

Bird Management in the Ruzizi Delta, Northern End of Lake Tanganyika in Burundi and the Democratic Republic of Congo

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ABSTRACT

The investigation of the management of birds in the Ruzizi Delta was conducted as part of a global doctoral research on the ecology, conservation and management of birds in the Ruzizi Delta through direct observation, the real bibliography and the virtual bibliography by internet. Direct observation led us to report on the problems of soils, hydrology, land and vegetation cover, wild animals on the banks of rivers and islets, natural ponds, lagoons and the coast of Lake Tanganyika. The real and virtual bibliography on the internet has revealed to us the development plans that we suggest for the Ruzizi Burundian Delta (RBD) and for the Ruzizi Congolese Delta (RCD). It recommends the formulation of projects in synergy for the conservation of birds and biodiversity in the RBD and the RCD. For the DRC, the study recommends legislating on the creation of a community reserve for the Ruzizi Congolese wetlands delta protection as was the case before the wars of 1996-2003. For Burundi, the study recommends the reforestation of a buffer zone for the demarcation of wetlands in areas in full urbanization, particularly around the City of Gatumba.

Key words: Bird Management; Development of crocodiles; Hippos management; Biodiversity management plan; Wild animals of the banks and islets.

INTRODUCTION

Bird ecology, conservation and management in the Ruzizi Delta were investigated both in Burundi and in the Democratic Republic of Congo (DRC) during 2019-2021. Water bird ecology told about 388 bird species sharing environment partitioning with 136 water bird species both in the Ruzizi delta of Burundi and of DRC. Bird conservation presented the Ramsar criteria fulfilled by the Ruzizi Delta with a particular focus on the Ruzizi Congolese Delta.

This was concerning the stakeholders' opinion to protect its wetlands as a Ruzizi Congolese Delta Community Reserve for wise conservation of the 139 bird species of which 101 fulfil six of seven Ramsar Criteria A1, A2, A3, A4i, A4ii and A4iv and 73 migrant bird species. The following chapter is dealing with bird management in the Ruzizi Delta, both in Burundi and in the DR of Congo.

Policy and Legal Framework

The main texts relating to Environmental Management in the two countries are (ADBG, 2015):

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Burundi: (i) Decree No.100/22/ of 7 October 2010 on the implementation of measures of the Environmental Code in relation to the Environmental Impact Assessment Procedure; (ii) Law No.1/01 establishing the Environmental Code in Burundi, which lays down basic rules for environmental management and protection against all forms of degradation so as to safeguard and promote the rational use of natural resources, combat various forms of pollution and nuisances and thereby

improve the population's living conditions while respecting the balance of ecosystems (ADBG, 2015);

DRC: (i) Law No. 11/009 of 09 July 2011, establishing fundamental principles of environmental protection; Ministerial Decree 013/2005 of March 2005 supplementing Decree 037/2004 of June 2004 on the establishment, organization and operation of structures intervening in the environmental and social assessment of the PMURR (ADBG, 2015); (ii) Decree 043/2006 of 8 December 2006 containing provisions relating to the obligation to carry out the environmental and social assessment of projects in DRC (ADBG, 2015); (iii) Decree 044/2006 of December 2006 on the establishment, organization and functioning of the GEEC, amended by Decrees 005/2007 of 30/01/2007 and 008/2007 of 03/04/2007 (ADBG, 2015).

Institutional Framework

Several actors in the two countries are involved in environmental and social management. These are (ADBG, 2015):

For Burundi: The Ministry of Water, Environment, Land and Urban Planning. This Ministry's prerogatives include the design and implementation of national regional development and environmental policy, especially through the definition and implementation of appropriate policies for land planning, natural resources protection and conservation: water, air, forests, wildlife and plant species (ADBG, 2015). The Ministry has a Directorate-General of Land Management and Environment, which is subdivided into four Departments including the Tourism and Environment Department. The latter is responsible for monitoring and reviewing environmental management assessments (ADBG, 2015). Other ministries concerned by the environmental management are the Ministry of Agriculture and Livestock, Ministry of Communal Development, Ministry of Mines and Energy, Ministry of Trade and Industry and Ministry of Interior and Public Security (ADBG, 2015);

For DRC: The Ministry of Environment, Nature Conservation and Tourism (MECNT, successor to MECNEF) is charged with environmental management (ADBG, 2015). Its responsibilities are to: (i) prepare environmental hygiene standards; (ii) monitor implementation of environmental impact assessments; (iii) control industrial pollution and environmental sanitation (Desyreé, 2015). In the particular case of the environmental management, the Ministry of Environment is responsible for granting the project a Certificate of Environmental Acceptability without which no project can begin. Pursuant to Ministerial Decree No 044/CAB/MIN/ECN-EF/2006 of 8 December 2006, the Congo Environmental Study Group assists the Ministry in the review of environmental management. Other ministries involved in the environmental management are the Ministry of Energy, Ministry of Labour and Social

Welfare, Ministry of Planning and Ministry of Land Affairs (ADBG, 2015).

