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Rweru-Bugesera Transboundary Wetlands Complex (Rwanda-Burundi)

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Document Sheet

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List of abbreviations

ARCOS	Albertine Rift Conservation Society
AU	African Union
BAU	Business As Usual
CBD	Convention of Biological Diversity
CoEB	Centre of Excellence for Biodiversity
COVID 19	Novel Corona Virus Pandemic of 2019
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GoB	Government of Burundi
GoR	Government of Rwanda
ha	hectare
IGEBU	Institute of Geography Burundi
INDC	Intended Determined Conditions
ISABU	Institute of Statistics of Burundi

INEAC	Institute of Environment Burundi
IRR	Internal Rate of Return
LVB	Lake Victoria Basin
NAPA	National Plan for Adaptation
NAIP	National Agricultural Investment Plan
NBI	Nile Basin Initiative
NGOs	Non Governmental Organization
NELSAP	Nile Equatorial Lakes Subsidiary Programme
NPV	Net Present Value
NST 1	National Strategy for Transformation 1 Rwanda
OBPE	Office of Burundi for Protection of Environment
PEER	Public Expenditure on Environment Review
TEEB	The Economics of Ecosystems and Biodiversity
RBWC	Rweru Bugesera Wetlands Complex
RDB	Rwanda Development Board
REMA	Rwanda Environmental Authority
TEV	Total Economic Value
US	\$ United States Dollar
WB	World Bank
WRI	World Resource Institute

Executive Summary

The Rweru Bugesera Wetlands Complex is a chain of lakes, marshlands and a river, and their basins, at the headwaters of the Nile River straddling Burundi and Rwanda. It consists of three small sub basins; Rweru - Mugesera, Cyohoha South and North and Akanyaru wetlands; all transboundary ecosystems of the Nile Basin. It's among the relatively smaller wetlands in the Nile Basin, covering about 3,889 square kilometers including the watersheds of the sub basins. It can be regarded as the southernmost reservoirs and watersheds of the Nile River. The assessment starts with a review of concepts and their applications to the study. In the section there is a review of the concepts of ecosystem, ecosystem services, biodiversity, wetlands and TEEB or the economics of ecosystems and biodiversity. There is also a short account of how the site is historically important to the Nile River.

The methodology has made use of secondary data and elite interviews by telephone or Skype to key informants. The latter method was opted instead of extensive field trips and physical meetings because this particular study was undertaken when the COVID 19 was still an active pandemic in the region. It also made use of GIS analysis. Moreover other methods in particular, market prices, travel cost, contingent valuations and benefit transfer were used in different parts of the study to establish the Total Economic Value of the wetlands. In all cases where used figures were old an adjustment to bring them to current valuation was carried out. The first set of findings is in section 3. From documentary review the study identifies the legal, policy and strategy landscape related to wetlands in Burundi and Rwanda. The main finding is that there are many regulatory instruments, which are robust to most sectors that have influence on the management and development of Rweru Bugesera Wetlands Complex – the case study. It is clear however that there is a gap, which is reflected by the fact that action of implementing these policies and strategies is not on average more than 35 per cent. The issue then is what is missing. It is some regulation at lower community levels and most obviously lack of enforceability of the laws and implementation of the policies and strategies. It is also most likely the net result of interests and influences of multiple stakeholders, which is considered in section 4. Following this finding the issue is taken among others as a theme in development options in the final section.

A second finding quite expected is that stakeholders and people with interest in and influence over the wetlands are multiple. A list of stakeholders with relative disposition to the wetlands reached 25 categories. The list includes primary and secondary stakeholders, local, national, regional, international and global. It includes stakeholders whose expectations and preferences are long term as well as state and non-state stakeholders. But there are also groups that have interests and influences, which are not uniform and do conflict. The latter statement explains why a study in the development of the wetlands is a study about tradeoffs to be made. A prospect of agricultural intensification in the wetlands using irrigation is pitted against the need to have adequate water for producing hydroelectric power. It is recommended that meaningful development options need to be informed by deeper analysis of tradeoffs and what action would need to be taken in the medium and long term. The aim of the analysis needs to be a search for a win- win situation in a frame of sustainable development of the wetlands for benefit sharing in the riparian countries involved.

The assessment has also carried out the identification of the ecosystem services using the Millennium Ecosystems Assessment as a guide and their subsequent valuation in the site. The actual components are collated from existing studies on the area. These are standard provisioning, regulation, cultural services and supporting services. A major finding is that provisioning services including aquatic resources had the highest value with an estimated economic value of USD 92,396,860. Others include regulation services USD 25,488,048; cultural services USD 1,862,040 and supporting services 4,352,200. Thus the Total Economic Value is thus estimated at USD **124,098,826**. Despite the evidence of valuable ecosystem services, that planning and decision-making can use there is also substantial degradation of natural resources related to the wetlands. The degradation is resulting from both human action and effects of climate change. The study finds cost of degradation in the area being high estimated at about USD 27,600,000 or at least 1.6 per cent of GDP of the two countries of Burundi and Rwanda.

The Development Scenarios considered are three fold. The first called Linear Development is in fact Business As Usual. It assumes there are efforts though not fully exerted with respect to sustainability principles economically, socially and environmentally. The second is the Best Case Scenario involving the sustainability principles and application of technology in a transboundary perspective. The Worst Case Scenario is where development is based on narrow economic objectives taken from localized and national contexts. The study identifies five pillars for 26 development themes as making a case for wise use of the wetlands complex. The conclusion synthesizes the findings and summarizes recommendations that are derived from the findings.

1.INTRODUCTION

Assessment of the Rweru Bugesera Wetlands complex is part of case studies commissioned by the Nile Basin Initiative in a broader Wetlands Management Strategy of the regional body. As expressed in the Terms of Reference for the case study, the purpose is to bring the multiple economic values related to ecosystems into the wetland management process. But it certainly serves several other purposes. The first is identification of the different ecosystem services of the underrated values of wetlands. They are not only the ‘supermarkets of the wilds’ but also the ‘kidneys of the landscape’ when regulation services are considered. Valuations also serve to show how investments in conservation or wise use – wetlands management are worth it.

Meanwhile the general objective of the study is to conduct economic valuation of biodiversity and ecosystem services of the Rweru Bugesera Wetland Complex. The latter valuation of the wetlands complex is important in light of possible on-site (in-situ) and offsite (ex-situ) development interventions.

Specific objectives include:

1. To investigate beneficiaries of case study wetland generated economic benefits

2. To determine the current value of case study wetland biodiversity and ecosystem services
3. To determine the economic impact of case study wetland degradation and loss
4. To determine the value added or costs of investing in case study conservation and wise use

The motivation of the case study is to bring economic value of wetlands and water related ecosystem services into the integrated wetland management and overall river planning and development decision-making. Additionally it will contribute to the Nile Basin TEEB study.

A second section of the assessment is a review of concepts and how they have been used in practice. The third outlines the methodology. The fourth section is solely on the institutional environment. Particularly it is an inventory of the policies, strategies and laws that govern the wetlands in the respective riparian countries of Burundi and Rwanda. The section includes also institutions related to wetlands management in Burundi and Rwanda. A fifth section analyses the types of stakeholders as people with interest, beneficiaries or have influence on Rweru Bugesera Wetlands. Section 6 is exclusively on identification and valuation of the ecosystem services. Section 7 assesses using available data and GIS the extent and cost of degradation. Section 8 describes three different development scenarios built to shed light on development options. These are Business As usual, Best Case Scenario and Worst Case scenario. Section 9 concludes the study with a synthesis and recommendations.

2. REVIEW OF CONCEPTS AND THEIR APPLICATIONS

2.1. Introduction

This section reviews concepts that are relevant to the study and provide background to the assessment undertaken and to some extent positions it in the

current research and project interventions in the Nile Basin. These concepts are the Ecosystem services, biodiversity and wetlands at general level. In relation to their applications is the emergence of the evaluation of ecosystems and biodiversity and how it has been taken in the Nile Basin Initiative. In relation to the concepts another facet of the application is the concern of degradation in the ecosystem services discourse and the role of stakeholders as a background to the benefits of the wetlands complex to the communities in and around the site as well as the economies of Burundi and Rwanda. A final conceptual review is that of development options and the wise use concept as a basis of the analysis in the assessment of scenarios and recommendation for actions and possible interventions on the site informed by TEEB in the Nile Basin Initiative.

2.2. Ecosystem services, biodiversity and wetlands

Ecosystems services

According to Millennium Ecosystems Assessment (2005) an ecosystem is a dynamic complex of plant animal and microorganism communities and the non-living environment interacting as a functional unit. Humans are part of the ecosystem.

Ecosystems are many and varied benefits to humans by natural environment from a healthy ecosystems such as agro ecosystems, forest ecosystems, grassland ecosystems and aquatic ecosystems (Wikipedia 2020).

Ecosystem services are the benefits provided to humans through the transformation of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services such as clean air, water and food (Costanza et al 1997). Ecosystem services are the benefits that people obtain from ecosystems (MA 2005).

The importance of nature to human well-being has been common knowledge from time immemorial. The emergence of ecosystem services as areas of

research can be traced to the 1970s when environmental economics started becoming an important element of development economics and sustainability discourse. An important study in this regard is the Critical Environment Problems (SCEP) that came up for the first time with the concept of environmental services (<https://css.au.dk/en/projects/shaping-cultures-of-prediction/playground-webexhibit/disciplinary-topics/climate-modelling/scep/>).

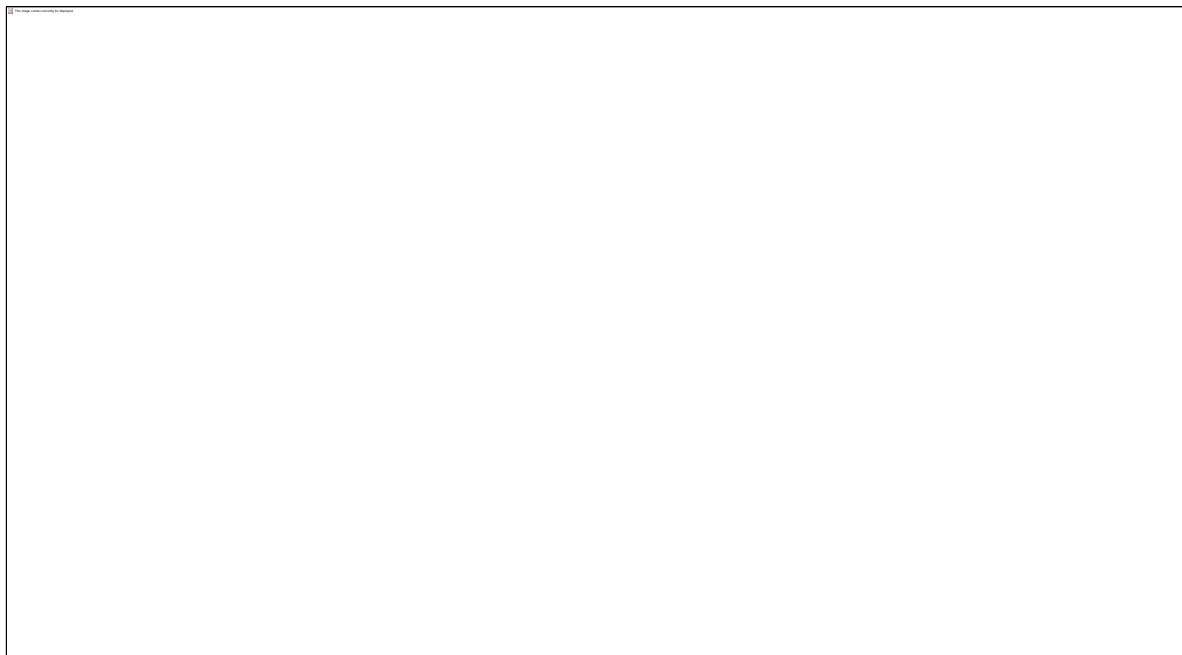
In the 1990s the ecosystem concept appeared as a research agenda that linked nature and human livelihoods (Van de Groot 1992, Costanza et al 1997 and Daily 1997).

At the beginning of the 21st century the ecosystem services approach became popular to policy makers mainly through the publication by the UN of the Millennium Ecosystems Assessment (MEA) in 2005. It is said the work that resulted into the Millennium Ecosystems Services Assessment started in 2001 and was later published in 2005 after involving over 1300 international experts from different disciplines (<https://vivagrass.eu/lessons/ecosystem-service-concept-and-classification-system>).

The MEA assessed the global human impact on ecosystems and their services, conditions and trends possible solutions for restoration, maintenance and sustainable use. The MEA found that 60.5% of all services evaluated were being degraded or used unsustainably.

The MEA is important in the production of a classification of ecosystem services that are being used in this study and TEEB. Ecosystem services include provisioning services, regulation, cultural and support services (Figure 1).

Figure 1: Ecosystem services



Source: MEA 2005

The classification above is that given by the Millennium Ecosystems Assessment. It has in a number of cases been used along with other related concepts or equivalents in the Ecosystems discourse. These are given in Table 1

Table 1. The Ecosystems related concepts

MEA	Equivalents
1. Ecosystem components	Components, features, attributes, properties
1. Physical, biological, (habitats,	chemical, species,

genes)

2. Ecological processes Processes, interactions, properties, functions
3. Within and between ecosystems
4. Ecosystem services Services, beneficiaries, values, functions, goods, product
5. Provisioning, regulation, cultural, supporting

Thus the services are also in terms of functions. Functions are what the wetlands will do and therefore more functional in showing the importance of the ecosystem services and do include both provisioning and non-provisioning services.

They are listed as follows;

i. Regulation functions

1. Storage and recycling nutrients
2. Ground water recharge
3. Ground water discharge
4. Erosion control
5. Water treatment
6. Maintenance of migration and nursery habitats
7. Maintenance of biological and genetic diversity
8. Storage and recycling of human waste
9. Storage and recycling of organic waste

10. Natural flood control and flow regulation
11. Salinity control
12. Climate stabilization
13. Carbon sequestration
14. Maintenance of ecosystem stability
15. Maintenance of stability of other ecosystems

ii. Carrier function

1. Agriculture, irrigation
2. Stock farming, grazing
3. Wild life cropping resources
4. Transport
5. Energy
6. Tourism and recreation
7. Human habitat and settlements
8. Habitat for nursing plant and animal species

iii. Production

1. Water
2. Food
3. Fuel wood
4. Medicinal and genetic resources
5. Raw materials for building

iv. Information

1. Research and education

2. Uniqueness and national awareness
3. Cultural heritage

The use of functions also arrays the fears of some that using the concept cultural services is good for classification but the most important thing is to identify the non material ecosystem services that have to be valued and preferably differentiate between services to individuals and to the community (Small et al 2017). Another advice taken in this report is considering ecosystem services change whenever possible than insisting to get and value the service delivery.

The importance of using the ecosystem approach is to ensure the study covers values beyond goods and services only. Thus as defined by the Millennium Ecosystem Assessment the aim is to ensure valuation and elaboration of development options include all services in the ecosystem and not those that are direct and have a market price only.

After the Millennium Ecosystem Assessment in 2005 emerged the TEEB initiative from 2007 to 2010 elaborated further below. It was an initiative started by the European Commission and the German Federal Ministry for Environment Nature Conservation, Building and Nuclear Safety after meeting of the G8+5 at Potsdam in Germany in 2007.

Biodiversity

Biodiversity is biological diversity. It is variability among living organisms from all sources including inter alia terrestrial, marine other aquatic ecosystems and the ecology complexities of which they are part. Therefore they include diversity within species and between species and ecosystems (Mburu 2007). Biodiversity includes genetic diversity, species diversity and ecosystem diversity (Swingland,

F 2000). One source has called 'Biodiversity the engine room of ecosystem services' (Australian government 2009).

Biodiversity is the B in TEEB (–the economics of ecosystems and biodiversity). After the TEEB initiative another important milestone has been the Mapping and Assessment of the Ecosystem Services by the European Commission. This produced the Economic Biodiversity Strategy to 2020. It aimed at halting loss of biodiversity and degradation of ecosystems and their services. It has the so-called Action 5 to improve Knowledge of the Ecosystems and their services in the EU. It had as a goal mapping and assessing ecosystem services by 2014 and economic values by 2020.

Biodiversity is facing threats and challenges. These include habitat alteration; overharvesting and climate change phenomena, which will be demonstrated to be present in the Rweru Bugesera Wetlands Complex.

The challenges are relevant to the study on Rweru Bugesera with regard to biodiversity (Mburu 2007) in the following ways;

1. More people earn greatest immediate benefits from exploiting biological resources than they do from conserving them
2. Areas with greatest levels of biodiversity are often those with fewest economic means to implement conservation
3. Overharvesting and depletion are consciously done without any efficient management of the exploitation
4. There is dearth of data on the economic significance of biodiversity

Thus, studies that involve the value of biodiversity in the realm of economics should as this one, serve a number of purposes;

1. Demonstration of value of biodiversity for awareness

2. Assist land use decisions basing on development options and scenarios
3. Setting of priorities for biodiversity under resource constraints
4. Determining damages for loss of diversity
5. Limiting or banning of trade in endangered species
6. Revising national economic accounts
7. Choosing economic instruments for saving biodiversity
8. Gathering evidence for challenges of biodiversity in transboundary context

Wetlands

Wetlands are the focus of this assessment. But in relation to the concepts defined above wetlands have the widest variety of ecosystem services and biodiversity. Wetlands though covering a relatively small part of land surface do occupy an important position in the relationship between humans and nature and their absence would affect people, birds and water. Wetlands are of interest to many international and national organizations (Wetland Initiative, Wetlands International, World Wildlife Fund, and International Union for Conservation, United Nations, the Nile Basin Initiative and quite significantly the RAMSAR).

RAMSAR Convention established in 1971 named after the meeting on wetlands held in Iran, defines wetlands as 'areas of marsh fen peat land or water whether natural or artificial or temporary with water that is static or flowing fresh or brackish or salt including areas of marine and water depths of which at low tides does not exceed 6 meters'. RAMSAR has grouped wetlands into 5 categories. Wetlands are marine (associated with seas) estuarine (associated with river mouths and deltas), lacustrine (associated with lakes) riverine (associated with rivers) and palustrine (non tidal forests and shrubs flooded with water). Wetlands include mangroves, peat lands, marshes, rivers, lakes, deltas, flood

plains, flooded forests, rice fields and coral reefs. They exist in every country and in every climate zone.

Wetlands were for long regarded as 'waste land' that could be reclaimed for agriculture or other uses. Today they are known to be very valuable to humans and nature. In relation to the ecosystems services they have been called 'kidneys of the landscape' and 'supermarkets of the wild'. Wetlands international notes that wetlands are important to people and the planet and points out that 64 per cent of wetlands have been lost since 1900. Africa's wetlands are most degraded. Out of 131 million ha in Africa 18.3 million are in the Nile basin occupying about 5 per cent of the land area (Wetland International Report 2018).

The assessment focusing on a Wetlands complex in the Nile Basin and particularly Rwanda and Burundi seeks to establish after identification and valuation what can be done in perspective to promote their wise use.

2.3. TEEB and the Nile Basin Initiative

TEEB

The TEEB initiative mentioned earlier involved studies that brought economic perspectives of ecosystem services in policy debate around 2007. It has involved highlighting economic value of biodiversity costs arising from biodiversity loss and ecosystem degradation.

With experts from different fields it has produced different guidelines (www.teebweb.org) as follows;

1. TEEB Ecosystem and Economic Foundations
2. TEEB Ecosystem in national and international policy making
3. TEEB in local and Regional Policy
4. TEEB in Business and Enterprise

5. TEEB Synthesis Report

These were followed by TEEB national studies.

