburantwa River (Rwanda-Burundi border) (RBM report, 2014). Despite adoption of more stringent protection, some threats have continued to increase (Figure 47).

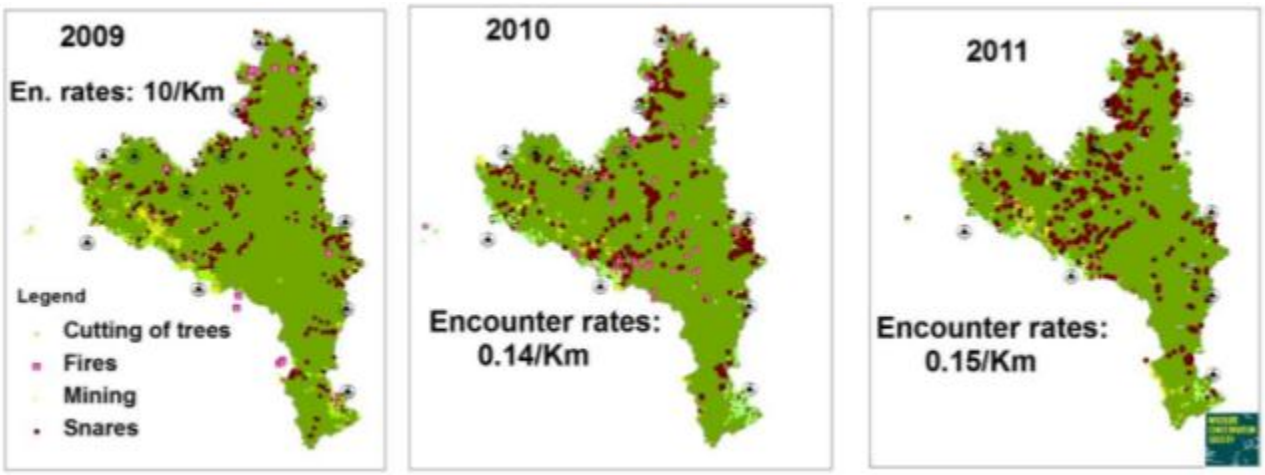


Figure 50: NNP threats on increase

Source: (Adapted from RDB, (2011). Illegal activities in Nyungwe National Park, Annual Report)

Another significant threat to NNP is related to invasive plant species, both indigenous and exotic. In particular, the liana *Sericostachys scandens* is a widespread indigenous invasive climber that colonizes recent forest gaps, leading to large mono dominant forest patches that can span over many hectares. In addition, the exploitation of NNP buffer zone by Nyungwe Forest Company is a great potential threat to NNP. Unless strong control measures are put in place, this exploitation coupled with the use of machines and chemicals can seriously harm NNP's ecosystem and biodiversity.

3.1.15.2. Risk assessment

Criterion A

Current decline

At the beginning of the 20th century, parts of the forest were cleared for farmland and the discovery of gold in the 1930s led to further degradation. Detection trends from 1984-2015 for NNP (Cyamudongo included) show that NNP lost 15% of its size (Figure 51). The status is thus **Least Concern** under this criterion.

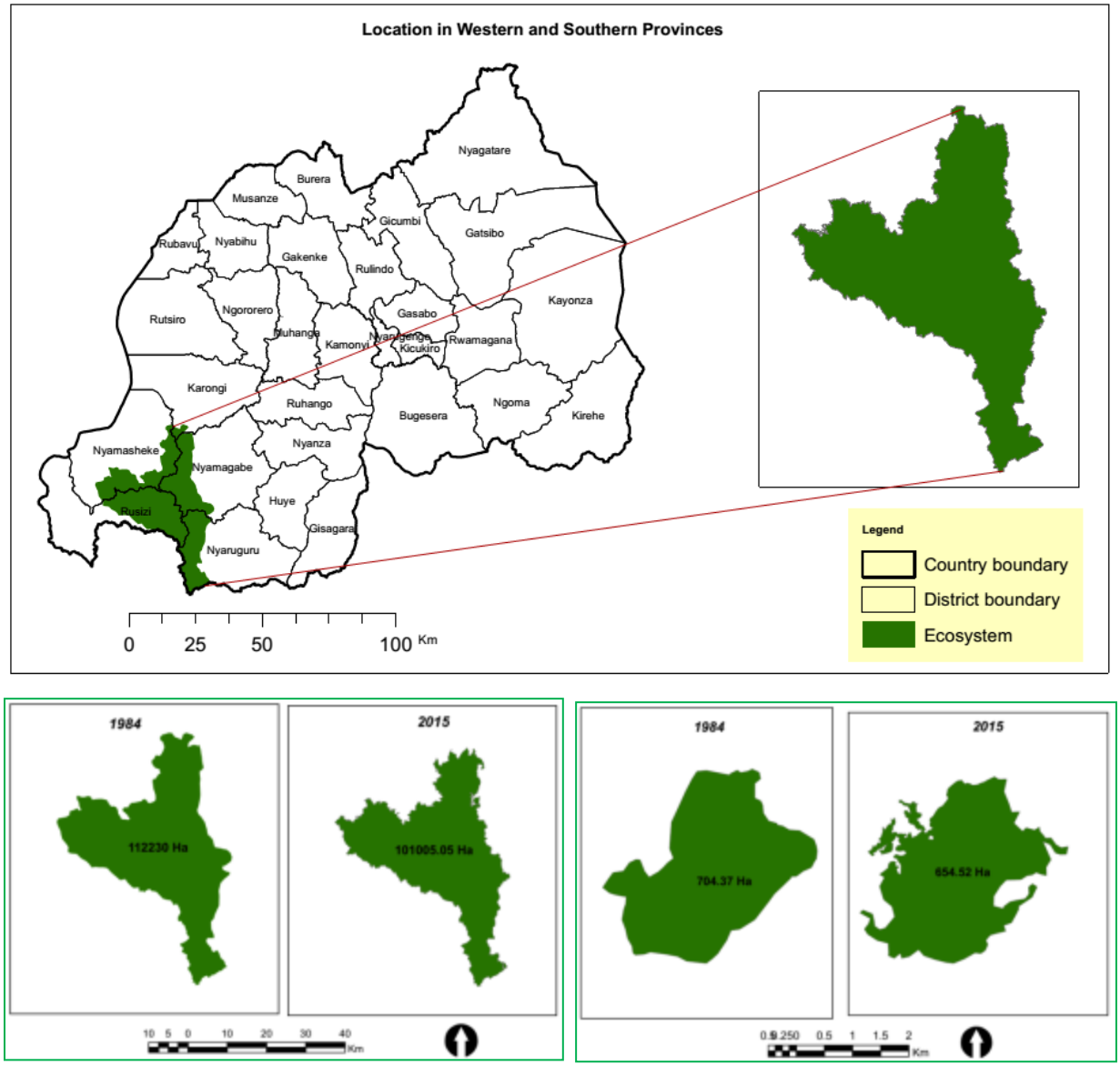


Figure 51: Changes in geographic distribution for NNP over past 30 years (below left: Nyungwe forest; below right: Cyamudongo forest)

Future decline

Although the park faces different threats, most of them that contributed to high reduction in geographic distribution took place when NNP was not yet gazette as a National Park. Since this new status 10 years ago, the rate of reduction has substantially decreased. Although further projections could provide more information we estimate that the reduction will not reach vulnerable category thresholds. The status of NNP is therefore **Least Concern** under this criterion.

Historic decline

Not assessed due to lack of data. NNP's status is **Data Deficient** under A3.

Criterion B

Extent of occurrence

The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems has an area of 5,919.88 km^2.This is less than 20,000 km^2, and thus, the status of NNP is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of all mountain forests, the minimum convex polygon indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of NNP is **Vulnerable** under B2 (Figure 10).

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems found in the western part of the country. Under this criterion, the status of NNP is **Endangered**.

Criterion C

Current decline

In past 30 years, different threats have negatively affected NNP's habitat. It was estimated that nearly 12,000 miners were working the Nyungwe watershed (south-western part of the park) between 1972 and 1985 with their activities expanding throughout the western and southern drainages of the forest. Huge amounts of soil within the valley bottoms were displaced in their search for gold, and dynamite was often used. Mining was also associated with other threats to conservation including stream channel destruction and diversion, pollution of waterways with sediment, and loss of the vegetation surrounding the rivers (Budowski, 1976). Wildfires also contributed to high environmental degradation. The fires that broke in 1997, where nearly 13,000ha of the forest was burnt, caused huge soil's degradations and a new vegetation type sprouted replacing original species (De Gryze et al., 2008). In addition the introduction of exotics pine plantations in buffer zone have led to acidification of the soil and eucalyptus is believed to cause suppression of natural forest understory, thus increasing risk of erosion and use excessive amounts of water. Other factors include road buildings. During the 1980's a Swiss-sponsored project situated on the north side of the forest cleared a forestry road 5 meters

wide across the forest to expedite timber (Vedder, 1988). The rate of change in abiotic variables is estimated at an extent of 70% with relative severity of more than 80%. Therefore, the status of NNP under C1 is **Endangered**.

Future decline

Although current situations indicate unlikely similar events to happen in next 50 years, however, based on conservation measures put in place since the establishment of this park 10 years, we can estimate that the threats on abiotic processes and interactions will continue to decrease down to 50% of extent, with same relative severity (80%). The status of NNP is therefore **Endangered** under this criterion.

Historic decline

Criterion not assessed due to lack of Data. NNP status is therefore **Data Deficient** under this criterion.

Criterion D

Current decline

The threats that affected the park's habitat were also affecting its biodiversity. Mining has had a serious impact on the forest fauna and flora through pollution and by causing destruction of their ecological niches…On the other hand, following the wildfires which caused a substantial loss of the forest, the burned area was immediately colonized with a fern species (*Pteridium aquilinum*), which formed a dense layer of 1-2 m, blocking out light and reducing or preventing the natural regeneration of tree seedlings (De Gryze et al., 2008). Other threats related to poaching, tree cutting, agricultural encroachment, grazing…contributed also to huge losses in biological resources and negatively affected different biotic processes and interactions (food regimes, reproduction behaviours, etc). As an example, it is estimated that 1570 ha of bamboo forest have been seriously reduced within NNP in the last 20 years (De Gryze et al., 2008). Estimated rate of extent in degradation of biotic processes and interactions over the past 30 years is 50% and a relative severity of 80%. This leads to **Endangered** status for NNP under this criterion.

Future decline

As for the assessment for degradation in abiotic variables, conservation measures of this the park can ensure positive projections in terms of biological resources safeguard in the future. However, these projections which could confirm extent and severity rates on biotic variables

were not done. There is need of fully inventorying the park's biodiversity and then make projections of changes over time. NNP status is therefore **Data Deficient** under this criterion.

Historic decline

Although we don't have enough data to assess this criteria, but the disappearance of elephants and buffaloes which once occurred in Nyungwe could be a good baseline to assess this criterion. The data would also consider historical background and changes that took place in terms of different taxonomic groups of the years. For example, some earliest records show that pastoralists moved their herds into the forest during the 1880s during a Rinderpest outbreak, and in the 1930sand 1940s many households coped with famine through access to the forest (Schnitzler & Fourrier, 1993; Chao, N. et al., 2012), but no quantitative data on which estimations of extent and severity in biotic disruptions could be based are available. Therefore, the status of NNP under D3 is **Data Deficient**.

Criterion E

No modelling of risks has been carried out to estimate ecosystem collapse; hence NNP is **Data Deficient** under criterion E.

OVERALL STATUS

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**LC**	**EN**	**EN**	**EN**	**DD**	**EN**
Subcriterion 2	**LC**	**VU**	**EN**	**DD**		
Subcriterion 3	**DD**	**EN**	**DD**	**DD**		

The overall status of NNP is estimated as being **Endangered (EN).**

3.1.16. Sanza Natural Forest

3.1.16.1. Ecosystem description

Abiotic environment and distribution

Sanza Natural Forest also known as Nyabitukura is located in Ngororero District, Muhororo Sector, at the hill of Uwintobo with an altitude of 1990m and a total surface of 23.9 hectares. Hydrological features in the area are dominated by Satinsyi River which contours the forest downhill. Uwintobo hill is also very rich in water streams (Figure 52). The soil of the region of Gatumba where Sanza is located is known to be rich in mines.

Figure 52: Overview of Sanza Natural Forest

Characteristic native biota

Sanza is an afromontane relict forest, with dominant plant species including Syzygium *parvifolium, Macaranga kilimanscharica, Neoboutonia macrocalyx, Myrianthus holstii* and *Albizia gummifera* (closest to the river). Some exotic tree species including *Alnus glutinosa, Pinus patula, Grevillea robusta* and *Eucalyptus div. sp.* are also found. *Alnus* and *Pinus* were planted as a buffer zone. Due to high level of degradation, animal diversity within is low. Some common birds have been observed though (e.g. *Scopus umbretta)*.

Threatening processes

Sanza forest is highly degraded by human activities such as mining, agriculture, grazing and logging. Different mining sites were found, and, the people involved in these mining activities deflect stream channels in order to feed the mining sites. Many holes dug inside the forest for canalizations contribute to the deterioration of the forest biodiversity of this already small forest

(Figure 53). The central part of the forest is particularly degraded the plants are scattered all around the big pits located in the center, and downwards to Satinsyi River. Despite the existing buffer zone, this one is violated and agricultural encroachment is very high because of the forest's location in a region with high population density, heavily relying on agriculture, and firewood.

Figure 53: Major threats of Sanza forest

3.1.16.2. Risk assessment

Criterion A

Current decline

Based on available data, Sanza Natural forest has lost 51% of its size over past 30 years (Figure 54). It is thus classified as **Endangered** under this criterion.

Future decline

Current trends of degradation will lead to definite **collapse** of this ecosystem over the next 50 years. Mining poses a very serious threat to this ecosystem, and there are no measures to limit this high degradation.

Historic decline

This criterion was not assessed due to lack of sufficient data, and the status of Sanza Natural Forest is **Data Deficient** under A3.

Criterion B

Extent of occurrence

The location of Sanza Natural Forest in the region of high mountains makes it grouping with other mountain forests found in the West of the Rwanda. The minimum convex polygon enclosing all occurrences of similar mountain forest ecosystems has an area of 5,919.88 km^2. This is less than 20,000 km^2, and thus, the status of Sanza Natural Forest is **Endangered** under B1 (Figure 10).

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of all mountain forests, the minimum convex polygon indicates that 32 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of Sanza Natural Forest is **Vulnerable** under B2 (Figure 10).

Number of locations

This mountain forest shares similar characteristics with other 8 ecosystems. The status of Sanza Natural Forest is thus **Endangered** under B3.

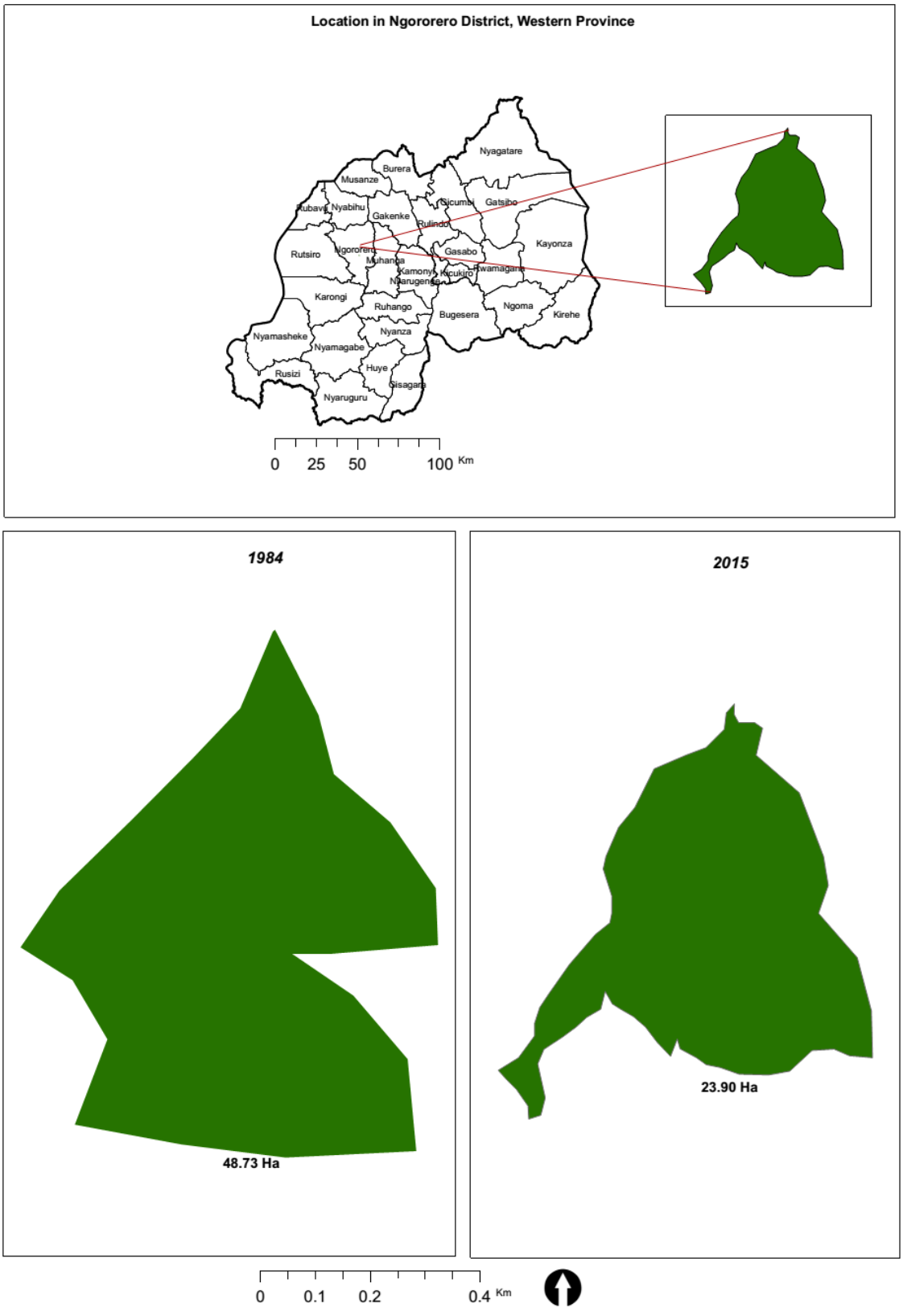


Figure 54: Changes in geographic distribution for Sanza Natural Forest over past 30 years

Criteria C and D

Illegal mining and agriculture encroachment have heavily degraded this small ecosystem beyond recovery. Under future scenarios, considering the current highly degraded and dispatched status, a collapsed state is assumed due to a great environmental degradation (Criterion C). Based on the field observations, current threats leading to high degradation of natural vegetation are very high to cause the collapse of Sanza forest (Criterion D). Therefore, the status of Sanza Natural Forest under criteria C and D is **Collapsed.**

Criterion E

Based on current situation, the probability of this ecosystem **collapse** is very high.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**EN**	**EN**	**CO**	**CO**	**CO**	**CO**
Subcriterion 2	**CO**	**VU**	**CO**	**CO**		
Subcriterion 3	**DD**	**EN**	**CO**	**CO**		

The overall status of Sanza Natural Forest is estimated as being **Collapse (CO).**

3.1.17. Volcanoes National Park

3.1.17.1. Ecosystem description

Abiotic environment and distribution

VNP is located in the north-western of Rwanda, in the districts of Nyabihu, Musanze and Burera, bordering the Democratic Republic of Congo and Uganda. The park covers an area of approximately 16,021 hectares (including Buhanga Eco-Park) with altitudes of 2,100m-4,507m. The park covers five volcanoes: Karisimbi (4,507m), Bisoke (3,711m), Sabyinyo (3,645m), Gahinga (3,474m) and Muhabura (4,127m). VNP is part of Virunga Massif, which includes also the Mikeno sector of Virunga National Park in DRC, and the Mgahinga Gorilla National Park in Uganda. Towards the South of the Virunga Volcanoes chain, VNP stretches for 40 km. At its narrowest point, VNP is a little over 1 km wide (Figure 55).

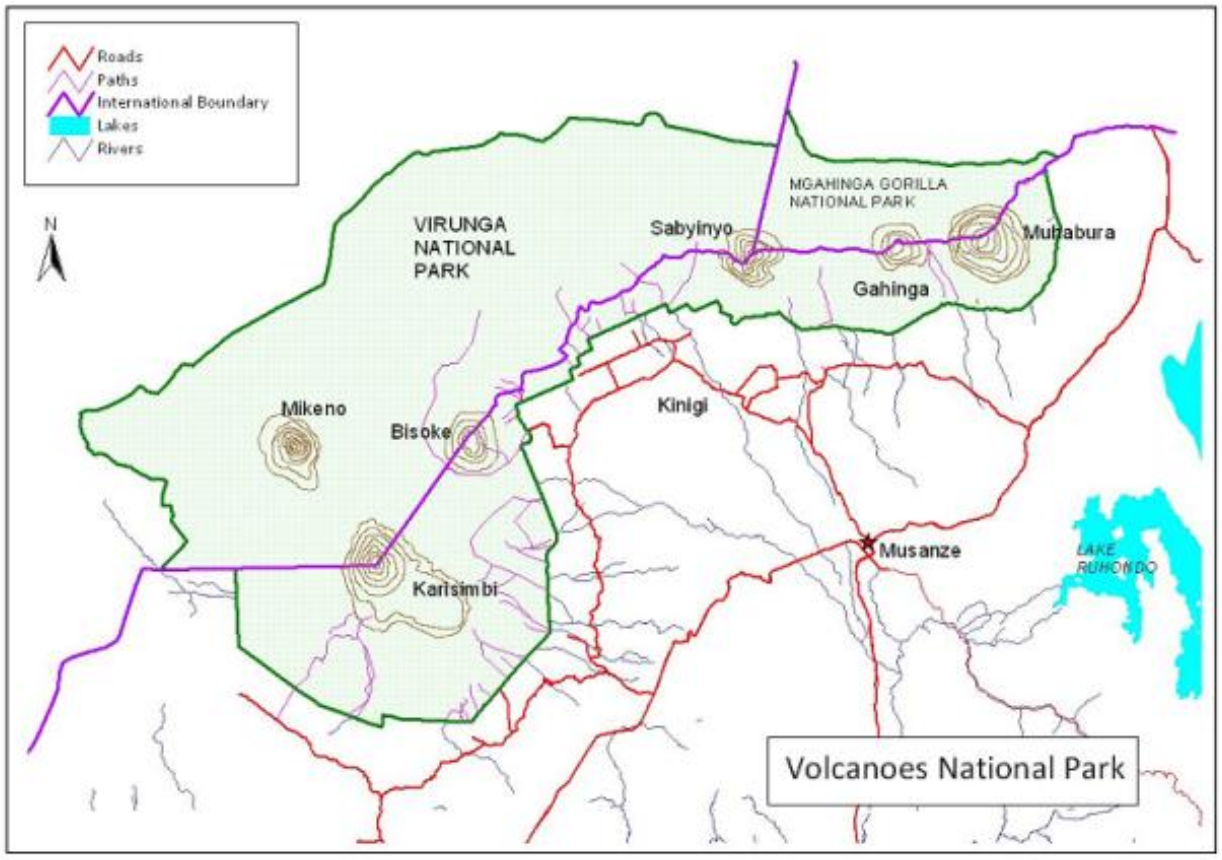


Figure 55: Map of Volcanoes National Park and neighboring protected areas in the Virunga Massif
Source: Adapted from RDB, 2012. The Volcanoes National Park Management Plan 2012-2021.

VNP comprises also Buhanga Eco-Park, a relict forest of about 18 hectares located in Nkotsi Sector in Musanze District. Despite its small size, this serene forest packs a great deal of biological and cultural significance. Various trails cross through towering trees home to a variety of birds and butterfly species. The location is built on an ancient sacred site that was used for coronation rituals of Rwandan kings.

Characteristic native biota

VNP is stratified in nine main vegetation zones along altitudinal gradients: Bamboo, Mimulopsis, Mixed forest, Herbaceous, Brush ridge, *Hagenia/Hypericum* Forests, Meadow, Sub-alpine and Alpine zones (McNeilage, 1995) (Figure 56).

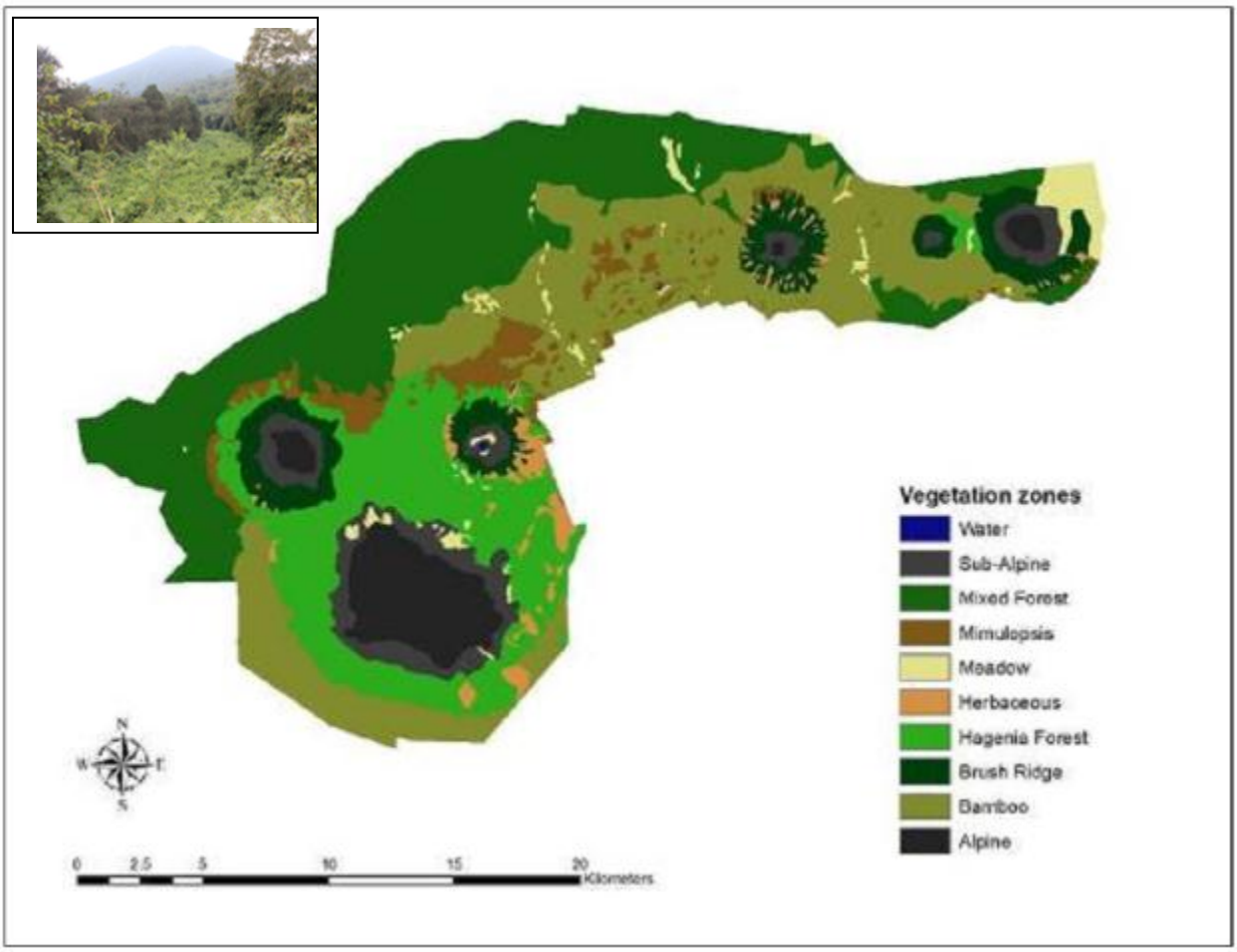


Figure 56: Vegetation Zones of Virunga Volcanoes National

Source: Adapted from Fawcett, K., *et al*. 2012 (Long term changes in the Virunga Volcanoes).

Considering the species of birds, mammals, reptiles, amphibians and birds found within the Albertine Rift, approximately 25% of the species richness and 45% of endemic species are found within the park, hosted in various vegetation zones. Common large mammals in the area include two threatened primate species: the Critically Endangered Mountain Gorilla (*Gorilla beringei beringei*) and the Endangered Golden Monkey (*Cercopithecus mitis kandti*); three ungulates species: the buffalo (*Syncerus caffer*), the black fronted duiker (*Cephalophus nigrifons*) and the bushbuck (*Tragelaphus scriptus*) and one elephant specie (*Loxodonta Africana*) (Plumptre *et al.,* 2003).

Threatening processes

VNP is surrounded by an extremely high human population density. Land scarcity in the region and the high potential for agricultural productivity on the volcanic soils has compelled farmers to cultivate on fragile slopes on the edge of the park. Data compiled in 2009 from the 12 park adjacent sector offices shows that today's mean population density amongst the territories adjacent to the VNP is 590 per km^2 and the growth rate is greater than 3% per annum. This threatens the VNP in terms of land use change in surroundings of the park, agriculture encroachment, poaching, bamboo forest cutting, degradation of sufficient suitable habitat mainly on mountain gorillas…Other threats include forest fires. Although they are infrequent, they are a serious threat to VNP because of the severe damage they cause. For example, the eastern side of the Muhabura Volcano is characterized by regenerating vegetation regimes probably as a result of repeated burning in the region. VNP fires have a number of causes, including accidental fires caused by beekeeping and honey collection activities, malicious fires set by poachers… In addition to the threats posed by the high human population and degrees of poverty, war and political unrest have plagued the region repeatedly. During the 1990s the Virunga Volcanoes was a refuge for both fleeing refugees and fighting groups increasing demand on park resources.

3.1.17.2. Risk assessment

Criterion A

Current decline

Over past 30 years, most of the loss of park land was in the lower elevation zones due to agriculture encroachment. Buhanga side was the most affected due to lack of protection status. VNP itself lost only 1% of its size. Together with Buhanga Eco-Park, the lost is estimated at 7% (Figure 57). This extent is very low to classify VNP as a threatened ecosystem. Therefore, the status of VNP is **Least Concern** under this criterion.

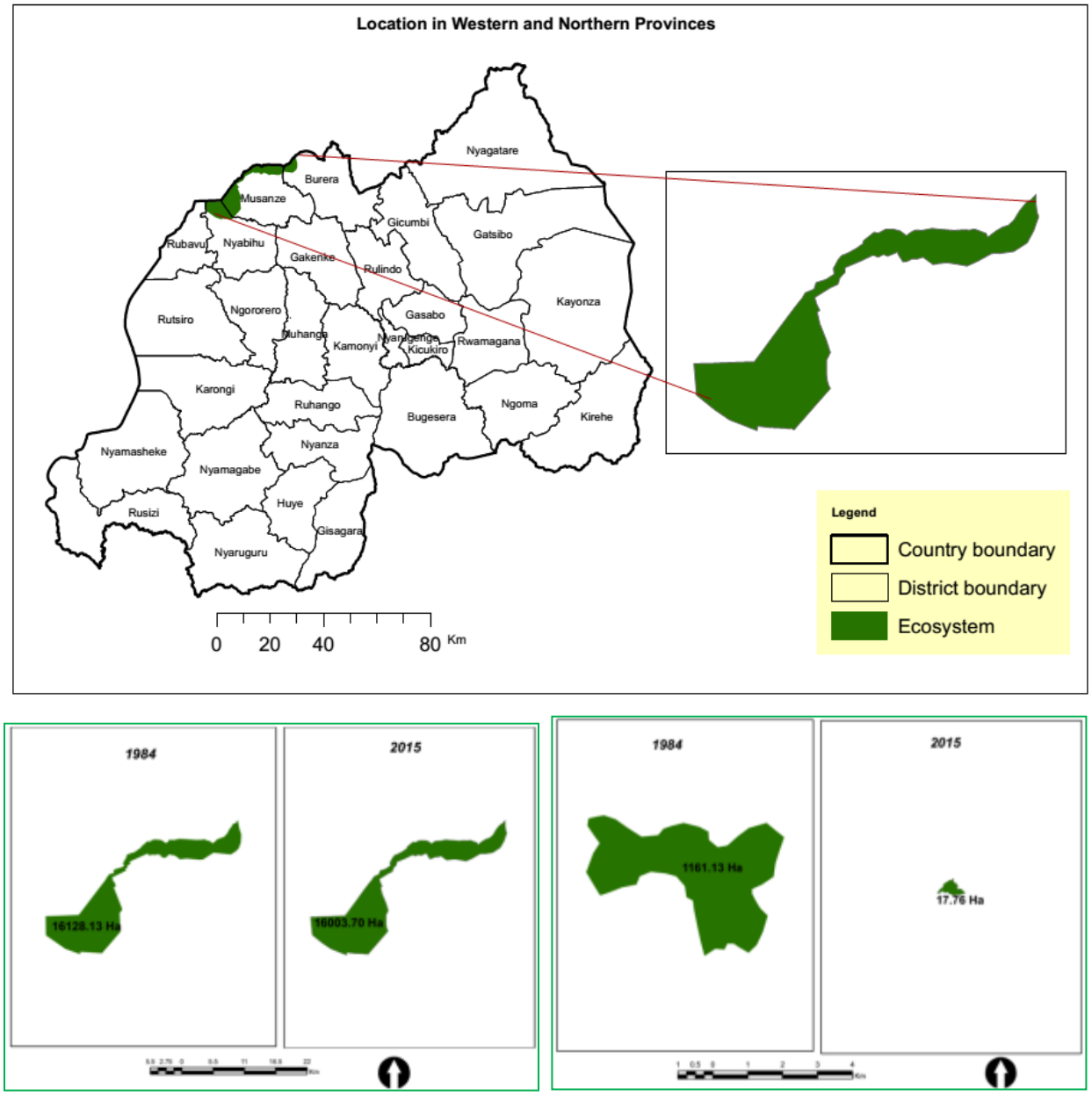


Figure 57: Changes in geographic distribution for VNP (below left) and Buhanga Eco-Park (below right)

Future decline

Conservation measures of VNP are sufficient to keep this ecosystem well protected. All potential threat exist (e.g. agriculture encroachment), there is no risk of categorizing this ecosystem in threatened category. The status of VNP is therefore **Least Concern** under A2.

Historic decline

Not assessed due to lack of data. The status of VNP is therefore **Data Deficient** under this criterion.

Criterion B

Extent of occurrence

The uniqueness of ecological characteristics of VNP due mainly to its origin as a volcanic ecosystem served to delimiting it with Buhanga Eco-Park only (Figure 58). Total EOO is 518.34 km^2. This is far less the thresholds of 2,000 km^2, which results in **Critically Endangered** status under this criterion.

Area of occupancy

Superimposing a 10 km grid over the mapped polygons of all mountain forests, the minimum convex polygon indicates that two 10kmx10km grid cells have an area of more than 1 km^2. Therefore, the status of VNP is **Critically Endangered** under B2 (Figure 58).

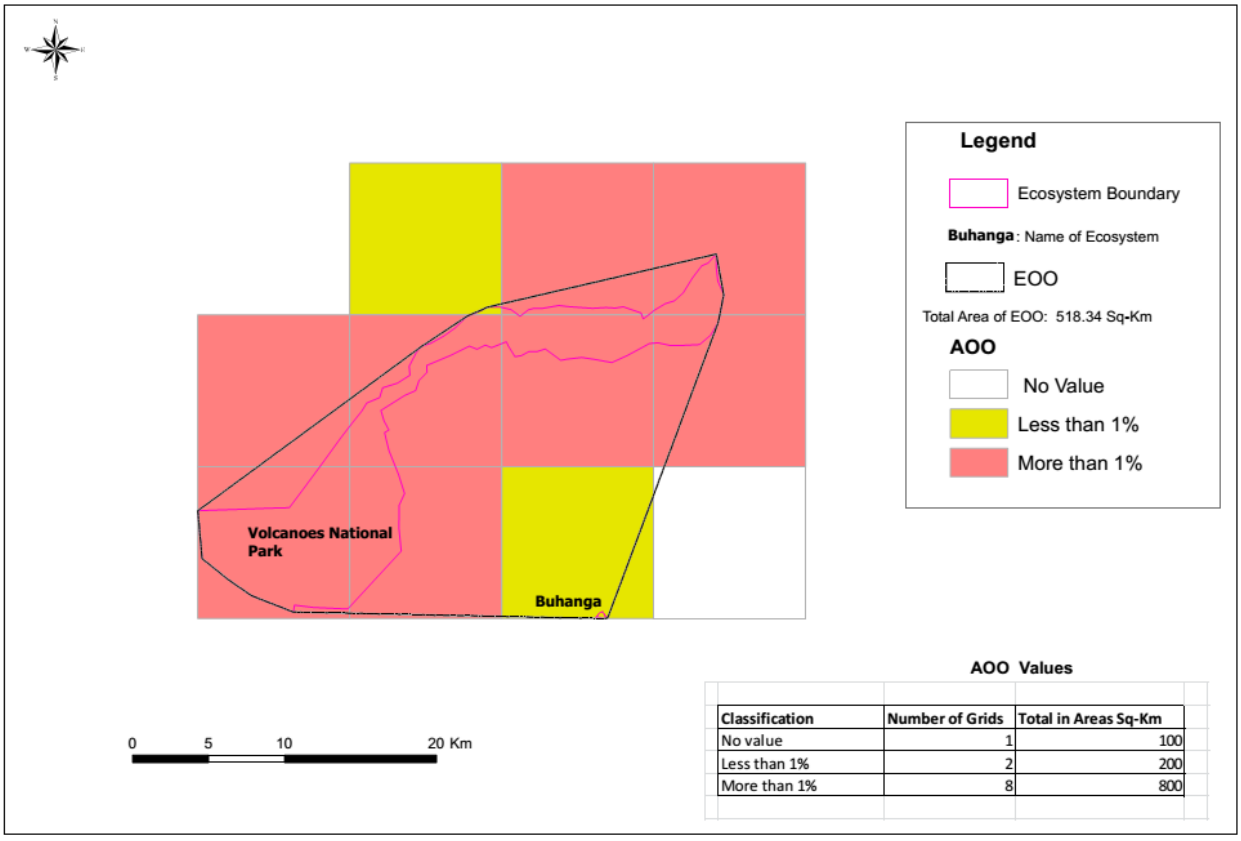


Figure 58: Extent of occurrence and Area of occupancy of VNP

Number of locations

Only two locations are considered under this criterion. The status of VNP under B3 is **Critically Endangered.**

Criterion C

Current decline

Disruptions in abiotic factors of VNP have been associated with encroachments due to high population around it as explained previous sections. The impact of this factor has caused huge disruptions in VNP natural ecosystem, and many changes in vegetation zones occurred consequently (e.g. on Bisoke mountain, some layers like bamboo stratum have completely disappeared). Water quantity in the area has also decreased as observed in some small lakes (e.g. Ngezi and Kabatwa). Although no causes known so far, but intensive agriculture in the surroundings of the park is among the main hypothetical causes. Moreover, risks associated with soil erosion around hiking trails exist. These trails are constantly being impacted by soil erosion from water run-off, as well as the impact of very heavy human use, and there is a constant need for repair and maintenance activities to keep trails open and safe for visitors. The estimation of the extent of impact can be estimated at 30% with severity of more than 80%. Therefore, the status of VNP is **Vulnerable** under this criterion.

Future decline

Despite strong measures put in place, like for example community conservation program and tourism revenue sharing schemes, it would take a very long time to mitigate current threats identified in previous sections. Further research might contribute in determining the projections, but our estimations on extent and relative severity of the threats on abiotic processes and interactions would reduce under threatened category thresholds. Thus, VNP's status under this criterion is **Least Concern**.

Historic decline

Criterion not assessed due to lack of Data. VNP status is therefore **Data Deficient** under this criterion.

Criterion D

Current decline

Gorillas are a good example for assessment of disruptions in biotic processes and interactions. When Schaller made his study of mountain gorillas in the late 1950's he estimated their population to be between 4500 individuals. In detailed censuses since the early 1970s the populations was found to have declined to 260-290 individuals. In 1981, the population reached only 242 individuals. At this time the gorilla population was threatened by habitat loss, poaching, habitat disturbance through cattle grazing and insecurity and conflict. From the mid-1980's onwards the population size has been slowly increasing up to 380 individuals in 2003. Today, gorilla population is estimated at 480 individuals. It can be hypothesized that this increase the removal of cattle and other conservation measures mainly in the sites of Karisoke groups has led changes in gorilla food availability and thus contributing to their increase. For other species, especially ungulates, their numbers has steadily decreased due mainly to poaching. Total number of snares recovered from VNP did not change, and many animals are victim to this deplorable activity (Fawcet, K. et al., 2012). As far as the flora is concerned, changes in vegetation zones indicate huge negative impacts on plants diversity. Other threats are related to invasive species both animal and plant. Dogs in particular have become a serious problem in recent years, and they represent a threat to the Mountain gorilla population as well as to Golden monkey and duikers. The problem of invasive and exotic species increased during the genocide period, when people moved into the VNP and practiced agriculture in the forest. Reducing the problem of these invasive and exotic species has now been identified as a priority for the conservation of the VNP's habitats and key biodiversity. We estimate that the extent of different identified threats on biotic variables is more than 50% with high severity (>80%). Therefore, the status of VNP under this criterion is **Endangered**.

Future decline

Under current conservation measures, we can estimate that the trends in threatening processes will decline. However, more efforts needed indicate that there is still a long way to go in terms of threats mitigation and reach below current thresholds of Endangered level. Thus, VNP's status is estimated to be **Vulnerable** under criterion D2.

Historic decline

Criterion not assessed due to lack of Data. VNP status is therefore **Data Deficient** under this criterion.

Criterion E

No modelling of risks has been carried out to estimate ecosystem collapse; hence VNP is **Data Deficient** under criterion E.

Summary

Criterion	A	B	C	D	E	Overall
Subcriterion 1	**LC**	**CR**	**VU**	**EN**	**DD**	**CR**
Subcriterion 2	**LC**	**CR**	**LC**	**VU**		
Subcriterion 3	**DD**	**CR**	**DD**	**DD**		

The overall status of VNP is estimated as being **Critically Endangered (CR)**.

Summary of listed threatened ecosystems

A total of 17 ecosystems has been listed as **threatened ecosystems** (table 2):

- 3 have been categorized as **collapsed**

- 10 categorized as **critically endangered** and

- 4 categorized as **endangered**.

Table 2: Summary of ecosystems assessment

Ecosystem	Overall status	Criteri(on)a determining overall status
1. Mashyuza Natural Forest	Collapsed	A, C, D and E
2. Sanza Natural Forest	Collapsed	A2, C, D and E
3. Ndoha Natural Forest	Collapsed	C and D
4. Busaga Natural Forest	Critically Endangered	D2
5. Dutake Natural Forest	Critically Endangered	A2
6. Gishwati Natural Forest	Critically Endangered	A1, C1, D1 and D2
7. Ibanda-Makera Natural Forest	Critically Endangered	A1, A2, B1, B2, D1 and D2
8. Karama Natural Forest	Critically Endangered	A2 and D2
9. Karehe-Gatuntu Natural Forest	Critically Endangered	A2 and D2
10. Mashoza Natural Forest	Critically Endangered	A2, B2, C2, D1 and D2
11. Mukura Natural Forest	Critically Endangered	C1 and D1
12. Nyagasenyi Natural Forest	Critically Endangered	A2, B1, B2, C1, D1 D2
13. Volcanoes National Park	Critically Endangered	B
14. Akagera National Park	Endangered	A1, B1, B2 and C1
15. Kibirizi-Muyira Natural Forest	Endangered	B1, C1 and D1
16. Muvumba Natural Forest	Endangered	B, C1, D1, D2
17. Nyungwe National Park	Endangered	B1, B3, C1, C2 and E1

3.2. Prohibited activities in threatened ecosystems

Among 17 assessed ecosystems, 3 are recognized national parks: ANP, NNP and VNP. ANP and NNP have been classified as Endangered while VNP is critically endangered (only under criterion B due to the uniqueness of its ecological characteristics which cause its EOO and AOO small). In addition, 2 forest reserves (Mukura and Gishwati) are in the process of getting gazetted as national parks too. For these five protected ecosystems, some defined conservation measures already exist. For the remaining twelve, three have been classified as collapse, and it should require a lot of means for their restoration. Other nine require much more effort to mitigate the threats that they are facing for their protection.

3.2.1. Terrestrial threatened ecosystems and IUCN Categories of Protected Areas

- ✓ **Category II: National Parks**

Referring to IUCN Categories of Protected Areas, ANP, NNP and VNP are already recognized as National Parks. Mukura and Gishwati can also be classified as National Parks although the process of getting them gazetted as National Park is ongoing.

- ✓ **Category III: National monuments and landmarks**

Under this category, Buhanga Eco-Park would fit well due to its cultural and traditional significance. However, Buhanga has already been linked with VNP to form one National Park, so it remains under category II.

- ✓ **Category IV: Managed wildlife sanctuaries and nature reserves**

These are protected areas set aside to protect characteristic flora or fauna, or to protect particularly threatened animal or plant species, to assure the natural conditions necessary to their protection. Under this category, Mashyuza Natural Forest and the associated thermal waters fit well. This area hosts two particular rare species: *Sterculia tragacantha* and *Nymphaea thermarum*. The two species are naturally found on this place *only*. Unfortunately, Mashyuza is much degraded that the chances of survival as a natural forest are very few.

- ✓ **Category V (Protected landscapes and seascapes) and VI (Managed-resource protected areas)**

None of the identified ecosystems fits the requirements of the remaining categories (Category V and VI).

The remaining uncategorized threatened ecosystems could be given a general status of **special forest reserves** to designate zones of restocking of indigenous species, and special regulations should be set up for their protection.

3.2.2. Prohibited activities

In general, all threats to natural ecosystems as identified in previous chapter should be strictly prohibited. For all threatened ecosystems, any activity likely to alter their state or nature should be banned (cutting, disturbing, damage, burning or destroying any forest produce, or removing or receiving any forest produce (except under authorized permission), planting or cultivation of crops, livestock farming, erecting of a building or enclosure, introduction of alien and exotic species, entry of persons or vehicles (except under authorized permission)…)

According to IUCN (1992), **national parks** must be under state control with the boundaries which may not be altered nor any portion alienated except by the competed legislative authority. Any form of hunting, and undertaking connected with forestry, agriculture or mining, any grazing, any excavation or prospecting, drilling, levelling of the ground, construction, any work tending to alter the configuration of the soil or the character of the vegetation, any act likely to harm or disturb the fauna or flora, including introduction of zoological or botanical species, whether indigenous or imported, wild or domesticated are **strictly forbidden**. Some activities might be allowed for scientific and management purposes and on the condition that strict measures are taken under the direction or control of the competent authority.

For **Managed wildlife sanctuaries and nature reserves** and **Managed wildlife sanctuaries and nature reserves**, the activities prohibited in category I and II also apply. More specifically however, all other interests and activities in these areas must be subordinated to the purpose of their protection.

CHAPTER 4. TERRESTRIAL THREATENED PLANT SPECIES

In Rwanda, the number of vascular plant species is estimated at 3000 (Eberhard, 2008). However, thorough inventories are needed to give updated figures. Different plant species have been listed as threatened. An exception was done for orchids which are recognized as rare species worldwide and listed on CITES lists. This group was not therefore assessed, and a list of the orchids of Rwanda as well as their habitats is found in appendix 4 of this report. Distribution maps for each species are provided in appendix 3.

4.1. Critically Endangered plant species

4.1.1. *Blighia unijugata* (Rwa: Umuturamugina, Eng: Triangle tops)

Blighia unijugata belongs to sapindaceae family. It is a dioecious, small to medium-sized tree up to 30- 35 m tall. Habitat is mostly in moist evergreen forest, but also in semi-deciduous forest, in more dry areas in riverine forest, and in wooded grassland and then often associated with termite mounds, up to 1900 m altitude. The species is used in traditional medicine for the treatment of rheumatism, kidney pain and stiffness, and they are reputed to have oxytocic action in childbirth. Bark decoction is taken to treat fever, and as purgative. Blighia was recorded in Karama, Ibanda-Makera and Mashoza natural forests. The species is thought to be also in ANP. However, during our field visit to ANP, it was not recorded. The population is unknown but believed to be declining due to habitat degradation and overexploitation for medicinal purposes. The decline is estimated at ≥ 50 %. Based on population reduction, criterion A is applied. Therefore, *Blighia unijugata* can be considered for Endangered A2 (a, c). Extent of occurrence is estimated at 18.2 km^2 which is far less than 100 km^2. Considering the extent of occurrence and current threats, criterion B is met. Hence, *Blighia unijugata* is considered as critically endangered CR B1 ab(i, iii)

Conclusion for *Blighia unijugata*: CR B1 ab(i, iii)

The species was recorded in Karama, Mashoza and Ibanda-Makera natural forests. Mashoza forest has no any special protection apart from saying that it is protected by local leaders. Karama and Ibanda-Makera are under RAB and some people are employed for the forests protection. However, no fences or buffer zones were found there. Surrounding people access the above mentioned forests for medicine, timber and fire wood collection and other activities like animal grazing. The special protection measures of these forests are recommended for the future survival of *Blighia unijugata*. Besides, further studies are needed to confirm the presence of the species in ANP

4.1.2. *Lobelia mildbraedii*

Lobelia mildbreadii belongs to the Family of Lobeliaceae. It is giant Lobelia while the most common Lobeliaceae are herbaceous species. Its habitat is restricted to swamps especially those with peat and less water.

Lobelia mildbraeadii is distributed in Eastern Africa swamp but in Rwanda, the species has taken refuge inside NNP swamps and in some rare swamps of VNP. It has been completely removed everywhere outside protected areas. It is declining even inside NNP and VNP due to global warming because it is a species with very narrow ecological range in terms of temperature.

Main threats come from the fact that the species is located at edges of peat bogs and therefore is more exposed to synergistic, physical and biological edges effects than any other species located deep in the ecosystem. Its AOO is limited to less than 10 Km^2. Based on the criterion B2 of IUCN version 3.1., the species can be ranked in the category of CRITICALLY ENDANGERED.

Conclusion: CR B2 (ii, iii, iv)

4.1.3. *Nymphaea thermarum* (Rwa: Imposha, Eng: Lily plant)

Nymphaea thermarum belongs to Nymphaeaceae family. It is a small plant with short rhizome up to 1–2 (−5) cm long. *Nymphaea thermarum* is the world's smallest water lily with leaves of only 1 cm in size, and tiny white flowers with bright yellow stamens. Its geographical range is restricted to Rwanda where the species is known only from one locality at the hot springs of Mashyuza between Bugarama and Nyakabuye at an elevation of 1100 m (S02◦34'99.8'' E29◦00'90.8''). No other population was detected and the species appears to be a local endemic of Rwanda; it is considered as a narrow Albertine Rift endemic not known outside Rwanda (Fischer and Rodriguez, 2010).

Conclusion for *Nymphaea thermarum*: Critically endangered CR B1ab(i,iii).

Nymphaea thermarum is listed as 'Extinct in the Wild' on the IUCN Red List of Threatened Species. However, it was recorded during our field visit in Mashyuza hot spring. Due to threats that this area is facing, special conservation measures should aim at protecting this very rare species by considering ex-situ conservation.

4.1.4. *Osyris lanceolata* (Rwa: Umusheshe, Eng: African sandalwood)

Osyris lanceolata belongs to santalaceae family. It is an evergreen shrub or small tree of 2-9 m, sometimes up to 14 m with flattened branches and drooping branchlets. Normally found in mountain slopes, rocky ridges where the original vegetation has been cleared (Nduwayezu et al, 2009). This species contains essential oils: roots and wood are scented and used to make cosmetics and perfume; and has a lucrative market in Germany, India, Indonesia and South Africa (Orwa et al., 2009). Furthermore, overexploited for medicinal purpose, extracts from the plant can cure certain diseases, including

the killer Hepatitis B (Orwa et al., 2009). One subpopulation occurs inside ANP; others were recorded in Karama forest in Bugesera district and Kibirizi-Muyira remnant forest in Nyanza district. The species is collected entirely for international trading. There is continuing decline due to direct overexploitation of this species for commercial purpose. The decline was estimated at ≥80 %. Hence, this species meets criterion A and qualifies for Critically Endangered A2 (a, d).The extent of occurrence is however estimated at 1,143 km^2 which is less than 5,000 km^2. Therefore, the species can qualify for Endangered B1ab (i, V) using criterion B. Criteria C, D and E were not evaluated due to the fact that the number of mature individuals was not known.

Conclusion for *Osyris lanceolata:* CR A2 (a, d).

Ex-situ conservation should help in conserving the species by trying the multiplication of *Osyris lanceolata* in tree nurseries and grow it in suitable areas.

4.1.5. *Pterygota mildbraedii* (Rwa: Umuguruka; Eng: Mubende witch tree)

This species belongs to sterculiaceae family. *Pterygota mildbraedii* is a deciduous, medium-sized to very large tree up to 60 m tall; bole branchless for considerable length, up to 200 cm in diameter. Habitat is warm and humid conditions with fertile alluvial soils in riverine at altitude of 1250-1500m. In Eastern Africa, *Pterygota mildbraedii* occurs in riverine and gallery forest and secondary forest in mountains. In Rwanda, *Pterygota mildbraedii* was only recorded in Ngoma district (Mashoza natural forest) and in some farmer's fields. The species does not occur in any protected area and it is found in a small remnant gallery forest and some few individuals were observed scattered in farmers' fields. Population size is unknown. It was commonly known but now it is believed to be declining due to overexploitation for medicinal purpose. This continuing decline of population is also due to habitat loss and degradation caused by agriculture encroachment and other illegal activities (fire wood, timber and medicine collection). During our field visit to this forest we met a traditional healer collecting medicinal plants. The reduction was estimated at ≥50 %. Therefore, the species can be considered for endangered EN A2 (a, c, d). Furthermore,

extent of occurrence is estimated at 0.2 km^2; far less than 100 km^2. Thus, *Pterygota mildbraedii* qualifies for Critically Endangered B1ab (i, iii).

Conclusion for *Pterygota mildbraedii*: CR B1ab (i , iii).

Pterygota mildbraedii does not occur in any protected area. It was recorded in unprotected areas and in famers' fields. Protecting the species in farmers' fields is practically impossible. Besides, small ecosystem in which the species is recorded has no special protection. Protection of Mashoza remnant forest is an urgent priority.

4.1.6. *Vernonia auriculifera* (Rwa: Igaragara)

Vernonia auriculifera belongs to compositae family. It is a large, tall-growing, woody, spreading shrub that reaches 1.8-7.5 m in height, commonly found along forest edges, on clear land, in riverine areas and on lake-shores. It occurs at altitude of 1600-2650 m. The species is exploited for medicinal purpose. Leaves are pounded, the juice extracted and taken as a treatment of fever. In Rwanda, *Vernonia auriculifera* was recorded in Gishwati. Considering the fact that this species is restricted to Gishwati and the later is facing threats such illegal activities (mining activities) this should results in the loss of habitat of this species which in turn lead to complete disappearance of the species. The population size is unknown. Illegal activities occurring in Gishwati are the root cause of the population decline which was estimated at ≥80 %. Based on the estimated population decline, *Vernonia auriculifera* qualifies for critically endangered CR A (a, c).

The extent of occurrence is estimated at < 5,000 km^2. Criteria B can be evaluated. Then, *Vernonia auriculifera* qualifies for Endangered B1ab (i, iii).

Conclusion for *Vernonia auriculifera:* CR A (a, c).

Being restricted to Gishwati and this forest is currently facing illegal mining activities destroying it. Thus, controlling these mining activities would ensure the future survival of *Vernonia auriculifera*.

4.1.7. *Xyris vallida*


Xyris vallida is small herb that belongs to the family of Xyridaceae. This family is very poor in terms of species richness as it has only three species recognized in Rwanda. Like M. violaceus, *X. vallida* is a good indicator of peat bogs but it is restricted in the areas with less water especially on the edges of peat bogs. Though it shares its habitat with *Miscanthus*, its Area of occupancy is narrower and can be estimated at 10% of the total AAO of the latter.

Furthermore, based on its physical location in the few remaining peat bogs (NNP, VNP, Rugezi), it is more exposed to synergistic, biological and physical threats. The species has been completely removed outside protected areas.

The total Area of occupancy of *X. vallida* is estimated at about 7 km^2. Compared to the threshold of AAO defined in the criterion B 2, the species fall strait in the category of CRITICALLY ENDANGERED species.

Conclusion: CR B2 b (ii,iii, iv)

4.2. Endangered plant species

4.2.1. *Acacia kirkii oliv. subsp. mildbraedii (*Rwa: Umunyaryera, Umunyinya, Eng: Kirk's acacia).

Acacia kirkii belongs to mimosoideae family. It is a tree of 10-15 m high with a flat-topped crown. Branches have sharp, paired and straight white thorns (Nduwayezu et al., 2009). The species is commonly found at 1300-1450 m in forest galleries, riverine and groundwater forests. This acacia is used in traditional medicine. A decoction of the roots serves as a remedy for stomach ailments (Najma Dharani, 2002). The species was recorded in ANP; also reported to appear at Umutara (Nyagatare) within areas receiving a total rainfall ranging between 537-1519 mm. The extent of occurrence is estimated at less than 5,000 km^2. *Acacia kirkii* can be considered for Endangered B1ab (i, iii).

Conclusion for *Acacia kirkii* EN B1ab (i, iii).

4.2.2. *Afrocanthium lactescens* (Rwa: Umukondokondo, Eng: Afrocanthium)

frocanthium lactescens belongs to Rubiaceae family. It is a deciduous shrub or small tree of 3-12 m high with hairy young branches. It grows in dry bushland, wooded grassland, riverine and forest gallery, at 1000-2300 m. This plant is used in traditional medicine; leaves are used as an antidote for poisoning. In Rwanda, the species has been recorded in Bugesera (Karama forest) and is reported to be present in Umutara (Nyagatare), at 1300-1800 m where rainfall ranges between 537- 1519 mm. Main threats is habitat degradation caused by illegal activities such grazing and agriculture encroachment which in turn result in population decline. This decline was estimated at ≥ 30 % allowing us to categorize the

species as vulnerable VU A2 (a, c). In addition, its extent of occurrence is estimated at < 5,000 km^2. Criterion B to be used; *Afrocanthium lactescens* can qualify for Endangered B1ab (i, iii).

Conclusion for *Afrocanthium lactescens:* EN B1ab (i, iii).
A special protection of its habitats is recommended.

4.2.3. *Albizia amara subsp. sericocephala* (Rwa: Umunaniranzovu, Eng: Bitter albizia).

Albizia amara belongs to mimosoideae family. It is a deciduous tree of 5- 15 m high with dense spreading crown. It grows in wooded grassland, bushland and thickets, at 400-1800 m (Nduwayezu et al., 2009). It is used in traditional medicine (bark and leaves). Bark serves as an emetic to induce vomiting; crushed leaves are used in the treatment of wounds (Najma Dharani, 2002). In Rwanda, this species has been recorded in only eastern region (ANP, Bugesera (Karama forest) and is reported to appear at Umutara (Nyagatare) and Kayonza) at 1300-1700 m where rainfall varies between 214- 1519 mm. Population size is not known. Its extent of occurrence is indeed continuously decreasing particularly in unprotected areas. As consequence, population is declining. Hence, criterion A is applicable. The decline was estimated at ≥ 30 % which allows us to categorize the species as vulnerable VU A2 (a, c). Taking into account EOO, criterion B can be applied. The extent of occurrence is estimated at less than 5,000 km^2. *Albizia amara* can qualify for endangered EN B1 ab(i ,iii). Criteria C, and E were found not applicable due to unavailable data.

