



Association pour la Conservation de la Nature
au Rwanda (ACNR)
Promoting Biodiversity Conservation and Sustainable use in Rwanda”

CONSERVATION AND SUSTAINABLE USE OF WETLANDS IN SOUTH-EASTERN OF RWANDA



PROJECT REPORT

**By Association for the Conservation of Nature in
Rwanda (ACNR)**



the bp conservation programme



Kigali, March 2004

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Project summary

In relation to its status of affiliation with Birdlife International, the Association for the conservation of Nature in Rwanda (ACNR) has won a prize to carry out a study aimed at the conservation and sustainable use of wetlands in the south-eastern of Rwanda.

The study has been carried out in the marshes of Nyabarongo (**IBA RWA 004**) and Akanyaru (**IBA RWA 005**) during the summer 2003. With Biodiversity survey (plants and birds), socio-economic study has been carried out too through the population living along these wetlands.

The methodologies used are those commonly used in relation to the plants and animals surveys. These are mainly the phytosociological survey for plants (Kent and coker, 2001) and Timed Species Counts (Pomeroy and al.1992). By using these methods a set of data has been collected both on plants, birds and other animals.

The vegetation of Nyabarongo and Akanyaru swamp is dominated by the papyrus in the zones that are permanent flooded. The species is generally associated with scattered herbaceous plants such as *Polygonum pulchrum* and *P. setusolum*.

In this vegetation, 44 species of plants mainly herbs have been recorded. They belong to twenty families with Asteraceae dominant in the fallow lands and Cyperaceae in the flooded zones.

With this complex mixture of marshes vegetation, there is a large variety of birds. In total, 46 species of birds have been recorded. Two of them are mentioned on the IUCN Red list (*Ardeola idea* and *Laniarius mufumbili*). When 4 others are on the annex I of CITES and therefore under its protection.

The rich biodiversity which occurs in the Nyabarongo and Akanyaru wetlands is under very high pressure of the population which is provided with many services from the swamp. As it appears from the socio-economic study, the swamp furnishes to the riverside people important services which allow them to satisfy their daily needs. Beside the agriculture mainly practiced during the dry season, the swamp provides building materials, fire wood and materials for crafts.

These activities lead to high threats that the wetlands are facing to as they are bordered by a high density of population. Therefore due to their rich biodiversity, important measures are to be taken to avoid the total destruction of these habitats and with them the extinction of species that pledge allegiance to swamp ecosystems.

List of Acronyms

ACNR: Association for the Conservation of Nature in Rwanda

BP : British petroleum

CITES: Convention on International Trade of Endangered Species

IBAs : Important Birds Areas

IUCN : International Union for the Conservation of Nature

PRSP : Poverty Reduction Strategy Paper

RSPB : Royal Society for the Protection of Birds

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1. Introduction

1.1. Background

With a high pressure of demography (8,000,000 inhabitants) on a small land (26,338 km²), a growth rate of about 3,7% and mainly agricultural economy, Rwanda remains one of the poorest countries of the World.

Nowadays, the high lands of the hills and the small swamps and valleys of confluence are transformed for agricultural exploitation. Only the zones of swamps represent the last reserves of agricultural fields. The satisfaction of growing feeding needs of the population makes absolutely exploited the wetlands which constitute today the last possibility of problem solving.

That's why in the context of the poverty reduction strategic plan (PRSP), the government of Rwanda placed in its priorities management and entertainment of swamp lands.

Projects of paramount importance are being executed or on the point of being introduced with the financial support of World Bank (culture of sugar cane, rice and other crops).

Such a vast programme of management risks to touch not only marshes that can potentially be exploited all over the whole country, but unfortunately also marshes which are strongly vulnerable such as those of Nyabarongo and Akanyaru.

However, those ecosystems have got a particular status on the biodiversity level. Indeed, those zones have been registered and identified among the important birds areas (IBAs) by Birdlife International (Birdlife, 2001) because of their great diversity of organisms generally in wetlands and particularly that of birds.

They also belong to the whole of wetlands in the great lakes region, located on River Nile waterway and which is known as a hibernation site for paleoarctic migratory birds (Sogreah, 1991).

Moreover, some birds, among others, are registered on the IUCN red data list of threatened species.