Soils

Alluvial material produces classic floodplain, clay and mineral, grey soils with low infiltration rates in the lowland valley (ADBG, 2015). Young transitional cambisols, characteristic of early soil formation, are found throughout the catchment, together with pockets of red/orange ferralsols and well drained red clayish soils that are typically found in old and weathered tropical situations. These soils all have high infiltration rates leading to rapid drainage on the slopes. While under forest cover they are porous and stable, but once the forest is removed the surface becomes hard and crusty and highly vulnerable to erosion by surface runoff under heavy rains. The older ones are generally suitable for agriculture given adequate rainfall (ADBG, 2015).

Hydrology

The Rusizi River around 117 km from Lake Kivu to Lake Tanganyika marks the boundary between DRC and Rwanda/ Burundi and descends from around 1,500 m above sea level in Lake Kivu to 770 m at its southern delta with Lake Tanganyika (ADBG, 2015). Its steepest gradients are found in the first 40 km along the border between Rwanda and DRC, where it descends through a narrow gorge, dropping some 500 m to just north of Bugarama City.

At 940 m it is joined by the Ruhwa River from Burundi, which forms the southern boundary between Rwanda and Burundi. Thereafter the river slows and adopts a more meandering path through the flatter Rusizi lowlands down to the Rusizi National Park floodplains in Burundi and DRC to the delta.

While most of the water in the Rusizi River comes directly from Lake Kivu, it is also fed by various tributaries of which the most important in Rwanda and Burundi are Nyamagana, Muhira, Kaburantwa, Kagunuzi, Rubyiro and Ruhwa, some of which (notably the Muhira) are significant sources of sedimentation (ADBG, 2015). This subdivision has been targeted for hydropower, agriculture, irrigation, water supply, peat production, and natural land use. Rusizi Nyungwe includes the catchments for the Ruhwa and Kaburantwa Rivers, and faces problems of artisanal mining with subsequent erosion and pollution of forest areas. On the Congolese site tributaries are Luvimvi, Luvungi, Sange, Runingu and Kiliba.

Land and Vegetation Cover

The vegetation of the lower Rusizi plain in Burundi as in the DRC appears like the soils that support it as a vast mosaic of different associations and a comparative

examination of these and of the soil map highlights their interdependence (Reekmans, 2016).

In the wetlands of the Delta, ten types of plant formations can be distinguished: (1) aquatic and semi-aquatic formations on the banks and permanent marshes; (2) clustering with *Typha domingensis*; (3) the *Balanites aegyptiaca* and *Sporobolus pyramidalis* formations, presenting very different dry season and rainy season facies; (4) association with *Bulbine abyssinica* (pseudo steppe); (5) xerophilic groves of *Cadaba farinosa* ssp. *Adenotricha*, *Commiphora madagascariensis* and the overpitted lawns associated with them; (6) The association with *Hyphaene benguellensis* var. *ventricosa*, dense forest formation of the Rusizi terraces; (7) forest formations of ravines, relics of the sclerophyllous forests of the flanks and valley bottoms of temporary rivers; (8) *Acacia hockii* recolonization formations, extending into the most degraded erosion ravines; (9) postcultural training for former peasantry; (10) ruderal formations, linked to the current or former presence of habitation (Reekmans, 2016). Some Plant life on the banks and islets are semi-aquatic: *Phragmites mauritanus*, *Cyperus articularis*, *Phoenix reclinata*, *Typha domingensis* and *Cyperus* sp. In many sections of the minor bed, semi-aquatic species are poorly represented (GLC, 2017).

Other non-aquatic species grow directly on the water's edge: *Hyparrhenia diplandra*, *Imperata cylindrica*, *Ficus vallis-choudae*, *Ficus capensiand*, *Musa paradisiaca* (ADBG, 2015). The main majorbed plant species are: *Combretum collinum*, *Albizia zygia*, *Sterculia tragacantha*, *Cyperus articularis*, *Pennisetum purpureum* and *Vernonia amygdalina* (ADBG, 2015). This vegetation has been degraded by the planting of crops, exploitation of fire wood, and trampling. Some cultivated species that prefer high humidity and characteristic of human activity now form part of the Ruzizi riparian landscape, e.g. banana plants comprising the following species: *Musa sapientium*, *M. nana* and *M. paradisiaca* (ADBG, 2015). Riparian vegetation serves as abiological corridor well known for its important functions of bank soil protection, shelter and source of food for many animals (insects, reptiles, birds, mammals, fish, macroinvertebrates and microinvertebrates).

The major bed contains terrestrial wildlife comprising: (i) arthropods such as: *Narceus* sp., *Anax imperator*, *Apis melifica* and *Papilio bromius*; (ii) reptiles such as: *Mabuaya striata*; and (iii) avian fauna with a strong presence of *Lagonostica senegala* (GLC, 2017). This wildlife is experiencing both quantitative and qualitative negative variations due to the degradation of the ecosystem (ADBG, 2015).

Wildlife on the banks and islets

The minor bed in the direct impact area constitutes the habitat for land wildlife represented by insects of the *Anax imperator* type (dragonflies), avian fauna and fish species

represented in particular by *Bubulcus ibis*, *Phalacrocorax carbo* and *Scopus umbretta* (ADBG, 2015). There are also tropical-waders: crowned cranes, many herons, many egrets (ox-peckers) and many cormorants (GLC, 2017).