Conclusion for *Albizia amara*: EN B1ab (i, iii)

As *Albizia amara* is found in a protected area (ANP), only law enforcement is required. Besides, protection measures such as putting fences and buffering are needed for unprotected areas. Furthermore, more research is needed to confirm the species existence at Umutara and Kayonza in order to enhance its protection.

4.2.4. *Bersama abyssinica subsp. abyssinica* (Rwa: Umukaka, Umuturamugina, Eng: Winged bersama)

Bersama abyssinica belongs to melianthaceae family. *Bersama abyssinica* is a handsome, well–foliaged tree of 7-15 m high. The species is common from East to South Africa, occurring along banks in wooded river valleys, at the edges of evergreen forests, open woodland, highland and lowland forests, at 1140-2550 m (Nduwayezu et al., 2009). It is used in traditional medicine. Leaves are crushed and used as snuff for colds; also chewed as an aphrodisiac; juice from the bark acts as a purgative; extract from young twigs used in the treatment of dysentery and roundworm; a root decoction is taken for epilepsy and for haemorrhoids (Najma Dharani, 2002). It was recorded in NNP and VNP, Gishwati and Busaga forest reserves, at 1800-2500 m. The total rainfall varies between 489-2130 mm. Main threats come from the habitat degradation and overexploitation for medicinal purpose causing population reduction.

The population reduction was estimated at ≥50% fitting with criteria A. This species can then qualify for endangered EN A2 (a, c). Besides, the extent of occurrence is estimated at 1,419 km^2; less than 5, 000 km^2. Taking into account the overexploitation, the illegal activities in its habitat and its extent of occurrence which is less than 5,000 km^2 makes the species to be considered for Endangered ENB1 (i, iii).

Conclusion for *Bersama abyssinica*: EN A2 (a, c), ENB1 (i, iii)

Controlling illegal activities and species exploitation would ensure the survival of *Bersama abyssinica* in the future.

4.2.5. *Caesearia runsorica (*Rwa: Imbayu, Umuhanda, Umuhandagore, Umunyereza)

It belongs to flacourtiaceae Family. *Caesearia runssorica* is a Small or middle-sized tree, rarely up to 40 m. high, bole cylindric, 20–40 (rarely up to 60) cm. in diameter; bark greyish-brownish, slightly rugose, is restricted in montane protected areas especially in NNP and Gishwati forest. Its extent of occurrence is estimated at 1251.7 Km^2 which is less than 5, 000 km^2. The number of sites colonized by the species is less than 5 based on the field observation, interview with local communities and collections stored in various herbaria. Reference made to herbaria collections information, the species was precisely located at Gisovu (Wisumo), Uwinka, and at 17km of Pindura Feeder Street. During our field work, the species has also been noticed at Gishwati. It has gone extinct everywhere outside protected areas. *Casearia runssorica* is also an endemic species of Albertine Rift and can only be encountered inside protected areas as the region is a very highly populated zone. The main threats come from Agriculture that is encroaching on PA and mining activities carried out in Gishwati forest.

Due to fact that it is a restrict species in two locations and its extent of occurrence estimated at less than 5,000 Km^2, *Casearia runssorica* can be assessed using criteria B. Then the species can be considered as endangered (IUCN, 2003).

**Conclusion*, Casearia runssorica* is: EN B1ab (i,iii).

Considering the main threats which are agriculture encroachment and mining activities carried out in Gishwati forest. Controlling these illegal activities can be recommended for the future survival of the species.

4.2.6. *Chassalia subochreata* (Rwa: Ikibonobono, Umumenamabuye, Umusabanyama)

Chassalia subochreata belongs to Rubiaceae Family. It is a shrub or small tree 1.8–9 m tall, with slender branched glabrous stems growing in montane forests form 1650 up to 2550 m of elevation. In Rwanda the species is distributed in many locations like NNP, Busaga and Gishwati. No specific use of the species is known either medicinal or timber but the species is mostly used as fuel wood by local communities. Its extent of occurrence and its area of occupancy are indeed continuously decreasing especially in unprotected areas. Population reduction was estimated at ≥ 30 %; thus qualifying for vulnerable VU A2 (a, c) by using criterion A. Its extent of occurrence is however less that 5,000 km^2 and can therefore be considered as endangered based on Criterion B1 of IUCN version 3.1.

Conclusion for *Chassalia subochreata*: EN B1 ab(i,iii).

4.2.7. *Commiphora africana* (Rwa: Umudahwera, Eng: Eng: African myrrh, Poison-grub commiphora)

Commiphora africana belongs to Burseraceae family. It is a deciduous spiny shrub or small tree 2.5-10 m with thorn-tipped branchlets. It grows in bushland and wooded grassland on rocky sites, clay or sandy soils, at 500-1800 m (Nduwayezu et al., 2009). *Commiphora africana* is over exploited for medicinal purposes. This species has many medicinal properties; especially its resin, bark and fruit. A decoction of boiled roots is taken for swollen testicles and stomach disorders. The bark is also chewed with tobacco and applied to the area of snakebite (Najma Dharani, 2002).

The species was found in ANP, Karama and Kibirizi-Muyira natural forests. In unprotected forests, the main threats were found to be illegal activities such as agriculture encroachment, animal grazing, forests cutting for charcoal, firewood and medicine collection resulting absolutely in the reduction of population. Moreover, for Muyira-Kibirizi in Mayaga, during our field visit we observed that some people around the forests are having arable plots inside this

forest. Population reduction was estimated at ≥ 30 % which leads us to categorize *Commiphora Africana* as vulnerable A2 (a, c).

The extent of occurrence is estimated at less than 5, 000 km^2. Considering habitat threats and extent of occurrence criterion B is applied; *Commiphora Africana* can qualify for Endangered B1ab (i, iii).

Criteria C and D were not evaluated for this species due to the fact that they require the number of mature individuals which is not available.

Conclusion for *Commiphora Africana:* EN B1ab (i, iii).

Protection measures are highly needed especially for Muyira-Kibirizi and Karama forests since they do not have any special protection.

4.2.8. *Dombeya torrida* (Rwa: Umukore, Eng: Forest dombeya)

Dombeya torrida belongs to sterculiaceae family. It is a deciduous tree usually 12-15 m, sometimes up to 25 m with dense crown and trunk reaching 50 cm in diameter. D. torrida is found in secondary or open montane, dry montane and upper montane forests, 1800-2700 m. It is often associated with Hagenia, Cassipourea and Cornus. Bark and roots are used as medicine to treat diseases such as worms. A decoction of the bark is taken for indigestion, especially after a large meal of meat (Najma Dharani, 2002). This species is found in NNP and VNP, Busaga, Gishwati and Cyamudongo natural forest reserves, at 2000-2700 m within the areas receiving the total rainfall ranging between 488- 2130 mm. The population size is not known, although it was thought to be declining because habitat threats, particularly in Gishwati natural reserve. Then, criterion A can be applied. Since the decline was estimated at ≥ 30 %, *Dombeya torrida* can be considered as vulnerable A2 (a, c). The main threats come from agriculture which is encroaching on Parks and illegal mining activities occurring in Gishwati.

Extent of occurrence is estimated at less than 5,000 km^2. Considering the extent of occurrence less than 5,000 and identified threats during our field visit, *Dombeya torrida* can be considered as Endangered B1ab (i,iii)

Conclusion for *Dombeya torrida*: EN B1ab (i, iii).

Controlling illegal mining activities in and around Gishwati forest would ensure the future survival of *Dombeya torrida* in this forest.

4.2.9. *Entandrophragma excelsum* (Rwa: Umuyove, Eng: African mahogany)

Entandrophragma excelsum belongs to Meliaceae family. It is a deciduous tree of 30-50 m tall with clear bole and strongly developed buttresses which extend 4-5 m up the trunk. In Rwanda, this species has been recorded in NNP and in Cyamudongo natural forest reserve, also planted in Ruhande Arboretum, from 1740-1800 m where rainfall ranges between 435-1969 mm. It is used for Timber, firewood, charcoal, ornament, avenue, veneer and shade. The extent of occurrence is estimated at 978.54 km^2 less than 5,000 km^2. This species is overexploited exclusively for timber; some local markets like Gacuriro are still commercializing furniture from E. excelsum.

Based on the extent of occurrence and overexploitation the species qualifies for endangered

Conclusion for *Entandrophragma excelsum:* EN B1ab (i,v).

Trading of timber from this species should be controlled, even prohibited.

4.2.10. *Erica johnstonii*

Like other Ericaceae species, E. johnstonii is very restricted in some habitats that are very threatened by climate change. They have a very narrow ecological range as matter of fact temperature is concerned. Some higher summits and valleys of NNP and VNP are still having some populations of E. johnstonii. Also, the species was recorded in Dutake remnant forest during our field visit. Dutake forest is highly degraded which could result in the loss of this species. The population size is unknown. Its extent of occurrence is estimated at 1170.15 km^2. Considering threats and EEO, *Erica johnstonii* can easily be considered for endangered category.

Conclusion for *Erica johnstonii*: EN, B1 ab (i,iii)

Law enforcement is needed in already protected areas; NNP and VNP while a special protection is recommended for Dutake remnant forest.

4.2.11. *Harungana montana* (Rwa: Umushayishayi)

Harungana montana is member of Clusiaceae Family. Shrub or tree up to 15-20 m tall, much branched, young stems densely covered with rusty stellate or dendrod hairs. It is a local endemic tree to NNP and it is restricted in some small zones of the western part of the forest. It makes stratified vegetation when mature on rocky zones of Karamba, Rwankuba, Uwinka and Gisovu. It is a species well adapted to grow on stressed and even disturbed habitats. It can be easily cohabitate with *Macaranga kilimandscharica* a very known secondary forest species of montane clouds forests. However, considered as single ecological factor, disturbance will only favour the latter because *Harungana montana* is more competitive on both rocky and disturbed areas. That is why the

species is mostly found around camping sites located on mountain summits, burned rocky areas of Karamba and Gisovu and so forth.

As it is difficult to estimate the population size or the area of occupancy of the species, no population declined was mentioned; meaning that criterion A cannot be used. The extent of occurrence can be easily used in this assessment. EOO for *Harungana montana* is estimated to less than 5,000 Km^2 given that the whole NNP is estimated at 970 Km^2. Therefore, it can be considered as endangered species. Moreover, it is known to be used for its timber when it is accessible. It owes its survivorship to the status of NNP as Protected Area otherwise, that species should be already lost forever all over the world.

Conclusion for *Harungana Montana*: EN, B1 b (i, iii)

4.2.12. *Ixora burundiensis* (Rwa: Ikinesha, umuhotora)

Ixora burundiensis is a member of Rubiaceae family. *It* is a shrub or small tree 4.5–16 m high with young branches glabrous and older branches covered with fawn slightly shiny gnarled bark. The species is mainly encountered inside forest ridges and dry woodland between 2100 and2250 m of altitude. Ixora burundiensis is distributed endemic to East Africa especially in Tanzania on the summits of Kungwe mount, in Burundi and Rwanda.

Within Rwanda, the species is occurring in few locations within NNP especially at Banda and Uwinka and some other locations.

It is a species of stressed and undisturbed areas within mountain forests zones of East Africa.

The only criterion applicable to use to assess the conservation status of *Ixora burundiensis* seems to be its extent of occurrence within NNP that is less than 5000 Km^2. Hence, the species can be considered as endangered based on the criterion B1 of IUCN version 3.1.

Conclusion for *Ixora burundiensis*: EN, B1 b(i,ii)

4.2.13. *Kigelia africana* (Rwa: Ikivungavungo, Eng: Sausage tree)

Kigelia africana belongs to Bignoniaceae family. It is a semi-deciduous tree, 5-15 m with a rounded crown. Bark: Grey to grey-brown bark which is smooth at first, then becoming rough and flaking in round patches with age. Fruits: Large grey-green and cylindrical fruits (30-60 cm long) which are often hanging on long stalks. It grows in moist woodland, wooded grassland, forest margins and along rivers and streams, 10-2500 m (Nduwayezu et al, 2009). This species is used in traditional medicine. A decoction from the bark is used as remedy for headaches and dysentery; a leaf decoction is taken for malaria. The dried fruit is powdered and used as a dressing for ulcers and syphilis, and is also applied locally for rheumatism. The fruit is also reported to be purgative (Najma Dharani, 2002). The species was recorded in ANP and Karama forest, from 1350-1500 m where rainfall ranges between 214-1519 mm. The population size is not known. Main threats come from illegal activities in non protected areas (firewood and medicine collection). Which reduce the population but the estimate of the reduction was ≥ 30 % resulting in categorizing *Kigelia Africana* as Vulnerable VU A2 (a, d).

The extent of occurrence is estimated at 1139.6 km^2 which is less than 5,000 km^2. Based on the threats to the habitat, extent of occurrence <5,000 km^2 and the number of sites colonized by the species which is less than 5, the species qualifies for Endangered B1ab (i, iii).

Conclusion for *Kigelia Africana:* EN B1ab (i, iii).

Kigelia africana was recorded in small ecosystem that needs a special protection to ensure the future survival of the species. Fencing and buffer zone creation are recommended.

4.2.14. *Lindackeria kiwuensis* (Rwa: Umunyagasozi, Bwizabwishyamba, Umwicarampundu, ikinesha, umubugidigwa, umunyarubabi, umuronzi)

Belonging to Flacourtiaceae family, *Lindackeria kiwuensis* is a small tree of 5 to 15 m high that occurs in montane forests of Albertine Rift where it is endemic. In Rwanda, the species is restricted within NNP. Based on data collected since 1950, the species was mostly found at Gisakura, Rangiro and Uwinka, Pindura road around Burundi border. Nowadays, the species is restricted in the western part of NNP dominated by primary forest. The extent of occurrence of the species is currently estimated at less than 5,000 Km^2. Threats to *Lindackeria kiwuensis* come mainly from forest cutting for various uses including agriculture purposes.

The species is completely extinct outside NNP due to Incompatible Land Use (ILU) dominated by agriculture systems.

Considering that *Lindackeria kiwuensis* extent of occurrence is less than 5,000 Km2, it can be considered as endangered species.

Conclusion for *Lindackeria kiwuensis:* EN B1 b (i, iii)

Since threats to *Lindackeria kiwuensis* come mainly from forest cutting for various uses, controlling forest cutting in NNP will ensure the future survival of the species as it is restricted to NNP.

4.2.15. *Mimulopsis excellens* (Rwa: Igihwapfu, Impwapfu)

Mimulopsis excellens is a member of Acanthaceae Family. It is strongly aromatic erect or scrambling shrubby herb to (3–5) m tall, sometimes forming large thickets; branches glabrous or laxly tomentose on upper nodes with long curly many-celled hairs to 5 mm long. Its altitude range varies between 1900 up to 3000 m particularly in Rwanda and Burundi. Within NNP, the species is known at Gisovu, Mount Muzimu, Mount Bigugu, Uwinka and on some other high lands of the forest. EOO of the species is less than 5,000 Km^2 and can therefore be considered as

endangered because of the decline of its area of occupancy due to internal vegetation dynamic that allow the colonization of forest as primary succession. In fact, *Mimulopsis excellens* colonises mostly open areas that are thereafter occupied by the next woody succession series. Reference made to the Criterion B of IUCN version 3.1, the species is endangered.

Conclusion for *Mimulopsis excellens:* EN B1 b(i,ii)

Due to the fact that there is a continuous decrease in extent of occurrence and the area of occupancy of *Chassalia subochreata* in unprotected areas, a special protection of those unprotected areas is a priority.

4.2.16. *Miscanthus violaceus*

Miscanthus violaceus is tall herb up to 4 m high that belongs to the family of Poaceae. Its habitat is restricted in peat bogs and can therefore be used as a good indicator of the presence of peat. It is distributed in the large peats of East Africa Mountains in Rwanda, Tanzania, Uganda, Eastern Congo and Burundi. The life of *M. violaceus* is widely dependent to the maintenance of peat bogs with their full ecological functions. The equivalent of *M. violaceus* is the Asian species namely *M. giganteus* that is currently used for biodiesel production.

In Rwanda, the species is only found in the small peats of NNP and at Rugezi Swamp. Outside protected areas, *M. violaceus* has gone extinct. The species is used as local material for fences constructions in rural areas around Rugezi swamp. Despite the minor usage of the species, it is very threatened by peat extraction and wetlands conversion to agriculture.

Based on the fact that the species is only found in two places, it can be ranked in the category of VULNERABLE species. However, when we consider its area of occupancy, the species falls into the category of ENDANGARED species because its total AAO is about 70 km^2 very far under the threshold of 5000 km^2.

Conclusion: EN B 2 (ii,iii,iv)

4.2.17. Newtonia buchananii (Rwa: Umukereko, Eng: Newtonia)

Newtonia buchananii belongs to mimosoideae family. It is a tall deciduous tree, 15-40 m with buttressed trunk and large, flat-topped spreading crown. It grows in lowland and upland rain forests, riverine and swamp forests, from 600- 2400 m (Nduwayezu et al, 2009). *Newtonia buchananii* is used in traditional medicine. A decoction of boiled roots, drunk twice a day, removes intestinal worms (Najma Dharani, 2002). This species was found in NNP, Cyamudongo forest reserve from 1300-2400 m where rainfall varies between 383-1969 mm. It was also recorded in Mashoza natural forest.

Population size is unknown. This very important timber species is becoming rare in its natural habit due to overexploitation (Nduwayezu et al, 2009). Population reduction was estimated at ≥50%. Based on this, the species can be considered as endangered A2 (a, d). Its extent of occurrence is estimated at 1016.2 km^2; less than 5, 000 km^2. Further studies are needed to assess population trend and to establish it in plantations. Based on the extent of occurrence and threats to this species, *Newtonia buchananii* qualifies for EN B1 b (i,iv)

Conclusion for *Newtonia buchananii:* EN A2 (a, d); EN B1b (i, iv).

Newtonia buchananii was recorded in some protected areas of Rwanda (NNP) and unprotected areas such as Mashoza forest. Hence, the protection of those unprotected ecosystems is an urgent priority.

4.2.18. *Ocotea usambarensis* (Rwa: Umutake, Umuganzo, Eng: Camphor)

Ocotea usambarensis belongs to Lauraceae family. It is a large evergreen tree, reaching 40 m with a massive trunk which is slightly fluted at the base.

It is common in the wetter montane and submontane forests, and prefers deep fertile soils with good drainage, from 900-2600 m (Nduwayezu et al., 2009). It is used as medicine (roots and inner bark). In Rwanda, the species has been recorded in NNP at 2430 m where rainfall ranges between 1394-1960 mm. This species is endemic to Albertine lift. The extent of occurrence is estimated at < 5,000 km^2. Due to the fact that the species is restricted to NNP with extent of occurrence estimated at 1010 km^2 which is less than 5,000 km^2, *Ocotea usambarensis* can qualify for Endangered B1ab (i, iii).

Conclusion for *Ocotea usambarensis*: EN B1ab (i, iii).

4.2.19. *Pentadesma reyndersii* (Rwa: Umwasa, urushehe)

It belongs to Clusiaceae Family. *Pentadesma reyndersii* is a tree known to be a local endemic to Rwanda only located in NNP where it makes dense vegetation. It is like present in Kibira forest (Burundi) which is a strait continuation of NNP but no record has been made up to now to confirm its presence. It is also recognized by IUCN as an endangered species.

No specific use has been recorded from surround communities as the species is only present with NNP and hence inaccessible for local communities. However, the species is known to be abundant at Rangiro, Gisakura and Bweyeye. It is a very good characteristic of primary forest and it is totally absent in the eastern portion of the forest. Due to recurrent wild fire from the Eastern portion of the park, *Pentadesma reyndersii* is currently only restricted in the western and southern Part of NNP. It is facing a continuous decline of extent of occurrence resulting in a population decline. The decline was estimated at ≥50%. Further wild fire should completely destroy the species that should be lost forever as it is a local endemic to NNP. Using criterion A, this species qualifies for endangered

EN A2 (a, c). Besides, its extent of occurrence is less than 5,000 Km^2 and hence can be considered as endangered species using the criterion B1 of IUCN, 2003. Criteria C and D were not evaluated due to unavailability of data on number of mature individuals.

Conclusion for *Pentadesma reyndersii*: EN A2 (a, c); EN, B1 b (i,ii)

Controlling wild fire can be suggested in order to avoid a complete destruction of the species that should be lost forever as *Pentadesma reyndersii* is a local endemic to NNP.

4.2.20. *Prunus africana* (Rwa: Umwumba, Eng: Red stinkwood/Bitter almond)

Prunus africana belongs to rosaceae family. It is an evergreen tree, 8-25 m, often with thin drooping branches and small buttresses. It grows in upland rain forest, dry montane and riverine forests or on termite mounds from 800-3000 m (Nduwayezu et al, 2009). This species is overexploited for medicinal purposes. Bark infusion serves as a purgative, and features in treatment of prostate problems; the bark is also pounded, water added and the red liquid drunk as remedy for stomachache; a leaf infusion is taken to improve appetite (Najma Dharani, 2002). Moreover, the plant is used in veterinary medicine. The species was recorded in NNP, Cyamudongo and Mukura natural forest reserves; at 2000-2300 m. Rainfall in these areas varies between 489-2008 mm. There is a population declining particularly in Mukura natural forest which is facing threats (mining activities inside and around the forest), the forest is seriously degraded. Besides, the overexploitation is a serious threat. It have been said that the bark is being sold in Europe and United States of America (USA) due to its medicinal properties. The decline was estimated at ≥ 50 %. Therefore, *Prunus africana* can be considered for endangered A2 (a,d).

The extent of occurrence is estimated at 1026 km^2 which is less than 5,000 km^2. This species qualifies for Endangered B1ab (i, iii, v)

Conclusion for *Prunus africana:* EN A2 (a, d); EN B1b (i, iii,v)

A particular attention should be paid to those ecosystems facing illegal activities like Mukura.

4.2.21. *Sterculia tragacantha* (Rundi: Igikungwe, Eng: African tragacantha)

Sterculia tragacantha belongs to sterculiaceae family. It is a massive deciduous tree of 15-24 m high with long cylindrical or buttressed bole and a rounded crown. It grows in swamp, riverine and gallery forests and occasionally in dry mixed forest or on lakeshores, at 750-1700 m (Nduwayezu et al, 2009). This species has been recorded in near the Mashyuza hot springs and is reported to be found at Gahini (near Lake Muhazi), from 1000- 1450 m. The rainfall in these areas ranges between 522-1633 mm. An extent of occurrence is estimated at less than 5,000 km^2. The species does not occur in any protected area of Rwanda. Efforts should be made to propagate and plant this species in other suitable places in order to maintain its existence. Due to the fact that *Sterculia tragacantha* is restricted in only two areas and unprotected ones, it makes it endangered and can qualify for Endangered B1ab (i, iv).

Conclusion for *Sterculia tragacantha:* EN B1ab (i, iv).

4.2.22. *Strombozia scheffleri* (Rwa: Umushyika, Eng: Strombosia)

It belongs to Olacaceae family. *Strombosia scheffleri* is a straight evergreen tree to 30 m high with a fluted trunk, dense crown and drooping branches. In Rwanda, this species is found in NNP and Mukura natural forest reserves, at 1400-2000 m where rainfall ranges between 489-2130 mm. Used for Timber (construction, interior works), firewood, charcoal, furniture, utensils (mortars), shade (banana, coffee and cacao) and food (fruits**).** The extent of occurrence is estimated at 1036 km^2 less than 5,000 km^2. The fact that Mukura natural reserve is facing illegal mining activities, the species is threatened by habitat degradation. Based on threats and the extent of occurrence, criterion B1 can be applied. Thus, the species qualifies for Endangered. A particular attention is recommended especially for Mukura natural reserve.

Conclusion for *Strombozia scheffleri:* EN B1ab (i,iii).

4.2.23. *Symphonia globulifera* (Rwa: Umushishi, Eng: Symphonia, Boarwood).

It belongs to Clusiaceae family. Symphonia globulifera is a straight evergreen tree, 15-40 m high with whorled branches and drooping branchlets. Red flowers which are borne in clusters of 6-8 heads from terminal cymes on short lateral branches. In Rwanda, this species has been recorded in NNP and Gishwati, from 1600-2400 m where rainfall ranges between 489-1969 mm. It is used for Timber (construction, interior work), firewood, charcoal, veneer, plywood, wooden spoons, tool handles, building poles, medicine (root and stem bark), shade, ornament, soil and water conservation, resin, dye and bee forage.

The extent of occurrence is estimated at 1257 km^2 which is less than 5,000 km^2. Its threats come mainly from habitat degradation; specifically Gishwati natural reserve facing illegal mining activities.

Considering the extent of occurrence and threats to the species, it can qualify for endangered.

Conclusion for *Symphonia globulifera:* EN B1ab (i,iii).

Controlling illegal activities particularly in Gishwati natural reserve is a priority.

4.2.24. *Tabernaemontana odoratissima*

Belonging to Apocynaceae Family, *Tabernaemontana odoratissima* is a small tree 5–15 m high with branches pale to dark brown. In Rwanda, the species grows around wet areas of NNP and is restricted in the western zone. Up to now, the species is only known into one location. It does not have a clear name in Kinyarwanda as it is most of the time confused with *Tabernaemontana johnstonii* (Umuronzi). Due to its particular odour, the research team has agreed to give to *Tabernaemontana odoratissima* the local name of "*umuhumuranabi"* to differentiate it from other *Tabernaemontana*.

It has no known specific use by local population but can be threatened by all kinds of threats against the western NNP part like agriculture encroachment, medicinal plants collection, and

collateral effects having a link to mining, poaching, bee keeping and so forth. Most the species of the same Genus are known to contain alkaloids that are valorised for medicinal uses. More investigations about medicinal properties of that species are needed to confirm or reject its medicinal importance.

However, due to the fact that the species is restricted in only one area of less than 5, 000 km^2, it makes it to be considered as endangered species when considering the criteria C of IUCN, 2003.

Conclusion for *Tabernaemontana odoratissima:* EN B1 ab(i, iii)

As *Tabernaemontana odoratissima* can be threatened by all kinds of threats against the western NNP part such as agriculture encroachment, medicinal plants collection, and collateral effects having a link to mining, poaching, bee keeping as well, there is a clear need to control these illegal activities in the Western NNP.

4.2.25. *Zanthoxylum chalybeum* (Rwa: Intareyirungu, Eng: Knobwood)

Zanthoxylum chalybeum belongs to Rutaceae family. It is a spiny deciduous shrub or tree, 2-10 m high with open and rounded crown. It grows in semi-evergreen or dry bushland, wooded grassland and in dry forest, often on rocky sites, from 1-1800 m (Nduwayezu et al, 2009). During our field work, this species was only recorded in ANP. The species has been overexploited in Rwanda for its medicinal properties. The leaves bark and roots are used as medicine and the bark extracts are said to cure malaria (pers.com.). The later causing population decline and this was estimated at ≥30 %. So, Criterion A can fit and this species qualify for vulnerable VU A2 (a, d).

However, the extent of occurrence is estimated at 1121.85 Km^2; less than 5,000 km^2. Based on the extent of occurrence and the current threats, criterion B can be applied. Then, Zanthoxylum *chalybeum* qualifies for Endangered B1ab (i, iv).

Conclusion for Zanthoxylum *chalybeum:* EN B1ab (i, iv)

Zanthoxylum chalybeum was recorded in only ANP. Since ANP is an already protected area, law enforcement is imperative to the survival of the species.

4.3. Vulnerable plant species

4.3.1. *Aframomum wuerthii*

A. wuerthii belongs to the family of Zingiberaceae. It is a perennial herb with leafy shoots well separated, 90 to 200 cm tall.

The species grows at the edge of a swamp forest with *Anthocleista grandiflora*, *Syzygium guineense* ssp. *parvifolium* and *Carapa grandiflora*. It is only known from a small population in Kamiranzovu swamp. It can therefore be considered as local endemic. Its life strictly depends on its habitat. Like other *Aframomum*, it may also be used as medicinal or cosmetic plant. Its fruits are usually eaten by monkeys.

Major threats come from the fact that the species is restricted in a very small population in Rwanda especially at the edge of Kamiranzovu swamp.

The most destructive threats should also come from the medicinal potential of *Aframomum* species. There are some fifty species of *Aframomum* in Africa and many species are widely used for medicinal, ethno dietary and spiritual purposes. They are very active as antifungal, cytotoxic, antibacterial, insect antifeedant, antiplasmodial, antihypercholesterolemic and antiviral (Tane, P. Et al., 2011)i.

Based on those threats and on the criterion D of IUCN version 3.1., the species is proposed to be part of the category of vulnerable species because it is restricted in only one location and its AOO is less than 2000 km2. This category is temporary because, the number of mature individuals in not yet known. With further investigations, the species can be lifted up in the categories “EN” or “CR”.

Conclusion: VU D2

4.3.2. *Dosternia nyungwensis*

D. nyungwensis belongs to the family of Moraceae and it is a very particular species based on its morphology. It is an herb up to 80 cm tall, stems ascending, woody at base, densely pubescent. Several species of *Dorstenia* are valued in Africa, Central America, and South America for their anti-infection, anti-rheumatic, and febrifugal properties. A decoction from the leaves of the *D. psilurus* is used to treat cough, headache, and stomach pain in Cameroon. In Panama and Mexico, *D. contrajerva* leaves are used to fight against fever and snake venom. Aside from their medicinal uses, *Dorstenia* plants are also used in the preparation of food such as in the case of *D. foetida*, where the tubers are cooked and eaten in Oman, and *D. psilurus*, whose rhizomes are used as spices for the preparation of *na'a poh* in Cameroon.

In Rwanda, *Dorstenia* is a very rare genus that has not yet been domesticated. More investigations are still needed to confirm its medicinal properties. Furthermore, *Dorstenia nyungwensis* is restricted in NNP around Kamiranzovu peat bog and Karamba. This should explain at some extent why it is not known by local communities for any medicinal activity.

Based on the fact that it is a very restricted species in two locations with NNP and considering that the species may have some medicinal properties, the criterion D of IUCN version 3.1. can therefore be applied and the species should be put in the category of VULNERABLE species.

Conclusion: VU D2

4.3.3. Lobelia petiolata

Lobelia petiolata belongs to lobeliaceae family. It is an endemic species only known in NNP (Rwanda) and Kahuzi Biega (DRC) forests. Within NNP, *L. petiolata* is only known in Eastern part of the forest namely at Uwasenkoko and at Bigugu mountain. Outside the forest, the species is absent. With reference to IUCN redlist assessment version 3.1., the criterion D2 can be applied and put the species in the category of Vulnerable species because it is found in small populations into less than five locations.

Conclusion for *Lobelia petiolata*: VU D2

4.3.4. *Myrianthus holstii* (Rwa: Umwufe, Eng: Giant yellow mulberry)

Myrianthus holstii belongs to Cecropiaceae family. Myrianthus holstii is a deciduous tree, 5-20 m with a short trunk, stilt roots and large branches. In Rwanda, this species is found in montane forest particularly on forest edges and watercourses in NNP, Busaga and Gishwati forest reserves, from 2000-2300 m. The rainfall in these areas ranges between 489-1969 mm. It is used for food (fruit), firewood, charcoal, soil conservation, soil improvement, fodder (leaves) and windbreak. This is an indigenous fruit tree that is domesticated in some areas because of its nutritional values. It is restricted species to uplands. Reference made to the criterion D of IUCN version 3.1., *Myrianthus holstii* can easily be considered as Vulnerable as it is only known in less than 5 locations.

Conclusion for *Myrianthus holstii: VU D2*

4.3.5. *Oxyanthus troupinii* (Rwa: Ingongo, Umugendajoro, Umuyebe, Umutovu)

It is a member of Rubiaceae Family. *Oxyanthus troupinii* is a species distributed in Western Uganda, Eastern Congo, Western Rwanda and Burundi particularly in mountain forests of NNP and Kibira. In NNP, the species is widely distributed from East to West and from South to North and make abundant populations mainly in Primary forests of Banda, Uwinka, Kamiranzovu, Rangiro and Gisakura.

The species is completely extinct outside protected areas due to land use for agriculture purposes. It is also known in various remnant mountain forests outside NNP especially at Gishwati and the like. EOO and AOO are constantly declining due to agriculture pressure on remnant forests. It is difficult to estimate the size of its population but the population decline was estimated at ≥30 %. Therefore the criterion A can be applied. From this, *Oxyanthus troupinii* can qualify for vulnerable VU A2 (c). However, the estimate of its extent of occurrence is less than 20,000Km^2. Beside that the species is endemic to Albertine Rift; it is also threatened in Rwanda due to agriculture and fire wood pressures. It can be considered as vulnerable species.

Conclusion for *Oxyanthus troupinii*: VU A2 (c); VU B1 b(i,ii).

Based on identified threats on the field, agriculture and fire wood pressures as well as other illegal activities occurring in Gishwati such as mining; all these should be controlled.

4.3.6. *Vaccinium stanleyi*

Vaccinium stanleyi belongs to the Familiy of Ericaceae. It is shrub of less than 4m high in most of the cases. It produces blue to black delicious berries eaten by both humans and monkeys. The habitat of V. Stanleyi is the same as most of other Ericaceous species growing on rocky slopes or in swamps, 2000-2950 m. In Rwanda the species is found at Kamiranzovu on summit of Mt. Bigugu and at Uwasenkoko in NNP. It is also found in the VNP. Outside Rwanda, the species is endemic to Albertine Rift in the Mountains of Eastern Congo, Burundi and Western Uganda. *V. stanleyi* species is the only representative of

the more temperate blueberries in tropical Africa. Blueberries are of special interest in the functional/medicinal food category due to the high levels of anthocyanin and polyphenolic antioxidant compounds they contain. Blueberries have a higher antioxidant capacity (in some cases as high as 40-50 mmoles TE/g) than other healthy fruits and vegetables[ii]. *Vaccinium* species are also reputed to be very efficient against scurvy since its berries are very high in vitamin C. Blueberries also acquired a folk reputation as a treatment for urinary tract problems, and this application has also been validated. Blueberries are strong diuretic (promoting urination), and the juice is often prescribed as dietary treatment for urinary tract infections, kidney disorders and other conditions where the passing of fluids is desirable.

Assessing the species against IUCN criteria, its Area of occupancy has been drastically reduced as such extent that the species is currently restricted in uplands protected areas in NNP and VNP. It can therefore be put in the category of **Vulnerable** species based on the criteria D.

Conclusion: VU D2

Table 3: Summary of plant species assessment

Scientific name	Kinyarwanda name	English name	French name	Status	Criteri(on)a determining overall status
1. *Blighia unijugata*	Umuturamugina	Triangle tops		Critically Endangered	CR B1 ab(i, iii)
2. *Lobelia mildbraedii*				Critically Endangered	CR B2 b (ii,iii, iv)
3. *Nymphaea thermarum*	Imposha	Lily plant		Critically Endangered	CR B1ab(i,iii)
4. *Osyris lanceolata*	Umusheshe	African sandalwood		Critically Endangered	CR A2 (a, d)
5. *Pterygota mildbraedii*	Umuguruka	Mubende witch tree		Critically Endangered	CR B1ab (i , iii)
6. *Vernonia auriculifera*	Igaragara			Critically Endangered	CR A2 (a, c)
7. *Xyris vallida*				Critically Endangered	CR B2 b (ii,iii, iv)
8. *Acacia kirkii*	Umunyaryera	Kirk's acacia		Endangered	EN B1ab (i, iii)
9. *Afrocanthium lactescens*	Umukondokondo	Afrocanthium		Endangered	EN B1ab (i, iii)
10. *Albizia amara*	Umunaniranzovu	Bitter albizia		Endangered	EN B1ab (i, iii)
11. *Bersama abyssinica*	Umukaka	Winged bersama		Endangered	EN A2 (a, c); ENB1 (i, iii)
12. *Casearia runsorica*	Imbayu			Endangered	EN B1ab (i, iii)
13. *Chassalia subochreata*	Ikibonobono			Endangered	EN B1 ab(i,iii)
14. *Commiphora africana*	Umudahwera	African myrrh		Endangered	EN B1ab (i, iii)
15. *Dombeya torrida*	Umukore	Forest dombeya		Endangered	EN B1ab (i, iii)
16. *Entandrophragma excelsum*	Umuyove	African mahogany		Endangered	EN B1ab (i, v)
17. *Erica johnstonii*				Endangered	EN B1ab (i,iii)
18. *Harungana Montana*	Umushayishayi			Endangered	EN B1ab (i,iii)

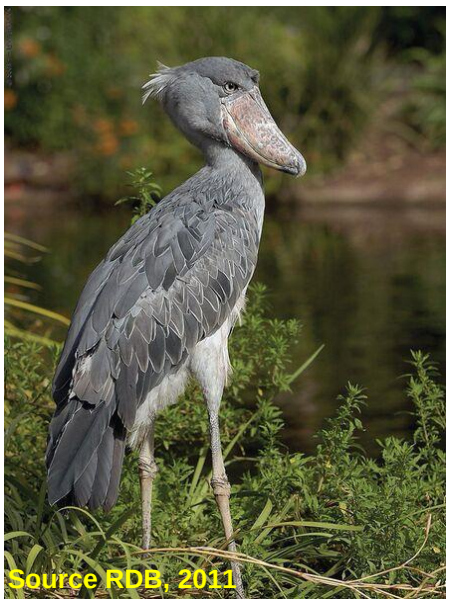
19. Ixora burundiensis	Ikinesha, umuhotora			Endangered	EN, B1 b(i,ii)
20. Kigelia africana	Ikivungavungo	Sausage tree	Arbre de saucisse	Endangered	EN B1ab (i, iii)
21. Lindackeria kiwuensis	Umunyagasozi,			Endangered	EN B1 b (i, iii)
22. Mimulopsis excellens	Igihwapfu,Impwapfu			Endangered	EN B1 b(i,ii)
23. Miscanthus violaceus				Endangered	EN B2 (ii,iii,iv)
24. Newtonia buchananii	Umukereko	Newtonia		Endangered	EN A2 (a, d); EN B1b (i, iv)
25. Ocotea usambarensis	Umutake, Umuganzo	Camphor	Camphrier d'Afrique	Endangered	EN B1ab (i, iii)
26. Pentadesma reyndersii	Umwasa, urushehe			Endangered	EN A2 (a, c); EN, B1 b (i, ii)
27. Prunus africana	Umwumba	Red stinkwood		Endangered	EN A2 (a, d); EN B1b (i, iii,v)
28. Sterculia tragacantha	Rundi: Igikungwe	African tragacantha		Endangered	EN B1ab (i, iv)
29. Strombozia scheffleri	Umushyika	Strombosia		Endangered	EN B1ab (i, iii)
30. Symphonia globulifera	Umushishi	Symphonia, Boarwood	Arquane	Endangered	EN B1ab (i,iii)
31. Tabernaemontana odoratissima				Endangered	EN B1 ab(i, iii)
32. Zanthoxylum chalybeum	Intareyirungu	Knobwood		Endangered	EN B1ab (i, iv)
33. Aframomum wuerthii				Vulnerable	VU D2
34. Dosternia nyungwensis				Vulnerable	VU D2
35. Lobelia petiolata				Vulnerable	VU D2
36. Myrianthus holstii	Umwufe	Giant yellow mulberry		Vulnerable	VU D2
37. *Oxyanthus troupinii*	Ingongo,			Vulnerable	VU A2 (c); VU B1 b(i,ii)
38. Vaccinium stanleyi				Vulnerable	VU D2

CHAPTER 5. TERRESTRIAL THREATENED BIRD SPECIES

In Rwanda, the avifauna is very rich and includes around 530 species, and two third of them inhabit the wetlands, mainly the Akagera Wetland Complex (Kanyamibwa *in* EXPERCO 2003). Many native species are listed on different conventions' lists as protected bird species (Appendix 5). Locally though, many of the species lack enough data for their assessment. Distribution maps for each species are provided in appendix 3.

5.1. Critically Endangered bird species

5.1.1. *Balaeniceps rex,* Gould *(*Rwa: Munwarukweto, Eng: Shoebill, Fr: Bec à Sabot)


Source RDB, 2011

Shoebill is large grey, stork-like waterbird with a fantastically unique bill. Is found in extensive papyrus grass and reed swamps and seasonally flooded marshes with floating vegetation, preferring those formed by papyrus (Wildscreen Archive, 2015) where it hunts solitarily along channels or small patches of open water (Vande weghe, J.P. & G. Vande weghe, 2011). Singles and pairs are confined to the interior of permanent and undisturbed swamps (Stevenson, T. and Fanshawe, J., 2002). It inhabits mainly extensive floating marshes and edges of tall reed beds or papyrus.

There is no enough information about the past of the population but according to the guides of ANP, the current population is suspected to be 5 individuals. Under the criterion A, this species is classified as Critically Endangered (A1ac). The population of Shoebill is very small with all mature individuals in a small area of the ANP. It occurs in a very small area in the middle Akagera basin, with an area of occupancy less than 500km2.The species is classified as Endangered under criteria (B2a). The whole population of all mature individuals is in one subpopulation. Under the criterion C, the species is classified as Critically Endangered (C2ai). The remaining population is very small and restricted in one ecosystem with the number of mature individuals less than 50 individuals. Under criterion D, the species is classified as Critically Endangered (D).

Overall, Shoebill is classified as **Critically Endangered** in Rwanda under criteria **B2aC2aiD.**

The population of Shoebill is confined in ANP with dubious information that the species makes a short migration to Tanzania. The park is well protected but the ecological status and local movement have to be monitored.

5.1.2. *Balearica regulorum,* Bennett, *(*Rwa: Umusambi, Engl: Grey Crowned Crane, Fr: Grue royale*)*

Grey Crowned Crane is predominantly grey plumage contrasts sharply with black and white wings, a crest of golden feathers sitting on top of the head, and a bright red gular pouch that hangs from the throat. The head is black with large white cheek patches, while the neck is pale grey. Males tend to be marginally larger than females but are otherwise indistinguishable. Juvenile Grey Crowned Cranes have a brownish plumage, with a darker crown and nape, while the face may be feathered and buffish.

The population of Grey Crowned Crane remains rich in the north-west around Lakes of Karago, Burera, Lake Kivu, Ruhondo, Kamiranzovu, Lake Kivu, ANP, and Rugezi swamp. The small population is also found in small patches of swamps, inundated grassland, lake and swamp edges, wet grasslands, wet valley bottoms and floodplains, moister agricultural lands throughout the country. The population of Grey Crowned Crane was very common throughout the country in the early 20th century when at least a pair was standing on each field. Flocks of over 300 birds were observed at a roost in the Nyabarongo valley near Kigali in the late 1960s and congregations of over one hundred birds used to be not rare in some areas (Vande weghe, J.P. & G. Vande weghe, 2011). Currently the population has disappeared from many sites in the country. The current population is estimated at 300-500 individuals (Morrison, K., and Baker, N., 2012) with the 108 individuals estimated in Rugezi Marsh in 2010 (Nsabagasani, C., 2010). Our recent big group record of 21 individual was in the Northern part of Rugezi (Butaro) in March 2015.

The decline of the Grey Crowned Crane in Rwanda is attributed primarily to the loss of wetlands and the capture of fledglings for the pet market, both of which results in reduced breeding success and decline of the mature individuals. Wetlands i.e. Cyunuzi, Akanyaru, Nyabarongo and small bogs were suitable habitat to this species but with the increase of human

demography, these wetlands are now transformed into farmlands. More recently, some adult birds were hunted and eggs were taken for food and the population is kept as pets in hotels and households which resulted in a high decline of the population. Today, chicks of Grey Crowned Crane are reared in households waiting to be eaten or sold to hotels around the country.

Over the past period the population of Grey Crowned Crane has declined and the causes of the reduction are not reversible and it may continue with the current over use of wetland. Under Criterion A, this species is classified as Critically Endangered (A1acd).

The Grey Crowned Crane is confined in many severely fragmented habitats and continues declining with extent of occurrence limited at less than 5,000Km2. Under the criterion B, the Grey Crowned Crane is classified as Endangered under criteria B1abciii.

The population of Grey Crowned Crane is very small with mature individuals less than 2,500. Under criterion C, the species is classified as Vulnerable under criteria C2ai.

The remaining population of Grey Crowned Crane is estimated to be around 500 and under Criterion D, the species is classified as Vulnerable (D1).

Overall, Grey Crowned Crane is classified as **Critically Endangered** in Rwanda under criteria **A1acd B1abc C2ai D1.**

The remaining population of Grey Crowned Crane is distributed in different localities including national parks and non-protected wetlands. The peat-lands that are not protected in Rwanda are under consideration, and the country's Peat Master Plan outlines its desire to generate 200 MW of power by 2017; if not well managed this may affect the remaining population of Grey Crowned Crane and other wetland dependent species. The rehabilitation of the confiscated population was initiated and must be supported and the remaining wetlands out of National parks have to be maintained.

5.1.3. *Bucorvus leadbeateri*, Vigors (Rwa: Ikigungumuka, Eng: Southern Ground-hornbill, Fr: Calao Terrestre du Sud)

Southern Ground-hornbill is a bird species of the Family of Bucerotidae. The southern ground-hornbill is the largest hornbill in the world and features a striking red facial and throat skin that contrasts with its black plumage. The bill of the southern ground-hornbill is long, thick and downward-curving, with a small casque on the

top. The eyes of this species are pale yellow, and its legs are black and quite robust.

The species inhabits open savannah areas, grassland or pasture and lightly cultivated areas. These birds are found in open woodlands and savannas, as well as nearby grasslands and scrublands, pastures and agricultural land. It is an omnivorous ground feeder, taking large insects, rodents, young ground bird, lizard all kind of rubbish and some crops (Maize and sweet potatoes). Until the late 1960s, wandering birds were reported from several localities in the Mayaga and Bugesera, but in more recent times the species was not recorded outside the Umutara region. ANP, Mutumba and the Akagera valley close to the Rusumo falls. In the first half of the 20th century it has been also reported from Rubavu at the Northern end of Lake Kivu (Vande weghe, J.P. & G. Vande weghe, 2011). However, the species is currently solely reported in ANP. The population was highly reduced and under criterion A this species is classified under A1ac (Critically Endangered). The species is confined in one locality (ANP) with extent of occurrence limited at 1,200Km^2. Under the criterion B, the Southern Ground Hornbill is classified as Endangered under criteria B1abiii. The population of Southern Ground Hornbill is very small subpopulations and all mature individuals are in one subpopulation. According to the park guide and park managers, the population is estimated between 10-15 mature individuals. Under the criterion C, the species is classified as Critically Endangered (C2ai). The remaining population is very small and restricted in one ecosystem with number of mature individuals less than 50 individuals. Under Criterion D, the species is classified as Critically Endangered (D).

Overall, Southern Ground Hornbill is classified as **Critically Endangered** in Rwanda under criteria **A1acB1abiii and iv) C2ai D.**

The remaining population of Southern-ground Hornbill is confined in ANP, a well protected site, with a suspect that it makes local or regional movement. The long-term monitoring of the ecological factors i.e. population size and trends, distribution and preferred habitat and movement will direct the decision-making on the development of the effective conservation strategies.

5.1.4. *Microparra capensis,* Linnaeus (Eng: Lesser Jacana, Fr: Jacana Nain)

The Lesser Jacana is a species of the Jacanidae family; with the primary habitats being coastal and inland wetlands and waterways.

The species was presumed to be extinct in Rwanda until recently when it was recorded in Bugesera and Rugezi wetlands. The species was formerly common in the 1940 and 1950s. It was probably affected by the large scale eutrophication of the most lakes and the subsequent of the floating vegetation of the lakes. The population has reduced in the past and some of the main causes of decline are ongoing. However, there was no estimate of the population and the rate of declining is not known.

The species was recorded only at Kamatana valley, Murago wetland and southern part of Rugezi Marsh and the total of these sites are less than 10km2. The species is classified as **Critically Endangered under criterion B (B2ii).**

At all sites where the Lesser Jacana was sighted, only few individuals were recorded: 4 in Rugezi, 4 at Kamatana and 2 at Murago. Under the criterion C, Lesser Jacana is classsified as Critically Endangered (C2ai).

The population of Lesser Jacana is very small and restricted to shrinking floating lakes with a population less than 50 individuals. Under criterion D, the species is classified as Critically Endangered. Overall, the Lesser Jacana is classified as **Critically Endangered** in Rwanda (**B2iiC2aiD**).

The population of Lesser Jacana remains in floating small and artificial lakes of Kamatana, Rugezi and Murago wetlands. Some individuals have also sigheted in Masaka region. The sites are exposed to human activities and they don't have any particular protection. The main factor in their decline is the loss of clean water in lakes. Sedimentation from soil erosion causes the loss of lily pads and lotus flowers. This species needs those. Since most lakes in their main habitats are sedimented their potential range is dreamatically reduced. The conservation effort of the mentioned sites is highly required to save the remaining population of Lesser Jacana in Rwanda.

5.1.5. *Netta erythrophthalma*, Wied-Neuwied (Eng: Southern Pochard, Fr: Nette brune)

Southern Pochard is a bird species of the Anatidae family. It inhabits the large bodies of rather deep, permanent or temporary, standing waters (including sewage ponds) and lakes with clear water and abundant underwater vegetation. The species feed chiefly seeds but also roots and vegetative parts of aquatic plants including water lilies, bladderwort, duckweeds, bulrushes, rice (Carboneras, C. & Kirwan, G.M. 2014). The population of Southern Pochard was never estimated in Rwanda but it has highly declined and is currently very uncommon. Until the early 1980s, it was at some moments of the year the most abundant duck on lakes Karago, Nyirakigugu and Bihinga with a total population of a few hundred birds. Until the early 1990s it was widespread and abundant in this area. Until the early 1960s is was also fairly common on all open waters of the Akanyaru and Nyabarongo valleys, and on the lakes of central Rwanda. However, on 13 October 2010 only six birds were seen on Lake Karago (Vande weghe, J.P. & G. Vande weghe, 2011). Under the Criterion A, the species is classified as Critically Endangered (A1a).

The population of this species has disappeared and the only surviving populations are found on the lakes in the Northwest of the country and some reservoirs and these are with an area of occupancy less than 10km2. Under the criteria B, the species is classified as Critically Endangered (B2ii). The current population of Southern Pochard is restricted to Lake Karago and only 6 pairs were sighted and all mature individuals are in one subpopulation. Under the criterion C, this species is classified as Critically Endangered (C2aii).

Overall, the Southern Pochard is classified as Critically Endangered in Rwanda **(A1aB2iiC2aiiD)**

The population of Southern Pochard is very small and restricted in one area while the other sites were reduced with the expanding agriculture and the subsequent increasing soil erosion, the water of these lakes became heavily loaded with fine sediments. Fortunately the lakes Nyirakigugu, Karago and Bihinga became recently protected. The study on the species' ecology, population and factors of distribution as can improve the conservation of remaining population of Southern Pochard in Rwanda.

5.1.6. *Polemaetus bellicosus,* Daudin (Eng: Martial Eagle, Fr: Aigle Martial)

The Martial Eagle is a very large eagle in the family of Accipitraidae. The species is with an average length of 78–96 cm and is restricted by its very short tail. The adult's plumage consists of dark grey-brown coloration on the upperparts, head and upper chest, with slightly lighter edging to these feathers. The immature is paler above, often whitish on the head and chest, and has less spotted underparts. It reaches adult plumage in its seventh year. Martial eagles have a short erectile crest, which is often not prominent. The legs are feathered to the heavy, powerful feet.


Source RDB, 2011

The population of this species has never been estimated in Rwanda, but until at least 1960s it used to occur throughout the eastern savannas and the central plateau but has highly reduced with the loss of the suitable habitat. Under the criterion A, Martial eagle is classified as **Critically Endangered (A2ac).**

In Rwanda, the species is fairly common breeding resident. It is mainly restricted to ANP, where in the late 1980s the estimated at 6 pairs local population was monitored. One pair also inhabited Volcanoes NP and in 2010 the species was seen in Gishwati Forest (Vande weghe, J.P. & G. Vande weghe, 2011) and an individual was sighted in Buhanga Eco-park in 2007. The range of this species is eastern region, central plateau and high land mountain but the quality of habitat is deteriorated. Under the criterion B, the species is classified as **Vulnerable (B2iiiii)**

The current number of mature individuals of Martial Eagle is too small throughput its range. Under the criterion C, the species is classified as **Critically Endangered (C1ai).** In Rwanda, the population of Martial Eagle is very small and the total population must be less than 50 individual. Under the criterion D, Martial Eagle is classified as **Critically endangered (D)**

Overall, the Martial Eagle is classified as **Critically Endangered** in Rwanda (**A2acB2iiiiiC1ai D).** The population of Martial Eagle is very small and has highly reduced due to the deterioration of its preferred habitat. The ANP and the mountain forests are well maintained as National parks or forests reserves. The long-term monitoring of the population size and distribution will contribute to the effective conservation of the remaining population.

5.1.7. *Psittacus erithacus,* Linnaeus (Rwa: Kasuku, Engl: Grey Parrot, Fr: Perroquet gris)

Grey Parrot is a bird species in the Family of Psittacidae. It has the pale grey plumage, with whitish edges to the feathers on the head and neck, which give a lacy or 'scalloped' appearance. The flight feathers are darker grey, the rump pale and the short tail a striking red. The beak is black, and on the face a large area of bare white skin surrounds the pale yellow eye. The species is famous for its intelligence and ability to mimic human speech, making it one of the most popular of all avian pets. It habits suitable forest from 700-2300m and it is more easily seen in open stands and forest edges, but it also occurs in extensive blocks of dense forest, where it often perches on dead branches of tall emergent trees. It also visits isolated, relict trees in cultivated land, where its nest has been found. This species occurs mainly in pairs, but until the late 1950's flocks of over 30 birds were recorded at evening flights in the area of Ntendezi (Vande weghe, J.P. & G. Vande weghe, 2011). The species suffers the habitat loss and poaching to be used as pet. The population was reduced and species disappeared in sites other than NNP where it is also reported as a rare species. Under the criterion A, this species is classified under A1ac (Critically Endangered).

The species is currently scarce breeding resident, known from the western and northern parts of the Nyungwe forest but at the beginning of the 20th century it was reported from forested islands in Lake Kivu (Iwawa). Now, the species is confined in one locality (NNP) with extent of occurrence limited at 1010.1Km2. Under the criterion B, the Grey Parrot is classified as Endangered under criteria B1abiv.

The population of Grey Parrot is very small but the species was never evaluated.

The remaining population is restricted in one ecosystem all mature individuals are in one subpopulation. Under Criterion D, the species is classified as Critically Endangered (D).

Overall, Grey Parrot is classified as **Critically Endangered** in Rwanda under criteria **A1acB1abivD.**

The population of Grey Parrot has reduced due to local and international trading and they are used as pets in Kigali and other small towns in Rwanda. The population kept in households must to be assessed and rehabilitated in the wild.

5.1.8. *Terathopius Ecaudatus,* Daudin (Eng: Bateleur, Fr: Aigle Bateleur)

The Bateleur Eagle is a medium-sized eagle in the family Accipitridae endemic to Africa and small parts of Arabia. The species is a colourful with a very short tail which, together with its white underwing coverts, makes it unmistakable in flight. The Bateleur is sexually dimorphic; both adults have black plumage, a chestnut mantle and tail, grey shoulders, tawny wing coverts, and red facial skin, bill and legs. The female additionally has tawny secondary wing feathers. Less commonly, the mantle may be white. In ANP, the breeding population could be estimated at 20-25 pairs in 1980 (Vande weghe, J.P. & G. Vande weghe, 2011).

Source: RDB, 2011

Currently the population has declined throughout the country mainly due to continuing habitat loss. There is a suspect of poisoning around ANP which alertly reduced the population of Raptors in Rwanda, including Bateleur. Under the criterion A, the species is classified as **Critically Endangered (A2ac).**

Bateleur is a common breeding resident: it can be encountered throughout the country but more abundant over the eastern savannas, especially the Umutara region and the ANP. It can also be seen in the Congo Nile divide or in volcano range (was recorded around Buhanga Eco-park). The suitable habitat of the place is less than 2,000km2 but the quality of habitat is deteriorated. Under the criterion B, the species is classified as **Vulnerable (B2iiiii)**

The current number of mature individuals is too small (less than 10 individuals according to some local birders). Under the criterion C, the species is classified as **Critically endangered (C1ai)**

In Rwanda, the population of Bateleur is very small and the total population must be less than 50 individual. Under the criterion D, the species is classified as **Critically endangered (D)**

Overall, the Bateleur is classified as **Critically Endangered** in Rwanda (**A2acB2iiiiC1ai D).** The population of Bateleur has highly reduced and the main reasons of declining being habitat loss involving food scarcity. The study on the population and distribution as well as maintaining the current size of the remaining forests will contribute to the effective conservation of the remaining population of Bateleur in Rwanda.

5.1.9. *Thalassornis leuconotus,* Eyton (Eng: White-backed Duck, Fr: Canard à dos blanc)


Source: RDB, 2011

The White-backed duck is a waterbird of the family Anatidae well adapted for diving. On occasions they have been observed to stay under water for up to half a minute. They search especially for the bulbs of water lilies.

Until the early 1970s, the nominate race was widespread and not uncommon. During the 1980s its distribution became restricted to the lakes of the Northern Rwanda and few small relict ponds in the east of the country. The species was presumed to be extinct until it was recorded at Kamatana Valley in 2014.

The population of this species has alertly declined in the past mainly due to sedimentation of lakes and loss of vegetation. The population was presumed to be extinct in the country. Under the criterion A, the species is classified as **Critically Endangered (A1)**. The current site so far known to host the remaining population of White-backed Duck in Rwanda is Kamatana Valley, a small pond with less than 1km^2. Under the Criterion B, the species is classified as **Critically Endangered (B2ii).**

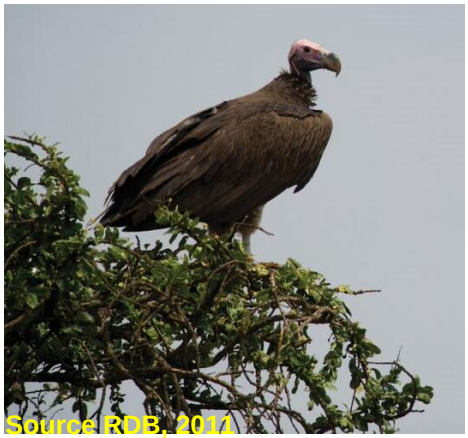
The population of White-backed Duck is in one location and is very small (one sub-population) of less than 250 birds and there is no hope of increase as far as the habitat is concerned. Under the criterion C, the species is classified as **Critically Endangered (C2aii**).

The Total population of the White-backed Duck is estimated at less than 50 individuals. Under the criterion D, the species is classified as **Critically Endangered (D).**

Overall, the White-backed Duck is classified as **Critically Endangered** in Rwanda (**A1B2iiC2aiD**).

The population of White-backed Duck was recently re-found in a small and non-protected artificial lake. The site is exposed to human activities and they don't have any particular protection. Kamatana Valley needs a special conservation by raising the communities' awareness and alternative source of water to ensure the protection of White-backed Duck and other co-habiting species.

5.1.11. *Torgos tracheliotus,* J. R. Forster (Engl: Lappet-faced Vulture, Fr: Vautour oricou)


Source RDB, 2011

Lappet-faced Vulture is a species of the Accipitridae Family and is the largest vulture in Africa. It is armed with a large and powerful beak and is easily recognised by its conspicuous size, bare, pink-skinned head and distinctive fleshy folds of skin, known as lappets, on the sides of its neck. The species was recorded in Nyungwe and eastern part of the country, mainly in Umutara region and ANP and an individual was recorded in Musanze town in 2007. Lappet-faced Vulture was a fairly common breeding resident until 1994 but now very uncommon. In the eastern savannah region, the population could be estimated at about 20-25 breeding pairs in the mid-1980s. Until the early 1970s the species could also be encountered in the central Bugesera region, especially during the dry season. At the end of 1997 the total Rwandan population was probably reduced to less than 20 birds, and currently to less than 10 birds (Vande weghe, J.P. & G. Vande weghe, 2011) mainly due to habitat loss and poisoning.