It is mainly the yellow warbler of marshes (*Chloropeta gracilirostris*), the gonolek of the papyrus (*Laniarius mufumbeli*), the warbler of white shoulders (*Bradypterus carpalis*), the striated canary (*Serinus koliensis*) and the stork beat -in-clog (*Balaeniceps rex*).

The great lands of papyrus also are hosting some species of earth's vertebrates such the Sitatunga (*Tragelaphus spekii*) and the silver monkey (*Cercopithecus mitis*) and invertebrates (insects, nematodes,...) strictly linked up to the marshes of papyrus.

The important biodiversity of those zones, as well as the presence of species of particular status justify sufficiently the great necessity of certain strategic sites conservation and wise use in the marshes of Akanyaru and Nyabarongo.

This action requires, however prerequisites including mainly studies on biodiversity in order to know precisely the status of living species dwelling in that marshy ecosystem

1.2. Objectives of the study

The global objective of this work is to contribute to conservation and lasting use of marshes of Akanyaru and Nyabarongo. More specifically, the project aims at the following particular objectives:

- To collect information on plants and animal biodiversity of the marshes of Akanyaru and Nyabarongo on the level of habitat as well as the status of certain key species;
- To emphasize Man's impact on the marshes and different threats this environment is submitted to;
- To direct a campaign of sensitization and conscientiousness for legislation aiming at the protection and the conservation of the wetlands in question.

1.3. Financial Frame

In relation to its status of affiliation with Birdlife, the Association for the Conservation of Nature in Rwanda (ACNR) has won a prize (3,500£) in the context of BP programme sponsored by British Petroleum. It also benefited from an additional financing from RSPB (2,100£) especially for ornithology capacity building.

1.4. Setting

The setting is the marshes of Akanyaru (IBA RW005) and Nyabarongo (IBA RW004) located along the Akanyaru and Nyabarongo rivers at the east of Butare Province and the South-East of Kigali city.

1.5. Research team

Here is the composition of the research Team

- Dr. Charles Ntaganda Charles, Professor at NUR and Member of ACNR and Team leader;
- Mr. Serge Nsengimana, President of ACNR
- Mr. Fidèle Ruzigandekwe, ornithologist and member of ACNR
- Mr. Fabien Rizinjirabake, Student at NUR
- Miss Aisha Nyiramana, Assistant lecturer at NUR
- Mr. Thomas Ntahumwe, Student at NUR
- Mr. Achilles Byaruhanga, Scientific contributor and Executive officer of Nature Uganda;
- Mr. Theoneste Rutagengwa, Permanent Secretary of ACNR
- Mr. Augustin Muramira, Treasurer of ACNR
- Mr. Anaclet Bazasangwa, Student at NUR
- Mr. Abraham Ngiruwonsanga, Member of ACNR

2. Context and General Description

2.1. Physical environment

2.1.1. Location

Nyabarongo and Akanyaru are swamp zones located at the south-east of Rwanda in the flood plains of Akanyaru and Nyabarongo rivers.

Coordinates and altitudes of the sites are as follows:

