Feasibility Study for an Integrated Watershed Management Programme for the Kagera River Basin

Grant No. TF095177

FINAL REPORT

10 December 2012

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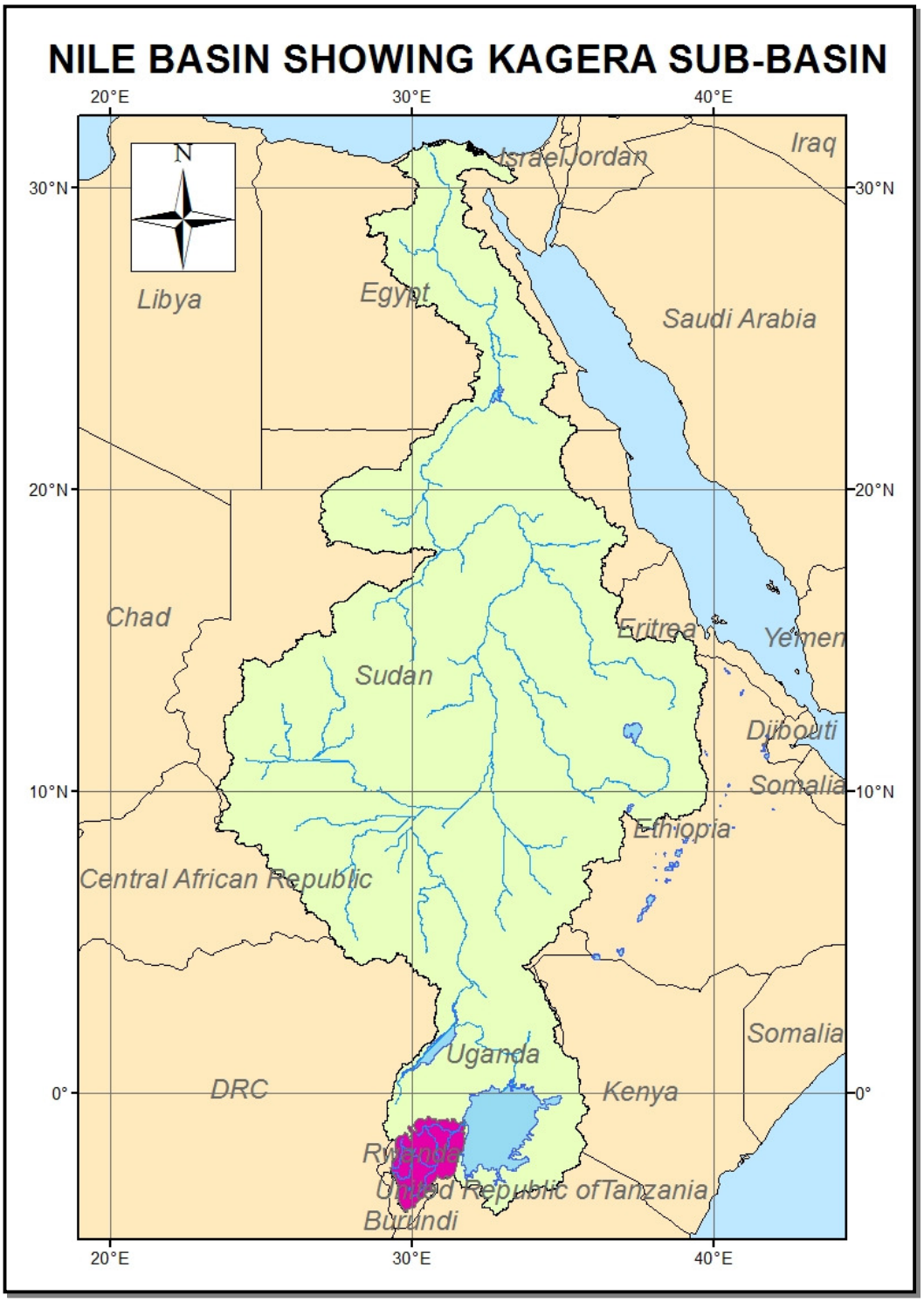
ACRONYMS

CBO	Community Based Organisations
CNTB	Commission for Land and Other Properties - Burundi
CSO	Civil Society Organisations
DFID	Department for International Development
DFS	District Forest Services - Uganda
DGHER	The Directorate General of Rural Water and Electricity - Burundi
DNA	Designated National Authority - Rwanda
DPAE	Provincial Ministry of Agriculture and Animal Husbandry (Burundi)
DSIP	Agriculture Sector Development Strategy and Investment Plan - Uganda
DSS	Decision Support System
DWD	Directorate of Water Development - Uganda
EAC	East African Community
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy - Rwanda
EIA	Environmental Impact Assessment
ENSAP	Eastern Nile Subsidiary Action Program
ERA	Energy Regulatory Authority
ESMF	Environmental and Social Management Framework
EU	European Union
EWURA	Energy and Water Utilities Regulatory Authority -Tanzania
FAO	Food and Agricultural Organisation of the United Nations
FAO	Food Agriculture Organisation
FD	Fisheries Department
FS-KIWMP	Feasibility Study-Integrated Watershed Management Project
FSSD	Forest Sector Support Department - Uganda
GIS	Geographical Information System
GoB	Government of Burundi
HYSIM	Hydrological Simulation Model
HYSIM-CC	Hydrological Simulation Model for Climate Change
ICT	International Centre for Research in Agroforestry – now World Agroforestry Centre
IFAD	Internal Fund for Agricultural Development
IGBU	Institut Géographique de Burundi
IIED	International Institute for Environment and Development
IMCE	Integrated Management of Critical Ecosystems -Rwanda
IMP	Irrigation Master Plan - Rwanda
INECN	The National Institute for the Environment and Nature Conservation - Burundi
ISAR	Rwanda Institute of Agronomic Sciences
IUCN	International Union for the Conservation of Nature
IWRM	Integrated Water Resource Management
KTIWRMDP	Kagera Trans-boundary Integrated Water Resource Management and Development Project
LRFC	National Land and Forest Research Centre - Rwanda
LTS	LTS International Ltd
LVBC	Lake Victoria Basin Commission
LVEMP	Lake Victoria Environment Management Programme
MAAIF	Ministry of Agriculture, Animal Industries and Fisheries - Uganda
MAFC	Ministry of Agriculture Food and Cooperatives –Tanzania

MCGDC	Ministry of community Development Gender and Children-Tanzania
MCTIPT	Ministry of Commerce, Trade, Industry, Posts and Tourism- Burundi
MEM	Ministry of Energy and Mines – Burundi, Tanzania
MFPD	Ministry of Finance, Plans and Development -Burundi
MINADEF	Ministry of Defence -Rwanda
MINAGRI	Ministry of Agriculture & Animal Resources - Rwanda
MINALOC	Ministry of Local Government, Good Governance, Community Development & Social Affairs - Rwanda
MINECOFIN	Ministry of Finance and Economic Planning - Rwanda
MINICOM	Ministry of Trade and Industry -Rwanda
MINIFRA	Ministry of Infrastructures - Rwanda
MINIRENA	Ministry of Water Energy and Natural Resources - Rwanda
MINISANTE	Ministry of Health -Rwanda
MNRT	Ministry of Natural Resources and Tourism-Tanzania
MOAL	Ministry of Agriculture and Livestock-Burundi
MOCD	Ministry of Communal Development -Burundi
MOH	Ministry of Health –Uganda
MOHSW	Ministry of Health and Social Welfare –Tanzania
MOLG	Ministry of Local Government -Uganda
MOLHD	Ministry of Lands, Housing and Urban Development -Uganda
MPHFA	Ministry of Public Health and Fight Against Aids - Burundi
MoTI	Ministry of Trade and Industry -Uganda
MoTW	Ministry of Tourism and Wildlife-Uganda
MRDP	Ministry of Relief and Disaster Preparedness - Uganda
MTPE	Ministry of Transport, Public Works and Equipment-Burundi
MWE	Ministry of Water and Environment - Uganda
MWETAUP	Ministry of Water, Environment, Territorial Administration and Urban Planning-Burundi
NAADS	The National Agricultural Advisory Services - Uganda
NAFA	National Forest Authority – Rwanda
NaFORRI	National Forest Resources Research Institute - Uganda
NAP	National Agricultural Policy – Rwanda
NAPA	National Action Plan for Adaptation
NBD	Nile Basin Discourse
NBI	Nile Basin Initiative
NBSAP	National Biodiversity Strategy and Plan - Burundi
NDIS	National Decentralization Implementation Secretariat - Rwanda
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NELTAC	Nile Equatorial Lakes Technical Advisory Committee
NEMA	National Environmental Management Authority - Uganda
NEMC	National Environment Management Council Tanzania
NFA	National Forestry Authority - Uganda
NGO	Non-Governmental Organisation
NIMP	National Irrigation Master Plan - Tanzania
NLC	National Land Centre - Rwanda
NORAD	Norwegian Agency for Development Cooperation
NPA	National Planning Authority - Uganda
NRE	Natural Resource Economist
NUR	National University of Rwanda
NWP	National Water Policy

NWSC	National Water and Sewerage Corporation - Uganda
OGMR	Rwanda Geological and Mines Authority
ONATOUR	Office National de la Tourbe - Burundi
ORTPN	Rwanda Office of Tourism & National Parks
PAIGELAC	Inland Lakes Integrated Development and Management Support Project
PEAP	Poverty Eradication Action Plan
PEARL	Partnership to Enhance Agriculture in Rwanda through Linkages
PES	Payment for Ecosystem Services
PMO-RALG	Prime Minister's Office-Regional Administration Local Government Tanzania
PRA	Poverty Reduction Strategy Paper
PRIMA	Progressive Realization of the IncoMaputo Agreement
PSF	Private Sector Federation Rwanda
RARDA	Rwanda Animal Resources Development Agency
RDB	Rwanda Development Board
REC-RWASCO	Rwanda Electricity and Water Supply Utility Company
REMA	Rwanda Environmental Management Authority
RMS	Rwanda Meteorological Service
RPSC	Regional Project Steering Committee
SIDA	Swedish International Development Agency
SPAT	Strategic Plan for Agriculture Transformation - Rwanda
TAMP	Transboundary Agro-Ecosystem Management Programme
TANESCO	Tanzania Electric Supply Company
TMA	Tanzania Meteorological Agency
TOR	Terms of Reference
TTB	Tanzania Tourist Board
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UWA	Uganda Wildlife Authority
UWASNET	Uganda Water and Sanitation Network
WAP	Water Action Plan - Uganda
WB	World Bank
WMD	Wetlands Management Department - Uganda


NILE BASIN SHOWING KAGERA SUB-BASIN
20°E
30°E
40°E
30°N
20°N
10°N
0°
N
Libya
Egypt
Israel
Jordan
Iraq
Saudi Arabia
Chad
Sudan
Eritrea
Yemen
Djibouti
Somalia
Ethiopia
Central African Republic
Somalia
Uganda
DRC
Kenya
Rwanda
United Republic of Tanzania
Burundi

EXECUTIVE SUMMARY

Introduction

This document is a summary of data collection and analysis, together with stakeholder inputs which took place between January 2011 and August 2012 resulting in the identification of feasibility level investment proposals for a Kagera Integrated Watershed Management Programme [KIWMP]. Full details of the study are contained in accompanying Annexes to this report.

The KIWMP as proposed will strengthen riparian cooperation and coordination through a programme of country-level integrated watershed management investment sub-projects and providing support to both country and trans-boundary capacity building and institutional strengthening.

The KIWMP aligns with NELSAP primary objectives of poverty reduction, reversal of environmental degradation and economic development.

Within the documentation the following terminology has been adopted: the Kagera 'watershed' is generally termed the 'sub-basin' herein, as this implies the recognition of its relationship to the broader Nile River Basin, downstream. Distinct parts of the Kagera sub-basin are referred to here as 'sub-watersheds'. Secondly, the individual interventions that the Feasibility Study (FS)-KIWMP proposes are termed 'sub-projects'. The FS-KIWMP as a whole is referred to by name or is termed a 'programme' rather than a 'project', to avoid confusion.

Characteristics of the Kagera Sub-Basin

The Kagera River drains a basin area of 59,800 km2, distributed between Burundi (22% of the basin area), Rwanda (34%), Tanzania (34%) and Uganda (10% of the basin area). The Kagera River provides the largest surface water contribution to Lake Victoria. The western boundary of the sub-basin is formed by a narrow ridge rising from 2,000 to 4,400 masl. To the east of the ridge is a deeply dissected plateau extending some 100 kms between 1,500 and 2,000 masl. Below 1,500 masl are undulating plains.

In broad overview the sub-basin exhibits a west-east gradient in terms of slope and susceptibility to erosion and sedimentation. With respect to meteorological characteristics, patterns of rainfall are of key importance. There is a west-east reduction in the average annual rainfall within the sub-basin, with the exception of higher rainfall close to the western margins of Lake Victoria Geographical. Trends in run-off follow the rainfall patterns closely. Rainfall exceeds potential evapo-transpiration (PET) along the entire western extent of the Kagera sub-basin with a similar small area of surplus close to Lake Victoria on the east. The pattern of annual irrigation demand is broadly similar to the difference between rainfall and PET, with minor differences being introduced due to the effects of other parameters (seasonal effects, soil type, etc.).

A watershed assessment was undertaken, which found that several distinct forms of degradation exist in the sub-basin, and certain other factors interact with the historical degradation to exacerbate conditions for the sub- basin population. Thus:

- The sub-basin has been heavily deforested already, especially in its upper reaches. In combination with the introduction of (mainly subsistence) agriculture on land which is often steep this has created a range of problems, including soil loss in particular.
- The loss of soils has greatly enhanced the turbidity of the surface water systems, and this in turn has led to negative effects on fisheries and hydropower potential.

- The poor levels of sewage treatment – especially in urban centres and in the sub-basin as a whole have given rise to a concurrent nutrient enrichment of the surface waters, and this has created eutrophic conditions, with the heavy growth of plants such as the water hyacinth.
- Wetlands in the sub-basin have come under significant pressure, and considerable areas of wetland have already been lost or degraded.

Two key factors have driven much of the degradation observed at the present time in the Kagera sub-basin. The first is population growth, which remains high for all four of the Basin States and creates continuing and increasing pressure on the natural resource base. The second factor relates to land tenure leading over time in many areas to smaller and smaller plots of degraded land.

The watersheds were characterised using two composite attributes: (i) a composite "low soil water availability" rating using rainfall-PET and percentage area under soils with low water holding capacity (Ferralsols and Lithosols), and (ii) a composite "land degradation" rating using population density and soil erosion risk. The watersheds were ranked and mapped. This was used to inform intervention priorities and a technical basis for engagement with stakeholders.

A wetlands assessment was undertaken, which found that enormous pressure has been put on the water and wetland resources of the Kagera sub-basin. This is from increasing uses driven by the rapidly expanding population such as deforestation, agricultural intensification, pollution, overuse and inadequate institutional frameworks for management of these natural resources. The two principal threats to wetlands in the Kagera sub-basin are siltation due to soil erosion and conversion to agricultural land; the soil erosion itself caused by deforestation of hillsides to produce cultivable/grazing land and poor farming practices. Whilst human activities, both direct and indirect, are the principal contributors to wetland degradation and loss, other factors include inadequate planning and management of resources, and lack of basin information and public – and institutional – awareness of wetland values. Wetlands are also degraded or lost because of policy deficiencies, planning deficiencies and institutional weaknesses.