Under Criterion A, Lappet-faced Vulture is classified as Critically Endangered (A1ace). The species is confined in different fragmented locations and the number of mature individuals has dramatically declined. The species can be classified as Endangered under this criterion (B1bv). The population of Lappet-faced Vulture is very small subpopulations and with an extreme fluctuations in number of mature individuals. The species is classified as endangered under criterion C (C2b). The remaining population is very small less than 10 individuals. Under Criterion D, the species is classified as Critically Endangered (D1).

Overall, Lappet-faced vulture is classified as **Critically Endangered** in Rwanda under criteria **A1aceB1bvC2bD1.**

The decline of the population of Lappet-faced Vulture is linked to the alteration of its habitat and non-targeted poisoning which was reported in Akagera late 90s. Maintaining the remaining forest and controlling the use of pesticides can save the remaining population of this species. There is also a need of finding out the current population in Rwanda.

5.1.12. *Trigonoceps occipitalis,* Burchell (Engl: White-headed Vulture, Fr: Vautour à tête blanche)

White-headed Vulture is a bird species of the Accipitridae Family. With its bare, pink face and bright orange-red bill with a peacock blue base, this is one of Africa's most colorful vultures. The bright facial colors contrast sharply with the black body, tail, wings and high ruff around its neck. The belly and thighs are white and its legs are pale pink. It prefers mixed, dry woodland at low altitudes, avoiding semi-arid thorn belt areas (Mundy *et al.* 1992 in BirdLife International, 2015). It lives in singles or pairs, and seems less dependent on large carcasses than other large vultures, since it takes also road casualties and many small dead animals, including small birds.

The species was most abundant in ANP and the Umutara region and sites in Northern region including Buhanga and Volcanoes National Park areas, Nyamagabe and NNP. Around 1985 its population could be estimated at 20-30 breeding pairs. After 1994, the population has dramatically reduced by poisoning to less than 20 birds. Under the criterion A, this species is classified as Critically Endangered (A1ace). The species is confined in different fragmented locations less and the number of mature individuals has highly declined. The species is classified as Endangered under this criterion B (B1bv). The population of White-headed Vulture is very small subpopulations and with an extreme fluctuations in number of mature individuals. The species is classified as Endangered under criterion C (C2b). The remaining population is very small less than 20 individuals. Under Criterion D, the species is classified as Critically Endangered (D).

Overall, White-headed Vulture is classified as **Critically Endangered** in Rwanda under criteria **A1aceB1bvC2bD.**

White-headed Vulture suffers the scarcity of food, habitat conversion throughout its range and non-targeted poisoning reported in Akagera in 90s. Maintaining the remaining forest and controlling the use of pesticides can save the remaining population of this species. The remaining population is not known and this can help to develop the effective conservation measures.

5.2. Endangered bird species

5.2.1. *Ardeola idae*, Hartlaub (Eng*:* Madagascar Pond Heron, Fr: Crabier malgache)

Madagascar Pond Heron is bird of the Ardeidae family. It principally inhabits freshwater wetlands, particularly shallow water bodies fringed with vegetation and adjacent trees and hunts always in shallow water (Vande weghe, J.P. & G. Vande weghe, 2011). It feeds on small fish, reptiles (lizards and geckos), amphibians (frogs) and small invertebrates including grasshoppers and beetles. Mostly in fresh water habitat, usually at pond edges, dams and sluggish rivers in wooded areas or fringing vegetation. It is a secretive, solitary feeder, only rarely forming flocks.

The trend of the population of Madagascar Pond Heron is uncertain as previous and the current status are unknown. The species is located in several fragmeted locations in Rwanda. One bird has been collected in Huye and this species has been recorded on small pools surrounded by shrubby vegetation in Central part of the country. It was also sighted in Nyabarongo, Akagera, wetlands in Kigali (Gatenga), in the ANP it was found around residual pools of inundated plains and in tall papyrus along the lake river and lake Kivu. The area of occupancy of this species is less than 2,000km^2 fragmented in different location. Under this criterion the species is classified as Vulnerable (B2ii). The population of Madagascar Pond Heron is globall estimated at 2,000 – 6,000 individuals (Ngang'ang'a, P., and Sande, E., 2008). In Rwanda, there was no any estimation of the population but it is in a small number. Single birds or groups of 2 or 3 have been recorded throughput the country, one bird has been collected in February in Huye (Vande weghe, 2011). The population may continue declining in the future as the suitable habitat (wetlands) is under destruction. Under this criterion, the species is classified as Endangered (C2ai) The total population of this species was not evaluated but is located in are more than 5 sites and it is classified as Vulnerable (D2).

Overall, **Madagascar Pond Heron** is classified as **Endangered** in Rwanda under the following final criteria: **B2iiC2aiD2.**

The population of Madagascar Pond Heron is declining with habitat loss. No any hunting or collection was reported in Rwanda. There is a need of long term monitoring of this species and maintaining the remaining wetlands (well managing their use) to ensure a viable population of this species in the future.

5.2.2. *Bradypterus graueri* (Rwa: Incenceberi, Eng: Grauer's Swamp-warbler, Fr: Fauvette de Grauer)

Grauer's Swamp-warbler belongs to order Passeriformes, sub-order Sylvanae, family Sylviinae (Sylviidae). The male has heavy white spotting on the throat and upper breast and the female has smaller spots on the breast.

The species is restricted to highland Swamps in the Mountains around Lake Kivu and Edward, in Eastern Democratic Republic of Congo (DRC), South Western Uganda, Rwanda and Northern Burundi. There different evidences of decline of the species in all its range. However, the rate of decline is not well understood.

The species is located in several fragmeted locations in NNP, in Rugezi swamp, VNP and in Mukura Forest. With an area of occupancy less than 100km^2 and some sites suffering the alteration. The species is probably extinct in Mukura as the wetland where the species used to be occurred is now transformed into potatoes farm. Under the criterion B, the species is clsssfied as Endangered (B1ii)

The population was estimated between 3,000 to 4,000 idividuals with the numbers of mature individuals continue to decline across to its range mainly due to habitat loss, grass cutting and agriculture in Rugezi and Mukura Forest. With the population being less than 10,000 individuals with the extreme fluctuations in number of mature individuals the species is classfied as **Vulnerable (C2b).** Overall, Grauer's Swamp Warbler is classified as **Endangered** in Rwanda **(B1iiC2b).** Grauer's Swamp-warbler is found in small and isolated populations, thus it may not benefit fully from site-based conservation action like the Important Bird Area approach. Although most of the sites where the species has been recorded in Rwanda are protected, some of the key sites such as the Rugezi Marsh and Mukura continue suffering the human pressure. The International Action Plan for Grauer's Swamp-warbler was elaborated but it needs to be translated into the national context and implementation process undertaken.

5.2.3. *Calamonastides gracilirostris*, Ogilvie-Grant (Eng: Papyrus Yellow Warbler, Fr: Fauvette jaune aquatique)

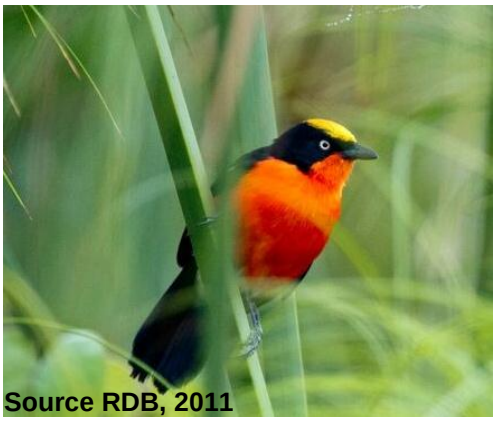
The Papyrus Yellow Warbler is a relatively brightly colored bird in the family of Sylviidae. Perched upright against the papyrus stalks, it displays an underbelly of rich yellow contrasting attractively with olive-brown upperparts. General observations have been of single birds, or pairs, foraging for tiny insects amongst papyrus.

Papyrus Yellow Warbler is a Lake Victoria near-endemic. It occurs along the Akanyaru and Nyabarongo rivers, and in the Kagogo valley of the Migongo region. Curiously it seems to be absent from the extensive papyrus beds of Akagera (Vande weghe, J.P. & G. Vande weghe, 2011). It occurs also in Rugezi swamp and used to occur in Mulindi valley and along Lake Ruhondo and Burera. These wetlands are subjected to the cultivation of sugarcane and survival crops while the papyrus in Rugezi Marsh was replaced by farming activities in the past. The area of occupancy is less than 500km^2 and continues to decline. Under the criterion B, the species is classified as **Endangered (B2b**). In all its range, the species is in low density and in or close to dense papyrus stands. The population is in extreme fluctuations and continues to decline with the transformation of papyrus into farmlands. Under the Criterion C, Papyurus Yellow warbler is classified as **Vulnerable (C2b).** The population of this species is not known and no any estimate was conducted.

Overall, the Papyrus Yellow Warbler is classified as **Endangered** in Rwanda **(B2bC2bD**).

The population of Papyrus Yellow warbler was never estimated but it is presumed to be declining as the wetlands are threatened by drainage for the cultivation of crops, such as rice and sugar cane. Papyrus in Rugezi was removed but is now recovering and the physical restoration can be encouraged for a quick recovery of the suitable habitat. The processes to gazette the Akagera basin as a RAMSAR site has to be supported and farming in Nyabarongo and Akanyaru wetlands regulated. Peat extraction in Akanyaru wetland is to be regulated as well.

5.2.4. *Laniarius mufumbiri,* Ogilvie-Grant (Eng: Papyrus Gonolek, Fr: Gonolek des papyrus)


Source RDB, 2011

The Papyrus Gonoleck is a species of bird in the Malaconotidae family and is globally listed by IUCN as Near Threatened species. The species is strictly dependent on papyrus, growing in homogeneous stands or mixed with other reeds or bushes, feeding in lower strata of the vegetation.

In Rwanda, The population size has not evaluated and the trend and rate of declining of the population is not known.

The species is breeding resident throughout the Akagera Basin including wetlands of Akagera complex, Nyabarongo and Akanyaru Wetlands. However, these wetlands are subjected to the cultivation of sugarcane and survival crops. The suitable habitat in Rugezi Marsh was replaced by farming activities. The area of occupancy is less than 500km^2 and continues to decline. Under the criterion B, the species is classified as endangered (**B2b**). The population has reduced and the species disappeared in Rugezi Marsh and in the other sites. The population is in extreme fluctuations in the number of mature individuals and continues to decline. Under the Criterion C, Papyrus Gonolek is classified as **Vulnerable (C2b).** The population of this species is not known and no any estimate was conducted.

Overall, the Papyrus Gonolek is classified as **Endangered** in Rwanda **(B2bC2bD**).

The population of Papyrus Gonolek was never estimated but it is presumed to be declining as the suitable habitat is transformed into farmlands. All sites where the species is confined are not protected. The processes to gazette Akagera basin as a RAMSAR site has to be supported as it can empower its protection and save the remaining population of Papyrus Gonolek. Farming in Nyabarongo and Akanyaru wetlands could also be regulated.

5.2.5. *Lybius rubrifacies,* Reichenow (Eng: Red faced Barbet, Fr: Barbican à face rouge)


Source RDB, 2011

The Red-faced barbet is a species of bird in the African barbet family Lybiidae. It has red colouring on the side of the face and around the eye, but is black on the dorsal side of the head. Its entire body is black and its wings are streaked with yellow.

The species is endemic to the Lake Victoria and its natural habitats are dry savannah, moist savannah, and arable land. In Rwanda, this species is occurring as a common breeding resident in ANP and Central Bugesera. Formerly it used to occur throughout the eastern savannas, including the area in Kigali and the Mayaga region. This species occurs in pairs or small parties of up to 6 birds

The population of **Red faced Barbet** is very small with all mature individuals in a small area of the ANP within an extent of occupancy of 1,122Km^2. The natural habitat of this species is disturbed by bush fire, even if it is currently controlled. The species is classified as Endangered under criteria B1ab (iii). All individuals of **Red faced Barbet** are in one subpopulation. Under the criterion C, the species is classified as Endangered (C2aii). The remaining population is very small and restricted in one ecosystem but the number of mature individuals not evaluated.

Overall, **Red faced Barbet** is classified as **Endangered** in Rwanda under criteria **B1ab (iii)C2aii).**

The remaining population of **Red faced Barbet** is confined in ANP, a well protected site at the moment. The long-term monitoring of the ecological factors, habitat, population trends, distribution and preferred habitat will direct the decision-making and development of effective conservation strategies.

5.2.6. *Necrosyrtes monachus,* Temminck (Rwa: Inkongoro, Eng: Hooded Vulture, Fr: Vautour charognard ou Percnoptère brun)

Hooded-Vulture is a bird species of the Accipitridae Family. The species is often associated with human settlements, but is also found in open grassland, forest edge, wooded savannah, desert and along coasts. It occurs up to 4,000 m, but is most numerous below 1,800 m. It feeds mainly on carrion, but also takes insects. Its incubation period lasts 46-54 days, followed by a fledging period of 80-130 days. Young are dependent on their parents for a further 3-4 months after fledging (Ferguson-Lees and Christie 2001 in Birdlife International, 2015). The population of Hooded Vulture was never evaluated in Rwanda but it is globally decreasing (Birdlife International, 2015) and in Rwanda the population occurs in pairs or small numbers, rarely more than 10-12. However, a concentration of up to 50-60 birds were regular until 1994 (e.g. at Gabiro) (Vande weghe, J.P. & G. Vande weghe, 2011). A group of 5 individuals was recorded in Ndoha Forest, in Kibuye, and 8 individuals between Kivumu and Musambira, on the road Kigali-Muhanga. Under the criterion A, this species is classified as Endangered (A1ace). The population of Hooded Vulture is very small with all mature individuals within an extent of occupancy of 1,122Km^2. The natural habitat of this species is disturbed by forest cutting for agriculture and other development activities. The species is classified as Endangered under criteria B1ab (iii and iv). The remaining population is very small and restricted in fluctuated ecosystem but the number of mature individuals not evaluated.

Overall, Hooded Vulture is classified as **Endangered** in Rwanda under criteria **(A1ace)B1ab (iii and iv).**

Hooded Vulture was reduced by the non-target poisoning and conversion of habitat leading to the scarcity of food. Maintaining the remaining forest and controlling the use of pesticides can save the remaining population of this species. There is also a need of estimating the real population in Rwanda, its trends and the status of preferred habitat in order to develop effective conservation strategies.

5.2.7. *Neotis denhami*, Children & Vigors, (Eng: Denham's Bustard, Fr: Outarde de Denham)

Denham's Bustard is a species of the Family of Otididae. It is large, long-legged birds with dull brown plumage on the back, finely streaked with black, and the under-parts are white. Its grey crown is bordered with black, and a black line runs through the eye with a white line forming an 'eyebrow' above. The long legs are yellow and its slender bill is a whitish horn colour. It inhabits the medium or short grasses, burnt or grazed and it wandered extensively in search of suitable habitat condition. Denham's Bustard was formerly occurred throughout the eastern savannah region and the central plateau, locally up to 2.300m on the Congo Nile divide. Currently the only places where the species can, at least seasonally, be expected are at Mutumba and Munkerenke plateaus in Central ANP (Vande weghe, J.P. & G. Vande weghe, 2011). The population of this species was not evaluated in the past, but has disappeared in some areas and is currently uncommon. Under the criterion A, this species is classified as **Endangered (A1ac).**

The population of Denham's Bustard is very small with all mature individuals in a small are of the ANP within an extent of occupancy of 1,122Km^2. The natural habitat of this species is disturbed by bush fire, even if it is currently controlled. The species is classified as Endangered under criteria B1ab (iii). According to the park guide, the population is very small, but was not systematically evaluated, and 100% all individuals are in one subpopulation. Under the criterion C, the species is classified as **Endangered (C2aii).**

Overall, Denham's Bustard is classified as **Endangered** in Rwanda under criteria **A1ac B1ab (iii) C2aii).**

Denham's Bustard inhabits the open grasslands and its population has undergone a dramatic decline induced by the extension of agriculture and large-scale planting of exotic trees for the production of fire wood and building poles. Currently, there is limited information on the distribution, the population size, the ecological requirements of Denham's Bustard. The remaining population is solely confined in Akagera NP, a well protected site. The conservation of Akagera National park and detailed assessment and long-term monitoring would direct the conservation measures of this species.

5.2.8. *Scleroptil levaillantii,* Valenciennes (Eng: Redwing Francolin, Fr: Francolin à ailes rouges)


Source RDB, 2011

The Red-wing Francolin is a bird species in the Phasianidae family. The species is an uncommon breeding resident to Rwanda.

The population of the species is on the negative threshold with reduction and disappearance of the suitable habitat. Until the 1970s the species had a widespread distribution throughout the country. It was very abundant on the pasture of the central plateau during the 1950s and was widespread on the lower slope of the volcanoes until the late 1990s. The species was abundant in Umutara region until the late 1990s but currently is very rare. Today, the population survives in small numbers in ANP where it inhabits grassland and wooded grasslands of plateau and hill tops, being absent from the lake-side savannas and in 2008 it was recorded in the tea state of Gisakura on the edge of NNP (Vande weghe, J.P. & G. Vande weghe, 2011). The population size has not evaluated and rate of declining is not known.

The species is located in one ecosystem with few sites inside the ANP within a small area of occupancy less than 500km^2. Under the Criterion B, the species is classified Endangered (B2aii).

The species lives in pairs and small coveys but large congregation of up to 20 individuals were recorded. According to the guides of the ANP the population is very small less than 250 mature individuals. The species is classified as Endangered in Criterion D (D1)

Overall, the Redwing Francolin is classified as **Endangered** in Rwanda (**B2aiiD1**).

The population of Redwing Francolin remains confined in one locality in Rwanda. The park is well maintained while the habitat out of the ANP has completely degraded and the species disappeared. The conservation effort of the ANP and the study on the ecological factors are highly needed to maintain the remaining small population of this species in Rwanda.

5.2.9. *Serinus koliensis*, Grant & Mackworth-Praed (Eng: Papyrus Canary, Fr: Serin de Van Someren)

The Papyrus Canary is a small bird in the family of Fringillidae. In Rwanda, the species is a fairly common resident and it inhabits papyrus swamps, feeding in the heads of the papyrus and in lush herbaceous vegetation on the edge of the wetlands, but never far away from papyrus. The population was never estimated but with the habitat status it is expected to be declining with habitat loss. Outside the breeding season it forages in small flocks of 10–20 birds.


Source RDB, 2011

The species occurs on the Congo-Nile divide and in the northern highlands up to 2,000 m locally also on the central plateau, and in the Akanyaru, Nyabarongo, Kibaya and Kagogo valleys (Vande weghe, J.P. & G. Vande weghe, 2011). However, the suitable habitat of the Papyrus Canary is transformed into farmlands. The papyrus in Rugezi Marsh was removed while Nyabarongo and Akanyaru wetlands are transformed into sugarcane and survival crops. The area of occupancy is less than 500km^2 and continues to decline. Under the criterion B, the species is classified as **Endangered (B2b**). The population of Papyrus Canary is in an extreme fluctuations and continue to decline with the transformation of the species' suitable habitat. Under the Criterion C, Papyrus Canary is classified as **Vulnerable (C2b).** As the population of this species is not known, the criterion D is not considered. Overall, the Papyrus Canary is classified as **Endangered** in Rwanda **(B2bC2b**).

The population of Papyrus Canary was never estimated but it is presumed to be declining as the wetlands are replaced by farmlands. Papyrus in Rugezi was removed and this affected highly the population of the species. The GoR has initiated the processes to gazette the Akagera basin as a RAMSAR site. This would contribute to the conservation of this species. Additionally, the wetland transformation in Rwanda must be done cautionary after the assessment of the negative and positive impacts on wildlife and their habitats.

5.3. Vulnerable bird species

5.3.1. *Cryptospiza shelleyi*, Sharpe (Eng: Shelley's Crimsonwing, Fr: Bengali de Shelley)

The Shelley's Crimsonwing is a species of Estrildid finch in the family of Psitacidae. This is possibly related to uncontrolled deforestation. The species is endemic to the Albertine Rift occurring as an uncommon resident. It occurs in the Congo-Nile Devide from VNP to Burundi border, including the Busaga Forest, but its distribution is very uneven and it is apparently absent from Cyamudongo forest. It used to be most abundant in the Mukura Forest where flocks of up to 20 birds were not uncommon in the late 1970s (Vande weghe, J.P. & G. Vande weghe, 2011).

However, Mukura Forest Reserve is under pressure by illegal miners and the natural forest is highly degraded and cases of local hunting were reported around Gishwati Forest. The population was not evaluated in the past.

The extent of area of occupancy of this species is estimated to be limited at 1,410Km^2. The population was not evaluated in Rwanda but it is very threatened with habitat loss in Mukura and Gishwati and Busaga Forests. Under the criterion B, the **Shelley's Crimsonwing** is classified as **Vulnerable** under criteria **B1a(iii and iv).**

The population is small and in extreme fluctuations in number of mature individuals and its classified as **Vulnerable** under **C2b** criteria.

The total population of this species was not evaluated but is located in area less than 5 sites and it is classified as Vulnerable (D2). Overall, the species is classified as **Vulnerable** in Rwanda under the following final criteria: **B1a(iii and iv)C2bD2.**

The population of **Shelley's Crimsonwing** is confined to the Mountain Forests in the Albertine Rift region. These forests were alertly reduced in the past but today there are promising initiatives to protect mountain forests in Rwanda. Nyungwe and Volcanoes NP are currently well maintained and the creation of Mukura-Gishwati forest shows the potential track.

5.3.2. *Francolinus afer,* Statius Müller (Rwa: Inkware, Eng: Red-necked Spurfowl - Francolin, Fr: Francolin à gorge rouge)

Red-necked Spurfowl (Francolin) is an African species in the Family of Phasianidae. The species is generally dark, brown above and black-streaked grey or white under-parts. The bill, bare facial skin, neck and legs are bright red. It is found in the southern half of the continent, from Kenya, and all the way down to South Africa. Pairs and family groups are widespread but local and often shy, in bushed and wooded grassland, thickets and in cultivation (Stevenson, T. and Fanshawe, J., 2002). In most areas in Rwanda, its upper altitudinal limit is about 2000m, but on the lava soil of the volcano areas it was encountered at 2,400m (Vande weghe, J.P. & G. Vande weghe, 2011).

The population of this species was on most of cases recorded in open areas in ANP and in farmlands in a distance from the closed forests. The population has dramatically reduced around non-protected ecosystems due to hunting and habitat loss and this species is classified as Vulnerable in Rwanda under criteria A1ade.

The population of Red-necked Spurfowl was widespread in savannah and gallery forests around the country. However, these forests are currently replaced by farming and grazing lands. The population is abundant and secured in ANP and during our field trips, the small population was reported in fragmented forests of Karama and Mashoza and in farmlands around Ibanda-Makera, Kibirizi and some individuals were sighted around Buhanga forest and this makes his makes an extent of occurrence of about 1400skm. The species is classified as Vulnerable under the following criteria B1a(iii and iv)

The population is small and in extreme fluctuations of mature individuals and it's classified as Vulnerable under C2b criteria.

The total population of this species was not evaluated but is located in are more than 5 sites and it is classified as **Vulnerable (D2)**

Overall, the species is classified as **Vulnerable** in Rwanda under the following final criteria: **A1adeB1a(iii and iv)C2bD2.**

The awareness raising and alternative protein income projects (rabbits, chicken, etc.) around the non-protected sites would be a good tool to protect the remaining population of this

species. There is also a need of finding out the real population in Rwanda and its trends in order to develop effective conservation strategies.

5.3.3. *Francolinus nobilis*, Reichenow (Rwa: Inkware, Eng: Handsome Francolin, Fr: Francolin noble)

Handsome Francolin is a bird species of the Phasianinidae Family. It is large, up to 35 cm long, terrestrial forest with a dark reddish brown plumage, grey head, red bill and legs, brown iris, bare red orbital skin and rufous grey below. It is distributed in mountain forests of eastern Democratic Republic of the Congo, southwest Uganda and borders between Burundi and Rwanda. In Rwanda, the species prefers the montane bamboo forest, which is a rare and patchy habitat in some areas i.e. NNP. Mukura Forest Reserve is under pressure by illegal miners and the natural forest is highly degraded and cases of local hunting were reported around Gishwati Forest. The population was not evaluated in the past.

The species is confined in the Albertine Rift landscape (Mukura, Gishwati, NNP and VNP) with extent of occurrence limited at 1,410Km^2. The population was not evaluated in Rwanda but it is very threatened in Mukura Forest with habitat loss and hunting in Gishwati Forest. Under the criterion B, the Handsome Francolin is classified as Vulnerable under criteria B1a(iii and iv)

The population is small in the extreme fluctuations in number of mature individuals and under criterion C it is classified as **Vulnerable (C2b).**

The total population of this species was not evaluated but is located in area less than 5 sites and it is classified as Vulnerable (D2)

Overall, the species is classified as **Vulnerable** in Rwanda under the following final criteria: **B1a(iii and iv)C2bD2.**

The population of Handsome Francolin is confined to the Mountain Forest in the Albertine Rift region. Apart from Nyungwe and Volcanoes NP, the other mountain forests are threatened by human activities. Mukura is highly affected by illegal mining while until 1995; Gishwati forest has reduced up to 95% of its original size. The creation of Mukura-Gishwati National Park will stop the illegal mining in Mukura and there is a hope of the improvement of the habitat status of Handsome Francolin.

5.3.4. *Kupeornis rufocinctus*, Rothschild (Eng: Red-collared Mountain-babbler, Fr: Timalie à collier roux)

The Red-collared Mountain-babbler is a species of bird in the Leiothrichidae family. It occurs in the Albertine Rift mountains in Burundi, Rwanda, Uganda, the Democratic Republic of Congo (Del Hoyo *et al.* 2007). In Rwanda, the species is a fairly common breeding resident throughout NNP, being less common along the drier northwestern edge and astern parts (Vande weghe, J.P. & G. Vande weghe, 2011). This is a species with a restricted range and, although it can be locally very common, it is known from only a few sites. The population size has not been quantified, but occasionally several groups join to form larger flocks up to 15 birds (Vande weghe, J.P. & G. Vande weghe, 2011).

The species is confined in one locality (NNP) with extent of occurrence limited at 1,011Km^2. Under the criterion B, the **Red-collared Mountain-babbler** is classified as **Vulnerable (B1ab (iii and iv).**

The population of **Red-collared Mountain-babbler** is very small with the whole population of mature individuals in one subpopulation. Under the criterion C, the species is classified as **Vulnerable (Caii)**

The number of mature individuals was never estimated bi the population is restricted within one location. Under the criterion D, the species is classified as **Vulnerable (D2)**

Overall, the **Red-collared Mountain-babbler** is classified as **Vulnerable** in Rwanda under criteria **B1ab (iii and iv) Caii D2**

The population of the **Red-collared Mountain-babbler** is confined to NNP with the small population. However, the reasons of the small population, the ecology, population size, etc. are not well known while the forest is well protected. There is a need to assess the distribution and status within NNP.

5.3.5. *Numida meleagris,* Neumann (Rwa: Inkanga, Eng: Helmeted Guineafowl, Fr: Pintade commune)

Helmeted Guineafowl is species of the family of Numididae with featherless heads and a dark grey or blackish plumage with dense white spots. The mature individual measure from 40–71 cm (16–28 inches) in length, and weigh 700–1600 grams or 1.5-3.5 pounds. The population is widespread in Africa south of the Sahara, but generally absent from rain forest and desert. It generally prefers warm, dry, open habitats, such as forest margins, savannas, steppes, semi-deserts and agricultural land from sea level up to an altitude of 3.000 m. In our areas, the species inhabits woodland and wooded grassland, thickets and fringing acacia, bush country, woodland and cultivation (Stevenson, T. and Fanshawe, J., 2002). In Rwanda, the species was recorded in different ecosystems of eastern of the country mainly around Lakes and some population in short grassland and acacias. Occasionally it wanders into open grassland plains, but most frequently it remains in the immediate vicinities of dense cover (Vande weghe, J.P. & G. Vande weghe, 2011). It was also reported in ANP, forests of Karama, Gako (in Bugesera), around forests of Ibanda-Makera (in Kirehe) and Mashoza (in Ngoma).

Currently the population of this species is abundant in ANP only, but it survives in a few places in the southern Bugesera region and around Ngoma District. It lives in a flock of up to about 50 birds (Vande weghe, J.P. & G. Vande weghe, 2011). Among 228 surveyed plots by Gatali (2013) this species was recorded in 7 plots only. The population has dramatically reduced in non-protected ecosystems. This was confirmed by interviewees around Mashoza, Ibanda-Makera Forests who affirmed the decline due to hunting and habitat loss. The population is affected by the habitat loss, hunting for home meat and some individuals are kept as pet and the species is classified as Vulnerable in Rwanda under criteria A1ade.

The species used to be occurred in savannah forest which are now reduced or replaced by farming land. The remaining population is abundant and secured in ANP but was also reported in fragmented small forests of Karama and Mashoza and in farmlands around forests of Ibanda-Makera this makes an extent of occurrence of about 1300skm. The species is classified as Vulnerable under the following criteria B1a(iii and iv)

The population is small in the extreme fluctuations in number of mature individuals and it is classified as Vulnerable under C2b criteria.

The total population of this species was not evaluated but is located in are more than 5 sites and it is classified as Vulnerable (D2)

Overall, the species is classified as **Vulnerable** in Rwanda under these following final criteria **A1ade B1a(iii and iv)C2bD2**

The Habitat loss and hunting are the main threats affecting the population of Helmeted Guineafowl in Rwanda but the population in protected areas (ANP) is well protected. The awareness raising and alternative protein income around the non-protected sites would be a good tool to protect the remaining population of this species. The population kept in households must also be relocated in the wild.

5.3.6. *Pitta angolensis,* Vieillot (Eng*:* African Pitta, Fr: Brève d'Angola)

African Pitta is an intra-Africa migrant bird species of Pittidae family. In our area, the species is known as an uncommon visitor, mainly as a passage migrant. It can be encountered throughout the country during its northward passage in April-June. It is mush scarcer during southward passage in November and December. Most birds fly overhead at night, and most records refer to birds attracted to lighted buildings and found dead or injured in Kigali, Huye, Rubona, Karongi, Rubavu or Musanze. A few birds were observed in gardens, *Eucalyptus* woods or dry thickets away from urban areas. There is one observation from Akagera Game Lodge and one from Buhanga Eco-Park.

The population size has not evaluated and the trend and rate of declining of the population is not known.

The species is located in different fragmented locations less than 5 sites with the area of occupancy less than 500km^2. Under the Criterion B, the species is classified Vulnerable (B2aiii).

Wherever the species was recorded in Rwanda (Buhanga, Kigali, Arboretum of Ruhande, etc.) only a single individual was sighted. The species is classified as Vulnerable in Criterion C (C2ai)

The population is located in fluctuated and non-protected areas and as the species moves in small population, it is subjected to the hunting by Raptors. Cases of injured individuals were

recorded in Musanze, Town, after escaping a raptor, in 2007 and a dead individual was seen in Kigali in 2013. Under criterion D, we classify this species as Vulnerable (D1).
Overall, African Pitta is classified as **Vulnerable** in Rwanda (**B2aiiiC2aiD1**).

The population of African Pitta is scattered in fragmented sites and its migration patterns and flyway routes are not well known in Rwanda. There is a need of maintaining the non protected forests i.e. Buhanga and Arboretum of Ruhande and then monitor the migration patterns and flyways routes to facilitate the decision-making on the conservation measures.

5.4. Species to be listed as Data Deficient in Rwanda

From our assessment, some species occurring on the checklist of birds in Rwanda or their records date for long time. Some of these species were not recorded on the surveyed sites and were reported as very rare by Vande weghe, J.P. & G. Vande weghe (2011) or absent by park managers or tourist guides. Further inventories would be necessary to collect more data about these species:

1. **Yellow-billed Barbet (*Trachyphonus purpuratus*)**

Probably a very uncommon and local resident. Discovered in 1987, this species could be heard annually from 1987 to 1990 in May, June and July in a small area in ANP, between Gihinga hill and the Southern end of Lake Rwanyakizinga (Vande weghe, J.P. & G. Vande weghe, 2011). However, a senior bird guides in ANP, Nkuranga Emmanuel, who is employed for more than 10 years has never seen this species since he is in this park. This gives a doubt that the species still existing in ANP.

2. **Willcocks's Honeyguide (*Indicator willcocksi*)**

A very uncommon resident. It was recorded in the Nyungwe Forest near Gisakura and near Gisovu at 2,200-2,300m in open-canopy forest. There is one record in the Gishwato forest at 2,400m (Vande weghe, J.P. & G. Vande weghe, 2011). Bird guides in NNP, Narcisse and Claver, affirmed not to have recorded this species since they are employed as guide. There is a need of confirmation of the existence of this species in NNP.

3. Buff-spotted woodpecker (*Campethera nivosa*)

A guineo-Congolian near-endemic, occurring probably as a very uncommon resident. a first pair was recorded on 12 November 1980 near Rutabanzigera at 1,750m in Nyirankesha valley in the western part of Nyungwe forest. Another pair was recorded on 22 July 1984 at Kayonza in riparian forest along Akagera river, formerly in ANP. During a survey in 1999 the species was apparently recorded at other places in the Nyungwe forest (Bweyeye, Kagano, Muzimu, Nyabihu, Uwasenkoko), but these recorded need to be confirmed (Vande weghe, J.P. & G. Vande weghe, 2011). According to the park bird guide, this species is no longer in NNP, details on its existence are highly needed.

4. Pygmy Falcon (*Polihierax semitorquatus*)

The race *castanotus* is an occisiaonal visitor. A pair was seen near Huye for nearly a full year at the end of the 1950s and a female was recorded in bushed grassland of the Umutara region on 12 April 1971 (Vande weghe, J.P. & G. Vande weghe, 2011). The species was reported to be not existing in this park but the extinction needs to be confirmed.

5. Beaudouin's Snake Eagle (*Circaetus beauduiini*)

An occasional visitor with two records of single immature birds on 3 December 1983 and 9 December 1984 in ANP (Vande weghe, J.P. & G. Vande weghe, 2011). There was no recent record and there is a doubt if the species still passing Rwanda.

6. Grasshoper Buzzard (*Butastus rufipennis*)

An occasional visitor, with one record of a single bird on 7 November 1982 in the Kamakaba plain of the Umutara region (Vande weghe, J.P. & G. Vande weghe, 2011). This is an old record which requires more update to confirm the existence or extinction of this species in Rwanda.

7. Crested Guineafowl (*Guttera Pucherani*)

In VNP a single bird was flushed in January 1971 in dense *Hypericum* thickets at nearly 3,000 m on Mount Karisimbi close to the border with the Democratic Republic of Congo (DRC). A feather belonging to that species was found in the same area in the late 1970s by J.P.von der Becke and shown to the first author. In those years, the species was well known in the nearby Rutshuru area of the DRC (*Chapin, 1932; Schoutened, 1966a; Curry-Lindahl, 1961 in* Vande weghe, J.P. & G. Vande weghe, 2011).

8. Secretary bird (*Sagittarius serpentarius*)

An irregular visitor. A single bird was collected between and Huye before 1960. In 1969 another was captured near Huye, and remained there in captivity until early 1970. During the dry season of 1972, there birds visited during several weeks the Umutara region, and a single individual was recorded near Lake Mpanga on 12 June 1990 (*Aurelien, 1957a; Schouteden, 1966a in* Vande weghe, J.P. & G. Vande weghe, 2011)

9. Verreaux's Eagle (*Aquila verreauxii*)

An occasional visitor. A single immature birds were recorded on 28 January 1952, 19 February 1971 and 16 January 1972 in ANP. Two birds were seen on 10 November 1986 above Bweyeye in the Nyungwe Forest. The origin of these birds remains unknown, but it is not impossible that a small population of this species exists along cliffs of north-Western Tanzania (Vande weghe, J.P. & G. Vande weghe, 2011).

10. Dark Chanting Goshawk (*Melierax metabates*)

An occasional visitor, with two records in the Umutara region. An adult bird were seen on 22 July 1984 just north of Gabiro, and a nearly adult was seen on 18 August 1994 near the Nyarubanda hill (*Dowsett & Forbes-Watson, 1993 in* Vande weghe, J.P. & G. Vande weghe, 2011)

11. Red-thighed Sparrowhawk (*Accipiter erythropus*)

An occasional visitor or perhaps a very uncommon resident, known from a single sight record in January 1990 in the Cyamudongo Forest (*Dowsett-Lemaire & Dowsett, 1990b in* Vande weghe, J.P. & G. Vande weghe, 2011).

12. Abyssinian Owl (*Asio abyssinicus*)

The race **graueri** is known from VNP, where single birds were recorded on 9 June 1979 in tall *Erica* thickets at 3,400 m on the eastern slope of Mount Bisoke and on 18 July 1981 in the same habitat at about 3,000m on mount Sabyinyo (Vande weghe, J.P. & G. Vande weghe, 2011) but there is no recent record of this species in VNP.

13. African Barred Owlet (*Glaucidium capense*)

An occasional visitor. A single bird, mobbed by small passerines, was recorded in day-time on 31 August 1981 on the Kitabiri hill in the ANP. This record seems to be far outside the known

distribution range of the species, but a recent record in eastern Burundi on 21 October 2009 is another indication that some birds move northward into the Great Lakes region (Vande weghe, J.P. & G. Vande weghe, 2011).

14. Black-shouldered Nightjar (*Caprimulgus nigriscapularis*)

The only confirmed record of this species is a specimen (rufous morph) photographed by J. Anderson on 13 December 2009 near the Rusumo falls. We suspect that the formerly fairly important breeding population of the northern Akagera and Kagitumba-Muvumba valleys referred to this species which is common in southern Uganda. Unfortunately these birds are now very uncommon in north-eastern Rwanda. They used to live below 1,600 m on edges of riparian forest, fringing *Acacia kirkii* or dry sclerophyllous thickets (Vande weghe, J.P. & G. Vande weghe, 2011).

15. Fiery-necked Nightjar (*Caprimulgus pectolaris*)

The race **fervidus** was collected on 2 April 1949 in clearing near Kamubuga on the edge of Nyungwe Forest. On 14 December 2009 it was also photographed by J. Anderson in abandoned agricultural land near the Rusumo falls. This species was collected in eastern Burundi and in the Kibondo area of north-eastern Tanzania. Accordingly we suspect that the now extremely reduced local breeding population of south-eastern Rwanda refers to this species. It used to be fairly common from the southern end of Lake Ihema to the area of the Rusumo falls, and it was the dominant nightjar in dense *pericopsis* woodland (Vande weghe, J.P. & G. Vande weghe, 2011).

16. Purple Roller (*Caracias naevius*)

An occasional visitor. Single individuals were recorded in August 1983 near Nyamata in the Bugesera region and on 1 November 1986 in Gabiro, formerly in ANP (*Dowsett & Forbes-Watson, 1993 in* Vande weghe, J.P. & G. Vande weghe, 2011).

17. Swallow-tailed Bee-eater (*Merops hirundineus*)

An intra-African migrant, occurring as an occasional visitor: five birds were seen during a few days in July 1984 by J. P, Lebel near Musha in the Buganza region (Vande weghe, J.P. & G. Vande weghe, 2011).

18. Eurasian Hopoe (*Upupa epops*)

A migrant from the Palearctic or from the northern tropics, known as an occasional visitor. A single individual was recorded near Ndama hill in the Umutara region on 12 April 1988; another in the Urwindi valley on 4 April 1990. Both sites were formerly included in ANP. These observations may refer to the Palearctic nominate race or to the race **waibeli** breeding in north-eastern Africa (Vande weghe, J.P. & G. Vande weghe, 2011).

19. Amur Falcon (*Falco amurensis*)

A Palearctic migrant, occurring as an occasional visitor. Two birds were recorded on 22 October 1972 in the Kirara plain of ANP, an adult male and two females were recorded on 2 April 1990 at Kibondo in the Umutara region and an adult male was recorded on 3 June 1990 near Lake Mpanga to the south of ANP (Vande weghe, J.P. & G. Vande weghe, 2011).

20. Eleonora's Falcon (*Falco eleonorae*)

A palearctic migrant, occasionally recorded. A single bird was seen on 25 January 1983 near Lake Hago in ANP (Vande weghe, J.P. & G. Vande weghe, 2011).

21. Fischer' Lovebird (*Agapornis fischeri*)

An occasional visitor. In July and August 1972 flocks of over 50 birds were recorded around Gabiro, formerly in ANP, and in the Icyanya region near Kigali. Several specimens were caught. Apart from this eruption single birds were recorded at several occasions in Kigali, but these had almost certainly escaped from captivity (Vande weghe, J.P. & G. Vande weghe, 2011).

22. Black-throated Wattle-eye (*Platysteira peltata*)

The race **mentalis** is a very uncommon resident or perhaps only a wanderer. A pair has been located on 24 October 1989 at 1,800m in the Mwaga valley to the south-west of Gisakura in the Nyungwe Forest by Dowsett-Lemaire. There is one older record by Aurelien in the same general area but with no details of date and exact locality. This species is common however in Kibira NP in Burundi, which is adjacent to NNP (Vande weghe, J.P. & G. Vande weghe, 2011).

23. Rufous-bellied Helmetshrike (*Prionops rufiventris*)

An occasional visitor. A single specimen of the race ***mentalis*** was collected near Astrida (now Huye) on 15 January 1950. As a bird of the Guineo-Congolian lowland forest and its associated riparian forests, it was perhaps an inhabitant of the riparian forest of the Akanyaru and

Nyabarongo valleys at 1,300-1,450m, in which case it must now be considered as locally extinct. However, its occurrence in central Rwanda is very unexpected (Vande weghe, J.P. & G. Vande weghe, 2011).

24. Red-eyed Puffback (*Dryoscopus senegalensis*)

This species was recorded in the Shava valley at about 1,800m in the Nyungwe Forest: on 4 August 1974 a female was building a nest in second growth along the river. Two weeks later the nest was abandoned with one broken egg, and no birds were seen. Attempts to find that species again have all failed, but most of the Shava and Tangaro valleys are nearly not accessible. This species of secondary lowland forest and forest edges or clearings must be considered as a very uncommon resident, perhaps now locally extinct (Vande weghe, J.P. & G. Vande weghe, 2011).

25. Red-tailed Shrike (*Lanius phoenicuroides*)

A Palearctic migrant, occurring as an irregular visitor. Single birds were seen on 24 October 1982 and 7 January 1985 in ANP, on 12 December 1986 in Kigali and on 22 November 2009 in Rwinkwavu (Vande weghe, J.P. & G. Vande weghe, 2011).

26. Yellow-bellied Hyliota (*Hyliota flavigaster*)

The race **barbazae** was a very uncommon breeding resident, but its current status is unknown. It used to occur in south-eastern Rwanda, where it inhabited *pericopsis* woodland close to the Rusumo falls. These woodlands were cleared, and the species is no longer resident in the area. However, it is not impossible that some individuals come from the Tanzanian side of the river where *pericopsis* is still abundant. This species was feeding mainly in the upper strata of the vegetation, usually in pairs, but sometimes it was associated to mix insectivores parties. It was moving fast through any type of foliage, gleaning insects from the underside of leaves and twigs (Vande weghe, J.P. & G. Vande weghe, 2011).

27. Dusky Lark (*Pinarocorys nigricans*)

An intra-African migrant, occasionally recorded in eastern Rwanda: a single bird was seen on 30 June 1990 on recently burnt grassland near the Ndama hill inside the former limits of ANP (Vande weghe, J.P. & G. Vande weghe, 2011).

28. Little Greenbull (*Eurillas virens*)

The nominate race was very uncommon resident. Since the early 1990s it is most probably locally extinct. It was recorded in Akagera valley between Kagitumba and the confluence of the Karangazi valleyand the Akagera river, where it inhabited riparian forest at 1,300m (Vande weghe, J.P. & G. Vande weghe, 2011).

29. Red-tailed Leaflove (*Phyllastrephus scandens*)

Very uncommon resident, most probably locally extinct. It was known from a few records in the Akagera valley at Kanyonza in the extreme north of the country. Its habitat was riparian forest at 1,300m. it was seen at any level of the vegetation, but it remained most often well concealed amongst dense climbers. It was found alongside Cabanis's Greenbul *ph. Cabanisi,* but both species were separated by size and perhaps also by subhabitat, the Red-tailed Leaflove occurring more frequently of higher level of the vegetation (Vande weghe, J.P. & G. Vande weghe, 2011).

30. Common Chiffchaff (*Phylloscopus collypita*)

A single bird has been recorded at about 2,700m on Mount Gahinga in VNP during the late 1970's by S. Millington. Unfortunately all data were lost (Vande weghe, J.P. & G. Vande weghe, 2011).

31. Olive-green Camaroptera (*Camaroptera chloronota*)

Formerly a very uncommon resident, now most probably locally extinct. It was found in the extreme north of the Akagera valley at Bushoro, Matimba and Kayonza in dense undergrowth of riparian forest (Vande weghe, J.P. & G. Vande weghe, 2011).

32. Green-backed Eremomela (*Eremomela canescens*)

An occasional visitor, a pair was recorded on 8 April 2010 in broad-leaved wooded grassland on the Kiyonza ridge in ANP (Vande weghe, J.P. & G. Vande weghe, 2011).

33. Brown Illadopsis (*Illadopsis fulvescens*)

A very uncommon resident in Rwanda. In 1991 this species was mistnetted near Ntendezi in the western edge of the Nyungwe Forest at 1,650m. In 1978 this species had also been collected in forest remnants at 1,350m in Musigati below Kibira NP in Burundi. This suggest that it used to occur in the submontane forests below 1,700m on the western slope of the Cong-Nile divide.

These forests have now been cleared, but this species might survive in the Cyamudongo forest (Vande weghe, J.P. & G. Vande weghe, 2011).

34. Spotted Creeper *(Salpornis spilonatus)*

The race **salvadori** is an occasional visitor. A first most probable observation was made in Gabiro in the late 1970's by A. Monfort-Braham. The bird was exploring the bark of tall *Maesopsis emini* trees near the game Lodge. Unfortunately the data were lost, and since this observation was far outside the range of the species (as known at that time) it was never mentioned. A recent, well documented observation was made on 25 July 2010 in the border areas of Lake Kivu at Nyamasheke by Narcisse Ndayambaje one of the bird guides for NNP based at Gisakura. This observation also seems to be far outside the known range of the species in East Africa according to Stevenson & Fanshawe (2007), but the species has been recorded several times in Ruvubu NP and the Kumoso region in north-eastern and estern of Burundi. It occurrence in Rwanda is not much surprising. It seems to indicate that this species is involved in some erratic wandering (Vande weghe, J.P. & G. Vande weghe, 2011).

35. Cassin's Flycatcher (*Muscicapa cassini)*

A very uncommon resident, known from only the Koko River at 1,700m on the south-western edge of the Nyungwe Forest. 1n 1976, 1977 and 1978, several pairs were found along the last 500m of the forested banks of this river. Today the forest has recorded considerably in that area and it is not sure if the species still exist in Rwanda. Dowsett-Lemaire was not able to reach the area in 1990. Currently the area is still very difficult to access, since the gold miners left the park and all footpaths are abandoned. This species hunts from dead wood or emergent stones and rocks over the open water of the river (Vande weghe, J.P. & G. Vande weghe, 2011).

36. Brown-chested Alethe (*Pseudalethe pollacephala)*

The race **vandeweghei** is a very uncommon resident. It has been reported from the lower western part of NNP at about 1,650m, and it existed, at least until the early 1980's, also at 1,300-1,400m in the riparian forests and semideciduous *pterigota* forests of the Kibaya and Kagogo vallyes in the Mugongo region. These forests have been almost totally cleared, and the remaining fragments are strongly disturbed, but the species is probably surviving in the Mashoza parike Forest. In some places it occurs on the same ground as the Red-throated Alethe *A. poliophrys*. It probably also survives in the lowest parts of the Cyamudongo Forest.

Solitarily or in pairs, it feeds on or near soil, often in association with ant columns (Vande weghe, J.P. & G. Vande weghe, 2011).

37. Blue-shouldered Robin-chat (*Cossypha cyanocampter)*

The race **bartelotti** is a very uncommon resident, currently known from only Birengero in ANP. It used to occur also in the Kibaya, Kagogo and Mwambi valleys south of Ngoma, and in the extreme north of the Akagera valley near Kagitumba within the former limits of ANP. It inhabited danse riparian forest and *Pterygota* forest at about 1,300m, feeding mainly on the ground under dense cover. Currently most of its habitat has been cleared, but the species might survive in the Mashoza Parike Forest (Vande weghe, J.P. & G. Vande weghe, 2011).

38. Collared Flycatcher (*Ficedula albicollis*)

A Palearctic migrant visiting the country in unknown numbers. A male, still in nearly full breeding plumage, was recorded in September 1980 on Kiyonza hill in ANP, a male was seen and photographed on 7 and 14 March 2010 near Musanze, and a female was photographed in October 2010 at Akagera Game Lodge (Vande weghe, J.P. & G. Vande weghe, 2011).

39. Western Violet-backed Sunbird (*Anthreptes longuemarei*)

The race **angolensis** was a very uncommon resident, but its current status seems uncertain. It was known from the Akagera valley above the Rusumo falls, where it inhabited *Pericopsis* woodland. It has not been recorded in Rwanda since the Late 1980's, but *Pericopsis* woodland is still abundant on the Tanzanian side of the river. Occasionally a bird could cross the river. This species lives in pairs, feeding in the upper strata of the vegetation mainly as a foliage gleaner. The only specimen collected was initially identified by Priggogine as an Eastern Violet-backed Sunbird *A. orientalis* because of its greenish upper tail coverts, typical for the race *angolensis* (Vande weghe, J.P. & G. Vande weghe, 2011).

40. Little Green Sunbird (*Anthreptes seimundi*)

A very uncommon resident, known from the north-western parts of the Nyungwe Forest at 1,700-1850m in the Nyirakesha and Bururi valleys. Probably often overseen, it inhabits open-canopy forest where it lives at all levels of the vegetation. It feeds solitarily or in pairs on small insects, and it has been reported to take fruit from *Urera* (Vande weghe, J.P. & G. Vande weghe, 2011).

41. **Blue-throated Brown Sunird *(Cyanomitra cyanolaema)***

A very uncommon resident, known from the north-western edge of Nungwe NP at 1,650-1800m in the Nyakabingo and Bururi valleys. It lives in open-canopy forest and second growth, feedings solitarily or in pairs on small arthropods and nectar of e.g. *Albizia gummifera* (Vande weghe, J.P. & G. Vande weghe, 2011).

42. Green-throated Sunbird *(Chalcomitra rubescens)*

An occasional visitor recorded in May and October 1970 in ANP. Being fairly common in the Ruvubu valley in the Burundi, this species could be more frequent around the Rusumo falls before 1975 (Vande weghe, J.P. & G. Vande weghe, 2011).

43. **Amethyst Sunbird *(Chalcomitra amethystina)***

A very uncommon resident or occasional visitor. A pair was collected and photographed for the first time on 26 August 2010 near Ngoma. This species is common in eastern Burundi, including the Ruvubu valley close to the Rwanda border (Vande weghe, J.P. & G. Vande weghe, 2011).

44. Beautiful Sunbird *(Cinnyris pulchellus)*

The nominate race is an occasional visitor, known from two records: a male in mixed plumage was seen on 22 August 1982 at Kanyonza near Kagitumba, and another male, also in mixed plumage, was seen near Gabiro on 12 October 1987 (Vande weghe, J.P. & G. Vande weghe, 2011).

45. White Wagtail (*Monacilla Alba*)

The nominate race is a Palearctic migrant, known as an occasional visitor. Single birds were recorded on 24 January and 19 February 1971 along Lake Kivumba in ANP and on 18 February 1972 in the Karangazi valley of the Umutara region (Vande weghe, J.P. & G. Vande weghe, 2011).

46. Forest Wood Hoopoe (*Phoeniculus castaneiceps*)

Forest wood hoopoe is species of the Phoeniculidae Family. Generally, Forest wood hoopoe is a bird of open woodland, savannah, or thornbrush, and are mainly arboreal. This species requires large trees both for feeding on as well as to provide hollows for nesting and nocturnal roosting. In Our areas, singles and family groups are rather uncommon residents of forest from 1200-2300m (Stevenson, T. and Fanshawe, J., 2002). The population was never quantified but

this species is a very uncommon resident in Rwanda. A single individual was seen in October 1989 at 2,450m on the eastern slopes of Mount Mizimu. Several previous observations in the same area and in the Bururi valley probably refer to the same species. This species was reported on WCS checklist (2008) and in 2010 it was recorded in the Shava valley near Busoro at 1,750m (Vande weghe, J.P. & G. Vande weghe, 2011). However, park guides affirm that the species is very rare and was never seen in the park in the recent past.

47. Pel's Fishing Owl (*Scotopelia peli*)

Pel's Fishing Owl is a species of the Strigidae Family. It is the largest of Africa's fishing-owls. It is reddish-brown bird, with a round head, large, dark eyes, a dark beak, and no ear tufts. The upperparts are marked with fine dark bars, while the underside is paler, with fine dusky streaks that become chevron marks on the flanks, and the tail is relatively short, with broad, dusky bars. It inhabits forest or woodland along the edges of rivers, swamps, lakes and estuaries, up to elevations of 1,700 metres.

The population was not evaluated but the species is very rare in Rwanda. It was recorded along lakes Birengero and Rwanyakizinga, and in the northern Akagera valley near Kagitumba (Vande weghe, J.P. & G. Vande weghe, 2011) but there is no enough information to evaluate the status of this species in Rwanda.

48. Slender-tailed Nightjar (*Caprimulgus clarus)*

The Slender-tailed nightjar is a species in the Caprimulgidae family. It is found in Democratic Republic of the Congo, Ethiopia, Kenya, Somalia, South Sudan, Tanzania, and Uganda. The species inhabits the dry bush, coastal scrub, and untended cultivation, often near water, from sea-level to 2000m (Stevenson, T. and Fanshawe, J., 2002). In Rwanda the species is recorded only in ANP where it inhabits wooded *Acacia* grassland and a steep rocky slope and an individual was recorded singing on the edge of the lake, and once a bird was singing on small shrubs far away in the huge permanent swamp to the north of Lake Rwanyakizinga (Vande weghe, J.P. & G. Vande weghe, 2011). The population was not evaluated and the distribution as well as other ecological factors are not assessed. Brief there is a lack of information of this species in Rwanda.

49. Yellow-bellied Eremomela (*Eremomela icteropygialis*)

The Yellow-bellied Eremomera is a species is in the family of Sylviidae. It is a very small bird 10 cm long and weighing around 9 g. Its upperparts are grey, becoming darker and more olive

on the wings and tail. The species is mostly found in dry scrublands and savannas, especially Acacia woodlands, but also in springs and oasis within arid areas, rural gardens and arable land. It inhabits *acacias* or mixed *acacia-combretum*, bushed and wooded grassland, being most abundant in *Acacia gerrardii* and *Acacia sieberana and* is well adapted to thorny trees, *(*Vande weghe, J.P. & G. Vande weghe, 2011)*.* It is widely distributed in sub-Saharan Africa, from sea level up to an altitude of 1.900 m. (planetbirds, 2015). In Rwanda, the only places where the species can be expected is the ANP. A record from the Mayaga region in 1956 suggests that this species used to exist throughout the eastern Savannah until at least in the 1950s (Vande weghe, J.P. & G. Vande weghe, 2011) and currently extinct. There is a need of more details on this species to evaluate its current status in Rwanda.

Table 4: Summary of bird species assessment

Scientific name	Kinyarwanda name	English name	French names	Status	Criteri(on)a determining overall status
1. *Balaeniceps rex*	Munwarukweto	Shoebill	Bec à Sabot	Critically Endangered	B2aC2aiD
2. *Balearica regulorum*	Umusambi	Grey Crowned Crane	Grue royale	Critically Endangered	A1acd B1abc C2a (i) D1
3. *Bucorvus leadbeateri*	Ikigungumuka	Southern Ground-hornbill	Calao Terrestre du Sud	Critically Endangered	A1acB1ab (iii and iv) C2ai D
4. *Microparra capensis*		Lesser Jacana	Jacana Nain	Critically Endangered	B2iiC2aiD
5. *Netta erythrophthalma*		Southern Pochard	Nette brune	Critically Endangered	A1aB2iiC2aiiD
6. *Polemaetus bellicosus*		Martial Eagle	Aigle Martial	Critically Endangered	A2acB2iiiiiC1ai D
7. *Psittacus erithacus*	Kasuku	Grey Parrot	Perroquet gris	Critically Endangered	A1acB1ab (iv)D
8. *Terathopius Ecaudatus*		Bateleur	Aigle Bateleur	Critically Endangered	A2acB2iiiiiC1ai D
9. *Thalassornis leuconotus*		White-backed Duck,	Canard à dos blanc	Critically Endangered	A1B2iiC2aiD
10. *Torgos tracheliotus*	Inkongoro	Lappet-faced Vulture	Vautour oricou	Critically Endangered	A1aceB1bvC2bD1
11. *Trigonoceps occipitalis*		White-headed Vulture	Vautour à tête blanche	Critically Endangered	A1aceB1bvC2bD
12. *Ardeola idae*		Madagascar Pond Heron	Crabier malgache	Endangered	B2iiC2aiD2
13. *Bradypterus graueri*	Incenceberi	Grauer's Swamp-warbler	Fauvette de Grauer	Endangered	B1iiC2b
14. *Calamonastides gracilirostris*		Papyrus Yellow Warbler	Fauvette jaune aquatique	Endangered	B2bC2bD
15. *Laniarius mufumbiri*		Papyrus Gonoleck	Gonolek des papyrus	Endangered	B2bC2bD
16. *Lybius rubrifacies*		Red faced Barbet	Barbican à face rouge	Endangered	B1ab (iii)C2aii).
17. *Necrosyrtes monachus*	Inkongoro	Hooded Vulture	Vautour charognard ou Percnoptère brun	Endangered	(A1ace)B1ab (iii and iv)
18. *Neotis denhami*		Denham's Bustard	Outarde de Denham	Endangered	A1ac B1ab (iii) C2aii)

19. *Scleroptil levaillantii*		Redwing Francolin	Francolin à ailes rouges	Endangered	B2aiiD1
20. Serinus koliensis		Papyrus Canary	Serin de Van Someren	Endangered	B2bC2b
21. Cryptospiza shelleyi		Shelley's Crimsonwing	Bengali de Shelley	Vulnerable	B1a(iii and iv)C2bD2.
22. Francolinus afer	Inkware	Red-necked Spurfowl Francolin	Francolin à gorge rouge	Vulnerable	A1adeB1a(iii and iv)C2bD2
23. Francolinus nobilis	Inkware	Handsome Francolin	Francolin noble	Vulnerable	B1a(iii and iv)C2bD2
24. Kupeornis rufocinctus		Red-collared Mountain-babbler	Timalie à collier roux	Vulnerable	B1ab (iii and iv) Caii D2
25. Numida meleagris	Inkanga	Helmeted Guineafowl	Pintade commune	Vulnerable	A1ade B1a(iii and iv)C2bD2
26. Pitta angolensis		African Pitta	Brève d'Angola	Vulnerable	B2aiiiC2aiD1

CHAPTER 6. TERRESTRIAL THREATENED MAMMAL SPECIES

Rwanda shelters 151 different types of mammal species (Chemonics International Inc., 2008). Distribution maps for each species are provided in appendix 3.