Akanyaru : 30° 01' E et 02° 04' S alt.: 1365 m

Nyabarongo : 30° 13' E et 02° 04' S alt.: 1345 m

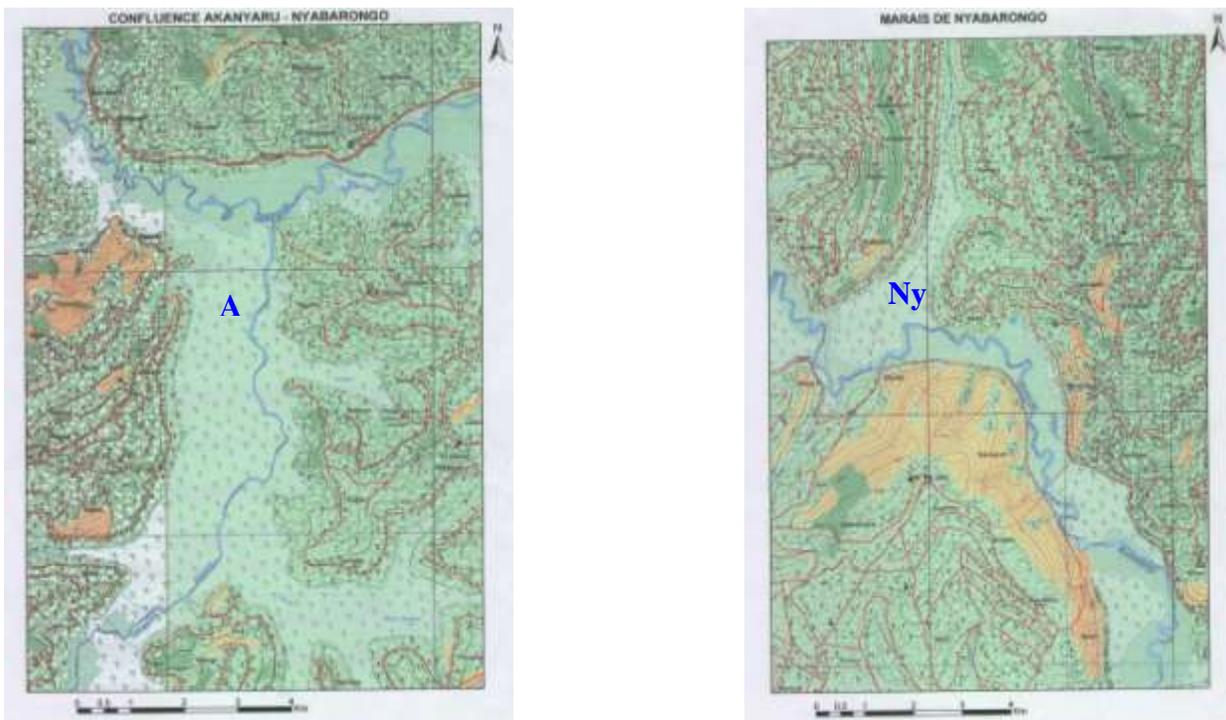


Fig. 1. Location of the sites A: Akanyaru site Ny: Nyabarongo site

2.1.2. Area

The swamps concerned with the present study cover an area of about 40,000 ha (10,000 ha for Nyabarongo and 90,000 ha for Akanyaru), that is one fourth of the total area of wetlands all over the country which is about 164,947 ha (Kayitare, unpublished).

2.1.3. Genesis and Morphology

Akanyaru and Nyabarongo swamps are the result of a dam for the initial outflow of waters of the rwandese hydrographic river system toward the North in the direction of Lake Albert. That blocking of waters caused valleys drowning of old waterways leading to thin sediments of clay, and then, the doorsteps initially blocking the evaluation towards the south were covered (various wet phases), a new outflow towards the south emptied certain dams and lead to an important alluvial deposits which are the origin of present alluvial plains (Rossi in Ntaganda, 1991).

The morphology of those plains is made of bank draught excluders, basins and channels with low water slightly deep and periodic submersion, permanent flooded depressions and old levees (Sogreah, 1989). Such a whole constitutes the important dwelling of respective waterways and generally seems to be flat when seen from far.



Fig.2.Picture of the Nyabarongo Swamp

2.1.4. Climate

The climate of the region is that of the country in general. It is characterized by alternation of wet seasons (from March to Mid June and from October to December) and dry season (from July to September and from January to February). The average year temperature of air is sufficiently uniform the whole year. It is about 21-22°C. Rains particularly intense of the hills fall heavily with storms during some hours, especially in the middle of the afternoon. The pluviometric year strip is about 1,000mm.

During the dry seasons especially between July and September, the soils where the water table falls at a depth superior to 2m under the slope of the natural land are subjected to be in deficit of water as far remarkable as the texture is coarse.

2.1.5. Vegetation

The swamps consist of a mosaic of landscapes of biotopes highly dynamic comprising lands of alluvial plains on hills presently cultivated, bank draught excluders along water ways and long lateral valleys.

Topographic conditions allow emphasizing a multitude of landscapes going from lands of alluvial plains and valleys towards marshes floating at *Cyperus papyrus* (Sogreah, 1989).

Habitat comprises the following landscapes units:

- A zone of piedmont and thalwegs occupied by cultures and basins of *Cyperaceae*;
- A zone of old colluvial and alluvial deposits collections made of mosaic of landscapes comprising cultures and papyrus places;

It is actually a mosaic of landscapes comprising cultures on hillsbottom and low slopes and thalwegs and alluvial plains and hills with temporal submersion somehow covered with *Phoenix reclinata*, *Mimosa Pigra*, *Securinega virosa*,...