So far the TEEB studies have revealed the following conclusions that inform this assessment

1. Ecosystems structure along with regulating and habitat production function produce ecosystem goods and services that are valued by humans
2. Many people value the existence of aquatic and marshland resources for their own sake or for the role they play in ensuring the preservation of plant and animal species whose existence is important
3. Total economic valuation of ecosystem services is the sum total of use values derived directly from use of the ecosystem and non use value derived from its existence
4. Human action affect the structures, functions and goods and services of ecosystem services
5. Understanding the links between human systems and ecosystems require the integration of economics and ecology
6. Nearly all policy and management decisions change relative to some baseline and most changes imply a trade off
7. Information about these trade offs can lead to better decisions about ecosystem protection
8. Aquatic ecosystems and wetlands are complex, dynamic, variable, interconnected and often non-linear and our understanding of the services they provide as well as how they are affected by human actions is imperfect and linkages difficult to quantify. The current estimates are subject to further mapping and in depth study as one area including sites both in Burundi and Rwanda.

9. Current state of ecology and environment and modeling allows for estimations
10. There is much more danger of underestimating the value of ecosystem goods than overestimating the values

On wetlands TEEB clearly defines the position of a case study like this one (Russi et al 2013) as follows;

1. The nexus between water, food and energy is one of the most fundamental relationship and increasing challenges for society. The Rweru Bugesera assessment embodies the trio and others
2. Water security is major and increasing concern in many parts of the world including the availability and quality. Both are true for the Nile Basin and for the transboundary wetland areas if water is contested as it is in the Rweru Bugesera Wetlands
3. Global and local water cycles are strongly dependent on wetlands. The Rweru Bugesera wetlands are connected to the entire Nile Basin water system and ex situ - the watersheds
4. Without wetlands the water cycle, carbon cycle and nutrients cycle would be significantly altered almost detrimentally. Yet policies and decisions do not sufficiently take into account these interconnections and interdependencies. The observation is relevant to laws, policies strategies and institutions related to wetlands in Burundi and Rwanda
5. Wetlands are solutions to water security. They provide multiple ecosystems services supporting water security as well as offering many other benefits and values to society and the economy. The argument in this assessment is also to look at future options of developing the wetlands in the context of the countries and the region.
6. Values of both coastal and inland ecosystem services are typically higher than for other ecosystem types. Rweru Bugesera Wetlands complex

estimates (even if estimates only) are substantial to both Rwanda and Burundi. Indeed our estimates of ecosystem services in this study are relatively higher than other estimated in the countries using Total Economic Valuation such as for forests

7. Wetlands provide natural infrastructure that can help meet a range of policy objectives beyond water availability and quality. They are invaluable in supporting climate change mitigation and adaptation, support health as well as livelihoods, local development and poverty reduction
8. Maintaining and restoring wetlands in many cases also lead to cost savings when compared to manmade infrastructural development
9. Despite their values and despite the potential policy synergies wetlands have been and continue to be lost or degraded. This leads to biodiversity loss, as wetlands are some of the most bio diverse areas in the world providing essential habitats for many species and loss of ecosystem services. This is generally found to be true as will be demonstrated for the case of Rweru Bugesera Wetlands
10. Wetlands loss can lead to significant loss of human wellbeing and have negative economic impacts on communities and countries e.g through exacerbating water security problem
11. Wetlands are water related ecosystem services and need to become an integral part of water management in order to transition to resource efficient sustainable economy at all levels and by all stakeholders is needed
12. Action at all levels and by all stakeholders' recognition of benefits and losses is important. Recurrently key respondents indicated awareness and education as important solutions to the Rweru Bugesera wetlands

Economic valuation of wetlands ecosystem services enhances informed public decision making concerns with regard to sustainable utilization of the ecosystem. The valuation in particular is crucial where the economic value of wetlands need to be compared directly against the monetary value of

alternative public investment (Nile Eco-VWU) <https://www.nile-eco-vwu.net/project-overview>)

At a general level, despite the multiple findings by TEEB elsewhere, the Nile Basin still has the challenge of completing the task of identifying and valuing of wetlands in its basin and mainstreaming the findings into planning decision making at river level. Moreover findings and values of the wetlands should help change the attitude of planners and stakeholders have had towards the ecosystems and biodiversity. Another importance of the assessments is identification of the tradeoffs and how they can be handled in development interventions that aim at wise use of the wetlands and natural resources around them. Assessments of degradation of ecosystems and biodiversity and its effects has been useful in showing how valuable ecosystems are by looking at how economic life becomes when they are no longer there after being depleted. Finally estimates, scenario building and possible interventions are important in decisions for wise use not only for national and regional levels but also for sites such as the case study area of Rweru Bugesera Wetlands Complex.

TEEB in the Nile Basin Initiative

The concepts of ecosystem services, biodiversity, wetlands enjoined in TEEB (the economics of ecosystems and biodiversity) have been applied in practice in Europe, US, several countries and currently the Nile Basin Initiative. TEEB supported by German Development Agency GIZ for the German Federal Ministry of Environment, Nature Conservation and Nuclear Safety is a clear 'motor' of the major Nile Basin Transboundary Strategies and more particularly the Wetlands Management Strategy of 2013. The strategy does among other functions the following:

1. Provide operational definition
2. Describe Nile Basin wetlands functions

3. Values and justify the applicability of the worldwide accepted principles (wetlands ecotones, wise use and equitable wetland resources use) within the Nile

The related Nile Basin Transboundary Wetlands project start off by indicating the roles of the wetlands and why they are of concern now. It states that some of the Nile Basin wetlands are designated as protected areas, Migratory Birds Flyway, Important Birds Areas, World Heritage Sites as well as wetlands of international importance under Ramsar Convention;

4. Nile Basin wetlands are undergoing habitat degradation and loss due to reclamation and conversion for agriculture, settlements and urbanization and invasive species
5. Also upstream utility for infrastructure development local community over exploitation and climate change
6. These threaten the intrinsic hydrological and ecological link between the wetlands and River Nile including overall health and life

This is exacerbated by inadequate knowledge and experience for mainstreaming wetland conservation and for making full use of ecosystem services in the planning process.

The Nile Basin Initiative is also concerned with the climate change effects, an issue that also recurs as one of the major concerns that may be addressed by proper management of wetlands. In this instance the role of the Climate Change intervention in the Nile is around;

1. Identification of present gaps and future threats
2. Knowing the inherent weaknesses and vulnerability impacts
3. Analysis of trends and risks
4. Defining requirements and constituents of climate change resilience basin wide

5. Setting out proper strategic objectives and outputs
6. Introducing effective mitigation and adaptation measures
7. Describing appropriate institutional set up

To be specific this assessment is part of the TEEB concept in the Nile Basin Initiative.

The Nile Basin has also, as indicated adopted the TEEB approach in valuing wetlands in the Nile Basin. It is appropriately referred to as 'TEEB inspired study'. The TEEB inspired study is under the Nile Basin Initiative Conservation and Sustainable Utilization of Ecosystem Services of Wetlands of Transboundary Relevance in the Nile basin

In introducing the TEEB panel of experts its aim is stated as 'to make nature's values visible'. The assessments as part of a family of other similar studies and case studies is required by the Nile Basin Initiative to mainstream the value of biodiversity and ecosystem services into decision making at all levels. As noted the valuation helps decision makers to realize the wide range of benefits provided by the wetlands. The importance of TEEB is also in relation to strengthening the view of wetlands as green water investment and promoting investment in them as well as providing evidence for conservation and wise use (www.nilebasin.org).

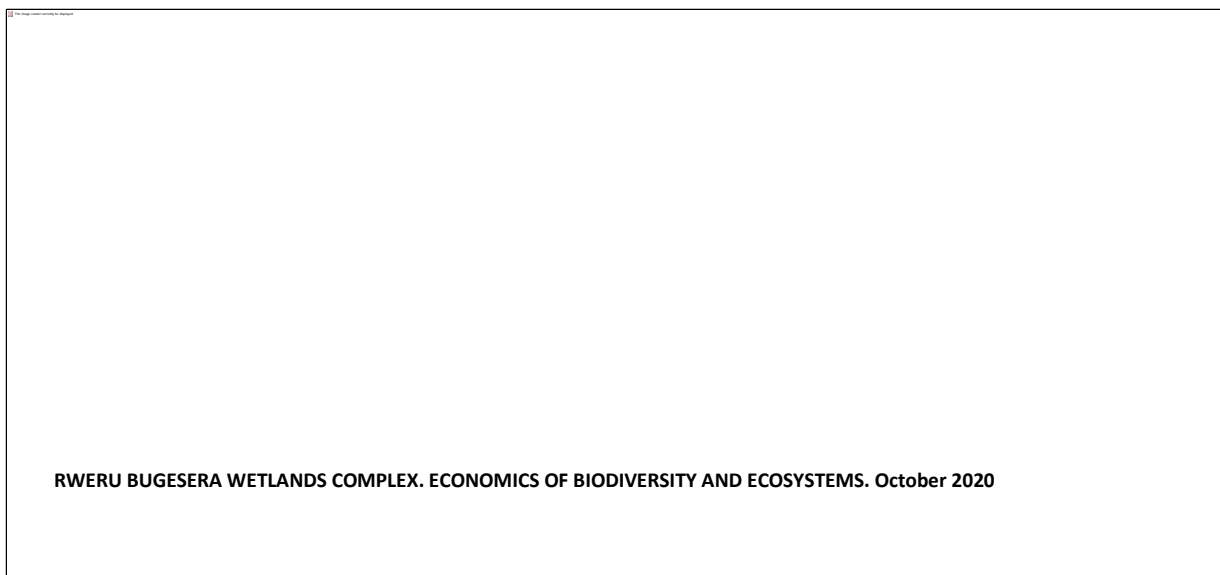
A current inventory points to 209 ecosystem valuations in the Nile basin. Out of these 80 are on freshwater wetlands. While Kenya has about 33.3 % of the studies, Rwanda has a mere 7 % and Burundi 1.7 per cent. Most of these are single country and single ecosystem services. There is still dearth of knowledge and a base for valuation of ecosystem services and biodiversity (Emerton, L 2018).

2.4.The site and the relevance of Burundi and Rwanda in the Nile Basin

The study area should be viewed within the Nile River basin discourse and its history especially in the parts of the basin surrounding Burundi and Rwanda. The position the study area can be linked to the historical importance of the source of the Nile. The Map of Ptolemy in antiquity located the sources of the Nile in the Great Lakes near the 'mountains of the moon'. The stories of explorers in the Great Lakes provide the present link of the site to the Nile River Basin. For the sources can be confirmed to be in the two riparian countries of Burundi and Rwanda (Phillips et al 2006).

In 1856 for the first time the London Geographical society organized the voyages to discover the source of the Nile. In fact John Hanning Speke in 1858 was the first to establish that the source of the Nile was at the mouth of the current White Nile on Lake Victoria. But more travellers and explorers established that other tributaries feed the source upstream. Kandt established (see Picture 1) that the source of the Nile is the Akagera River while Baumann established that the source of the Nile is the Ruvubu in Burundi. The Akagera is in Rwanda fed by the Nyabarongo River. Tributaries whose sources have been traced feed Nyabarongo to Nyungwe Forest in Rwanda. However this, which is most recent, is not as established as the furthest point of the Ruvubu River in Rutovu of Southern Burundi where one of the explorers built a symbolic pyramid to evoke the distant link to Egypt the most downstream and most Nile dependent country in the basin.

Picture 1:Rweru is a historical lake



P

Source: Author's photo of the billboard

In fact Akagera River flows into Lake Rweru. As you visit Lake Rweru on its shores on the Rwanda side at the Nyiragiseke Village an old billboard with the brief narrative meets you.

Note that in some writings they refer to Rweru as 'Rugwero' and Cyohoha as 'Cohoha' (the latter is used on the Burundi side of the wetlands). Kagera in history of explorers, known as **Alexandra**, flows out from Lake Rweru. From the Lake it flows east along Rwanda - Burundi border and Rwanda and Tanzania border to a confluence with Ruvubu River. It then flows along Rwanda Tanzania border over Rusumo Falls. It takes a turn to the East following Tanzania and Uganda border and empties its waters into Lake Victoria in Uganda. The journey to Lake Victoria forms the Kagera Wetlands which are relatively more popular in Lake Victoria Basin but do not apparently include the Rweru Bugesera Wetlands complex.

Rweru is thus the southernmost water reservoir in the Nile River Basin. To the west of Akagera after it ceases to be called Nyabarongo at Kanzenze near Nyamata in Bugesera Rwanda and to the East of Ruvubu in Burundi is a large area that is thus drained by the River Nile. From the Rweru southeastwards is Cyohoha another lake fed by tributaries linked to Akagera. The narrow area between the two lakes and the interlinked Akanyaru wetlands are the physical site of the case study. It can be regarded as the southern most wetland complex in the Nile Basin, which is important as the upstream source of the Nile waters.

The latter observation brings in how the site is important and how it has a place in the list of case studies. Phillips et al. (2006) on Kagera River Basin identifies the importance of upstream, headwater parts of the basin. Important because indeed the complex is part of the Kagera Basin only that in this context it involves Burundi and Rwanda, the only countries straddling the wetlands complex. The Kagera Basin includes also Uganda and Tanzania, which are not part of our transboundary wetlands complex although they are distantly linked in the Nile River context and is anyway part of the NBI NELSAP Subsidiary Action Programme).

Thus the wetlands complex can be a harbinger to number of issues;

1. Institutional development and interstate agreements between Burundi and Rwanda in the Kagera Basin could form part of the future benefit sharing scenarios in the Nile Basin as a whole
2. The area is characterized by use of 'endogenous' water resources on rights, duties and obligations. The case of down stream countries are those of 'exogenous' water resources involving out of basin transfer of water resources which dominate the hydro politics of the Nile Basin
3. Unlike Sudd or Machar, which are in one country - Sudan only the wetlands, complex in this study involves more countries directly Burundi and Rwanda and indirectly as noted (in relation to Kagera Basin) Tanzania and Uganda. It is not transboundary simply because it is in the Nile Basin.

What the latter means is that Rwanda and Burundi waters are produced internally while 77 per cent of water in Sudan and 97 per cent of Egypt come from external sources. But essentially the Sudd and others can be said to be sensitive to upstream rainfall in the equatorial lakes region of Burundi, and Rwanda.

Table 2: Rwanda and Burundi attributes

	Area in sq km	Area in basin	%	Mean rainfall
Burundi	27834	13,260	0.4	1,110
Rwanda	26,338	19,876	0.6	1,105

Source: Philips 2006

The Kagera provides 40% of the surface water flow or about 20,000 million cubic meters. Upstream countries are already important to water quality. With increasing turbidity, signs of eutrophication and water hyacinth the way upstream handle their landscape and wetlands will have effect on water quality upstream (key informant).

It is also important to mention here that issues of water transfers could also arise, according to one respondent, as building a dam on the Rusumo Falls for Rwanda, Burundi and Tanzania could have implications on how much water should continue to flow out of the Lake Rweru and the Akagera. Meanwhile the completion of the Rusumo Falls is thought to be invoking new socio economic relations with people around the area that may need to study water resources uses and tradeoffs that may arise in the long run. The same respondent foresees building of a dam(s) also along the Ruvubu River, which may also lead to a need to look at the net water flows to the Rusumo and Kagera River. In the last section is an analysis on pollution from of water hyacinth but clearly and possibly also in form of chemicals from water flowing from the headwaters of the Nile Basin through the Akagera River. The case study on the wetlands and how they

relate to water quantity and quality in the Nile Basin from upstream countries should be of special interest to the Nile Basin.

3.METHODOLOGY

3.1. Site description

The site consists of; administratively Kirundo Province in Burundi and Bugesera District in Rwanda. The details of the constituent sub basins are given in other sections of the report.

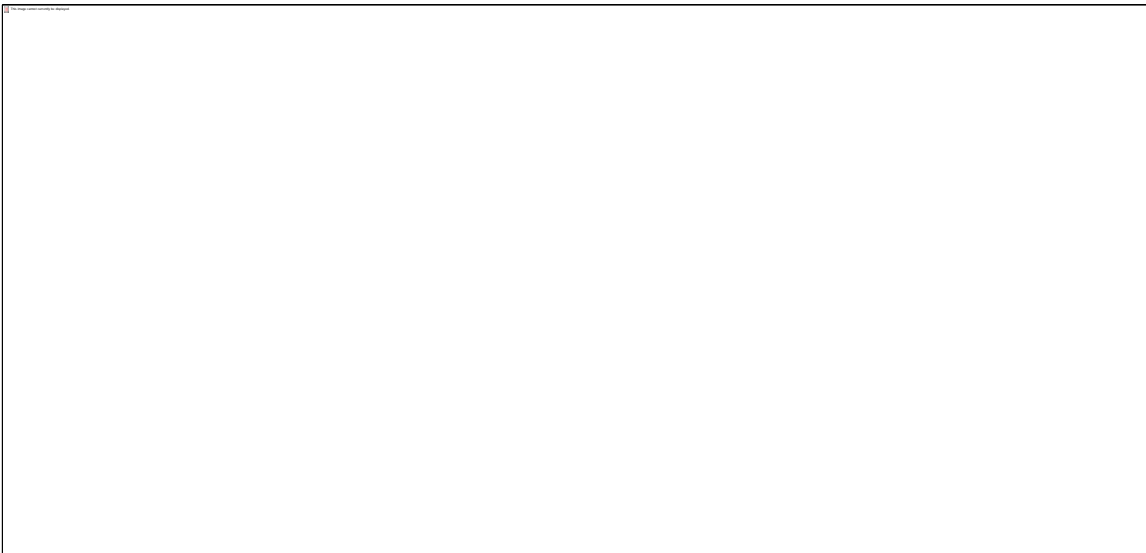
Specifically it is about the wetlands complex in the site area, which literally means the aquatic bodies, rivers and marshland areas that are shared by the two Nile Basin countries. For a comprehensive analysis of in situ and ex situ green water infrastructure the site area includes watersheds and drainage areas of the sub basins.

The Burundi and Rwanda sections of the site share common geophysical and ecological conditions. They share a common name of BUGESERA agro ecological zone. They are regarded as low altitude, depression, better known for long dry seasons of up to 7 months, cycles of drought and food shortages. Being regarded as relatively less fertile for agriculture has meant that wetlands have high value to communities living adjacent to them for food security especially during the dry seasons. And in fact the Burundi side of the site for times before the 1990s was regarded as the food basket of the respective countries. Conflict by 1993 and effects of climate change have made the area now relative poor compared to others.

But Bugesera is also known to have experienced rapid population growth in recent years, which has increased the dependency on wetlands. There is also as a result, competition in the use of common water resources. Both Rweru and Cyohoha lakes lie across the boundaries of Burundi and Rwanda and Akanyaru wetlands are along a corridor that marks also the common boundary of Burundi and Rwanda (Map 1).

Using GIS the lakes and wetlands and their watershed added up to 3988.74 sq km or 398,874 ha. The area using GIS techniques has been analyzed further for other quantities and for valuation within the broad area (see the Maps in Section 6).

Map 1: The case study area



Source: estimated online by Author

The area as indicated in Figure 4 covers both L Rweru and L Cyohoha, Akanyaru River and their sub basins. In the analysis of secondary data it will be noted that there are studies, which were confined to some parts of the site on both sides of the Wetlands. For example there are studies referring to Rweru Mugesera exclusively on the Rwanda side and Cyohoha North also on the side of Rwanda. And the latter has brought confusion between Mugesera and Bugesera. While Mugesera is a lake also in the Nile Basin included in the study it is not the same as Bugesera the ecological zone that straddles the two countries of Burundi and Rwanda.

But there are also studies focusing on the Lakes of the North in Burundi and Cohoha and Akanyaru from the Burundi side. There is one comprehensive study by the NELSAP that took the whole area of Bugesera Transboundary Resources Management popularly known as GIRET as one. It generated a lot of useful secondary data used in this assessment. For specific sectors is a study by the African Development Bank that covers the site on both sides of the Burundi and Rwanda border and appropriately refers to the area as Bugesera Natural area.