6.1. Critically Endangered mammal species

6.1.1. *Giraffa camelopardalis* (Linnaeus , 1758) (Rwa: Munagajosi/Twiga; Eng: Giraffe; Fr: Giraffe))

Belonging in the family of Bovidae, with a long neck and legs, a giraffe may reach 5–6 m tall, with average weight around 1,000kg; males are taller than females, each individual giraffe has a unique coat pattern.

The giraffe is found in Africa, in Rwanda, it is only found in ANP. The giraffe is found in Africa, in Rwanda, it is only found in ANP. The giraffe was introduction to ANP in 1986 with 6 giraffe (4 females and 2 males) for conservation and tourism purposes, given the normal inter-birth periods of at least 2 years. A female giraffe gets mature between 5 and 6 years. Based on the introduced population today we should have more than 300 (three hundreds) giraffes; instead, there are currently around 60 giraffes in the park (ANP 2013) and some threats leading face this ecosystem (CR A4abcd). The extent of occurrence is 1122 km^2, with a degraded habitats, and in poor quality which categorize the species under criteria for B1ab (iii). Certainly the mature individuals are less than 50 under habitat fragmentation which results in critically endangered category under criteria for C1 2a (ii) and D1. Therefore the giraffe is assessed as **Critically Endangered** (CR) under the critera **CR A1abcd; C2a (ii); D1.** Control illegal activities by strict

law enforcement, habitat quality assessment are recommended and monitoring of existing populations and public awareness is highly recommended.

6.1.2. *Gorilla Gorilla beringei beringei* (Matschie 1905) (Rwa: Ingagi; Eng:Mountain gorillas; Fr: Gorille de montagne)

The mountain gorilla is a migratory species belonging to the family of hominidae, Gorillas can be identified by nose prints unique to each individual and weight up to 200kgs. They live in families and predominantly folivores (Groves 2005). The mountain is a very fragile primate, which ca not be found in any zoo in the world, it is listed on the CITES list in first categories. It has been categorized by IUCN as an endangered species; it is endemic to the Albertine rift. The Mt gorillas are only found in the virunga massif with around 480 individuals (Gray *et al.* 2011) and the Bwindi Impenetrable National Park in Uganda with 400 individuals (Robbins *et al.* 2012). A total of 480 gorillas can be found in the Virunga massif, roughly, a half of Mt gorillas of the massif frequent the VNP Rwanda at a time. In the virunga massif, the Mt gorillas has recognized a steady increment from 1980's, the recent increase was around 26% (from 2003 to 2010) , the current threats include continuing the illegal activities dominated by snares (Gray *et al.* 2011). Given that around 200 gorillas frequent the VNP, under veterinary control and high protection, and recent vegetation shifts and habitat degradation, these results in categorizing the species as critically endangered under criteria A4abcd. The extent of occurrence is 160km^2, with a lack of buffer zones around their range and some of the key food started to shift upwards, therefore the species is assessed as Endangered under criteria B1ab (iii), there are no signs of population decline of fluctuation or extinction during the last 30 years therefore the criteria C, D and E are not evaluated. The final categorization is **Critically Endangered CR A4abcd.** A continuous research and protection is needed to ensure the survival of the species. Control illegal activities by strict law enforcement, habitat quality assessment are recommended and monitoring of existing populations and public awareness is highly recommended.

6.1.3. *Loxodonta africana africana* (Blumenbach, 1797) (Rwa: Inzovu; Eng: African savannah elephant; Fr: Elephant)

Belonging to the family of elephantidae, the African elephant is the biggest and largest terrestrial large mammal; it can reach a height of 4 m and weigh up to 7,000 kg. It is distinguished by its long trunk, tusks and large ears. Elephants are herbivorous. It is considered as keystones species due to its impact on their environments. The habitat is made of Savannah. The savannah elephant has been recorded in ANP. The original population disappeared in 1960's due to hunting. In 1975, a group of 26 young elephant were three babies that needed hand-rearing and one youngster named Mutware "the Chief" were translocated from Bugesera to ANP. Even if the population trend is promising with 88 total numbers of elephant individuals in the park (ANP 2013), they are largely hunted for ivories, which leads the population to fluctuate, furthermore, their habitats is seriously degraded , the species is categorized as critically endangered under criteria A4abcd. The extent of occurrence 1122 km^2 with habitat degraded by bush fire, and natural disasters such as drought, therefore, it is assessed as endangered under criteria B1ab (iii). Even if there are no signs of population fluctuation during the last 10 years, obviously there are a low number of mature individuals which categorize the species as critically endangered in the criteria under C1, the population is very small, and however, there are no information on the number of the mature individuals, therefore the criteria under D is not evaluated. Based on the total population which may extinct in case of few attempts by poachers, this result in the categorization of **Critically Endangered CR A4abcd; C1.** Extensive field research to know its habits, ecological role, status trends, distribution and public awareness is recommended. Control illegal hunting by strict law enforcement, habitat quality assessment is recommended and monitoring of existing populations and public awareness is highly recommended.

6.1.4. *Loxodonta africana cyclotis* (Blumenback,*1797)* (Rwa: Inzovu; Eng: African forest elephant; Fr: Elephant)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Belonging to the family of elephantidae, the African forest elephant is smaller than savannah elephant, herbivorous; it is also the keystones species due to its impact on their environments. The elephants are the major crop raiders around the park. The main threats are poaching for ivory and lack of buffer zone, the subspecies has extinct in NNP. The total number of forest elephant in the VNP is considered as declining, the current estimate was less than 10 elephant s in the VNP which come seasonably, mainly during the dry seasons. The total number of elephant population frequenting the VNP is decreasing from around 100 in 1991 (Plumptre 1991) to 30 in 2004 (Owiunji *et al.* 2005) and less than 10 in 2010 (Arakwiye *et al.* 2010), in the VNP, the elephant visit the wetlands and lakes, however these places are almost disappearing, therefore the species is assessed under criteria of CR A1abcd. The extent of occurrence is 160 km^2, generally there is habitat loss in the area, this categorize the species under criteria of EN A1; B1ab (iii). Given that the number of mature individuals is surely low which falls in critically endangered category under criteria for C12a(ii) and D1, as the species migrate between neighboring parks, and by considering higher illegal hunting in the Virunga National Park, the species may extinct, therefore, the criteria under E strengthen the species as critically endangered.

These results categorized the species as **Critically Endangered CR A1abcd; C2a (ii); D1; E.** Research is important to monitor the population trends, law enforcement and trans boundary collaborative protection efforts are need. Control illegal activities by strict law enforcement, habitat quality assessment are recommended and monitoring of existing populations and public awareness is highly recommended.

6.1.5. *Redunca arundinum* (Hamilton Smith, 1827) (Eng: Reedbuck)


Photo credit:
Christopher Kidd

Belonging in the family of Bovidae, the reedbuck measure from 60 up to 90 cm, its color is reddish brown. The reedbuck lives in the few countries of the southern Africa. It is found in savannah lands, in Rwanda, it is found in ANP. The current population has declined to less than 50 individuals the population comparing to 74 individuals recorded within 10 years, the current threats includes poaching and habitat degradation which lead to categorize the species as Vulnerable under criteria A4ab. The extent of occurrence is less than 1122 km^2, there is a habitat degradation and poor quality of the habitat, which categorize the species as criteria EN B1ab (iii). Given the current number of the mature individual is below the IUCN threshold and there is continuation fluctuation and population decline, the species is assessed under criteria for CR C2a (i); D1. Considering the current threats and number of individuals including mature, the highest criteria remain unchanged as **Critically Endangered CR C2a (i); D1.** Research investigating habitat quality and current population trend is recommended. Control illegal activities by strict law enforcement, habitat quality assessment are recommended and monitoring of existing populations and public awareness is highly recommended.

6.1.6. *Rhinolophus hilli (Aellen, 1973)* (Eng: Horsehoe bat; Fr: Redunca)

The Hill's horsehoe bat is a species of mammal in the Rhinolophidae family, feed on insects. Endemic to Rwanda, it is categorized as Critically Endangered species by IUCN. Its population might be declining, but there is no accurate data, therefore the criteria A are not evaluated. The species is only found in 7 caves in NNP, therefore the areas of occupancy are below the IUCN threshold for critically endangered. Its habitat is threatened by human activities (agriculture), illegal activities and disturbances and use of forest resources, which categorize the species under the criteria for CR B1ab (iii,v)+2ab(iii,v), there is no data on population trend and fluctuation, the criteria under C and D is not evaluated. Therefore the criteria remain unchanged: **Critically Endangered CR B1ab (iii,v)+2ab(iii,v).** Research is important to monitor the population trends and continuous protection of the habitat.

6.2. Endangered mammal species

6.2.1. *Aepyceros melampus* (Lichtenstein, 1812) (Rwa: Impala; Eng: Impala; Fr:Impala)


Females


Male

Belonging in the family of Bovidae, the impala is a sexually dimorphic antelope; females are smaller than the horned males. The body length is 120–160 cm (head-body) the tail is generally less than 50cm; males may reach around 70kg and 50 for females. The impala inhabits savanna grasslands and woodlands close to water sources. Impala are fast runners and are known for their leaping ability which may reach 3m of heights. It is found in southern Africa, in Rwanda it is only found in ANP. The population trends shown fluctuation the population with the current 1057 individuals in 2013 from 1890 recorded in 1998 and the population is targeted by poachers, which results in category for EN A4abcd. The threats included poaching, degradation and fragmentation of the habitats. The extent of occurrence is 1122km^2, which recognize a habitat loss and in poor quality, therefore it is categorized as EN B1b (iii). There is no indication of low number of mature individuals, therefore the criteria under C, D and E is not evaluated. The results categorize the species as **Endangered EN A4abcd.** Further research is recommended to assess the quality of the wild habitat and status of population. Monitoring of remaining population and effective law enforcement is recommended to safeguard the remaining population.

6.2.2. Cephalophus nigrifrons (Gray, 1871) (Rwa: Ifumberi; Eng: Black fronted duiker; Fr: Cephalophe a front noir)

The duiker belongs to the family of bovidae, it averagely weight of 10 kg, it is found in the ANP, the VNP, and NNP. It is extinct in all the other Rwandan forest mainly due to poaching. The total number of duiker in the VNP has dramatically changed from around 2,000 individuals in 1991 (Plumptre 1991) to 200 individuals in 2004 (Owiunji *et al.* 2005) and around 200 individuals in 2010 (Arakwiye *et al.* 2010). The duiker are estimated around 1000 in NNP (WCS 2014) but increasing, while, the number of duiker in the ANP is not well known but very few, therefore, it is categorized as Vulnerable under criteria A4cd. The EOO is The EOO is less below 5,000 km^2, but the habitat has been reduced during the last 30 years, and continued to be degraded, therefore the criteria is assessed as EN B1ab (iii). There is no data indicating population fluctuation, decline of extinction, therefore the criteria under C, D, and E are not evaluated. The results categorize the species under criteria for **Endangered EN B1ab (iii).**). Research on habitat quality, strict law enforcement and population trends are recommended.

6.2.3. *Cercopithecus ascanius*, (Audebert, 1799) (Rwa: Umukunga; Eng: Redtail monkeys; Fr: L'ascagne)

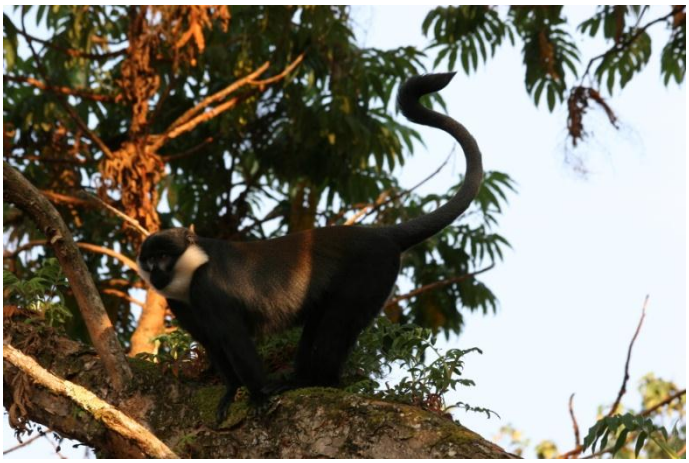
The red-tailed monkey, black-cheeked white-nosed monkey, red-tailed guenon, redtail monkey, or Schmidt's guenon, is a species of the Cercopithecidae family. The red-tailed monkey is usually black, red, or orange. It mainly feeds on fruit, it is found in Sub-Saharan Africa, in Rwanda, they are found in the NNP, with a very rare or opportunistic sighting, and possibly, surveys can end up without any detection or very few encounter rate of even less than 0.01 (WCS 2014), there is no

sufficient data to estimate the population, the criteria under A is data deficient. The extent of occurrence is 1010 km^2, and its habitat is being degraded overtime, therefore, it is categorized under the criteria of EN B1ab (iii), the species are often hunted; however, there is no data on population fluctuation and/or decline, thus the criteria under C, D and E is not evaluated. The results categorize the species under criteria of **Endangered EN B1ab (iii).** Extensive research and monitoring of remaining population is recommended.

6.2.4. *Cercopithecus hamlyni* (Pocock, 1907) (Rwa: Igihinyage; Eng: Owl-faced monkey; Fr: Cercopitheque a tete de l'hibou)

Belongs to the family of Cercopithecidae and classified as Vulnerable by IUCN, the Owl-faced monkey with the average adult weighing 7 to 10 kg (Groves 2005). The population estimate is 3.4 individuals per group (Easton et al. 2011), and the forest is thought to host less than 30 groups, which gives an estimate of less than 100 individuals, but, there is no previous records to estimate the population decline. The criteria under A are not evaluated. In Rwanda, this species is found in NNP, it is only restricted to the bamboo zone as areas of occupancy which covers only 32 km^2, which is 1% of the NNP (Easton et al. 2011). Local people harvest the bamboo, and illegal activities such as trapping affect the species. This categorize the species as endangered under criteria B1ab (iii); since, there is small population which may decline under current threat to the habitat, this species is categorized as endangered under criteria for C1 (a,i), therefore, the species is assessed under criterion **Endangered EN B1ab(iii);C1(a,i).** Impact of the current bamboo degradation on the species as well as population trends should be investigated.

6.2.5. *Cercopithecus l'hoesti* (P. Sclater, 1899) (Rwa: Icyondi; Eng: L'hoest's monkey: Singe de montagne)



Belongs to the family of Cercopithecidae and classified as Vulnerable species by the IUCN, the adult l'hoesti's monkey weights between 3.5 to 6 kg, it is predominantly herbivores (Groves 2005). The density has increased from 1.7 to 3.6, means the total population is estimated around 4000 individuals in NNP (Plumptre *et al.* 2002; WCS 2014), and criterion under A is not evaluated. Endemic to the Albertin Rift, L'hoesti's monkey is only found in the NNP and the Gishwati forest, they are found in most part of the forests, the EOO is less than 5000 km^2, the species is assessed for EN B1ab (iii). The current threats includes hunting, habitat loss and forest encroachment, there is no signs of population decline or fluctuation, therefore the criterion under C and D are not evaluated. The species is assessed as **Endangered** based on the criterion **EN B1ab (iii).** Research is needed to further investigate the present status and state of the habitat.

6.2.6. *Cercopithecus mitis kandti* (Matschie 1905) (Rwa: Inkima; Eng: Golden Monkey; Fr: Singe doré)

The golden monkeys belong to the family of *Cercopithecidae.* With a diadem, and golden back, the golden monkey is an endangered species to the IUCN due to the habitat loss. It is only found in the Virunga massif, it is also found in the remnant part of Gishwati forest in Rwanda (Groves 2005). Given that the total number of the golden monkey reported in MGNP (Twinomugisha *et al.* 2006), the total golden monkey population is between 2,500 and 3,500

individuals in the world; the total population in Gishwati (almost degraded) is thought to be less than 100 individuals (Pers. Com). The current population is thought to be declining with 40% decline recorded in the one of park of the Virunga massif. The total population in the VNP is estimated to be around 2000 individuals. The species is assessed as Vulnerable under criteria A. Extent of occurrence is around 190 km^2, and the area of occupancy which is the bamboo zone is estimated around 53 km^2. Local people harvest bamboo for local use(Aveling 1984), it is thought that the bamboo zone is under threats due to the environmental changes, therefore the criteria under B can be categorized as endangered under criteria B1 ab(iii)c(i,ii). Considering the possible decline in golden monkey population, the number of mature individuals (less than 2500) is expected to decline in the next 5 years; therefore the criteria under is categorized as endangered under criteria for C1. Given the number of total individuals, thus the criteria under D and E are least concern. Based on the EOO, the species is assessed as **Endangered** based on the criterion of **EN B1ab (iii) c(i,ii);C1.** A continuous trend on population trend, quality of the habitats and habitat degradation is highly recommended.

6.2.7. Cercopithecus mona (Schreber, 1774) (Eng: Mona monkeys; Fr: La Mone)

The mona monkeys belongs to the family of Cercopithecidae, arboreal species living in groups of up to 30 individuals. It mainly feeds on fruit; the mona monkey carries food in cheek pouches. It is mainly found in sub-Saharan Africa countries and but very rare in central Africa. In Rwanda, the mona monkey is only found in NNP, with a very rare or opportunistic sighting, and possibly many surveys can end up without any detection or very few encounter rate from 0.2 in 2009 to 0.02 in 2014 (WCS 2014), there is no sufficient data to estimate the population, the criteria under A is data deficient. The extent of occurrence is 1010 km^2, and its habitat is being degraded overtime, therefore, it is categorized under the criteria of EN B1ab (iii), the species are often hunted; however, there is no data on population fluctuation and/or decline, thus the criteria under C, D and E is not evaluated. The results categorize the species under criteria of **Endangered EN B1ab (iii).** Extensive research and monitoring of remaining population is recommended.

6.2.8. *Colobus angolensis angolensis* (P.Sclater, 1899) (Rwa: Inkomo, Imbeya; Eng: Angolan black-and-white colobus; Fr: Colobe d'Angola)


Image courtesy of Kambogo I. (RDB)

The Angola colobus, Angolan black-and-white colobus, or Angolan colobus is an arboreal species and mainly feed of plant leaves, belonging to the subspecies of Sclater's Angola colobus and Cercopithecidae family. The Angola colobus has black fur and a black face, surrounded by long, white locks of hair. It also has a mantle of white hair on the shoulders. Its tail is longer (75cm) than head body length (up to 70cm) and the body weight varies between 9 to 20 kg. In Rwanda, the Angolan colobus is only found in NNP. The Angolan colobus seems to be concentrated in some patches of the park, mainly in the north-western part of the park, some groups may made of more than 300 individuals (Plumptre 2002, WCS 2014). The population of the colobus seems to be declining with the encounter rate of 3 individuals in 2009 to 1 individuals in 2014 and often hunted (WCS 2014), therefore, the species is endangered based on the criteria A4abcd., The EOO is less than 5000 km^2, and there is a loss of habitat quality and encroachment, the area occupied by the Angolan colobus is less than 1/3 of the park. However, there is no information regarding the population fluctuation of population declines therefore, thus the criteria under C, D and E is not evaluated. The species is assessed under the criteria for **Endangered EN A4abcd; B1ab (iii).** Monitoring and surveys of the remaining populations and their habitats is also required throughout its occurrence range.

6.2.9. *Crocidura lanosa* (Balsac, 1968) (Eng: Kivu long-haired shrew)

The Kivu long-haired shrew is a species of mammal in the soricidae family, feed on insects. It is found in DRCongo and in Rwanda, In Rwanda, they are only found in NNP (Peterhans et al. 2013). It is categorized as endangered species by IUCN. The current population is not known. It is threatened by habitat loss, there is continuing decline in the EOO, quality of the habitat and number of locations, the extent of occurrence is 1010 km^2, this results in categorization of EN B1ab (iii). The population trends, the number of mature individuals and their decline are not available, therefore the criteria under C,D, and E are not evaluated. Consequently, the cited category is **Endangered EN B1ab (iii).** Extensive field research to evaluate quality of the habitat and population trend is recommended.

6.2.10. *Damaliscus korrigum* (Ogilby, 1837) (Rwa: Inyemera; Eng: Topi)

Belonging in the family of Bovidae, the Topi's head-and-body length can range from 150 to 210 cm resemble hartebeest but have a darker coloration and lack sharply angled horns. They have elongated heads, a distinct hump at the base of the neck, and reddish brown bodies with dark purple patching on their upper legs. Ranging in the Savannah, in Rwanda, it is found in ANP. The population trends shown fluctuation the population with the current 560 individuals recorded in 2013 from 770 recorded in 1998 and the population is hunted, which results in category EN A4abcd. The extent of occurrence is 1122km^2, which recognize a habitat loss and in poor quality, therefore it is categorized as EN B1ab (iii). The current population under criteria for C categorizes the species under VUC1. There is no indication of low number of mature individuals, therefore the criteria under D and E is not evaluated. Given that the current population may decline in case of any time, the species is categorized as **Endangered EN A4abcd; B1ab (iii).** Further research is recommended to assess the quality of the wild habitat and status of population. Monitoring of remaining population and effective law enforcement is recommended to safeguard the remaining population.

6.2.10. *Delanymys brooksi* (Hayman, 1962) (Eng: Delany's Mouse)

Delany's Mouse is a rodent of the family of Cricetidae,herbivore, with long hind legs and long tail, It is categorized as Vulnerable species by IUCN under criterion B1ab(iii). Endemic to the Albertine Rift, it is only found in high altitude (1700-2625 m) in and near marshes, living in moist montane forests. In Rwanda, it is only found in NNP, the population size is not known, criteria under A is not evaluated. Its habitat is threatened by habitat loss, and poor quality of the habitat, while its extent of occurrence is 1010 km^2, therefore, it is categorized as endangered under the criterion EN B1ab(iii), there is no records in population decline or fluctuations therefore the criteria under C,D, and E are not evaluated . Therefore, the species remains **Endangered EN B1ab (iii).** State of habitat, latest distribution patterns, and habitat quality should be assessed.

6.2.11. *Equus quagga* (Linnaeus, 1758) (Rwa: Imparage; Eng: Zebra; Fr: Zèbre)

Belonging in the family of equidae, the zebra is animal with creamy white legs, lower neck, belly, inside of thighs and buttocks; the upright stiff mane of hairs ends abruptly and consists of dark chestnut hairs.

It is found in Savannah in areas with poor vegetation cover. The habitat is made of Savannah. It is found in southern African parks. In Rwanda it is only found in the ANP which recognize a higher poaching incidence, and fire. The current total population has shown an increase up to 999 individuals within the last 10 years (ANP 2013), but with a decline in the EOO, thus the species is categorized as Vulnerable under A4bc. The extent of occurrence has been reduced

to half with a remaining area of 1122 km^2, with poor quality of the habitat which falls in criteria for EN B1ab (iii). There are no indications of mature individuals decline or fluctuation, thus the sub criteria under C and D are not evaluated. The Zebra qualifies for **Endangered EN B1ab (iii).** Research investigating habitat fragmentation and degradation and current population trend is recommended.

6.2.12. *Hippopotamus amphibious* (Lennaeus, 1758), (Rwa: Imvubu; Eng: Common hippopotamus or Hippo; Fr: Hippopotame)

Belonging in the family of hippopotamidae, the hippo is a large mammal found in sub-Saharan. The males may weigh up to 1500kg while females weigh up to 1300kg. Hippo is capable of running 30 km/h over short distances, and it is ranked among the most dangerous animals in Africa. In Rwanda, the hippos are mainly found in ANP, and its surrounding lakes and rivers. The population trends shows a steady increase from 552 to 885 within 10 years, the mains threats are poaching and habitat degradation and degraded quality of the habitat, the species is categorized under criteria for VU A4abcd; while the extent of occurrence is 1122km^2, threatened with habitat degradation and poor quality of the habitat which falls in EN B1ab(iii), given the number of total individual, the criteria under C is least concern, there is no indication of few mature individuals in decline, therefore the criteria under D is least concern. The species is categorized as E**ndangered** based on criteria for **EN B1ab (iii).** State of habitat, latest distribution patterns, and habitat quality should be assessed.

6.2.14. *Hippotragus equinus* (Desmarest, 1804) (Kin: Inkoronko; Eng: Roan antelope; Fr: Antilope Rouane)

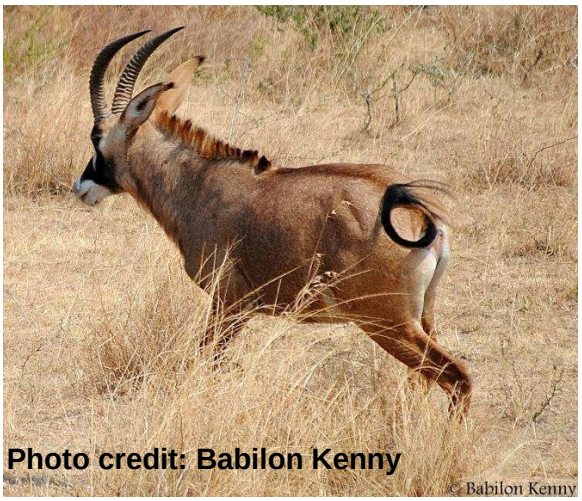


Photo credit: Babilon Kenny

Belonging in the family of Bovidae, Roan antelope is one of the largest antelope, it only found in southern Africa; adult Roan may weigh up to 280kg. Ranging in the Savannah woodlands, in Rwanda, it is only found in ANP. The current population is around 88 individuals, there are no previous data to document the population trends, but with great probability of the fluctuation of the population with no detection during past 3 surveys, and the habitat degraded with poor quality, the criteria under A is data deficient. The extent of occurrence is 1122km^2, which recognize a habitat loss and in poor quality, therefore it is categorized as EN B1b (iii). Given that the current population is low with low number of mature individuals, the species can be categorized under C2a (i), and D1 as endangered. Based on the EOO and current population, the species is expected to decline in case of any time, the species is categorized as **Endangered EN B1b (iii); C2a (i); D1.** Further research is recommended to try to assess the current population, assess the quality of the wild habitat and status of population.

6.2.15. *Kobus ellipsiprymnus* (Ogilby, 1833) (Rwa: Indonyi; Eng: Waterbuck; Fr: Kobe defassa)

The waterbuck belongs to the bovidae, sexually dimorphic animal; it may reach around 120 cm tall, and may weigh between 160-260 kg. A gregarious animal living in savannah, it is found only in ANP. The total population shown a decline with 1144 recorded in 2010 and 948 recorded in 2013 (ANP 2013), there a population decline which categorizes the species under criteria of ENA4abcd. The extent of occurrence is less than 1122 km^2, the threat including habitat loss and poor habitat

quality which falls in criteria for EN B1ab (iii). The current population under criteria for C categorizes the species under VUC1. There is no indication of low number of mature individuals, therefore the criteria under D and E is not evaluated. Following the recent surveys that shown the population declines, the highest category of this species met is **Endangered EN A4abcd B1ab (iii).** Further research is recommended to assess the quality of the wild habitat and status of population. Monitoring of remaining population and effective law enforcement is recommended to safeguard the remaining population.

6.2.16. *Lophocebus albigena* (Gray, 1850) (Rwa: Igishabaga; Eng: Grey-cheeked mangabey; Fr: Mangabey)

The grey-cheeked mangabey is an arboreal monkey belongs to Cercopithecidae, lives in groups of between 5 to 30 individuals. It feeds primarily on fruit, particularly figs. It is found in the forests of central Africa, In Rwanda, the grey-cheeked mangabey endemic to NNP, mainly in the west, with few sightings in the southern section of the park, specifically at Nyabitondo and Uwinka. The population of the mangabey seems to be declining based on encounter rates from 0.5 in 2009 to 0.1 in 2014 (Plumptre et al. 2002; WCS 2014), however there is no data to estimate the population, therefore criteria A is data deficient . The extent of occurrence is 1010 km^2, and the current threats includes hunting, habitat loss and forest encroachment, this falls in criteria of EN B1ab (iii). Due to the data deficient, there is no information regarding the population fluctuation of population declines therefore, thus the criteria under C, D and E is not evaluated. Based on the EOO, the species is assessed as **Endangered** under criteria of **EN B1ab (iii).** Research is needed to further investigate the present status and the status of the habitat.

6.2.17. *Lophuromys rahmi* (Verheyen, 1964) (Eng: Brush-furred Rat)

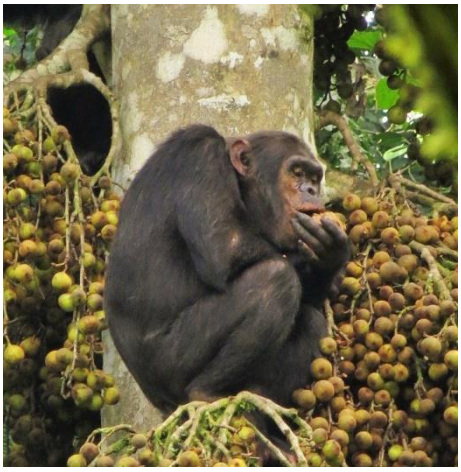
Brush-furred Rat is a rodent of the family of Muridae, it is both nocturnal and diurnal, it feeds on insects and plants, it weight up to 100g. It is categorized as endangered species by IUCN. Endemic to the Albertine Rift. In Rwanda, it is only found in NNP. It is threatened by habitat loss and poor quality of the habitat, encroachment and resource use, the population size is not known, criteria under A is not evaluated. Its habitat is threatened by habitat loss, and poor quality of the habitat, while its extent of occurrence is 1010 km^2, therefore, it is categorized as endangered under the criterion EN B1ab (iii). There is no records in population decline or fluctuations therefore the criteria under C,D, and E are not evaluated, therefore the criteria remains **Endangered EN B1ab (iii**). State of habitat, latest distribution patterns, and habitat quality should be assessed.

6.2.18. *Oreotragus oreotragus* (Zimmerman 1783), (Rwa: Igihondamabare; Eng: Klipspringers; Fr: Oréotrague)


Photo credit: Christopher Kidd

Klipspringers are herbivores, belongs to Bovidae. It is found in Sub Saharan countries reaching approximately 58 cm (22 inches) at the shoulder, form breeding pairs; although males are generally larger than the female. In Rwanda, the Klipspringers are only found ANP. The current population size is not known, but very few as the surveys left undetected, he mains threats are poaching and habitat degradation and poor quality of the habitat, the extent of occurrence is less than 1122km^2, therefore the species is categorized as EN B1ab (iii), there is no indications of population decrease, therefore the criteria under C, D, and E are not evaluated. The species is categorized as **Endangered** based on criterion **EN B1ab (iii).** Further research to assess the quality of the habitat, overall population trends is recommended. In future, sustainable use may be recommended after determining overall population's level.

6.2.19. Pan troglodytes (Blumenbach, 1775) (Rwa: Impundu; Eng: Chimpanzee; Fr: Chimpanze)



This primate belongs to the Hominidae; it is classified as vulnerable species by IUCN, the chimpanzee stands up to 1.2 m high and weighs as much as 70 kg. Chimpanzees live in large multi-male and multi-female social groups. Chimpanzees make tools and use them to acquire foods and for social display (Goodall 1986). Chimpanzees have traditionally been kept as pets in a few African villages. In Rwanda, the chimpanzee is found in the NNP and Gishwati forest , living in specific areas, with at total number of chimpanzees remains stable with individuals estimated is equal to around 400 individual from 2002 in NNP(Plumptre et al. 2002; WCS 2014), including Gishwati forest with less than 30 individuals (pers. com.). The population has had slight decline, therefore, the species is categorized as Vulnerable under A4cd, the EOO is less than 5,000 $km^{2,}$ but one of the habitat, Gishwati has been reduced from 328 km^2 to around 20km in the last 30 years, The current threats include hunting, habitat loss and forest encroachment, which falls under criteria for EN B1ab (iii).Based on surveys, there is no population decline or fluctuation, therefore the criteria under C and D are not evaluated. Therefore, it is categorized as under **Endangered EN B1ab (iii).** It is important to monitor the habitat quality in the patches used by the species, and investigate why the population is stable (not increasing).

6.2.20. *Panthera pardus* (Linnaeus, 1758) (Rwa: Ingwe; Eng: Leopard; Fr: Leopard)

Photo credit: Sarah Hall (ANP)

The leopard belongs to felidae, the leopard may stand up to 66cm at the shoulder; the head and body length is 117cm. The tail is very long and slender averaging about two third of the head and body length. May weight up to 40 kg, it has a deep, laterally compressed body with comparatively short, stout legs and very broad and large paws. Leopard is globally found in the Sub-Saharan Africa, and Asia. Even if there were no surveys on the species, it is sporadically seen ANP and

possibly in Ibanda makera forest, the habitat is made of Savannah, gallery forest and around small patchy forest. There were reported sightings (before 30 years) of Leopard in Mukura forest (pers. com), and Kibirizi-Muyira and NNP (pers. com), and VNP (Gyldenstolpe 1928), however, there was no recent sightings. The population size is not known thus criteria A is not evaluated, while the remnant extent of occurrence (EOO) is estimated to be less than 5,000 km^2, with habitat degradation and fluctuation in some of the localities, the species is categorized under criteria EN B1ab (iii) c (i,iii). There are no indications of population decline or fluctuation, thus the sub criteria under C and D are not evaluated. Based on the EOO and current threats to the habitat, the species met the criteria for **Endangered EN B1ab (iii) c (i,iii).** Research investigating habitat fragmentation and degradation and current population trend is recommended.

6.2.21. *Phacochoerus africanus* (Gmelin, *1788)* (Rwa: Isatura; Eng: Common warthog or warthog; Fr: Phacochère)

Phacochoerus africanus is considered as a wild pig in the family of Suidae, it is found in the grassland, savanna, and woodland of the sub-Saharan Africa, the common warthog is medium-sized species; the warthog has two pairs of tusks, their head-and-body lengths range from 0.9 to 1.5 m. Males are may weigh up to 150kg . In Rwanda, it is found in ANP. The population trends shows a steady increase from 240 to 741 within 15 years the main threats are poaching and habitat degradation, the species is categorized under criteria for VU A4abcd; while the extent of occurrence is $1122km^2$, threatened with habitat degradation and poor quality of the habitat which falls in EN B1ab(iii). given the number of total individual, the criteria under C is least concern, there is no indication of few mature individuals in decline, therefore the criteria under D is least concern. The result is **Endangered EN B1ab (iii).** State of habitat, latest distribution patterns, and habitat quality should be assessed.

6.2.22. *Ruwenzorisorex suncoides (Osgood, 1936)* (Eng: Ruwenzori shrew)

The Ruwenzori shrew known as the Osgood's Montane Shrew is a species of mammal in the soricidae family, weigh up to 18g, greyish and rounded head, and feed on insects. It is categorized as vulnerable species by IUCN. Endemic to the Albertine Rift, it is only found in the Albertine Rift, living along streams in the cloud forests. In Rwanda, it is only found in NNP. The population size is not known. It is threatened by habitat loss, there is continuing decline in the EOO, quality of the habitat and number of locations, the extent of occurrence is 1010 km^2, therefore, it is categorized as endangered under the criterion EN B1ab (iii). With no records in population decline or fluctuations therefore the criteria under C,D, and E are not evaluated. The criteria remain **Endangered EN B1ab (iii, iv).** Extensive field research to evaluate quality of the habitat and population trend is recommended.

6.2.23. *Sylvicapra grimmia* (Linnaeus, 1758), (Rwa: Isha; Eng: Common duiker; Fr: Céphalophe couronne)

The common duiker also known as the grey or bush duiker, is a small antelope with small horns found in Sub Saharan countries, it is found in Savannah, generally weighs 12 to 25 kg ; although females are generally larger and heavier than the males, they are generalists diet. Male are territorial they prefer to rest in places with elevated ground, where they can observe their territory. In Rwanda, the common duiker is only found ANP. The current population size is not known, but very few as the surveys left undetected, he mains threats are poaching and habitat degradation and poor quality of the habitat, the extent of occurrence is less than 1122km^2, therefore the species is categorized as EN B1ab (iii), there is no indications of population decrease, therefore the criteria under C, D, and E are not evaluated. The species is categorized as **Endangered** based on criterion **EN B1ab (iii).** Further research to assess the quality of the habitat, overall population trends is recommended. In future, sustainable use may be recommended after determining overall population's level.

6.2.24. *Sylvisorex lunaris (Thomas, 1906)* (Eng: Moon Forest Shrew)

The moon forest shrew (*Sylvisorex lunaris*) is a species of mammal in the soricidae family, weight up to 12g, feed on insects; they predominantly live in forest or riverine habitat. It is categorized as vulnerable species by IUCN. Endemic to the Albertine Rift, it is only living in moist montane forests. In Rwanda, it is only found in NNP. The population size is not known. There is continuing decline in the EOO, quality of the habitat, the extent of occurrence is 1010 km^2, therefore, it is categorized as endangered under the criterion EN B1ab (iii). With no records in population decline or fluctuations therefore the criteria under C,D, and E are not evaluated, the criteria remains **Endangered EN B1ab (iii).** Extensive field research to evaluate quality of the habitat and population trend is recommended.

6.2.25. *Sylvisorex vulcanorum* (Hutterer & Verheyan, 1985) (Eng: Volcano shrew)


Photo credit: Chris Roche

The volcano shrew belongs to the soricidae, endemic to the albertine rift, it is only found in the high altitude rain-forests of Rwanda, Burundi, DRCongo and Uganda, specifically, it lives in moist area and swamps.

However, its population trends are not known. It is found in the VNP. The extent of occurrence is less than 160 km^2, with habitat degradation and fragmentation, some moist areas are already drying up, therefore, it can be categorized as endangered under B1ab(iii). Given that there is no data on population decline or fluctuation, the criteria under A, C, D is not evaluated. Certainly, the species is categorized as **Endangered EN B1ab(iii).** State of habitat, latest distribution patterns, and habitat quality should be assessed.

6.2.26. *Syncerus caffer caffer* (Sparrman, 1779) (Rwa: Imbogo; Eng: African savannah buffalo; Fr: Buffle).

Belonging in the family of Bovidae, the African buffalo may weigh between 500-900kgs

(Savannah species), while the forest species may weight from 250-450kgs, its height may reach 1 to 1.7m and the head and body length ranges between 1.7-3.4m, with short legs while tail can be from 70 to 110 cm, with males normally larger than females. Their habitat is made of Savannah, gallery forest Protected areas, and around small patchy forest. In Rwanda, they are recently known in ANP, and were seen in Makera forests in 2000s'. The total population showed an increase since 1998 with 2093 living in ANP (ANP 2013), but The African buffaloes are highly poached for meat, and its habitat is often hit by fire, thus the species is categorized as Vulnerable under A4bc. The current extent of occurrence is 1122 $km^{2,}$ with habitat degradation and fragmentation, therefore the species is categorized under criteria of EN B1ab (iii). There are no indications of mature individuals decline or fluctuation, thus the sub criteria under C and D are not evaluated. This species is categorized under criteria for **Endangered EN B1ab (iii).** Research on habitat fragmentation and degradation, and quality and population fluctuation is needed.

6.2.27. *Syncerus caffer nanus* (Sparrman, 1779) (Rwa: Imbogo; Eng: African forest; Fr: Buffle).

Belonging in the family of Bovidae, the African forest buffaloes may weight from 250-450kgs, its height may reach 1 to 1.7m and the head and body length ranges between 1.7-3.4m, with short legs while tail can be from 70 to 110 cm, with males normally larger than females. Their habitat is made of Mt forests. They are recently known in the Virunga massif a component of the Virunga National Park in D.R.Congo, Mgahinga Gorilla National Park in Uganda and the VNP in Rwanda, the species has extinct in the NNP due to poaching. The total number of buffaloes in the VNP is considered as declining, the current estimate was less than 200 buffaloes in the VNP, a decrease from around 550 in 1991 (Plumptre 1991) to 360 in 2004 (Owiunji *et al.* 2005) and less than 200 in 2010 (Arakwiye *et al.* 2010), the species is categorized as Vulnerable under criteria A. The EOO is 160 km^2 and the habitat does not have a buffer zone, therefore the species can be categorized as endangered under criteria B1ab (iii). The buffaloes are major crop raiders around the park and they are highly targeted by poachers which lead to continuing decline, in addition, the number of mature

individuals is below 200, therefore, the species is categorized as Critically Endangered under the criteria C1, as the species migration in neighboring parks, and there is no signs of extinction, the criteria under D and E are not evaluated. Based on these assessments, the species can be categorized as CR C1, however, the probability of the species migration between the Virunga massif parks, the category given under B and C is down listed to **Endangered EN B1ab(iii**). Strict law enforcement and population trends monitoring is of paramount.

6.2.28. *Taurotragus oryx (Pallas,* 1766), (Rwa: Inimba; Eng: Cape eland; Fr: Eland du cap)

The common eland of the family of bovidae, also known as the southern eland or eland antelope, is a Savannah species with adult male can reach around 1.6 m and can weigh up to 942 kg. It is the second largest antelope in the world. It is found in ANP. The population shows a poor population growth with the current total population estimated around 193 individuals (ANP 2013), located in fragmented areas which categorize the species under criteria for EN A4abcd. The extent of occurrence is 1122 km^2, with poor quality of the habitat and habitat loss and often hunted or falls in traps, therefore, it is categorized under criteria for EN B1ab (iii). There is no data on population decline for the criteria under C, D, and therefore, they were not assessed. The results categorize the species as **Endangered** under criteria for **EN A4abcd+ B1ab (iii).** Strict law enforcement, research investigating habitat quality and is recommended. Control illegal activities by strict law enforcement, habitat quality assessment are recommended and monitoring of existing populations and public awareness is highly recommended.

6.2.29. *Thamnomys venustus* (Thomas, 1907) (Eng: Kemp's Forest Rat)

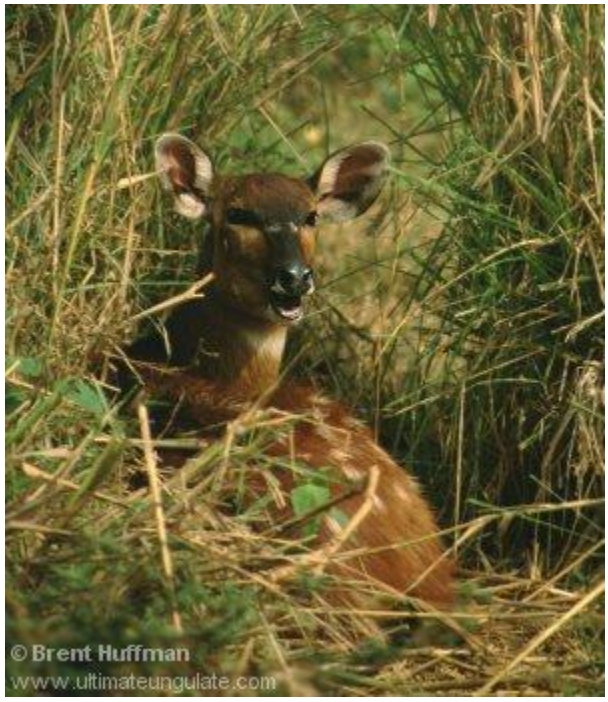
The Kemp's Forest Rat is a rodent of the family of Muridae, arboreal, and herbivore, with broad feet and long tail. It is categorized as vulnerable species by IUCN under criteria B1ab (iii). Endemic to the Albertine Rift, it is only living in moist montane forests. In Rwanda, it is only found in NNP. The population size is not known, criteria under A is not evaluated. It is threatened by habitat loss and quality of the habitat, its extent of occurrence is 1010 km^2, it is categorized as endangered under the criterion EN B1ab (iii). There is some report on population

trends but with no clear data on population fluctuation or decline therefore the criteria under C,D,and E is not evaluated, this results to categorize the species as **Endangered EN B1ab (iii).** State of habitat, latest distribution patterns, and habitat quality should be assessed.

6.2.30. *Tragelaphus scriptus* (Pallas, 1766) (Rwa: Impongo; Eng:Bushbuck; Fr: Guib harnaché)

The bushbuck belongs to the family of bovidae and weigh from 45 to 80 kgs, it is found in the VNP, and NNP. It is extinct in all the other Rwandan forest mainly due to poaching. The total number of bushbuck in the VNP is considered as recovering from estimated population of was less than 200 bushbuck in the VNP, a decrease from around 5850 in 1991 (Plumptre 1991) to 50 in 2004 (Owiunji *et al.* 2005) and around 700 individuals in 2010 (Arakwiye *et al.* 2010). In the ANP, the number of bushbuck is not well known, therefore, the criteria under A is not evaluated. The EOO is less below 5,000 km^2, and the habitat has been reduced during the last 30 years, and a continuing habitat degradation has been observed, this categorize the species under criteria of EN B1ab (iii). Today, the bushbucks are highly targeted by poachers, and it is expected to continue to decline by considering the poaching pressures, but there are no records of the mature individuals fluctuation and decline, therefore the criteria under C, D and E are not evaluated. Based on the EOO, the species is assessed as **Endangered EN B1ab (iii)**. Research on habitat quality is recommended, strict law enforcement and population a trend monitoring is of paramount.

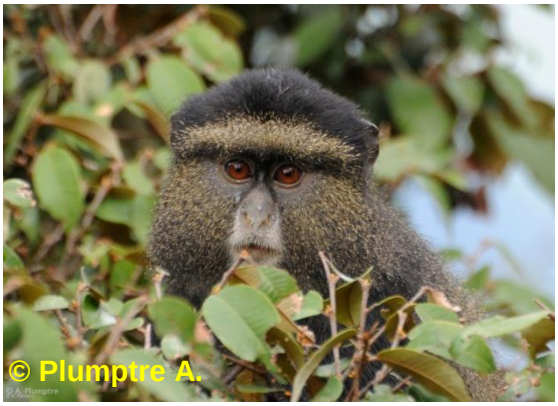
6.2.31. *Tragelaphus spekii* (Sclater, 1863). (Rwa: Inzobe; Eng: Sitatunga; Fr: Sitatunga/Guib d'eau)



The Sitatunga or marshbuck is a swamp dwelling antelope belongs to bovidae family with males considerably larger than females, they weigh up to 120kgs. In Rwanda, the sitatunga is only found in the swamps of the ANP and, it is suspected to be found Akanyaru wetlands, the species is extinct in Rugezi wetlands due to hunting. The current population size is not known, but very few as the surveys left undetected, the mains threats are poaching and habitat degradation and poor quality of the habitat, the extent of occurrence is less than 1122km^2, therefore the species is categorized as EN B1ab (iii), there is no indications of number of mature individuals decrease, therefore the criteria under C, D, and E are not evaluated. The species is categorized as **Endangered** based on criterion **EN B1ab (iii).** Further research to assess the quality of the habitat, overall population trends is recommended. In future, sustainable use may be recommended after determining overall population's level.

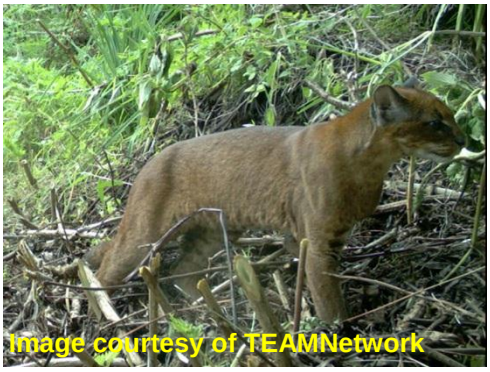
6.3. Vulnerable mammal species

6.3.1. *Cercopithecus mitis doggetti* (Pocock, 1907) (Rwa: Inkima; Eng: Silver monkey; Fr: Singe argente)



Also called the diademed monkey, the blue monkeys can weigh between 4 and 8 kg, they are mostly frugivorous, and occupy the tropical forests near equator. In Rwanda, it is found in NNP and ANP, Gishwati and Busaga forests. In NNP, the population has dramatically declined from around 10,000 individuals in 2009 to 4,000 individuals in 2014 (WCS 2014), which declined at 60%, under degraded forests which categorize the species under criteria for ENA4abcd . The extent of occurrence is less than 5,000 km^2, and its habitat is being degraded overtime, therefore the criteria under EN B1b (iii) is applicable, the species are often hunted but there is no data on population fluctuation and/or decline. Given that there is no data on total population decline or fluctuation, the criteria under A, C, D is not evaluated. Given that the species has colonized some of the wetlands surrounding existing or extinct natural forests. Accordingly, the species is down listed as **Vulnerable** under criterion **VU B1b (iii).** Further research to assess the quality of the habitat and overall population trends is recommended.

6.3.2. *Felis aurata* (Temminck, 1827) (Rwa: Injangwe; Eng: African golden cat; Fr: *Chat dore*)



The African Golden cat is a medium-sized cat about the size of domesticated cat, crepuscular, nocturnal and carnivores, solitary species, belongs to Felidae family measuring, their weight ranges from about 5 to 16 kg. It is categorized as near threatened species by IUCN, its population tends to decrease. The African golden cat is found in the African tropical forests. In Rwanda, it is found in NNP (it was commonly recorded around Kamiranzovu wetlands, and Uwasenkoko) (Chao 2008), the VNP. It is almost disappeared in private lands, only remaining in protected areas, but there is no data on population trends, the criteria under A is data deficient. The extent of occurrence is less than 20,000 km^2, with some

fluctuation in localities, combined with habitat loss which falls in criteria VU B1ab (iii) c(i). There is no data on population fluctuation or decline, therefore the criteria under C, D and E is not evaluated. Therefore, it is categorized as Vulnerable under the criterion **VU B1ab (iii) c(i).** Further research on the distribution, population trends, and awareness and people attitudes toward the species is recommended.

6.3.34. *Leptailurus serval* (Schreber, 1776) (Rwa: Imondo; Eng: Serval; Fr: Serval)

The serval is a medium-sized cat, species native to Africa, it is a nocturnal, territorial and carnivore species, the serval belongs to Felidae family measuring, their weight ranges from about 7 to 18 kg. Found in the south of Sahara, in Rwanda, the serval is found ANP, NNP (it was commonly recorded around Kamiranzovu wetlands, and Uwasenkoko) (Chao 2008), Ibanda Makera forests, Mukura, Gishwati, VNP, and Buhanga ecopark, it is almost disappeared in private lands. It is targeted by poachers to be using in traditional cultures such as Kuragura and traditional medicine. It is listed on CITES's appendix, the only population remains in protected areas, but there are not records on population trends. Its extent of occurrence is less than 20,000 km^2, with some fluctuation in localities, combined with habitat loss which falls in criteria VU B1ab (iii) c (i). There is no data on population fluctuation or decline. Therefore it is categorized as **Vulnerable** under the criterion **VU B1ab (iii) c(i).**
Further research on the distribution and population trends is needed.

6.3.4. *Potamochoerus larvatus larvatus* (F. Cuvier, 1822) (Rwa: Ingurube y'ishyamba; Eng: Bushpig; Fr: Potamochère)

The bush pig is a member of the suidae and weight from 55 to 150 kg, it is omnivores, and they resemble the domestic pig. It is widespread in the South Eastern countries of Africa. In Rwanda, the bush pig is found in the ANP, NNP, Ibanda Makera forests, the bush pig has extinct in Mukura, Gishwati, Muyira forests, VNP, and Buhanga

ecopark. In NNP, the population has declined from 984 bush pigs in 2009 and to 706 bush pigs 2014 due to hunting (WCS 2014), this threat is also found in other localities of the bush pig, therefore, it can be categorized as Vulnerable under criteria A4abcd. There extent of occurrence is less than 5000 km^2, and there is habitat loss and fluctuation in localities, therefore, the species can be categorized under EN B1ab (iii,iv) c (i). Given that the whole population size in not know, therefore there is no data for criteria C, D and E. By considering the EOO and habitat, and considering its ability of adaption in different habitat the species is down listed as **Vulnerable** under criterion **VU B1ab (iii, iv) c(i).** Further study on their distribution, strict law enforcement is recommended.

6.3.5. *Rousettus aegyptiacus* (Geoffroy, 1810), (Rwa: Agacurama; Eng: Egyptian Fruit Bat; Fr: Chauve souris)

The Egyptian Fruit Bat belongs to the pteropodidae, with frugivorous, gregarious habit; the Egyptian fruit bat is medium sized fruit bat with a comparatively large head and dog like muzzle. There is short vestigial tail. The hind feet are large with well-developed claw on each of the five digits. The wing span is about 61cm. When hanging vertically in its diurnal roost the head is normally carried at right angles to the rest of the body. Habitat includes inhabit caves, in the sea cliffs. Its habitat is Savannah and recently known localities include ANP, their niche includes natural caves, underground irrigation tunnels, open wells around the VNP and NNP. They are thousands in a population; the main threats are threats are habitat destruction and fragmentation, and the extent of occurrence is above 5000 km^2, therefore it can be categorized as VU B1ab (iii). There are no indications of population decrease; therefore the criteria under C, D, and E are not evaluated. Thus the final category is **Vulnerable VU B1ab (iii).** Further research on the distribution and quality of the habitat is highly needed.

Table 5: Summary of mammal species assessment

Scientific name	Kinyarwanda name	English name	French names	Status	Criteri(on)a determining overall status
1. *Giraffa camelopardalis*	Munagajosi	Giraffe	Giraffe	Critically Endangered	A1abcd; C2a (ii); D1
2. *Gorilla beringei beringei*	Ingagi	Mountain gori	Gorille de montagne	Critically Endangered	A4abcd
3. *Loxodonta africana africana*	Inzovu	African savannah elephant	Elephants	Critically Endangered	A4abcd; C1
4. *Loxodonta africana cyclotis*	Inzovu	African forest elephant	Elephants	Critically Endangered	A1abcd; C2a
5. *Redunca arundinum*	Isasu	Reedbuck	Redunca	Critically Endangered	C2a (i); D1
6. *Rhinolophus hilli*		Horsehoe bat	Chauve souris	Critically Endangered	B1ab (iii,v)+2ab(iii,v)
7. *Aepyceros melampus*	Impala	Impala	Impala	Endangered	A4abcd
8. *Cephalophus nigrifrons*	Ifumberi	Black fronted duiker	Céphalophe à front noir	Endangered	B1ab (iii)
9. *Cercopithecus ascanius*	Umukunga	Redtail monkeys	L'ascagne	Endangered	B1ab (iii)
10. *Cercopithecus hamlyni*	Igihinyage	Owl-faced monkey	Cercopithèque à tete de l'hibou	Endangered	B1ab(iii);C1(a,i)

11. *Cercopithecus l'hoesti*	Icyondi	L'hoest's monkey	Singe de montagne	Endangered	B1ab (iii)
12. *Cercopithecus mitis kandti*	Inkima	Golden Monkey	Singe doré	Endangered	B1ab (iii) c(i,ii);C1
13. *Cercopithecus mona*	Umukunga	Mona monkeys	La mone	Endangered	B1ab (iii)
14. *Colobus angolensis angolensis*	Inkomo, Imbeya	Angolan black-and-white colobus	Colobe d'Angola	Endangered	A4abcd; B1ab (iii)
15. *Crocidura lanosa*		Kivu long-haired shrew		Endangered	B1ab (iii)
16. *Damaliscus korrigum*	Inyemera	Topi		Endangered	A4abcd; B1ab (iii)
17. *Delanymys brooksi*		Delany's Mouse		Endangered	B1ab (iii)
18. *Equus quagga*	Imparage	Zebra	Zebre	Endangered	B1ab (iii)
19. *Hippopotamus amphibious*	Imvubu	Common hippopotamus or Hippo	Hipoppotame	Endangered	B1ab (iii)
20. *Hippotragus equinus*	Inkoronko	Roan antelope	Antilope rouane	Endangered	B1b (iii); C2a (i); D1
21. *Kobus ellipsiprymnus*	Indonyi	Waterbuck	Kobe defassa	Endangered	A4abcd B1ab (iii
22. *Lophocebus albigena*	Igishabaga	Grey-cheeked mangabey	Mangabey	Endangered	B1ab (iii)
23. *Lophuromys rahmi*		Brush-furred		Endangered	B1ab (iii)

		Rat			
24. Oreotragus oreotragus	Igihindamabare	Klipspringer		Endangered	B1ab (iii)
25. Pan troglodytes	Impundu	Chimpanzee	Chimpanze	Endangered	B1ab (iii)
26. Panthera pardus	Ingwe	Leopard	Leopard	Endangered	B1ab (iii) c (i,iii)
27. Phacochoerus africanus	Isatura	Common warthog	Phacochère	Endangered	B1ab (iii)
28. Ruwenzorisorex suncoides		Ruwenzori shrew		Endangered	B1ab (iii, iv)
29. Sylvicapra grimmia	Isha	Common duiker	Céphalophe couronné	Endangered	B1ab (iii)
30. Sylvisorex lunaris		Moon Forest Shrew		Endangered	B1ab (iii)
31. Sylvisorex vulcanorum		Volcano shrew		Endangered	B1ab (iii)
32. Syncerus caffer caffer	Imbogo	African savannah buffalo	Buffle	Endangered	B1ab (iii)
33. Syncerus caffer nanus	Imbogo	African forest	Buffle	Endangered	B1ab (iii)
34. Taurotragus oryx	Inimba	Cape eland	Eland du cap	Endangered	A4abcd+ B1ab (iii)
35. Thamnomys venustus		Kemp's Forest Rat		Endangered	B1ab (iii)
36. Tragelaphus scriptus	Impongo	Bushbuck	Guib harnaché	Endangered	B1ab (iii)
37. Tragelaphus spekii	Inzobe	Sitatunga	Guib d’eau	Endangered	B1ab (iii)

38. *Cercopithecus mitis doggetti*	Inkima	Silver monkey	Singe argenté	Vulnerable	B1b (iii)
39. *Felis aurata*	Injwangwe	African golden cat	Chat doré	Vulnerable	B1ab (iii) c(i)
40. *Leptailurus serval*	Imondo	Serval	Serval	Vulnerable	B1ab (iii) c(i)
41. *Potamochoerus larvatus larvatus*	Ingurube	Bushpig	Potamochère	Vulnerable	B1ab (iii, iv) c(i)
42. *Rousettus aegyptiacus*	Agacurama	Egyptian Fruit Bat	Chauve souris	Vulnerable	B1b (iii

CHAPTER 7. TERRESTRIAL THREATENED HERPETOFAUNA

The herpetofauna of Rwanda is less known compared to other taxonomic groups, and there is no enough data to estimate the number of amphibians and reptiles. Further investigations and field surveys are needed to fill this gap. Distribution maps for each species are provided in appendix 3.

7.1. Critically Endangered herpetofauna

7.1. Hyperolius castaneus (Ahl, 1931) (Eng: Brown reed frog)


Source: Corey E. Roelke, 2010

The brown reed frog belongs to the family of hyperoliidae, it is categorized as vulnerable species by IUCN, it is only found in Albertine Rift Regions. It prefers the moist habitat especially the higher altitude swamps and its surroundings below 3000m altitude. The population trends are not known, thereore the criteria under A is not evaluated. It is generally threatened by the habitat loss, degradation of the quality of the habitat. In Rwanda, the species is only found the wetlands of the in the VNP and NNP, which is estimated to be less than 50 km^2. The extent of occurrence is 1170 km^2, which the area of occupancy is estimated to be below 50 km^2. Given that the wetlands and moist areas of the VNP are drying up (Runyambo 2009), there is a continuous threat on the habitat. There are no indications of population decrease; therefore the criteria under C, D, and E are not evaluated. Therefore, the species is categorized as Critically Endangered under criterion CR B1ab (iii)c(iii). There is possible population decrease. The assessment results in **Critically Endangered CR B1ab (iii)c(iii).** Further research to know latest population trends is recommended in the core habitats and habitat quality.