Aquatic fauna

The *Cichlidae* family is the most represented with 8 species, including the *Oreochromis niloticus*, the second most frequently bred fishing the world after the Asian carp (ADBG, 2015). It is followed by the *Cyprinidae* family (5 species) to which the barbell (*Barbus altianalis*) belongs and which is the only known fish to migrate between Lake Kivu and Lake Tanganyika. The *Clariidae* family is a minority (3 species), as well as the *Clupeidae* family (GLC, 2017).

Urban Settlements

Bujumbura and Uvira are the main urban settlements around the Ruzizi Delta, which have the highest populations and are lakeside settlements and by implication have the greatest effects on the Ruzizi Delta catchment (ADBG, 2015).

A 2012 DRC census yielded estimates of around 170,000 populations in Uvira (ADBG, 2015). Censuses in 2008 in Burundi estimated the populations of Bujumbura at around 500,000, followed by 24,000 in Cibitoke (GLC, 2017).

All trends within the region and beyond predict that these urban populations will increase not only rapidly but also disproportionately in relation to rural areas in the near future, with the greatest growth in the bigger cities of Bujumbura and Uvira (ADBG, 2015). A conservatively estimated doubling of current populations within the next 20 years can be expected throughout the Ruzizi Delta Management Programme for Burundi and DRC (GLC, 2017).

Hydropower and Irrigation

Existing and planned hydropower dams are impacting in a major way on the Lake Kivu and Rusizi River catchments (GLC, 2017). Two are already in place, and two more are planned. Rusizi I, at the mouth of the river from Lake Kivu and owned by DRC, has an installed capacity of 28.2 MW and was built in 1958. Rusizi II, built in 1989 and owned by all three countries, has a capacity of 39.9 MW. A 26 Rusizi III is planned to add 147 MW and Rusizi IV another 287 MW. The plans for both of these dams are however on hold as even Rusizi II is currently operating substantially below capacity (ADBG, 2015).

Transportation

Two poorly maintained 2-lane roads run along either side of the catchment from Bukavu in the north to Bujumbura

(the RN5) in the south east in Burundi, and to Uvira (the N5) in the south west south in DRC (GLC, 2017). Other more minor roads are in even worse condition. Apart from the RN5 and N5, and the ports in Bukavu, Uvira and Bujumbura, transport infrastructure is relatively undeveloped. This situation is unlikely to persist (ADBG, 2015).

There are major plans to improve road and rail systems throughout Africa in order to support 33 Development Corridors on the continent. The Northern Development Corridor encompasses Kenya, Uganda, Rwanda, Burundi and DRC (PPCR, 2017).

Road and routes will be upgraded and opened up from Mombasa to Bujumbura and from Kampala through Kigali to Goma, Bukavu and Bujumbura. The Goma-Bukavu-Bujumbura route will pass to the East of the CRAG (Centre for Research in Agricultural Genomics), while a Central Corridor from Dar-Es-Salaam will pass to the South and East.

While neither highway is likely to pass through the CRAG itself, their developmental impacts will be felt throughout the region, with major benefits and costs accruing to different constituencies and interests (GLC, 2017).

Hypothesis

We hypothesized that a management plan for the Ruzizi Congolese Delta similar to that of the Rusizi Burundian Delta, would effectively contribute to the conservation of birds, crocodiles and hippos of the Ruzizi Delta, both in Burundi and in the DRC.

RESULTS AND DISCUSSION

The chapter deals with the Ruzizi Delta management plan actions in the Republic of Burundi and in the Democratic Republic of Congo. Table 1 presents the ecosystems and the actions of the management plan that can include the Ruzizi Delta in the Aichi Biodiversity Conservation targets in both the Republic of Burundi and the Democratic Republic of Congo.

The Rusizi Delta Management in the Republic of Burundi

In the Republic of Burundi, the ecosystems and the actions of the development plan are (Table 1 A):

(1) The lake Shore Areas (LSA) which includes the ecosystems of the Great Rusizi River Mouth (GRRM), S 03° 21' 47.7' / E 029° 16' 01.6' 777m altitude up to the Small Rusizi River Mouth (SRRM), S 03° 21' 15.8' / E 029° 12' 45.2' 773m above sea level, approximately 7km in length. The action of the management plan to be carried out is to comply with regulations relating to protected

environments. Indeed, these regulations exist but are not respected because on several occasions, the riparian vegetation dominated by reed (*Phragmites* spp), papyrus (*Cyperus papyrus* L. Cyperaceae) and *Cyperus* with alternate leaves or False papyrus or even umbrella plant, up to 1.2m in height (*Cyperus alternifolius*), often sold commercially under the improper term of "Papyrus", although very important for the nutrition, reproduction, hiding, and weaning of fish, birds, hippos, crocodiles, and the biodiversity of shorelines in general, suffers from overexploitation, illegal and restrictive fisheries and even unnecessary waste.

(2) The Great Rusizi River Downstream (GRRDS) extending from the Great Rusizi River Bridge (GRRB), S 03° 20' 27.8' / E 029° 16' 23.5' 779m altitude up to the Great Rusizi River Mouth, about 3km. The action of the management plan to be carried out is the protection of river banks for the sustainable conservation of fish, hippos, crocodiles, birds and biodiversity in general.

(3) The Great Rusizi River Upstream (GRRUS) extending from the Great Rusizi River Bridge (GRRB) up to the Vugizo Burundian Site (in Mpanda), S 03° 20' 27.8' / E 029° 16' 23.5' 779m above sea level, at about 7km of distance in marshy environments alternated by streams. The action of the management plan to be carried out is the Ruzizi Wetland Action Plan (WAP).