Past and current experience has demonstrated that wetlands cannot be isolated from their sub-watersheds, and that management interventions must apply to the whole sub-catchment in which a wetland lies. Major cumulative impacts on wetlands have resulted from agricultural practices in the uplands and in the wetlands themselves.

Projects Portfolio

Following an extensive stakeholder consultation process a number of sub-projects were identified for the watersheds as well as the wetlands within them. The need for an integrated and joined up approach across the sub-basin was appreciated in the assessments. The priority watershed sub-projects comprise of 4 country programmes and two basin wide programmes. The country programmes would be administered by NELSAP and implemented through government structures in each of the four countries – engaging with communities and civil society. These country programmes are built upon the stakeholder proposals, but also propose additional interventions where these can augment and strengthen the country programme.

Based on the wetland sectoral analysis and technical assessments, stakeholder interviews and literature surveys a focus on those wetlands for which project interventions would have a large-scale impact and are trans-boundary in nature is proposed. Guided also by the RAMSAR guidelines and best practice in the NBI-NTEAP Wetlands and Biodiversity Strategy this feasibility study proposes two types of potential wetland sub-projects: one that focuses on the improvement of management of wetlands of high significance that cross

international borders; and one that focuses on the acquisition of technical knowledge and information through practical intervention.

The proposed portfolio of country programmes and their sub-projects is summarised in the table below.

Country	Project Title
Burundi	Integrated Watershed Management, Akanyaru Sub-watershed
Burundi	Stabilisation of Banks of Watercourses and Hillside Afforestation to reduce erosion and siltation, Ruvubu-1, Ruvubu-2 and Gitenga Sub-watersheds
Burundi	Hill irrigation and rainwater harvesting in Cankuzo, Karuzi, Kirundo, Muyinga and Ruyigi Provinces
Burundi	Protection of Ecosystems through Environmental Flows, Ruvubu National Park.
Burundi	Alternative Livelihoods for Wetland Communities thru' Ecosystem Approach in the Nyamuswaga Wetlands.
Burundi	Assessing Impacts on Wetlands of Water Harvesting and Development on Groundwater Resources.
Rwanda	Soil & Water Conservation, Soil Improvement, Improved Fodder Production and Re-forestation, Akanyaru Sub-watershed, Nyaruguru District
Rwanda	Soil Conservation, Rainwater water harvesting, small-scale irrigation, Fruit and Fodder trees, Kagitumba Sub-watershed
Rwanda	Sustainable fishing at Lake Muhazi.
Rwanda	Protection of Wetland Ecosystems thru' Maintaining Environmental Flows.
Rwanda	Artificial wetlands for sustainable urban drainage
Tanzania	Soil Conservation in Karagwe and Ngara Districts
Tanzania	Protection and Conservation of Water Sources in Muleba and Biharamulo Districts
Tanzania	Supply of potable water to 15 villages, Kayanga, Bunazi and Kyaka Townships in Karagwe and District.
Tanzania	Flood Management in the Bigomba and Burugi Valleys: Ngara, Biharamulo & Muleba Districts.
Tanzania	Robust evidence base to inform management decision-making
Tanzania	Feasibility Study for Fisheries in Karagwe District, + Fish Ponds
Uganda	Land Rehabilitation in Kikagate Sub-County, Isingiro District
Uganda	Integrated Water Resource Management (IWRM) project, Kakuuto County in Rakai District
Uganda	Integrated Water Resource Management Project, Maziba catchment, Kabale District.
Uganda	Robust Evidence Base for informed Wetlands Management Decision Making
Uganda	Assessment of Potential for Payment for Environmental Services from Polluting Sources, Kagera-4 Sub-watershed
Uganda	Soil Conservation and Rehabilitation, Sustainable Wetlands Management and Alternative Livelihoods for Wetlands Communities through Ecosystem Approach, Ntungamo and Kagitumba (North) Sub-watersheds
Basin wide	Strategic Wetlands Classification for the Kagera sub-basin
Uganda and Tanzania	Management of Transboundary Ramsar Sites in the Kagera sub-basin

The sub-projects were prioritised based on their contribution to ameliorating the land degradation and soil moisture deficit issues identified in the "hot spot" sub-watersheds.

An assessment of the environmental and social safeguards for the sub-projects was then made, within the context of an Environmental and Social Management Framework (ESMF). The aim of the ESMF is to provide an overall framework for environmental and social management of the planned sub-project activities under the KIWMP of the Kagera sub-basin

shared by Rwanda, Burundi, Tanzania and Uganda. It is meant to be used a management tool during project implementation. It describes the steps to be undertaken in the selection and implementation of sub-projects to be supported under KIWMP so that potential negative environmental and socio-economic impacts can identified and mitigation measured implemented. The ESMF also provides a framework to enable communities/beneficiaries to screen sub-projects and institutional mechanisms and responsibilities to address adverse environmental and social impacts.

Finally, an economic and financial costing and analysis was undertaken on the proposed sub-projects. This has resulted in a five year investment programme built upon 25 sub-projects together with support packages covering programme management, coordination, capacity building and policy development. The total financial cost of the KIWMP over five years is US$ 614.72 million. The total economic cost is US$ 505.40 million which is 82% of the financial cost (as a result of eliminating the premium on foreign exchange, eliminating taxes and adjusting unskilled labour by an estimated shadow wage rate).

Table of Contents

1. INTRODUCTION

1.1 Background

The Kagera sub-basin includes the head waters of the White Nile (front map) and is an important upstream component of the Nile River basin as a whole. It is the largest tributary of Lake Victoria contributing 32% of the surface runoff into the Lake[1]. It serves a population estimated at approximately 15 million inhabitants located in four riparian States: Burundi; Rwanda; Tanzania and Uganda.

All four of the Basin States exhibit very high percentages of poverty and the sub-basin is largely characterised by subsistence agriculture. As a result of population pressure and land tenure practices the available land for cultivation is limited on a *per capita* basis and land degradation, high stream sediment loads and livestock feed and biomass fuel deficits are common.

In view of the multi-sectoral nature of these problems a comprehensive and integrated watershed and wetland management approach is required that addresses not only the immediate but also the root causes of natural resource degradation and poverty.

The Terms of Reference (TOR) called for the preparation of an Integrated Watershed Management Programme and a portfolio of sub-projects (Task 2). These sub-projects are to contribute to addressing catchment degradation issues and achieving the optimal and sustainable integrated use of natural resources of the watersheds, with minimum damage to the environment and for the benefit of the inhabitants of the watershed and the communities linked to them. The TOR also called for the preparation of a Wetland Management sub-programme and sub-projects that promote product development including alternative livelihoods, and develops recommendations for improvements (Task 3).

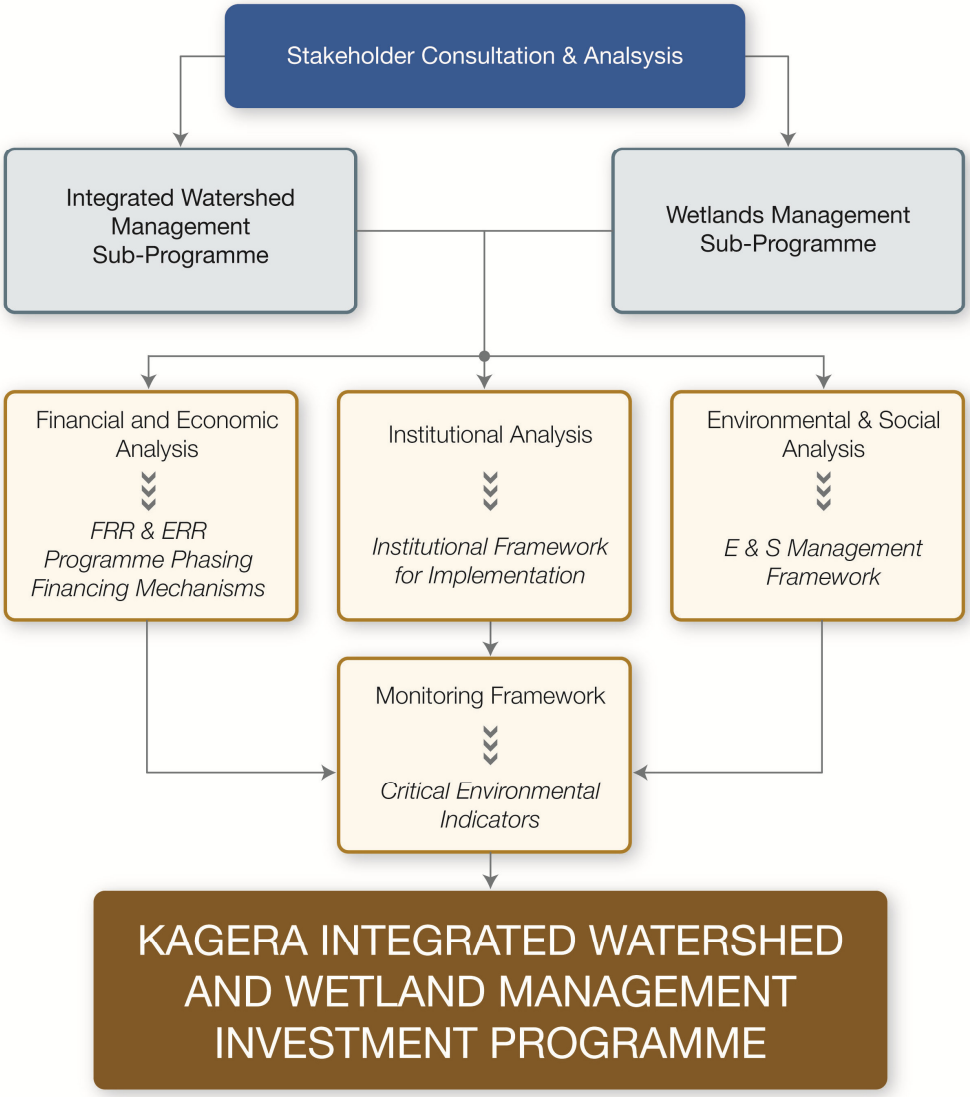
Together, these two sub-programmes form the Kagera Integrated Watershed Management Investment Programme (KIWMP) that falls within the national planning frameworks, as well as meeting project preparation and social and environmental safeguard requirements of the World Bank (Task 7). The whole process involves stakeholder analysis (Task 1), and will be subject to financial and economic Analysis (Task 4), institutional analysis (Task 5) and environmental and social analysis (Task 6). This process, structure and outputs are shown diagrammatically in Figure 1.

Certain issues concerning nomenclature should be noted here. Firstly, the Kagera 'watershed' is generally termed the 'sub-basin' herein, as this implies the recognition of its relationship to the broader Nile River Basin, downstream. Distinct parts of the Kagera sub-basin are referred to here as 'sub-watersheds'. Secondly, the individual interventions that the FS-KIWMP proposes are termed 'sub-projects'. The FS-KIWMP as a whole is referred to by name or is termed a 'programme' rather than a 'project', to avoid confusion.

This report is a summary of the various detailed tasks undertaken by the consultants (which are presented in Annexes A-F) and the subsequently identified components of the KIWMP.

[1] However, 85 percent of the total water supply for Lake Victoria comes from nocturnal rainfall over the Lake.

Figure 1. Structure and Process of the Development of the sub-basin KIWMP



1.2 Programme Objectives

The overall *programme development objective* is to "advance long term investments and capacity building to leverage investment opportunities in the Kagera sub-basin."

The *immediate objective* of the KIWMP is to:

> **Provide continued and enhanced support to the sustainable watershed management of the sub-basin in order to improve the living conditions of the people, create alternative livelihoods, enhance agricultural productivity and protect the environment.**

The overriding regional significance of this will be its contribution to enhanced food security and poverty alleviation in the sub-basin and its long term contribution to arresting degradation of the natural resource base.

The FS-KIWMP is focused upon the selection of high-priority sub-projects pertaining to watershed and wetlands management, for implementation in the near future in the Kagera sub-basin.

1.3 Structure of the Report

Chapter 1 provides an outline of the overall programme objectives, a brief over-view of the characterization of the sub-basin and the sub-watershed assessment.

Chapter 2 provides the baseline sub-basin watershed and wetland conditions in the basin which include, existing and past conditions, current activities, population and economic and socio-economic conditions, economic and financial baseline, legal and institutional arrangements.

Chapter 3 outlines the characterisation of the sub-watersheds, water pollution risk, priority sub-watersheds identified for intervention, criteria and identification of first round projects and intervention strategies.

Chapter 4 outlines the Wetlands Management sub-programme. The characterization of wetlands in the sub-basin focusses on their vales and functions, their importance and current degree of degradation. The technical assessment looks at past initiatives, on-going and proposed wetland projects and the current country institutional and legal frameworks. There follows a description of sub-project selection and a summary of the “Plan” and “Topic” sub-Project Identification Fiches.

Chapter 5 describes the KIWMP formulation process from the beginning. It describes how first and second approximation projects were identified. It also describes the Watershed and Wetland Management Action plans and gives summaries of all watershed and wetland projects of country and transboundary projects. It finally prioritises the 10 hotspot sub watersheds for intervention out of the 22 sub watersheds.

Chapter 6 describes the results of the Environmental and Social Analysis, outlines the Environmental and Social Management Framework and vulnerable groups and gender issues and measures that can be used to address vulnerability in the sub projects.

Chapter 7 describes the overall financial and economic analysis of the KIWMP and details financial analysis per watershed and wetland sub-project. It also outlines the financial arrangements of the KIWMP

Chapter 8 describes the KIWMP investment proposal of both the watersheds and wetlands programme.

Chapter 9 results of the institutional analysis and outlines the proposed institutional framework for the implementation of the overall Integrated Watershed and Wetlands Investment Programme. It also outlines the various stakeholders involved in watershed management in the basin.

Chapter 10 outlines the monitoring and evaluation (M&E) system and the proposed KIWMP Results Framework.

Full technical reporting on these tasks is presented in the Annexures to this report.

Annex	Title
A	Integrated Watershed Management Action Plan (including sub-project fiches)
B	Wetlands Analytical Assessment
C	Integrated Watershed Management Investment Plan (including economic and financial analysis)
D	Environmental and Social Management Framework and Stakeholder Participation Guide
E	Institutional Analysis
F	Watershed Assessment

2. BASELINE CONDITIONS

2.1 Baseline Sub-basin Conditions

Located in the Great Lakes region of Africa, the Kagera River drains a basin area of 59,800 km^2, distributed between Burundi (22% of the basin area), Rwanda (34%), Tanzania (34%) and Uganda (10% of the basin area; see DWD/WWAP, 2005). The Kagera River provides the largest surface water contribution to Lake Victoria, which is the second largest freshwater lake in the world (Sene and Plinston, 1994).

The western boundary of the sub-basin is formed by a narrow ridge rising from 2,000 to 4,400 masl. To the east of the ridge is a deeply dissected plateau extending some 100 kms between 1,500 and 2,000 masl. Below 1,500masl are undulating plains.