7.1.2. Leptopelis karissimbensis (Ahl, 1931) (Eng: Karisimbi tree frog)


Source: Corey E. Roelke, 2010

The Karisimbi tree frog belongs to the family of hyperoliidae, it is categorized as endangered species by IUCN, it is only found in Eastern D.R.Congo, Rwanda and Uganda. There is possible population decrease due to the environmental changes. Karisimbi tree frog prefers the moist especially the higher altitude swamps below 3100m altitude. The population trend is not known, therefore the criteria under A is not evaluated. In Rwanda, the species is only found the wetlands (areas of occupancy) of the VNP and NNP which can be estimated to be less than 50Km2, the extent of occurrence is 1170 km^2, given that the wetlands of the VNP are drying up (Runyambo 2009), there is a continuous threat. There are no indications of population decrease; therefore the criteria under C, D, and E are not evaluated. The species is categorized as **Critically Endangered** under criterion **CR B1b (iii)c(iii**). Further research to know latest population trends is recommended in the core habitats as well as the reason behind the habitat degradation.

7.2. Endangered herpetofauna

7.2.1. *Python sebae* (Gmelin, 1788) (Rwa: Uruziramire; Eng: African rock python)


Image courtesy of Steve Spawls

The African rock python belongs to the family of pythonidae, it is a large, non-venomous snake of the Sub Saharan Africa, it is the Africa's largest snake and one of the five largest snake species in the world, is length may reach exceed 6m. The African rock python kills its prey by constriction and often eats animals up to the size of antelope, occasionally even crocodiles. The African rock python face some threats such as habitat reduction 'and hunting, it is listed on CITES' appendix. Mostly found close to the water. The snake is found in a variety of habitats, from forests to near deserts, although usually near sources of water. In Rwanda, the African rock python is found in ANP and Bugesera region. Its population trends are not known, therefore the criteria under A is not evaluated. It is threatened by habitat loss and poor quality of the habitat, the extent of occurrence is less than

5,000 km^2. However, the population trends are unknown. There are no indications of population decrease; therefore the criteria under C, D, and E are not evaluated. Therefore, it is categorized as **Endangered** under criterion **EN B1ab (iiii) c(iii).** Further research to know latest population trends is recommended in the core habitats and habitat quality.

7.2.2. *Xenopus wittei*, (Tinsley, Kobel & Fischberg, 1979) (Eng: De Witte's clawed frog)

De Witte's clawed frog belongs to the family of Pipidae. It is only found in DRCongo, Rwanda and Uganda; it prefers habitats with moist montane forests in high-altitude Rivers, swamps and fresh water lakes. The population trend is not known, therefore the criteria under A is not evaluated. In Rwanda, the species is only found the wetlands, lakes and rivers of the in the VNP and NNP below 3000m alt. The extent of occurrence is 1170 km^2, given that some of its habitat such as the wetlands and rivers or stagnant water is drying up. It is categorized as Endangered under criterion **EN B1ab (iii)c(iii).** There are no indications of population decrease; therefore the criteria under C, D, and E are not evaluated. Therefore, it is categorized as **Endangered** under criterion **EN B1ab (iii)c(iii).** Further research to know latest population trends is recommended in the core habitats and habitat quality.

Table 6: Summary of herpetofauna assessment

Scientific name	Kinyarwanda name	English name	Status	Criteri(on)a determining overall status
1. *Hyperolius castaneus*		Brown reed frog	Critically Endangered	B1ab (iii)c(iii)
2. *Leptopelis karissimbensis*		Karisimbi tree frog	Critically Endangered	B1b (iii)c(iii)
3. *Python sebae*	Uruziramire	African rock python	Endangered	B1ab (iiii) c(iii)
4. *Xenopus wittei*		De Witte's clawed frog	Endangered	B1ab (iii)c(iii)

CHAPTER 8. CONCLUSION

Based on the results obtained for the study about *"the establishment of a list of threatened terrestrial ecosystems and species of Rwanda",* it has been clearly demonstrated that more endeavours are still needed to conserve and to sustainably exploit the terrestrial ecosystems and species in Rwanda.

Some ecosystems are highly degraded and their restoration might highly cost reference made to the amount and the nature of their current status. It is the case of Sanza, Mashyuza and Ndoha Natural Forests which are classified as collapse. However, a site like Mashyuza has a very strong potential to be valorised as a touristic site and based on that, it should attract more attention for rehabilitation because of the presence of hot springs. It is therefore strongly recommended to restore the remaining natural forest and the surrounding springs for their unique and unmatched touristic and aesthetic values. This would also to contribute to the conservation of its unique species like *Sterculia tragacantha* and *Nymphaea thermarum.*

The three National Parks (ANP, NNP and VNP) face some threats despite the protection that they benefit from the government and other various initiatives. VNP and Mukura-Gishwati National Park-to-be are particularly threatened and ranked in the IUCN category "Critically Endangered" though many efforts are made to maintain the ecosystems. Much more efforts are also needed to conserve those ecosystem because it is not only threatened by anthropogenic activities but also constitute very fragile ecosystems due to climate change. For VNP, it has already been demonstrated that Gorilla ranging is more and more shifting upward because of the shift of the plants species that they feed on. Temperature rising seems to be the biggest cause of that ranging and plants distribution change.

Forests like Busaga, Dutake, Ibanda-Makera, Karama, Karehe-Gatuntu, Mashoza and Nyagasenyi are remnant forests that are *Critically Endangered* mainly due to anthropogenic activities. They are scattered all over the country creating a reasonable porosity for biodiversity conservation. Once they collapse, some species will be very negatively affected especially those with limited dispersal mechanisms, restricted species, small populations and large Mammals. It is therefore strongly recommended not only to set up a conservation status to those ecosystems as recommended in this study but also to find out ways and means to enlarge

them so that they can be ecologically viable. In addition to recognized IUCN protection status for some ecosystems, the remaining uncategorized threatened ecosystems could be protected under general status of special forest reserves.

Beside ecosystems' assessment, species have also been assessed using the categories and criteria of IUCN version 3.1 and the results show that many species are currently threatened throughout the country.

For plants, mostly the criterion B and D were used as the data available was mostly about distribution. EOO of many species fall in the categories of threatened species but should also become less concerned as the territory is expanded. However, beside standard conservation measures, endemic species should get more attention for conservation.

As far as mammals are concerned, large mammals generally need large spaces to survive. Some species confined in one or two locations have mostly classified as critically endangered. There is a need increase their population size so as to avoid genetic drift. Most of Mammals assessed are in the category of endangered species and many of them are also recognized as threatened at international level by IUCN. They are mostly distributed inside Protected Areas because they have gone extinct in the outside. Conservation should therefore strengthen ecosystems protection so as to avoid habitat degradation.

Bird speces have been assessed, but it was established that a big number of species reported in Rwanda have very few data for them to be assessed.

With regard to amphibians, two species have been recognized as Critically Endangered mainly due to habitat degradation. They are also more exposed to extinction due to climate change as far as they colonized wet and cool areas. The conservation of such species passes inevitably to habitat restoration and conservation.

This study revealed that there are some gaps in different taxonomic groups, especially for birds. Therefore, we recommend a thorough biodiversity inventory across the country which should serve as a baseline for future similar assessments aiming to evaluate the implementation of the proposed conservation measures. Finally, we strongly recommend setting up a law that should protect all threatened ecosystems and species assessed.

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APPENDICES

Appendix 1. IUCN Red List criteria for ecosystems assessment (Keith, *et al.*, 2013)

			Critically Endangered	Endangered	Vulnerable
A		Reduction in geographic distribution over ANY of following periods:			
	1	Present (over the past 50 years)	≥80%	≥50%	≥30%
	2a	Future (over the next 50 years)	≥80%	≥50%	≥30%
	2b	Future (over any 50 year period including the present and future)	≥80%	≥50%	≥30%
	3	Historic (since 1750)	≥90%	≥70%	≥50%
B		Restricted geographic distribution indicated by EITHER:			
	1	Extent of a minimum convex polygon enclosing all occurrences (Extent of Occurrence), OR	≤2,000 km²	≤20,000 km²	≤50,000 km²
	2	The number of 10×10 km grid cells occupied (Area of Occupancy)	≤2	≤20	≤50
		AND at least one of the following (a-c):			
		(a) An observed or inferred continuing decline in EITHER:			
		i. a measure of spatial extent appropriate to the ecosystem; OR			
		ii. a measure of environmental quality appropriate to characteristic biota of the ecosystem; OR			
		iii. a measure of disruption to biotic interactions appropriate to the characteristic biota of the ecosystem			
		(b) Observed or inferred threatening processes that are likely to cause continuing declines in either geographic distribution, environmental quality or biotic interactions within the next 20 years			
		(c) Ecosystem exists at …	1 location	≤5 locations	≤10 locations
	3	A very small number of locations (generally fewer than 5) AND			
		prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and thus capable of collapse or becoming Critically Endangered within a very short time period			
C	1	Environmental degradation over the past 50 years based on change in an abiotic variable* affecting…	≥80% extent with ≥80% relative severity**	≥50% extent with ≥80% relative severity	≥50% extent with ≥50% relative severity
				≥80% extent with ≥50% relative severity	≥80% extent with ≥30% relative severity
					≥30% extent with ≥80% relative severity
	2	Environmental degradation over the next 50 years, or any 50-year period including the present and future, based on change in an abiotic variable affecting…	≥80% extent with ≥80% relative severity	≥50% extent with ≥80% relative severity	≥50% extent with ≥50% relative severity
				≥80% extent with ≥50% relative severity	≥80% extent with ≥30% relative severity
					≥30% extent with ≥80% relative severity
	3	Environmental degradation since 1750 based on change in an abiotic variable affecting…	≥90% extent with ≥90% relative severity	≥70% extent with ≥90% relative severity	≥70% extent with ≥70% relative severity
				≥90% extent with ≥70% relative severity	≥90% extent with ≥50% relative severity
					≥50% extent with ≥90% relative severity

D	1	Disruption of biotic processes or interactions over the past 50 years based on change in a biotic variable* affecting…	≥80% extent with ≥80% relative severity**	≥50% extent with ≥80% relative severity	≥50% extent with ≥50% relative severity
				≥80% extent with ≥50% relative severity	≥80% extent with ≥30% relative severity
					≥30% extent with ≥80% relative severity
	2	Disruption of biotic processes or interactions over the next 50 years, or any 50-year period including the present and future, based on change in a biotic variable affecting…	≥80% extent with ≥80% relative severity	≥50% extent with ≥80% relative severity	≥50% extent with ≥50% relative severity
				≥80% extent with ≥50% relative severity	≥80% extent with ≥30% relative severity
					≥30% extent with ≥80% relative severity
	3	Disruption of biotic processes or interactions since 1750 based on change in a biotic variable affecting…	≥90% extent with ≥90% relative severity	≥70% extent with ≥90% relative severity	≥70% extent with ≥70% relative severity
				≥90% extent with ≥70% relative severity	≥90% extent with ≥50% relative severity
					≥50% extent with ≥90% relative severity
E		Quantitative analysis that estimates the probability of ecosystem collapse to be…	≥50% within 50 years	≥20% within 50 years	≥10% within 100 years

Appendix 2. IUCN Red List criteria for species assessment (IUCN, 2012c)

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

- **(a)** direct observation *[except A3]*
- **(b)** an index of abundance appropriate to the taxon
- **(c)** a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality
- **(d)** actual or potential levels of exploitation
- **(e)** effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented **OR** Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals			
(c) Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals			

C. Small population size and decline

	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

D. Very small or restricted population

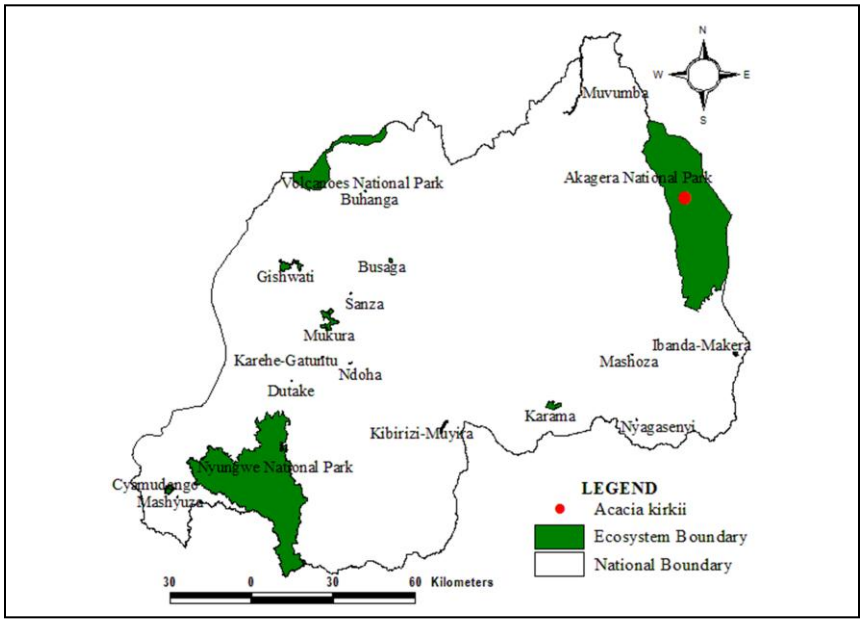
	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	**D1.** < 1,000
D2. *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	**D2.** typically: AOO < 20 km² or number of locations ≤ 5

E. Quantitative Analysis

	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Appendix 3. Distribution maps

A. Plants



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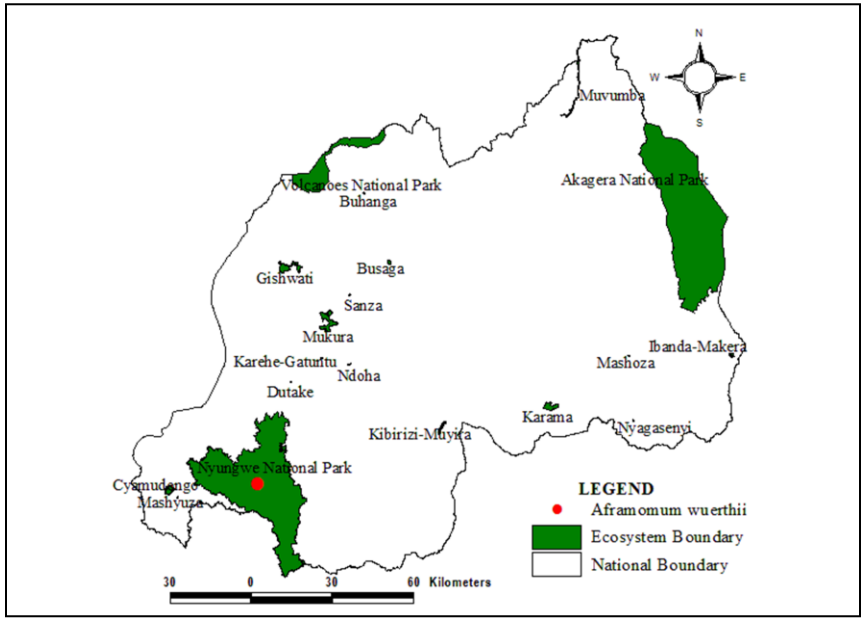
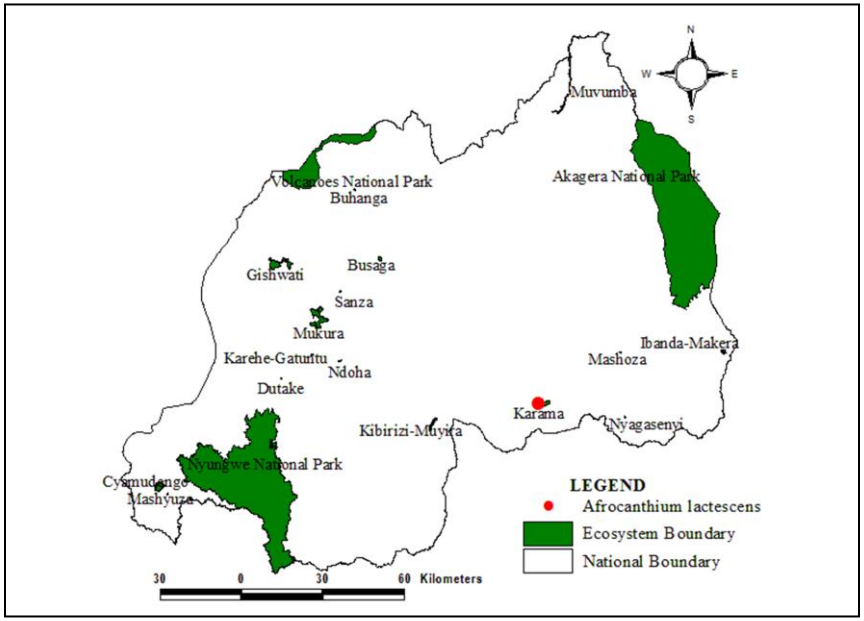
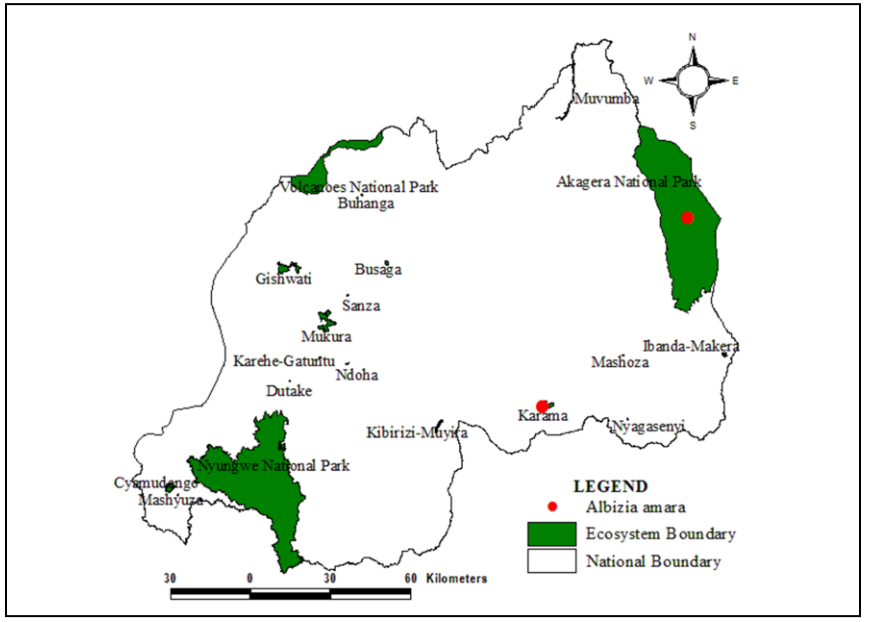


Aframomum wuerthii



Afrocanthium lactescens



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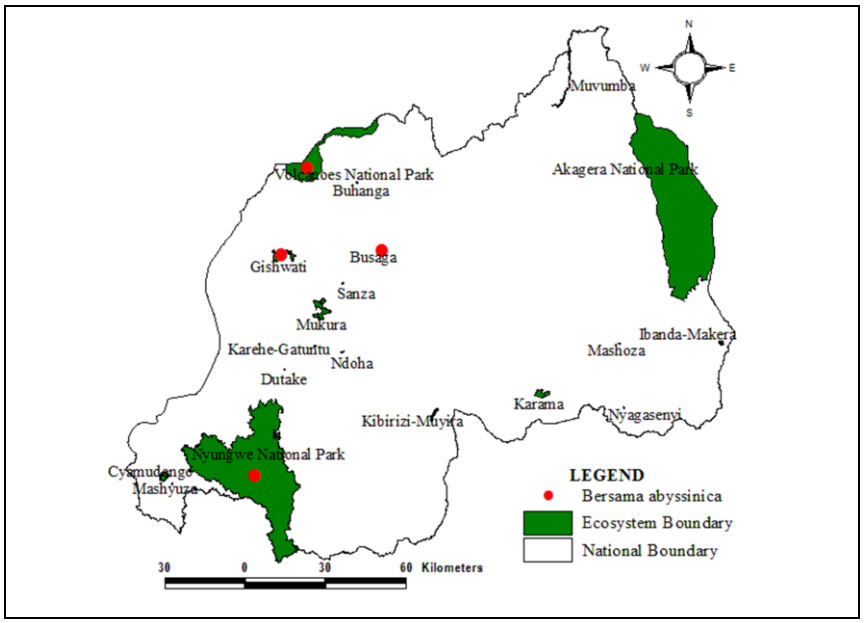
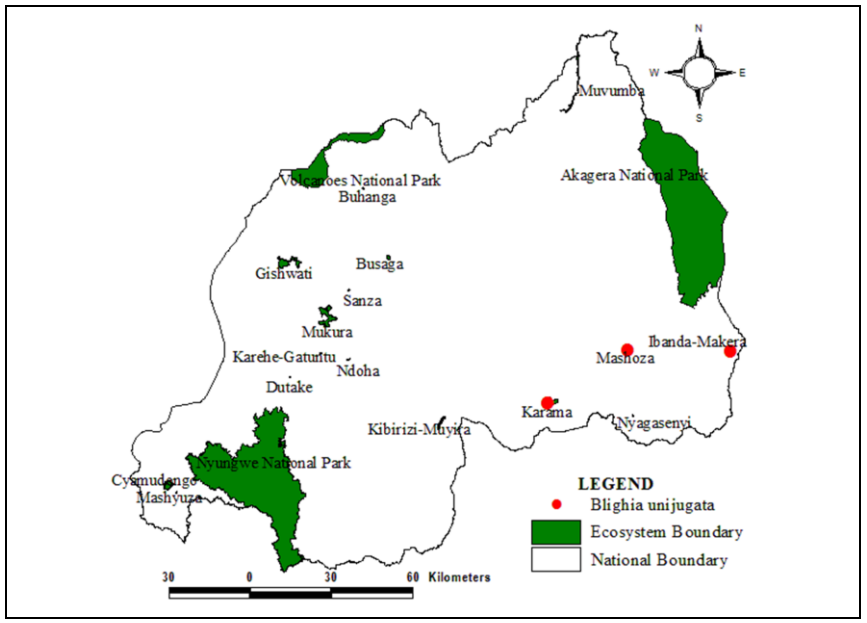
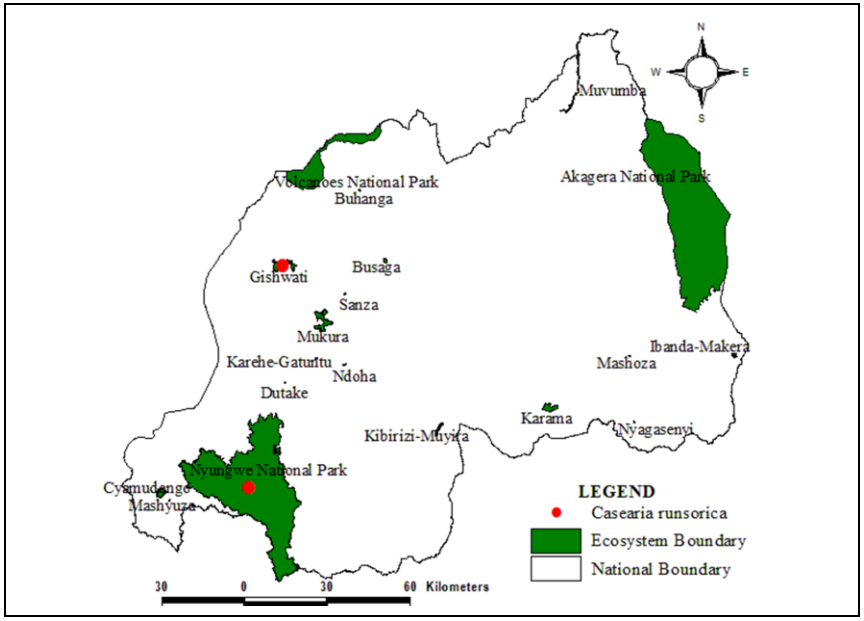


Bersama abyssinica



Blighia unijugata



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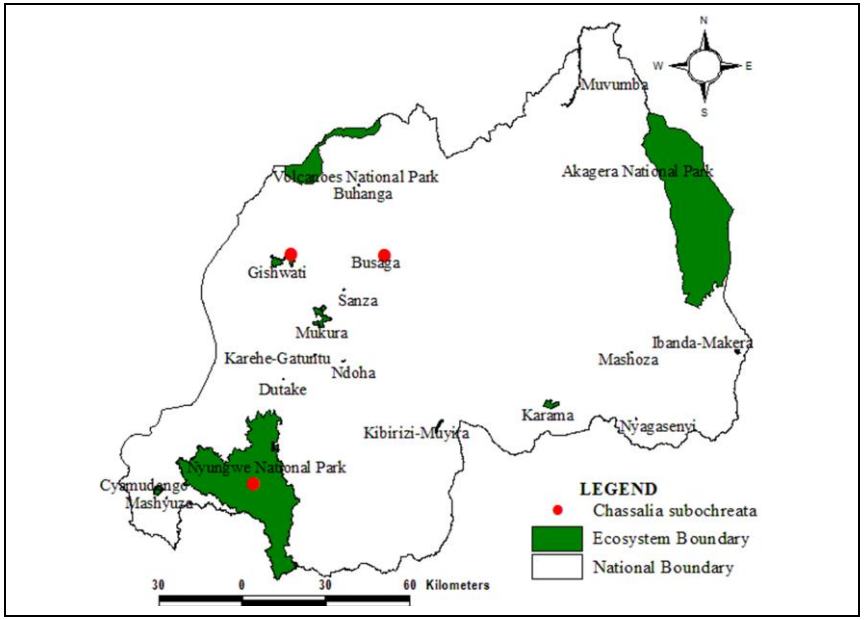
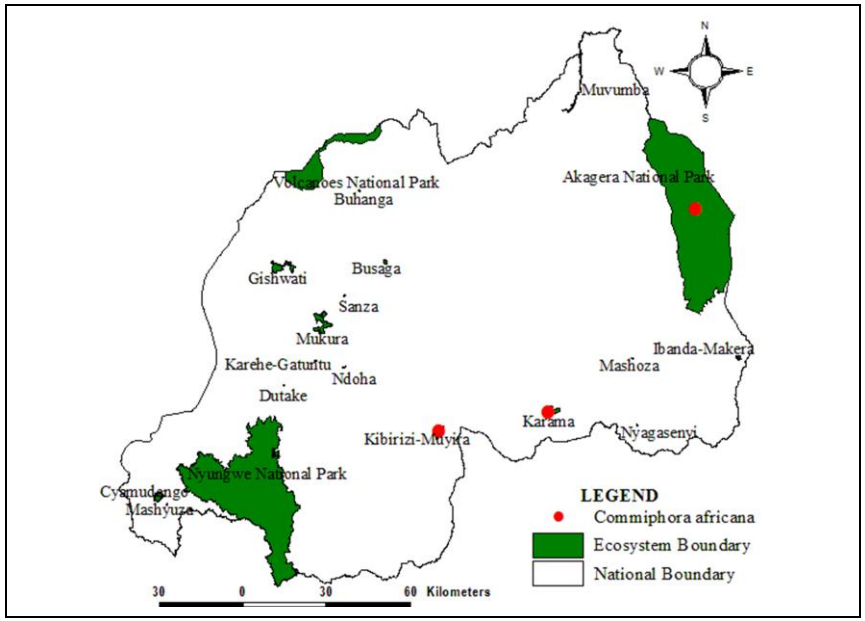
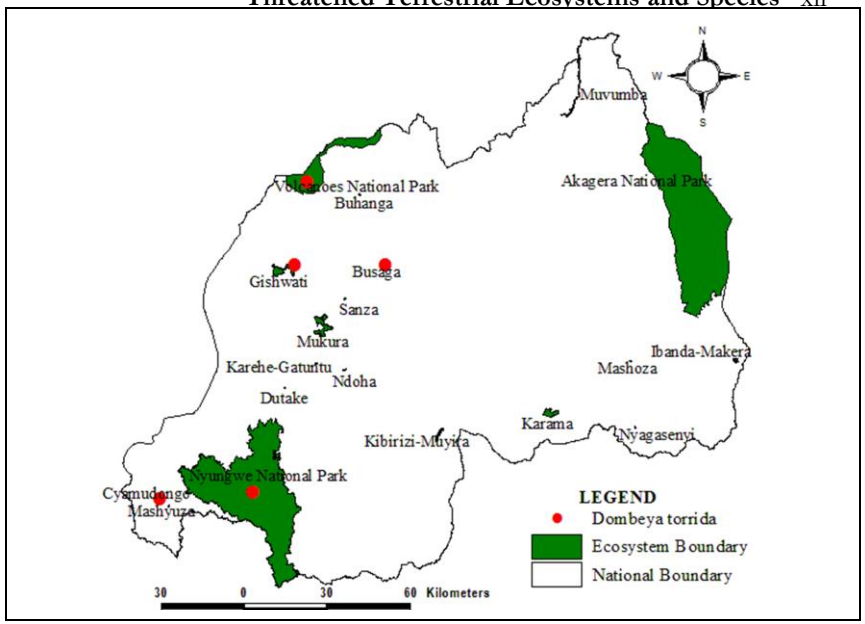


Chassalia subochreata



Commiphora africana



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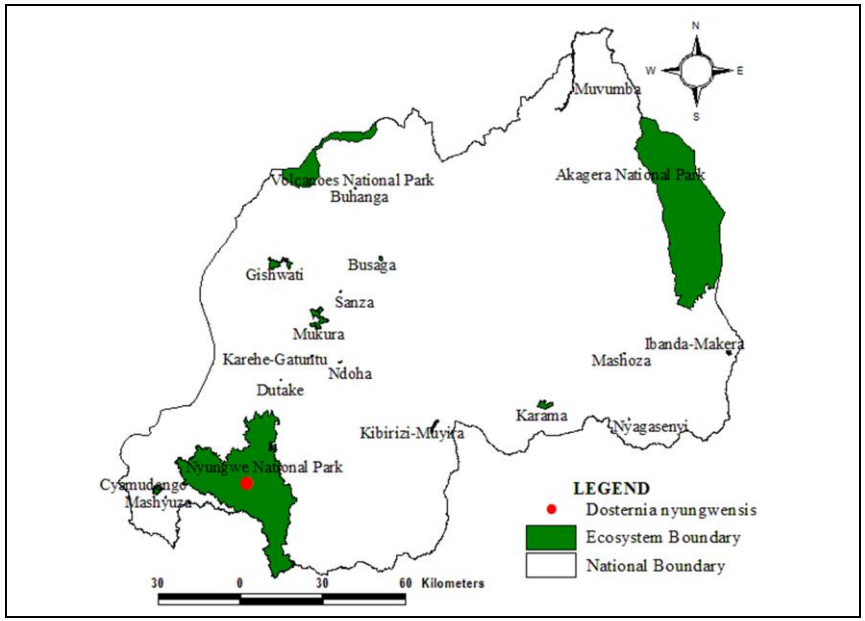

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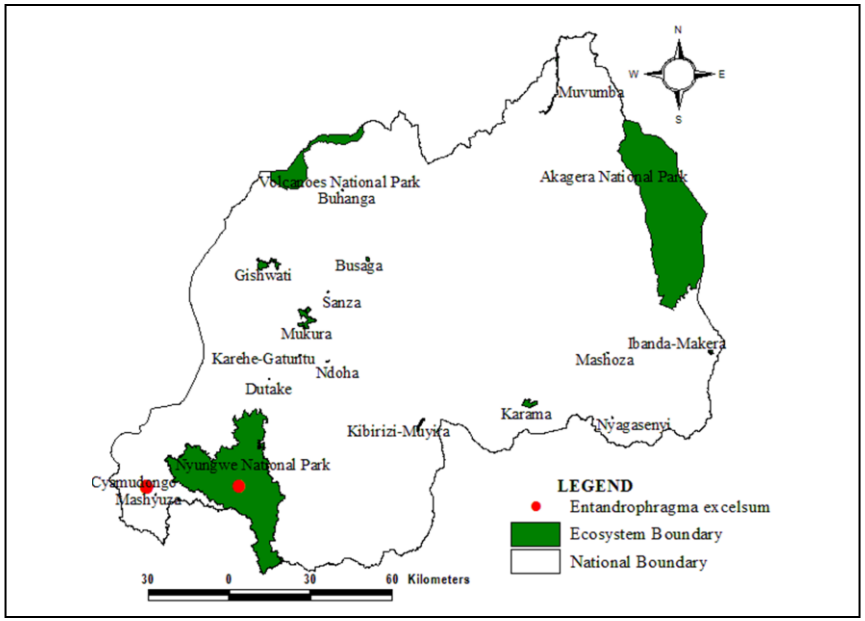

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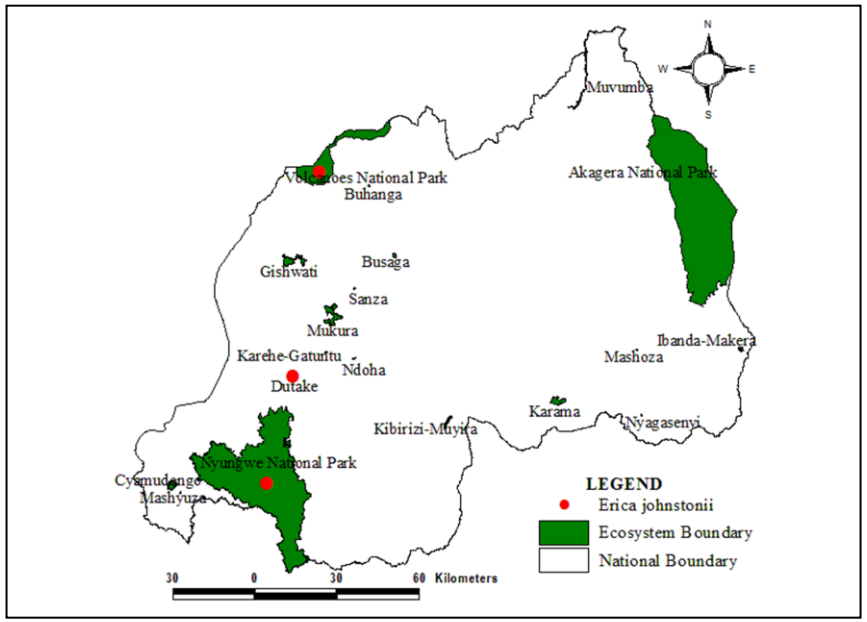
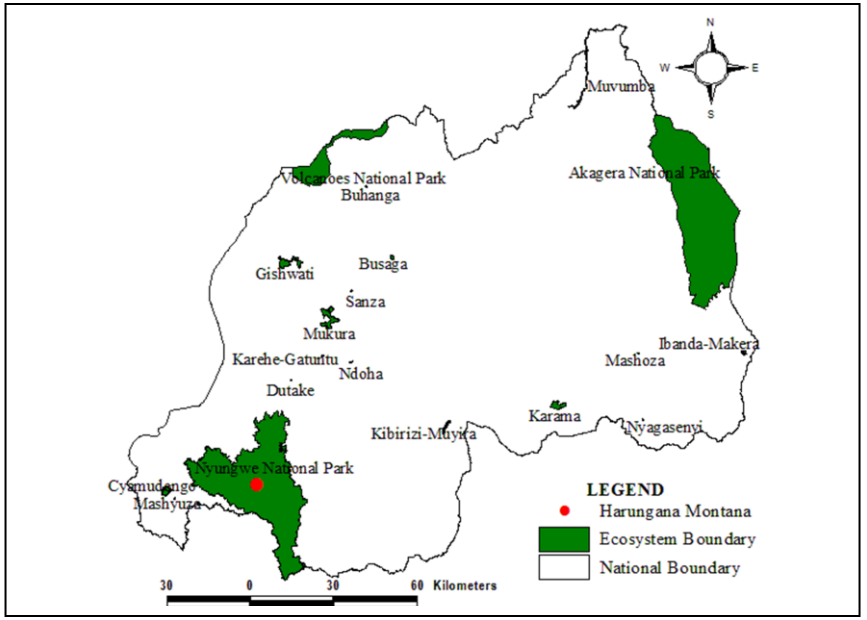


Erica johnstonii



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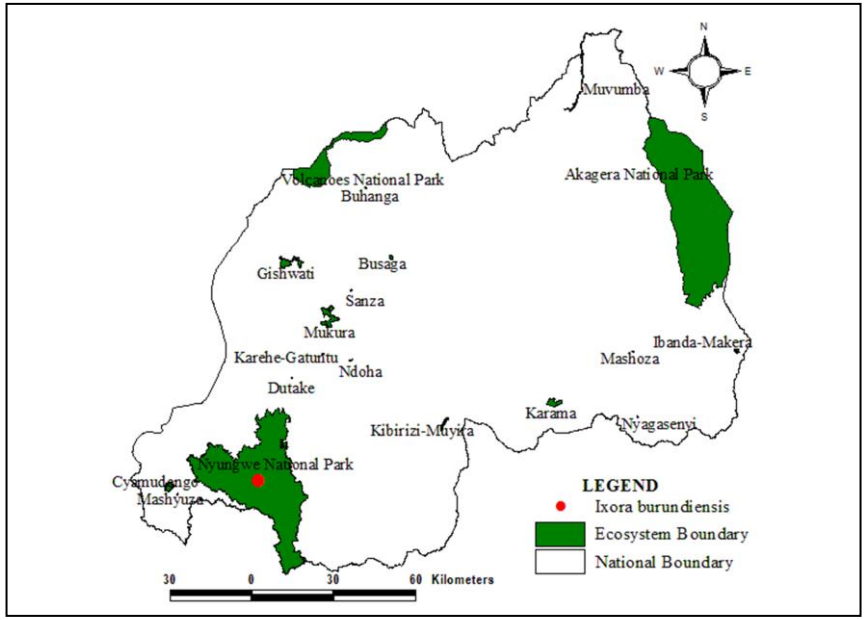
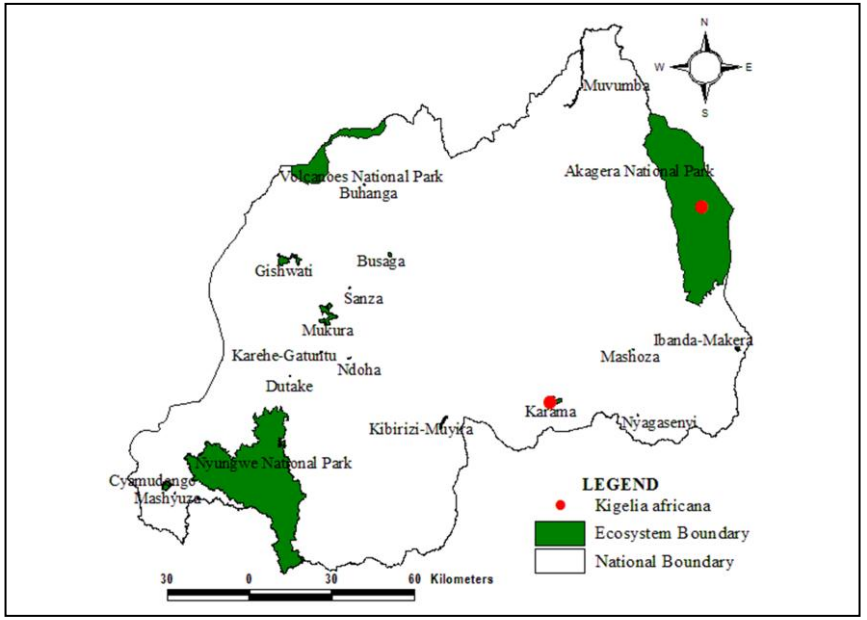
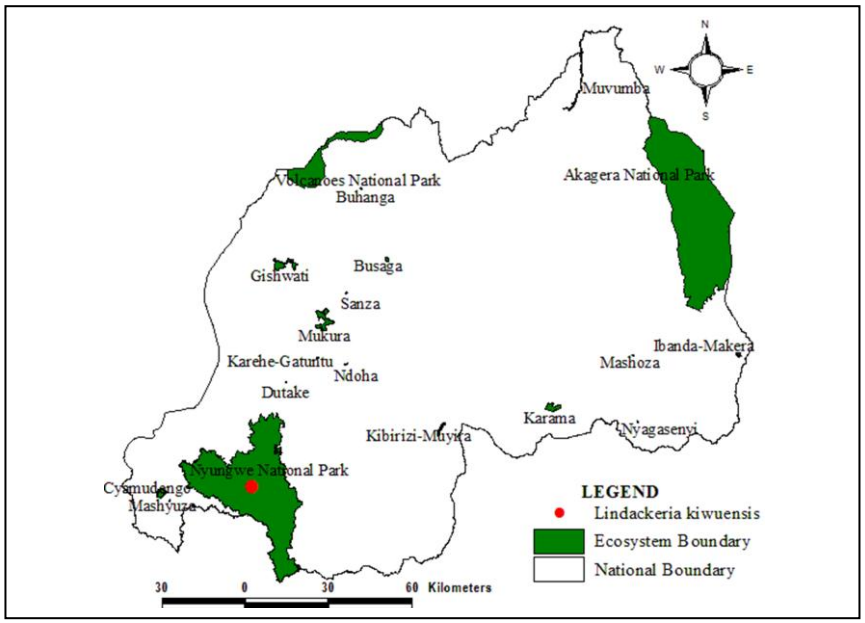


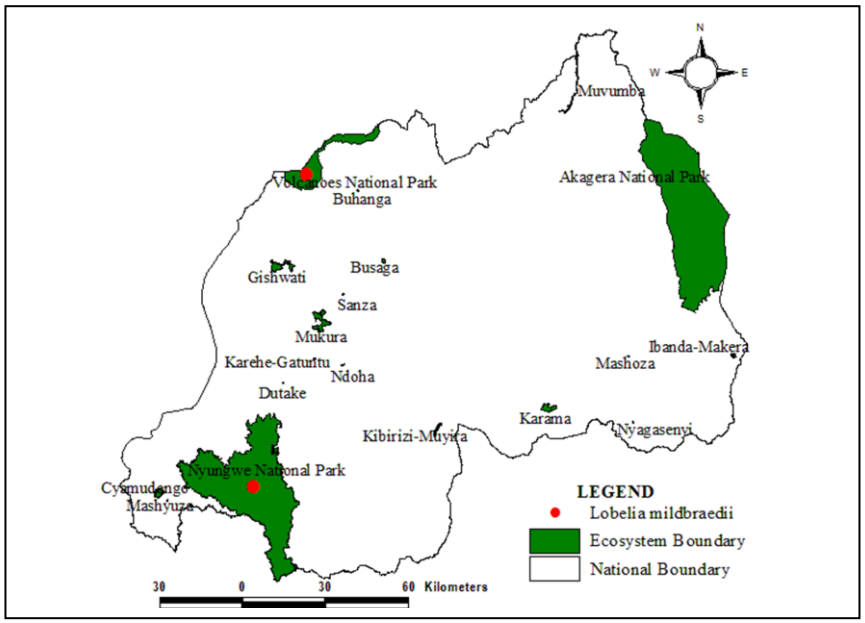
Ixora burundiensis



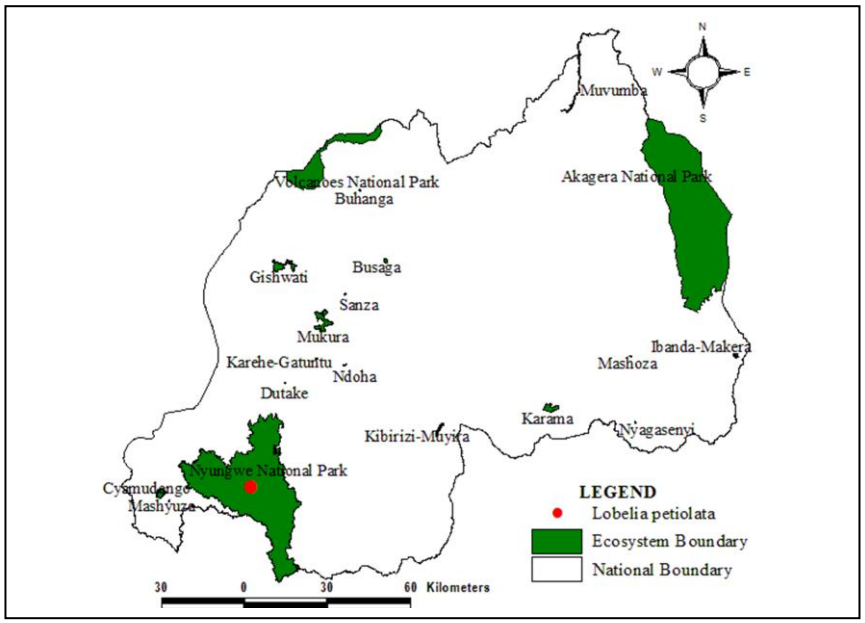
Kigelia africana



Lindackeria kiwuensis



Lobelia mildbraedii



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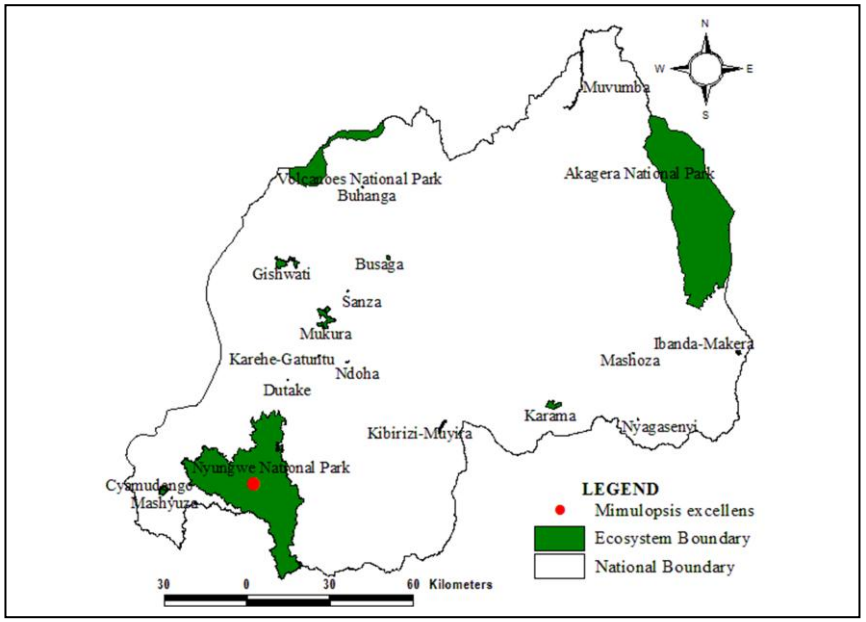
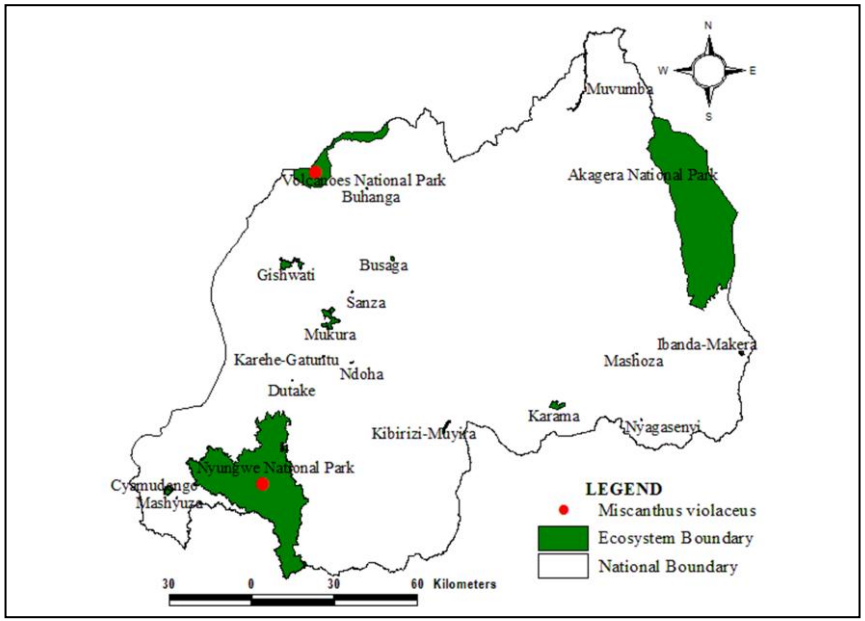


Mimulopsis excellens



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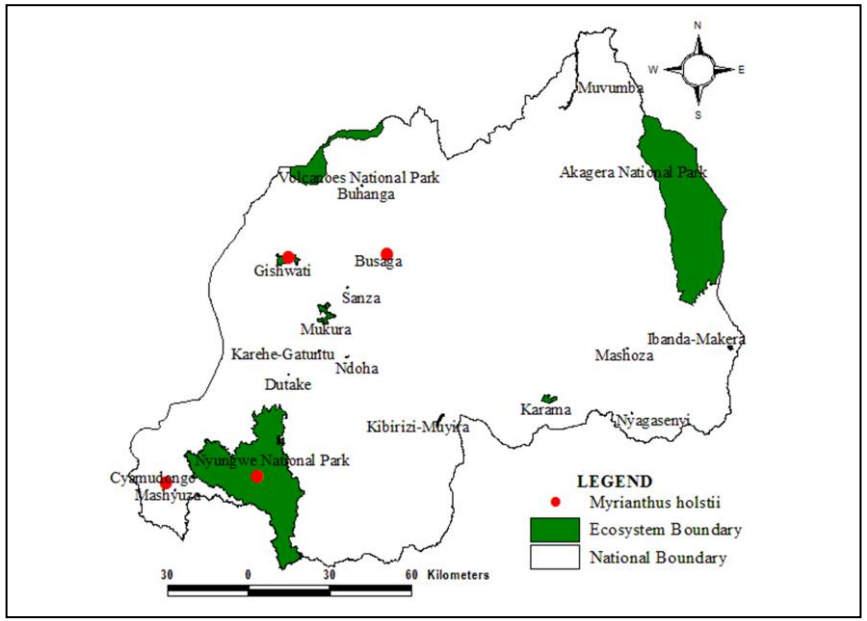
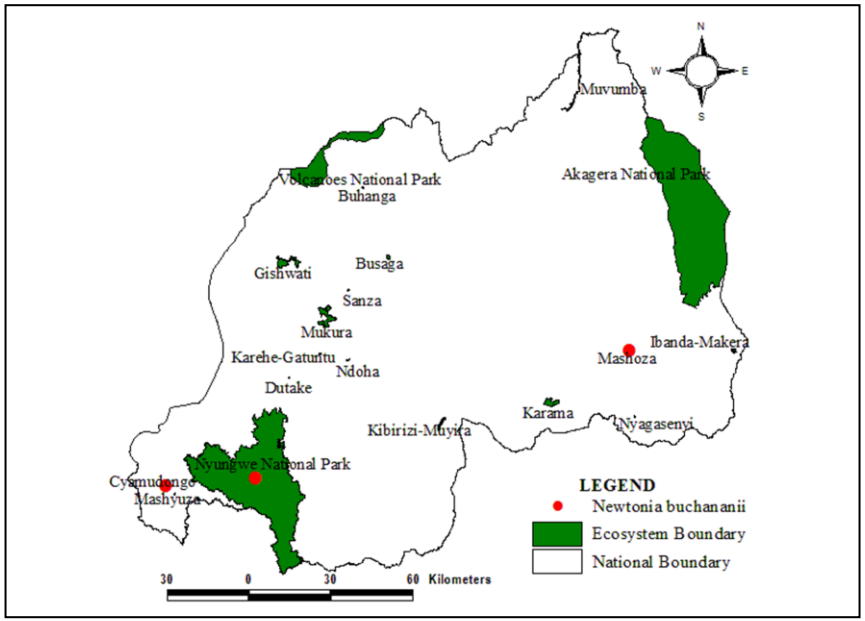
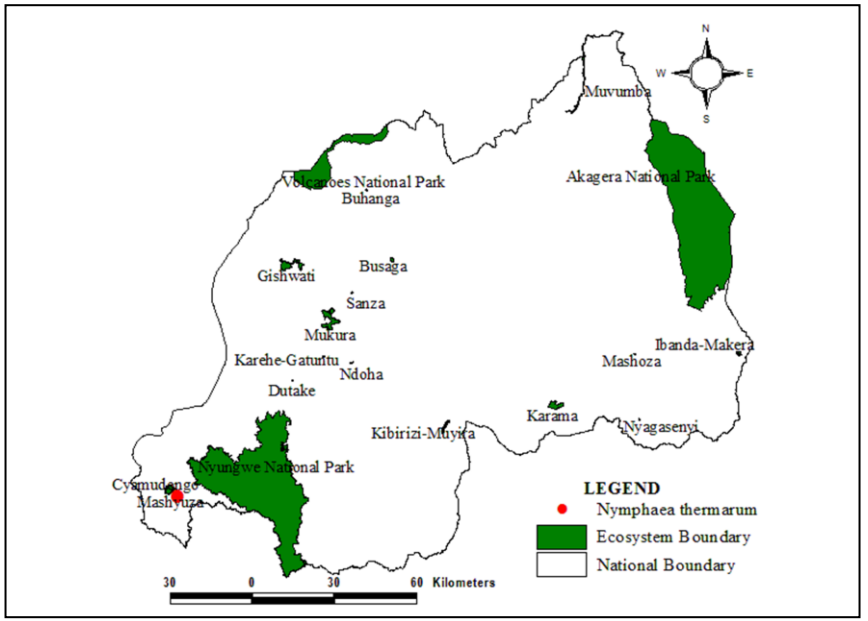