2.2. Human medium

The population density in that region is among the most important ones in the country. It is... (General Census, 2002). That increases the pressure on the marshes and affects highly the future of important sites for conservation of biodiversity in general and that of birds in particular.

2.3. Present status of the swamps

There are not yet actually swamp management plans because of the fact that they belong to the collectivity. People continue exploiting them in disorder so that it causes huge perturbations on biodiversity. Zones within the reach of farmers and cleared during the dry season are generally under culture. The main crops are beans, sorghum, maize and various vegetables.

In the peat lands unused to agriculture, local communities gain building materials as well as arts and crafts needs (*Papyrus*, *Typha* and other trees of various woody creepers).

They also gather fodder for some animals and grass as straw for banana plantations. During the dry season, those zones are often victims of forest fire generally provoked to catch wild animal or to graze cattle there.



Fig.3: Bush fire in the Nyabarongo marsh

3. Biodiversity Survey

3.1. Techniques and methods

3.1.1. Plant survey

After having identified the wet zones of Akanyaru and Nyabarongo, we have already chosen two interesting sites for the inventory of the vegetation.

The sites chosen are one at the confluence between Nyabarongo and Akanyaru (at Mukagoma), the other near the bridge of Nyabarongo making link between Bicumbi and Gashora district (at Gatare).

Our initial approach planned to collect data on the vegetation in a 1m radius placettes and distant within 20 -50 m along a transect.

Considering the inaccessibility of the swamps still intact zones and great homogeneity of vegetation, a detailed inventory on transects has not been possible. Only a rapid evaluation has been done on the edge of the zones and on busy stations for arts and crafts materials.

In the fallow lands easily to reach and where vegetation is more varied, collections of data have been done on oriented transect from piedmont to the flow of Nyabarongo, 12 collections of data have been done there.

For the swamp of Akanyaru, considering its extreme similarity of vegetation with that of Nyabarongo, it has not been necessary to do any collection of data there.

However, Occasional selections of samples have been done in particular habitats (case of 2 small blocs of trees plantation and fodder in the middle of *Papyrus* place).

In different plots, available species of plants have been identified and harvested for further identification. Determining of unknown specimens has been realized at the Herbarium of Pharmacopée Centre at IRST (Institut de Recherche Scientifique et Technologique) - Butare.

Proportion of collecting species have been evaluated according to the method of Braun Blanquet and arranged into 6 classes depending on their predominance.

- 5 for species containing more than 75%
- 4 for species containing between 50 and 75%
- 3 for species containing between 25 and 50%
- 2 for species containing between 5 and 25%
- 1 for species containing between 1 and 5%
- + for species containing under 1%

For each species, it has been also necessary to take note of its biological form (B.F.) and three classes have been distinguished:

- a) small shrubs
- b) Grass
- c) Seeds and *Cyperaceae*

3.1.2. Birds surveys

After having benefited from a seminar managed by Mr. Achilles Byaruhanga (Executive Director of Nature Uganda), an inventory of birds has been carried out in the swamp of Nyabarongo according to the method of counting Timed species counts. The constraint related to movement and the similarity of biotopes obliged us to limit the work at that swamp only located not far from Kigali City where the accessibility was easier and cheaper.

The swamp of Akanyaru has been rapidly visited for a quick glance at the place and basic inventory of Bird life.

3.1.3. Information on other animals

In addition to the *aves*, we also took note of the presence of certain animals met on the site from information given by riverside people.

Besides, as most of earth's animals don't always want to be seen by watchers, contacts with local people allowed collecting data on wildlife hard to notice.

3.2. Data analysis and Interpretation

3.2.1. Vegetation

a) General aspects of the site

1. Valley out of flood near the bridge of Bicumbi-Kanzenze
Fallow of *Polygonum pulchrum*

- Size: about 85 cm
2. Mound of *Echinochloa pyramidalis* on grey-brown clay soil, spotted with stain
Height of superior stratum: 60cm
 3. Soil newly reshaped with fresh fallow of *Polygonum senegalense* and *Ageratum conyzoides*
 4. Fallow of *Oryza bartii* on clay soil in flooded basin
 5. Fallow in flooded basin of *Echinochloa pyramidalis*
 6. Mound out of flood with dry land of *Mimosa pigra*
Size: 2 m
 7. Mound of *Phragmites mauritianus* on the piedmont
Size: 2 m
 8. Basin of *Polygonum pulchrum* and *Cyperus papyrus*
Size: 1,5 m
 9. Draught of piedmont with *Mimosa pigra* and *Sesbania sesban*
Size: 4 m
 10. Piedmont deeply removed with various crops and feet of *Vernonia amygdalina*
 11. Muddy basin of *Typha latifolia*
 12. Permanent flooded zone with *Cyperus papyrus*

b) Data characteristics of Akanyaru sites

Site1: meadow with *Cyperus papyrus*, *Polygonum pulchrum*, *Echinochloa pyramidalis* and *Ludwigia abyssinica*