The Burundi side includes those transboundary sub basins that include also smaller lakes of Rwihinda and Kazingiri. These are the Bugesera part of the Burundi side known in scientific works as Lakes of the North

3.2. Types of Data and sources

Quantitative and qualitative methods are appropriate in maximizing data and information to be collected on the study area. All quantitative data involving quantities were from secondary sources. The major sources were from projects run by the Nile Basin especially NELSAP SAP and major transboundary project documents

Data Sources

ARCOS studies	Albertine Rift Conservation Society
GIRET project	Bugesera Transboundary Resources Management Project
IGEBU Burundi	Institute of Geography of Burundi
NELSAP briefs	
TEEB databases	
Rwanda Water Portal Rwanda	
REMA	Rwanda Environmental Management Authority
UR-CGIS	University of Rwanda GIS
WRI	World Resources Institute

Qualitative information was collected by using virtual interviews (described below) conducted as a guided discussion along a schedule that had been sent to prospective respondents. A few of the pictures were taken from a field visit to the site that involved no holding meetings since these had not been permitted

GIS Maps were used to estimate shares of ecosystem components and the overall degree of degradation. The degradation is derived from comparing land use cover from satellite image maps over different years particularly 1990, 2000, 2010 and 2015. The rest of degradation data was extracted from national studies on degradation in Burundi and Rwanda.

Types of ecosystems were extracted from studies especially those by ARCOS on the Rwanda side and transboundary projects data of each sub basin on both sides.

3.3. Virtual interviews

Statistical sampling earlier suggested was not used because a physical field visits could not be conducted. This is because of the inaccessibility of the site area due to the presence of COVID 19 pandemic in Burundi and Rwanda. Instead respondents were randomly selected from e-mail lists of Nile Basin stakeholders specifically from both Burundi and Rwanda. Prospective respondents were sent e-mails requesting interviews with a request to indicate what virtual medium they would prefer to use and which time was convenient. A short questionnaire is appended to this report showing areas of interest for discussion.

3.4.Valuation Methods used

i. Market price method

We estimate the economic values for ecosystem products or services that are bought and sold in a commercial market. Although no data collection of goods and services was carried out where the quantities were available e.g price of a kg of fish current market price was used. $V_i = P_i * Q_i$ where V is the value of the good I, P is the price, Q is the quantity

ii. Travel Cost Methods

Estimated economic values associated with ecosystems or sites that are used for recreation. Assumes that the value of a site is reflected in how much people are willing to pay to travel to visit the site. Travel costs from Bujumbura and Kigali to site area for tourism and recreation are used. Cost of overnight stay in hotels is also included .The two sites are within driving distances from the capital cities respectively. Travel cost were learnt from adverts by tourist agents.

1. Damage Cost or Replacement cost

It is also known as Substitute Cost Method. This is the economic value based on costs avoided resulting from lost ecosystem services, costs of replacing ecosystem services or cost of providing substitute services. The estimates of

degradation of ecosystems are multiple but one of the estimates has been the cost of projects of preventing the degradation at national level adjusted for a sub national site for both sides of the wetlands (GoB 2018).

2. Contingent Valuation Methods (CVR)

Estimates economic values for virtually any ecosystem or environmental services. It is the most widely used method for estimating non-use or 'passive use' values. Ask people to directly state their willingness to pay for specific environmental services based on hypothetical scenarios. Not directly used but uses such data from previous studies of some areas particularly done by ARCOS (2017) on Mukura forest in Rwanda and Nirere(2014) on Nyabarongo in Akanyaru sub basin.

v. Benefit Transfer Method

Estimates economic values by transferring existing benefits estimated from studies already completed for another location or use (Costanza, van de Groot Rudolf, Emerton, Kakuru). This has been used extensively for gross estimates of values of the wetlands and basins of the two major lakes Rweru and Cyohoha and that of Akanyaru River sub basin. Adjustments have been made to bring the used prices/ rates up to date and to compare them with similar rates in areas in the region of East Africa and of more or less similar geophysical characteristics.

The valuations from the database are used in estimating the values of the wetland components. As noted and underlined they are supplemented by qualitative explanation especially those from field surveys and secondary sources. For ecosystems where clearly no estimates can be provided this is indicated.

3.5.Risks and threats

There have been challenges to studies of a transboundary nature. The efficiency and easiness of collecting data depends on the political climate between the two-transboundary countries. The success of the Wetlands, taken as a transboundary area, will be realized better if there is a stronger inter - country collaboration beyond project level interventions. For the moment there is dependency on the regional bodies for use of data that is already available and collected from both countries and the region.

The field surveys and visits were not conducted anyway because by the time the research team was ready to start the COVID 19 pandemic had made travel and field work not feasible. Besides using secondary data available and tools like GIS, Elite Interviews guided by a simple schedule were administered to professional and opinion leaders from both countries.

As in other cases involving ecosystems and biodiversity, accuracy and availability of data remain a challenge. Even after imputing for non-market and non-quantitative services there is a big likelihood that these are underestimates. In the meantime for evaluating ecosystem services only those estimates that can be seen to be reasonable are included. Some ecosystem services are acknowledged to be present and presented descriptively.

But there is a possibility also mentioned earlier that our estimates may seem on the high side. This is compared to estimates of other wetlands in the Kagera Basin. This may look true if you confine the study to the water bodies and the marshlands that surround them. But as shown the catchments and watershed are interlinked ex situ to the Nile Basin and have been included as shown by the map. However these are decomposed at component levels and can be compared to other areas and useful for appreciation of value of ecosystems and biodiversity.

The usefulness of the study outputs is premised on being validated by parties with shared stake and opinion in the transboundary area. In the study it has been assumed that features in the area is common no matter on which side of the boundary it is. It is convenient to use the features and data for analysis but it is also important to recognize the views of some respondents that similar attributes or challenges can be given differing prioritization across borders in the same site area. The latter observation provides a finding and justification for a transboundary mechanism in looking at common development scenarios and options. While we made a distinction between state and non-state stakeholders it is really possible that even within state stakeholders or non-stakeholders expectations and value judgments may differ depending on which side of the border a stakeholder is. The transboundary nature of the case study should prevail even if it is in several cases additively arrived at.

Conflicting expectations of different stakeholders and differentiated influences for decision making may delay action or lead to activities that can be contested in relation to their sustainability. The implications of the former observation to transboundary wetlands are one of the issues taken up towards the end of this report.

4. LAWS, POLICIES, STRATEGIES AND INSTITUTIONS

Besides the overall framework in the Nile and in relation to SDGs water, water resources, wetlands are well provided for in law, policies, strategies and institutions of both countries Burundi and Rwanda (Table 3). They are both signatories to international conventions that are related to the wetlands and the Rweru Bugesera Wetlands Complex.

Table 3:Laws, policies and strategies relevant to Rweru Bugesera Wetlands

Burundi	Rwanda
Vision 2025	Vision 2020
Framework for Growth and Poverty reduction 2012-2015	Economic Development Policy and Poverty Reduction 2013-2018
Environmental code 2000	National Strategy for Transformation ¹ 2018-2024
Forest Code 1985	Organic Law on Environment 2005
EIA Decree 2010.	National Strategy on climate Change 2010
National Water Resources Management 2001	Green Growth and Climate Resilience Strategy
Water code Law 1/02 of 26/3/2012.	Rwanda Biodiversity policy 2011
National Strategy and Action Plan Climate Change 2012	Rwanda water law 2008
National Strategy for Biodiversity 2013 -2012	National Policy on Water Resource Management 2011
National Environmental Strategy	Rwanda Water Master Plan

Major laws, policies and strategies on environment and natural resources are in place. There are several other strategies and policies on sectors that have a relation to water, natural resources and marshlands. In Burundi there are for instance the following;

1. Sector Strategy for Energy Sector in Burundi 2011
2. National Forestry Policy of Burundi 2017
3. National Agricultural Strategy 2008 - 2015
4. National Sustainable Land Use Strategy 2007
5. National Action Programme to fight land degradation

There are also institutions, which have under their responsibility water, environment and other aspects that are related to management of wetlands. The following are the most notable;

1. Ministry of Water, Environment, Physical Planning and Urban Development. In charge and regulation of environmental management
2. OBPE – Burundi Environment Protection Office. In charge of enforcement and monitoring trade in flora and fauna. In charge of standards and responsibilities
3. IGEBU-National Institute of Geography. E.g. National focal point for Africa Adaptation Initiative
4. ISABU-National Institute of Agriculture
5. INEAC –National Institute of Environment
6. ISTEERU- Institute Statistique et des Etude Economique
7. Sector Working Group on Water, Sanitation and environments

There are projects and platforms that are also relevant to management of natural resources and wetlands

8. National Water Partnership
9. National Platform for Risk Prevention and Disaster Management

10. ACCESS Climate Change Adaptation for Soil and Water Resource Conservation project financed by Special Fund for Energy and Climate
11. Watershed Management and Climate Resilience Improvement (PAV VARC)
12. Communication and Early Warning Strategy for Adaptation to Climate Change
13. Integration of Smart Agriculture into NAIP

Similarly Rwanda has strategies and policies for other sectors that have a bearing on the functioning of natural resources and wetlands

1. National Strategy for environment and natural resources 2018 – 2024
2. Energy Sector Strategic Plan 2019
3. National Agricultural Policy
4. Forest sector strategic plan 2018-2024
5. Land policy and law 2004 and 2005
6. Economics of Climate change 2009

Rwanda has institutions that govern natural resources and the environment

1. Ministry of Environment
2. Rwanda Environment Management Authority
3. National Institute of Statistics
4. UR Geographical Information Systems
5. FONERWA –National Environment and Climate Change Fund
6. Rwanda Water Portal
7. ARCOS- Albertine Conservation Society Network – Rwanda

8. CoEB – Centre of Excellence for Biodiversity at University of Rwanda
9. Rwanda Environment Awareness Organization
10. Rwanda Initiative for Sustainable Environment

Both countries are signatories to International conventions on environment including wetlands

1. Convention on Biological Diversity 1992
2. UN Water Convention 1997
3. Nile Cooperation Framework 2009
4. Aichi Targets part of the Strategic Plan of CBD 2011-2020
5. RAMSAR Convention 1971 on conservation of Wetlands
6. Wetlands International 1937
7. IUCN- International Union for Conservation of Nature 1948

By virtue of being members of major regional and international organizations Rwanda and Burundi have other mechanisms governing or supporting management of wetlands and the environment.

1. EAC. The East African Community is a six country regional economic cooperation that includes Burundi, Ethiopia, Egypt, Kenya, Rwanda, South Sudan, Tanzania, and Uganda and among other regional integration goals, oversees matters of protecting and managing the environment. A flagship project that oversees wetlands is the Lake Victoria Environmental Management.

2. NBI. Burundi and Rwanda are also members of the Nile Basin Initiative. As noted in the institutional position of this project it has a Wetland Management Strategy as well as a Subsidiary Action Programme in the Equatorial Lakes region known as NELSAP
3. AU. The African Union to which Burundi and Rwanda are members has also in its programmes on protection and management of the environment including wetlands

From the information in this section it can be said that the finding shows a relatively broad, legal and regulatory landscape mainly at national levels. After finding that the level of action is on average low not exceeding 35 per cent (see below on degradation) and can go as low as 20% (ARCOS 2019) in the two countries and thus current vulnerability of the case wetlands there is a need to know why and what could be done as development options are considered. A number of questions arise from this finding

1. Which gaps in the legal, policy, strategy and institutional framework still exist?
2. Which are other factors that hinder enforcement of existing laws and even conventions that need to protect, restore or wisely manage the wetlands to the site level?
3. What would be done for the specific wetlands?

One argument has been general problem of implementation or from our previous discussion the power of influential stakeholders or caring less for the components of wetlands that have no market value. Nkurunziza in Tvedt (2010) says on Burundi that only a few of formulated projects on the water resources get implemented because of conflicts. Information at macro and from either side of the wetlands explains this paradox of many institutions. A project at the Kagera Basin level (FAO-GEF 2013) in relation to conflict over resources finds that there are weak and ineffective institutions to effect natural resources management policies, laws and regulations at lower level as well as lack of

transboundary mechanisms. The Rweru Bugesera Wetlands has also latent conflict of resources and for the time being the waters of Lake Rweru is a current center of conflict¹. One opinion leader indicated in a major meeting that Burundi and Rwanda are not on having similar vies on how to handle the Akanyaru Wetlands. While extensive peat exploitation is taking place on the Rwanda side the Burundi part has been expecting some more protective actions of the wetlands. But its clear that the number of laws, policies and strategies do not get to down effectively to the wetlands sites and simultaneously across the borders of both Burundi and Rwanda.

Africa Water Facility (2006) talked of poor institutional arrangements, lack of coordination and poor ownership of the instruments. There is the argument of lack of technical and financial capacity. One elite respondent discussed the problem as the lack of convening powers by those in charge of environment and as noted later drawing little budgets for environmental expenditure. It is not easy for the Ministry of Environment in any of the two countries to bring awareness or make governments commit funds for environmental protection of a certain transboundary wetland. It may equally be difficult for environmental authority to convince agricultural authority that using more fertilizers in upstream parts of the Nile Basin will have in the long run effect of pollution downstream. Yet this means that a lot more evidence has to be collected and the regional bodies mentioned provide an opportunity for taking further the agenda to the level of complex transboundary wetlands. Needless to mention also that the transboundary cases like this one do not only need understanding between states but also between disciplines, sectors and different branches of government.

The first set of evidence required is to establish how the local administration and local communities take up regulation and institutions that aim at wise use of wetlands in which they are stakeholders. A number of respondents indicated

¹ E.g see http://www.angop.ao/angola/en_us/noticias/africa/2004/8/37/Burundi-Rwanda-experience-border-insecurity,525636a6-5e4d-4823-b62d-238eb70831f7.html

that it might be a question of awareness and education at community level and local administration at site level. However where there is need for a 'fence and fine' policy to protect certain parts of the Wetlands Complex local level regulation and decrees can be taken up along with awareness creation.

So far it was indicated that the geographical scope of the wetlands is not clear. There is also need to know what is where and which needs, what type of wise intervention. Technically this can be called Mapping of the Ecosystem Services. One elite respondent indicated that some of the information may be available but there is a lack of common, shared and coordinated approach to the Rweru Bugesera Wetlands. One emphasis, study or intervention may be on Rweru alone while another is on Cyohoha or Akanyaru and in a number of cases not from a transboundary perspective. The partners in Akagera Basin, Nile Basin, Lake Victoria Basin interventions etc do not seem to have a common shared platform with the ability to influence other stakeholders in taking action. During the study it was informed from some respondents that there was (an authority other than the Nile Basin) carrying out a similar study for the entire Kagera Basin allegedly with natural capital accounting framework. The scope of this study could not permit full scale mapping of wetlands components in the transboundary wetlands complex. Indeed from the last section of the report the number of aspects that may distil in the wise use of the wetlands are really plenty.

For example the LVEMP within the East African Community has the following remission and cross border issues

1. Promote regional aquatic ecosystems land scape conservation
2. Support design and review of management plans
3. Implement site level interventions for unique habitat
4. Strengthen cross border collaboration
5. Build capacity for sustainable management of resources

6. Strengthen livelihoods diversification and enhancement
7. Design and pilot market based mechanisms
8. Develop and pilot innovative conservation approaches and tools

Cross border collaboration addresses priority transboundary issues

1. Unsustainable use of water resources
2. Wetland and forest degradation
3. Wildlife and habitat loss
4. Governance, policy and institutional weakness
5. Declining fisheries and fish stocks
6. Increased sedimentation, pollution and eutrophication

In this case like in others the rate of trickling down of these good ideas to the site level of Rweru Bugesera is not known. The coordination mechanisms between regional bodies such as NBI and EAC and major partners in wetlands management may lead to better sharing of information, cutting down of duplication and coordinated partnerships with the state actors.

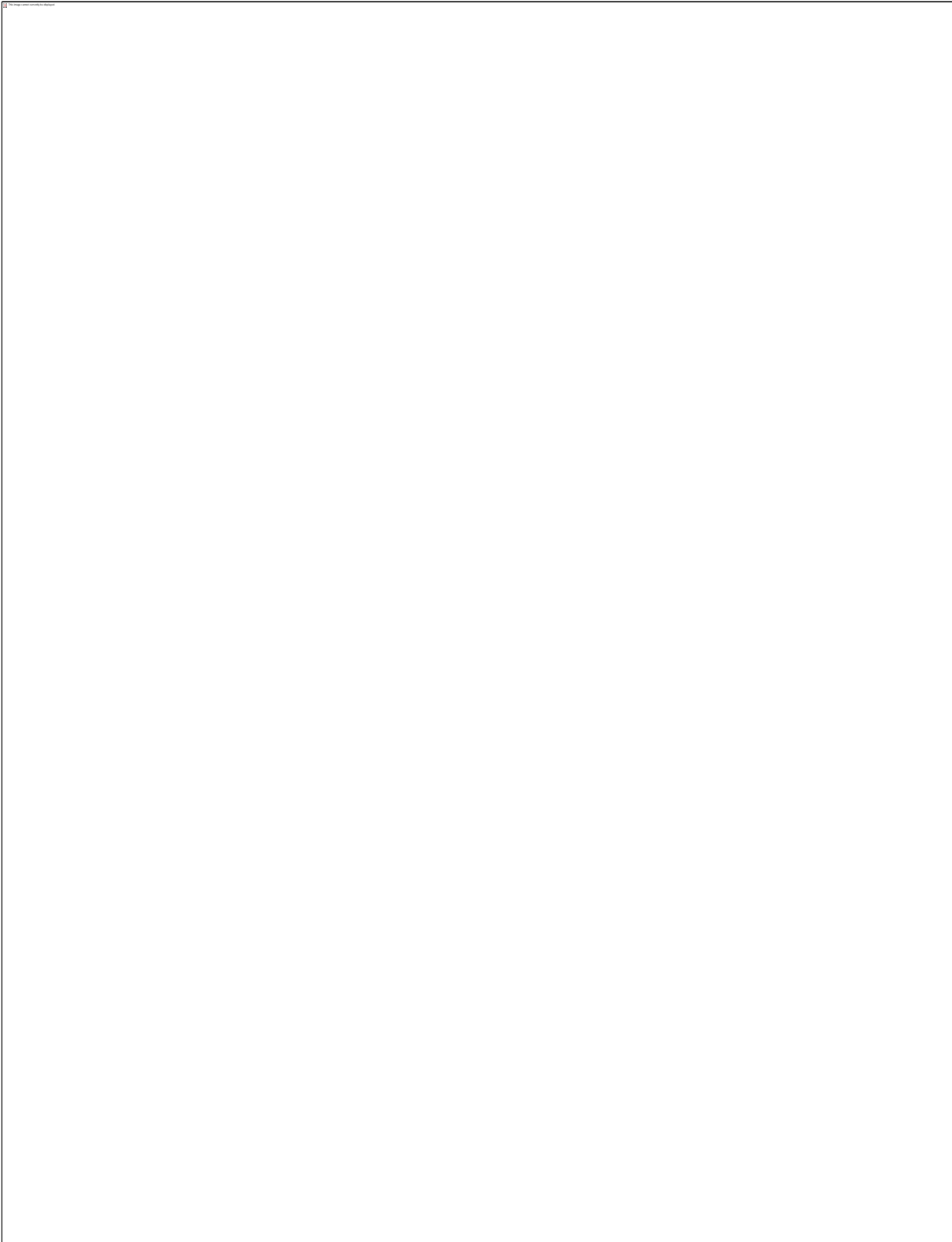
Another policy framework that may be used by both countries to influence interventions in the wetlands is Agenda 2030 or the Sustainable Development Goals. Though global it is commonly subscribed to by both countries and supported by almost every development partner in Burundi and Rwanda. It is also an integrated approach that links different goals replete with different indicators for its implementation.

SDGs are clear on how protection of the public commons is required to achieve development. In particular SDG 15 target 9 states that 'by 2020 ecosystems and biodiversity are integrated into national and local development processes and poverty reduction, strategies and accounts'. TEEB has an objective to

mainstream the values of biodiversity and ecosystem services into decision-making at all levels.