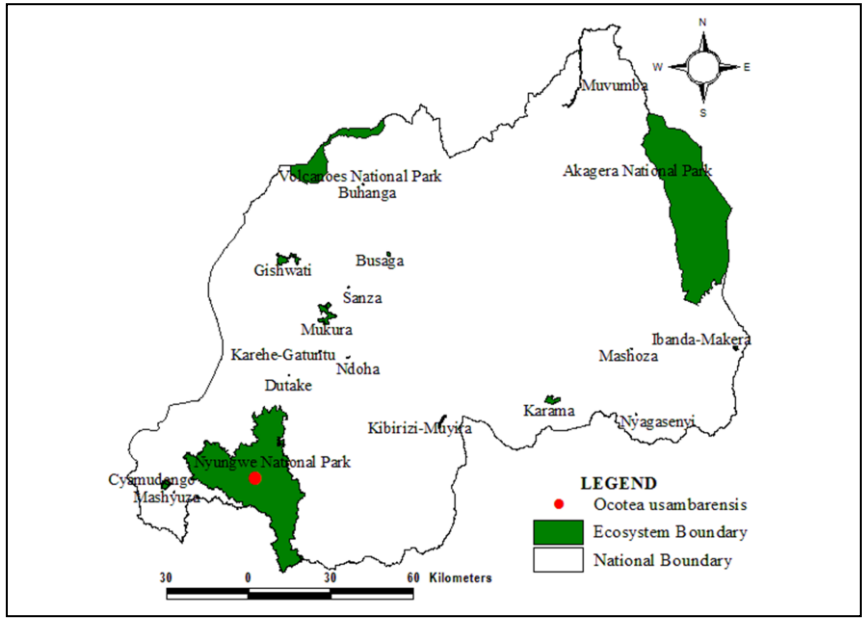
Myrianthus holstii



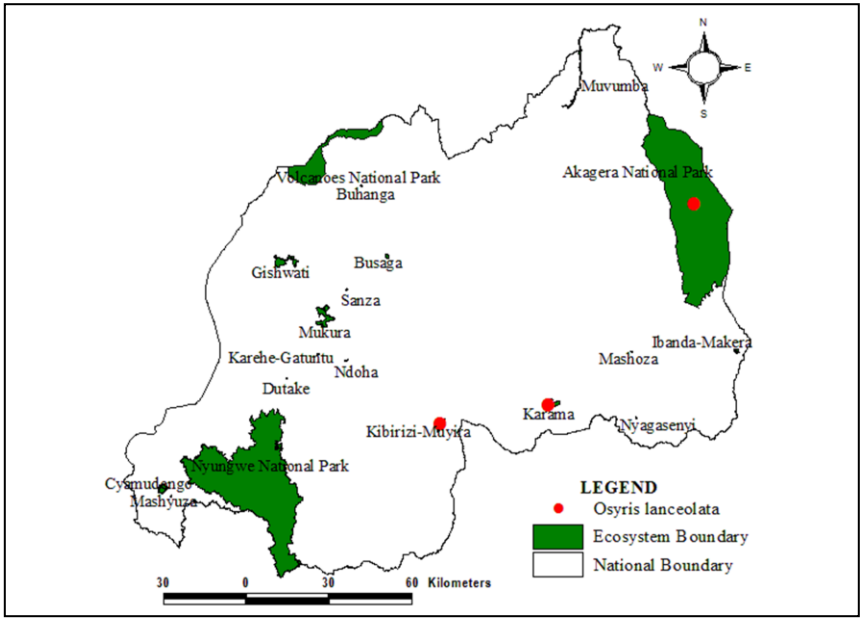
Newtonia buchananii



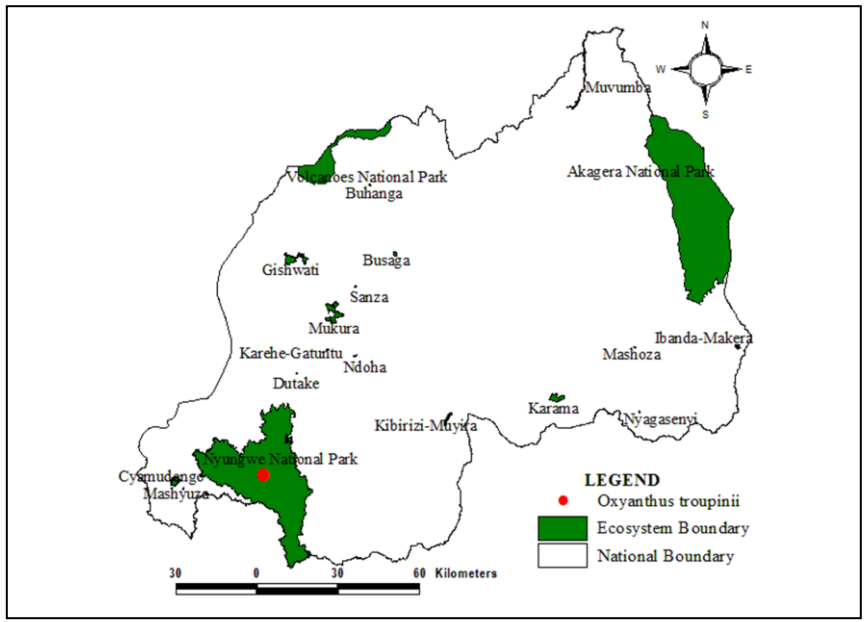
Nymphaea thermarum



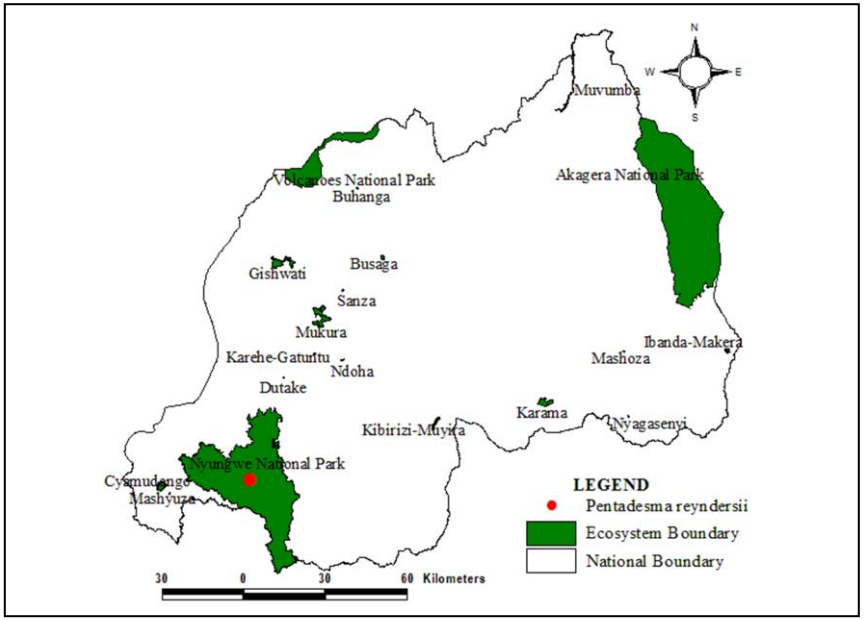
Ocotea usambarensis



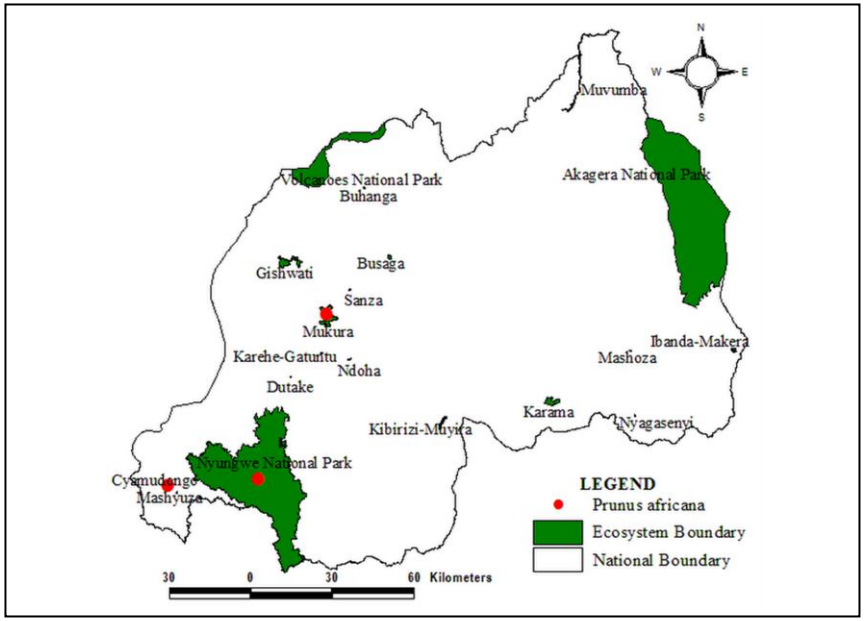
Osyris lanceolata



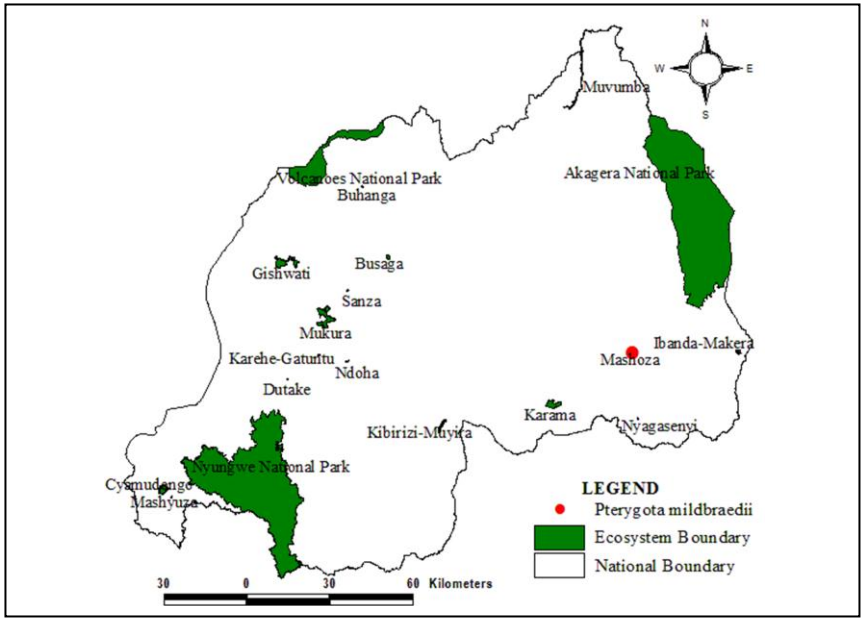
Oxyanthus troupinii



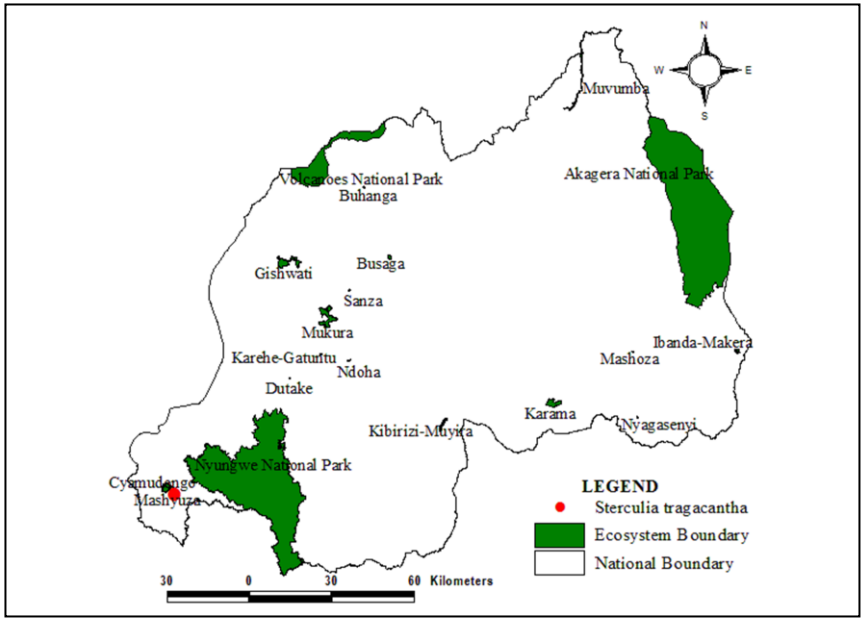
Pentadesma reyndersii



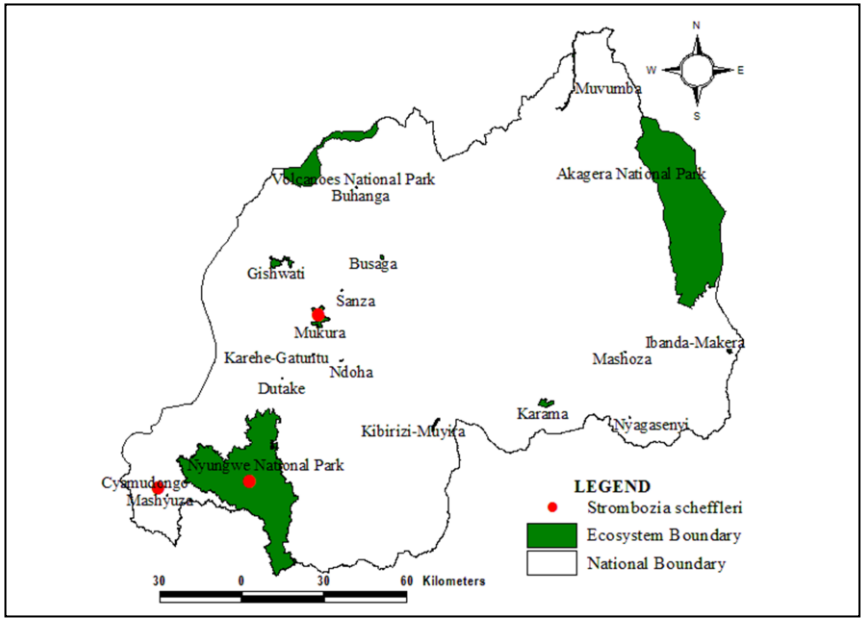
Prunus africana



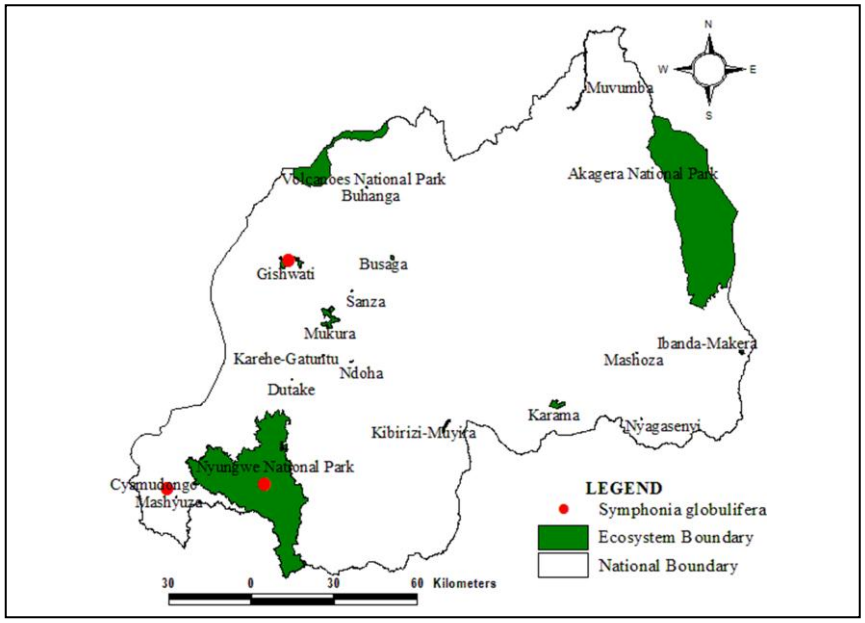
Pterygota mildbraedii



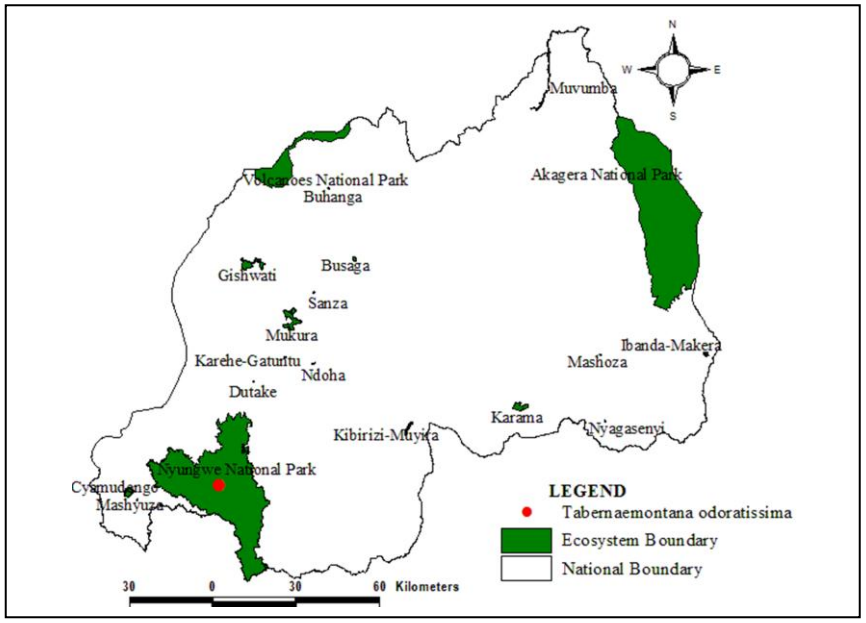
Sterculia tragacantha



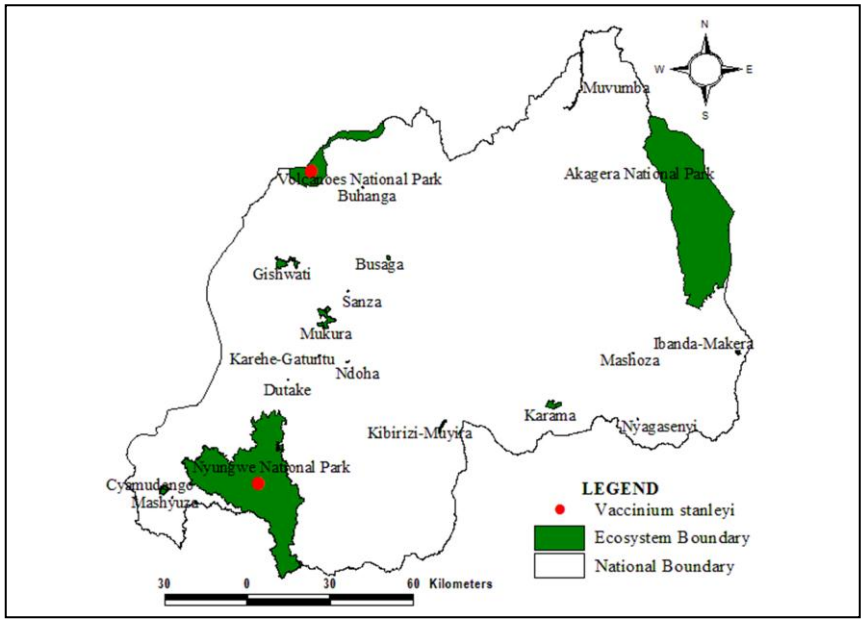
Strombozia scheffleri



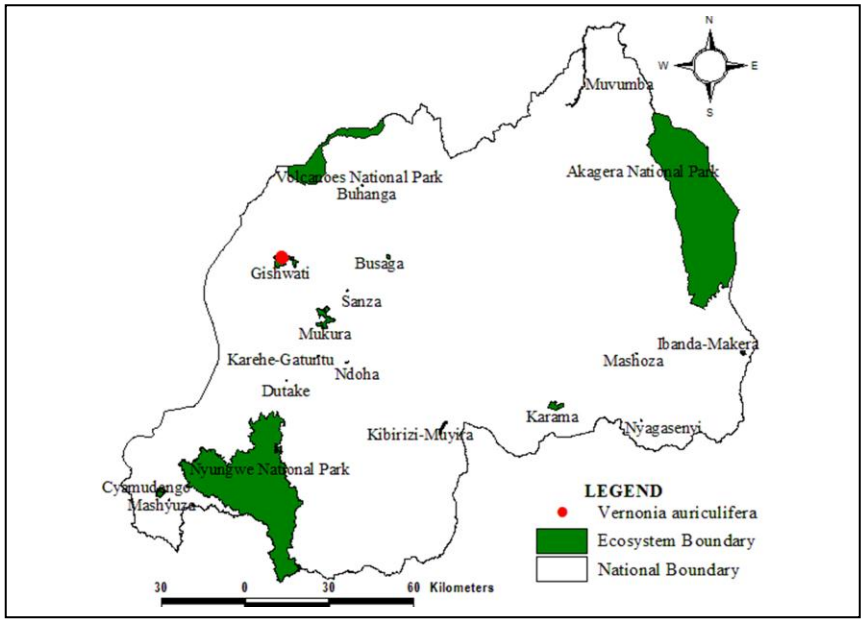
Symphonia globulifera



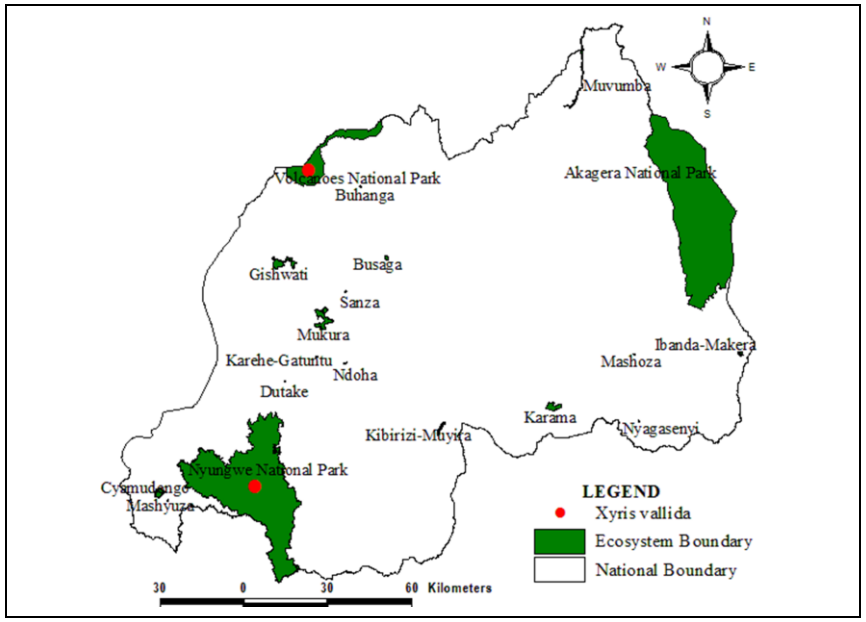
Tabernaemontana odoratissima



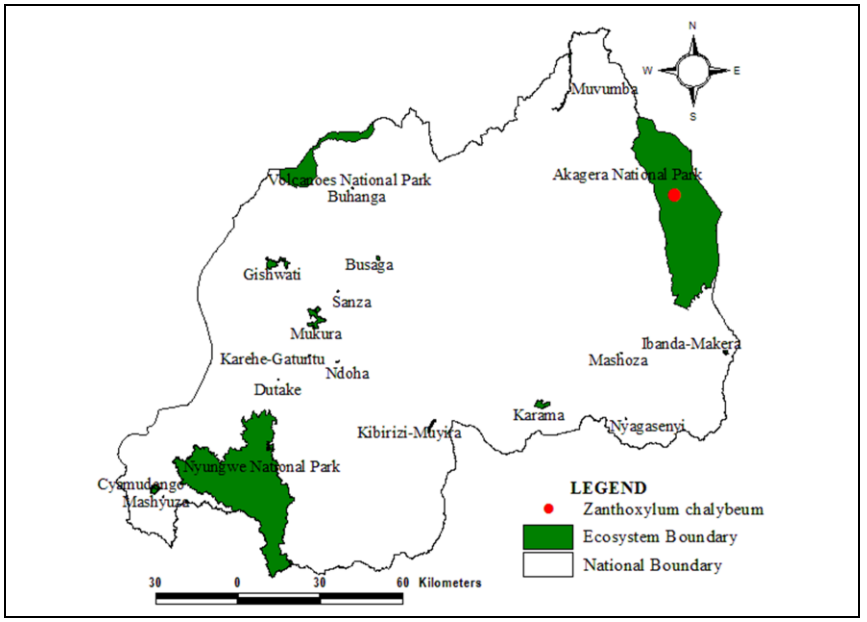
Vaccinium stanleyi



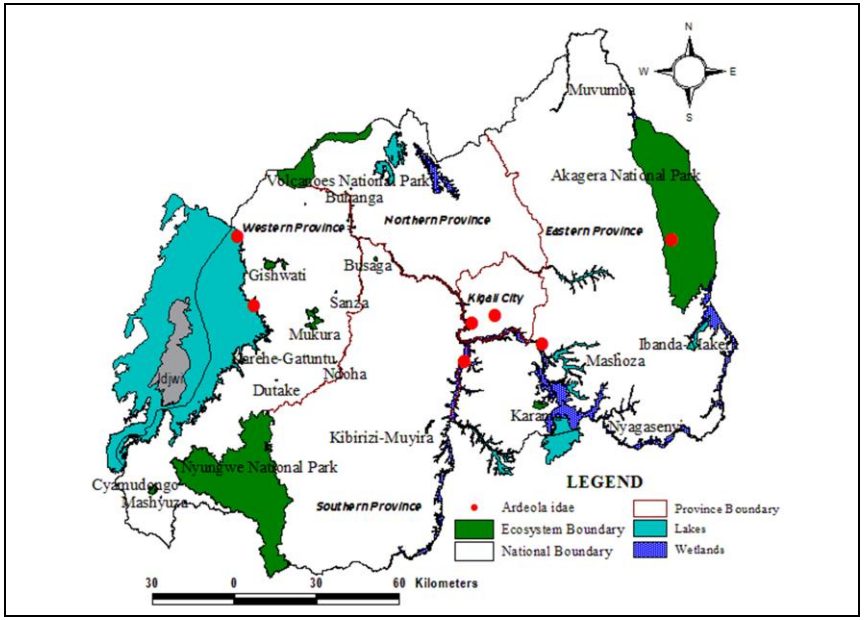
Vernonia auriculifera



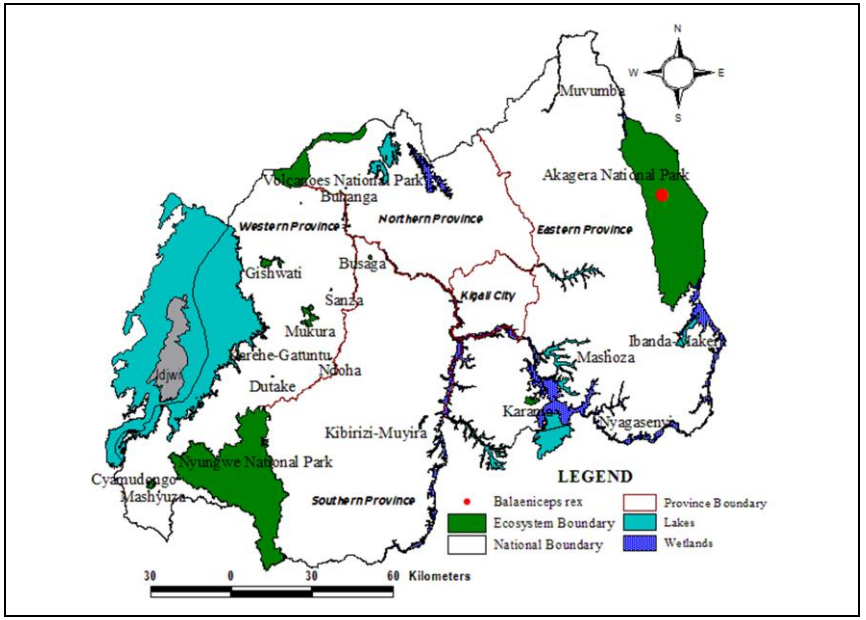
Xyris vallida



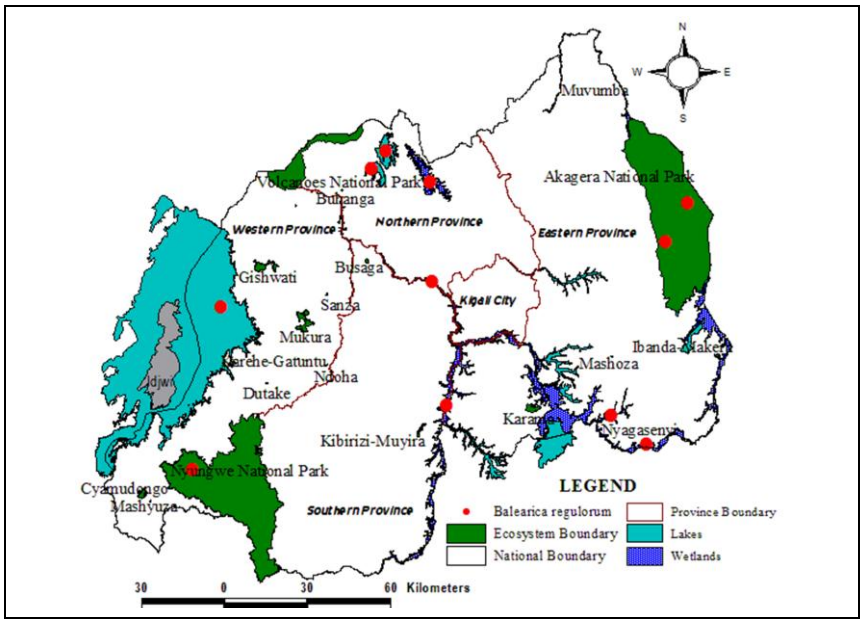
Zanthoxylum chalybeum



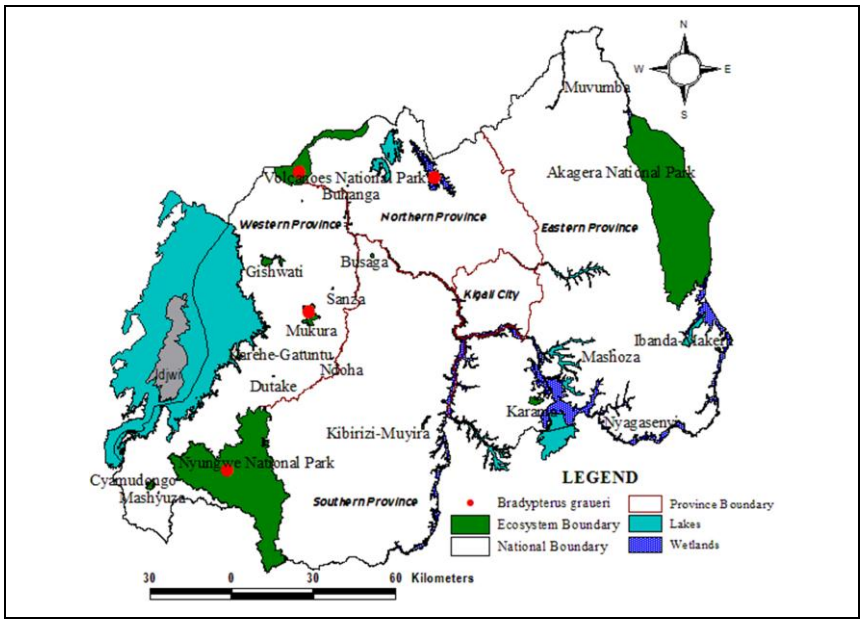
Ardeola idae



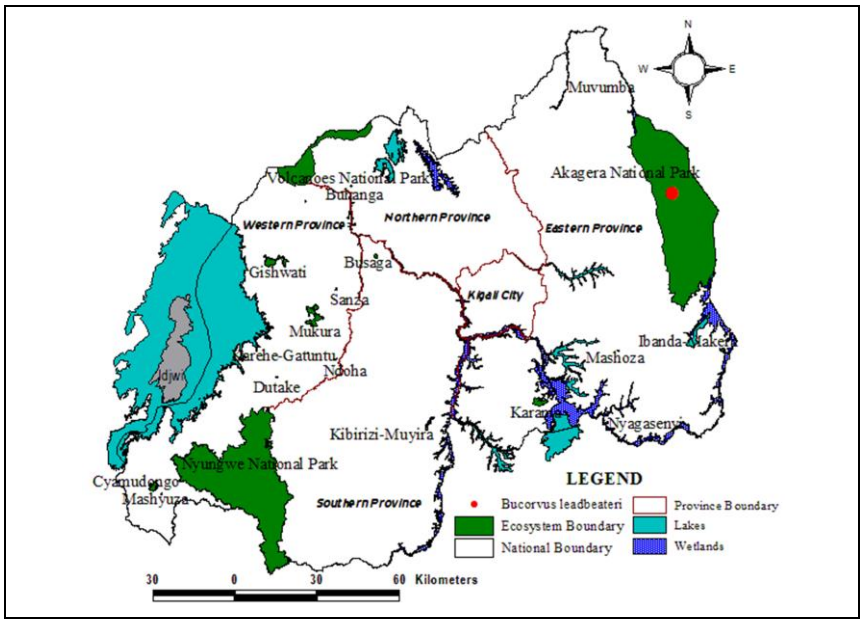
Balaeniceps rex



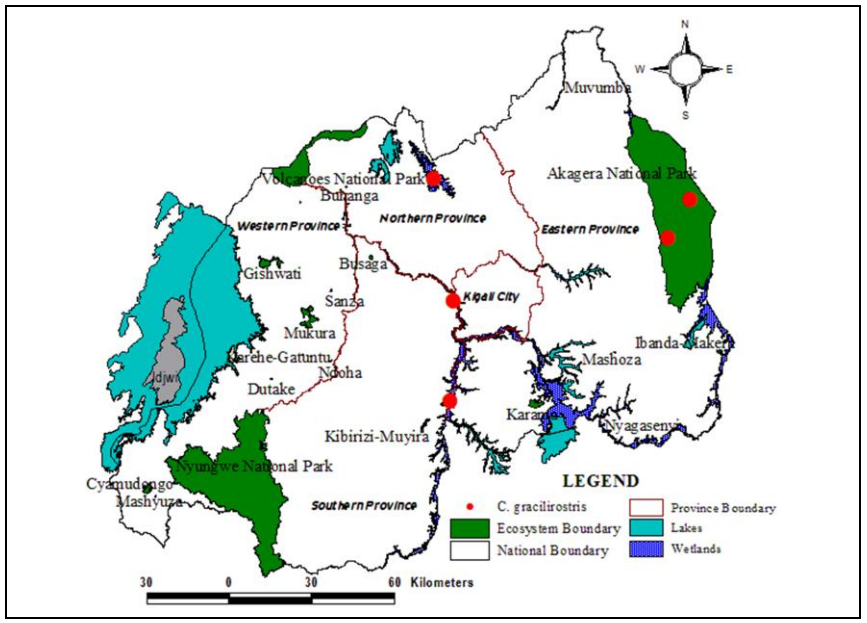
Balearica regulorum



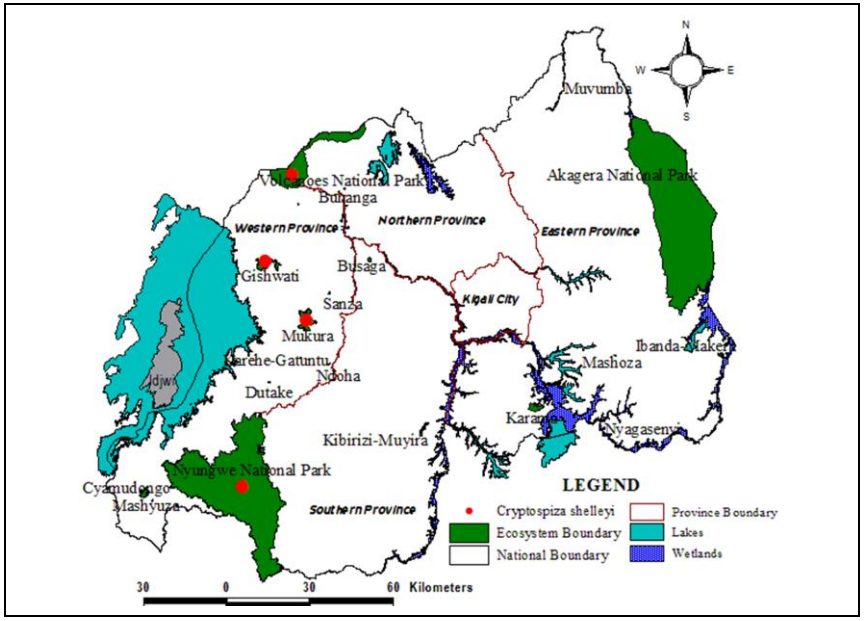
Bradypterus graueri



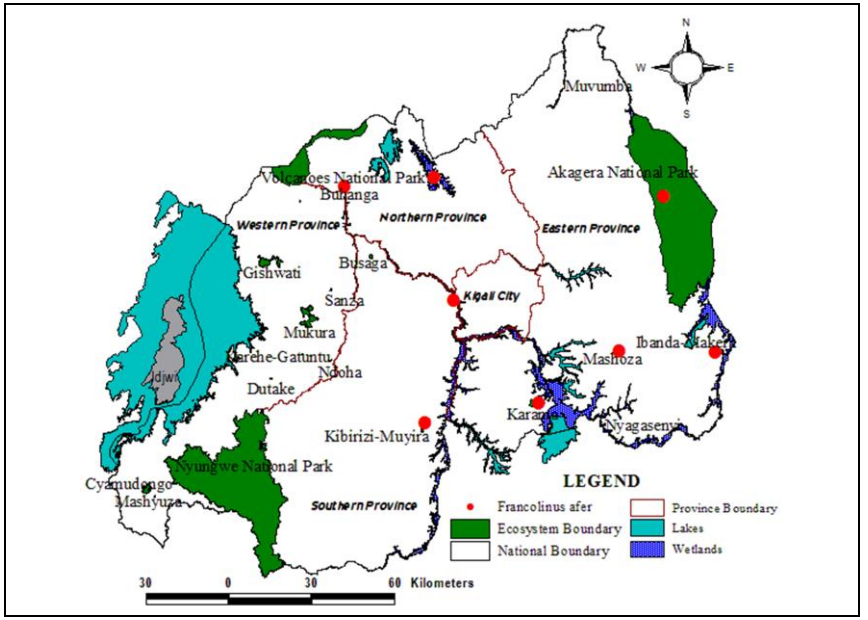
Bucorvus leadbeateri



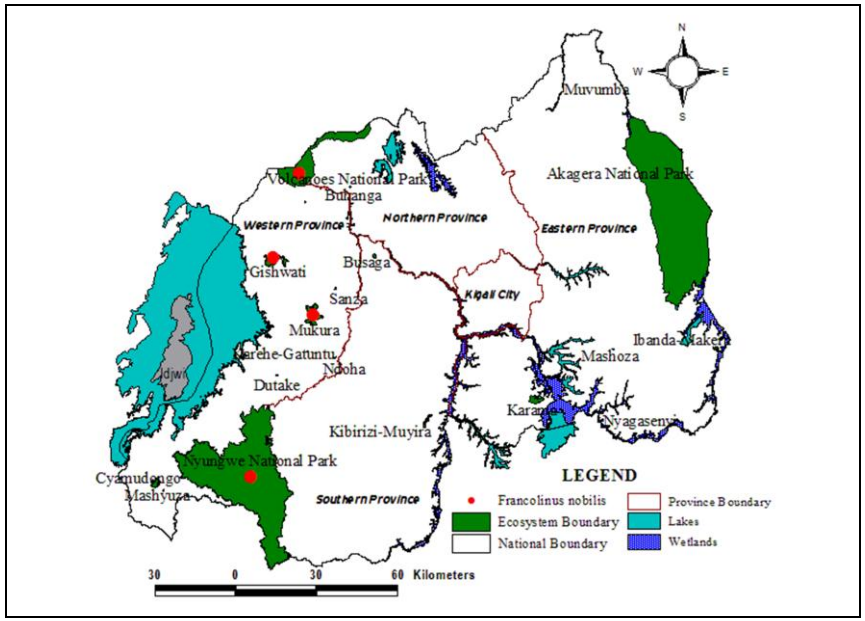
Calamonastides gracilirostris



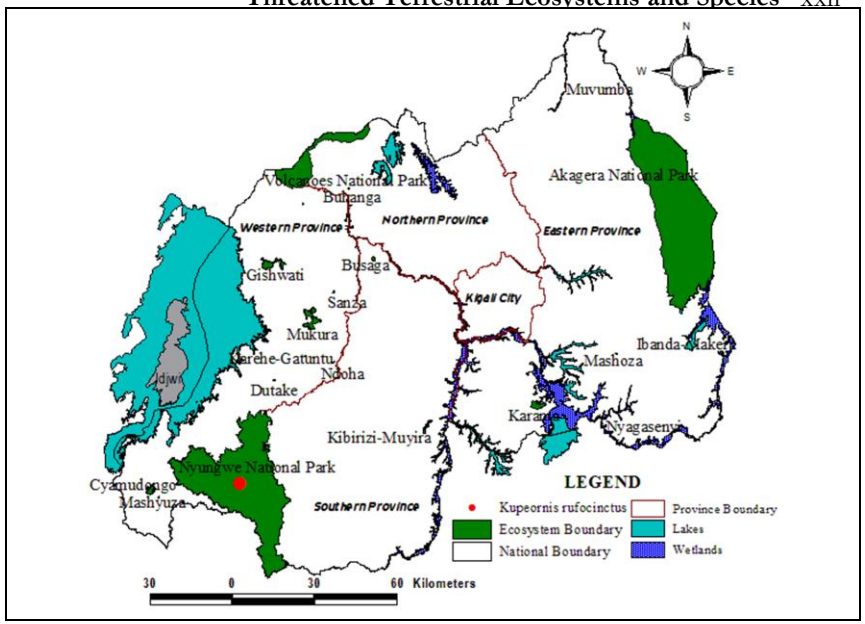
Cryptospiza shelleyi



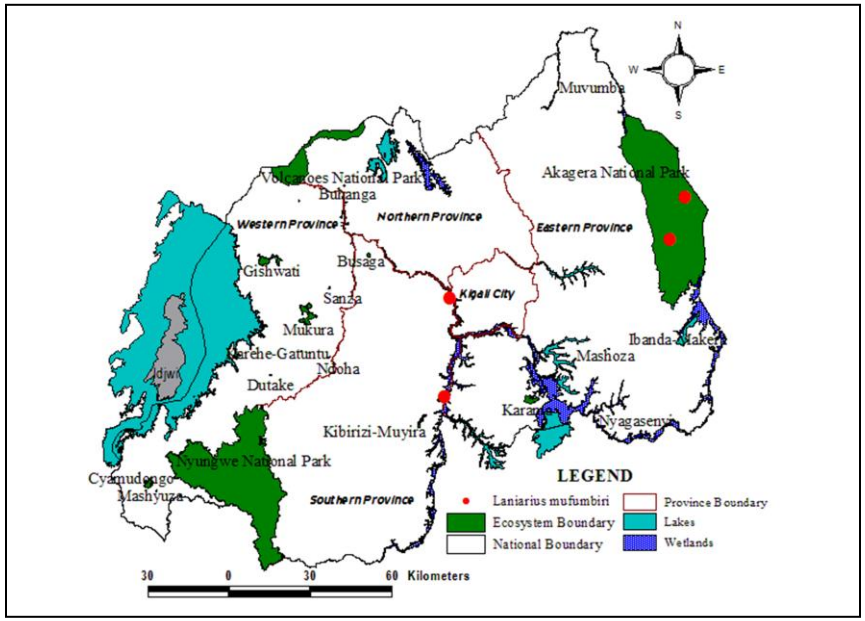
Francolinus afer



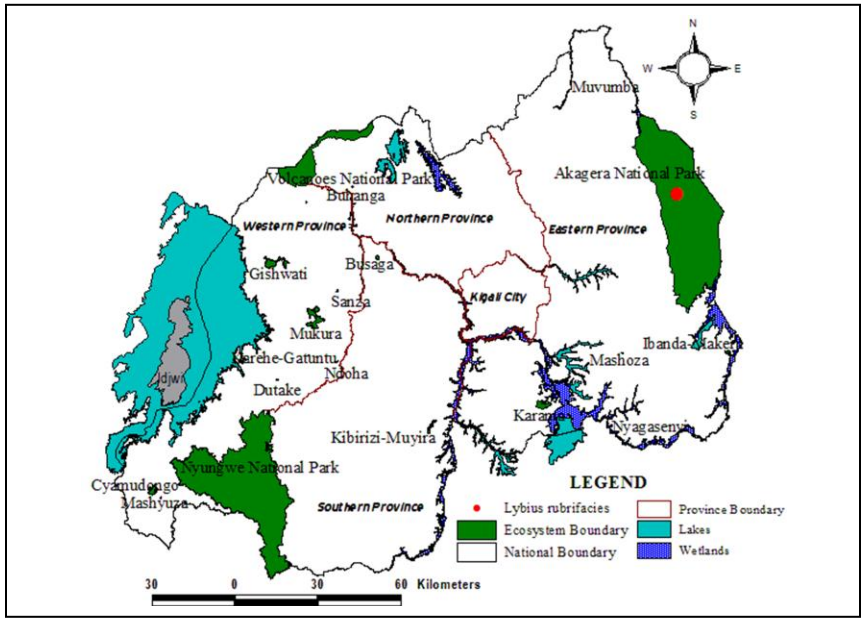
Francolinus nobilis



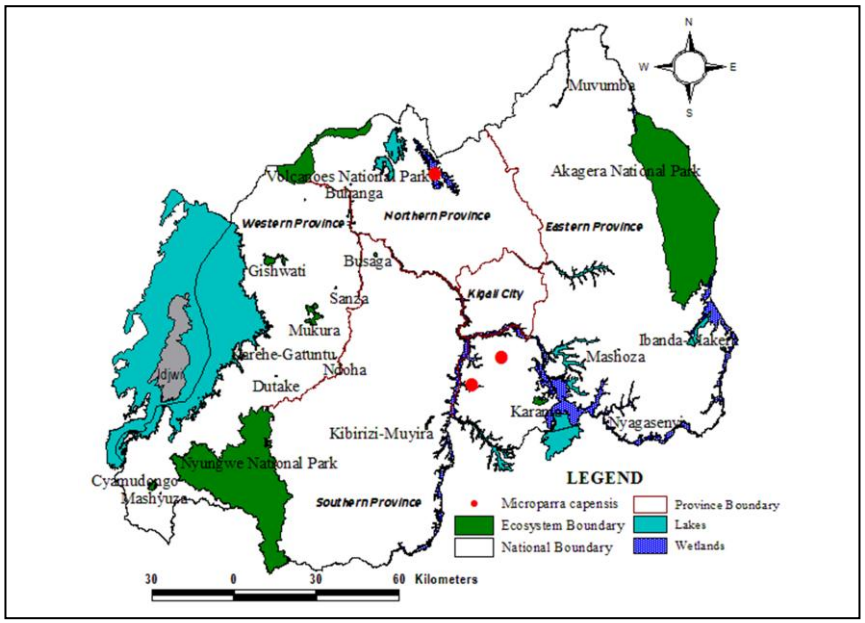
Kupeornis rufocinctus



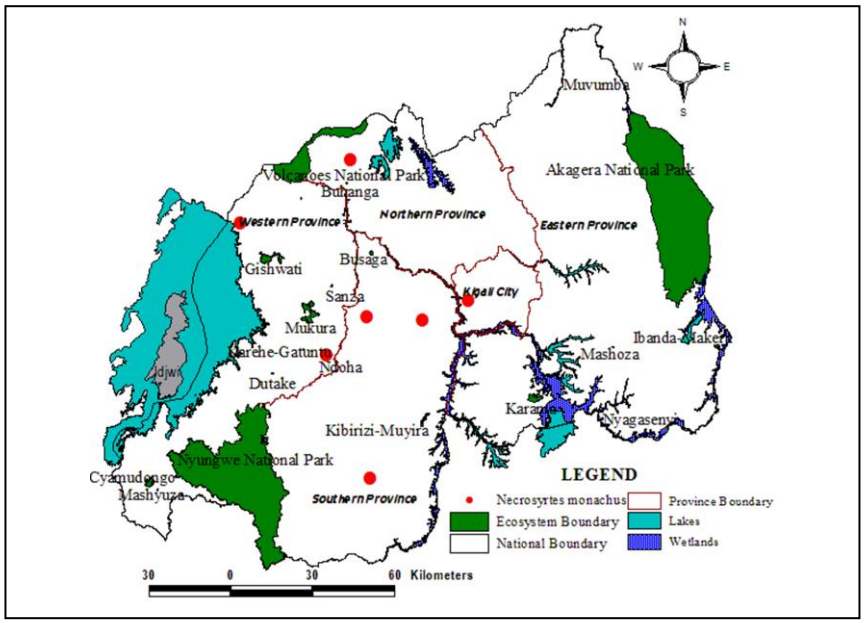
Laniarius mufumbiri



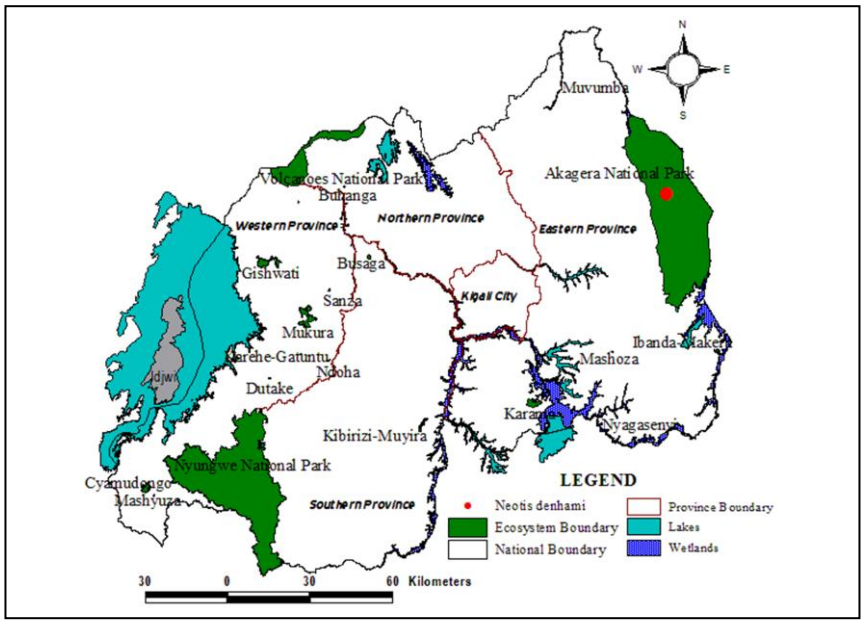
Lybius rubrifacies



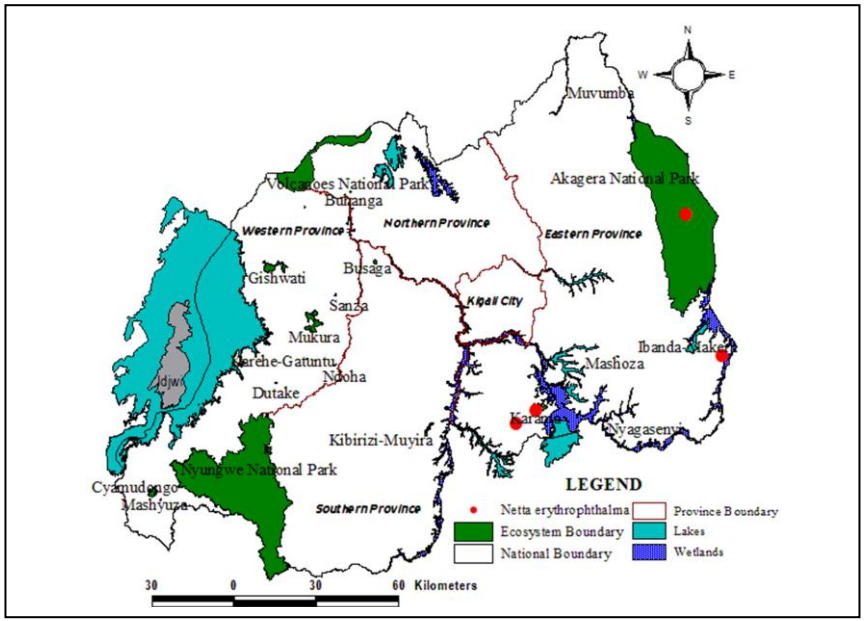
Microparra capensis



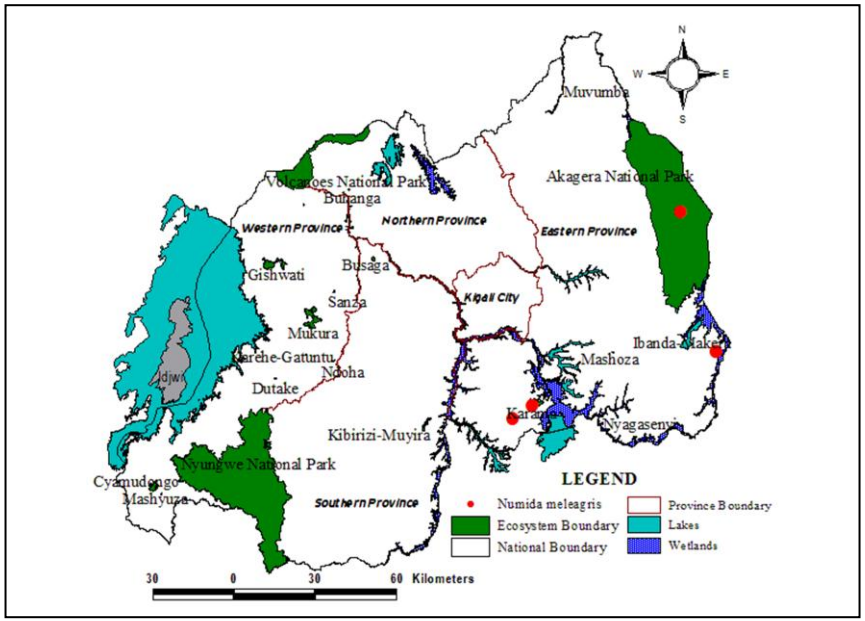
Necrosyrtes monachus



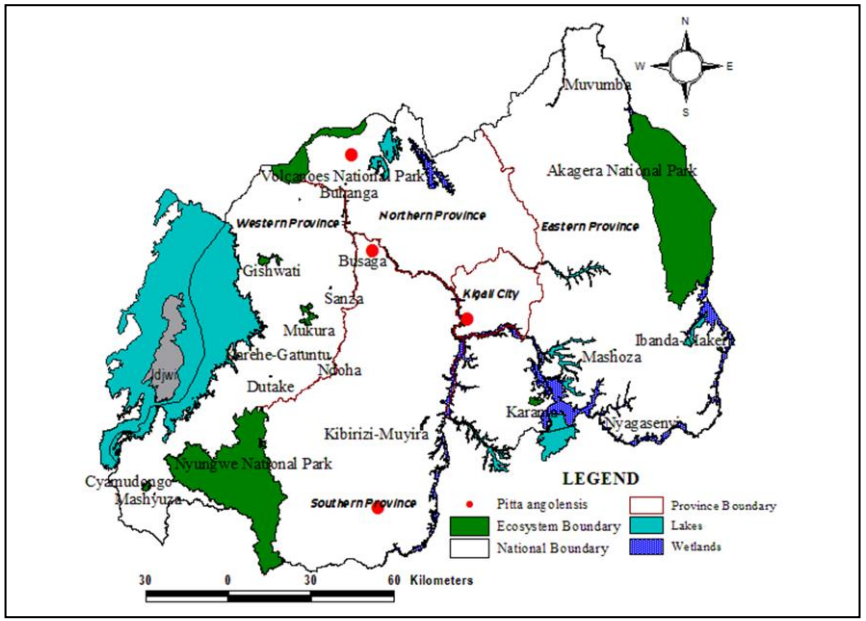
Neotis denhami



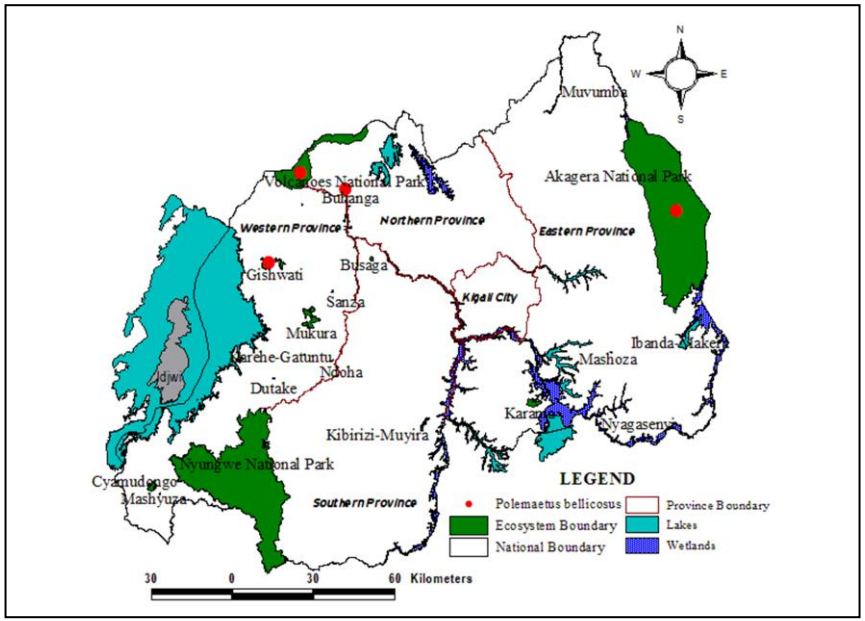
Netta erythrophthalma



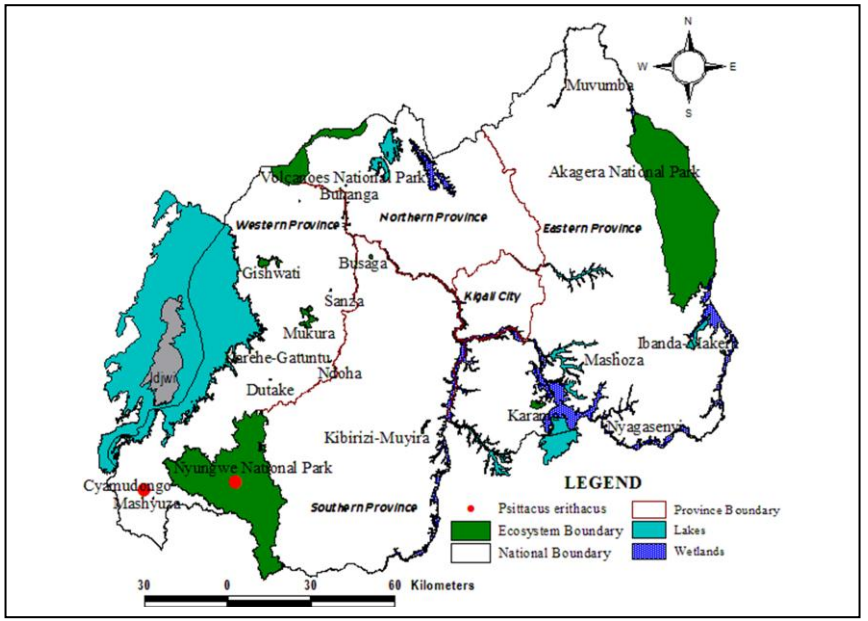
Numida meleagris



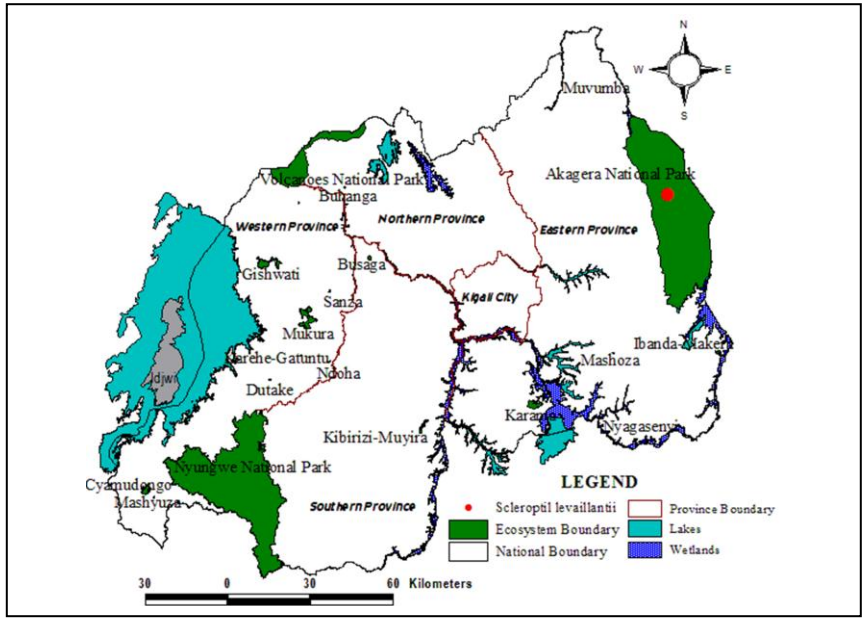
Pitta angolensis



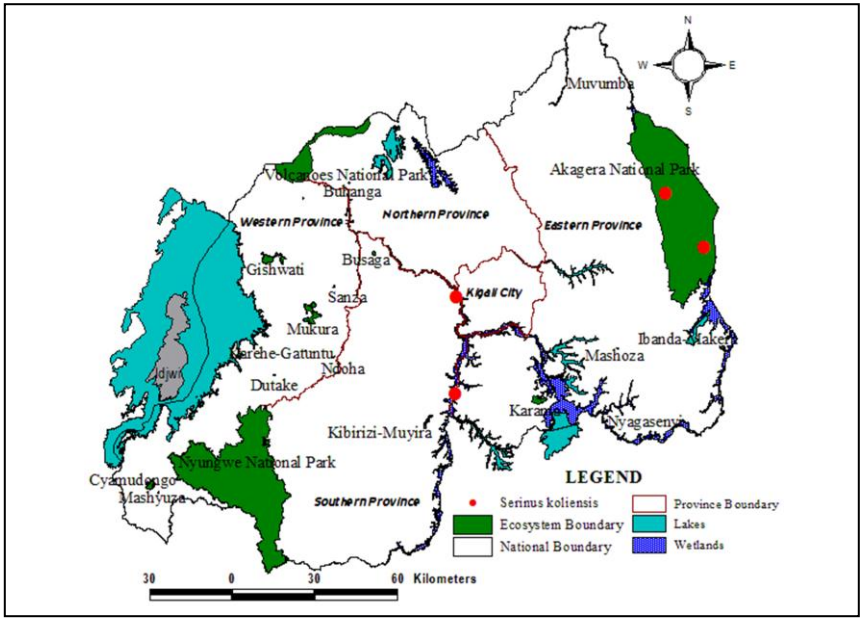
Polemaetus bellicosus



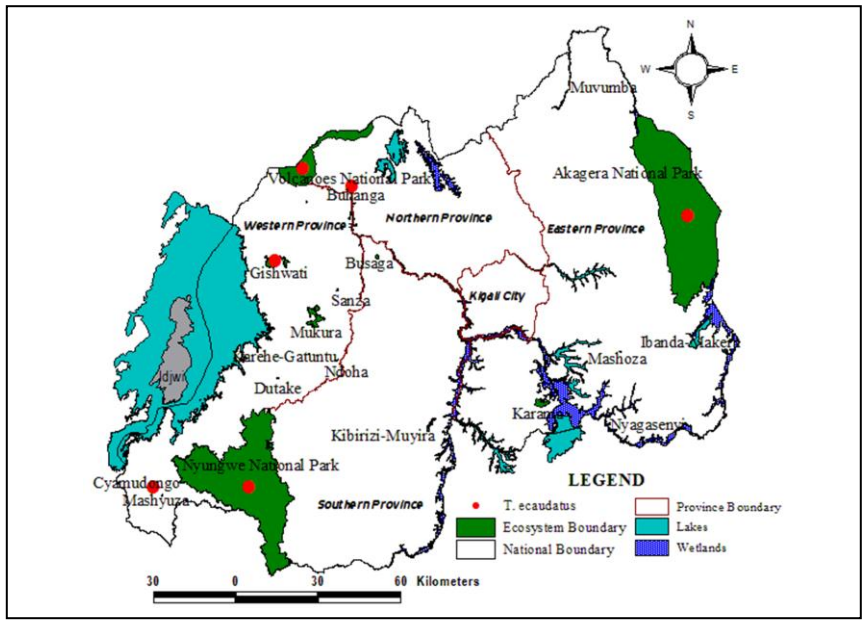
Psittacus erithacus



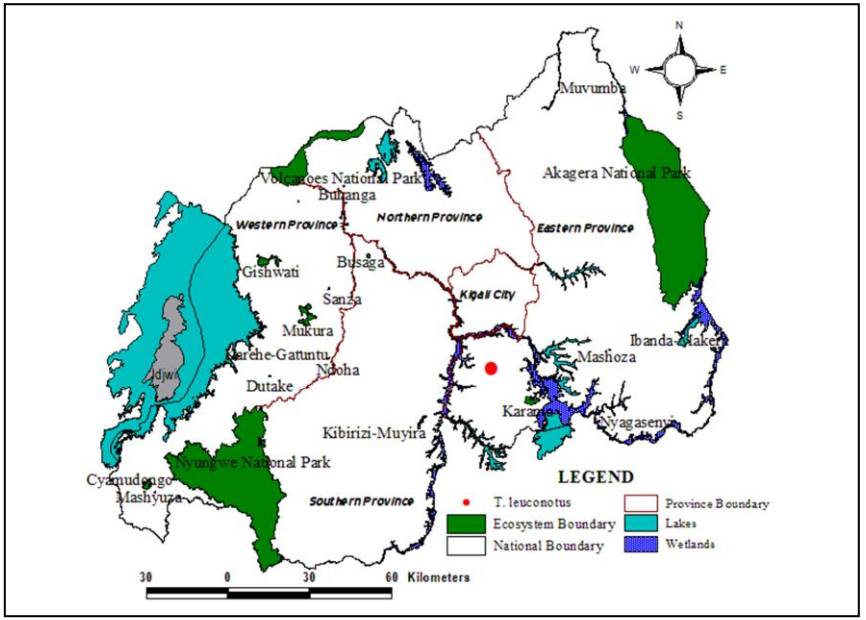
Scleroptil levaillantii



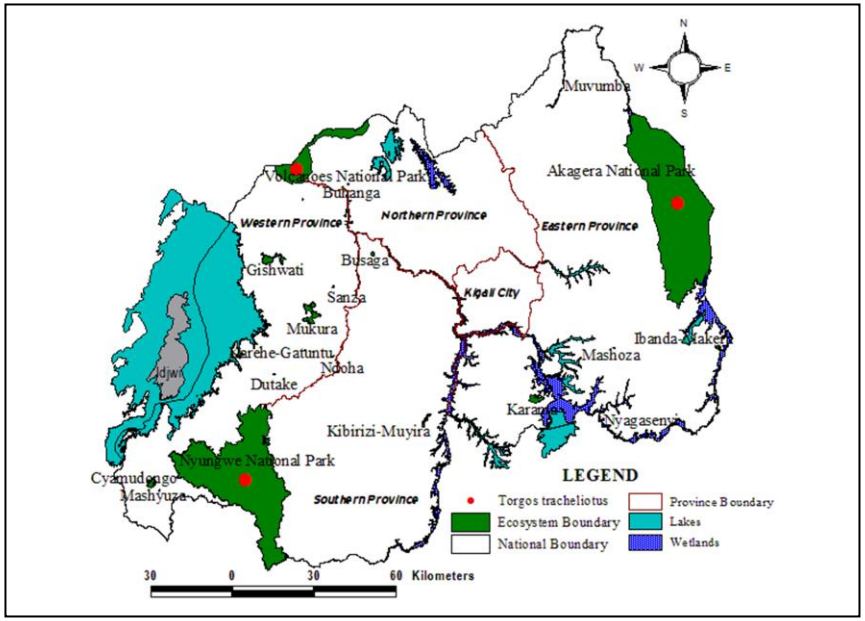
Serinus koliensis



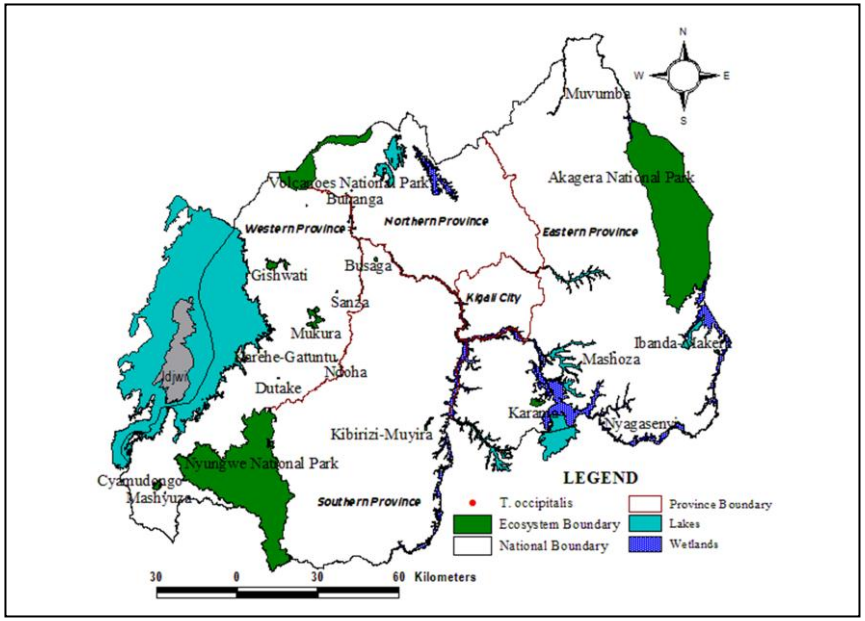
Terathopius Ecaudatus



Thalassornis leuconotus

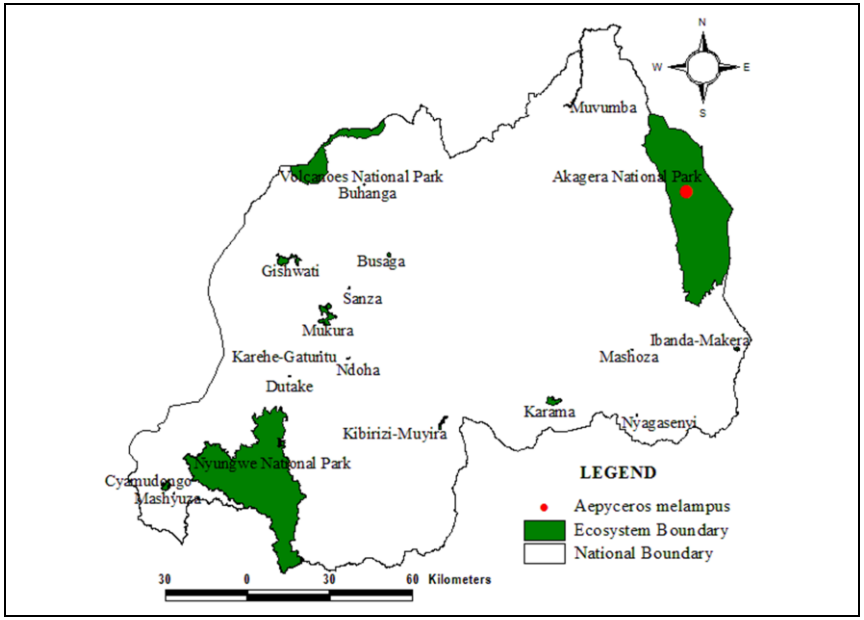


Torgos tracheliotus

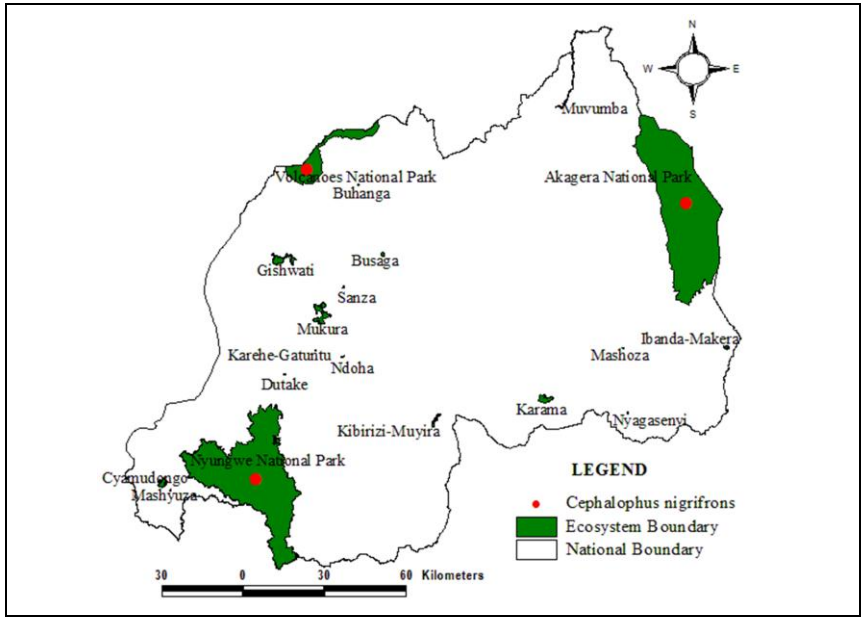


Trigonoceps occipitalis

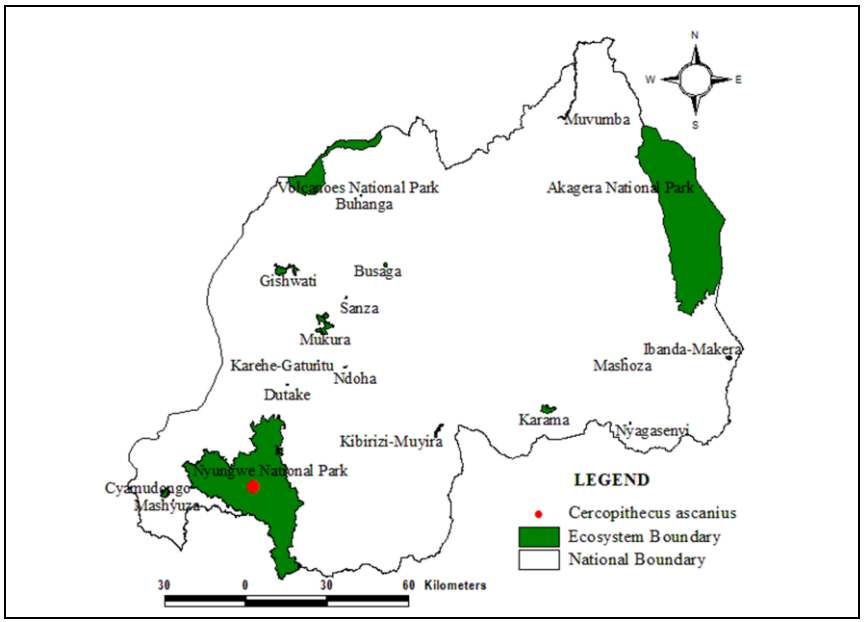
C. Mammals



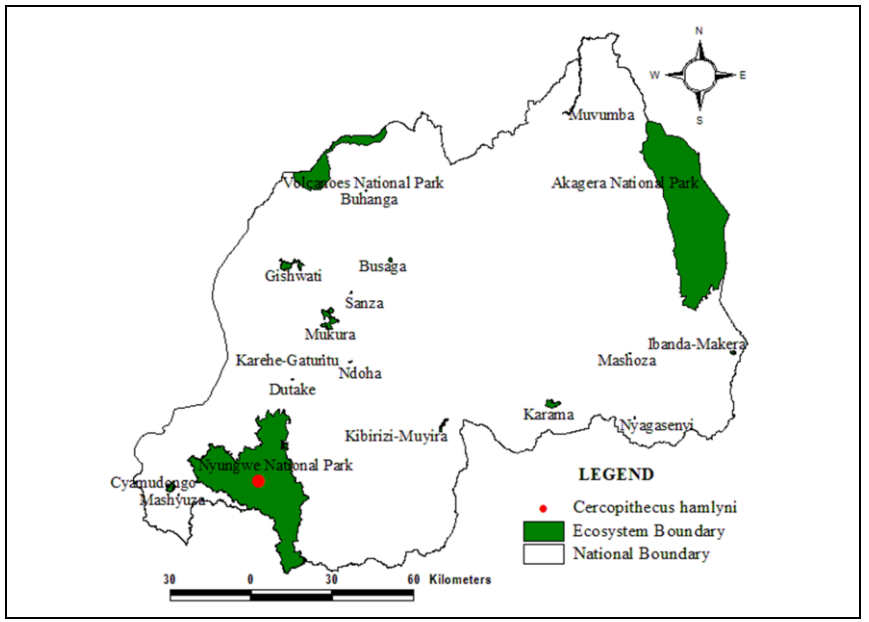
Aepyceros melampus



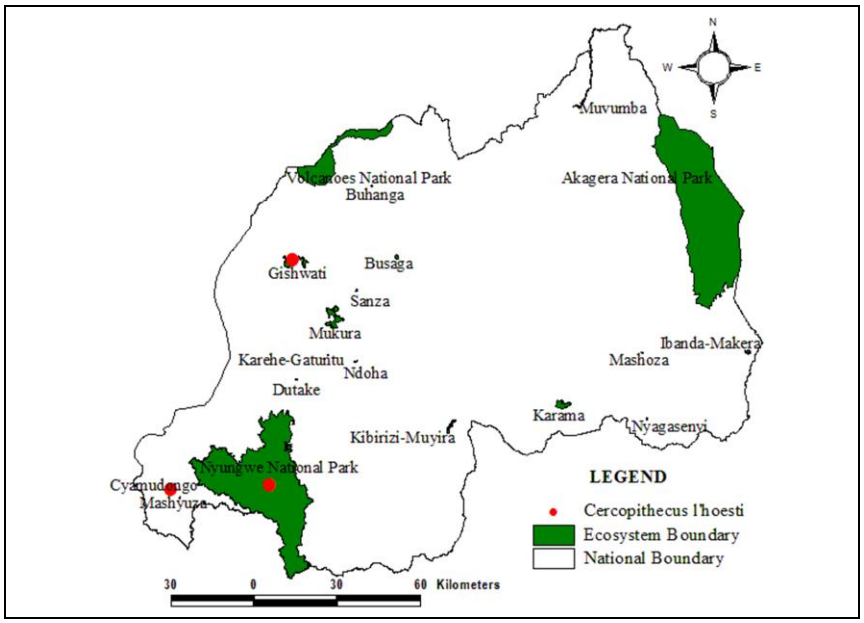
Cephalophus nigrifrons



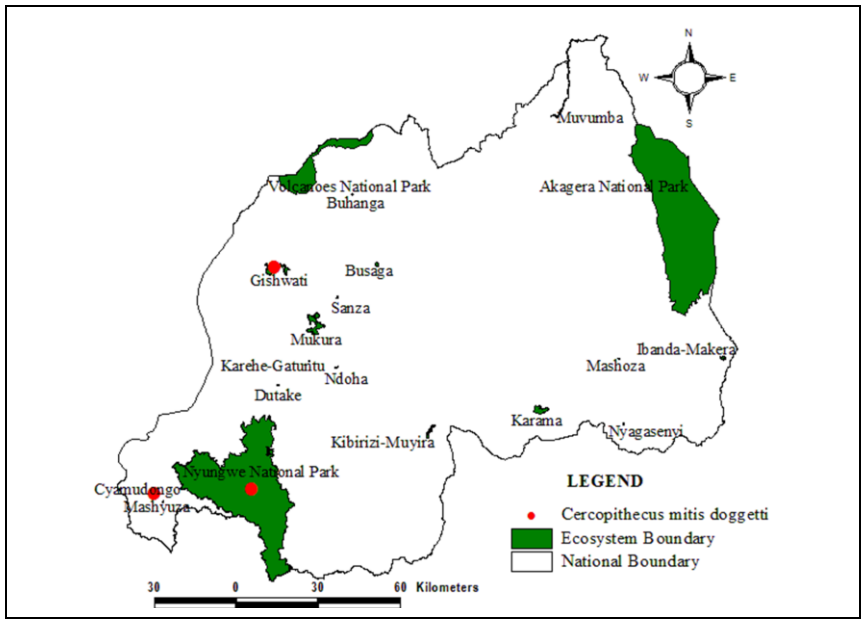
Cercopithecus ascanius



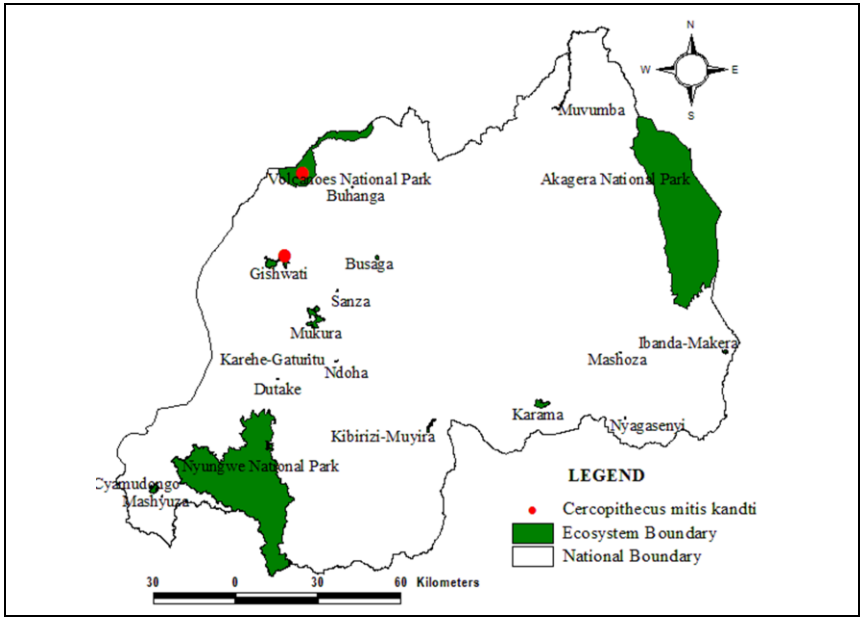
Cercopithecus hamlyni



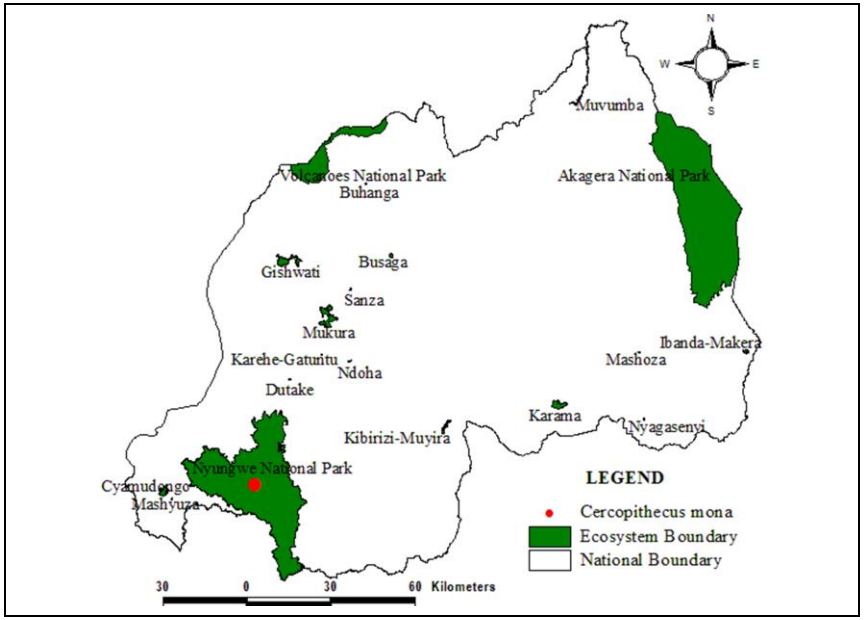
Cercopithecus l'hoesti



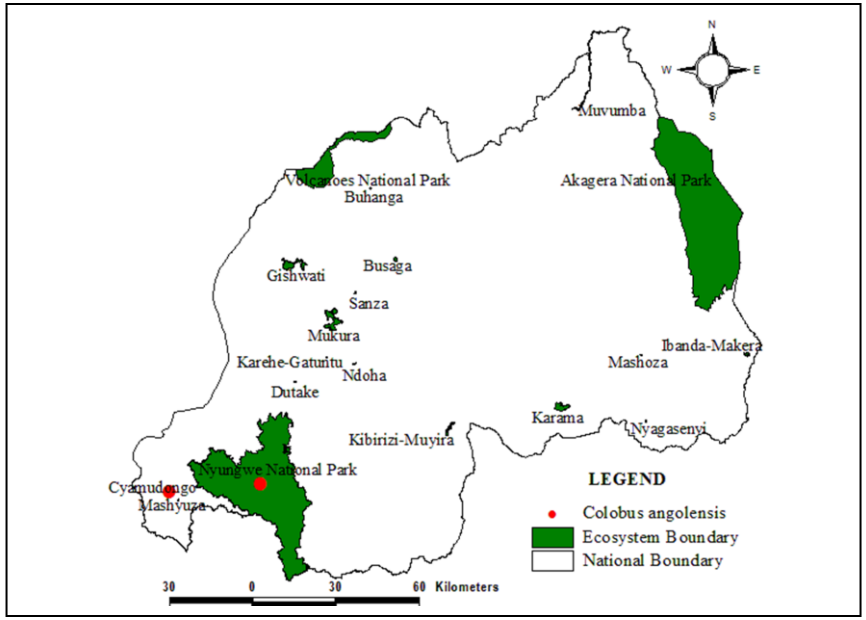
Cercopithecus mitis doggetti



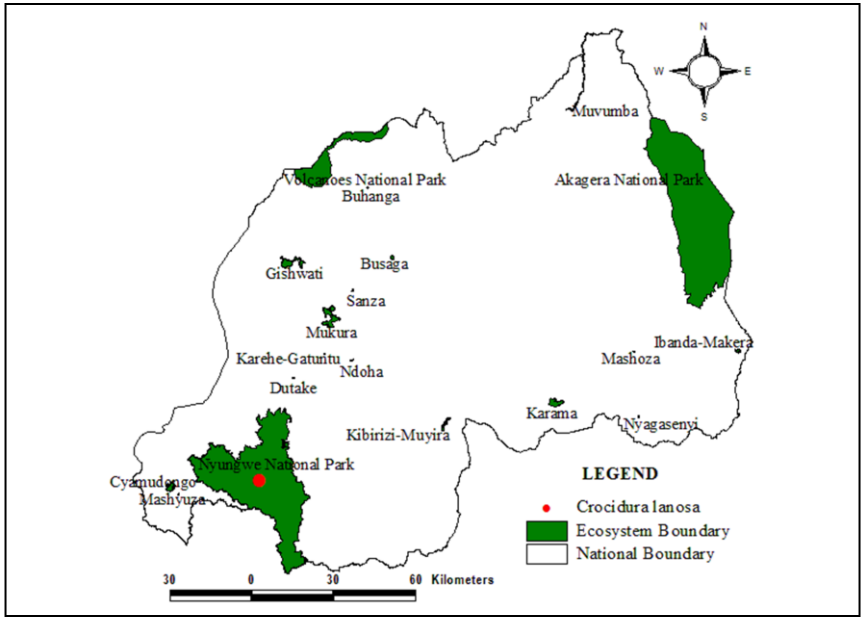
Cercopithecus mitis kandti



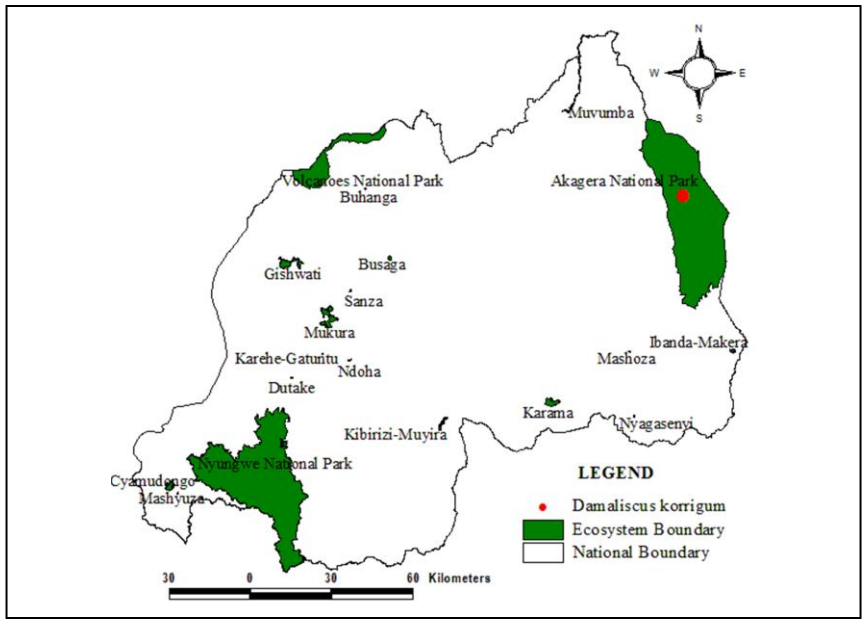
Cercopithecus mona



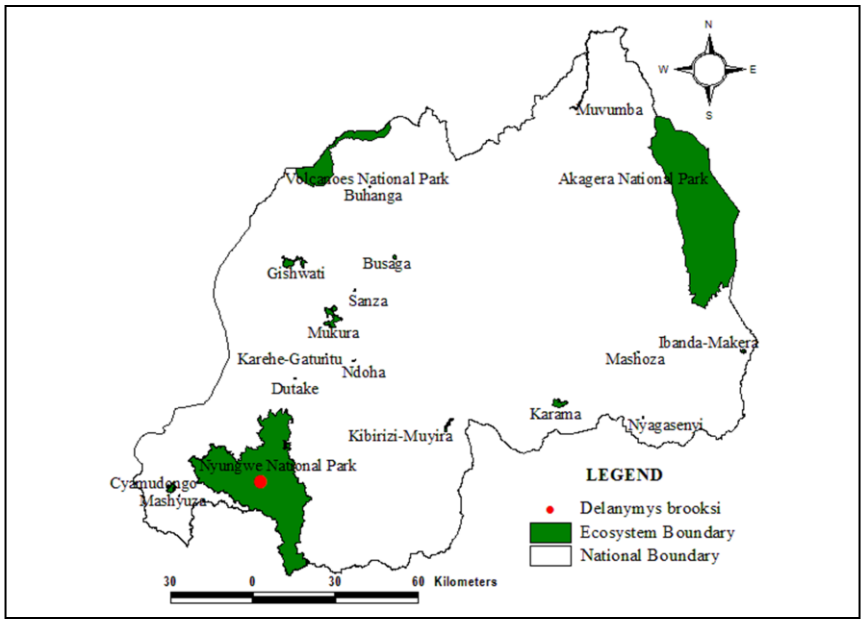
Colobus angolensis angolensis



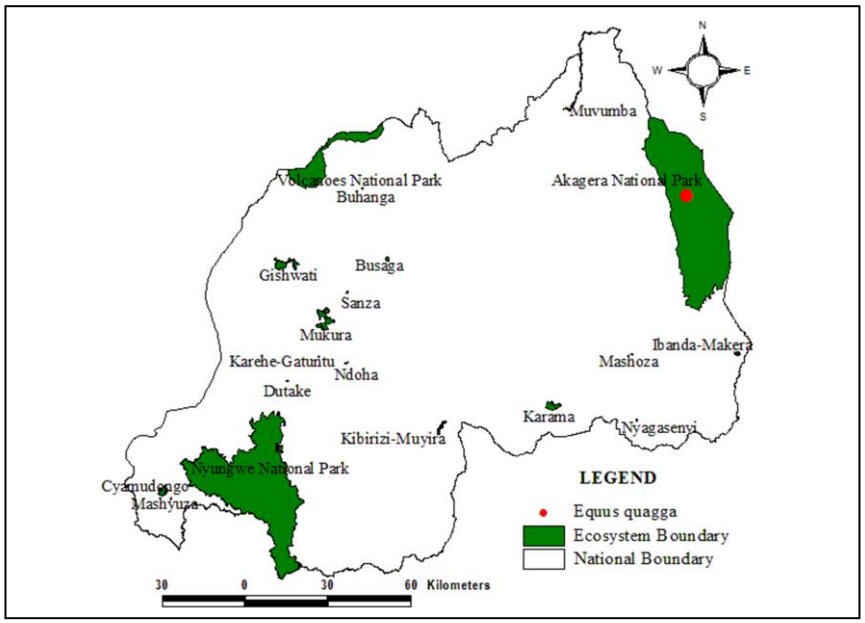
Crocidura lanosa



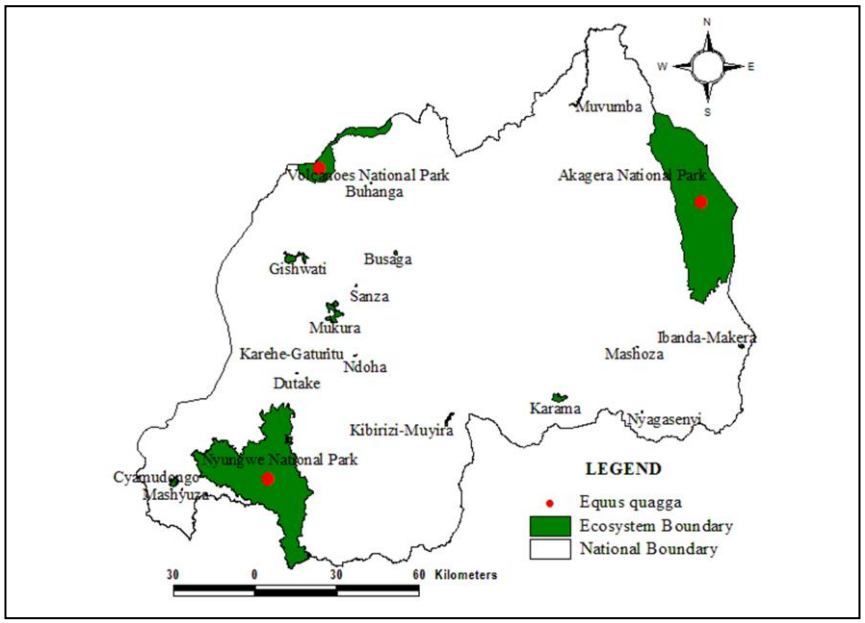
Damaliscus korrigum



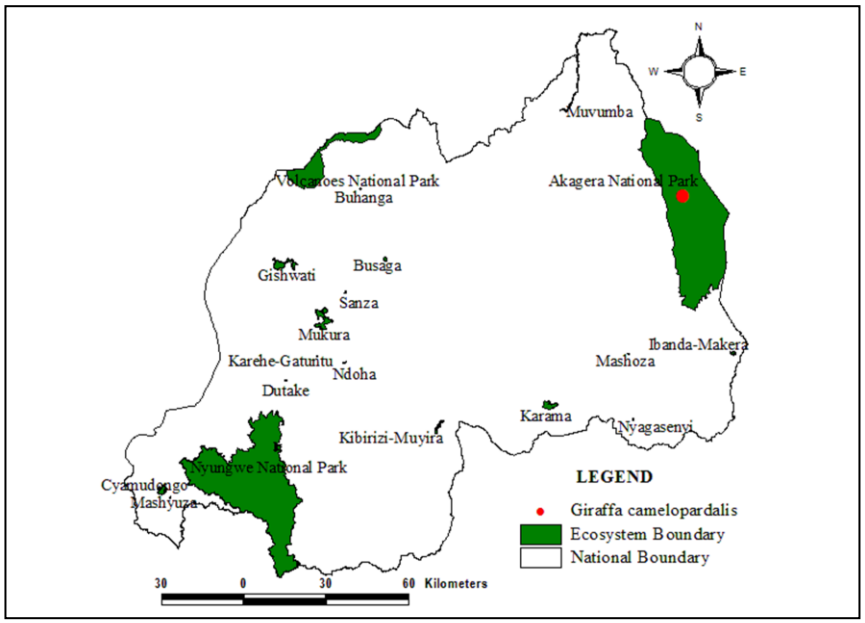
Delanymys brooksi



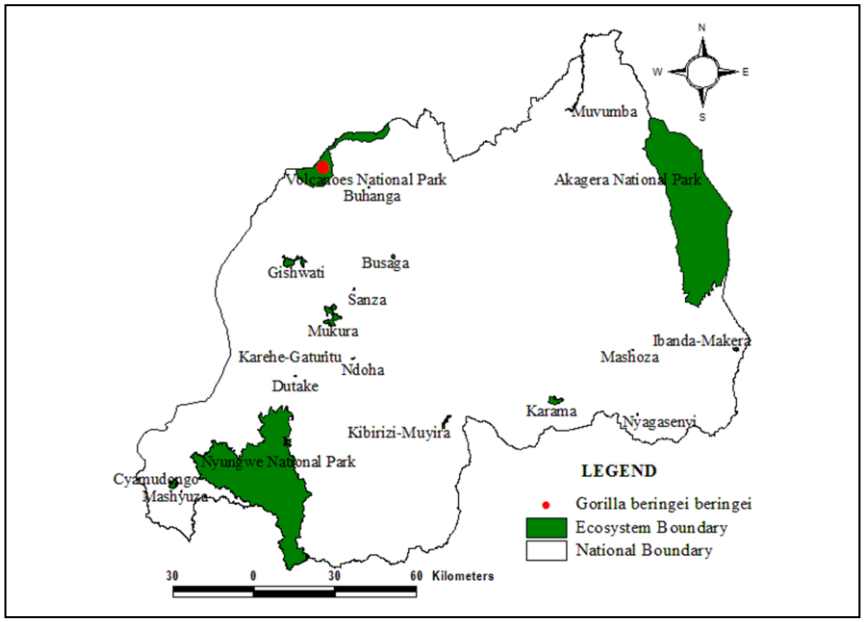
Equus quagga



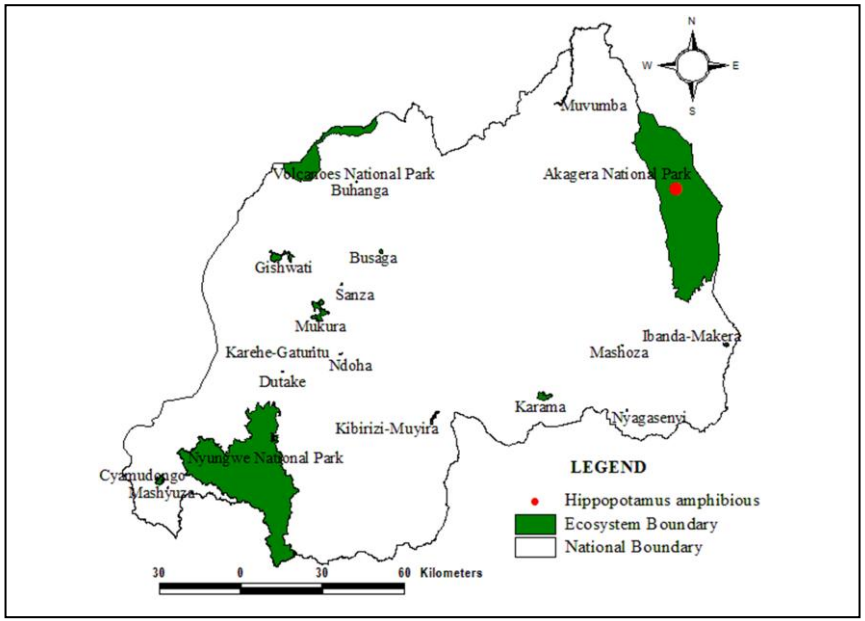
Felis aurata



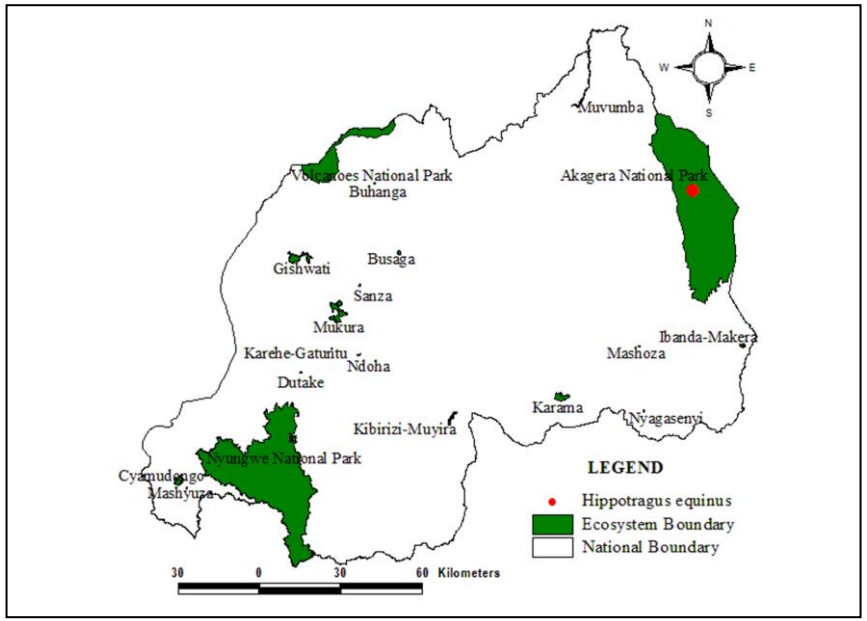
Giraffa camelopardalis



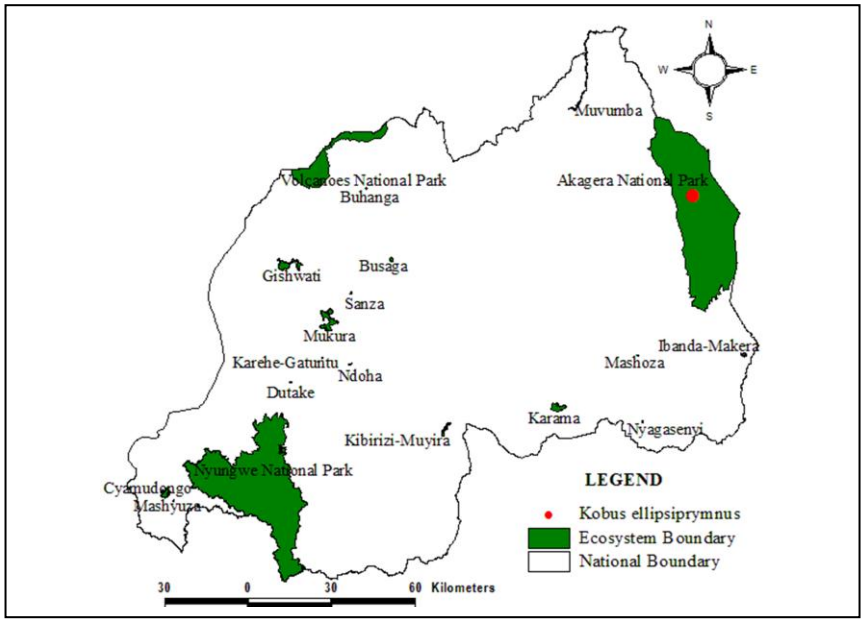
Gorilla beringei beringei



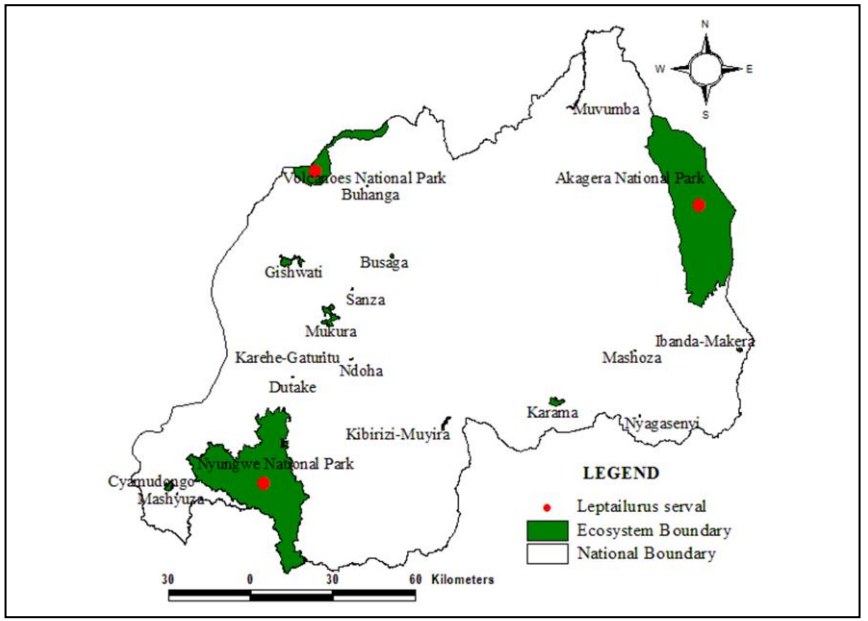
Hippopotamus amphibious



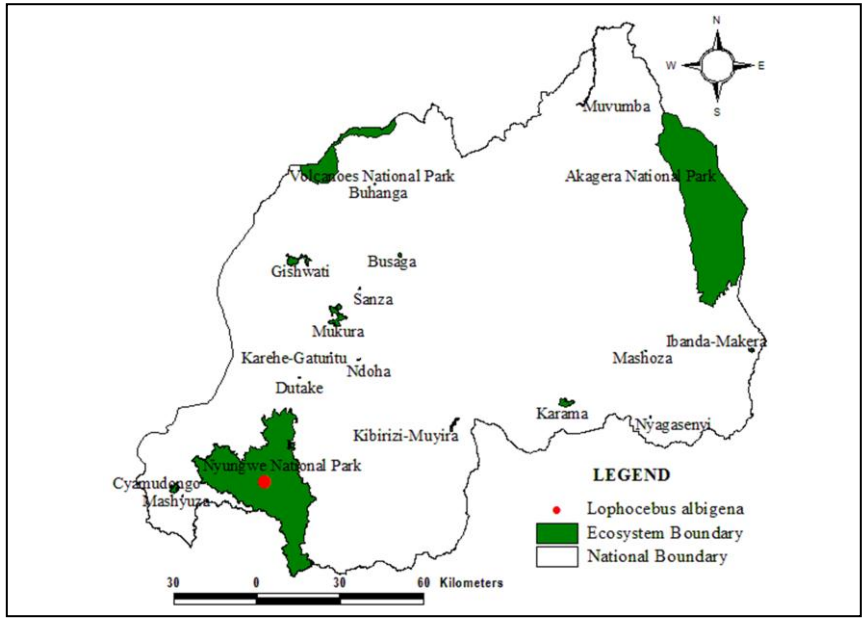
Hippotragus equinus



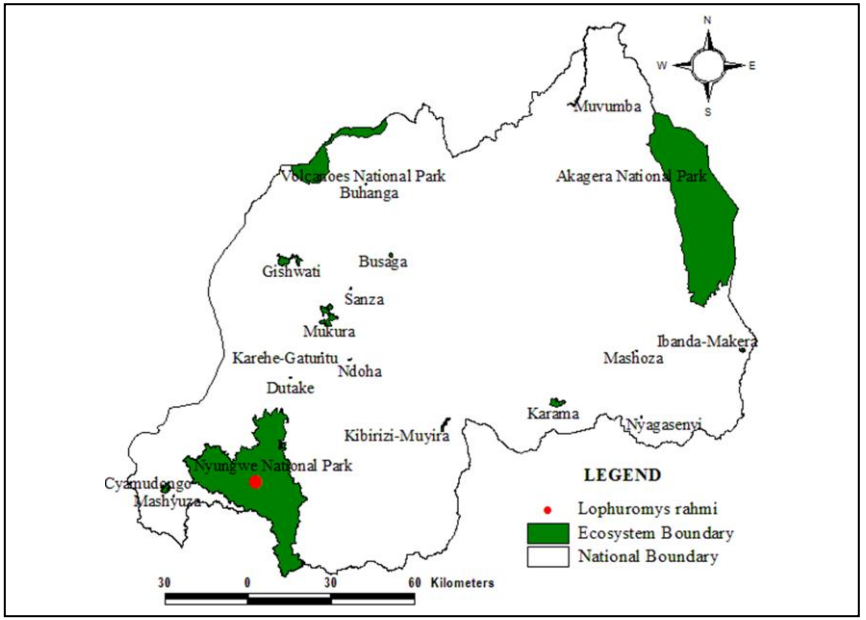
Kobus ellipsiprymnus



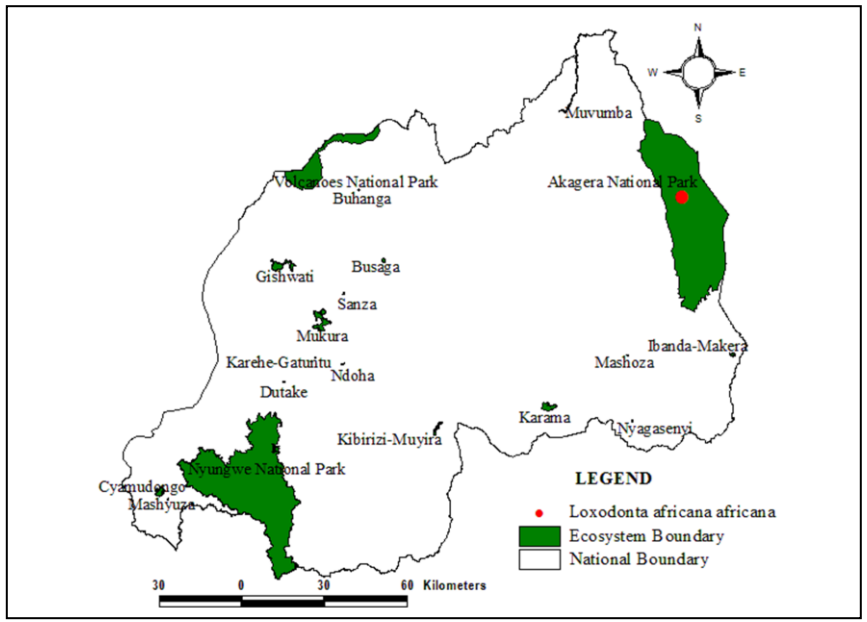
Leptailurus serval



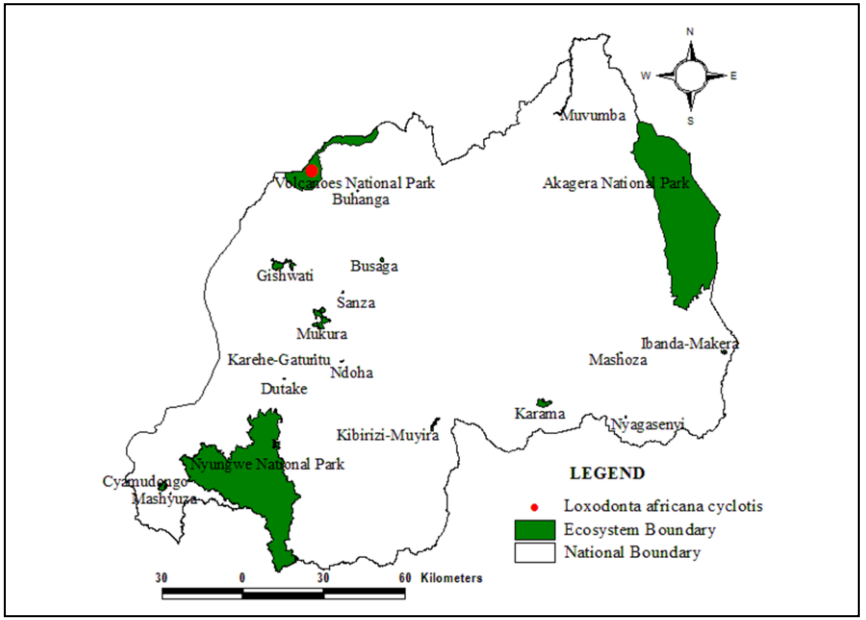
Lophocebus albigena



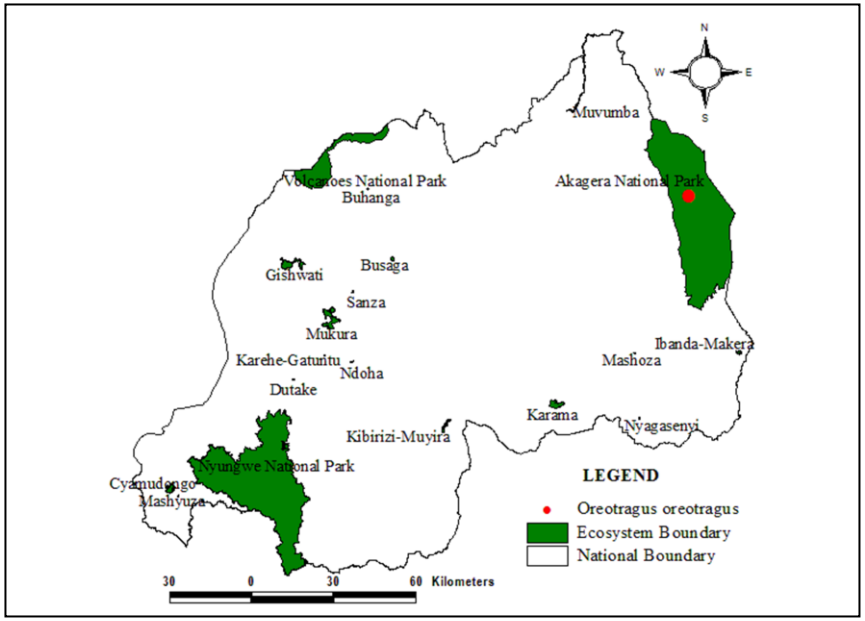
Lophuromys rahmi



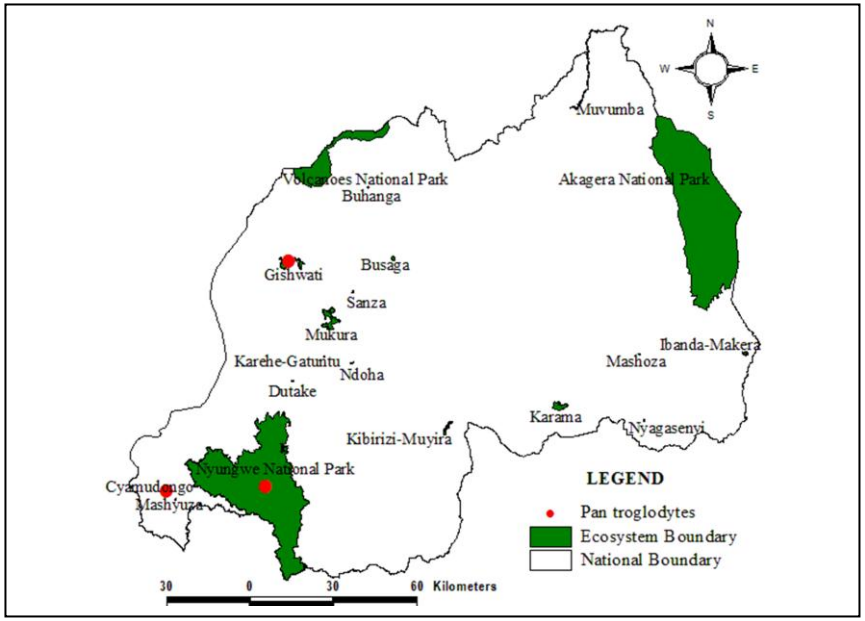
Loxodonta africana africana



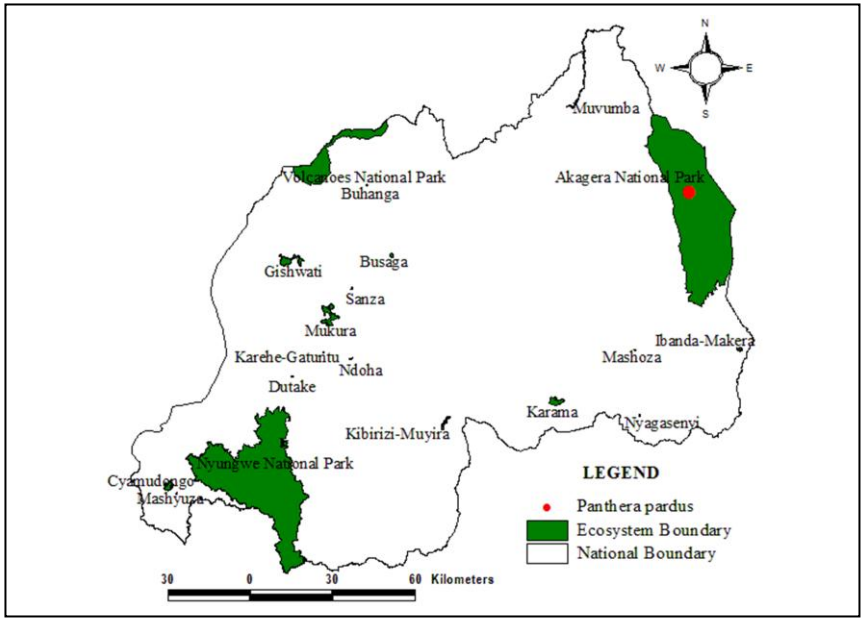
Loxodonta africana cyclotis



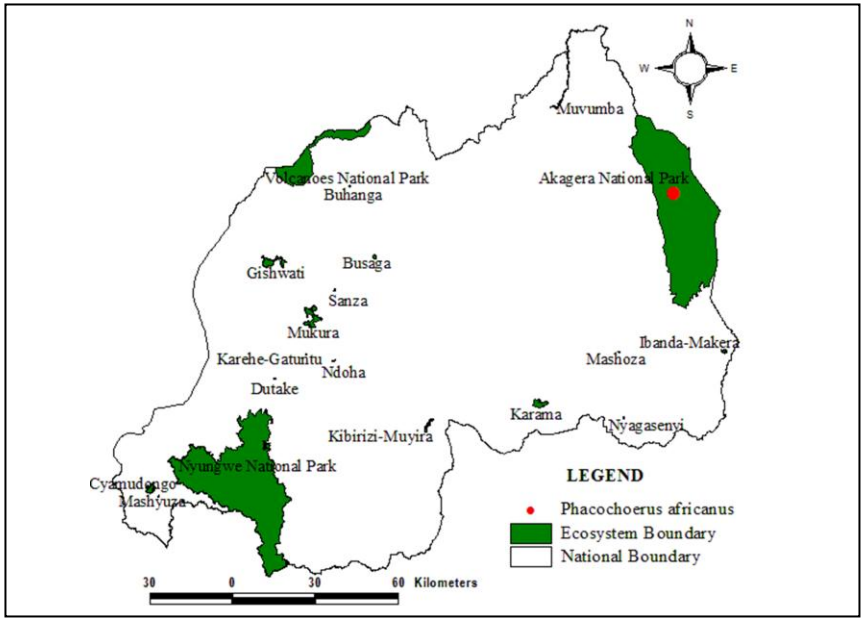
Oreotragus oreotragus



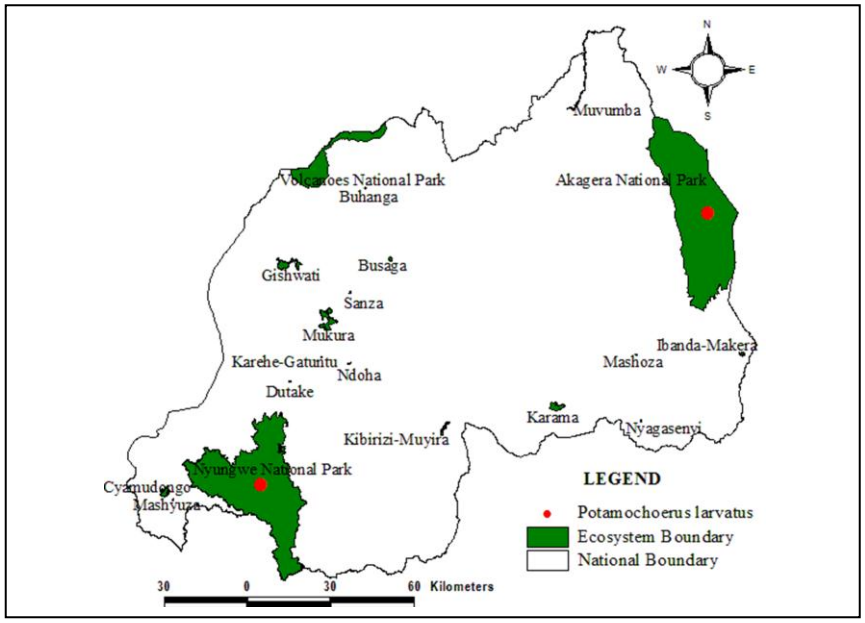
Pan troglodytes



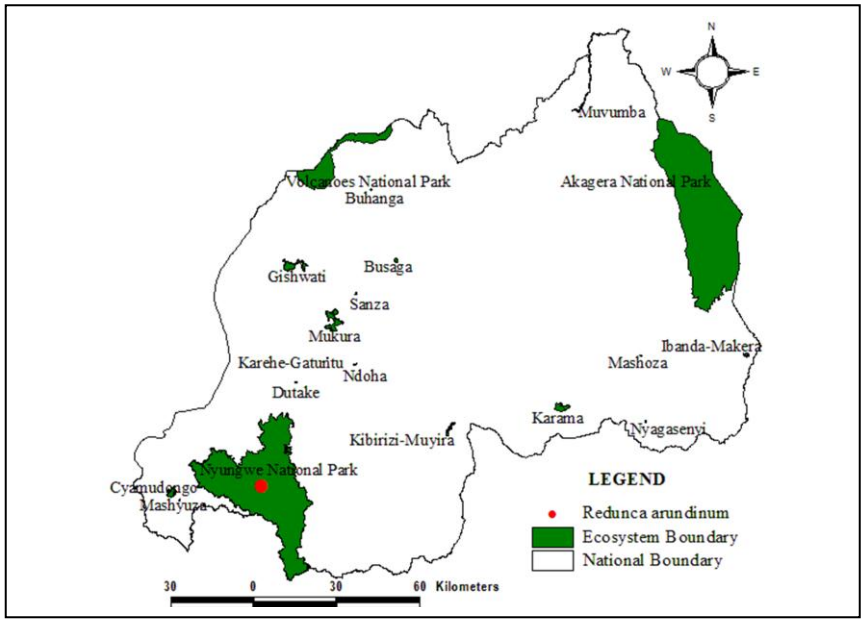
Panthera pardus



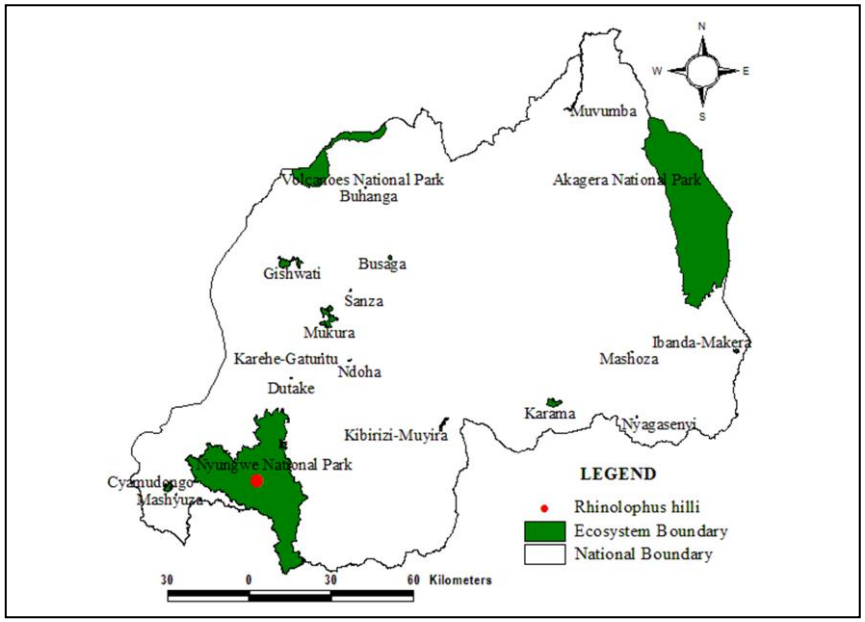
Phacochoerus africanus



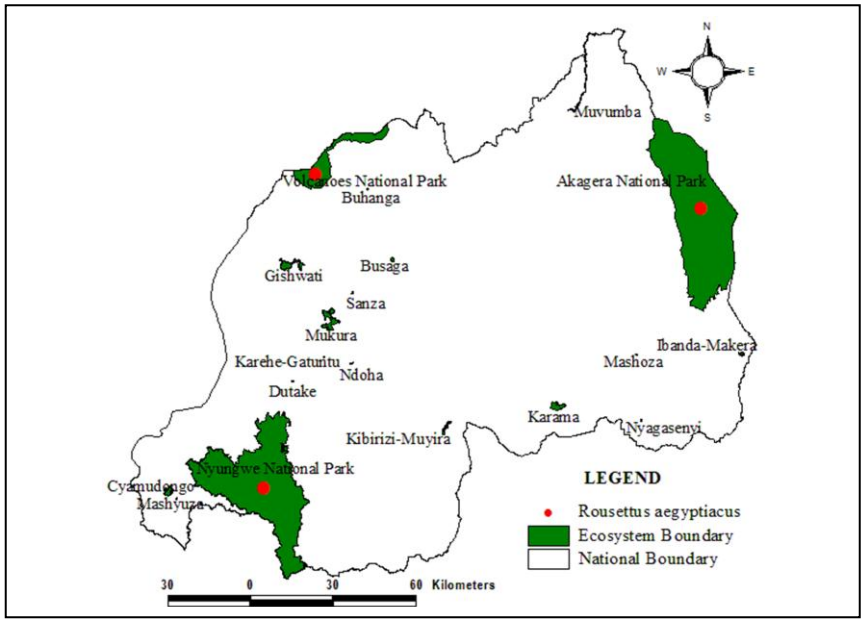
Potamochoerus larvatus larvatus



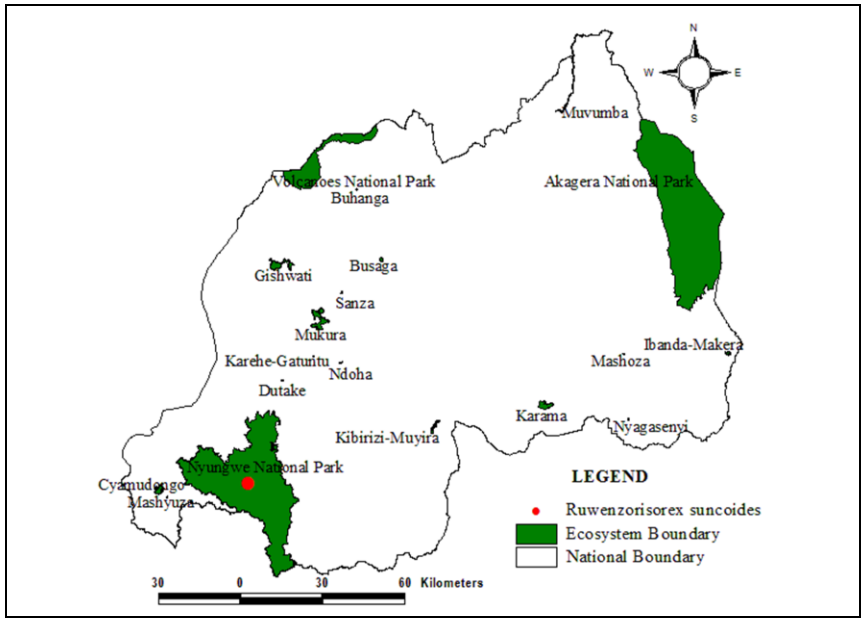
Redunca arundinum



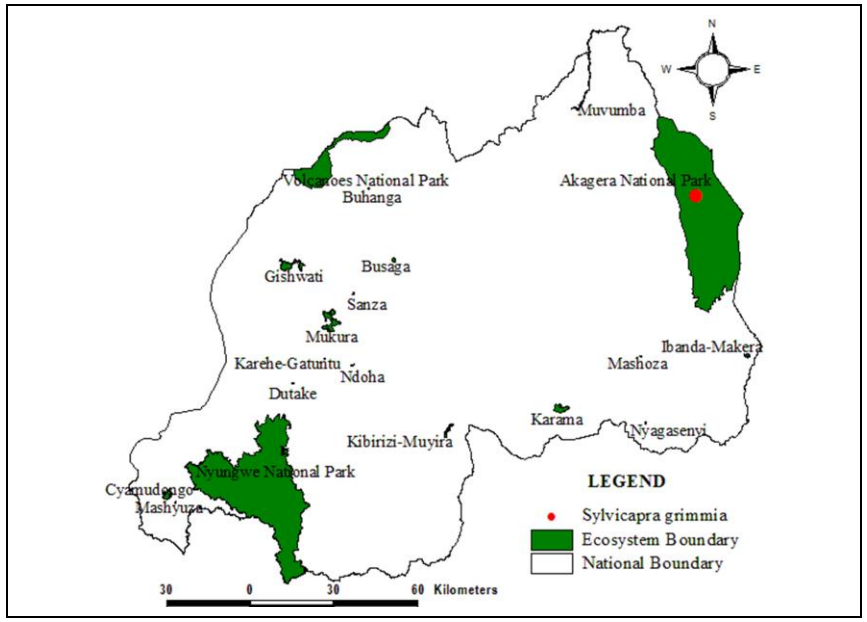
Rhinolophus hilli



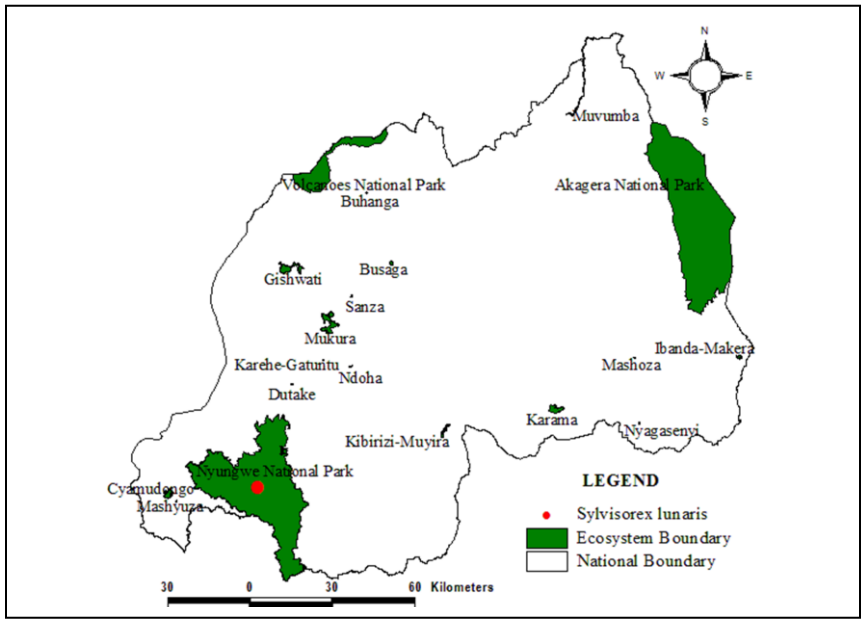
Rousettus aegyptiacus



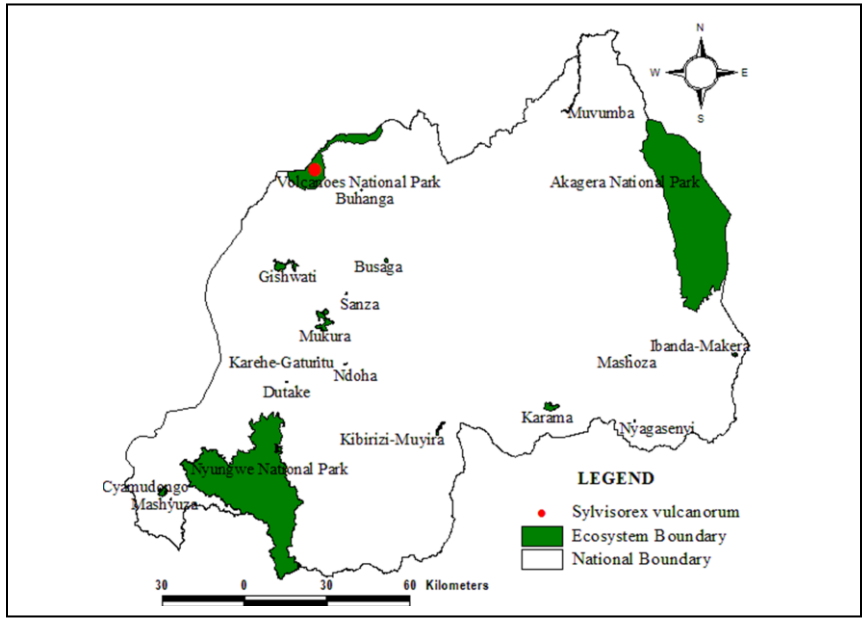
Ruwenzorisorex suncoides



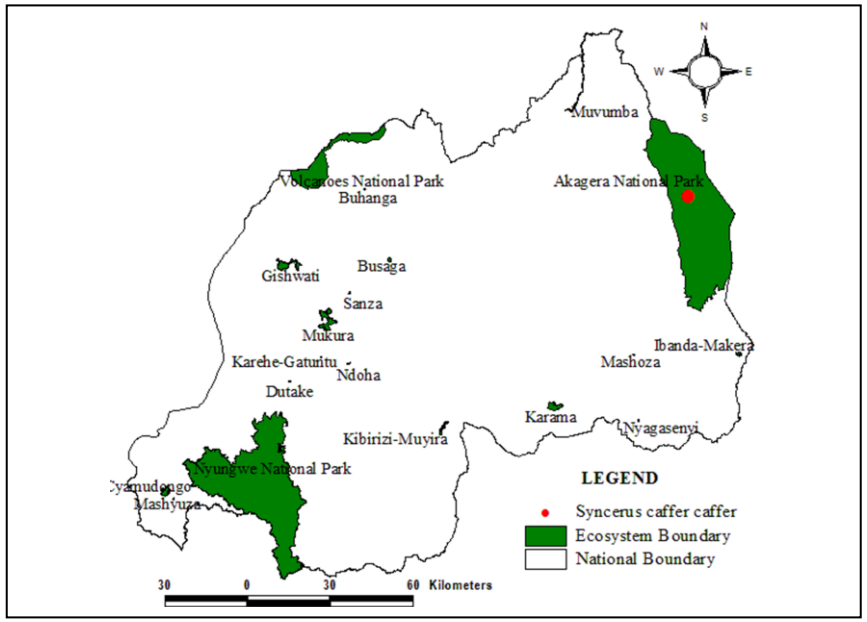
Sylvicapra grimmia



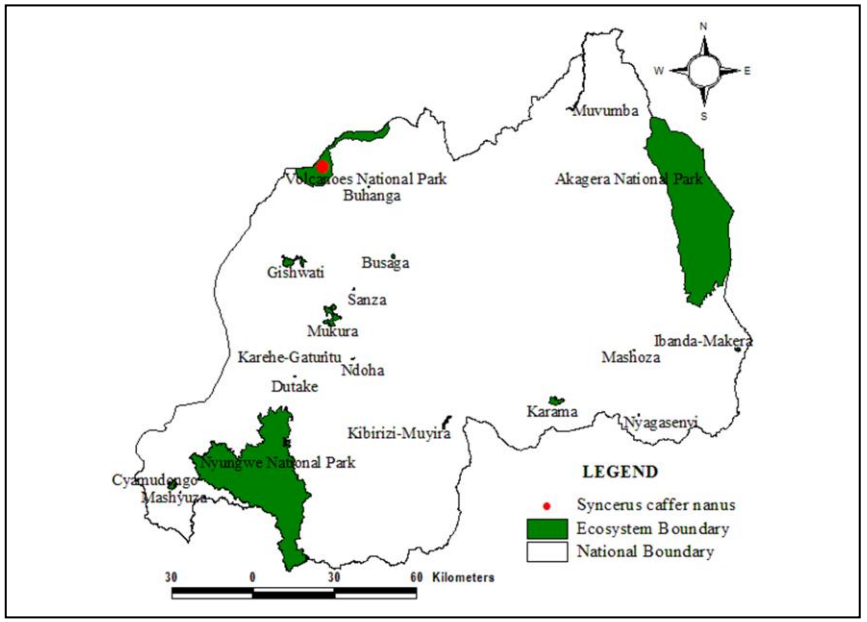
Sylvisorex lunaris



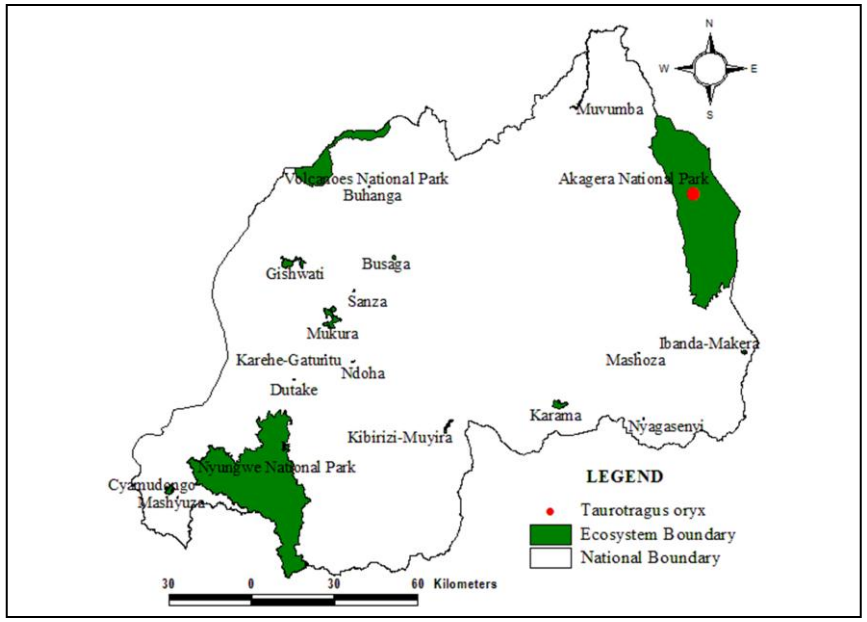
Sylvisorex vulcanorum



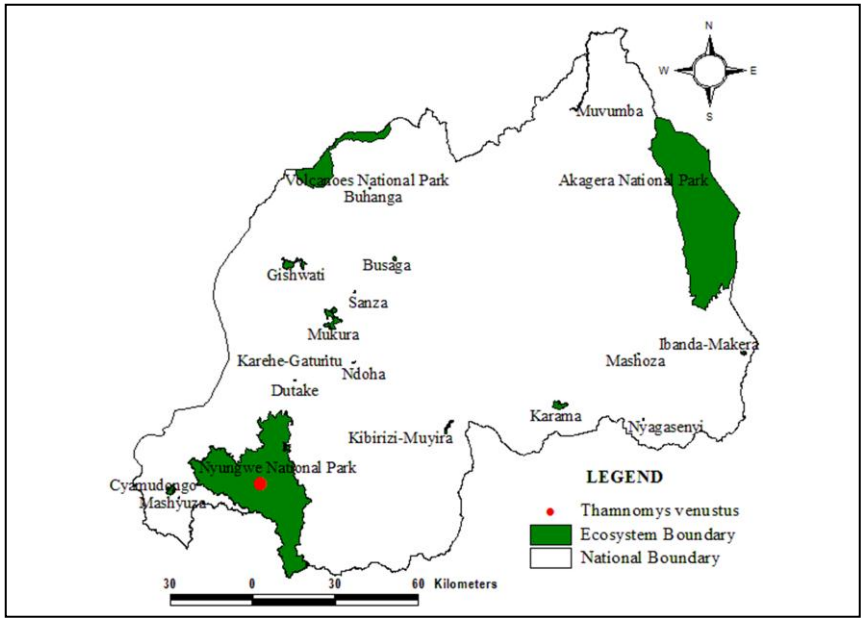
Syncerus caffer caffer



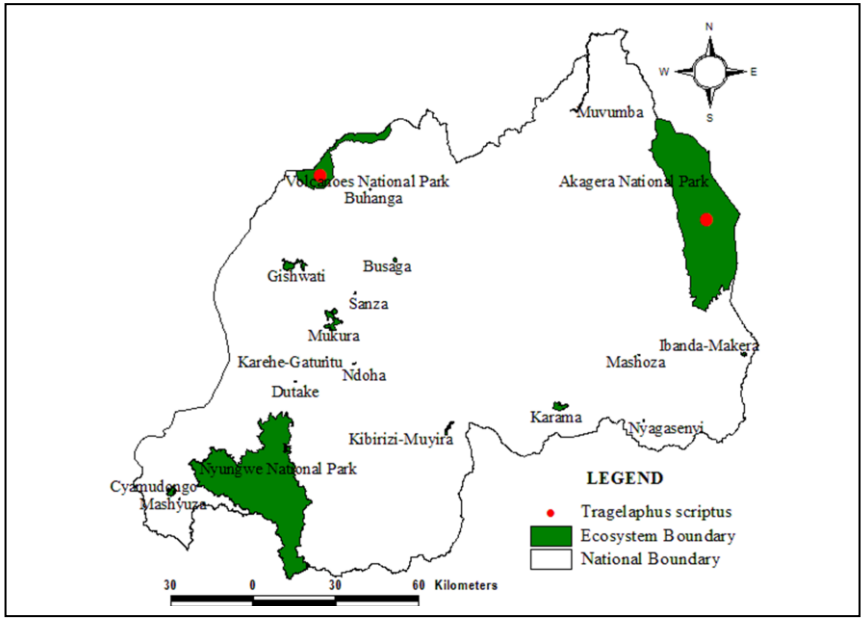
Syncerus caffer nanus



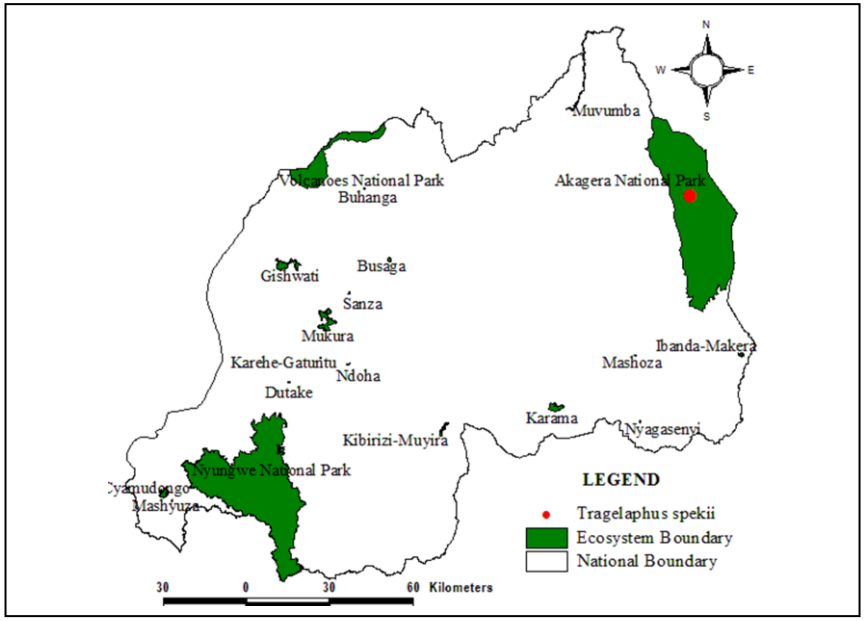
Taurotragus oryx



Thamnomys venustus

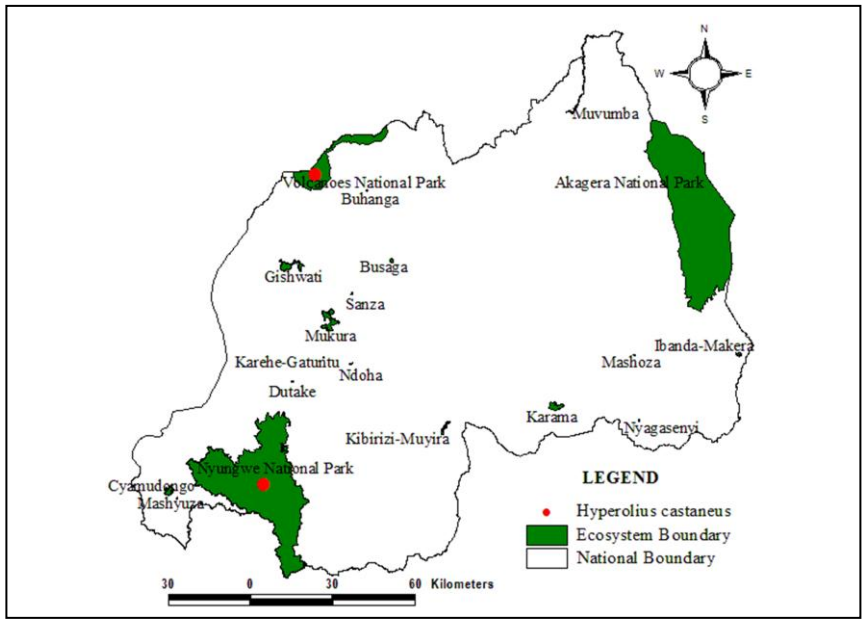


Tragelaphus scriptus

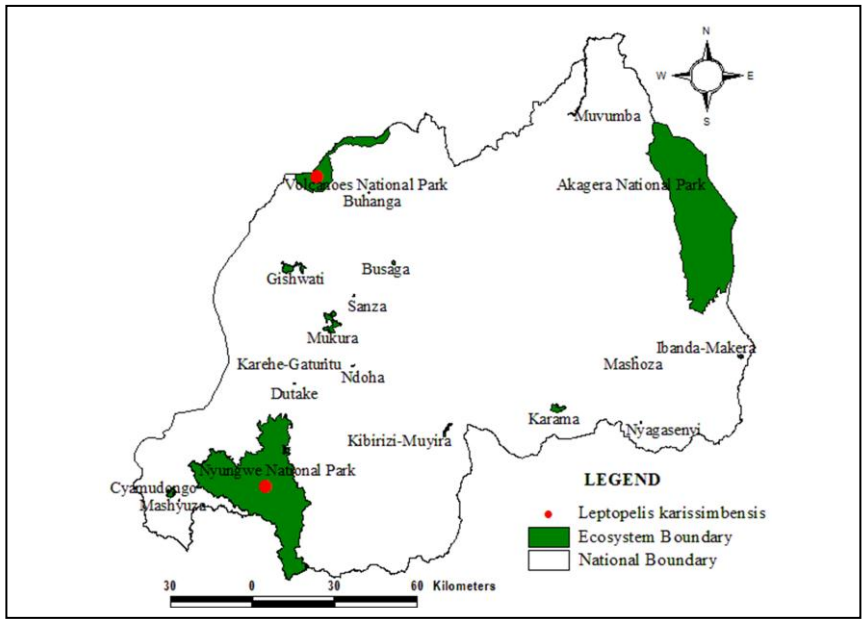


Tragelaphus spekii

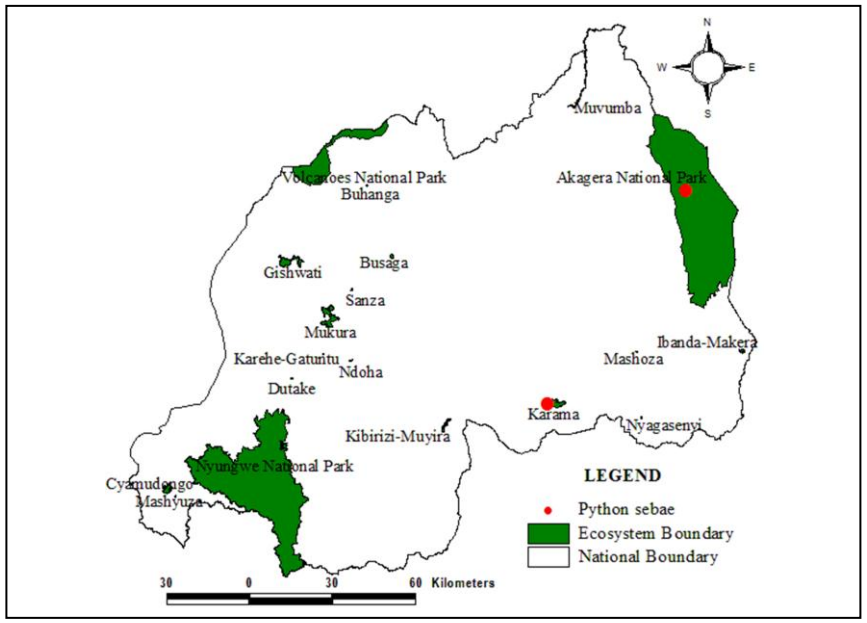
D. Herpetofauna



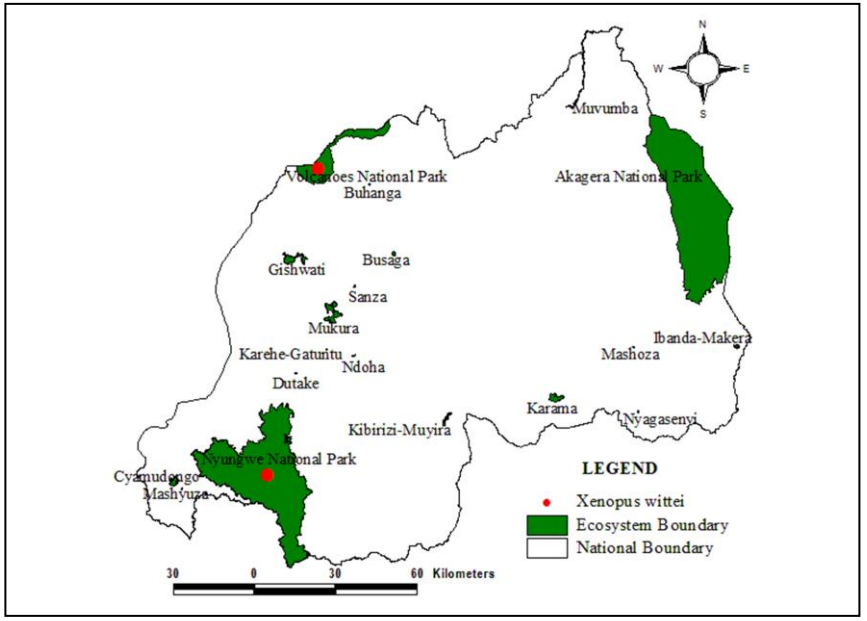
Hyperolius castaneus



Leptopelis karissimbensis



Python sebae



Xenopus wittei

Appendix 4: Orchids of Rwanda listed on CITES

No	Species	Habitat
1.	*Aerangis kotschyana*	Savannah, Clear forests,forest galleries
2.	*Aerangis ugandensis*	Forest almost montane
3.	*Aerangis verdickii*	Tree savanahs, galery forests
4.	*Ancistrorhynchus clandestinus*	Primary montane forest
5.	*Ancistrorhynchus tenuicaulis*	Primary montane forests
6.	*Angraecopsis gracillima*	Montane forest
7.	*Angreacopsis pusilla*	Montane forest
8.	*Angraecum chamaeanthus*	Montane forest
9.	*Angraecum distichum*	Montane forest
10.	*Angraecum humile*	Montane forest
11.	*Angraecum infundibulare*	On rocks
12.	*Angraecum moandense*	Montane forests
13.	*Angarecum sacciferum*	Epiphyte in rain forest
14.	*Anselia africana*	Savannah,Forests,forest galleries
15.	*Bolusiella iridifolia*	Montane forest
16.	*Bolusiella maudiae*	Epiphyte in rain forest
17.	*Bolusiella talbotii*	Epiphyte in rain forest
18.	*Bonatea steudneri*	Savannah and dry wood
19.	*Brachycorthis friesii*	Savannah
20.	*Brachycorthis pubescens*	Grassland and open wood
21.	*Bulbophyllum bavonis*	Montane forest
22.	*Bulbophyllum burtii*	Montane forest
23.	*Bulbophyllum cochleatum var colcheatum*	Montane forest
24.	*Bulbophyllum cochleatum var. brachyanthum*	Montane forest
25.	*Bulbophyllum cochleatum var. bequaertii*	Montane forest
26.	*Bulbophyllum cochleatum var. inflatum*	Montane forest
27.	*Bulbophyllum cochleatum var tenuicaule*	Montane forest

28.	*Bulbophyllum comatum*	Montane forests
29.	*Bulbophyllum encephalodes*	Montane forests
30.	*Bulbophyllum expallidum*	Montane forests
31.	*Bulbophyllum falcatum*	Montane forests
32.	*Bulbophyllum intertextum*	Montane forests
33.	*Bulbophyllum josephii*	Montane forests
34.	*Bulbophyllum kivuense*	Montane forests
35.	*Bulbophyllum oreonastes*	Montane forests
36.	*Bulbophyllum prorepens*	Montane forests
37.	*Bulbophyllum saltatorium var. saltatorium*	Montane forests
38.	*Bulbophyllum sandersonii subsp. Stenopetalum*	Montane forests
39.	*Bulbophyllum scaberulum*	Montane forests
40.	*Bulbophyllum schimperianum*	Montane forests
41.	*Bulbophyllum spec. nov.*	Montane forests
42.	*Bulbophyllum unifoliatum*	Montane forests
43.	*Bulbophyllu vulcanicum*	Montane forests
44.	*Calanthe sylivatica*	Forests,Rocks
45.	*Calyptrochilum christyanum*	Montane forests
46.	*Chamaeangis odoratissima*	Montane forests
47.	*Chamaeangis sarcophylla*	Montane forests
48.	*Chamaeangis vesicata*	Montane forests
49.	*Chaseella pseudohydra*	Montane forests
50.	*Cheirostylis lepida*	forest galleries
51.	*Cribbia brachyceras*	montane forests
52.	*Cynorkis anacamptoides*	montane forests,marshes
53.	*Cynorkis debilis*	montane forests
54.	*Cynorkis kassneriana*	montane forests and Marshes
55.	*Cynorkis symoensii*	montane lawns
56.	*Cyrtorchis arcuata ssp. Arcuata*	Montane forests,wet banks
57.	*Cyrtorchis arcuata ssp. Whytei*	Montane forest

58.	*Cyrtorchis crassifolia*	shrubland,groves
59.	*Cyrtorchis neglecta*	wooded forests
60.	*Cyrtorchis praetermissa*	xerophilic forests
61.	*Cyrtorchis ringens*	montane forests
62.	*Diaphananthe bindens (SWARZexPERS.)SCHLECHTER*	montane forests
63.	*Diaphananthe bilobata (SUMMERH)RASSMUNSSEN*	montane forests
64.	*Diaphananthe densiflora (SUMMERH)SUMMERH*	montane forests
65.	*Diaphananthe fragrantissima (REICHENB.f.)SCHLECHTER*	mesophilic forests,forest galleries,shrubland
66.	*Diaphananthe globuloso-calcarata(DEWILD.)SUMMERH*	montane forests
67.	*Diaphananthe lorifolia*	montane forests
68.	*Diaphananthe ovalis SUMMERH*	montane forests
69.	*Diaphananthe pulchella*	montane forests
70.	*Diaphananthe rohrii*	montane forests
71.	*Diaphananthe rutila*	montane forests
72.	*Disa aconitoides*	postforestry savannah
73.	*Disa eminii*	Marshy areas
74.	*Disa erubescens*	Shrubland,Rocky steppes
75.	*Disa fragrans REICHENB.f.*	Montane forests
76.	*Disa hircicornis*	wet areas
77.	*Disa ochrostachya*	shrubland,steppic or marshy
78.	*Disa robusta*	Montane forest formation
79.	*Disa stairsii*	montane forests,,forest galleries
80.	*Disperis anthoceros*	montane forests,forsts galleries
81.	*Disperis dicerochila*	marshy forests
82.	*Disperis kilimanjarica*	rivulary forest ,marshes
83.	*Disperis nemorosa*	Montane forests
84.	*Disperis reichenbachiana*	marshy forests
85.	*Eggelingia clavata*	Monate forest
86.	*Eggelingia ligulifolia*	Marshes,peat bogs
87.	*Epipactus africana*	montane forests

88.	*Epipogium roseum*	Montane forest
89.	*Eulophia abyssinica REICHENB.f.*	savannah,marshes
90.	*Eulophia angolensis*	wet areas
91.	*Eulophia caricifolia*	marshy and rivulary forests
92.	*Eulophia clitellifera*	Humid savannah
93.	*Eulophia cucullata*	forests galleries,forests,savannah,fallows
94.	*Eulophia eustyachya*	savannah
95.	*Eulophia fridericii*	Wood land and rocky grassland
96.	*Eulophia guineensis*	Gallery forest and dry forests
97.	*Eulophia horsfallii*	montane forests,rivulary forests,forests galleries,open marshes
98.	*Eulophia livingstoniana*	savannah
99.	*Eulophia odontoglossa*	Savannah and dry forest
100.	*Eulophia orthoplectra*	savannah, on marshy soil
101.	*Eulophia parvula*	savannah
102.	*Eulophia spec. nov.*	Monate forest
103.	*Eulophia streptopetala*	montane forests,forsts galleries,Fallows,Lava Plain
104.	*Eulophia subulata*	Savannah and swamps
105.	*Eulophia zeyheri*	Savannah and dry forests
106.	*Gastrodia rwandensis*	Montane forest
107.	*Graphorkis lurida*	Lowland rain forest, gallery forests
108.	*Habenaria anaphysema*	steppic savannah,Marshes