The Kagera sub-basin includes many lakes and marshlands. The lakes and marshlands attenuate river flows, and the Kagera has a high base-flow component resulting from the water storage in these lakes and marshlands (Sutcliffe and Parks, 1999). The marshlands along the river valleys are inundated during floods in the peak rainfall months of April and May, whilst the lowest water levels are in August-October. Marshlands cover 2.9% of the area of the Kagera sub-basin and open water bodies another 1.6%, which does not reflect their significant importance to the sub-basin as a whole.

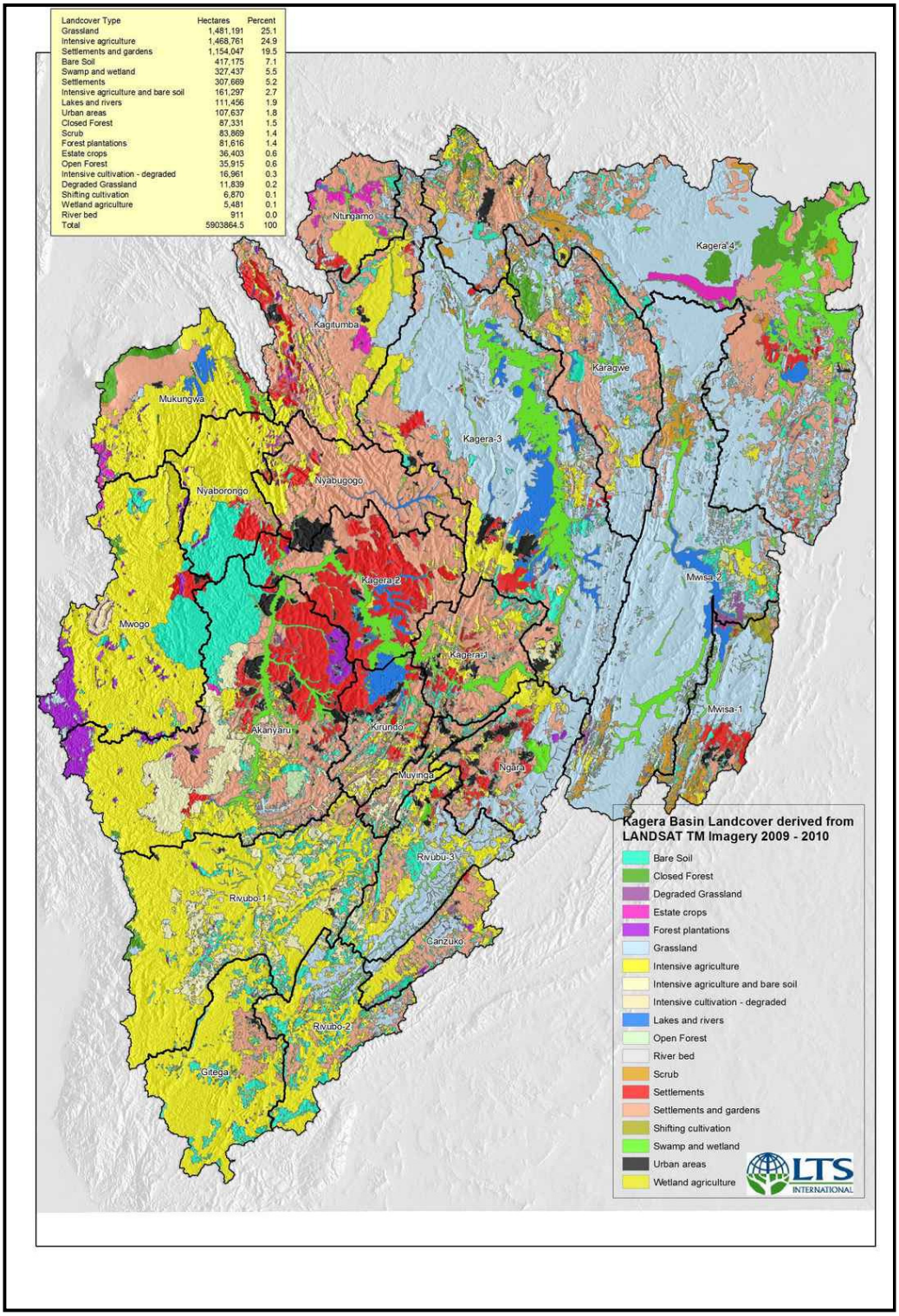
Precipitation exceeds 2000 mm/year in sub-watersheds toward the west, and in the east is over 1800mm/year. The sub-watersheds with the lowest precipitation are in the north and the south-east. However, potential evapo-transpiration (PET) exceeds rainfall over most parts of the sub-basin except for a narrow strip along the western higher parts on the Nile-Congo Divide.

The areas of dominant land cover types are shown in Table 1 and Map 1. Very intensive agriculture and settlement with homestead gardens are the most extensive land cover types covering some 52.3 % of the sub-basin.

Table 1. Land cover/Land use in the Kagera sub-basin (ha and %)
Source: Landcover mapping from LANDSAT images by Consultants

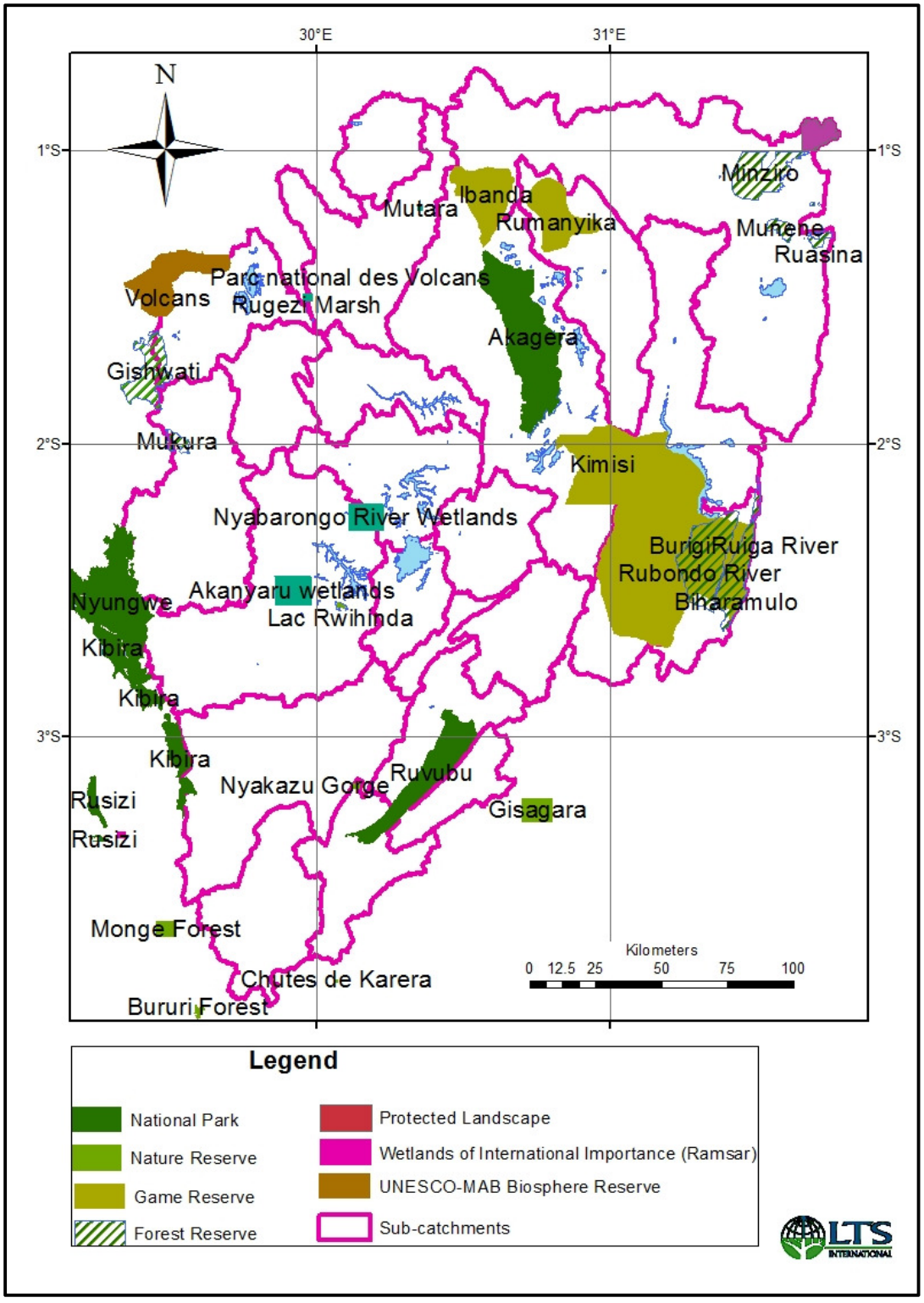
Landcover Type	Hectares	Percent of Total
Grassland	1,481,191	25.1
Intensive agriculture	1,468,761	24.9
Settlements and gardens	1,154,047	19.5
Bare Soil	417,175	7.1
Swamp and wetland	327,437	5.5
Settlements	307,669	5.2
Intensive agriculture and bare soil	161,297	2.7
Lakes and rivers	111,456	1.9
Urban areas	107,637	1.8
Closed Forest	87,331	1.5
Scrub	83,869	1.4
Forest plantations	81,616	1.4
Estate crops	36,403	0.6
Open Forest	35,915	0.6
Intensive cultivation - degraded	16,961	0.3
Degraded Grassland	11,839	0.2
Shifting cultivation	6,870	0.1
Wetland agriculture	5,481	0.1
River bed	911	0.0
Total	**5,903,865**	

Map 1. Land cover / use for Kagera sub-basin (Source Kagera Monograph and LANDSAT 2010)



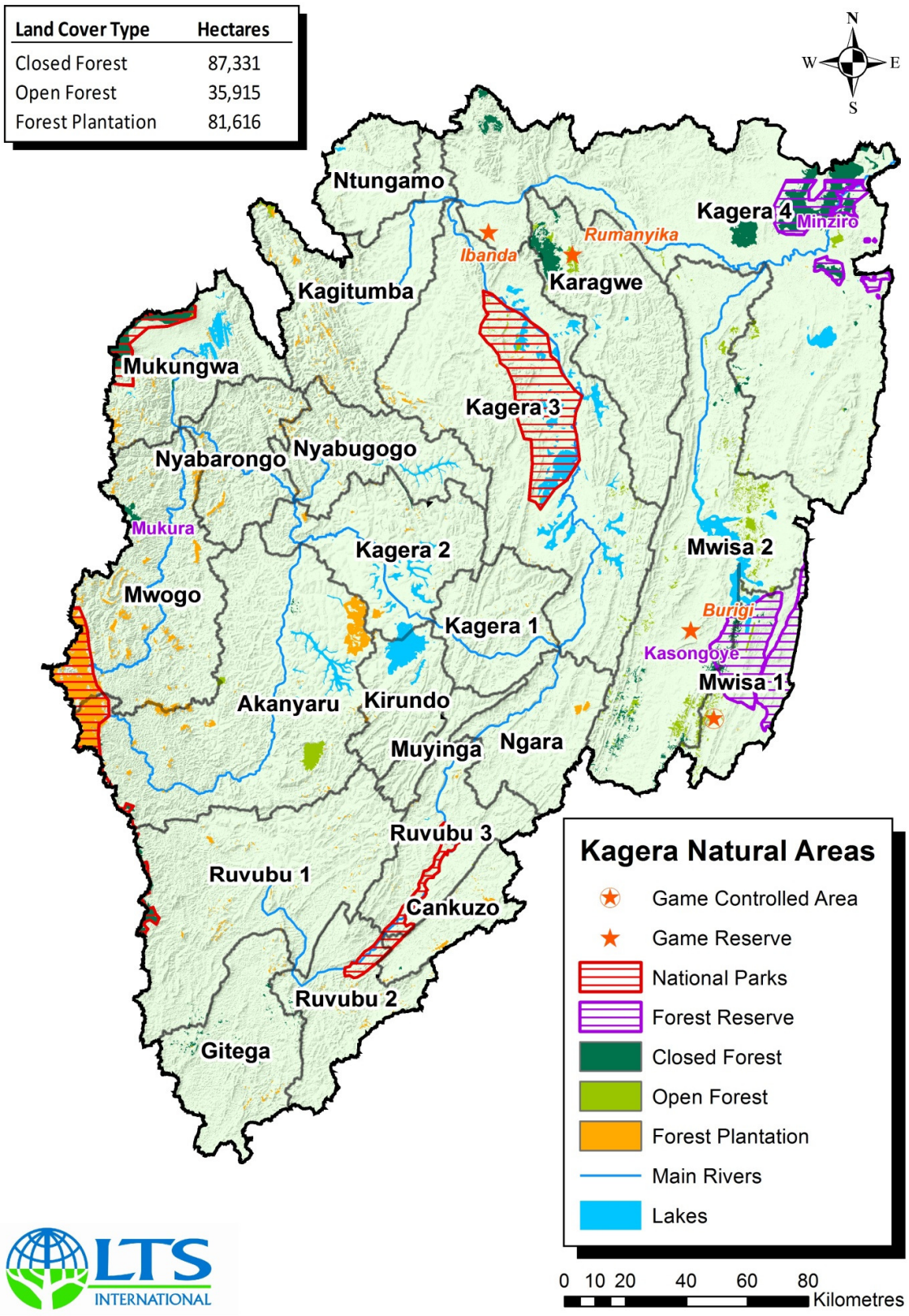
This is mainly located in the central and western parts of the sub-basin at higher altitudes and in areas with higher rainfall. Grassland covers some 25.1% and is found mainly in the drier central and eastern parts of the Sub-basin. Closed and Open forests are now confined to just 2.1% of the sub-basin area (Map 3).

Map 2. Protected areas of the Kagera sub-basin (Source Landsat 2010 and Kagera Monograph)



The protected areas in the Kagera sub-basin include: 4 National Parks, 3 Game Reserves, 1 Game Controlled Area, 3 Nature Reserves (Map 2) and 21 Forest Reserves. Some of the protected areas are reported to be severely affected by human activities like cultivation, bush fires, settlement creation, poaching / hunting and over-exploitation of timber, fuel wood and charcoal and medicinal plants (NBI, 2001).

Map 3. Forest types and protected areas of the Kagera sub-basin (Source Landsat 2010 and Kagera Monograph)



2.2 Baseline Watershed Conditions

2.2.1 Extent and severity of land degradation

The Kagera sub-basin is underlain by metamorphic rocks of the Precambrian Karagwe-Ankolean series. Geologically recent uplift and tilting have determined the basin's topography which is marked by ridges running in a generally south-west to north-east direction. The most extensive soil types located within the central parts of the sub-basin are Ferralsols. These are derived from deeply weathered acidic rocks and are therefore of low fertility, acidic and increasingly having aluminium toxicity. In the north-eastern uplands on steep slopes are Leptosols, which are shallow and often stony. Being located on steep slopes they are especially susceptible to erosion and being shallow have low water holding capacity.