(4) The Shrub Landscape Areas (SLA) extending from the Numerator Point Areas (NPA), S 03° 21' 11.1' / E 029° 16' 16.3' 779 m altitude to the Ponds of Mukartutsi 1 and Mukartutsi 2, at 5km distance in wooded steppe including the two ponds of Mukartutsi 1 & Mukartutsi 2, extending over the marshy area to the Gatumba border post. The actions of the management plan to be carried out are the regeneration of the wooded steppe, the protection of ponds and wetlands by reforestation of a buffer zone demarcating the official boundaries of the Rusizi National Park from the urbanizing environments of Gatumba.

The Ruzizi Delta Management Plan in the DR of Congo

In the Democratic Republic of Congo (DR of Congo), the ecosystems and the actions of the management plan are (Table 1B):

(1) The lake Shore Areas (LSA) which includes the ecosystems of the Small Rusizi River Mouth (SRRM), S 03° 21' 15.8' / E 029° 12' 45.2' 773m altitude up to the site of Kilomoni 2 S 03° 20' 48.0' / E 029° 11' 30.8' 779m above sea level, approximately 3km in length. The action of the management plan to be carried out is to ensure protect the Lake shore areas for aquatic vegetation, fish, hippos, crocodiles and biodiversity wise conservation (Bashonga B., 2013).

Table 1-A. Ecosystems and Management action plan of the Ruzizi Delta in Burundi and in the DR of Congo A Rusizi Burundian Delta

Ecosystems	Designate	Coordinates	Distance	Management Action Plan	Observation
LSA	GRRM	S 03° 21' 47.7" / E 029° 16' 01.6" 777 m	7km	Strict respect the PA's regulations	Not respected
	SRRM	S 03° 21' 15.8" / E 029° 12' 45.2" 773 m		Protect reed vegetation	Not protected
GRRDS	GRRB	S 03° 20' 27.8" / E 029° 16' 23.5" 779 m	3km	Protect the river banks	Not protected
	GRRM	S 03° 21' 47.7" / E 029° 16' 01.6" 777 m		Protect the river banks	Not protected
GRRUS	GRRB	S 03° 20' 27.8" / E 029° 16' 23.5" 779 m	7km	Protect Wetlands Areas	Not protected
	VBS/Mpanda	S 03° 19' 00.3" / E 029° 16' 49.3" 775 m		Protect Wetlands Areas	Soil erosion
SLA	NPA	S 03° 21' 11.1" / E 029° 16' 16.3" 779 m	5km	Reforest a protective buffer zone	No Park limit
	MP 1	S 03° 21' 13" E 029° 14' 50" E 772 m	1.5km	Protect Wetlands Areas	No Park limit
	MP 2	S 03° 21' 13" E 029° 14' 36" 773 m	1.5km	Protect important Ponds	No Park limit

Legend: LSA, Lake Shore Areas; GRRM, Great Rusizi River Mouth; SRRM, Small Rusizi River Mouth; GRRDS, Great Rusizi River Downward Stream; GRRB, Great Rusizi River Bridge; GRRUS, Great Rusizi River Upstream; VBS, Vugizo Burundian Site; SLA, Shrub Landscape Areas; NPA, Numerator Point Areas; MP1, Mukartutsi Pond 1; MP2, Mukartutsi Pond 2. **Source:** Our fieldwork 2019-2021

Table-1 B. Ruzizi Congolese Delta

Ecosystems	Designate	Coordinates	Distance	Management Action Plan	Observation
LSA	SRRM	S 03° 21' 15.8" / E 029° 12' 45.2" 773m	3km	Ensure protect Lake shore areas	Overexploitation
	Kilomoni 2	S 03° 20' 48.0" / E 029° 11' 30.8" 779m		Protect wetland areas	Overexploitation
KCPO	KMPO	S 03° 20' 24.3" / E 029° 12' 45.1" 781m	1.5km	Ensure protect wetland areas	Overexploitation
	KCO	S 03° 20' 22.4" / E 029° 12' 08.6" 783m		Ensure protect wetland areas	Overexploitation
KyWA	KyPA	S 03° 20' 49.2" / E 029° 11' 30.7" 775m	3km	Ensure protect pond areas	Overexploitation
	KyWA	S 03° 21' 15.5" / E 029° 12' 44.5" 775m		Ensure protect wetland areas	Overexploitation
KaWA	KaQO	S 03° 19' 50.8" / E 029° 12' 11.2" 774m	1.5km	Ensure protect wetland areas	Overexploitation
	NPEA	S 03° 20' 04.7" / E 029° 12' 36.4" 775m	3km	Ensure protect wetland areas	Overexploitation
VCA	VCPO	S 03° 16' 08.5" / E 029° 14' 27.1" 781m	7km	Ensure protect watercourse	Overexploitation
	KiRSA	S 03° 15' 41.6" / E 029° 13' 34.8" 785m		Ensure protect watercourse	Overexploitation