It is noteworthy also that SDGs have four ecological goals. SDGs view sustainability as being not only economic, but also social and environmental. SDGs talk of linking **people, planets, prosperity** and **place** (4Ps). The essence of **total economic valuation** today is not only market prices of provisioning services of ecosystems but also the regulatory, cultural and supporting services. It is about both direct and non-direct services. TEEB looks at SDGs in almost similar lenses akin to the 4Ps. biosphere, society and the economy. This approach emphasizes linkages between human well being ecosystem services and biodiversity

Table 4: Relation between wetlands and SDGs



Source: RAMSAR 2018

5.STAKEHOLDERS AND BENEFICIARIES

The significance of the study could be regarded as, technically, for the use of the Nile Basin Initiative and its partners. As indicated under significance it is useful to

professionals and researchers in biodiversity, wetland management and sustainable development. But above all this study is directed to an array of actors and an audience with interest and influence in wetlands –the **stakeholders**. The interest and significance is in relation to stakes in wetlands in general and Bugesera area in particular.

Who are interested in the wetland complex and how? In the latter part of the question the issue is about which components of the wetlands are of interest to which stakeholder and whether it is as individuals, communities, corporations, nations or multinationals. With the **interests** what are the expectations from the use of wetlands? What are the **influences** each of the stakeholder has? And ultimately this results in tensions or multiplicity of interests that lead to the need to make **tradeoffs** in the development options in the short and long terms.

Stakeholders are both **primary** and **secondary**. Primary stakeholders are directly linked to the wetlands and have high expectations to the users. These like the farming and fishing communities depend greatly for livelihoods on the wetlands but may have little influence on the decisions around the wetlands complex. Table 5 shows the different categories of users/stakeholders. Secondary may be remote or indirect users with derived benefits that are not necessarily tangible. Table 6 is a matrix of interest and influence of known stakeholders.

Expectations to the wetlands are also **present** and **future**. They are as noted above benefits that are reaped in the short as well as the long run. Indeed some stakeholders may have seasonal or short term preferences in the use of wetlands (farmers and private investors in agriculture) whereas national and conservationists have interests in the long term sustainability of the use of the wetlands complex as well as protection of the non economic and non market uses of the wetlands that have no direct market value but are immensely important for the sustainability of people and living organisms.

It is thus important for such a study to point out areas of development that will lead to win-win situations in terms of benefits to different stakeholders. How can the farming, livestock keeping and fishing communities realize how certain short term gains may compromise long term existence of the wetlands and related products?

Table 5. Categories of users

Users	Elaboration
Direct Extensive users	Directly harvest wetland goods in a sustainable manner
Direct Intensive users	These have access to new technology
Direct exploiters	Dredge sediments in the wetland exploiting minerals, clay and peat
Agricultural producers	Convert land into agricultural land areas
Water users	Use wetlands as a source of water for agriculture, irrigation etc
Indirect users	Flood mitigation
Human settlement	Expansion
Nature conservation	Conservation
Non users	Intrinsic value of wetlands

But also how can investors and partners in sustainable development remember that the livelihoods of those depending on the wetlands are of great importance. National actors and government may need to appreciate the need for wetlands restoration where there has been high levels of degradation but at the same

time all stakeholders need information to realize how non - provisioning function of wetlands such as flood mitigation and water regulation are important. In this regard is also how the water resources management is important to the Nile Basin blue and green water policies.

Influence mentioned above is also important to address. National governments and regional bodies have relatively higher influence on decisions of using and developing all or some components of the wetlands. It is important to have laws and regulations as well as institutions that govern wise use of the wetlands, which also involve participation of all the stakeholders.

A major categorization is grouping stakeholders by **state** and **non-state**. In the study the governments that are involved are those of Burundi (GoB) and Rwanda (GoR). It is pointed out in this report that although the study is about a transboundary area, the biggest influence is with the sovereign states. The success of implementing the development options depends not only on the good will of the state actors but their readiness to appreciate the collective benefits of transboundary collaboration. Non-state actors are important in terms of pressure and for communities adjacent the wetlands as the beneficiaries or losers of interventions undertaken. Thus there is the reason of emphasizing the win - win solutions in planning for the future of the Rweru Bugesera wetlands.

The distinction between **national**, **regional** and **global** stakeholders is also important. Are there people and entities that stand to benefit from the development? It is analyzed in this section that the Rweru Bugesera wetlands complex is part of the Akagera Sub Basin of the Nile Basin. Burundi and Rwanda are part of the East African communities. It should then be clear that the development and how the future of the wetlands is determined is of interest to regional governments and people and broadly the Nile Basin riparians positively in some cases analyzed negatively.

Which are the **international** and **global** interests in the evaluation of Rweru Bugesera wetlands? The most direct instances are the RAMSAR convention. It is indicated that large parts of the Bugesera Wetlands have been indicated as of international importance. The RAMSAR criteria usually indicate why a wetland is internationally important and deserves to be protected. The most important is having species of flora and fauna that are threatened by extinction or areas where migratory birds nest and reproduce. There are more but in the assessment it is indicated that the wetlands complex has species that need protection.

It is indicated in the analysis also that the sites in the wetlands are of interest to researchers, tourists and conservations from different parts of the world.

Table 6: Multiple stakeholders and beneficiaries

Stakeholder Category	Br	Rw	Glob	Reg	Pri	Sec	Int	Infl
1 Government Ministries	V	V			V		V	V
2 Parliament	V	V					V	V
3 Autonomous government agencies		V					V	V
4 Local Government Administrators	V	V			V		V	V
5 NGOs working in the area	V	V					V	V
6 NGOs working on environment	V	V					V	V
7 International NGOs with opinion	V	V	V				V	V
8 Private Sector	V	V					V	V
9 Infrastructure Developers	V	V					V	V
10 Researchers	V	V	V	V			V	V

11 Conservationists	V	V	V	V	V	V
12 Tour operators	V	V			V	V
13 Farmers	V	V			V	V
14 Livestock keepers	V	V			V	V
15 Women	V	V			V	V
16 Youth	V	V			V	V
17 Genocide Survivors		V			V	V
18 IDP	V				V	V
19 Foreign Investors Agriculture	V	V	V	V		V
20 Foreign Investors Industry	V	V	V	V	V	V
21 Hotel Owners	V	V			V	V
22 Donors	V	V	V			
23 Nile Basin	V	V		V	V	V
24 LVEMP				V	V	
25 Green Growth bodies	V	V	V		V	V

Br=Burundi Rw=Rwanda Gl=Global Reg=Regional In+Interest Infl+ Influence

Now the crucial issue is who is the most important of these stakeholders whose interests need to be preserved. The quickest answer is the communities of farmers and livestock keepers living near the wetlands whose livelihoods the respective governments care for. Their food security, health and development are very important for national development.

Indeed the area is important to the entire countries in the sub basins of the Akagera sub basin of the Nile basin. But it is noteworthy that some of the anthropogenic practices are the causes of degradation and unsustainable use of

natural resources. The effect is not on the populations themselves but also on the region and water users down stream. These are explored in the assessment and the need for development trajectories that lead to sustainable win –win situations presented.

By way of concluding this section it is clear that stakeholders are multiple and multilevel. But there are two issues that may be necessary for the understanding the development trajectories of Rweru Bugesera Wetlands. These are derived from elite interviewees.

Firstly communities of fishermen, farmers, women and local leaders need awareness and education not only on environmental conservation, effects of climate change but also the immense value of ecosystem services and biodiversity. If some areas have to be protected it should be understood by the lowest levels of stakeholders but also alternative activities taken.

Secondly, the science of climate change and the Economic Valuation of Wetlands may seem to understandable to those who are involved at professional and some government levels. But these need to be generally and easily understood by other stakeholders. A private sector stakeholder would be a better partner if he or she gets profits from investing in the Wetlands knowing the rules and regulations and the implications of what he/she is doing to the future of the communities around the wetland and country.

While the communities need to be accommodated through a principal of participation, an elite respondent mentioned equally the need for practical application of the principles of complementarity and reciprocity in transboundary matters of the Rweru Bugesera Wetland (Stoa R 2013).

The issue of stakeholders is not confined to people but also to components. It is mentioned in a number of instances that the need for harnessing energy is pitted against the need for irrigation water. The acquisition of HEP is good but affects the ecosystems and the socio economic needs of communities in the proximity of the dam. Obviously the 'fence and fine' mentioned above is good for the conservationist and governments but may be disdained by communities living near the wetlands.

Of course there are stakeholders whose interest converge. The genocide survivors of Ntarama would like Kayumba wetlands conserved because they were their sanctuaries during the Genocide against Tutsi in Rwanda just as the women who would like to continue exploiting the wetlands for production of cultural goods.

6. ECOSYSTEM SERVICES OF RWERU BUGESERA AND THEIR VALUES

6.1. The general features of the sub basins

Rweru

Rweru as seen from the maps in previous sections is a lake close to the most northern point of Burundi and is known by early explorers as the most distant start point of the Nile River. Rweru is an aquatic mass in a generally savannah area. It lies at altitude 1324 and 1565 m and has 114 square kilometers in Burundi and 75 in Rwanda. Its shoreline is 76 km surrounded by marshes. The Kagera flows out of the lake. Water is about 223 million cubic meters with a depth of 5 m. It is most valued for fish and agriculture and its islands such as Mazan. Other benefits include fuel-firewood, fodder and papyrus from the wetlands.

Rweru is 30 km from Nyamata, 45 from Kigali and 35 from Kirundo. Rweru is an important transboundary water body that regulates the Akagera River, which feeds into the Nile through the Rusumo Hydro electric rapids.

The Rweru basin has a wide biodiversity known in vernacular. Birds such as Umusambi (cranes), *Umusavu* and *Inkware*. Mammals include *imvubu* (hippos), *inzobe*, *igihura*, *imondo*, *inkende*, *inzubyi* and *inkima*. Reptiles include *ingona* (crocodile), *imburu*, *uruziramire* (python) and *ibinyamago*. Flora include, *icyumwe*, *urukugo*, *urufunzo*, *isovu*, *umugote*, *amarebe*, *igorogni*, *umuyengeyenge*, *igicumucumu*, *umugeyo*, *umudoboli* and *urusenguri* (ARCOS 2008).

Rweru is threatened by water hyacinth and pollution. It is regarded as drying up. Water hyacinth reduces fish and all dirt from Akagera are emptied in the lake. Around Lake Rweru there is evidence of water borne diseases especially schistosomiasis about 21.1 % of the population in 2010(Niyituma et al 2017)).

There was a project on rehabilitating Lake Rweru wetland in 2013. Lake Rweru is regarded as reservoir for Lakes Mugesera, Sake, Akagera and Nyabarongo. There have been other projects around the lake such as Rweru protection and soil management and Rweru modern green village. But despite these, the current situation does not involve the most optimal and sustainable development trajectory as all the efforts have been shown to add up to a 35 per cent action and does not have any meaning to about 30 per cent of the people.

Cyohoha

Cyohoha is another lake at 1350 m of altitude. Around the lake is agricultural land. Its surface is 7400 ha and with the basin it occupies 51,200 ha. The flora and fauna of Cyohoha is a good potential for development decisions. Mammals include; Hippopotamus, Sitatunga, Velvet monkey, crested porcupine, African clawless otter, Congo clawless otter, spotted necked otter, Honey badger, African Civet, Wild cat and African Golden cat. There are 48 reptile species and 19 amphibians.

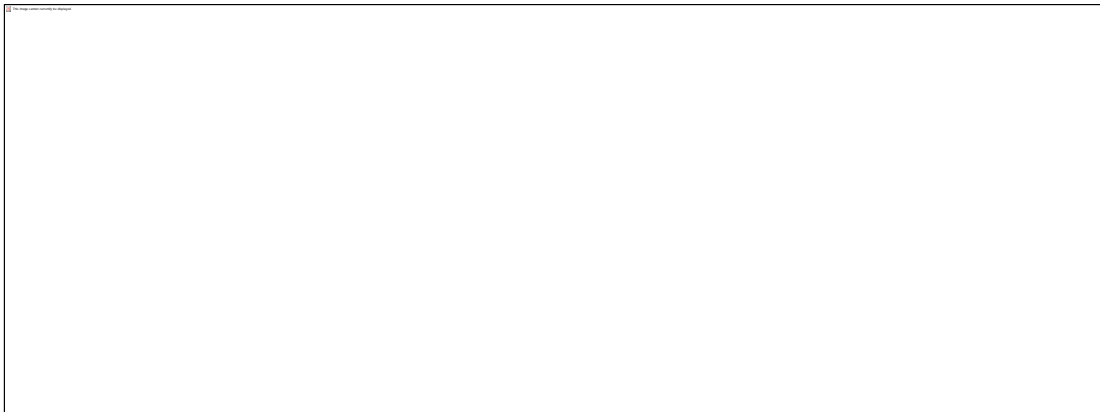
The flora in vernacular include; umuhati, umuseru, umubari, ikigugu, urufunzo and umugisu, runanura, inkoba and urukeca, ikizangange, amarebe, irenya, igoromi, urukembagufa and umubirizi. The Cyohoha basin is 64 % cropland, 3 per cent closed to open herbaceous, natural lakes 14%, permanently flooded zone 1%, rainfed crop 13 and general shrubs 1 % plus some little forest plantations amounting to 2 square kilometers

Akanyaru

Covering 300 sq km over a narrow, 80 km-long band along the course of the Akanyaru River, the Akanyaru Wetlands start off in the south straddling the Rwanda – Burundi border, and wind their way north to the village of Ntarama, where the sluggish Akanyaru joins the much larger Nyabarongo River.

Though they're probably less-visited than any other birding site in the country, the papyrus-dominated swamps here have been recognized as an Important Bird Area by Birdlife International and are home to more than 54 species, including the vulnerable Papyrus Yellow Warbler and Papyrus Gonolek, along with examples of Great snipe, Pallid harrier, and the Malagasy pond heron.

Picture 2: Akanyaru river

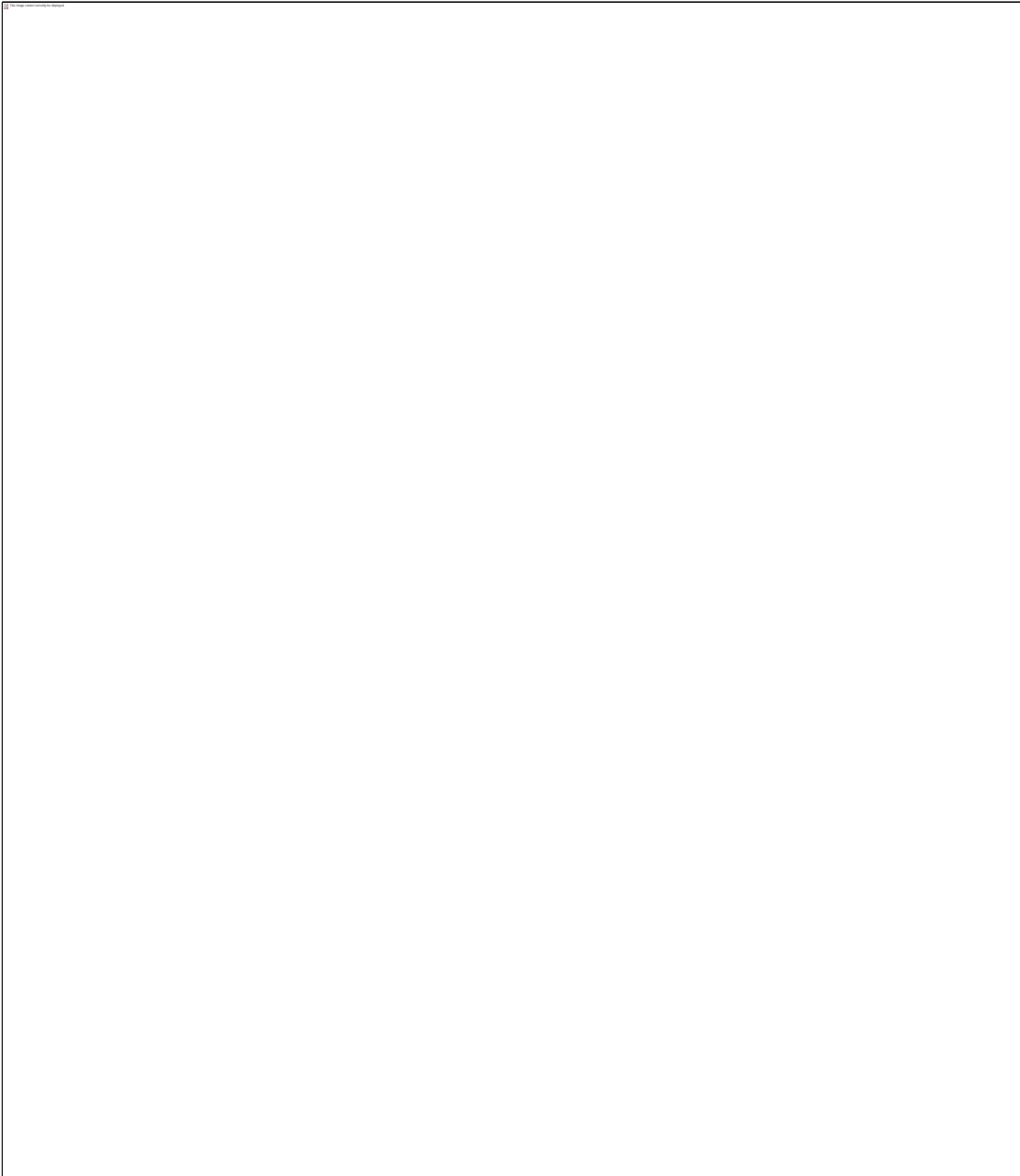


6.2.Land use and cover

The Rweru- Bugesera Wetlands site is complex and unique. The complexity is based on, as noted, presence of aquatic, riverine and marshlands and related

natural resources including flora and fauna. It is also complex in relation to how it involves multiple services, multiple stakeholders and two countries of Burundi and Rwanda.

In the map of the area (which is the same as Figure 2 that was populated by the GIS experts) general and simple categorization of ecosystems is shown. The largest part is occupied by crops (34.8 per cent) followed by grassland (28.7), shrub land (12.3 per cent), forests (16.4 per cent) and open water (6.7 per cent)(2016). The shares using transfer values gives us the first estimates of the values of the site area and the values of individual components. These in relation to the open water and wetlands amounts to what is classified as provisioning services. These are followed by the values of regulation services of the ecosystem and cultural services. The supporting services could not be estimated but are known generally.



Source: UR GIS

6.3. Ecosystems services of Rweru Bugesera Wetlands Complex

The ecosystem services as mentioned several times before are of two types; namely aquatic in terms of lakes and rivers that are many in the area and marshlands. In the smaller scope there are Lakes Rweru and Cyohoha. Considering the administrative areas of Kirundo and Bugesera as a whole the area has a large number of lakes and surrounding wetlands whose development or even protection has either been non-existent or sub optimal.

Provisioning

Provisioning is the most visible of usefulness of wetlands because it involves tangible goods and services that can be quantified and marketed. It is common to look at them in order of importance. In Rweru Bugesera wetlands they are in the following order (ARCOS 2011).

1. Water
2. Food
3. Medicinal products
4. Raw materials for building²
5. Materials for household goods³

Water is ranked number 1 by almost 80 % of the population living near the complex. Fish is second with 61% agriculture 30% and fodder for livestock as well the use of papyrus. With regard to water 87% is for domestic use, 54% for irrigation 49% for animals and 31% for construction. About 77% of the farmers include fishing with 5% wholly dependent on it. Rweru Bugesera wetlands complex is very useful to people living near the water and marshlands. Services from the wetlands include water for use in abundance, cropping in the dry season, cheap fish and animal feeding.

There is evidence of medicinal goods in the wetland. Despite enumerating them by traditional names and in some studies identifying them by their scientific names there seems to be no study demonstrating their potential value especially to the health sector. In this age of innovation and drawing from experience of countries like India the herbs that are usually destroyed when wetlands are exploited could be very useful.