Several distinct forms of degradation exist in the sub-basin, and certain other factors interact with the historical degradation to exacerbate conditions for the basin population. Thus:

- The sub-basin has been heavily deforested already, especially in its upper reaches. In combination with the introduction of (mainly subsistence) agriculture on land which is often steep this has created a range of problems, including soil loss in particular.
- The loss of soils has greatly enhanced the turbidity of the surface water systems, and this in turn has led to negative effects on fisheries and hydropower potential.
- The poor levels of sewage treatment – especially in urban centres and in the sub-basin as a whole have given rise to a concurrent nutrient enrichment of the surface waters, and this has created eutrophic conditions, with the heavy growth of plants such as the water hyacinth.
- Wetlands in the sub-basin have come under significant pressure, and considerable areas of wetland have already been lost or degraded.

Two key factors have driven much of the degradation observed at the present time in the Kagera sub-basin. The first is population growth, which remains high for all four of the Basin States and creates continuing and increasing pressure on the natural resource base. The second factor relates to land tenure leading over time in many areas to smaller and smaller plots of degraded land. For example soil erosion in Burundi is attributed to several factors. Whilst 90% of rural households own some land for subsistence farming, these holdings are increasingly small, the mean area being 0.5 ha, due to the traditional practice of dividing land equally amongst inheritors (WSP 2003, IFAD 2012) [2,3]. The resulting land tenure system of long, narrow plots enhances risk of sheet erosion[4].

The highest risk is found on the cultivated areas along the montane ridge and foothills forming the western boundary of the sub-basin. The areas of Alisols and Ferralsols are at the highest risk because of their shallowness (Alisols) and low fertility (Ferralsols). Areas of very intensive cultivation based on small hedged homestead fields and extensive banana groves are at less risk, whilst those areas with large open fields with no hedges are at the highest risk.

Some 40 percent of the sub-basin area is estimated to have a high soil erosion risk[5] (Table 2). Burundi and Rwanda have higher the sub-basin average areas of high erosion risk whilst Tanzania and Uganda have slightly lower than sub-basin areas.

[2] WSP International Sweden AB, ERM and BCEOM (2003) *Kagera Basin Management Project*
[3] IFAD (2012) *Republic of Burundi Rural Recovery and Development Programme Project Performance Assessment*
[4] BRL Ingénierie (2008) Kagera River Basin Monograph
[5] "High" risk equates to the 3rd and 4th quartile of SLEMSA erosion rates: "Low) = 1st quartile, Moderate = 2nd quartile.

Table 2. Soil erosion risk (ha) in the Kagera sub-basin by country

KAGERA SUB-BASIN

Erosion Risk	Area (ha)	%
Low	1,715,982	29%
Moderate	1,807,829	31%
High	2,380,054	40%
Sub-basin	**5,903,865**	

BURUNDI

Erosion Risk	Area (ha)	%
Low	257,405	19%
Moderate	441,142	33%
High	630,259	47%
Sub-basin	**1,328,806**	

RWANDA

Erosion Risk	Area (ha)	%
Low	479,146	23%
Moderate	586,200	28%
High	1,017,822	49%
Sub-total	**2,083,168**	

TANZANIA

Erosion Risk	Area (ha)	%
Low	834,635	41%
Moderate	649,222	32%
High	553,643	27%
Sub-total	**2,037,500**	

UGANDA

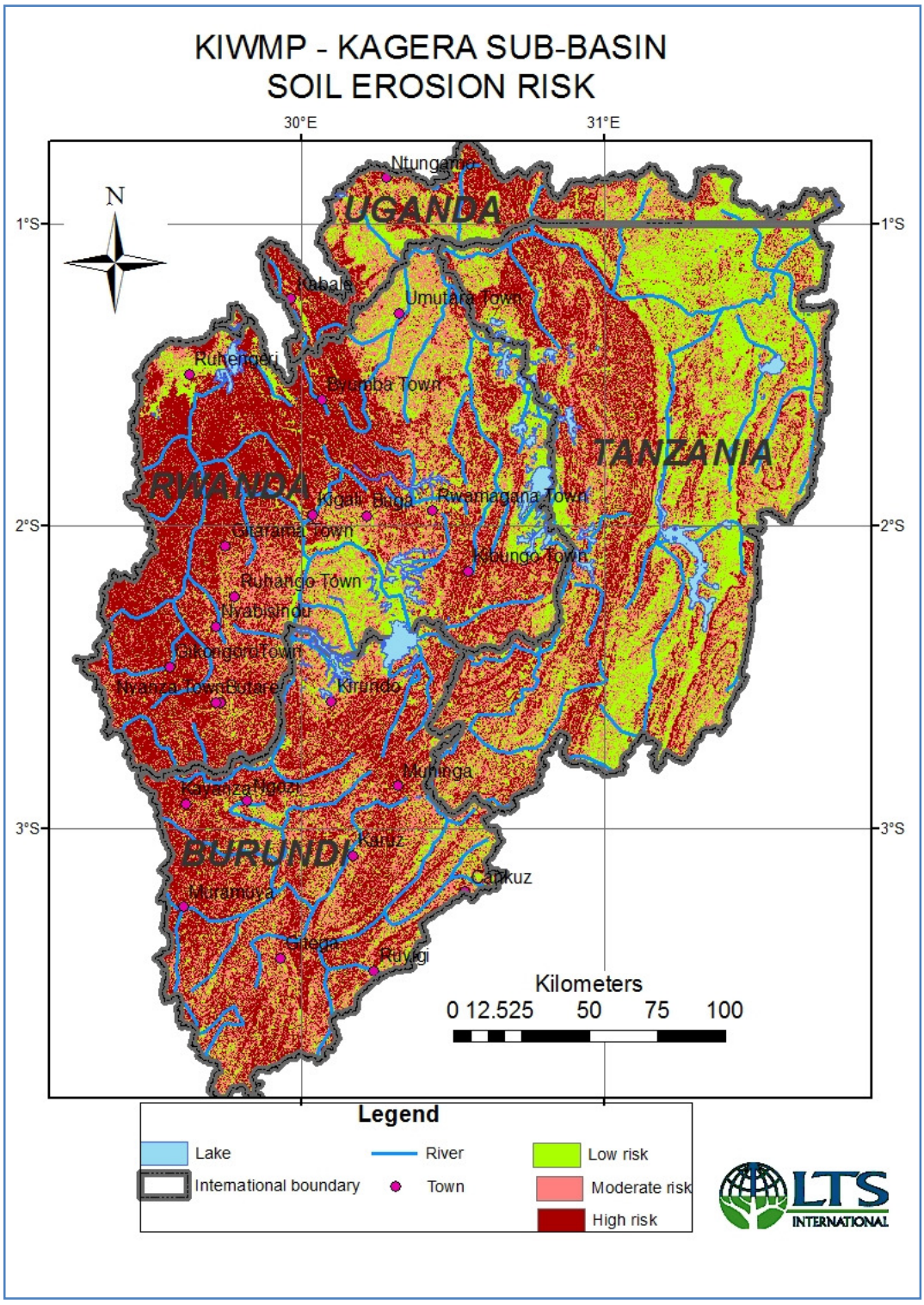
Erosion Risk	Area (ha)	%
Low	146,718	32%
Moderate	131,501	29%
High	176,439	39%
Sub-total	454,658	

Source: Soil erosion mapping using SLEMSA by LTS consultants

In broad overview the sub-basin exhibits a west-east gradient in terms of slope and susceptibility to erosion and sedimentation (Map 4).

Map 4. Soil erosion risk in the Kagera sub-basin

(Source: FAO Soil data, ASTER DEM, Landsat data and SLEMSA modelling)



2.2.2 Past and present measures for watershed management and soil and water conservation

In Rwanda in the 1991 agro-economic survey, on average 1.4% of holdings owned land treated with radical terraces, 21.6% reported having planted hedgerows (on average 56m/ha), 47.8% anti-erosion ditches (161m/ha) and 60.3% grass strips (205m/ha) (Clay 1996). Preliminary data of a national farm survey in 2005 mentions 64% of parcels treated: 5.1% radical terraces, 38.6% hillside ditches and 20.4% other measures (MINAGRI, unpublished data). There are no data for the other countries.

Bekele-Tesemma et al. (2009) reviewed past studies in Rwanda to show that yield increase due to soil and water conservation ranges from 45 to 216%. Based on the current cropping practices in the sub-project sites, the World Bank's Land Husbandry, Water Harvesting and Hillside Irrigation Project Appraisal Document (World Bank, 2009) a conservative increase in yield of 30% was used for traditional annual crops and 50% for perennial crops.

Rill and sheet erosion are problems in the Ugandan part of the Kagera sub-basin, the latter due to uncontrolled excess rainwater runoff and resulting in gullies[8]. The largely acid soils in Mbarara District limit productivity. Other sources of soil degradation include the driving of cattle across the Rwampara Hills. Upland terrain in this District is characterised by rocky, bare soils with greater erosion on steeper slopes. The high plateau, however, does support cultivation, but unsuitable land practices that contribute to soil degradation persist. These include prolonged annual burning, over-cutting of vegetation and agricultural expansion into marginal areas without practicing soil and water conservation measures[6].

The construction of terraces to conserve soil on steep land is culturally undesirable to most smallholder farmers in the Ugandan Kagera (Baijukya *et al.* nd)[7]. Old colonial contour bunds have often been destroyed to increase arable land area[8].

Several factors have been identified as contributing to soil degradation, which include:

- The practice of leaving arable land bare increases its susceptibility to erosion processes[8.]
- High population pressure, which promotes continuous cultivation. Population pressure inhibits the uptake of previously used methods to restore soil condition, such as shifting cultivation and bush fallow. It is noted that in Kabale fallow periods are no longer used.
- Rare use of livestock manure; this is mainly used in homesteads. Grazing in fallow fields can boost productivity of crops subsequently planted there, but generally, use of the same land for both practices is rare.
- Regional characteristics including the land relief and soil types that are vulnerable to erosion
- Forest degradation due to woodfuel and charcoal demand, which is exacerbated by high population[9].

Agroforestry (eucalyptus, pine) has been implemented as a means to control soil erosion. Examples include mixed eucalyptus with banana or maize, and pine with cow peas (FAO 2011)[10].

Soil conservation terraces have been unsuccessful. For example, a previous food for work initiative led to the creation of terraces, but lack of clear ownership amongst farmers resulted in poor maintenance[11]. Recently, development of these terraces under a rural development

[6] FAO (no date) *Background Information on Natural Resources in the Kagera River Basin*, available from: **http://www.fao.org/fileadmin/templates/nr/kagera/Documents/Suggested_readings/nr_info_kagera.pdf** [Accessed 31/10/12]
[7] Baijukya, F (no date) Agroecosystems of Kagera River Basin in Tanzania: niches for PES to enhance sustainable land management,
[8] Osiru, D S O (2006) *REPORT ON CROP/FARMING SYSTEMS AND PRA*, FAO.
[9] CGIAR
[10] FAO (2011) *Kagera TAMP* Regional workshop on land planning and management, available from: http://www.fao.org/fileadmin/templates/nr/kagera/Documents/PES_workshop_August2011/Day1/KAGERA_TAMP2__UGANDA_.pdf [Accessed 31/10/12]
[11] Baijukya, F et al. (no date) Land Degradation and Opportunities for Sustainable Management of Kagera River Basin-Tanzania,

programme targeting disadvantaged rural families and communities affected by the recent crisis was abandoned as too costly[7].

2.2.3 Adequacy of current practices in respect to erosion and sediment yield management in rivers

Given the similarity among the four countries within the sub-basin in terms of bio-physical characteristics and farming systems these rates are likely to be applicable across the sub-basin. Fleskens (2007) has reviewed a range of studies in Rwanda and Burundi with regard to the adequacy of current practices in respect of vegetative erosion control. These are shown in table 3. Clearly hedges are very effective in controlling soil erosion and these become more effective with time.

Table 3. Impacts of Plant Cover and Vegetative Conservation Measures on Soil erosion (t/ha/yr) and % Rainfall runoff (Fleskens, 2007)

Plant Cover	Treatment	Erosion (t/ha/yr)	Runoff % rainfall	Reduction factor of Conservation measure
Bare soil	Tilled parallel with slope	300 - 550	10 - 40%	
Manioc,potato,maize/bean	Traditional hoe tillage	50 - 150	10 - 37%	6 - 4
Crops as abo=ve+ 200 trees per ha	litter 50kg/tree/yr	30 - 50	5 - 7%	10 -11
Crops as above+ trees + hedges every 5 to 10m	Biomass: 3 to 6 kg/m2/yr	yr1: 7 - 16:	10 - 15%	43 34
Crops as above+ trees + hedges every 5 to 10m		yr4 1 - 3	1 - 3%	300 - 186
Crops as above +trees+hedges	Covered ridges every 5 m	1-4	0.1 - 2%	300 - 138
Banana plantation	Open, mulch removed	20-60	5 - 10%	15 - 9
Banana plantation	Mulch (10t/ha/yr	1-5	0 - 2%	100 - 110
Coffee plantation	Mulch (20t/ha/yr)	0-1	0.1 - 10%	300
Pinus forest, pasture, old fallow	5- 10t/yr litter	0-1	1 - 10%	300

The UN Environment Programme (UNEP) has ranked Rwanda among the world's top countries that have planted many trees in 2007. Rwanda is ranked the sixth after planting over 50 million trees from January to the beginning of this month. The country ranked third on the continent after Ethiopia and Kenya.

In Burundi plantations have replaced most natural forests. Forest Resource Assessment (2010) has reported that between 1990 and 2010 Burundi lost an average of 5 850 ha, or 2.02%, of forest per year. In total, between 1990 and 2010, Burundi lost 40.5% of its forest cover (FRA, 2010). One of the largest remaining natural forestlands is the Kibira National Park which, together with the adjacent Nyungwe National Park in Rwanda forms one of the greatest remaining tracts of mountain forests in East Africa and the most biodiversity rich ecosystem in the Albertine Rift. According to official statistics, about 6% of Burundi's total land (152 000 ha) is forest. About 14% of this forest cover is made up of natural forest and the remaining 86% is plantation forest, which has been expanding since 2000 in an effort to meet the needs of the population for fuelwood and timber and to restore tree cover (USAID, 2011).

Technology packages are available for: watershed management and these include improved seed and seedlings for fodder plants and trees to control erosion. A World Bank ex post evaluation of the Agricultural Rehabilitation and Sustainable Land Management Project (World Bank, 2012) showed that the results indicate a high overall return on investment, and individual sub-project returns were higher than in the original PAD analysis. An estimate of economic NPV that included the 622 forestry sub-projects covering 93,526 ha was calculated. The NPV rose from BIF 43.7 million to BIF 72 billion by including BIF 19 billion from carbon sequestration of 2.6 million tons of carbon over 20 years.

2.3 Baseline Wetland Conditions

2.3.1 Introduction

The Kagera is a transboundary river and, as such, each of the riparian countries are faced with the challenge of making maximum use of the water resources within its territory for its own socio-economic development, whilst not compromising the legitimate right of its neighbours to the same shared resources. Downstream, the Kagera wetlands are important to Lake Victoria because the wetlands regulate flows and treat water entering the lake; degradation of the Kagera wetlands could reduce these important ecosystem services. Wetlands in the Kagera sub-basin are used in many different ways and play an important role in the national economies of the four basin countries (also referred to in the text as riparian states). Human well-being is closely linked to the state of ecosystem services which make valuable contributions to livelihoods, particularly for rural households which face food insecurity, poverty and vulnerability.