Legend: LSA, Lake Tanganyika Shore Areas; SRM, Small Rusizi River Mouth; KCPO, Kavimvira Congolese Post Office; KMPO, Kavimvira Migration Post Offices; KCPO, Kavimvira Customs Post Offices; KWA, Kavimvira Wetland Areas; KyWA, Kyamvubu Wetland Areas; KyPA, Kyamvubu Pond Areas; KyWA, Kyamvubu Western Areas; KaWA, Kahorohoro Wetland Areas; KaQO, Kahoroho Quarter Office; NPEA, Nyangara Pond Eastern Area; VCA, Vugizo Congolese Site; VCPO, Vugizo Congolese Post Office; KiRSA, Kiliba Refectory Sugar Areas. **Source:** Our fieldwork 2019-2021

(2) The Kavimvira Congolese Post Office (KCPO) which comprises the Kavimvira Migration Post Offices (KMPO), S 03° 20' 24.3" / E 029° 12' 45.1" 781m altitude extending up to the Kavimvira Customs Post Office (KCPO), S 03° 20' 22.4" / E 029° 12' 08.6" 783m above sea level, about 1.5km distance length in Western direction. The action of the management plan to be carried out is to ensure protect wetland areas for the sustainable conservation of fish, hippos, crocodiles, birds and biodiversity in general.

(3) The Kyamvubu Wetland Areas (KyWA) extending from the Kyamvubu Pond Areas (KyPA) S 03° 20' 49.2" / E 029° 11' 30.7" 775m, 3km up to the Kyamvubu Western Pond Areas (KyWPA) S 03° 21' 15.5" / E 029° 12' 44.5" 775m above the sea level, at about 3km distance length in pond and wetland areas. The actions of the management plan to be carried out are the pond area protection and the Ruzizi wetland delta protection. (4)The Kahorohoro Wetland Areas (KaWA), extending from the Kahorohoro Quarter Office (KaQO) S 03° 19' 50.8" / E 029° 12' 11.2" 774m above the sea level up to the Nyangara Pond Eastern Area (NPEA) at about 1.5km.

The action of the management plan to be carried out is the wetland areas protection by setting aside permanent wet areas for birds, hippos and biodiversity conservation. (5) The Vugizo Congolese Site (VCA), extending from the Vugizo Congolese Post Office (VCPO) S 03° 16' 08.5" / E 029° 14' 27.1" 781m altitude up to the Kiliba Sugar Factory Areas (KiSFA), at 7km, extending as well up to the Sector 7 of Kiliba Areas, 14km from VCPO, in a wetland area made of irrigation canals discharging water from the Kiliba River into the Nyangara Pond. The actions of the management plan to be carried out are to ensure protect watercourse, wetland areas and shrub landscape areas by reforestation of a buffer zone demarcating the boundaries of the watercourse and shrub landscape to protect from people cultivation areas (Bashonga B. , 2013).

Wetlands protection for livelihoods improvement

Once protected, the Ruzizi Congolese Plain will play a key role in enhancing fish stocks and strengthening sustainable management of fisheries (CBD, 2013). Aichi Biodiversity Target 6 well help to deal with which fish and invertebrate stocks and aquatic plants are harvested in the Ruzizi Delta (GIEWS, 2016). Which are under or moderately exploited (GEF, 2020b). Which are fully exploited (Judith, Juvénal, Abed, & Ntababarwa, 2020). Which are overexploited, depleted or recovering (Desyreé, 2015). Wetlands protection increases farm production, fishing production, cow breeding with milk improvement and job creation in local community for the Ruzizi Congolese Community Reserve.

Wetlands protection for birds and biodiversity conservation

The present doctoral thesis aims to highlight which bird species to protect in the Ruzizi Delta, and when the delta will be protected all biological diversity including fish and plants will be as well sustainably protected (CBD, 2013). Who are the stakeholders that may be affected by efforts to reduce overexploitation (Desyreé, 2015) How can they be involved, how would they be affected, and how can their needs addressed (Desyreé, 2015). What are the trade-offs to consider (GEF, 2020b). What additional resources (financial, human and technical) will be required to reach the national target that is set, how can additional funds be raised and what are possible funding sources (CBD, 2013). In protected wetlands, birds are secured with trees and bush sheltering, reproduction and resting spaces secured, food such as fish, seeds and insects available.

Once protected, the Ruzizi Congolese Plain will promote sustainable production of natural resources in areas under agriculture, aquaculture and forestry (GEF, 2020b). Aichi Biodiversity Target 7 deals with what are the opportunities and constraints to enhancing sustainable management. What are the potential ecological, economic, and social costs and benefits of enhancing sustainable management (CBD, 2013). What biodiversity related problems could be addressed through sustainable management and how could sustainable management be used to address the main threats to biodiversity (GEF, 2020b).

Who are the stakeholders that may be affected and how can they be involved and their needs addressed (CBD, 2013)! Then, what are the trade-offs to consider and if there are stakeholders who could also act as champions for enhancing sustainable management (CBD, 2013).

Wetlands protection for peace building among wetlands stakeholders

Welcoming indigenous peoples and local communities into shared Ruzizi Congolese Plain governance structures and management as a Community Protected Reserve or Natural Protected Reserve is an important strategy to ensure respect and integrate traditional knowledge into governance and management measures (GEF, 2020b). Aichi Biodiversity Target 18 advocates that community lives and Parties need to develop approaches which take into account the diversity of indigenous and local communities as well as their specific national circumstances (CBD, 2013).