Table 7 : Traditional medicinal herbs

Herb	Where
------	-------

² These include items like ropes and reeds

³ mats, chairs, etc are made from wetlands products

Umuzibaziba7	Wetland forest
Umurehe	Woodlands along the stream
Umuberanya	Wetland
Umukeri	River
Umuravumba	River bank
Umusagara	River bank
Umwisheke	Grassland around river
Umusharita	Mix
Bamburwa	Cultivated land
Umugombe	Open habitat
Cyanya	Mix
Umuharati	River bank

Source: ARCOS 2008

Picture 3: Some products of the wetlands



Source: own field photo

Regulating services

There is along list of regulation services performed by wetlands in various places. What is interesting to the study is how each of the services is relatively important to the wetlands complex. The relative importance has been established though. However there is a challenge of getting the values of most of these(see below) a finding that indicates lack of data on several more regulating services.

Table 8 . Regulation services of ecosystems in RBWC

Service	+	+/_	-
1 Storage and recycle of nutrients	V		
2 Storage and recycling of human waste	V		V
3 Storage and recycling of organic waste	V		V
4 Ground water recharge		V	
5 Ground water discharge		V	
6 Natural flood control and flow regulation	V		
7 Erosion control		V	
8 Salinity control	V		
9 Climatic stabilization	V		
10 Carbon sequestration	V		
11 Maintenance of migration and nursery habitats	V		
12 Maintenance of ecosystem stability	V		
13 Maintenance of integrity of other ecosystem services	V		
14 Maintenance of biological and genetic diversity	V		

Source: own from discussion with respondents

Cultural services

Under ecosystem services classification indicated in the methodology these are quite diverse and potentially very valuable. The services include intellectual, spatial and spiritual values. They include recreational experiences, ecotourism and scientific activities.

Like in any other wetland in Rwanda products have been useful for producing ornamental and goods of decorative value. Women have been the major beneficiaries of reeds from wetlands for making mats and fibred containers.

Boys and livestock keepers are known to enjoy aquatic areas for recreation and swimming. There is opportunity in water sports, kayaking and tourism in the site. Other forms of recreation that have not been studied for exploitation include bicycling, camping, freshwater fishing, non-monetized boating, motorized boating, hiking, small game hunting, waterfowl, hunting, off-road vehicles, picnicking and sightseeing.

A particular cultural ecosystem service is tourism. Tourism is cited in both Rwanda and Burundi sections as a potential economic activity related to the aquatic and terrestrial resources. In the study area there is a focus around Lakes Rweru and Cyohoha but also for the several lakes both in Bugesera district⁴ and Kirundo Province. Rwihinda Lake in Kirundo is actually known as Lac des Oiseaux- the Lake of Birds although a respondent believes the number has been reduced and for Akanyaru as noted several species are in danger. The most common forms of tourism are for bird watching and ecotourism and on the side of Rwanda cultural and possible recreational visits. It is possible to visit the area from either Kigali or Bujumbura and back or from one country ending in another depending on political conditions in the two countries that host the study area

⁴ Bugesera district development strategy

The tourism sector is the largest earner of foreign exchange in Rwanda, which received about 932,000 tourists in 2016. Burundi host about 299,000 in 2017. It is however a fact that the share of tourists going to the Bugesera area of both countries is still limited

Picture 4: Avitourism is an ecosystem service that can be exploited wisely



Source: Field photo near Lake Rweru

Tourism in Burundi and Rwanda revolve around lakes. Avitourism is around the two-shared lakes of Rweru and Cyohoha. Rwanda has 9 while Burundi has 3 more lakes. Noteworthy is that Lake Rweru was put on world list of tourist attractions in 2018. On visiting Lake Rweru there is a board indicating that bird watching is still thriving. But a notable feature of the shore of Lake Rweru among others was absence of a hotel or restaurant for tourist.

For Burundi there is a typical advert of a package of visiting the Wetland area and viewing bird at Lake Rwihinda and going back to Bujumbura the next day. But how these activities can be promoted to earn money that will lead to sustainable development of the area is a topic for study especially with regard to community participation in conservation for tourism development.

The site it has been documented provides a haven for rare birds and plants that are useful for scientific purposes. The Lake Rwihinda on the Burundi side is aptly called the Lakes of Birds (Lac de Oiseaux).

Some wetlands on the Rwanda side for example around Kayumba in Ntarama provided hiding places during genocide and have been so valued that some communities are against any activity that would take away the marshlands in the areas.

Supporting services

These as described earlier these are services required by all other services. They include nutrient recycling, soil formation, pollination, habitat provision and biodiversity.

6.4. Value of the ecosystem services

Assumptions

The first observation is that not all services outlined above can have a price. The values are for the services that have them or estimates can be done from other studies through benefit transfer values. While the estimates will help in providing minimal economic evidence with available data, it means a more extensive study to get more values is still important.

The study area has natural resources that include aquatic products comparable in value estimates with those in the region and internationally. Using these estimates per area gives an idea of the value of the ecosystem component.

The benefit transfer values are those that have been derived from a cross section of studies (Costanza 1997, Emerton and Boss 2005, Kakuru 2015). The

Swiss Agency (2004) using for example 89 studies across continents have a number of estimates

1. Highest median economic values of all wetland types is \$ 374 per ha per year (using Dutch Wadden Sea and Rufiji Delta Tanzania)
2. Recreational opportunities and amenities \$492 per ha per year
3. Flood control and storm buffering \$ 464 per ha per year
4. Recreational fishing \$ 374
1. Water filtering \$ 286
2. Biodiversity \$ 214
3. Habitat nursery \$ 201
4. Hunting \$ 123
5. Water supply \$ 45
6. Fuel wood \$ 13

These figures are those of 2004 and thus need to be adjusted for changes in price/inflation. The Bureau of Labor in the US (<https://www.in2013dollars.com/us/inflation/2004?amount=820000>) shows that a dollar in 2004 has to be adjusted by raising it by 37.7 per cent. The prices were reached using at least a site in Tanzania within the East African region. The following adjusted rates are used in this section.

Table 9: Benefit transfer rates adjusted for valuation

	Type	rate /ha 2004	adjusted
Wetlands	All	374	515

Recreation opportunities	Cultural	492	677
Flood control	Regulating	464	639
Water filtering	Regulating	286	394
Biodiversity	Supporting	214	295
Habitat nursery	Supporting	201	277
Water supply	Provisioning	45	62
Fuel wood	Provisioning	13	18

Other rates used other methods as will be deemed appropriate for the ecosystem service in consideration.

Assume also by estimating from the GIS maps that crop around the three-sub basin is at least a fifth of the entire cropland estimate and the price of one hectare of cropland without building or crops is a market transaction rate of about USD 1250(www.landgovernance.org/assets/20160627-Factsheet-Rwanda.pdf)

Another assumption based on interview is that at current market average price of cattle in the area is on average USD 167 and USD 17 for goats and sheep respectively.

Water and marshlands

Aquatic resources are indicated as the most important. The surface area of Lake Rweru is 114sq kilometers or 11400 hectares, while Cyohoha covers 7,400 ha. Using transfer value the value of the two water bodies is as shown as Table 10.

Table 11: Total Economic Value of water and wetlands

	Area in ha	Value in US\$
L.Rweru	11400	5,870,977
L Cyohoha	7400	3,810,985
Total		9,681,862

In light of the Nile Basin it is sensible to include other lakes because the entire area is actually part of the larger Nile River Basin.

Agriculture

Agriculture is a very important activity in the study area. Firstly it is the one that supports the livelihoods of the people living near the wetland areas. Secondly it involves household and community agriculture as well as larger scale and commercial agriculture, which wetlands can attract. But for our study it also represents an important component in the decisions to conserve or exploit. The issue here is the value of agriculture in the study area. The value of agriculture in the study area can be explained in quantitative terms as in other sections but also in qualitative terms in terms of the usefulness to farming communities and the potential to private sector investors in relation to commercial crops. Qualitatively it is agriculture that gives a better picture of the historical evolution of Bugesera area as a potential to the countries and communities in the area and region.

In the delineated area of the wetland complex and GIS estimates that it occupies the largest part of the basin and from the cap it can be seen it is concentrated around the wetlands. Its share is 34.8 per cent. At this stage the picture is how the case area is generally worth. Thus, using the estimate of a price of a hectare of cropland without considering the value of the crops that will be planted the total value is as follows;

Table 12. Estimate value of agriculture in area

Total area in ha	Share of cropland	Estimate with agriculture in ha	Estimate area with agriculture value	Total value
398874	34.8	138,808.152	500	69,404,076

The value looks high. However it is also possible to say with investment in technology and modern farming that can raise productivity the area and as said the wetlands can produce more. What would be required would be to look at agriculture and different crops and productivities as a study on its own in light of wise use, sustainable agriculture in the wetland complex.

Livestock

Ecosystems services in the wetlands complex support the development of livestock that benefit the communities near the wetlands. The lakes and marshlands are important to livestock development. Livestock can be regarded as part of agriculture. However in relation to its interface with the ecosystem services and in particular in the Bugesera of Rwanda and Burundi it has a unique role that has been evolving influencing the estimate value of the wetlands complex.

The place Nyamata in the Rwanda part of the Bugesera area is said to be linked to the etymology of where there is milk or **amata** in vernacular. The area of Busoni in Kirundo district of Burundi has been recorded as an area of livestock keepers with large herds of cattle that freely thrive on the ecosystem services. Its for example known that like agriculture wetlands are very important to livestock during the dry season and for water. In practice livestock is also responsible for the degradation of wetlands especially in the parts of Burundi where there has continued to be free-range livestock keeping. The Rwanda side,

it is said the livestock per capita has been diminishing and there is a tendency for promote modern breeds in zero grazing stables⁵ as a government policy.

Away from the marshlands are possibilities of ranching projects such as the designated areas of Gako (Rwanda) and Murehe (Burundi) most likely for beef. For evaluation purposes livestock should also include ruminants such as goats and sheep that thrive well in the savannah like vegetation of Bugesera depression. Estimates are in Table 13

Table 13: Estimate value of livestock in Rweru Bugesera Wetlands

Livestock	Estimate in the site area	Estimate value each in USD	Estimate value
1 Cattle	64,400	167	10,688,000
2 Goats	112,000	17	1,904,000
3 Sheep	11,200	17	190,000
Total			12,782,400

Fishing

Fish is important notably in Lake Rweru and Lake Cyohoha. There is prospect for developing fishing in the area especially in the rest of the lakes. There is currently concern about degradation of fishing resources. One respondent narrated of a predatory species that feed on other fish and is responsible for the diminishing yield from Lake Rweru. And that particular fish is not preferred as food by residents of the wetlands. There is also invasion by the water hyacinth weed that among its responsibilities is reduction of reproduction of fish. At present total value can be estimated at tonnes 550 per annum for the two

⁵ A good example is the Rweru pilot village which was recently awarded 200 modern cattle by the Indian Prime Minister

lakes. The bunch of fish in the picture that may be about two kilograms were purchased on the shore of Lake Rweru for Rwf 2,000(August 2020) when the exchange rate per dollar was on average 0.96.

Table 14: Estimate value of fish in Rweru Bugesera

Tons	Kg	Unit price	In USD	Total Value
550	550,000	1000	0.96	528,000

Picture 5. Fish from Lake Rweru



Picture Fish from Nyiragiseke on the shores of Lake Rweru

Source: Field picture 7/8/2020

There is a distinction between demersal fishing in shore, which is said to be over exploited. However, pelagic or offshore fishing has not been exploited. It is also an important issue for the wise use development options.

But given the number of lakes in the wetlands complex the value would be many times more if sustainable fish culture is considered as a development option to be pursued in the next 30 years as we suggest later.

Regulating services

Table 15: Ecosystem services –regulation values

	Median Value est	% Estimate total basin	Estimate total	Adjusted
Flood control and other regulating services	639	10	254,880,486	25,488,048
			Total	25,488,048

Cultural services

The valuation of tourism is usually by looking at travel cost. In this regard it has been indicated that about 15 to 20 people visit RUMIRA for bird watching spending about US \$ 230. Estimate a minimum of 50 visits or 100 for the entire area per month.

Table16: Estimate Value of Tourism

	Number per year	Travel	Rate US \$	Total
1	1200	Out of pocket Expenditure	230	276,000
2	1200	Transport	50	60,000
3	1200	Accommodation	100	120,000
				456,000

Thus this is an area, which in relation to the development option of the wetlands that needs to be looked into.

Other cultural services

Table 17: Other cultural services

	Rate	%	Estimate ha	Value
Recreation	677	20	7,031,200	1,406,240
Total				

Supporting services

Table 18: Supporting services

	Rate	Per cent	Total	Adjusted
Habitat nursery	277	30	3,778,800	1,133,640
Biodiversity	295	80	4,023,200	3,218,560
				4,352,200

6.5. Summary Total Economic Value of ecosystems the wetlands complex

Table 19: Total Economic Value

	Ecosystem services	Value
1	Provisioning	92,396,338
2	Regulating	25,488,048
3	Cultural	1,862,240
4	Supportive	4,352,200
		124,098,826

In this study, benefits of the wetlands to people and organizations is only part of the complex nature of the wetlands. In terms of sustainable development and wise use of wetlands provisioning is only one of the services. There are regulatory, cultural and support services that are considered as part of the wetlands that need to be invested in as well.

There are various stakeholders with different expectations and influences on the development of the wetlands as already mentioned in the previous sections of methodology and stakeholders. Thus there are trade offs that have to be encountered and which inform the choices in considering development options.

The wetlands are also unique in comparison with other wetlands in the region;

1. The site provides a clear case where wetlands are not regarded as wastelands that need to be reclaimed. The Bugesera depression in both Rwanda and Burundi are renowned for long dry seasons and food shortages. Wetlands support farmers in their proximity to produce food during the dry season
2. Parts of the area have been identified as one of international importance. The area Rweru Mugesera has been proposed as a RAMSAR area while the Landscape of the Northern Lakes is also protected
3. The existence of aquatic areas in form of lakes and marshlands offers a wide spectrum of multifunctional services
4. Nonetheless there is evidence of degradation and unsustainable use of major ecosystem services (next section)
5. Rweru Bugesera clearly demonstrates how there exists several non provisioning services that have led to underestimates of the value of wetlands.

But as a conclusion the value of the wetlands complex is substantially high. It involves lakes and marshlands and the river Akanyaru and Akagera part in

Bugesera as well as the Lakes of the North in Northern Burundi. Above all it is consistent with the view that the values of wetland ecosystems is many times more than that of forests (see e.g. ARCOS 2017) or a single wetland like Mara (Nile Basin 2016)⁶. It is comparable to the synthesis of transboundary values of Sango-Minziro Wetlands (USAID 2016)⁷

7. DEGRADATION

7.1. Introduction

Degradation sees rapid decline in species and habitat diversity mostly in developing countries. The replacement is poorer and human dominated landscapes. World poor including women are thought to be the agents of degradation because they rely on natural resources for survival such as for fuel and other wild products. But this may be a distortion. Some of the destructions of wetlands may be because of richer private investors living away from the wetlands. In our study area there are extensive mining of peat for fuel –not by women but by organizations and for government. In forests, private operators log illicitly for wood and charcoal. But the starting point for this section is that degradation of biodiversity and ecosystems is a reality and current situation recorded and conceded by all the respondents.

7.2. Burundi side of the Wetlands complex

It is conceived that the condition of degradation countrywide gives a picture of what is happening to the wetlands and lakes to the north. Most official documents concede pervasive rates of all sorts of degradation.

In drawing the INDCs (GoB 2015) for Burundi the following are outlined as the major features of degradation in Burundi

1. Drying up of lakes
2. Disappearance of aquatic flora

⁶ The study puts Mara wetlands at \$18,453

⁷ The Sango –Minziro value is slightly above \$200mil-synthesised while this Rweru Bugesera estimates TEV of \$ 41,912,148

3. Deterioration of water quality
4. Increased rain water erosion and siltation
5. Complete silting of dams affecting HEP e.g. Buhiga, Kayenzi
6. Increased run off from land degradation
7. Scarcity of firewood and wood charcoal
8. Flooding in low land
9. Falling water levels of lakes ...Cyohoha, Rweru, Rwihinda, Kazingiri. 400 metres recession in the case of Rweru
10. Disappearance of certain plant species

However there is need to streamline the rates and types of degradation to the local area on the Burundi side.

Delineation of Bugesera area in Burundi is

1. Ecological zone mainly Kirundo and part of Musinga between 2 degrees 18 East and 2 degrees 30 South and 29 degrees East to 30 degrees 33 East. Kirundo 82 per cent of the area while Musinga occupies 12 per cent only.
2. It is bordered to the South by the Central Plateau, North by Lake Rweru and Cyohoha and to the North East by Kagera and Nyabarongo
3. It covers about 151,400 ha and is about 1550 m in altitude

4. The population of Kirundo is well more than 630,000 with a low level of urbanization of about 2.2 per cent and Muyinga also has a population over 630,000 with urbanization rate of 1.8 per cent. It has been generally listed as protected. Paysage Protégé du Nord 2011 to include Cyohoha, Rweru, Gacimirundi, Kanzigiri, Nagitamo, Narungazi, Rwihinda with about 16,242 ha including Murehe Forest(GoB 2013)

The GoB (2013) Strategy on Bugesera depression 2013-2020 states that degradation is caused by demographic pressure, poverty, bad governance and climate change. The Bugesera area has a population density of 408 per sq km in Kirundo. About 90 per cent of the population depends on natural resources on fragile small parcels with low fertility. This justifies why there is population pressure on using marshlands near lakes and along the Akanyaru. There is also here pressure from livestock on the buffer zone of Akanyaru wetlands and Murehe forest. The pressure is also accentuated by poverty among the population with Kirundo having till recently about 80 per cent of the population below the poverty line. The climate change is regarded as a very important driver of the degradation. It has been estimated that average temperature may go up between 1 and 3 degrees. Bugesera is the agro ecological zone most prone and sensitive to climate change. The results have been decline of the water levels mentioned in general change in ecological conditions and the degradation of Akanyaru wetlands. Degradation in the Burundi area has been classified according to its effect on natural biodiversity as different from agro biodiversity.

Natural biodiversity is degraded because of:

1. Pressure of expanding agricultural land
2. Search for pastures
3. Practice of free range pastures
4. Wood resources and vegetation
5. Poverty and few livelihood alternatives

6. Commercialization has depended on vegetation reduction
7. Weak application of laws lack of training on fishing (GoB 2013)

There are specific conditions to lakes and forests. The most notable is Lake Rwihinda also as noted above known as Lac des Oiseax. It is facing pollution and especially traces of pesticides, illicit fishing and invasion of a predatory fish earlier mentioned for Rweru. The most notable forest is Murehe, which is noted as having been encroached by settlement and pastures. There is mining and illegal wood harvesting and invasive species. The Burundi side of the Wetlands Complex includes a corridor referred to as Nyavyamo-Akanyaru-Cohoha-Kazingiri-Rweru-Akagera. The degradation in this corridor includes drainage of marshlands, pollution, inappropriate fishing, deterioration of pastures in Akanyaru, invasion of predatory fish species, water hyacinth in Rweru and fires in Akanyaru.

Agrobiodiversity degradation includes the following;

1. Agricultural practices
2. Soil erosion
3. Low fertility
4. Plant diseases
5. Pastoralism
6. Forestry conversion into agriculture
7. Illicit wood cutting
8. Dry seasons effects (GoB)

As noted the analysis is part of the Strategique Nationale et Action sur la Biodiversity dan le Depression de Bugesera 2013-2020(GoB 2013). Like wise in drawing the IWRM for Burundi it is noted that the problem is poor institutional

arrangement, lack of coordination and poor ownership of instruments. The document further reiterates the recurrent cause of degradation population growth, internal conflict and uncontrolled pollution.