Enormous pressure has been put on the water and wetland resources of the Kagera sub-basin through increasing uses driven by the rapidly expanding population such as deforestation, agricultural intensification, pollution, overuse and inadequate institutional frameworks for management of these natural resources. These threats affect both the quantity and the quality of the water resources in the sub-basin, and cause degradation of wetlands and loss of some or all the ecosystem services. More details are found in 2.3.3

2.3.2 Inventory of wetlands

The most significant wetlands are listed in Table 4 and shown in Map 5 (compiled from Hughes and Hughes (1992), FAO (1998), Tounkara and Diaw (2003) and REMA (2009)).

While many of them lie within one of the four Basin countries, many make up or are associated with the borders between countries, hence, are trans-boundary wetlands. Ideally these require joint management as the effects of mis-management on one side of a wetland can affect the whole wetland. However, trans-boundary management can be particularly complex, for example Map 6 shows the complex inter-relation of wetlands and lakes in Kagera 3 sub-watershed. The map shows the connection of the numerous shallow lakes, wetlands and the Kagera River. The implications of this are that when designing wetland interventions these interconnections need to be taken into account so the interventions do not jeopardise the integrity of the wetland ecosystem.

Map 5. Spatial distribution of wetlands and the extent of wetland degradation in the sub-basin

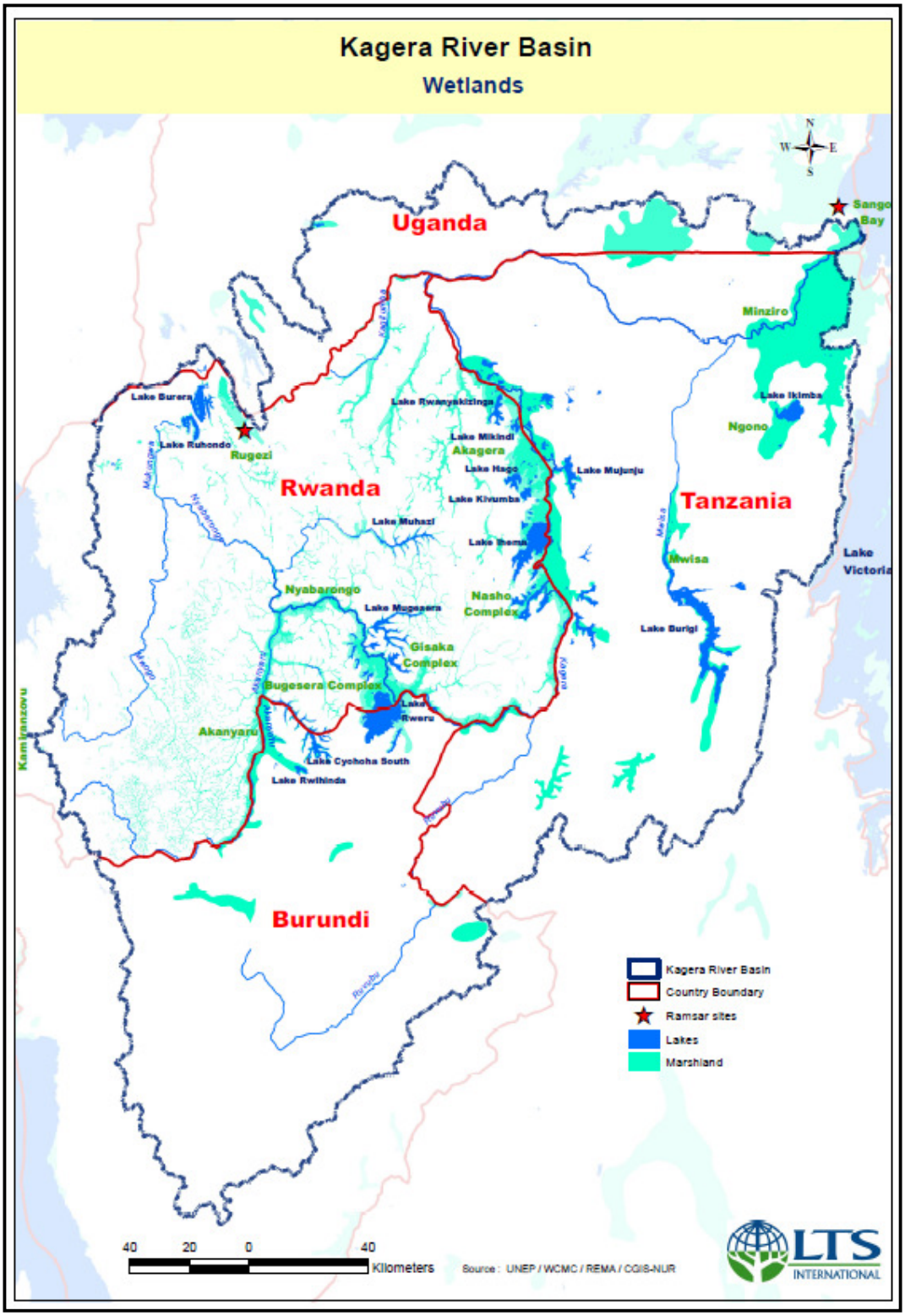
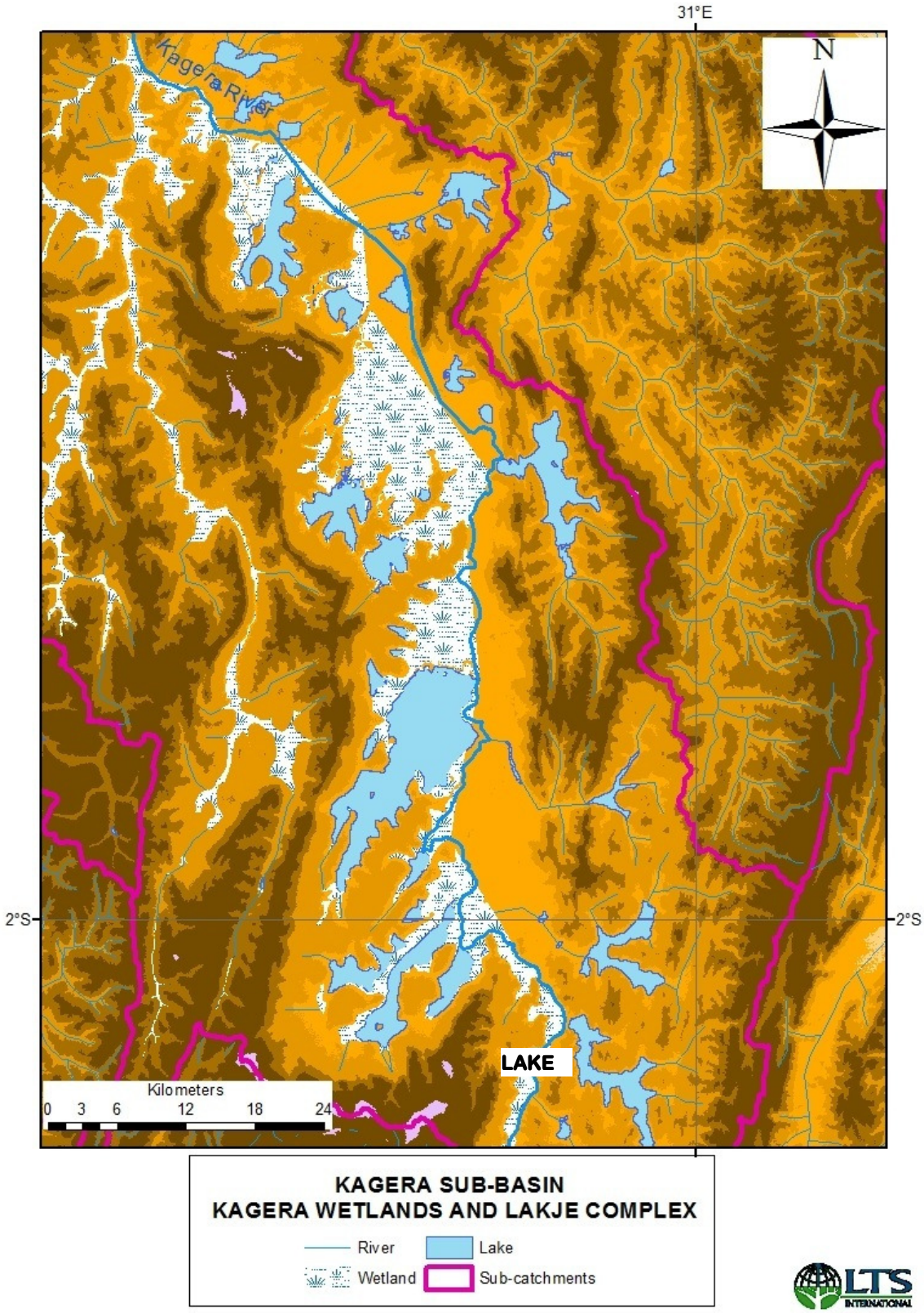


Table 4. Wetlands of significance in Kagera sub-basin
(sources: Hughes & Hughes (1992), FAO (1998), Tounkara and Diaw (2003), REMA (2009))

Name (country*)	Component lakes/marshlands	Area (km^2)	Comment
Akagera complex (Rw/Tz)	Lakes Hago, Ihema, Kivumbo, Mihindi, Rwakibara, Rwanyakizinga, Rweshikana Marshlands Akagera	146	National Park status (a third of original size due to land pressure), tourist destination. 1200-1500m altitude. Organic soil with less developed peat. More than 500 bird species, 9 of amphibians, 34 of reptiles, several CITES-listed fish species, large mammals. L. Ihema vegetation dominated by giant marsh grass which is important source of detritus in Kagera River; other grasses and herbaceous plants provide important habitat and source of nutrients for fish.
Bugesera complex (Bu/Rw)	Lakes Cyohoha North, Cyohoha South, Gaharwa, Gashanga, Kanzigiri, Katshamirinda, Kidogo, Kilimbi, Mirayi, Rumira, Rweru Marshlands Akayaru, Nyabarongo	1200	1200-1500m altitude. Organic soil with less developed peat, though extensive peat deposit found in Akayaru valley near Boyongwe in Burundi used for fuel.
Lakes Bugiri, Ikimba (Tz)		195	Both lakes 1200 m altitude. L. Burigi is surrounded by papyrus swamps and patches of forest, and partly lies within Burigi Game Reserve. Neither lake has an outflow (Kassenga, 1997)
Lakes Burera, Ruhondo (Rw)		83	High altitude, deepest lakes in Kagera sub-basin at 165m, 68m deep, respectively (majority are 3-7m depth), low biodiversity and phytoplankton. Tourist destination.
Gisaka complex (Rw)	Lakes Birira, Mugesera, Sake	80	L. Mugesera is principal habitat of several endemic species, some of which are protected, can experience great variation in water level when papyrus barriers are breached.
Kamiranzovu Marshland (Rw)		13	2300m altitude. Tourist destination in Nyungwe Forest Reserve.
Lake Mohasi (Rw)		34	Tourist destination.
Nasho complex (Rw)	Lakes Cyambwe, Mpanga, Nasho	43	
Lake Rwihinda (Bu)		92	1480m altitude. 12 km^2 lake with 80 km^2 marshland to west. May be referred to as the "bird lake". Habitat of some endemic species, some of which are protected.
Minziro Forest (Tz)		58	Seasonal swamp forest reserve. Home to many rare species of birds. The ecosystem is at threat from tree cutting, plant extraction, wood collection and charcoal making.
Mwisa and Ngono Marshland s(Tz)		44	Marshlands along Mwisa and Ngono tributaries to Kagera. Dominant vegetation is papyrus and water hyacinth.
Rugezi Marshland (Rw)		67	Ramsar wetland. High altitude marshland >1800m. Peaty soil. Tourist destination. Important for biodiversity with 51 vegetation species including several CITES-listed grass species, many animal species considered to be endangered and in need of protection, more than 10,000 bird species some of which also CITES-listed.
Ruvubu Marshland (Bu)	Marshlands Kayongozi, Luvironza, Ruvubu	460	1500m altitude. Permanent and semi-permanent marshlands dominated by papyrus in valleys of Ruvubu tributaries. Wetlands in lower valleys have National Park status, tourist destination. Over 400 bird species, 98 mammal species, 20 insect species, 8 bat species, 10 primates, 6 arthropods. Some mammals on IUCN red list & indigenous tree species of socio-economic importance.
Sango Bay-Musambwa Island-Kagera Wetland and Floodplain (SAMUKA) (Tz/Ug)		551	Ramsar wetland on Ugandan side. Seasonal papyrus swamp forest reserve where Kagera River enters L. Victoria. Biodiversity of global significance and high conservation value; important bird area, endemic species of fish, dragonflies, butterflies and endangered hardwood species (Davenport and Howard, 1996). Wetland significantly reduces the amount of water entering L. Victoria from R. Kagera (Haskoning, 2001).

* Bu Burundi, Rw Rwanda, Tz Tanzania, Ug Uganda

Map 6. Wetlands and Lakes Complex in Kagera-3 Sub-watershed



Wetlands in Rwanda

A recent inventory of wetlands in Rwanda identified 101 lakes covering a total surface area of 1495 km^2, 860 marshlands covering 2785 km^2 (10.6% of the country's surface) and 861 rivers totalling 6482 km in length (REMA, 2008). Of the marshlands, the largest of which are clustered around rivers, 41% were covered by natural vegetation and 59% had been or were being cultivated. However, some of these 1822 wetlands fall in the Congo basin which drains to the west, rather than the Kagera/Nile basin. The two largest marshlands are the Akagera complex along the Tanzanian border to the East and the Rwero-Mugesera complex in the south (Hughes and Hughes, 1992). There are other smaller marshland areas in flat places in the valleys and extensive marshlands on the high central plateau.

Wetlands in Tanzania

It is estimated that there are some 54,390 km^2 of lakes and marshlands In Tanzania, representing 5.8% of the total surface area of the country, but this does not include seasonally inundated floodplains (Hughes and Hughes, 1992).

The Kagera sub-basin forms only a small part of Tanzania but there is concern, not only about the impact on land, water and wetlands of development activities in Tanzania, but also of the impacts on both the quantity and quality of river flow of upstream activities in Burundi and Rwanda.

Wetlands in Uganda

Uganda's wetlands cover about 18% of the total surface area of the country (DWD/WWAP, 2005), composed of 5% lakes and 13% marshlands and swamp forest. There are many lacustrine and riverine marshlands, some seasonal floodplains at the heads of the large Rift valley lakes, and several small lakes.

Currently, wetlands are simply classified as: vital (have unique function, includes Uganda's Ramsar sites), critical (have important function, but not unique) and variable (of benefit to the wider community). A new classification is being developed based on Ramsar where the emphasis is on ecosystem services. The total value of Uganda's wetlands in economic terms is difficult to determine because some of the values are regarded as free public goods. However, wetlands are believed to supply direct or subsistence employment for 2.7 million people (almost 10% of the population) and about USD 100,000 per year is estimated to accrue from wetland resources through crop cultivation, papyrus harvesting, brick-making and fish farming (DWD/WWAP, 2005). Apart from SAMUKA (Sango Bay-Musambwa Island-Kagera Wetland and Floodplain), the majority of Uganda's wetlands lie outside protected areas.