For setting national targets Aichi Biodiversity Target 18 points at who are the indigenous, local or traditional communities in the country (CBD, 2013), how are their traditional knowledge, innovations, practices and customary use of biological resources being respected (GEF, 2020b); What processes or mechanisms are in place to promote this respect (ICCN, 2012); How effective have they been (ICCN, 2012); How could their effectiveness be improved (Judith, Juvénal, Abed, & Ntababarwa, 2020);

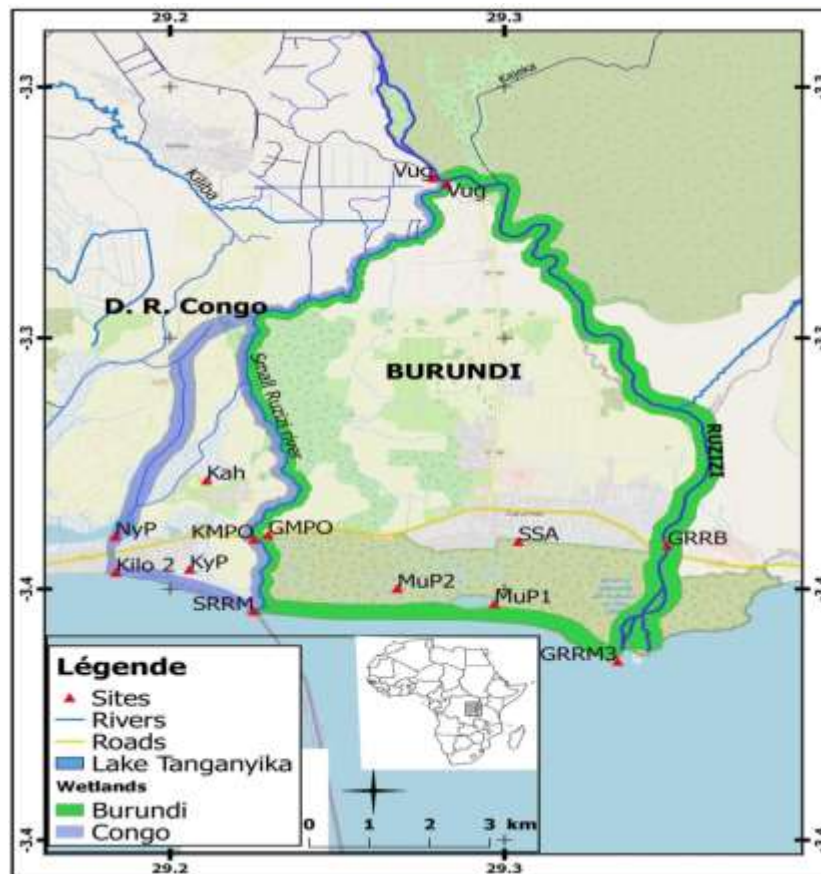


Figure 1 The Ruzizi Delta in DRC and in Burundi

Legend: Sites in DRC: **Vug**, Vugizo Site; **Kah**, Kahorohoro flood village site; **NyP**, Nyangara pond site; **KMPO**, Kavimvira Migration Post Office; **Kilo 2**, Kilomoni 2 fishing beach site; **KyP**, Kyamvubu Pond site; **SRRM**, Small Ruzizi River Mouth site. Sites in Burundi: **Vug**, Vugizo site; **SSA**, Steppe and Shrub Area; **GRRB**, Great Rusizi River Bridge; **GMPO**, Gatumba Migration Post Office; **Mup1**, Mukartutsi Pond 1; **Mup 2**, Mukartsi Pond 2; **GRRM**, Great Rusizi River Mouth site. Source: **Our fieldwork of 2019-2021.**

and what other national legislation and international obligations need to be considered (ICCN, UNESCO, CPM, UNDP, GEF, & WCS, 2008).

Setting national targets looks as well at how has traditional knowledge been integrated and reflected in the implementation of the Convention (CBD, 2013); What mechanisms are in place to promote this convention (ICCN, 2012); How effective have they been (CBD, 2013); How could their effectiveness be improved (GEF, 2020b); Has a national focal point and related provisions been appointed (CBD, 2013); Has a national action plan to protect, preserve and promote the knowledge, innovations and practices of indigenous and local communities and encourage sustainable use of biodiversity been developed (GEF, 2020b); Do community action plans exist (CBD, 2013). Setting national targets should be full and effective participation of indigenous and local communities, with regards to the integration of their knowledge in the implementation of the conservation convention.

Aichi Biodiversity Target 18 considers how will the convention implementation effectiveness be enhanced (CBD, 2013); How action plans for the protection, preservation and promotion of indigenous and local community knowledge, innovations and practices are being developed (ICCN, 2012); If systems in place are granting prior informed consent from indigenous and local communities regarding their knowledge, innovations and practices (CBD, 2013); If measures in place at the national level recognise the rights to customary sustainable use of biodiversity (ICCN, UNESCO, CPM, UNDP, GEF, & WCS, 2008); If the stakeholders may be affected by efforts to respect traditional knowledge and integrate it into the implementation of the conservation convention (IUCN, 2010); If they can be involved and their needs addressed (FAO, 2016);

If there are trade-offs to consider and how stakeholders are informed of their rights and obligations related to such knowledge (GEF, 2020b); If there are processes in place at local and/or national level for prior informed

consent or for the development and adoption of mutually agreed terms (CBD, 2013). Future research will deal with following indicators for sustainable biodiversity conservation in the Ruzizi Congolese Delta: (1) Trends in degree to which traditional knowledge and practices are respected through full integration, participation and safeguards in national implementation of the Strategic Plan; (2) Trends of linguistic diversity and numbers of speakers of indigenous languages, like Kiswahili, Kifuliru, Kivira, Kibembe, Kishi, Kihavu, Kirundi, Kinyarwanda, Kirega, etc.; (3) Trends in land-use change and land tenure in the traditional territories of indigenous and local communities; (4) Trends in the practice of traditional occupations.