Site2: Aquatic meadow of relictual flasks of *Pistia stratiotes*

Site 3: (islet of Kinama) Forest gallery with *Phoenix reclinata* among the following plants:

<i>Acacia brevispica</i>	<i>Paullinia pinnata</i>
<i>Acacia polyacantha</i> sbsp.	<i>Phyllanthus niruri</i>
<i>Campylacantha</i>	<i>Rhus natalensis</i>
<i>Bridelia brideliifolia</i>	<i>Securinega virosa</i>
<i>Cassia didimobotrya</i>	<i>Sesbania sesban</i>
<i>Cissampellos mucronata</i>	<i>Taccazea</i> sp.
<i>Cissus adenaucaule</i>	
<i>Cynodon dactylon</i>	
<i>Erythrina abyssinica</i>	
<i>Ipomoea involucrate</i>	
<i>Maytenus heterophylla</i>	

Site 4 : Dry basin with *Cyperus digitatus*

Site 5: (Islet of Kinjenje) schruberry with *Sesbania sesban* and *Pennisetum purpureum*

3.2.2. Plants survey

A series of phytosociological collection of Data realized in the swamp of Nyabarongo provided data mentioned in table 1.

Table 1: List of plants at Nyabarongo swamp

Species	b.f.	samples											
		1	2	3	4	5	6	7	8	9	10	11	12
AMARANTHACEAE													
<i>Alternanthera sessilis</i>	b		2										
<i>Amaranthus dubius</i>	b										x		
<i>Celosia trigyna</i>	b					x							
APIACEAE													
<i>Hydrocotyle manii</i>	b											x	
ASTERACEAE													
<i>Ageratum conyzoides</i>	b		x	4		X							
<i>Botriocline longipes</i>	b						x						
<i>Bidens pilosa</i>	b										x		
<i>Crassocephalum pallidum</i>	b											x	
<i>Erigeron floribundum</i>	b					x							
<i>Galinsoga parvifolia</i>	b										x		
<i>Melanthera scandens</i>	b			X									
<i>Tagetes minuta</i>	b										x		
<i>Vernonia aemulans</i>	b	X	x										
<i>Vernonia amygdalina</i>	b											3	
BRASSICACEAE													
<i>Rorippa cryptantha</i>	b	X	x										
BORAGINACEAE													
<i>Heliotropium sp.</i>	b			X									
CAPPARACEAE													
<i>Cleome hirta</i>	b			X									
COMMELINACEAE													
<i>Commelina benghalensis</i>	b	X									X		
CONVOLVULACEAE													
<i>Ipomoea cairica</i>	b									x			
<i>Ipomoea involucrata</i>	b					x		1			1	x	
CYPERACEAE													
<i>Cyperus digitatus</i>	c							1	2x				
<i>Cyperus distans</i>	c			X		X							
<i>Cyperus dives</i>	c		x										
<i>Cyperus papyrus</i>	c			X						X	X		5
<i>Cyperus pectinatus</i>	c											x	
<i>Fuirena pubescens</i>	c											x	
DROSERACEAE													
<i>Drosera madagascariensis</i>	b											x	

List of plants at Nyabarongo (continued)