Wetlands in Burundi

Burundi has six significant lakes comprising Lake Tanganyika (8%), which is not in the Kagera sub-basin, four lakes in the Bugesera complex on the border with Rwanda, including Lakes Cyohoha and Rweru, and Lake Rwihinda. In addition there are numerous small lakes in the hills and mountains. Marshlands cover 1180 km^2 or about 5% of the land area (Hobbs and Knausenberger, 2003). The Malagarasi marshland is the largest wetland and the most diverse, with over 140 bird species recorded. Some 6% of Burundi's marshlands are protected or identified for protection, and only 22% not yet exploited; 69% are used for agriculture, 1.8% for clay and sand harvesting and 1.2% for peat extractions.

2.3.3 Issues in wetland degradation

Significant wetland degradation has already occurred in the vicinity of several lakes in the Akagera complex (Lakes Hago, Ihema, Rweshikana) and upstream of Rusumo Falls. Lake Rwihinda in Burundi, which contains variety of migratory and sedentary birds, has been affected by agricultural activities leading to destruction of natural vegetation and some avifauna (BRL, 2008).

Human population places many demands on water and other natural resources of the Kagera sub-basin, such as medicinal plants, papyrus grass used for making mats and ropes, and also for roofing, peat extraction for fuel, and fish and animals for food. The expansion of human settlements and farming areas, road construction, landfill/waste disposal, increased demand for water for people and food, etc all results in the overuse of existing water resources and the exploitation of new water sources.

The main threats to wetlands from agriculture are the increased sediment input to wetlands caused by soil erosion from deforested hillsides and the degradation of marshlands caused by their drainage and irrigation for agriculture. Livestock may also be put to graze on marshland areas. Soil erosion is significant and widespread in upper catchments due to intensive cultivation and livestock-keeping and a lack of soil erosion measures such as bench or progressive terracing (SHER, 2002). In addition to degrading wetlands, high sediment yields increase flood risk by filling in stream beds, reduce the productive capacity of farms where the soil erosion is occurring and the financial viability of downstream irrigation systems, and contribute to downstream sediment and nutrient loading (Swallow et al., 2009[12]).

As the availability of suitable land for cultivation decreases and the population increases, extension of agricultural exploitation of marshlands is likely, particularly in the upper parts of the basin and/or in drought years. Farmed marshlands often form part of a production system contiguous with the neighbouring hillsides. Development in marshlands involves the digging of drains where the excavated soil is laid on the remaining islands to create land elevations which form the basis for future cultivated land plots.

The numerous lakes, extensive wetlands and networks of rivers and streams are sources of fish for the local communities around them. Fisheries and aquaculture play an important role in poverty alleviation in the Kagera sub-basin and offer great economic potential for the future. The connection between the rivers, lakes and wetlands in the sub-basin is shown in Map 6.

Water resources in the Kagera sub-basin have been heavily polluted with untreated domestic and industrial waste, rendering the water unsuitable for direct consumption and increasing the costs of treatment before it can be used. Key cities in the basin include Kigali with an approximate population of 950,000, Butare (90,000[13]), Bujumbura (300,000), Gitega (60,000), Bukoba (100,000) and Kabale with approximately 50,000 inhabitants[14].

However there are efforts geared towards addressing water and sanitation problems such as the Lake Victoria Water and Sanitation Programme. It is a regional water and sanitation programme, currently being implemented in 7 towns in the Lake Victoria Basin through cooperative agreements between UN-HABITAT and the 3 East African Governments of Kenya, Uganda and Tanzania to the tune of approximately US$ 16 million. The programme comprises an integrated package of interventions, including water supply and sanitation improvements, solid waste management, drainage improvements in key areas, as well as capacity building and training[15].

Water resources in the Kagera sub-basin have been heavily polluted with untreated domestic and industrial waste, rendering the water unsuitable for direct consumption and increasing the costs of treatment before it can be used.

[12] Swallow, B. M., M. F. Kallesoe, U. A. Iftikhar, M. van Noordwijk, C. Bracer, S. J. Scherr, K. V. Raju, S. V. Poats, A. Kumar Duraiappah, B. O. Ochieng, H. Mallee, and R. Rumley. 2009. Compensation and rewards for environmental services in the developing world: framing pan-tropical analysis and comparison. Ecology and Society 14(2): 26.
[13] According to the GeoNames geographical database
[14] http://en.wikipedia.org
[15] www.unhabitat.org

2.3.4 Existing plans and on-going projects in wetland conservation and development activities in the sub-basin

Table 5 briefly presents current and future planned wetland related projects that will be working within the Kagera sub-basin. The detail is provided in the Wetlands Annex B. These represent a range of development activities and funding agencies covering irrigation and hydro-electric power (HEP) infrastructure, agricultural development and livelihoods diversification. There are few that cover the sub-basin as a whole; those likely to have largest impact are the TAMP and, if it goes ahead, the Rusumo falls HEP scheme. There is scope for further sub-basin-wide complementary activities on wetlands conservation and local community development.

Table 5. Present and future projects in Kagera sub-basin involving wetland management

Details	Objective
Bugesera Natural Region Rural Infrastructure Support Project (Bugesera PAIR) (Bu/Rw) - *See also main text* 2010-2016, 47M USD (SWECO, 2010)	• To reduce poverty in the cross-border Bugesera region through improve food security • To build irrigation infrastructure, access roads and storage facilities, to increase agricultural production and to conserve soil and water
Decentralisation and Environmental Management Project (DEMPII) (Rw) – *See also main text* 2008-2013, 6.0M USD (www.rema.gov.rw)	• To contribute to poverty reduction and economic development through sustainable use and management of natural resources • To integrate environment with development and promote sustainable livelihoods using decentralisation as a delivery mechanism • To provide Districts with the capacity to plan, manage and ultimately benefit from environmentally sound development activities
Extending Wetland Protected Areas through Community Conservation Initiatives (COBWEB) (Ug) – *See also main text* Date 2009-2013, 3.8M USD (www.natureuganda.org)	• To strengthen Uganda protected area network by expanding the coverage to include the country's biologically important wetland ecosystems • To develop sustainable (wise use) management strategies to be implemented by rural communities in two pilot wetlands (Pian-Upe-Bisina-Opeta and Mburo-Nakivale)
Farm Income Enhancement and Forest Conservation (FIEFOC) (Ug) 2006-2010, 77M USD	• To improve incomes, rural livelihoods and food security in the country through sustainable natural resources management and agricultural enterprise development, thereby contributing to poverty alleviation • Conservation through tree planting and watershed management
Inland Lakes Integrated Development and Management Support project (PAIGELAC) (Rw) - 2002-2012 (Tounkara and Diaw, 2003)	• To contribute to strengthening food security • To improve the incomes in the fishing sector in a sustainable manner through building institutional capacities, increasing national fish production, and diversifying activities of fishermen among other activities
Irrigation Development and Watershed Management Project in the Lake Victoria Basin in Tanzania (Tz) 2011-2012 (NELSAP, 2011)	• To sustainably improve the living conditions and incomes of rural populations in five proposed irrigation sites (Bugwema, Isanga Valley, Manonga, Mara Valley, Ngono) and their surrounding watersheds. The Ngono scheme is in the Kagera sub-basin. The total area of all proposed schemes is 216 km^2
Kakono multi-purpose scheme (Tz), Feasibility stage (BRL, 2008)	• HEP generation (53 MW) to Tanzania • Irrigation water to Tanzania and Uganda

New Rice for Africa (NERICA) (Ug) www.warda.cgiar.org	• To promote rice growing in Uganda, which depends on rain-fed cultivation, using NERICA, a hybrid rice that combines high yields of Asian rice with strong disease and drought resistance of African varieties • To provide technical assistance to Sustainable Irrigated Agriculture Development Project in Eastern Uganda
Nyabarongo Dam (Rw) Under construction 2008-2012 SWECO (2010)	• 363 Mm^3 capacity reservoir on Nyabarongo river for future water supply to Kigali • HEP generation (28 MW) to Rwanda • Irrigation water to Rwanda
Rural Sector Support Project II (RSSPII) (Rw) 39M USD in 3 phases (MINAGRI, 2008)	• To revitalise the rural economy and improve the quality of life of the rural poor through increased transfer of technical and financial resources for sustainable rural development • To accelerate agricultural intensification and promote the emergence of a vibrant, commercially-oriented rural economy • To increase agricultural production and marketing in marshland and hillside areas targeted for development in an environmentally sustainable manner
Regional Rusumo Falls Hydro-Electric Project (RRFP) (Bu/Rw/Tz) 257M USD (mid 2008 prices) http://en.wikipedia.org/wiki/Rusumo_Power_Station	To enhance economic and social development in the region through productive multipurpose use of electricity to support investments in sustainable livelihoods. It will have the following main elements: • A hydroelectric power station of 90 MW over the Rusumo Falls; • Transport facilities connecting the Rusumo Falls hydroelectric power plant to the electricity networks of Burundi, Rwanda and Tanzania; • The mechanism for the co-management of electricity production facilities • Irrigation
Transboundary Agro-Ecosystem Management Programme (Kagera TAMP) (Bu/Rw/Tz/Ug) 2010-2014, 30.3M USD (www.fao.org/nr/kagera)	• To adopt an integrated ecosystems approach for the management of land resources in Kagera sub-basin that will generate local, national and global benefits • To contribute to improved food security and rural livelihoods, protection of international waters in Lake Victoria and Nile basins, and climate change adaptation and mitigation
Integrated Management of Transboundary Water Resources of the Lakes Rweru and Cyohoha and the Akanyaru marshland (GIRET) 60 M USD.	• The objective of the project is to contribute to poverty reduction and reverse environmental degradation in the Bugesera region and to improve the transboundary water resources of Lakes Rweru, Cyohoha and the Akanyaru marshlands
Kirehe community based Watershed Project (KWAMP) 61.3 M USD http://operations.ifad.org/web/ifad/operations/country/project/tags/rwanda/	• The goal of KWAMP is reduction in rural poverty in Kirehe District through improvement in household food and nutrition security, asset ownership and quality of life indicators, particularly amongst vulnerable groups. It has three components namely: local institutional development; agricultural intensification; and feeder road rehabilitation
Lake Victoria Water and Sanitation Programme (LV WATSAN) US$ 16 million (KE,TZ, UG[16])	• Promote pro-poor water and sanitation investments in the secondary urban centres in the Lake Victoria Region • Support development of institutional and human resource capacities at local regional levels for the sustainable delivery of improved water and sanitation services • Facilitate realization of upstream water sector reforms at the local level in the participating urban centres • Reduce the environmental impact of urbanization in the Lake Victoria Basin

[16] www.unhabitat.org

2.3.5 Lessons in wetland conservation and development in the sub-basin

In summary, the lessons in wetland conservation and development from the review of past and current initiatives in the Kagera sub-basin are noted below.

Landscape

A basin perspective is critical to address the key environmental issues and sustainable solutions require an integrated approach involving economic, environmental and social aspects and participation of all relevant stakeholders.

Wetlands cannot be isolated from their watersheds: management interventions must apply to whole catchment. Similarly, transboundary wetlands must be managed as a single entity, with investments benefits all local communities.

Often, the solutions are already known; the challenge is scaling-up to make a real difference to people in longer duration projects.

Developmental

Participation of all key stakeholders, particularly beneficiaries, is important however costly or time consuming.

Participatory management frameworks involving local groups made up of key local stakeholders e.g. watershed management committees are important to ensure appropriate operating practices, adaptive management and continued maintenance.

Environmental benefits must be strongly linked to improved livelihoods for local people and communities: community-driven watershed management projects should comprise natural resource conservation interventions which generate ecosystem services and livelihood improvement activities that are largely household based.

Incentives such as payment for ecosystem services and the polluter pays principle have potential to facilitate implementation of sustainable management practices.

Targeted use of incentives can help to develop investments for natural resources conservation where the proposed interventions are new or where there is likely to be resistance.

Strategic Management

There is a lack of institutional capacity to monitor, plan and manage water resources in (parts of) the Kagera sub-basin effectively and sustainably.

Effective interaction and cooperation across ministries (horizontal) and through the various levels of government (vertical), and harmonisation of policies, is necessary to facilitate solutions to problems.

Interventions to improve management practices should be accompanied by awareness raising, information dissemination and environmental education targeted at several levels in society and vice versa i.e. awareness-raising should be accompanied by demonstration activities.

Focused, motivated management and interest of local institutions can help overcome barriers in technically complex and politically sensitive projects, and sustain local actions.

Information

There are insufficient long-term data for the design of water-related schemes and for the integrated management of the transboundary Kagera sub-basin. However in Rwanda REMA established the Wetlands Information System under the Integrated Management of Critical Ecosystems (IMCE) project (2006-2011). Rwanda's wetlands were classified into 101 lakes, 860

marshlands and 861 rivers. 59% of marshlands are being or have been cropped. The marshlands are classified into 38 marshlands requiring full protection, 475 for exploitation under condition of a full EIA, and 347 for exploitation after a basic EIA. The project also developed an inventory of marshlands associated with four critical ecosystems and made recommendations as to their level of protection or conditions of use and established local watershed management committees and community-based management plans to promote sustainable and rational use of marshlands.

Scientific research should be targeted to fill knowledge gaps and/or address specific ecosystem and socio-economic problems, in order to provide information that can be translated into policies and management plans.

Management decision-making lacks technical information: research on environmental, biological and socio-economic aspects of wetlands is crucial to address some of the gaps in wetland knowledge, a key gap being economic valuation of wetland services

2.3.6 Wetland values, functions and attributes of the wetlands of conservation significance

The typical uses of Kagera wetlands by humans are presented in Table 6. Some marshlands occur along the boundaries of National Parks and Reserves and form buffer zones between the protected areas and the neighbouring land and people. Other marshlands, especially the high altitude and/or peat soil ones, are often the sources of major rivers or of water supply for people or industry, and changes to the hydrological functioning (such as drainage or peat extraction) can cause major impacts downstream e.g. the Rugezi marshland in Rwanda. Wetland ecosystems often contain specific, sometimes endemic flora and fauna which may be protected by national or international law. Again changes to such wetlands can result in the reduction or loss of biodiversity. The local context for the key uses and functions is outlined below.

Wetland cultivation

The main threats to wetlands from agriculture are:

- Increased sediment input to wetlands caused by soil erosion from deforested hillsides
- Degradation of marshlands caused by their drainage and irrigation for agriculture.
- Livestock grazing on marshland areas.
- Soil erosion is significant and widespread in upper catchments degrading wetlands,
- High sediment yields increase flood risk by filling in stream beds.

The majority of the population of the Kagera sub-basin are engaged in agricultural activities. Some farmers cultivate small plots for food production in the rainy season, others cultivate swamp and riverine banks of the Kagera in the dry season when they have no other water source (Table 6). Many marshlands are under traditional cropping or have been modified through extensive drainage or irrigation, particularly for rice production and sugar cane growing (REMA, 2009[17]). In Burundi, Tanzania and Uganda, wetland grasslands provide critical areas for livestock grazing, especially during the dry season.

[17] REMA (2009): Rwanda State of Environment and Outlook Report.