One account also notes on how Kirundo once a 'food basket' of Burundi has become a 'destitute zone.' The same argument of population pressure is also used but this time in relation to movements and conflict. Noted earlier the 1993 conflict led to large numbers of Internally Displaced People (IDPs) by then about 50,000. These used natural resources, burning grass and hacking trees for fuel and shelter. One Director noted that they even used classroom chairs and desks for firewood and their cattle overgrazed, stripping all the land of all vegetation including papyrus and other grass used to make mats.

The same narrative on degradation by human action points to the disappearance of popular trees like eucalyptus in areas of Rugero and Nyamisagara and depletion of the Murehe Forest renown for its bamboo and aquatic grasses. The first decline of water was between 1998 and 1999 but the worst was in 2003 when it is said the area saw no rain at all. Food deficits started to be a visible effect of degradation in 2004.

Consistent with the analysis on legal and policy framework the Strategie point out weak institutional capacity as a major problem related to the Rweru Bugesera wetlands area. As an instance the Institute on Environment and Conservation (INECN) is said to lack qualified personnel, material, finance and has no means to sensitize the local administration. This observation is important in looking at the current situation in light of future wise use that is considered towards the end of the report.

7.3. Rwanda side of the wetlands complex

Rwanda has a historical case of degradation of land, biodiversity and ecosystems. The most common are soil erosion and deforestation. The most immediate effect of erosion is fall in fertility of the soil and loss of arable land.

This in turn makes wetlands very lucrative source of livelihoods leading in turn to over exploitation. It is also known that soil erosion has led to sedimentation in rivers and wetlands, biodiversity loss and crop destruction. The waters of Nyabarongo as are that of Ruvubu are brown, loaded with sediments from surrounding watersheds.

Like Burundi the most important agent has been the anthropogenic agent and especially in the period of mass movement of people and resettlements because of conflict. From 1990- 2015 60 per cent of forests were cleared in favour of other land uses.

WCS (2019) graphically explains the process of degradation as ‘strenuous efforts to produce enough food resources for the ever growing population of the country from limited land resources have resulted into land scarcity, over exploitation, soil and land degradation, deforestation and wetlands degradation.’

Large parts of the country loose between 100-150 tons of soil per hectare per year. It is said that ‘although wetlands are ecologically sensitive ecosystems with indispensable services they offer to sustain livelihoods they have been alarmingly degraded (WCS 2019). Excessive wetland reclamation has taken place.

From 1988 to 2016 about 100,155 ha of wetlands or 36 per cent of original area were converted into other land uses. Between 2000 and 2015 140,000 ha were converted into paddy fields.

Another agent of degradation is climate change, which has led to unexpected floods, droughts and long dray spells. Between 2013 -2017 climate change is responsible to the fall in maize yields by 138.29 kg per hectare.

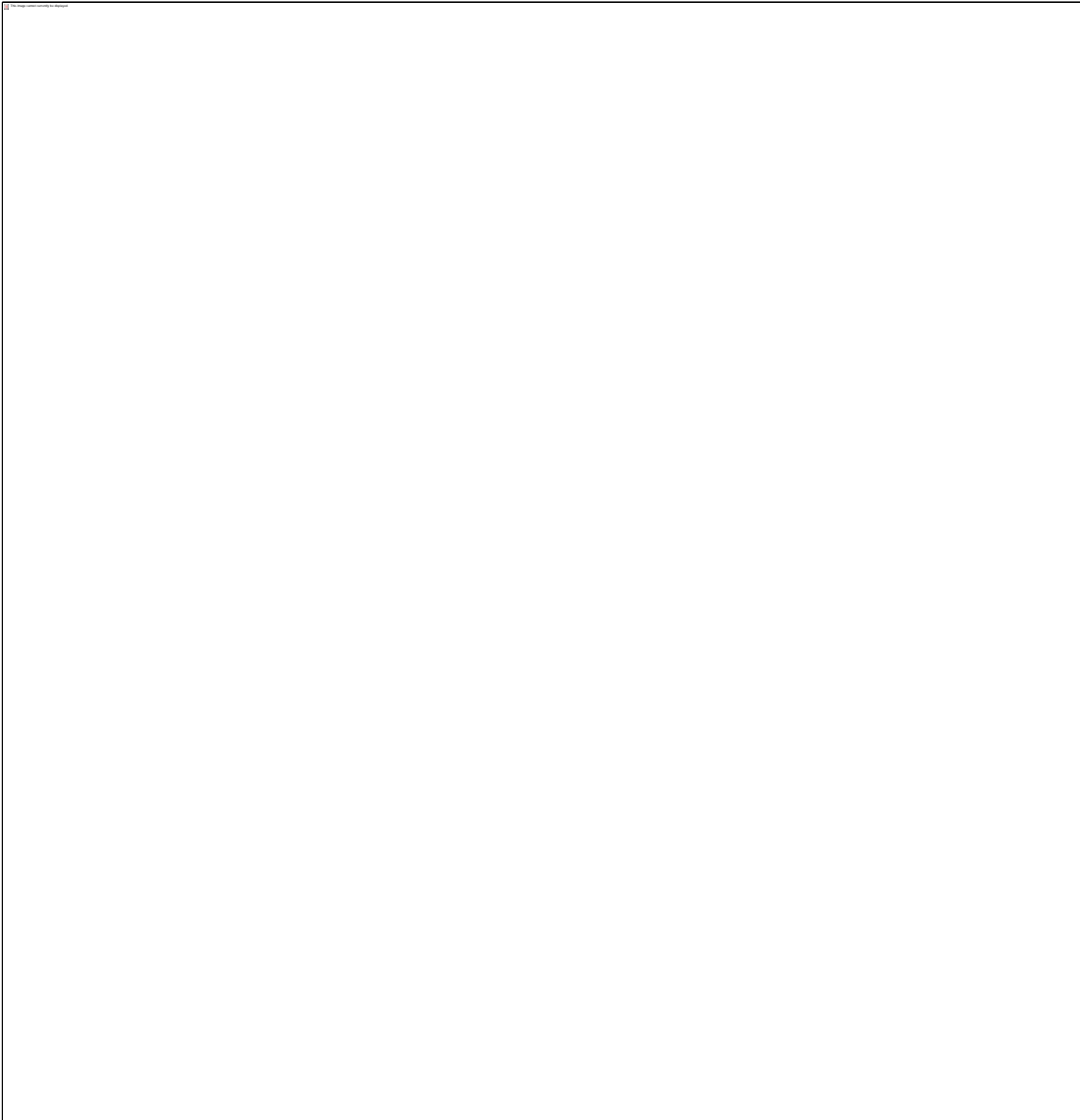
Climate change resulting in natural average temperature by 1 per cent can result in reduction of national coverage of wetlands by 12.5 per cent. Other effects of climate change have been summarized as follows

1. Season creep
2. Flooding of swamps and lowlands
3. Land degradation
4. Shortage of ground water resources
5. Extreme weather event
6. Changes to the growing seasons of crops and forests
7. Unpredictable movements of people

Bugesera

Rweru has endangered bird's species. Grey crowned crane, Malagasy pond heron, Madagascar squacco Heron and Papyrus Gonole. Endangered mammals are Congo clawless otter, potted necked otter hippo and other.

GIS shows evidence of degradation on the Rwanda side using changes in land cover from 1990 to 2015.



The degree of degradation derived from the Rwanda maps reflects what has been happening in the entire area. From the map the wetlands, which used to be 13.1 per cent of the area is now almost zero in percent with only 89.5 hectares left. In the meantime it is clear that cropland shot up to 41.2 per cent and grassland to 13 per cent. Forests have gone down from 21.4 per cent in 1990 to 2.2. per cent in 2015. Settlements have gone up from 0.2 per cent to 1.1 percent.

7.4.Overall

Generally for both Rwanda and Burundi and applying to the Rweru Bugesera Wetlands degradation is a chain reaction. There is a rapid growth of population. In the recent years the annual average has been over 3 per cent and Rwanda 2.5 per cent. In Rwanda, for example, every year the numbers of children who are

born are in excess of 300,000, which is a population of a large district like Bugesera. The majority of these, about 90 per cent in Burundi and 75 per cent in Rwanda depend on agriculture and natural resources. This is dictated by the need to feed the growing population and the need for rapid economic growth. In the 1960s to 1990s the need to feed more people resulted in clearing forests for more arable land. With poor agricultural farming systems the agriculture harmed soil fertility and integrity.

There is also the demand for forest products for fuel and building. The rate of deforestation in Rwanda and Burundi due to the demand for fuel and settlement became clearer in the 1990s and can be related to conflict. It was noted earlier that in 1993 there was a lot of IDPs in Kirundo. That's the time there was massive degradation and destruction of the environment. In Rwanda after 1994 1 in every 3 person was displaced. Related but not in this case study was the occupation of a part of Akagera National Park for settlement. Bugesera on the part of Rwanda received a substantial number of returnees and as recent as 2008 Rwandans from Tanzania were resettled in the vicinities of Lake Rweru.

Noteworthy is that biofuel burning is not only degrading the environment but also leads to indoor pollution. There is resultant pollution of water, which has effect on health as well. There is also degradation resulting from effects of climate change which leads to natural disasters like floods, long dry seasons and famines

Environmental degradation is a common problem in Rwanda and Burundi and the site area in particular. What has been a challenge is the cost of these degradation. The degradation is both in the aquatic masses, the marshlands around them and the watersheds in the study area. Population pressure, soil erosion, grazing, industrial development, weeds -hyacinth- invasion and natural resources exploitation.

We found in section 4 that the case of wetlands as seen in the section is not short of laws policies and strategies. The real issue is why the implementation does not work to control degradation. It is further argued that getting information is one step but another should be a concrete step to reverse degradation, protect and wisely use the wetlands. Besides we also argue that the transboundary dimension of the challenge is still very weak. In both Burundi and Rwanda there are clauses of handling the transboundary challenges but the problems on the wetlands are still binding (The Guideline on IWRM in Burundi and the Water Resources management Rwanda).

In the meantime that we shall analyze wise use it is important to recognize specific deficiencies that may bear on the wetland

1. Lack of payment system to communities like OES
2. Economic policies may tend to offer incentives that encourage their destruction
3. Insecure property rights do not encourage sustainable use
4. Poor enforcement of existing laws and regulation
5. Lack of political will
6. Lack of institutions and capacities
7. Lack of adequate information and knowledge on functions and benefit

Table 20:Major types of degradation in Rweru Bugesera

	Degradation
1 Falling water level Rweru	Drying lakes
2 Falling water level Cyohoha	Drying lakes, sedimentation
3 Unsustainable Fishing Rweru	Overexploitation
5 Unsustainable use of marshlands	Overexploitation

5 Water hyacinth	Pollution
6 Soil erosion	Erosion (Rusumo, over grazing Kirundo)
7 Animal depletion/overhunting	Loss of fauna
8 Disappearance of plants	Loss of flora

Source: Synthesised from reports

The problem of the water hyacinth is probably one of the most prominent of all issues that have attracted transboundary attention. Needless to point out that it affects flows of water into the White Nile and has affected the capacity to fish in the lakes. But above all is the debate of how to control it using alternative approaches like producing fertilizers out of them or handicrafts by women. It has become apparent that besides that the use of the water hyacinth as raw materials for women handicrafts and manure the weed reappears within a short period of time in a manner that sustainable control of the weed is not yet assured by the efforts by NGOs supported by international organizations and the government. Further research in relation to its significance and control seem to be required.

Threats

Threats are a conventional term used in relation to degradation. The following (in the box) are the threats to biodiversity and ecosystems in the study area.

1. Unsustainable agriculture
2. Peat mining
3. Invasive species
4. Bush fires

5. Grass cutting
6. Grazing
7. Bricks making
8. Dam and sand mining
9. Limited and unsustainable buffer zone
10. Use of exotic species
11. Population growth

The threats can be rated according to parts of the Wetlands complex generally as follows;

Table 21: Level of threats in Rweru Bugesera

Threat	Rweru	Cyohoha South	Akanyaru
1 Agriculture	H	H	H
2 Pollution	H	H	H
3 Peat mining	-	-	H
4 Sand and clay mining	L	L	M
5 Invasive species	H	H	H
6 Bush fire	H	L	H
7 Infrastructure development	L	L	M

By way of elaborating the summary in the table agriculture has involved loss of habitat, eutrophication and presence of nitrates and pesticides in drinking water. Pollution has involved loss of sources of water, presence of chemicals in drinking water and impact on food and loss of aesthetic and recreational facilities. Peat has involved loss of habitat, peat layer reduction disappearance

and degraded soil quality as well as reduced water storage and climate change. Clay/sand has led to water turbidity, loss of biodiversity, fish production and siltation. Bush fire leads to loss of habitat and biodiversity and infrastructure leads to loss of habitat, pollution, and water scarcity.

One study, which is clearly transboundary, points to the culprit as weak and ineffective institutions to effect natural resources management policies laws and regulations at lower level (FAO GEF). Another finding, which is quite important for our study, is that there is lack of transboundary mechanisms of addressing conflict around transboundary or shared wetland resources. Although the focus is not on conflict over resources it was noted that in fact there are tensions around the use and fishing in Lake Rweru which is a good pointer of the challenge of planning and managing transboundary resources.

7.5 Cost of degradation

The loss by degradation is immense. Most estimates are national. Thus, combining the estimates for both Rwanda and Burundi and interpolating for a region approximately 8 per cent of both countries could arrive at the cost of the loss for the Rweru Bugesera wetlands. These are conservative estimates because the case study area contains wetlands that are the most vulnerable to degradation by human beings and climate change.

The most recent study on Burundi indicated that the cost of environmental degradation is USD 376 million or 12.1 per cent of GDP (GoB 2014, GoB, WB and TerrAfrica 2018). Land degradation was 4 per cent and water pollution 3.8 per cent. Updating cost of degradation of Rwanda brings an estimate of USD 203 million (UNEP 2007).

As percent of GDP the cost of degradation is high for Burundi 12 percent as well as Rwanda 7 percent compared to other countries with significant levels of degradation. This means the transboundary wetlands of Rweru Bugesera cost of

degradation is well above 27.6 million USD, which is about 1.6 per cent of the GDP of the two countries.

Table 22: Environmental degradation

	Per cent of GDP	Year
Burundi	12.1	2014
CAR	8.0	2010
China	3.5	2010
India	5.7	2013
Rwanda	7	2014

Source: GoB et al (2018)

Cost of deforestation is flow of net benefits as a product of value of ecosystem services per hectare time's annual average acreage deforested over 2001 and 2014. Which in Burundi alone was estimated to be USD 3.4 million or 0.1 per cent of GDP in 2014. It was then estimated that 38 per cent of land in Burundi is under serious degradation.

But this time we need to be careful with applying wholesale the figures to Bugesera Wetlands. Maps show moderate degradation of the soil mainly because the area is not as hilly with slopes as the rest of Rwanda and Burundi.

But of course degradation has many other forms that have affected severely Bugesera. Climate change led to a downward trend in rainfall. For example climate change is estimated to have led to fall in yield worth USD 120 mill per year in Burundi in 2014. One study Munyeshyaka (2016) noticed reduction in production among 90 per cent of the respondents and 85 per cent started getting problems in meeting ordinary obligations like paying school fees. Using a

tenth as the estimate for both countries means this would be about USD 2.4 mill in 2014. The estimate for Wetlands derived from Burundi estimates was 3.8 per cent of GDP meaning the wetlands of the North of Burundi and Rwanda side would perhaps account for 3.8 per cent of GDP.

Yet another way of looking at the loss of degradation is looking at the amount the countries are willing to pay as projects of correcting degradation. The project on landscape restoration in Burundi was put at 30million dollars (GoB 2018)⁸. The project for integrated water resources management of the Bugesera region was estimated at USD 40 million (GIRET). These are costs of replacement, which are definitely low, but which reflect how much is forgone to finance effects of degradation.

In the Scenario building below we have a case of Business As Usual. The estimates are costs of inaction or what could be regarded as linear development assuming population growth continues naturally and food security is secured anyhow from existing natural resources no matter what is happening. In concrete terms if no action against degradation in the wetlands are taken Lakes will dry up by year 2050. In one study a loss of 1 ha is USD 33,000 as a cost of storms of the area (Costanza 2013). Of course this may look high but if it was not Bugesera Wetland as one respondent posited ‘what was the cost of destruction by floods in Kigali City recently? What was the cost of degradation in Gatumba Burundi recently?’ This gives a picture of the cost in a different context for the site area but in relative terms it is costly to lose environmental components through degradation.

On the other hand we tend to see the cost when there is disaster like a drying lake. The drying of Lake Chad sent a lot of messages to the cost of environmental degradation. Cyohoha North is known to have almost dried up in late 1990s. Water levels in Lake Rweru are recorded to be falling and shores receding for

⁸ GoB (2018) Burundi Landscape Restoration project

hundreds of meters. One account threatens that the Lake Rweru and Cyohoha could in no time dry up if nothing is done. In one study Agricultural yield will fall down leading to famines and hunger.

With lack of regulating ecosystem services of the wetlands, effects of climate change will be immense and there will be costs of seeking medical help for an increase of diseases. Escalated water pollution will lead to fall in water quantity and quality flowing from the wetlands downstream the Nile River. The cost of inaction can be in thousand of millions of dollars.

One indicator of limited response to degradation is for example a public environmental expenditure review (WB 2016). For Burundi it found that environment took only 1.6 of budget between 2010 and 2016 and only 1.9 for Rwanda between 2009 and 2013. Mozambique for example had 4.3 per cent between 2007 and 2010.

There is also what is called Environmental Protection Index (EPI) run by Yale University(WB 2016). Burundi scored 43.7 per cent while Rwanda scored slightly higher 50.34 in 2016. In the region Tanzania scored 58.4 per cent, Uganda 57.8 percent and Kenya 62.9 per cent. The Sub Saharan average was 53.29.

Climate change was indicated as an agent of degradation. In the two countries' temperatures are expected to go up on average between 1 and 3 degrees Centigrade. By that rainfalls will for example go up by 10 per cent and seasons disrupted. Looking at Burundi and Rwanda indices for vulnerability and readiness to climate change are not very good.

Table23: Readiness and vulnerability

Readiness	Vulnerability
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Rwanda	0.5	0.6
Burundi	0.35	0.7

Source: GoB (2017)

The latter figures are of course national and may apply differently to the local site are of Rweru and Bugesera but are supportive of the earlier finding of limited action to protect the environment and wetlands despite the large number of laws and strategies in place. But above all the overall meaning of the information is that the ecosystems services in Rweru Bugesera Wetlands are multiple and valuable definitely much more than the figures arrived at so far. But at the same time there is pervasive rates of degradation that threaten the sustainability of the environmental benefits from the area.

8. SCENARIOS AND WISE USE OF WETLANDS RESOURCES

8.1. Introduction

In relation to wetlands the primary task for planning, policy and advocacy is to identify and value ecosystem services in situ. It is important to show holistically how the wetlands complex resources are multiple. It is important to show that focusing on provisioning only is incomplete without considering the role of regulating, culture and support services in the development of the wetland complex as a transboundary entity or in parts across the borders of both Burundi and Rwanda. From the previous section it has become clear that identification is not enough. Although it is possible to show how valuable are wetlands using available data and ecosystems identified the knowledge is not complete. More comprehensive mapping and valuation using different methods is required. Nonetheless it is possible to use the current state of information to look into trajectories of development. The aim being sustainable uses of the wetland resources that are valuable but currently vulnerable. In fact this means wise use of wetlands should not wait till when all the prices are right and known and all valuations are complete and precise.

8.2 Scenarios

Typical scenarios are threefold. There is Business As Usual, which is like **Linear Development**, then there is a **Worst Case Scenario** and then there is the **Best Case Scenario**. In our assessment there is need to consider each within a context of a transboundary site involving more than one country. It is also for better appreciation to give these a time horizon of say 30 years or intervention in wetlands management to 2050.