Species	b.f.	Samples									
		1	2	3	4	5	6	7	8	9	10
EUPHORBIACEAE											
<i>Ricinus communis</i>	b										x
FABACEAE											
<i>Sesbania sesban</i>	a	x			X				1	2	
LAMIACEAE											
<i>Leonotis nepetaefolia</i>	b										1
MIMOSACEAE											
<i>Mimosa pigra</i>	a						5			3	
MYRICACEAE											
<i>Myrica kandtiana</i>	a										
<i>Sacciolepis africana</i>	b			x							
POLYGONACEAE											
<i>Polygonum pulchrum</i>	b	5	2	4	X	1					
<i>Polygonum senegalensis</i>	b			x							
<i>Polygonum setusolum</i>	b				x	1	1	1	4	1	1
<i>Polygonum strigosum</i>	b										
Thelypteridaceae											
<i>Cyclosorus striatus</i>	b										
TILIACEAE											
<i>Triumfetta cordifolia</i>	b						x				
TYPHACEAE											
<i>Typha domingensis</i>	c										
VERBENACEAE											
<i>Clerodendron rotundifolium</i>	b										x

- a: small shrubs
b: herbs
c: cyperaceous

The vegetation of Akanyaru and Nyabarongo swamps is dominated by the papyrus in the zones of permanent flooded basins. This species is generally associated with scattered herbaceous plants such as *Polygonum pulchrum* and *P. setusolum*.

Islets of *Typha latifolia* occupy rabble zones well drained, while mounds out flood are occupied by bushes of *Mimosa pigra*, *Sesbania sesban* and *Triumfetta cordifolia*.

The edges of swamps, piedmonts and thalwegs are planted by various crops, in the middle of which some traces of forest persist with, among others,

Markhamia lutea, *Acacia polyacantha* subsp. *campylacantha*, *Securinega virosa*, *Bridelia brideliifolia* and *Sapium ellipticum*.

In recent fallow lands, sometimes on temporal submersion land, a mixture of species is developed, comprising *Oryza barthii*, *Cyperus digitatus*, *C. dives* and a lot of cosmopolite ruderal plants.

3.2.2. Birds survey

Table 2: List of recorded birds in Nyabarongo wetlands

Nom scientifique	english name	French name	status
Pelecanidae			
<i>Pelecanus rufescens</i>	Pick-backed pelican	Le Pélican	
Ardeidae			
<i>Ardea cinerea</i>	Grey heron	Héron cendré	
<i>Ardea melanocephala</i>	Black-headed Heron	Héron à tête noire	
<i>Ardea purpurea</i>	Purple Heron	Héron pourpré	
<i>Ardeola idae</i>	Madagascar Squacco Heron	Héron crabier du Madagascar	IUCN
<i>Ardeola ralloides</i>	Squacco heron	Le bihoreau européen	
<i>Butorides striatus</i>	Green-backed heron	Le petit heron crabier commun	
<i>Egretta garzetta</i>	Little Egret	Aigrette garzette	CITES
<i>Nycticorax nycticorax</i>	Night heron	Le bihoreau commun	
Scopidae			
<i>Scopus umbretta</i>	Hammerhop	Ombrette	
Ciconiidae			
<i>Anastomus lamelligerus</i>	Yellow-billed Stork	Anastome à lame jaune	
<i>Mycteria ibis</i>	Opened-billed Stork	Anastome à lame ouverte	
Threskiornithidae			
<i>Platalea alba</i>	African spoonbill	La spatule	
<i>Bostrychia hagedash</i>	Hadada	Ibis hagedash	CITES
<i>Threskiornis aethiopica</i>	Sacred ibis	Ibis sacré	CITES
Anatidae			
<i>Alopochen aegyptiacus</i>	Egyptian goose	Oie d'Egypte	CITES
<i>Anas erythroryncha</i>	Red-billed Teal	Le Canard à bec rouge	
<i>Anas undulata</i>	Yellow-billed ducks	Le canard à bec jaune	
Accipitridae			
<i>Aquila wahlbergi</i>	Wahlberg's Eagle	Aigle de Wahlbergi	
<i>Haliaeetus vocifer</i>	Fish Eagle	Aigle pêcheur	
<i>Hieraaetus dubius</i>	Long crested Eagle		
Gruidae			
<i>Balearica pavonina</i>	Black-crowned Crane	Grue couronnée	
Charadriidae			
<i>Charadrius tricollaris</i>	Three-banded plover		
<i>Vanellus crassirostris</i>	Long-toed Plover	le pluvier à long doigt	
Scolopacidae			
<i>Actitis hypoleucos</i>	Common sandpiper		
Caprimulgidae			
<i>Macrodipteryx vexillaria</i>	Pennant-winged nightjar		