Table 6. Typical direct and indirect uses of Kagera wetlands

Direct uses	Indirect uses
Clay and sand mining	Water regulation, storage and recharge
Commercial and subsistence fisheries	Water quality and purification
Communal grazing	Aesthetic value
Fuel wood and construction materials	Conservation and preservation
Horticulture and plantation	Cultural and/or historic significance
Medicinal plants	Ecotourism
Navigation and traditional boating	Environmental and educational value
Papyrus harvesting	Natural research area
Recession agriculture and cultivation lands	Recreation
Settlement	Scientific research and monitoring
Small and large scale irrigation	Spiritual significance
Urbanisation and infrastructure development	
Waste dumping	
Water supply for drinking	

Wetlands' role in water provision

Water level is strongly influenced by the growth and disappearance of vegetation, particularly in the lower reaches (below Rusumo Falls) where wetlands have a particularly dominant effect on the water balance due to the storage and release of water. Above Rusumo Fall, the water depth of the Ruvubu river has decreased to the extent that it is possible to cross on foot for 8-10 months a year (Baijukya et al., undated[7]). Indeed, the tributaries of the Kagera sub-basin are increasingly drying out during the dry season due to the widespread problem of increased runoff and lack of water retention due to poor vegetation cover.

It is estimated that 50% of Rwandans do not have access to clean drinking water, exacerbated by the conversion of wetlands into agricultural land, thereby destroying an inexpensive method of purifying water and necessitating substantially higher future investments to have clean water (UNEP/IISD, 2005a).

In Uganda, wetlands have been found to provide potable water supplies valued at about USD 25 million per year (NEMA, 2001). Around five million people are estimated to consume at least 50 million litres of water daily from wetlands (Uganda National Wetlands Programme 2004). However, UNEP/IISD (2005c) reports that Uganda is expected to experience water stress by 2025 due to the continuing degradation of the country's wetlands which provide indispensable ecosystem and regulating services including maintenance of the water table, water filtration, flood control, groundwater recharge and microclimate regulation. The Nakivubo wetland in Kampala is estimated to contribute USD 1.7M per year to the economy as a wastewater treatment plant (DWD/WWAP, 2005).

Risks to Wetlands from HEP

Humans require power and the hydropower potential of the Kagera sub-basin has been estimated at about 490 MW of which only about 44 MW, or less than 10%, has been developed to date (BRL, 2008). Many possible schemes have been rejected due to current social and/or environmental concerns, but three schemes under consideration are Nyabarongo in Rwanda (28 MW), Rusumo Falls in Rwanda (90 MW distributed equally between Burundi, Rwanda and Tanzania) and Kakono in Tanzania (53 MW); construction is started for the first one, and ESIA presently ongoing for the latter two. Potential impacts of large dams include significant upstream flooding, with increased evaporation and GHG emissions from the reservoir, and a reduction in downstream flow which impacts wetland ecosystems. With the demand for power increasing all the time, there is a growing interest in small, mini and micro-hydro schemes which are run-of-

river or have minimal reservoirs and minimal construction works, as well as relatively low environmental and social impacts compared to large hydro. In most cases, they may be developed using standardised, readily available equipment and with minimal environmental and licensing procedures. An example of this is the mini, run-of-river hydro scheme at Kikagati in Uganda (10 MW).

2.4 Population and Socio-economic Features[18]

2.4.1 Population and land use

The basin population in 2006 was estimated to be 16.5 million people; and expected grow to 32.8 million by 2030 based on average population growth rates for the period 1999-2015 of 3% per year[19]. The population density within the basin averages 227persons/sq.km and varies between 45 and 1,900persons/km2. The highest densities are found in the western half of the sub-basin and the lowest in the central plains (see map 7). The population mainly depends on subsistence level farming, herding and fishing activities. Agriculture accounts for over 75% of the productive uses of land in the basin. However, the varying ecologies in the 4 countries provide for a range of locally-adapted cropping, livestock and fishing activities and livelihood systems that are strongly influenced by water availability and quality.

The farming system remains essentially subsistence agriculture, with low or negligible purchased inputs, high labour input and limited sale of surplus food and cash crops (banana, maize, coffee), and livestock products (meat, milk, hides, breeding stock). Limited areas are under commercial farms (sugar cane, horticulture, coffee, tea). Some of the drier areas in eastern Rwanda and the drier belt across the North West Tanzania–Uganda border were, until recently, still used for semi-nomadic pastoralism – but most pastoralists have now settled to adopt other livelihoods.

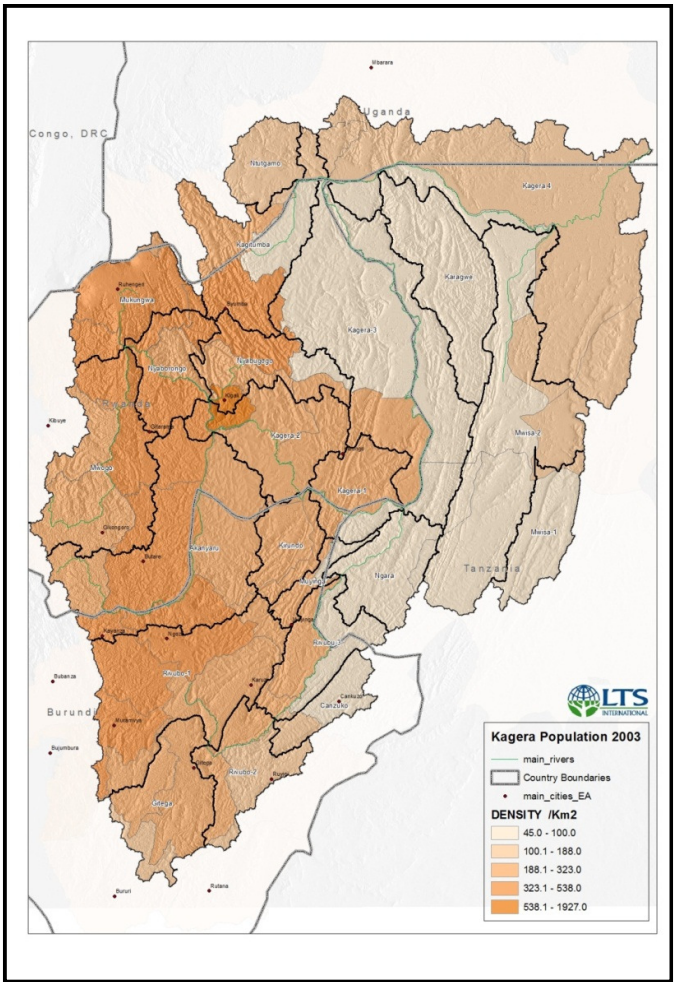
2.4.2 Social and economic development plans

The basin's socio-economic development plans are set out in each country's economic growth strategy and visioning documents.

In Burundi's economic growth strategy 2006 emphasises the medium- and long-term development of Burundi for the reduction of poverty. The PRSP's most pertinent points are the re-launching of agriculture, livestock, fisheries, and fish farming and the improvement of environment protection.

[18] For more details of this section refer to Annex D.
[19] Adapted from the NELSAP Transboundary Cooperative Framework and Management Strategy (2008) by COWI Uganda.

Map 7. Population density in Kagera sub-basin (2003)



In Rwanda Vision 2020 Umurenge is essentially about decentralization and the main mechanism for delivering poverty reduction through integrated interventions. It will accelerate poverty reduction by promoting pro-poor actions at the grassroots especially in rural areas. Already, 30 sectors (the poorest sector in each of 30 districts) have been selected for piloting the Concept of Vision 2020 Umurenge, borrowing from the Millennium Villages concept. Planned integrated activities include labour intensive public works, cooperatives development, provision of productive skills and enhancing access to productive skills, among others.

In Tanzania the National Strategy for Growth and Reduction of Poverty (MKUKUTA II) describe the interventions required for socio-economic development under the growth for income development, improvement of life and social-well-being, good governance and accountability clusters.

In Uganda, Vision 2025 aims at attaining sustainable socio-economic development, which maintains or enhances environmental quality and resource productivity on a long-term basis in order to meet the needs of the present generation without compromising the ability of the future generation to meet their needs.

2.4.3 Land use plans

In Burundi the National Strategy of Sustainable Land Use (2007) provides strategic orientations for a coherent framework for future instruments of planning and sector actions. It also provides the basis of a legal framework of the strategy for an adequate and appropriate institutional restructuring, the necessary resources to implement the strategy, and an action plan detailing the tasks to be undertaken in the first three years of implementation. The 2011 Land Code is aimed at the best optimal organization and exploitation of space, the creation and development of urban areas

In Rwanda, the administration system is used as the key of land tenure security, acting to register and transfer land. All Rwandans enjoy the same rights of access to land (implying that there can be no ethnic or gender discrimination). Title to all land should be registered so that it can be traded, except where doing so would fragment the land into plots less than 1 ha in area. Land use is meant to be optimal and households are encouraged to consolidate plots to ensure that each holding is not less than 1 ha. An individual owner is meant to have a maximum size of 50 hectares. Families are required to hold land in common to avoid fragmenting the land into parcels that are too small.

In Tanzania most of the land falling within the sub-basin is un-surveyed and undeveloped, invariably leading to conflicts over land use. For optimal utilization of land, participation of the private sector in land development (surveying, zoning, etc) is very critical. The interventions being undertaken are detailed under the different land legislation and in the MKUKUTA II.

In Uganda land use planning is influenced by the Uganda Land Policy (2011). The policy addresses historical injustices and colonial legacies, contemporary issues, mainly arising from such legacies; and land use and land management issues.

2.4.4 Relevant environmental regulations and policies

Burundi

In Burundi the National Environment Strategy of Burundi is a response to resolve conflict between the objectives of development and those of protection of natural and environmental resources, proposing measures suitable to restore or safeguard a balance between interests of development and those of environment. The Environmental Code 2000 sets the fundamental rules intended to enable the environmental management and protection against all forms of degradation so as to safeguard and promote the rational exploitation of natural resources, fight against pollution, and improve the population's living conditions in respect of the balance of ecosystems. Access to land is regulated by the 2011 Land Code (GOB Land Code 2011). It introduces land certificates (*certificate foncier*) and decentralized land administration; revocation of governors' authority to allocate state land. The delimitation of public land, protection of parks and forests, and payment of compensation in case of land expropriation will be regulated by the upcoming 'Code d'aménagement du territoire' (last draft from 2008). In the meantime, the 1986 code still applies[20].

Rwanda

Rwanda's policy framework for environmental management is grounded in four key documents: the National Environment Policy (NEP 2003), the Economic Development and Poverty Reduction Strategy (EDPRS 2007-2012)), the Rwanda Organic Law 2005 and the Land Policy 2004. The major objectives of the NEP are to improve the standard of living and the sustainable use of natural resources and to protect and manage natural areas for balanced and sustainable development. The Organic Law is the principal law on protection of the environment. Vision 2020 (Umurenge) addresses sustainable management of national holdings, the environment, and such natural resources as soils, water, energy, and biodiversity. Water Resources Management is addressed by the National Policy for Water Resources Management 2011. The

[20] *www.**land**governance.org*

goal of the policy is to manage and develop the water resources of Rwanda in an integrated and sustainable manner so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with full participation of all stakeholders in decisions affecting water resource management.

Tanzania

In Tanzania the national policies related to the environment and watershed management are The National Poverty Eradication Strategy, Development Vision 2025, Poverty Reduction Strategy Paper, National Strategy for Growth and Reduction of Poverty, Agricultural Policy, Agricultural Sector Development Strategy, Agriculture and Livestock Policy, Mineral Policy, National Energy Policy, National Environmental Policy, National Fisheries Sector Policy and Strategy Statement, National Forest Policy, National Irrigation Policy, National Land Policy, National Water Policy, Natural Resources Law, Rural Development Strategy. Most of the policies stress the need for community participation and involvement in management of the environment and natural resources.

Uganda

In Uganda the environmental management framework is anchored in the National Environment Management Policy. Subsequent policies, laws and strategies for sustainable development are anchored in this policy. Its overall goal is "sustainable social and economic development which maintains or enhances environmental quality and resource productivity on a long-term basis that meets the needs of the present generations without compromising the ability of future generations to meet their own needs". Overall, the legal and policy framework for integrating environmental concerns in development is strong, and has actually become even stronger in the recent years. This has been shown in the case of the Constitution, National Environment Act and National Planning Authority Act. Further, whereas the policies and laws formulated in early 1990s broadly talk of socio-economic development, those in 2000s expressly specify the importance of poverty reduction and livelihoods. Further detail on relevant regional and international policies and conventions is in Annex D.

2.4.5 Key socio-economic development pressures

The basin's land and freshwater resource base, associated biodiversity and populations whose livelihoods and food security depend on those resources, are threatened by land degradation, declining productive capacity of croplands and rangelands, deforestation and encroachment into wetlands. The situation is exacerbated as most of the people are very poor and they are unable to invest in improved resources management. Refugee movements in recent decades have further increased pressures on resources in the sub-basin, raising actual and potential conflicts between interest groups and across countries. In addition more widely across the basin there is a breakdown in traditional land protocols that regulate grazing[21].

The resulting human-induced transfer of nutrients, in addition to variations in soil, land form and hydrology has led to large differences in soil fertility across the basin. Traditional land use systems sustained high productivity with low external resource inputs relying on rotations, fallows, shifting cultivation and transhumance / nomadic livelihoods. Increasing pressures on land resources due to population growth has led to changing land use systems, overexploitation of resources and greater reliance on poorer lands for crop and livestock production. In turn, this exacerbates poverty and vulnerability to environmental and health shocks, as well as inability to satisfy basic requirements – food, shelter clothing and access to health services, education and safe drinking water.

[21] *www.fao.org*

Wetland formation and development is influenced by climate, some wetlands formed in wetter and cooler past climates may no longer be stable under current or possible future conditions. There is a lot of uncertainty in the Nile Equatorial Lakes region about how precipitation and temperature will change as climate changes. Whilst it is unclear how precipitation patterns might change, most models suggest an increase in average temperature, possibly causing more frequent drought, and an intensification of rainfall during the rainy seasons, potentially leading to increased flooding and erosion (SEI, 2009). However, in the region it is difficult to separate possible climate change impacts from the effects of natural climatic variability and consequences of overexploitation of natural resources.

According to the Water Climate and Development Programme for Africa the impact of climate change on the intensity and frequency of precipitation extremes and daily maximum temperatures are projected to be significant in the basin. The length of the wet seasons is expected to reduce implying longer dry spells for most of the months and this is related to the projected increase in the mean daily maximum temperature. Precipitation extremes will significantly affect the storm design curves which are very useful for many engineering applications and water managers are advised to plan for floods and landslides. Farmers are also advised to take into consideration the impact the extreme precipitation and change in length of the wet seasons will have on agricultural production and food security[22].

2.4.6 Key social and technical constraints limiting the sustainable utilization and benefits from watershed resources

The traditional livelihood strategies of land use such as rotational farming, leaving the land fallow, shifting cultivation and nomadic livelihoods are not as viable as they used to be due to increases population pressure. In addition agricultural techniques such as burning and repetitive tillage have had negative impacts on the environment.