Business As Usual

With narrow economic objectives of rapid economic growth and operating from a localized approach of managing the Rweru Bugesera Wetlands means its not only Business as usual but the end result after 30 years will be not be better than today. All anthropogenic activities continue and the traditional environmental resources are used without any major effort to put in interventions that are based on multi stakeholder benefits. The management of ecosystems is localized at community and national levels. It is fortunate if people will attain some economic growth especially if individual group interests will prevail and the pressure of population growth and climate change lead to a future that is worse than the present.

Worst Case Scenario

The worst is most pessimistic and undesirable. The Business As Usual may bring deterioration but the waste case scenario is when not only there is localized management of ecosystem resources but also the wetlands are damaged seriously to the extent that in 30 years some of the components of the wetlands have disappeared and people around the wetlands are worse off substantially. These wetlands were damaged in the process of pursuing narrow economic benefits with disregard to sustainable use of the wetlands for which a few people in few categories of stakeholders benefited at the expense of transboundary benefits and future generation.

Best Case Scenario

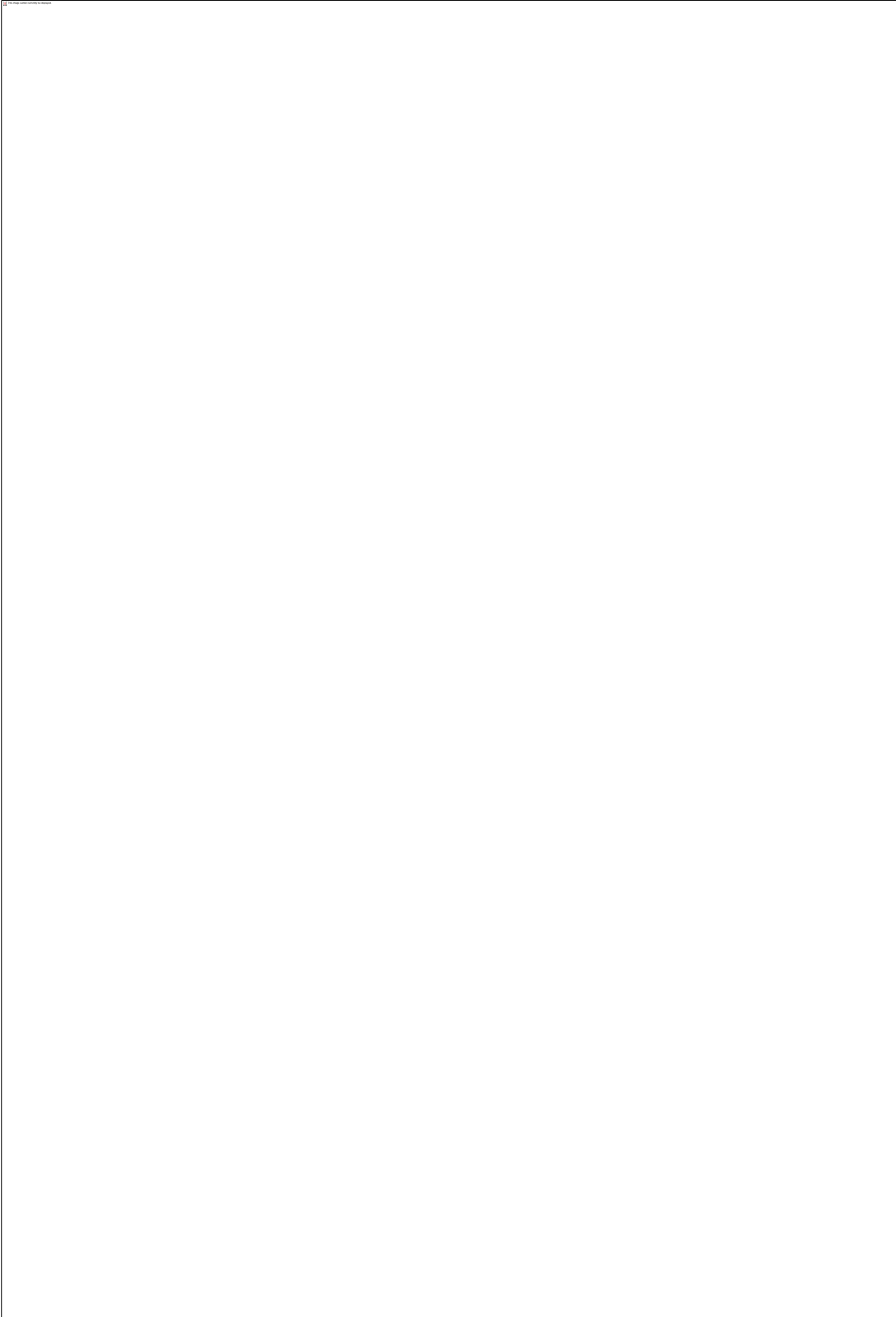
The scenario involves cognizance and application of sustainability principles at economic, social and environmental levels. There is also consideration of transboundary and most likely the integrated approach involving multinational and multi-stakeholders participation and benefit. There is use of technology to best practices of integrated resource management to achieve maximum benefits with minimum degradation in the next 30 years. By 2050 the use of the wetlands resources have brought improved livelihoods to residents of the transboundary area and peaceful use of the resources sustainably. This is the optimistic scenario that development of the wetlands complex is most likely to strive working for.

8.3. Wise use development options

In analyzing issues that have been considered in an integrated and comprehensive management of the wetlands a number of themes that are not mutually exclusive and which are not exhaustive were identified in the assessment. These have added to 26 components, which can be looked at independently. The components are summarized looking at them in the lenses of the three scenarios.

In the Table that follows are the 26 issues that are viewed within the three scenarios red for worst case scenario, yellow for linear or Business As Usual and green for best case scenario or wise use

Table 24: Scenario of development components of the wetlands complex



In the rest of this section each of the component is described briefly in relation to wise use or best-case scenario and the challenges to be addressed.

1. Laws, policies and strategies

The legal and regulatory framework was seen to be abundant and robust to most sectors. Most of these are time bound and the primary concern is implementation where and how. But it is clear there are no legal and transboundary mechanisms that can look after decisions on Rweru Bugesera as an area. It has not been possible to get information on local level decrees and by laws. Indeed despite the existence of these instruments there have been tensions and misunderstanding on for example the fishing rights in the Rweru Lake. The wetlands development and wise use will continue to depend on what takes place in the respective countries.

An expert noted that in each of the countries the convening powers of authorities on environment are still weak. There is a good environment for protection of the environment of the wetlands mainly due to international conventions and targets like CBD, SDGs and Aichi agreements. Yet it is absolutely true that rapid economic growth and poverty reduction may take precedence to environmental protection especially in countries where agricultural development is the immediate backbone of the respective economies.

Another expert noted positively that each water and environmental body in the two countries of Burundi and Rwanda have mechanisms of handling transboundary matters. On paper yes and by another expert the only hope for a transboundary intervention is through the Nile Basin and in particular NELSAP. The issue is to what extent can NELSAP have the executive authority of guiding specific wise action across borders. Truly there are projects that have been done and are taking place with a transboundary mandate but these do not lead to concrete follow up if the members of the two sides of the wetlands do not take ownership of the outcomes.

There is high expectation of using international intervention like RAMSAR convention. The example of Rugezi wetlands in Rwanda has been cited. There are 4 areas under RAMSAR in Burundi. One expert cited the example of Ruvubu National Park in Burundi and the Lakes of the North the latter virtually in the case study area to point out the overall weakness when the issue has to do with downstream countries of the Nile Basin. Protection does not prevent building for example more dams along the resources such as the Ruvubu. Protection does not mean prevention of possible pollution by water hyacinth or other bad practices although for wetlands. The issue remains of getting instruments and mechanisms of enforcing wise use of Rweru Bugesera Wetlands from local to regional and global levels including looking at which collaborative evidence and powers can enable NBI to impress wise use on all stakeholders.

Overall the suggestions by the Strategie for Bugesera Depression 2013-2020 on Burundi side is also relevant for the whole area;

1. To ensure institutions at provincial, communal level and local level are in place in relation to the Wetlands Complex. On the Rwanda side the provincial level is equivalent to the Bugesera District
2. Legal enforcements of instruments that are in place
3. Local conservation initiatives
4. Civil society participation
5. Tourism potential exploitation
6. Corridor for animal migration between Murehe (Burundi) and Gako (Rwanda)
7. Buffer zones creations and protection
8. Transboundary ecosystem management

9. Water

Water has been cited as the most important component of the ecosystems in the Wetlands Complex of Rweru Bugesera. Here focus is on water for drinking, for livestock, for agriculture through irrigation and for fishing grounds. Fishing is considered separately as is agriculture because they all need wise use considerations for sustainable development of the wetlands. But what has been missed in all studies is the requirement of water for the Nile Basin in quantity and quality. Wise Use of Rweru Bugesera Wetlands is for local demands but it is also for water down stream. The nearest down stream demand is the Rusumo Hydro Electric Dam. By quantities less water from Kagera and Rwanda that pass through Rweru will have a bearing on the amounts of water flowing into the Rusumo Dam. It should be recalled also that Rweru is also connected to Cyohoha South and Akanyaru. Even if the quantity could be assured through holistic wise use and protection of the environment there is the issue mentioned of water pollution either by water hyacinth and chemicals. Wise use in broad terms is also about how the quantity and quality of the water in situ the wetlands can be assured.

But then is the wise use of water endogenous to the lakes, rivers and marshlands of the area? It would for example be another issue if there were disproportionately large amounts of water being drawn for irrigation. But most of the falling water levels in the Lakes for the moment is more because of sedimentation from agriculture, falling rainfall following climate change and deforestation but also from inadequate protection of watercourses in the area. Water levels in lake Rweru and Cyohoha south went down by half. Water was seen to have receded by 400m on Burundi side. Cyohoha North had dried up and now is being restored. Agriculture and peat mining at industrial scale are invading Akanyaru

The consideration of the water sector therefore brings in the issue of ex-situ actions that are important for the wetlands and the Nile Basin. It is therefore important to point out that wise use with regard to waters of Rweru Bugesera should include ex situ interventions in watershed management and reduction of dependency of communities on the wetlands as suggested by one respondent.

This not only includes hillside irrigation but also the rainwater harvesting that ensures availability of water for other uses away from the valleys.

10. Agriculture

The aspects of wise use in this section are not mutually exclusive. There is a nexus between agriculture, biodiversity, ecosystem services and externalities including human health. There is also as in some sections nexus between food, water and energy. But as noted agriculture is both the candidate and villain of protection. It has been mentioned that over time the need to expand agriculture has encroached on environment. The food security needs have exerted pressure on wetlands. The GIS showed that as cropland increased drastically pristine wetlands with their natural ecosystems and biodiversity diminished quickly.

Yet on both sides (by countries) there is policy drive for rice intensification projects. The agriculture is also the meeting place of all stakeholders and disciplines. The private investor local or international would like to reap from agriculture in the most productive wetlands. For decades communities have depended on the valleys for surviving long spells of the dry season. There has been expansion of arable land in all types of ecosystems. Thus although the highest prospects are from development of agriculture, it is also one of the major concerns with regard to emission of Green House Gases that accelerate effects of climate change. In the wetlands agriculture can change the water table and elevate levels of evaporation and evotranspiration. Agriculture has also interaction with ecosystems, agricultural lands, pastures inland fisheries infrastructure technology policies, regulation, institutions, culture, traditions involving growing, processing, distributing and consuming food-value chains

Agriculture is a meeting point of competing aspirations requiring tradeoffs; agronomist- with feeding growing population, environment –saving the planet, sociology with sustainable rural livelihood and economists with efficient markets for cheap food.

To be more specific and relevant is a need to know where in the wetlands is agriculture and how and which crops. This is the component of the ecosystem where technologies can enhance productivities and feed more numbers without expanding cropland. But also this is the aspect where climate smart agriculture can be used to promote less effect of agriculture on climate change.

There are cases where people like near Lake Rweru in Rwanda are moved to drier lands to conserve the wetlands. These are accompanied by other interventions to promote watershed management and other practices that stimulate agriculture that reduces dependency on wetlands. This is the green water infrastructure development ex situ. There is also the need to see how other water bodies can be used for economically efficient irrigation that can enhance all season agriculture without harming the sustainability of the 'blue' water.

Integrated transboundary interventions were proposed by GIRET. But there has been no single project that considers agriculture in the context of the Rweru Bugesera Transboundary Wetlands as one and cognizant of other components of the ecosystems and most especially the participation of other stakeholders.

11. Fishing

Just as important is water fish is also an important aspect of biodiversity and ecosystems that evokes the need for wise use. Firstly it is important to promote fish as source of livelihood and income in all water bodies that are plentiful in the site area. Many of the lakes whether because of pollution or because of other chemical reasons have not contributed a lot to production of fish. Indeed aquaculture may be through other freshwater ponds in the area.

It was also reported that fish is a source of conflict in Lake Rweru. It appears that there has been over fishing in a manner that fish has become scarce in the lake and some fishermen cross borders of countries in search of fish. The practice

brings back the localized view of the resources in the site. But because fish do not know any boundary, strategies to make the lakes more sustainable in producing fish for food and market policies and regulation on fish exploitation would need to be transboundary. If it is to avoid fishing for some months to allow reproduction of fish this would better be transboundary. If it is to use less damaging techniques of fishing this needs to be transboundary in Rweru, Cyohoha and Akanyaru.

Two more problems that will be mentioned below are the invasion of predatory species and the problem of the water hyacinth. The fish that eats other smaller fish and is not eaten is a problem to the lakes generally. The effect of the water hyacinth to the flow of water out of Rweru is common also just as is the diversion of the course of the Kagera River away from Rweru, which is also common to both countries as it is connected to the discharge into the Nile upper headwaters.

12. Livestock

Livestock is part of agriculture. It was mentioned as part of the stakes in the wetlands. It was mentioned how over the years free range livestock became an agent of degradation in the areas of Kirundo and Busoni. It was mentioned how large tracts of land are being required for beef cattle ranches in the areas of Gako in Rwanda or the other side of Murehe forest in Burundi. There is a question of which breeds of animals need to be promoted and where. It's also a question of ruminants. Yet above all livestock especially cattle can also be accelerators of climate change. But livestock can be used in an integrated approach as a source of nutritious food, income and manure. The Prime Minister of India gave the residents of Rweru village, on the Rwanda side stocks of hybrid cows. These productive breeds do not have to forage and destroy the environment as they are based in stalls using zero grazing method. But there is need to have information and data on how this approach can be pervasively used over the wetlands and how they can reduce over reliance and unsustainable use of the marshlands near the wetlands.

13. Marshlands

Marshland is almost what most understands by the wetlands. Indeed these are almost second important in the site area. This is because they are not only eligible for agriculture but are the ones that have the most important for regulatory services as ‘kidneys of the landscape’ and ‘supermarkets of the wild’. There is logic from our previous analysis that every stakeholder feels wise by exploiting the marshlands because any way in other cases they would be regarded as wastelands. From GIS and secondary data almost all marshlands have been or about to be exploited. The wisdom in doing this has been mediated by the previous drying of Cyohoha lakes. But above all there has been no account of how many species of flora and fauna have been lost-the animals, the wild and cultural goods and most especially the birds. Wise Use however is on the wisdom of having some areas for agriculture, which is sustainable, and others that can be preserved for their biological values. This needs knowledge on which marshes if any would rather be protected and which would need to be restored for long term and climate change purposes. Indeed there is evidence that restoration of marshlands is possible(e.g. Rugezi in Rwanda).

There seem to have been studies on these and especially for the RAMSAR convention in identifying which of these are of international importance. But these seem to have been for some areas of the site and argue for protection from the localized and national interests without mainstreaming the transboundary and riparian interests.

14. Restoration

Which wetlands and especially marshlands have been abused and are a liability to biodiversity and ecosystems. Field observations show extensively developed valleys that with or without government interventions are being exploited for agriculture. The crop of rice and vegetables seem to have thrived well in the valleys in the increased exploitation over the last 15 years. But which of these wetlands in Rweru Bugesera wetlands complex could be eligible for restoration

into beds for biodiversity and ecosystem services that can sustain the environment in the medium to long term future.

15. Watershed management

The Bugesera depression seems to be regarded as lowlands that are not prone to heavy soil erosion. The area is however clearly in the Nile Basin or even more specifically the Akagera Basin. There are hills in Bugesera and Murehe Forest in Kirundo are catchment areas of the Lakes Rwihinda and others in the area. Watershed management is now a discipline by itself and present an ex situ consideration of wetlands management as noted before. Again there have been projects from the management of watersheds and encouraging hillside irrigation as a wise intervention that can protect valleys that provide water into the Akagera and subsequently the Nile. But these have been standalone according to their financing bodies and respective government or regional bodies promoting them. None has had a geographical scope involving the Rweru Bugesera Wetlands Complex as such with planned results of wise development of the area.

16. Pollution

Pollution in the Rweru Bugesera Wetland seems to be an area of interest in justifying the site as of transboundary concern. It was argued that the wetlands complex is important in the Nile Discourse because it is the headwaters or the origin of the Nile. It was noted that the bigger controversies are around Blue Nile Waters between Egypt, Sudan and Ethiopia. However taking the Nile Basin as one is the *modus operandi*. But now in fact as regards pollution by chemicals or

pesticides or water hyacinth is a concern to upstream areas of the Nile Basin and need to be addressed as part of the site but also as of importance to the Basin. Studies that have been attempted by different stakeholders need to be coordinated and different interests and influences considered

17. Regulation ecosystem services

In the preliminary sections of the report this was elaborated clearly as important to economic valuations. The economic valuations of biodiversity and ecosystems have become important because of pointing out the importance of the non marketable and non provisioning goods and services that are valued because of their capacity to regulate the environment. The wise use concept is incomplete because it is not possible to take stock adequately of the regulatory services and possibly give them a value. The escape root has been to value provisioning and those few regulatory services that can be reasonably estimated. It is sensible. But how much are the regulatory services of the wetlands complex known as one transboundary body? For example there is a good study on Rwanda Bugesera ecosystems that was carried out about 6 years ago. There is equally or even more detailed study of biodiversity of Cyohoha from Burundi side, which sheds light on what of pristine flora, and fauna is still available but these are just localized and have no transboundary focus and usefulness to the entire region.

18. Cultural ecosystem services

The Millennium Ecosystems Assessment includes cultural services as part of the ecosystem typology presented in section 2. Like regulatory services it is easy to overlook it because of difficulties of identification and quantification. In other cases it is important when tourism and recreational potential are considered as cultural. These are considered separately below. There has not been a comprehensive study on the value quantitatively of other cultural services from the wetlands complex. One specific case is the use of papyrus in making mats and handicrafts. There are elements of aesthetics that can be derived from visiting and the natural or very deep respects of marshlands like Kayumba as

refuge of people during the Genocide against Tutsi in Rwanda. This is also close to a literature on how the Akagera River has been equated to the conveyance to the Nile for bodies that were being disposed of during the Genocide against Tutsi. The latter may become important when people who may also visit other parts of wetlands complex visit some sites of genocide in the Bugesera area. May be least said but culturally important are wetlands as rendezvous for rituals and practices among young girls on their journey to adulthood where they learn to weave mats and exchange secrets of the transitions into adulthood.

19. Biodiversity

Biodiversity was referred to in several areas as central to the study but also as part of the ecosystems and sort of studied for decisions for international importance of wetlands. Degradation was classified as natural or agricultural. It is in this regard that for the future development of the wetlands complex the position of biodiversity is important. It is biodiversity that makes sense out of conservation and wise management of wetlands. The worst-case scenario will be when all hotspots for biodiversity and species of international importance become extinct. These range from mammals to rare birds and plants.

20. Transport

There used to be an interest in transport on the stretch of the Akagera River that is navigable. There is no study indicating use of the Lake Rweru and Cyohoha for cross border transport. Yet there is definitely a potentiality that has not been fully exploited on promotion of water sports in lakes through kayaking and using canoes for fishing as a sport. Again the issue of transport and other possible services emphasize the hypothesis that ecosystem and biodiversity hotspots are usually undervalued and when their value is appreciated there lacks holistic or coordinated evidence with transboundary value.