109.	*Habenaria attenuata*	Montane grassland
110.	*Habenaria brachylobos*	Montane forest
111.	*Habenaria chirensis*	understorys in Cupressus plantations
112.	*Habenaria coeloglossoides*	Steppic savannah
113.	*Habenaria epipactidea*	shrubland
114.	*Habenaria filicornis*	Forests
115.	*Habenaria huillensis*	Xerophilic groves,savannah
116.	*Habenara icheumonea*	Humid montane grassland
117.	*Habenaria macrandra*	Montane rain forest

118.	*Habenaira macostele*	Montane grassland and wetlands
119.	*Habenaria malacophylla*	forests galleries
120.	*Habenaria peristyloides*	Montane forests
121.	*Habenaria petitiana*	Montane lawns and forests
122.	*Habenaria praestans*	Wet lawns
123.	*Habenaria schimperiana*	savannah,forests galleries
124.	*Habenaria tenuisipa*	wet steppic savannah,Montane forests,
125.	*Habenaria welwitschii*	shrubland
126.	*Holothrix aphylla*	savannah
127.	*Liparis bowkeri*	Montane forests,on banks ,Cultures
128.	*Liparis epiphytica*	steppic savannah
129.	*Liparis deistelii*	Swamp rain forests
130.	*Liparis harketii*	Montane forests near streams
131.	*Liparis nervosa*	Grasslands and swamps, rain forests
132.	*Liparis odontochilus*	Montane forest f
133.	*Malaxis webrbaueriana*	Rainforests and gallery forests
134.	*Margeliantha burtii*	Montaine forests
135.	*Margeliantha lebelii*	Seondary habitats of montane forests
136.	*Microcoelia bulbocalcarata*	Montane forests
137.	*Microcoelia globulosa*	Forests,xerophhilic groves,savannah
138.	*Microcoelia koehleri*	xerophilic groves,shrubland
139.	*Microcoelia nyungwensis*	Montane forests
140.	*Nephrangis filiformis*	Montane forests,forest galleries
141.	*Nervilia adolfi var. adolfi*	Montane forests
142.	*Nervilia bicarinata*	Galerry forests, 1300m
143.	*Nervilia cf. gassneri*	Montane forest
144.	*Nervilia petraea*	Rain forests and plantations, 1700m
145.	*Oeceoclades maculata*	Dry forest and shrub lands
146.	*Oeceoclades saundersiana*	Gallery forests and rain forests, 1450m
147.	*Platylepis glandulosa*	Swampy and shady places

148.	*Podangis dactyloceras*	Epiphytes montane forest
149.	*Polystachya aconitiflora*	Montane forests
150.	*Polystachya adansoniae*	forests,Marshes with *Erica*
151.	*Polystachya anastacialynae*	Epiphyte in rain forest
152.	*Polystachya bennettiana*	Xerophilic groves
153.	*Polystachya bicarinata*	Montane forests
154.	*Polystachya bifida*	Montane forests
155.	*Polystachya calluniflora*	Montane forests
156.	*Polystachya caloglossa*	Montane forests
157.	*Polystachya cribbianna*	Montane forests
158.	*Polystachya cultriformis*	Clear forests,Montane forests,shrubland
159.	*Polystachya denrobiiflora*	aride savannah,lawns,Steppes
160.	*Polystachya dewanckeliana*	Montane forests
161.	*Polystachya disticha*	montane forest
162.	*Polystachya eurignatha*	Epiphyte montane forest
163.	*Polystachya fabriana*	Montane forests
164.	*Polystachya fallax K*	Montane forests
165.	*Polystachya fusiformis*	Montane forests
166.	*Polystachya galeata*	Montane forests
167.	*Polystachya hastata*	Peats of Montane forests
168.	*Polystachya kermesina*	Montane forests
169.	*Polystachya lawalreeana*	Montane forests
170.	*Polystachya leonardiana*	Montane forests
171.	*Polystachya leucorhoda*	Montane forests
172.	*Polystachya lindblomii*	Montane forests
173.	*Polystachya macropoda*	Montane forests
174.	*Polystachya mildbraedii*	secondarized montane forests
175.	*Polystachya modesta*	shrubland
176.	*Polystachya odorata*	Edges of Pyrethra plantations
177.	*Polystachya pachychila*	Montane forest

178.	*Polystachya pamelae*	Montane forest
179.	*Polystachya paniculata*	Forests,Plain of Lava
180.	*Polystachya poikilantha*	Forest galleries,Montane forests,bamboo
181.	*Polystachya polychaete*	Montane forest
182.	*Polystachya proterantha*	Montane forest
183.	*Polystachya retusiloba*	Montane forest
184.	*Polystachya ruwenzoriensis*	Montane forests with formation in Erica
185.	*Polystachya samilae*	Montane forest
186.	*Polystachya simplex*	Montane forest
187.	*Polystachya spatella*	Montane forests
188.	*Polystachya tenella*	Peats of Montane forests
189.	*Polystachya tenuissima*	Rivulary forests
190.	*Polystachya transvaalensis*	Forests,Marshes
191.	*Polystachya tridentata*	Montane forest
192.	*Polystachya troupiniana*	Montane forests ,formation with Arundinaria
193.	*Polystachya undulata*	Montane forest
194.	*Polystachya virginea*	Montane forests
195.	*Polystachya vulcanica*	Montane forests,heaths
196.	*Polystachya winigeri*	Montane forests
197.	*Polystachya woosnamii var woosnamii*	Montane forests
198.	*Polystachya woosnamii var nyungwensis*	Montane forests
199.	*Rangaeris muscicola*	Montane forests
200.	*Rhaesteria eggelingii*	Montane forests
201.	*Rhipidoglossum arbonieri*	Montane forests
202.	*Rhipidoglossum bilobatum*	Montane forests
203.	*Rhipidoglossum delepierreanum*	Montane forests
204.	*Rhipidoglossum densififlorum*	Montane forests
205.	*Rhipidogloglossum globulosocalcaratum*	Montane forests
206.	*Rhipidoglossum kamerunense*	Montane forests
207.	*Rhipidoglossum ovale*	Montane forests

208.	*Rhipidoglossum pulchellum*	Montane forests
209.	*Rhipidoglossum rutilum*	Montane forests
210.	*Satyrium amblyosaccos*	Grazed savannah
211.	*Satyrium breve*	Marshes
212.	*Satyrium coriophoroides*	Marshes,Valleys
213.	*Satyrium crassicaule*	Forests,Savannah,Marshes
214.	*Satyrium ecalcaratum*	Areas with *Erica*
215.	*Satyrium orbiculaire*	Arid lawns
216.	*Satyrium schimperi*	alpine lawns,steppic savannah
217.	*Satyrium trinerve*	wet banks
218.	*Solenangis clavata*	Montane forest
219.	*Stolzia cupuligera*	Montane forest
220.	*Stolzia repens*	Montane forest
221.	*Stoliza sp.nov. 1*	Montane forest
222.	*Stoliza sp.nov 2*	Montane forest
223.	*Stolzia williamsonii*	Montane forest
224.	*Triceratorhynchus viridiflorus*	Montane forest
225.	*Tridactyle anthomaniaca*	Montane forest
226.	*Tridactyle filifolia*	Xerophilic groves,Montane forest
227.	*Tridactyle bicaudata*	Montane forest
228.	*Tridactyle cf. tridactylites*	Montane forest
229.	*Tridactyle eggelingii*	Montane forest
230.	*Tridactyle gentilii*	Montane forest
231.	*Tridactyle scottelii*	Montane forest
232.	*Tridactyle stevartiana*	Montane forest
233.	*Tridactyle tricuspis*	Montane forest
234.	*Tridactyle tridentata*	Xerophilic groves
235.	*Tridactyle virgula*	Xerophilic groves,Montane forest

Appendix 5: Birds of Rwanda protected under different convetions

A. List of bird species protected under CMS convention

No	Sc Name	Vernacular name (where available)	Common Name
1	*Ardeola idae*		Madagscar Pond Heron
2	*Falco naumanni*		Lesser Kestrel
3	*Falco vespertinus*		Red-footed falcon
4	*Hirundo atrocaerulea*	Intashya	Blue Swallow
5	*Ixobrychus minutus minutus*		Little Bittern
6	*Ixobrychus sturmii*		Dwarf Bittern
7	*Ardeola rufiventris*		Rufous-bellied Heron
8	*Mycteria ibis*		Yellow-billed stork
9	*Ciconia nigra*		Black Stork
10	*Ciconia episcopus*		Woolly-necked Stork
11	*Ciconia ciconia*		White Stork
12	*Plegadis falcinellus*		Glossy Ibis
13	*Threskiornis aethiopicus aethiopicus*	Nyirabarazana	African Secred Ibis
14	*Platalea alba*		African Spoonbill
15	*Pandion haliaetus*		Osprey
16	*Aviceda cuculoides*		African Couckoo Hawk
17	*Pernis apivorus*		European Honey Buzard

18	*Milvus migrans*		Black Kite
19	*Circus aeruginosus*		Western marsh-Harrier
20	*Circus macrourus*		Pallid Harrier
21	*Circus pygargus*		Montagu's Harrier
22	*Accipiter badius*		Shikra
23	*Accipiter ovampensis*		Ovampo Sparrohawk
24	*Butastur rufipennis*		Grasshopper Buzzard
25	*Buteo buteo*		Common Buzzard
26	*Buteo oreophilus*		Mountain Buzzard
27	*Aquila pomarina*		Lesser Spotted Eagle
28	*Aquila rapax*		Tawny eagle
29	*Aquila nipalensis*		Steppe Eagle
30	*Aquila wahlbergi*		Wahlebergi's Eagle
31	*Hieraaetus pennatus*		Booted Eagle
32	*Falco tinnunculus*		Common Kestrel
33	*Falco amurensis*		Amur Falcon
34	*Falco eleonorae*		*Eleonora's Falcon*
35	*Falco concolor*		*Sooty Falcon*
36	*Falco subbuteo*		Eurasian Hobby
37	*Falco biarmicus*		*Lanner Falcon*
38	*Falco peregrinus*		Pergrine Falcon
39	*Otus scops*	Igihunyira	Eurasian Scops Owl

40	*Coturnix coturnix coturnix*		Common Quail
41	*Porzana porzana*		Spotted Crake
42	*Porzana parva parva*		Little Crake
43	*Porzana pusilla intermedia*		Baillon's Crake
44	*Aenigmatolimnas marginalis*		Striped Crake
45	*Crex crex*		Corncrake
46	*Sarothrura boehmi*		Streaky-breasted Flufftail
47	*Glareola pratincola*		Collared Pratincole
48	*Glareola nordmanni*		Black-winged Pratincole
49	*Sterna nilotica nilotica*		Gull-billed Tern
50	*Sterna caspia*		Caspian Tern
51	*Sterna bengalensis*		Lesser Crested Tern
52	*Chlidonias leucopterus*		White-winged Tern
53	*Merops apiaster*	Umusamanzuki	European Bee-eater
54	*Coracias garrulus*		European Roller

B. List of bird species protected under AEWA agreement

No.	Scientific Name	Vernacular name	Common Names
1	*Tachybaptus ruficollis*	Imbata	Little Grebe
2	*Podiceps cristatus*		Great Crested Grebe
3	*Pelecanus onocrotalus*		Great White Pelican
4	*Pelecanus rufescens*		Pink-backed Pelican
5	*Phalacrocorax carbo*		Great Cormorant
6	*Ixobrychus minutus*		Little Bittern
7	*Ixobrychus sturmii*		Dwarf Bittern
8	*Nycticorax nycticorax*		Black-crowned Night-Heron
9	*Ardeola ralloides*		Squacco Heron
10	*Ardeola idae*		Madagascar Pond-Heron
11	*Ardeola rufiventris*		Rufous-bellied Heron
12	*Bubulcus ibis*	Inyange	Cattle Egret
13	*Ardea cinerea*		Grey Heron
14	*Ardea melanocephala*	Uruyingoyongo	Black-headed Heron
15	*Ardea purpurea*		Purple Heron
16	*Casmerodius albus*		Great Egret
17	*Mesophoyx intermedia*		Intermediate Egret
18	*Egretta garzetta*		Little Egret
19	*Mycteria ibis*		Yellow-billed Stork
20	*Anastomus lamelligerus*		African Openbill
21	*Ciconia abdimii*		Abdim’s Stork
22	*Ciconia episcopus*		Woolly-necked Stork
23	*Ciconia ciconia*		White Stork
24	*Leptoptilos crumeniferus*		Marabou Stork

25	*Balaeniceps rex*	Munwarukweto	Shoebill
26	*Threskiornis aethiopicus*	Nyirabrazana	Sacred Ibis
27	*Plegadis falcinellus*		Glossy Ibis
28	*Platalea alba*		African Spoonbill
29	*Dendrocygna bicolor*	Imbata y'amazi	Fulvous Whistling-Duck
30	*Dendrocygna viduata*		White-faced Whistling-Duck
31	*Thalassornis leuconotus*		White-backed Duck
32	*Plectropterus gambensis*		Spur-winged Goose
33	*Sarkidiornis melanotos*		Comb Duck
34	*Alopochen aegyptiacus*		Egyptian Goose
35	*Nettapus auritus*		African Pygmy-goose
36	*Anas undulata*		Yellow-billed Duck
37	*Anas erythrorhyncha*		Red-billed Duck
38	*Anas acuta*		Northern Pintail
39	*Anas querquedula*		Garganey
40	*Anas crecca*		Common Teal
41	*Anas hottentota*		Hottentot Teal
42	*Netta erythrophthalma*		Southern Pochard
43	*Oxyura maccoa*		Maccoa Duck
44	*Balearica regulorum*	Umusambi	Grey Crowned Crane
45	*Sarothrura elegans*		Buff-spotted Flufftail
46	*Sarothrura boehmi*		Streaky-breasted Flufftail
47	*Rallus caerulescens*		African Rail
48	*Crecopsis egregia*		African Crake
49	*Amaurornis flavirostris*	Inkoko y'amazi	Black Crake
50	*Porzana pusilla*		Baillon's Crake

51	*Porphyrio alleni*		Allen's Gallinule
52	*Gallinula chloropus*		Common Moorhen
53	*Gallinula angulata*		Lesser Moorhen
54	*Fulica cristata*		Red-knobbed Coot