Table 2 (cont.): List of recorded birds in Nyabarongo wetlands

Coliidae			
<i>Colius striatus</i>	Speckled mousebird	Le coliou	
Alcedinidae			
<i>Ceryle rudis</i>	Pied kingfisher	Martin pêcheur Pie	
<i>Halcyon leucocephala</i>	Malachite kingfisher	Martin pêcheur à tête grise	
<i>Halcyon senegalensis</i>	Woodland kingfisher	Le Martin pêcheur du senegal	
<i>Megaceryle mazima</i>	Giant kingfisher	Le Martin pêcheur géant	
Picnonotidae			
<i>Picnonotis barbatus</i>	Common bulbul	Bulbul commun	
Turdidae			
<i>Cossypha heuglini</i>	White browed robin chat		
Sylviidae			
<i>Acrocephalus rufescens</i>	Greater swamp warbler		
<i>Bradypterus carpalis</i>	White-winged warbler	Fauvette à taches blanches	
<i>Chloropeta natalensis</i>	Yellow Warbler		
<i>Cisticola erythrops</i>	Red faced Cisticola		
<i>Cisticola galactotes</i>	Winding Cisticola	La Cisticole roussâtre	
Muscicapidae			
<i>Muscicapa aquatica</i>	Swamp flycatcher		
Nectarinidae			
<i>Cinnyris erythrocerca</i>	Red-chested Sunbird		
Ploceidae			
<i>Euplectes axillaris</i>	Fan-tailed Widowbird	La Veuve à épaulettes rouges	
	Nothern brown-throated weaver		
<i>Ploceus castanops</i>			
<i>Ploceus melanocephalus</i>	Yellow-backed Weaver		
<i>Ploceus pelzelni</i>	Slender billed-Weaver	Le tisserin	
Malaconotidae			
<i>Laniarius erythrogaster</i>	Black-headed Gonolek		
<i>Laniarius mufumbiri</i>	Papyrus Gonolek	Le Gonolek de Grant	IUCN

On the whole , our inventory has led to 46 species of birds belonging to twenty families. Two of them are mentioned on the **IUCN red list**. It is mainly *Ardeola idea* (vulnerable) and *Laniarius mufumbili* (near threatened). As to *Alopochen aegyptiacus*, *Egretta garzetta*, *Bostrychia hagedash*, *Threskiornis aethiopicus*, they are protected by **CITES**.

3.2.3. Information on terrestrial animals

After personal observations and information received from local population, we noticed that Akanyaru and Nyabarongo swamps shelter a diversity of animals belonging to different systematic groups.

Beside Sitatunga, papyrus places are the shelter of some herds of silvery monkeys (*Cercopithecus mitis*) and some snakes while waterways shelters hippopotamus, crocodiles and a lot of fish.

4. Socio-economic study

4.1. Objective of the study

This study aims at, among others, collecting enough information in relation with socio-economic importance of swamps for the population as well as the identification of riverside threats to the swamps and formulating required recommendations as remedies. Therefore the needs and attitudes of the population towards swamps management have been mentioned.

4.2. Zones of the study

the socio-economic study consisted of investigation carried out under the form of questionnaires to the riverside people of the two sites which were concerned with inventories of vegetation and birds; namely the site located at the confluence between Akanyaru and Nyabarongo (between Kanzenze District of Kigali Ngali Province and Butamwa district of Kigali City).

That site is located near the bridge of Nyabarongo making a link between Bicumbi and Gashora districts of Kigali Ngali Province.

Because of limited means to carry out that socio-economic study, the investigation was led with the population limited to Bicumbi, Kanzenze and Butamwa districts, which dispose of great proportion considering the area of the studied swamps.

4.3. Technics and Methodology

For each district, we considered only the households to answer the questionnaire. That questionnaire contained in all 48 questions grouped into 4 chapters namely, identification of informant, the condition of life, economic activities and activities of swamp conservation.

Moreover, the group of informants comprised all social levels such as intellectuals, women, young people, and grown-ups in order to vary data collected. Each one answered individually to the questions in front of the investigator.

4.4. Data analysis and Interpretation

4.4.1. Characteristics of the sample

The Population investigated comprises 20 informants from 6 cells, 2 sectors, 2 Districts and 1 Province.

Its characteristics are mentioned in the following table.