Constraints of the study

Constraints to the management of birds in the Ruzizi Congolese Delta are mainly due to the poor land distribution policy and non-compliance with laws on wetlands and biodiversity. These are given from the following extract of law no 011/2002 (Kabila, 2003).

CONCLUSION

The paper presents bird management in the Ruzizi Delta in Burundi and the DR of Congo: Ecosystems, ecological habitats coordinates and the main action plans to conduct for wise bird and biodiversity conservation and management.

The Rusizi Burundian Delta

The Rusizi Delta in Burundi is for the most part a protected area (Figure 1). Its problem is compliance with the texts relating to protection because several times during our doctoral research, we have repeatedly surprised reed cutters in the protected area on the lakeshore area. Also the vegetation along the two Mukartutsi ponds 1 and 2, hardly grows any more as it was the case twenty years ago. The boundaries of the park with the rapidly urbanizing environments of Gatumba are also not remarkable.

The Rusizi National Park currently occupies an area of 10 673 ha according to Decree No. 100/282 of November 14, 2011 amending certain provisions of Decree No. 100/007 of January 25, 2000 on the delimitation of national parks and nature reserves (MEEATU, Convention, & WWF, 2014).

It includes two sectors: the "Delta" sector around the mouth of the Rusizi River, 1 363 ha (17%) in the south and the "Palmeraie" sector, 6 647 ha (83%) in the north (MEEATU, Convention, & WWF, 2014). An estimated area of 2 663 ha between the two sectors and belonging for the most part to the Rusizi Delta, seems to have lost its

protected area status (MEEATU, Convention, & WWF, 2014).

However, if well managed, the Rusizi Delta is a rare wetland in the biogeographic zone of Lake Tanganyika, the Ruzizi plain, and the Ruzizi river itself which plays a connecting role between lakes Tanganyika and Kivu and which forms a border between Burundi, the Democratic Republic of Congo and Rwanda. The Ruzizi Delta constitutes a set of rare and extremely useful wetlands for the conservation of biological diversity in Central Africa (MEEATU, Convention, & WWF, 2014).

The Ruzizi Congolese Delta disposable space

The Ruzizi Congolese Delta occupies the space of a hexagon. It stretches from the Small Ruzizi River Mouth to Kilomoni 2 at about 3 km in western direction, then northward to the eastern part of the Nyangara pond including the area where the Small Ruzizi River flows into the Nyangara pond at about 3km, then towards the Sector 7 of the Kiliba Sugar Factory at about 3km, then in eastern direction 7km to the Kiliba Sugar Factory Headquarters, then beyond 4 km eastbound on the road to the Vugizo border post, and finally downstream the small Ruzizi River straight to its mouth on Lake Tanganyika at 17 km, making about 34 km in contour (Figure 1).

The plan of its management for a sustainable conservation of birds and biodiversity consists of the protection of wetlands downstream along the small Ruzizi River to Kahorohoro village, then the wetlands around Kahorohoro village including the Nyangara eastern wetlands, crossing the road to the Kyamvubu wetlands including Kyamvubu Pond, and finally the lakeshore areas and underwater of Lake Tanganyika between Kilomoni 2 and the Small Ruzizi River Mouth.

This delimitation excludes the dry areas of the Kiliba Sugar Factory in which the birds and biodiversity are not threatened due to sugar cane cultivation favorable for bird and wild life including wild animals.

RECOMMENDATIONS

For both the Republic of Burundi and the DRC

The donors for biodiversity conservation are sometimes the same for Burundi and for the Democratic Republic of Congo (DR of Congo). We can consider ALT (Lake Tanganyika Authority), LTMC (Lake Tanganyika Management Committee), IUCN (International Union for Conservation of Nature), WWF (World Wildlife Fund), GEF (Global Environmental Facilities), WCPA (World Commission on Protected Areas), BirdLife International, Ramsar Secretariat, CITES (Convention on International Trade in Species), AEWA (Agreement on the Conservation of African-Eurasian Migratory Waterbirds),

CBD (Convention on Biological Diversity), UNEP (United Nations Environment Program), WCMC (World Conservation Monitoring Centre) (GEF, 2020b).

The UNEP-WCMC is the specialist biodiversity assessment centre of the United Nations Environment Programme, the world's foremost intergovernmental environmental organization. The Centre has been in operation for over 30 years (UNEP, WCMC, & IUCN, 2016), combining scientific research with practical policy advice. UNOPS (United Nations Project Services Office), ILTMB (Interim Lake Tanganyika Management Body), ILTMS (Interim Lake Tanganyika Management Secretariat), FAO (Food and Agriculture Organization of the United Nations), EEMA (Environment and Energy Management Agency), EPA (Environmental Protection Agency / USA), UNDP (United Nations Program for development) and finally RECORD (Cooperative Network on Waste and the Environment). It is the result of a triple cooperation between industrialists, public authorities and researchers. Its main objective is to finance and carry out studies and research in the field of industrial waste and pollution (RECORD, 2003).