55	*Himantopus himantopus*		Black-winged Stilt
56	*Glareola pratincola*		Collared Pratincole
57	*Glareola nordmanni*		Black-winged Pratincole
58	*Vanellus spinosus*		Spur-winged Plover
59	*Vanellus albiceps*		White-headed Lapwing
60	*Vanellus senegallus*	Inkurakura	Wattled Lapwing
61	*Vanellus coronatus*		Crowned Lapwing
62	*Vanellus superciliosus*		Brown-chested Lapwing
63	*Charadrius hiaticula*		Common Ringed Plover
64	*Charadrius pecuarius*		Kittlitz's Plover
65	*Charadrius tricollaris*		Three-banded Plover
66	*Charadrius forbesi*		Forbes's Plover
67	*Charadrius marginatus*		White-fronted Plover
68	*Charadrius asiaticus*		Caspian Plover
69	*Gallinago media*		Great Snipe
70	*Gallinago gallinago*		Common Snipe
71	*Numenius phaeopus*		Whimbrel
72	*Tringa erythropus*		Spotted Redshank
73	*Tringa stagnatilis*		Marsh Sandpiper
74	*Tringa nebularia*		Common Greenshank
75	*Tringa ochropus*		Green Sandpiper
76	*Tringa glareola*		Wood Sandpiper

77	*Calidris alba*		Sanderling
78	*Calidris minuta*		Little Stint
79	*Calidris temminckii*		Temminck's Stint
80	*Calidris ferruginea*		Curlew Sandpiper
81	*Philomachus pugnax*		Ruff
82	*Larus fuscus*		Lesser Black-backed Gull
83	*Larus cirrocephalus*		Grey-headed Gull
84	*Larus ridibundus*		Common Black-headed Gull
85	*Sterna nilotica*		Gull-billed Tern
86	*Chlidonias leucopterus*		White-winged Tern
87	*Rynchops flavirostris*		African Skimmer

C. List of bird species protected under CITES convention

No	Scientific Names	Vernacular Names	Common Names
1	*Aquila nipalensi*		Steppe Eagle
2	*Aquila pomarina*		Lesser Spotted Eagle
3	*Aquila rapax*		Tawny Eagle
4	*Aquila verreauxii*		African Black Eagle
5	*Asio capensis*		African Marsh Owl
6	*Balaeniceps rex*	Munwarukweto	Shoebill
7	*Balearica regulorum*	Umusambi	Grey Crowned-Crane
8	*Bubo africanus*		African Eagle-Owl
9	*Bubo poensis*		Fraser's Eagle-Owl
10	*Bubo lacteus*		Giant Eagle-Owl
11	*Buteo augur*		Augur Buzzard
12	*Buteo oreophilus*		Forest Buzzard, Mountain Buzzard
13	*Circaetus pectoralis*		Black-breasted Harrier-Eagle, Black-breasted Snake-Eagle, Black-chested Snake-Eagle
14	*Circus aeruginosus*		Eurasian Marsh-Harrier, Marsh Harrier, Western Marsh-Harrier
15	*Circus macrourus*		Pale Harrier, Pallid Harrier
16	*Circus pygargus*		Montagu's Harrier
17	*Circus ranivorus*		African Marsh-Harrier
18	*Dendrocygna bicolor*		Fulvous Tree-Duck, Fulvous Whistling-Duck
19	*Elanus caeruleus*		Black-shouldered Kite, Black-winged Kite
20	*Falco amurensis*		Amur Falcon, Eastern Red-footed Falcon
21	*Falco ardosiaceus*		Grey Kestrel
22	*Falco concolor*		Sooty Falcon

23	*Falco cuvierii*		African Hobby
24	*Falco eleonorae*		Eleonora's Falcon
25	*Falco naumanni*		Lesser Kestrel
26	*Falco subbuteo*		Eurasian Hobby,
27	*Falco tinnunculus*		Common Kestrel, Eurasian Kestrel,
28	*Falco vespertinus*		Red-footed Falcon, Western Red-footed Falcon
29	*Gypohierax angolensis*		Palm-nut Vulture, Vulturine Fish-Eagle
30	*Gyps africanus*		African White-backed Vulture
31	*Accipiter badius*		Little Banded Sparrowhawk, Shikra
32	*Haliaeetus vocifer*		African Fish-Eagle
33	*Hieraaetus ayresii*		Ayres's Eagle, Ayres's Hawk-Eagle
34	*Hieraaetus pennatus*		Booted Eagle
35	*Hieraaetus spilogaster*		African Eagle, African Hawk-Eagle
36	*Lophaetus occipitalis*	Sarunfuna	(Long-crested Eagle
37	*Macheiramphus alcinus*		Bat Hawk, Bat Kite
38	*Micronisus gabar*		Gabar Goshawk
39	*Milvus migrans*		Black Kite, Pariah Kite, Yellow-billed Kite
40	*Necrosyrtes monachus*		Hooded Vulture
41	*Neotis denhami*		Denham's Bustard, Stanley Bustard
42	*Otus senegalensis*		African Scops-Owl
43	*Pandion haliaetus*		Osprey
44	*Phoeniconaias minor*		Lesser Flamingo
45	*Poicephalus meyeri*		Brown Parrot, Meyer's Parrot
46	*Poicephalus robustus*		Brown-necked Parrot, Cape Parrot
47	*Polemaetus bellicosus*		Martial Eagle
48	*Psittacus erithacus*		Grey Parrot

49	*Sagittarius serpentarius*		Secretarybird
50	*Sarkidiornis melanotos*		Duck, Knob-billed Goose
51	*Scotopelia peli*		Pel's Fishing-Owl
52	*Spizaetus africanus*		Cassin's Hawk-Eagle
53	*Strix woodfordii*		African Wood-Owl, Woodford's Owl
54	*Tauraco porphyreolophus*		Purple-crested Turaco, Violet-crested Turaco
55	*Tauraco schuettii*		Black-billed Turaco
56	*Terathopius ecaudatus*		Bateleur, Bateleur Eagle
57	*Torgos tracheliotus*		Lappet-faced Vulture, Nubian Vulture
58	*Trigonoceps occipitalis*		White-headed Vulture
59	*Tyto alba*		Barn Owl

Appendix 6: Field data collection tools

Field data sheets

i. Field data sheet for ecosystem assessment

Field data Collection Form

Date:

Time:

Name of the assessor:

Cell:

Sector:

District:

Province:

Identification number of Ecosystem

GPS readings:

Number	Lat	Long.	Altitude	Map datum	EPE
# 1					
# 2					
# 3					

1. Site ownerships

1.1. Public ☐
1.2. RDB ☐
1.3. Private ☐
1.4. Other ☐

2. Site category

2.1. Forest ☐
2.2. Gallery ☐
2.3. Other ☐ Precise ……

3. General Observations:

Ecosystem specificities: Land use:……..

4. Main threats:

ii. Data collection sheet for species

Ecosystem/ location	Species name	Habitat	Habitat quality	Availability/ population size/ abundance	Utilization	Level of exploitation	Threats	Harvesting/collection/ trapping methods

Current population trend	Disappeared species	Causes of population reduction/species disappearance	Management of causes	Suspected population reduction/species disappearance in the future	Conservation measures

iii. Questionnaire

The questionnaire comprises two sections (A and B):

(A) for different institutions and managers (administered in English)

(B) for local population and communities (administered in Kinyarwanda)

(A) General Questionnaire (Institutions and managers)

Please respond to questions with a tick or a cross

- Tick one or more answers when applicable
- Please provide details for open questions

Part I Identification

Name of respondent (optional) .....

Post of the respondent .....

Name of institution/Organisation (optional).....

Status of institution

- Public ☐
- Semi-public/Parastatal ☐
- Private ☐
- International ☐
- Non-governmental ☐
- Academic/Research Institute ☐
- Other ☐ Please specify:…….

Please indicate the area of jurisdiction or interest of your organisation

- Regional (Africa-wide) ☐
- Sub-regional ☐
- National ☐
- District ☐
- Local ☐

Contact details: .....

P.O. Box .....

Telephone .....

Email .....

Website .....

Date .....

Part II . Questions

1. What is the area of your institution/ intervention in Natural Resources Management given the following categories?
   - Natural Resources Management in general ☐
   - Protected Area Management ☐
   - Forest Resources Management ☐
   - Others ☐ Please specify:……
2. In the above tasks are you considering the threatened ecosystems / plants / animals ?

3. How do you describe a threatened (ecosystem, plant, animal)?
   - No gazetted natural ☐
   - Disturbed natural ☐
   - no gazetted and disturbed ☐
   - Others (please specify) .....
4. Do you have any data about threatened (ecosystem, plant, animal)?
   - Yes ☐
   - Not ☐
5. If yes, in which format do you keep those data
   - Papers files ☐

- Paper/ Hardcopy maps ☐
- Digital (vector and raster) ☐

6. How is the access to data in your institution

- Generally unrestricted access ☐
- Restricted access to some users ☐
- For internal use only (unavailable for external use) ☐

7. What are the main negative activities affecting the natural ecosystem and wildlife habitat in your area?

a. Hunting
b. Cultivation
c. Grazing
d. Mining
e. Grass cutting
f. Water drainage
g. Erosion
h. Encroachment
i. Others.....

8. What do you think are the drivers of these activities?

a. Lack of environmental awareness/education
b. Lack of livelihood alternative/Poverty
c. Shortage of land
d. Sources of handcraft materials
e. Ignorance
f. Others .....

9.Community involvement in improving the threatened (ecosystems, plants, animals) Management compare to zero involvement?

Yes ☐ No ☐

10.Please summarize the involvement of local community role

.....

11. What do you consider are the main constraints to the management of threatened (ecosystem, plants, animals)?

_____

12. How willing are you to protect threatened (ecosystem, plants, animals)?

_____

13. Please provide any additional comment not covered in this questionnaire.

.....

(B) Ibiganiro bigenewe abantu banyuranye (*Ibimera n'inyamaswa)*

Itariki ……

Umwirondoro
Akarere……..... Umurenge.....Akagari.....Umudugudu……..
Imyaka: ..... .Akazi: .....
Mumaze imyaka ingahe muri aka gace?

a. 1-5
b. 6-10
c. 11-15
d. 16-20
e. 20+

(Gusubiza ibibazo hakurikijwe ubwoko bw'ikinyabuzima)

A. Ubwoko bwose buboneka
1. Mwatubwira amazina y'inyamaswa n'ibimera biboneka muri aka karere (harimo cyane cyane amazina y'ikinyarwanda……)

……..……
2. Mwatubwira ubwoko buboneka hano hakurikijwe iyi lisiti tubabwiye? (harimo cyane cyane amazina y'ikinyarwanda……)
3. Ingano za buri bwoko uko mukunze kuzibona?

a. Nyinshi cyane
b. Nyinshi
c. Ziringaniye
d. Nke

4. Ugereranyije ubwo bwoko bukunze kuboneka bufite imyaka ?
   a. Ntoya
   b. Ikuze
   c. Ibindi….

5. Abantu bazica / bazisarura babikora ubwo bwoko bungana iki?

   Ntoya
   Ikuze
   Ibindi….

6. Mutubwire uko ubwo bwoko busa ……
7. Hari ubwoko mwajyaga mubona butakibaho? Yego ☐ Oya ☐
Niba ari yego, mutubwire izina?
8. Kubera iki ubwo bwoko butakibaho?

   a. Konona/kwangiza/gusenya aho bwabaga
   b. Guhinga
   c. Guhiga
   d. Kwimuka
   e. Ubuzima busanzwe
   f. Ibindi ..... Sobanura.....

9. Ubu bwoko tubabwira mukunze kububona gute?
   a. Cyane
   b. Rimwe na rimwe
   c. Gake
   d. Nta na rimwe

B: Konona / Gusarura/ Kwica

1. Ese hari ubwoko muzi bucuruzwa? Yego Oya Ntabyo nzi
Niba ari yego, ni ubuhe bwoko bucuruzwa cyane?
   i. Ubwoko bwoko butwarwa bungana iki?

ii. Ese ubwo bwoko bukoreshwa iki?
    a. Gutunga mu rugo
    b. Kurya
    c. Kugurisha
    d. Kugurisha n'amahotels
    e. Ibindi.....

iii. Ni izihe ngingo / ibice bikoreshwa .....

2. Ese hari ubwoko bwicwa hakoreshejwe amarozi? Yego Oya

Niba yego, kubera iki?

3.Ese guhiga/gusarura amoko anyuranye bikunze kubaho muri aka gace? Yego Oya

Niba ari yego bikorehwa iki ?

a) Kurya
b) Imiti
c) Umuco
d) Ibikoresho by'ubutabire
e) Ubushakashatsi
f) Gukina
g) Ubukorikori
h) Gutunga
i) Gucuruza
j) Gutaka
k) Ibindi .....

4. Ni iyihe mirimo abantu bakora ino yica/yangiza aha hantu hakimeza?

a) Guhiga
b) Guhinga
c) Kurisha
d) Gucukura
e) Kwahira

f) Kugomorora amazi
g) Isuri
h) Kwikebera
i) Ibindi.....

5. None se ibi bikorwa byo konona biterwa n'iki?

a) Kutiga / ubujiji
b) Imibereho mibi / ubukene
c) Ubutaka buke
d) Ibikoresho by'ubukorikori
e) Kutamenya
f) Ibindi .....

6. Imihindagurikire y'ingano z'ubwoko bunyuranye

a) Umubare w'ubwoko ……
b) Niba umubare wiyongera , ni mu kihe kigero (umubare) ……..
c) Niba umubare ugabanuka (% mu myaka icumi ihize). …
d) Ntibihinduka ……
e) Ntabyo nzi…….

7. Imiterere y'ahantu:

a) Ingero zo kugabanuka mu myaka 10 ishize ……
b) Kugereranya uko bizamera mu myaka 10 iza ……
c) Ni izihe ngamba zo kurinda ibidukikije ziri mu karere (harimo amapariki, amategeko / amabwiriza n'ibindi):

_____