Table4: Characteristics of the population sample

Average age	20 -54 years
Sex ratio - women - men	45 % 55%
Level of study - without schooling - primary school - secondary school	30% 35% 35%
Activities - Farmers - Students - Paid workers	60% 10% 30%
Types of housing - Puddle clay - Bricks - Thatched - Iron sheets - Tiles	30% 70% 15% 55% 30%
Possessions - radio - radio and bicycle - Neither radio nor bicycle	30% 40% 30%

The characteristics of the sample offer enough confidence margin as far as information obtained are concerned on the use of the swamp and problems undergone by riverside people.

4.4.2. The use of the swamp

Fuel - fire wood - charcoal	100% 15%
Agriculture	85%

Cattle farm	35%
Housing materials Papyrus	25%
Other uses	
- herbs for preparing banana wine	65%
- herbs for arts and crafts	35%
- medicinal plants	20%
- springs	85%

The swamp of Nyabarongo furnishes to the riverside people important services which allow them to satisfy their daily needs. Besides the agriculture mainly practiced during the dry season, the swamp provides building materials, fire wood, household use and others for arts and crafts.

People get rivers water and channels for domestic water needs.

The vegetation of the swamp provide also medicinal herbs for people who are often short of money to go to health centers or are unable to make the long distance which separates them from those centers.

4.4.3. Information on the animals of the swamp

55 % of the informants say that people sometimes hunt animals in the swamp. Here are some of the animals they hunt:

Sitatunga:	30 %
Otter:	20 %
Monkeys:	20 %
Aphalophe:	10 %
Hare:	10 %
Trush:	10 %
Duck:	5%

The reasons that people mention to justify the use of the swamp for agriculture are the following:

- Survival reasons : 55 %
- Lack of enough fields : 25 %
- Long hasting dry season : 5 %
- Strong need of sugar cane : 15 %

50 % maintain that the animals of the swamp damage cultures in the fields. Here are some animals they have mentioned.

- Monkeys
- Thrush
- Birds
- Mice
- Hippopotamus
- Frogs

To keep their cultures safe, people protected their fields by hunting those animals. Some of them use bush fire to dislodge and catch the animals.

4.4.4. Threats which act on the biodiversity of the swamp

The information obtained on the use of the swamp and various attitudes of the people towards that swamp show that it is exposed to important threats. Agricultural activities reduce the stretch of the swamp and, thus, reduce the optimum space for the survival of certain species of large territory.

The disorderly deduction of building materials of arts and crafts from the swamp constitutes also a serious threat because through lack of other alternatives income generating, those activities are going to increase in proportion to the increasing of population.

In a word, hunting animals, either for flesh or for cultures protection is a phenomenon commonly mentioned. Such hunting by traps or by bush fire in the swamp contributes to the reduction of animal population and risks to cause the disappearance of rare species.

5. Conclusion

The study of plant and animal biodiversity associated with socio-economic studies allowed to discover the richness of Akanyaru and Nyabarongo swamps and to understand the use of those sites by local communities as well as the threats which overwhelm those respective environments.

Amongst plant and animals species, the great majority pledges allegiance to swampy ecosystems and risks to disappear following the abusive use of their biotope.

More particularly, we identified, in the swamp, some species of birds whose necessity of conservation is imperative (*Laniarius mufumbiri*, *Ardeola idae*).

Human threats which weigh on those wetlands are mainly the occupation of lands of culture, the collection of arts and crafts materials, building materials and various bush fires. There is also the hunting of Sitatunga for its much appreciated flesh meat.

The programmes considered in the context of swamp management, as far as they don't take into account studies of impacts led beforehand, constitute also very serious threats

6. Recommendations

Authorities must consider opinions and interests of the population. They must,

- Advice to the population;
- Give jobs to the population;
- Train and sensitize the population;

- Apply participative management between authorities and population;
- Give pesticides and other agriculture materials ;
- Support creation of local communities ;
- Show future interests of swamp management.

7. Constraints

Many constraints didn't allow to well carrying out the studies.
Most of them are as follow:

- Lack of enough capacity to carry out sufficiently the timed species count (TSC);
- Unavailability and long distance for persons involved in ornithology;
- Serious dependences for movements and many hazards;
- Impossibility of camping through lack of equipment and security situation still slightly reliable;
- Difficulties of coordinating a team committed to other activities;
- Different motivation for students;
- Delay in funds deposit;
- Disruption of academic calendar which didn't allow students to be available on due time.

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