A common development plan taking into account the particularities of each country should concern the Ruzizi Delta, given its role in the accommodation of the 19 species of mammals (*Hippopotamus amphibius*, *Tragelaphus scriptus*, *Tragelaphus spekei* etc...); 90 species of fish, two species of crocodiles (*Crocodylus niloticus* & *Mecistops cataphractus*); 220 species of birds including 130 resident and 90 migratory species; terrestrial, aquatic and benthic macroinvertebrates, evaluated at 15 families: Atyidae, Hydrophilidae, Naucoridae, Mesovelidae, Aeschnidae, Cordulegasteridae, Gomphidae, Capnidae, Potamoniidae, Hydrobiidae, Lymnaeidae, Planorbidae, Physidae, Viviparidae and Unionidae (Beni & Pascal, 2012), microinvertebrates (zooplankton) evaluated in three groups including Copepods (*Cyclopoids*, *Calanoids*), Cladocera (*Diaphanosoma*) and Jellyfish (*Limnognathia tanganyicae*) (Beni & Pascal, 2012); 190 species of plants necessary for survival, reproduction, food and as places for sheltering, recreation and weaning of animals (MEEATU, Convention, & WWF, 2014) and (Luthra et al, 2017).

In the delta, trees and other plants should grow freely without being cut for an indefinite period allowing them to reach the maximum height of over 15-30m, with the most advanced possible age beyond 40 years, which actually is no longer the case. The Ruzizi Delta like Lake Tanganyika faces a variety of threats, the most important of which are pollution, sedimentation, overfishing, and destruction of sensitive habitats (UNDP, GEF, & UNOPS, 2002). This doctoral thesis provides the information necessary to fight against the threats of microinvertebrates, macroinvertebrates, fauna and flora of the Ruzizi Congolese Delta, the protection of its

ecosystems and its sensitive habitats as a community reserve and potential Ramsar site.

The peculiarities of the DR Congo would be the absence of a contiguous protected area with the Burundian Rusizi National Park and Rusizi Ramsar Site, the insufficiency of more sustained inventory studies for flora, birds, macroinvertebrates and microorganisms. These, although invisible to the naked eye, are necessary for the recycling of organic and inorganic materials and for the re-circulation of organic and inorganic chemical elements immobilized in living beings (RECORD, 2003).

The particularities of the Republic of Burundi would be the reforestation of a buffer zone of demarcation of protected areas with the rapidly urbanizing environments of Gatumba and Cibitoke along the Rusizi River to the north and north-west of the Great Rusizi River Bridge (Pont de l'Unité) as well as respect for the protection texts of the Rusizi National Park in the Delta Sector, particularly on the Lake Tanganyika Shore areas between the Great Rusizi River Mouth and the Eastern bank of the Small Ruzizi River Mouth.

The Republic of Burundi

For a sustainable conservation of the birds and biodiversity of the Rusizi Delta, the results of our doctoral research recommend compliance with the texts relating to the protection of the Rusizi National Park and Ramsar Site as well as the reforestation of a buffer zone of demarcation of the boundaries of the protected areas of the Rusizi Delta Sector from the rapidly urbanizing areas of Gatumba. This reforestation of the buffer zone can provide the trees with firewood, wood for construction, trees for shade, erosion control and windbreaks, and fruit trees or fruit plants.

Fort the Democratic Republic of Congo

Our doctoral research recommends capitalizing on its results and previous studies to initiate the process of creating a Community Reserve in the Ruzizi Congolese Delta. This will include the west bank of the Small Ruzizi River, the Kyamvubu and Nyangara ponds, the lake shore areas from the Small Ruzizi River Mouth to Kilomoni 2 and the adjacent aquatic part, the Kyamvubu and Nyangara ponds and their respectively adjacent marshes, the marshes of the Small Ruzizi River from Kahorohoro to the Sector 7 and alongside the Small Ruzizi River up to Vugizo.

Then, people in charge of the Ruzizi Congolese Delta Community Reserve will draw up a development plan on the basis of these scientific results comprising:

- User signatures on the extent and type of management of the area to be protected;
- The visa of the Uvira Mayor on the project to create the Community Reserve in the Ruzizi Congolese Delta;

- The visa of the Administrator of the Uvira Territory on the project to create a Community Reserve in the Ruzizi Congolese Delta for the outside area from the Uvira City;
- The support of international organizations having the environment and the conservation of birds and biodiversity in their attributions;
- The decree of the Governor of the South Kivu Province setting the limits and sealing the management mode of the Community Reserve with operating budget support to strengthen local initiatives;
- The development of a project to be submitted to the ICCN (Congolese Institute for the Conservation of Nature) for the creation of a Community Reserve in the Ruzizi Congolese Delta;
- The request for recognition of the Ruzizi Congolese Delta Community Reserve will be sent to ICCN which will submit it to the Ramsar Secretariat for the Ruzizi Congolese Delta Ramsar Site designation.

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Conflicts of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper.

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