21. Energy

All studies in the RBWC are relative. There is no quantification of energy services offered by forests through wood as fuels. However and is its used here there are estimates of indoor pollution caused by burning wood. There would thus be a need to know in quantitative terms how much energy can be extracted from sources that do not damage the environment. There is high potential of peat as a source of energy and a lot of work has been done in the Akanyaru. A plant is being completed that will generate electricity to the area in both countries from peat. The advantages of using the Rusumo HEP must be plenty but these need to be viewed on how they can assist among other important roles, the sustainability of the wetlands complex especially access to electricity from renewable sources can augment demand for power and thus sustainability.

The energy sector in relation to agriculture presents the most vivid tradeoff (ARCOS 2019). Achieving energy transition goals might constraint certain agricultural transformation of water for irrigation. If agriculture for irrigation was prioritized then it would compromise HEP.

22. Medicine

Several studies have shown abundance of herbs and traditional medicine. There is no comprehensive research on how these are important in their communities, how they can be used in the context of Indigenous Knowledge and how thus they can be valued as replacement cost for over the counter drugs in pharmacies. Another possibility would be how insignificant and perhaps how unviable are these sources of cure because of the degree of degradation and the impossibility of getting the same upland.

23. Wild goods

Wild goods are a broad concept. It would include for instance wild fruits, wild vegetables, wild tubers and perhaps even honey. To what extent these have been damaged is important to know and how it is possible to preserve some of these or wisely switch to the substitutes if any upland. A common wild good that

is cited often is building material directly as a product of the wetlands as ‘super markets’ of the wild or perhaps in an organized manner like getting bricks from kilns in the adjacent areas to the wetland as well as sand mining.

24. Wild animals and birds

The animals in the wetlands may have been decimated as a result of degradation, hunting and bush fires (Akanyaru). In this study some were just mentioned but no quantities were given. There are other studies that indicate as part of biodiversity disappearance of some species of loss the animals (eg Sitatunga) that can no longer be viewed. For the lake basin there are studies showing the threat to birds. In turn it has been shown that the area has a big potential of avitourism. It is still possible to ensure Lake Rwihinda is still Lac des Oiseaux 30 years from today. The first step, which may have been done, to a good extent is knowing the location and quantities followed by enforcing measures to protect the areas over a period of time and putting in place plans to promote activities such as tourism that would make them viable while protected from human action.

25. Gender and Youth

GIRET and correctly so identified gender as an important planning and management wetlands. What is the role of the woman in protecting and good management of resources in the wetlands? But also what are the consequences of degradation to the work of women and how is inclusion in the process of conserving and good.

The discussion of future and sustainable use of resources has to include the youth. The rationale is not social inclusion but also a way of creating jobs in the wetlands and natural resources sector and issue of ownership because in 30 years plus the youth will be the adults who will be required to use the resources even more wisely. Inclusion of women, youth and men who understand the role

of gender is in the sense of SDGs and sustainability part of wise use and will address issues of development and poverty reduction in the areas meaningful.

26. Tourism and recreation

Tourism in Burundi and Rwanda is a major foreign exchange earner. It was included in the valuation of ecosystem services. However in looking at development options, tourism is currently very underdeveloped and undeveloped. Looking ahead to create more income and reduce the burden on the wetlands tourism is a wise promotion for the area. Yet tourism cannot be about bird watching only. A visit to the site shows no hotels near the area. The logic is that Bujumbura and Kigali are both short driving distances from the areas. But it is also true that other attractive areas in Burundi and Rwanda are also reachable from the capitals and yet tourists spend money in those areas. The environment for tourism and recreation can support the wise use of the environmental hot spots especially the lakes and the birds in all the sub basins including Akanyaru. Of course this will go hand in hand in with developing other forms of tourism in the proximity of the wetlands such as the Ruvubu National Park or ecotourism in Rwanda. It is also noteworthy that there are also types of recreation that would need to be facilitated and developed given the abundance of lakes and the river.

27. Research and scientific work

There is here and there statement of what needs to be known. Knowledge gaps are the first area of research. There is biodiversity research, conservation research and social economic research. Indeed where there is information it has been for specific localized parts of the wetlands or national. Another area is how the wise use needs Payment of Ecosystem Services and livelihood research. Research is supposed to provide evidence for actions and effects of trade offs. Each category of stakeholders, the benefits and cost of specific actions done need to be known. The innovative action and technology uptake for efficient production in different sectors and disciplines need research. Monitoring and

evaluation of progress, precaution and prediction of consequences needs information and its dissemination.

28. Settlement

The GIS analysis showed how settlements even if a small share have increased tremendously over the years. In fact settlement showed a larger share of 1.1 per cent than marshlands around the lakes. Settlements issues were described at national and localized level and not at site level-RBWC. But in terms of wise use it is also important to address where to locate settlements. Where communities have for centuries lived by the lake or marshlands encouraging them to settle away from their source of livelihoods need to be well informed to be wise. This is in terms of what alternative and attractive livelihoods can be promoted. Where settlements may continue to be in the proximity of the wetlands the participation in conservation or sustainable production should be informed by knowledge and understanding as soon as it is possible. Settlements as noted may also have to be informed by cost of healthy livelihoods in the proximity of marshlands or on watersheds.

29. Infrastructure

Infrastructure is a broad concept. It means roads that may link the site and prospective attractive areas ex situ. Green water infrastructure means infrastructure that will promote the preservation of the environment. The immediate issue that needs further knowledge ex situ is the relationship between different infrastructure and the wetlands. A good example that qualifies Bugesera depression as a Cinderella agro ecological zone is the number of infrastructural investments that have taken place at the Rwanda side.

These for now include, Kigali Leather Industry, Imana Steel Industry, PEAL Ltd, Maleba Ltd and Bugesera Industrial Park. Forthcoming are Kanyonyomba Water Treatment Plant, Gako Beef project, Gako Irrigation scheme, Rwanda Institute for Conservation Agriculture, Ntare School, Kanzenze Water Treatment Plant,

Cassava Processing Industry, Bugesera Stadium Construction and Mayange Rice Company.

Bugesera area is now home of a new Bugesera International Airport. This will be larger than the small airstrip near Musinga or even Bujumbura and Kigali. It has a good Environmental Impact Assessment. But in perspective what knowledge need to be gathered for the transboundary wise use and development trajectory of over 30 years? What could be done to encourage these and others in the wetlands to use green technologies and infrastructure? What are the implications of rapid development to principles of complementarity, reciprocity and equity common in the Nile Basin discourses?

30. Community awareness and information

In one study it was indicated that the level of knowledge of the need for protection of environment is not more than 30 per cent. GIRET transboundary project had included this as an area to invest in for sustainable use of water resources. Awareness and information is important for effective participation in wise use of the area. There is a wide network of information sharing but this also may not be coordinated for the wetlands sub basin under study. The matter may involve a good study of communication actors, needs and what needs to be done exclusively for the wetlands complex.

31. Financing

One question is the availability of funds for the wise use actions. It has been argued by a number of respondents that a big constraint has been the finances to undertake sustainable actions in that even environmental ministries still get relative low shares of national budgets. But there is also the issue of many projects sponsored by bilateral and multilateral partners of Burundi and Rwanda that may not always consult to have a coordinated approach to the area. The existence of EAC and Lake Victoria Basin, the Akagera Basin, the African Union and Nile Basin is an advantage to the area. Yet it would be interesting to know

whether there is a common understanding of the geographical and transboundary nature of wetlands complex.

One instance of transboundary financing is the implementation of the Rusumo Hydroelectric power station. Which lessons can it give on thinking of finances for a transboundary mega project? How does inadequacy of funds and resources compromise wise use of the wetlands and how can resources be mobilized? In the Nile Basin framework upstream wetlands with endogenous water uses such as Burundi and Rwanda need to provide evidence of how they are part of the benefit-sharing framework and shared vision of peace building and poverty reduction in the Nile Basin an issue that in within the transboundary nature of wetlands complex .

An example of a transboundary multi-finance project is for example Lake Kivu and Rusizi River Basin on Water Quality Management project with grants from donors and in kind contribution by the government and other funders; African Development Fund \$10.65 mil, African Water Facility \$5mill,GIZ\$2mill,REG 2.3 mill ,Nordic Development Fund \$3.2mill and in kind \$ 1 mill GoB,\$1 mil GoR \$ 1 mill and DRC \$ 1 mill a total of \$ 26.15mil for water quality only

32. Capacity building

Capacity building is about individuals, organizations and institutions. For climate change effect on wetlands there is need for, information, education and communication. There is need to strengthen aptitudes of people especially women and farmers for intensified sustainable production. There is need to build capacity for ex situ production practices and capacity to support institutions for adaptation priorities.

33. Technology

Technology is one of the key inputs in the best-case scenario. It is required for efficiency in production and ability to shift to alternative production modes. Technology should be used to improve access to water while enhancing efficiency use. Technology has to be used in efficient and sustainable water use in agriculture especially sustainable technology. Technology is important in dissemination of information, communication and education. Technology is required in providing renewable energy facilities. Technology can be used to provide communication on climate risks and adaptation to the risks.

There have been several studies and there are activities going on each or some of these components together. There are authorities of different calibers at national, regional and basin levels working on the management of natural resources. What have they been doing and how effective are their interventions? It is important then to see what are the options for development of one or all of the geophysical components of the wetlands as well as across the different ecosystem services.

1. How is conservation and exploitation determined in which components and where?
2. Which activities in the site area indicate concern for wise use and which activities are BAU
3. For which developments can we see long term risks of sustainability and by how much?
4. Which aspects are national and which are transboundary?
5. Where are sectoral priorities across the basin?

Development as noted is literally exploitation as opposed to full protection. What is actually happening is some amount of each is happening. What is important is how wise or sustainable is the current use of the wetland resources.

As noted (HDR 2006) Business As Usual without proper management can lead to disaster.

“Mismanagement of international water basins threatens human security in some direct ways. Shrinking lakes and drying rivers affect livelihoods in agriculture and fisheries, deteriorating water quality harmful consequences for health, unpredictable disruption in water flows exacerbate effects of drought and floods “

Rwanda and Burundi are both poor countries. Maximizing growth from the same natural assets in the wetlands is important for sustainability as in the following direct instances

1. Using output from available natural assets such as fishing techniques and practices that avoid catching young fish
2. Sustainability increase demand for natural resource goods and services such as tourism
3. Encouraging technical change through using technology to increase natural resource productivity such as use of efficient technology
4. Growth through increasing the capital stock can be achieved by investments, policies and institutions for natural capital and removing the constraints to greater investments financing

A holistic understanding of the environment and looking at the entire wetlands complex in that robust sense

1. Soils, water, climate and landscape
2. Flora, fauna, ecosystems and biodiversity
3. Use of land and sites of special significance
4. Heritage, recreation, and cultural assets
5. Considering links of the understanding to livelihoods

A worst-case scenario can be reached by investments that do not lead to reduction of degradation in the Nile Basin such as

1. Degrading agricultural lands
1. Falling water levels
2. Shrinking forests
3. Diminishing supply of clean water
4. Dwindling fisheries
5. Climate change effects
6. Water weeds

At wetlands level the following features may characterize the localized approach;

1. Conversion to other uses, thus destroying flood buffers and resulting in siltation, pollution, biodiversity and floods;
2. A scarcity of agricultural land;
3. Condemnation of wetlands as a breeding ground for mosquitoes;
4. Decline in fish catches and preferred fish species in the rivers and lakes;
5. Poverty and lack of employment opportunities;
6. Ill-defined wetland boundaries;
7. Unsustainable resource harvesting;
8. Low awareness of wetland economic values and ecological functions;
9. Inadequate legislation enforcement and compliance;
10. An increase in water hyacinth; and
11. Climate change, which may also threaten the hydrological regime of wetlands

It may be realized that this will still be a broad brush reviewed from different interventions, which is better said than done.

8.4. Integrated approach to Sustainable Rweru Bugesera Wetlands Development

In the previous section 26 components were discussed. They could be more or less. The immediate operational issue would be how to handle them if some interventions are conceived. Most likely you may not have as many project interventions as indicated. An approach suggested is that which integrated several and related themes that would create synergies and efficiency in development as well addressing tradeoff that are internally common in the respective sectors or components. They are presented in the following Table 24 as pillars

Table 24: Proposed pillars for integrated approach to development options

Development areas of intervention	Components

Pillar 1.	Wise Use of lakes, marshes and the river	1.	Water resources
		2.	Agriculture
		3.	Livestock
		4.	Fishing
		5.	Energy
Pillar 2.	Protection, restoration and conservation of strategic areas in RBWC	1.	Regulation
		2.	Biodiversity
		3.	Cultural services
		4.	Wild goods
		5.	Wild animals
Pillar 3	Promotion of Green water infrastructure development	1.	Transport
		2.	Watershed management
		3.	Tourism and recreation
		4.	Technology
		5.	Settlements
Pillar 4	Governance and Enabling drivers for sustainable development	1.	Transboundary laws and regulation
		2.	Gender and youth and stakeholder roles
		3.	Awareness Information and education
		4.	Capacity building
		5.	Financing
		6.	Research and science

The list can go on. But the issue is to understand that development options are a matter of choice. But then choice in economics is always rational under resource scarcity. Wise use is choice of combination of actions involving multiple activities to get maximum benefits and sustainable development under resource scarcity.

Of promoting wise use there are other important interventions that have been noted by other studies. These include promotion of associations and cooperatives that are used to mobilize efficient working of communities in the area. There is also creation of markets, improving property rights, refining international policies and improving governance as a whole.

As one respondent who is responsible and an expert in wetlands and the RAMSAR convention put it there is no full knowledge of the state of the wetlands in terms of biodiversity and ecosystems as well as their value. Indeed as these are known and little or no action is taken the end result in the medium and long run is destruction much worse than what is noticeable today. Development options should involve forward looking, guiding integrated and comprehensive action and forestalling future disaster

Oladele talking of Urgency of RAMSAR Convention on Wetlands in Africa states that 'work is not being done effectively because of lack of political will and human resources among others to implement the convection'. But against our problem of transboundary entities may be pitted against the believing more in national sovereignties of riparian countries. For instance AU (2020) on issues of conservation of Nature and Natural Resources lists species that need to be protected. Yet it has a statement that in a way covers each state in taking action but in a way obliges them to respect interest of others.

'Reaffirming that states have in accordance with the Charter of the United Nations and the principles of international law, a sovereign right to exploit their own resources pursuant to their environmental and developmental policies'

But also obliges them to respect interest of other countries; 'the responsibility to ensure that activities without their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction'

In any way it should be clear that development options do not mean exclusion of some activities and not others. Some areas will be for conservation, others for restoration and other for natural resources efficient.

9.CONCLUSION

The Rweru - Bugesera Wetlands Complex is an environmental hotspot in the Nile Basin, which consists of aquatic ecosystems, rivers and marshlands located between Northern Burundi and Eastern Rwanda. It is a transboundary area with Rweru Mugesera, Cyohoha and Akanyaru sub basins. The following facts and findings summarizes the assessment

1. The Rweru Bugesera Wetlands complex represents the southernmost chain of wetlands in the Nile Basin with the headwater of the Nile River from what is believed to be the source of the Nile. The site shares a common agro ecological zone of Bugesera between Burundi and Rwanda and encompasses the administrative districts of Kirundo in Burundi and Bugesera in Rwanda.
2. Studies and projects have been carried out on the area but in a disjoint manner by different organizations interested in the area for different authorities and at different country levels. There has not be any coordinated effort to put evaluate knowledge available on the ecosystems of the wetlands as a transboundary entity.
3. The site clearly has multiple ecosystems services and multiple stakeholders. But a lot of more knowledge and values are wanting. A comprehensive mapping of the environmental stocks and flows has not been done for the area as one.
4. It was found that the two countries to which the wetlands complex belong have a wide ranging policies and strategies to govern wetlands including the site area. Yet implementation and enforcing them is broadly rated at 30 to 35 per cent, which means coupled with population pressure,

degradation and climate change the future of the wetlands may not be sustainable unless action is taken.

5. With available data and information the value of ecosystems of the Wetlands is about USD 124 million plus
6. But there is evidence of pervasive degradation which has been estimated at USD 27million or at least 1.6 per cent of GDP of the two countries of Burundi and Rwanda
7. Given the assembled findings on ecosystem services and the need for sustainable development of the area there is choice between linear development and the best-case scenarios as a way forward to wise use. The best case choice would be embracing sustainable management of ecosystems in the medium and long term, application of technologies to spur high levels of productivity in different sectors
8. A minimum of 26 areas of focus in the best case scenario have been identified ranging from laws and regulations to capacity building and technology which need to be looked at in an integral way for wise use of the ecosystem services in the wetlands complex.
9. Four pillars of interventions are possible for clustering these development options involving wise use that determine an optimal use of resources while not damaging the environment. These include water and marshes provisioning services, protection, restoration and conservation initiatives, green infrastructure development and governance of the wetlands resources including cultural services that can spur sustainable development of the wetlands

Development options is not about conserving the wetlands or exploiting the wetlands alone. It should be a wise combination of conservation and protection as well as sustainable management of natural resources implicit in the pillars. This is as noted earlier requires sequencing of interventions starting with a comprehensive mapping of stocks and flows of ecosystem services. Development options include designation of which of the areas need to be designated as RAMSAR areas of international importance other areas could be

developed for agriculture, fishing, tourism and several other ex situ the wetlands but which contribute to sustainable development of the area. A major important action would be strengthening the institutions and mechanisms from local level to the transboundary levels with capacity to oversee the development options required for wise use and green water infrastructural development

The recommendations for the site follow from the findings. Indeed each of the identified components could form a recommendation of its own. However following from the broad lines the following constitute what could be done to help move forward towards enhancing TEEB in the Nile Basin and getting evidence for stakeholders in the country.

1. Conduct a more detailed identification and mapping of ecosystem services especially where values such as that for regulating services needs technical studies
2. Following from 1 gather more data to put together a credible TEEB database for the wetlands complex as part of the current effort on Managing Wetlands in the Nile Basin
3. Look into how laws, policies and strategies for protection and management of wetlands can be better enforced and plans implemented with a clearer transboundary focus
4. Develop mechanisms to enable sectorial, state and regional stakeholders work jointly for sustainable development of the wetlands complex
5. Follow up current and potential interventions for protection of critical ecosystems and biodiversity in the national framework or as RAMSAR sites
6. Support work for a comprehensive and integrated master plan for the long-term development of the wetlands complex.

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Appendix 1: Interview Guide

RWERU BUGESERA TRANSBOUNDARY WETLANDS COMPLEX		
1	<i>In what capacity do you know the Rweru Bugesera Wetlands Complex</i>	
	Government	
	Local admin	
	Researcher	
	Farmer	
	Advocacy	
	NBI	
	International	
2	<i>Which component is most prone to unsustainable use</i>	
	water in the lakes	
	marshlands	
	fishing ground	
	livestock grazing	
	birds	
	animals	
	traditional medicine	
	water in the marshlands	
3	<i>Give examples of changes/events in the past 20 years that are most noticeable about the wetlands estimate by %</i>	
	water levels	
	quantity of fish	
	water hyacinth	
	plants	
	animals	
	birds	
	wild foods	
	traditional medicine	
	cultural products	
4	<i>In current development activities who is benefitting most from the wetlands</i>	
	farmers	
	livestock keepers	
	fishermen	
	private investors in agriculture	
	private investors in other sectors	
	local government	
	foreign investors	
5	<i>Which do you think are the most important development options in the next 15 years</i>	
	intensive agriculture	
	protection of some areas	
	fishing	
	tourism	
	improved fishing	
6	<i>Who do you think is the most important influential stakeholder in the Rweru Bugesera Transboundary Wetlands development</i>	
	Governments(Rwanda and Burundi)	
	Local governments where the resources are	
	Communities adjacent to the resources	
	International donors	
	Private investors	



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ONE PEOPLE
ONE VISION

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