There has also been limited or negligible government support and lack of incentives for natural resources management. There are weak governance mechanisms for the common pool land and water resources and many resource users do not participate in decision making, especially the poor, women and youth.

The communities living in the basin have limited access to improved technologies, information and services (research, credit, reliable markets, inputs and dispensaries). In upland areas, water is scarce both for domestic use and livestock as wells and watering points are mostly in lowland areas, or is sold from kiosks at prices most people cannot afford. In large areas of the basin, fuel wood is also in increasing short supply and alternatives such as paraffin or electricity are only accessible in the few urban centres.

Labour is a major constraint, especially due to the severe impacts of HIV/AIDS and malaria, which particularly affects women. Sickness also diverts limited incomes from investment in land for care and medicines. Markets are limited to certain commodities and prices for most agricultural products are extremely low and unreliable, often affected by urban pro-policies and exploitation by 'middle-men'.

Insecurity of land tenure restrains investment in the land and discourages youth from entering into agriculture due to delays in inheriting land and low potential incomes. As a result of HIV/AIDs and rural exodus, there is a serious generational loss in the transfer of local/ indigenous knowledge (traditional medicines, use/management of local species/ varieties, soil and water management, biocontrol of pests and diseases, etc.). Many households are headed by women, and as a result of the war, in Rwanda women now comprise 60% of the total population (WSP International, 2003).

In Rwanda 56.9 per cent of the total population were living below the poverty line and 37.9% were extremely poor in 2006 and in the rural areas about 64.7 per cent of the population were living in poverty. Agriculture is the backbone of the economy and it contributed an average of

[22] http://www.gwp.org/en/WACDEP/IMPLEMENTATION/Where/Kagera/

about 36% of total GDP between 2001 and 2008, and it employs more than 80 per cent of the population. But the sector is very fragile. Rough terrain, erosion and climatic hazards combine with geography and the lack of modern technology to create serious constraints to agricultural development[23].

Poverty in Burundi is particularly severe, where the economy has stagnated as a result of the civil war and insecurity (agriculture provides 95% of food needs and 80% of export income - largely tea and coffee; subsistence food crops occupy 90% of cultivated land).

The highly variable biophysical conditions and varied land use-livelihood systems developed by different socio-economic and cultural groups, through local experiences, knowledge and exchange of germplasm and driven by needs and opportunities faced by the growing populations, has led to the conservation and development of characteristic highly adapted species (drought resistant plant species, mobile animal races) and high within-species diversity in the Kagera sub-basin. However, this agro-ecosystems and biodiversity heritage is increasingly threatened by overexploitation of resources and resulting degradation which are influenced by the transboundary nature of the basin.

2.4.7 Assessment of economic losses associated with soil erosion wetland and land degradation

Nearly 40% of Regional Gross Domestic Product (RGDP) is derived from the value of primary goods produced directly from the natural resource base. The growing population and the expansion of production into increasingly marginal land has led to watershed degradation due to loss of soil fertility and erosion, shortage of grazing and loss of woody biomass cover. Formal economic accounts take into account changes in capital stocks of factors of production through investment and depreciation. To estimate economic growth correctly it is important that the stock of natural resources is treated in the same way. However, because many natural resources are neither traded commodities nor have a formal market, it is difficult to quantify depreciation costs in economic terms. However, some very general estimates can be made to estimate:

- The cost of replacing soil fertility which is used over and above annual replacement level (by animal manure, chemical fertiliser etc.)
- The cost of replacing animal fodder that is used over and above its annual replacement level
- The cost of replacing fuel wood and construction timber that exceeds annual growth rates, both in "natural" vegetation and plantations.

The use of fertilisers in the Kagera sub-basin[24] is probably less than 5 kg/ha p.a. so the non-sustainable use of soil fertility is expected to be high, an observation that is confirmed by IFPRI studies, which estimate losses of 60-100 kg per cultivated ha of NPK per annum in all four riparian States (Nutrient Depletion in the Agricultural Soils of Africa, 2020 Brief 62, IFPRI). The estimate takes into account both nutrient mining and absolute soil loss. The cost of making good this annual loss by increasing chemical fertiliser application would be about US$ 50 per ha p.a. in 2011[25]. Over a cropped area in the basin of two million ha, this amounts to US$ 150 million or 7% of the value of the crops sector of the RGDP (constant 2011 US$ 1,397 million, albeit estimated for different years between 2004 and 2009). To return soil fertility to higher levels would of course cost more; the estimated cost would simply halt the decline.

There are about 3.1 million TLU in the Kagera sub-basin. This is a reasonably accurate estimate because it was based on total administrative area stock statistics. At a dry matter requirement of 5kg per day per TLU, the total requirement of dry matter by grazing stock in Kagera sub-basin is

[23] http://www.ruralpovertyportal.org/country/home/tags/rwanda
[24] Fertiliser use in Rwanda is about 4,000 tons annually over an arable area of two million ha, Burundi uses about half this tonnage on a slightly larger area. About 10% of the area is treated with FYM each year.
[25] FOB fertiliser prices in 2011 are: urea $416 per ton, TSP $530 per ton and MOP $623 per ton (World Bank). Prices have been adjusted for active nutrient content. The ratio of NPK lost through both nutrient mining and soil erosion is assumed to be 3:1:1.

estimated as 5.7 million tons pa. Assuming about 60% of this is from "natural" grazing (the balance being from crop residues and hay) then the demand for dry matter from natural grazing is about 3.5 million tons pa. Annual dry matter productivity of lowland grazing in Kagera is about 1.5 tons per ha pa where rainfall is less than 800 mm per annum, increasing to 4 tons per ha pa in upland areas. The area of grazing in the Kagera sub-basin is in the order of 2.7 million ha (derived from vegetation mapping): taking into productivity differences by altitude and accessibility the annual dry matter production from grazing land may be about 3 million tons pa. Dry matter resources may be declining by about 0.5 million tons pa. The cost of replacement of this by, for example incremental hay production would be (at a yield of 5 tons per ha require 85,000 ha with a production cost of about US$ 50 per ha excluding labour) about US$ 4.3 million, or about 0.1% of the RGDP. Again, this cost would simply halt the rate of loss.

The total use of fuel wood and construction timber per annum (both urban and rural consumption) in Kagera is estimated as in the order of 10 million tons of woody biomass pa (rural fuel wood demand per capita is about 800 kg pa alone and the consumption for building materials may be an additional 10%). The annual incremental yield of woody biomass varies from forest at about 7 m^3 per ha pa, to bush land at about 0.2 m^3 per ha pa. Applying these production figures to the area of physiographic vegetation types in the sub basin suggests an annual production of about 8.7 million tons per annum (converting at 0.6 m^3 per ton), suggesting a deficit of production of about 1.8 million tons per annum. The area required to produce 1.8 million tons of woody biomass under plantation conditions would be about 120,000 ha for which establishment costs would be about US$ 180 million, or 4% of the value of the entire basin RGDP.

Even these superficial calculations show the enormous cost required to achieve environmental sustainability. The depreciation costs of soil loss and unsustainable use of dry matter and woody biomass may be in the order of US$ 335 million per annum and if included in the sub basin accounts would reduce the estimate of RGDP by about 9%, lowering the observed growth rate and implying (since the costs of environmental depreciation are not borne equally throughout the sub basin) that some members of the population, particularly those dependent on primary production may be becoming absolutely disadvantaged in terms of RGDP per capita.

For wetlands economics losses due to degradation would amount to the reduction of ecological services currently valued at about US$ 34 million per annum which is about 0.8% of RGDP.

2.5 Economic and Financial Baseline

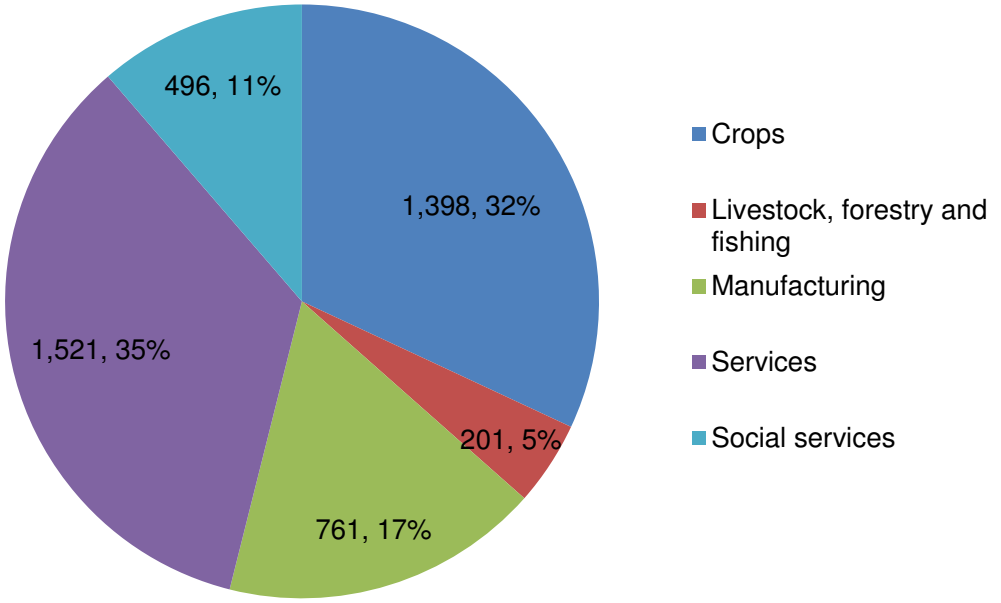
The complete economic and financial data and analysis are presented in Annex C.

2.5.1 Kagera sub-basin RGDP estimate

The estimated Regional GDP of the Kagera sub-basin was about US$ 4.3 billion in market prices (constant 2011 US$). Expressed in PPP, RGDP was US$ 10.1 billion. Compared with many other river basins in Africa of similar size (60,500 km2) this is a substantial RGDP – reflecting the high population density of over 250 per km2 (15.2 million people).

The financial value of the main economic sectors comprising RGDP is shown in Figure 2. The economic activity in the basin is undiversified, with a small secondary (manufacturing) sector, a large service sector (much of which is "informal") and a moderate value of social service provision (11%). The primary sector is the largest at 37%, and of that food crops dominate at 32%. In terms of value, the cash crop sub-sector is very small, and livestock, forestry and fishing together only account for about 5% of the RGDP.

Figure 2. RGDP of Kagera sub-basin by sector (Constant US$ 2011)



The small proportion of the livestock sub-sector in the RGDP has attracted comment, but this can be explained. The proportion of the livestock sector has been estimated on the basis of livestock numbers reported by administrative area in recent statistics, converted into TLU: as such it is likely to be accurate, but a numerical under-estimate. Nevertheless, the Eastern Cattle Corridor in Uganda occupies only a small proportion of the total sub-basin area. But most important the productivity per TLU is very low, hence the relatively small proportion of the livestock GDP in the sub-basin economy. The large proportion of the service sector in the regional economy has also attracted comment, but includes all activity in the informal service economy. In any event, the RGDP estimates provided here are only indicative. It would take several months of work by an economics unit in a river basin planning authority to assemble the statistics required for a more accurate estimate.

2.5.2 Trade between riparian states

A project aimed at promoting the growth of riparian state economies in a river basin must necessarily consider the status of international trade between those states. International trade is a manifestation of comparative advantage, and development plans for trans-boundary basins should take into account the most economic use of basin resources within their respective territories. Table 7 shows the trade status in 2009, sourced from the International Trade Centre Market Analysis data. Note that only Tanzania, a coastal country has a substantial export trade. Only Uganda exports more than 5% of its total exports to other riparian states, other inter-riparian state trade is negligible: Uganda is both land-locked and a relatively large economy compared with neighbouring Burundi and Rwanda. Burundi exports nothing to the other riparians; the country is still under reconstruction. Tanzania and Uganda both export to Burundi.

The total value of trade between riparian states was only US$ 92.7 million in 2009. About half of this is in commodities and half in manufacturing. The total trade volume between the riparian states is only about 2% of the RGDP of the Kagera sub-basin, and a tiny proportion of the combined GDP of all four states. The reasons for this include poor connecting infrastructure, three of the states being landlocked and low diversification of economies and markets. This is sufficient to suggest that if inter-regional trade will be a lynch pin of the development in the Kagera sub-basin, it is going to have to be built from a very low base.

Table 7. International Trade between Riparian States of the Kagera sub-basin

Exporter	Importer	Exporter's exports to importer value 2009 in US$ thousand	Exporter's exports to world value 2009 in US$ thousand	Importer's imports from world value 2009 in US$ thousand	% of exports to world	% of imports from world
Rwanda	Rest of the World	211,417	211,417			
	Burundi					
	Tanzania	142	802	665,724	18%	0%
	Uganda	305	3,444	1,101,290	9%	0%
Burundi	Rest of the World	112,923				
	Rwanda					
	Tanzania					
	Uganda					
Tanzania	Rest of the World	2,954,048	2,954,048			
	Rwanda	3,251	177,880	81,990	2%	4%
	Burundi	4,748	629,201	132,587	1%	4%
	Uganda	20,167	1,515,306	2,335,313	1%	1%
Uganda	Rest of the World	978,611	978,611			
	Rwanda	30,117	859,250	209,620	4%	14%
	Burundi	20,389	374,191	99,998	5%	20%
	Tanzania	13,564	550,911	3,792,320	2%	0%

2.6 Legal and Institutional Arrangements within the Sub-basin

2.6.1 Relevant (decentralized) water and related natural resources management institutions

Table 8 provides an overview of the institutions that engage in watershed, wetland and environment per country. For more details refer to Annex E on institutional analysis. A discussion of applicable regulations and policies is already covered under section 2.3.3. Details can be found in Annex E.

Table 8. Overview of Institutions engaged in watershed and wetland activities in the sub-basin

Institution	
Wetlands management	
Burundi	• National Institute for the Environment and the Conservation of Nature (INECN)
Rwanda	• Rwanda Environment Management Authority (REMA)
Tanzania	• River Basin Water Offices, Ministry of Water (MOW) • Wetlands Unit, Wildlife Division, Ministry of Natural Resources and Tourism (MNRT)
Uganda	• Wetlands Management Department (WMD), Ministry of Water and Environment (MWE)
Environmental management	
Burundi	• Ministry of Water, Environment, Territorial Administration and Urban Planning (MWETAUP) • National Institute for the Environment and the Conservation of Nature (INECN)
Rwanda	• Ministry of Natural Resources, Land, Forests, Environment and Mining (MINIRENA) • Rwanda Environment Management Authority (REMA)
Tanzania	• Division of Environment, Vice-President's Office • National Environmental Management Council (NEMC)
Uganda	• Directorate of Environmental Affairs (DEA), Ministry of Water and Environment (MWE) • National Environmental Management Agency (NEMA)
Water resources management, hydrological monitoring	
Burundi	• Geographic Institute of Burundi (IGEBU) • Ministry of Water, Environment, Territorial Administration and Urban Planning (MWETAUP)
Rwanda	• Ministry of Natural Resources, Land, Forests, Environment and Mining (MINIRENA)
Tanzania	• River Basin Offices, Ministry of Water and Irrigation (MOWI)
Uganda	• Directorate of Water Resources Management (DWRM), Ministry of Water and Environment (MWE)
Water supply and sanitation	
Burundi	• Institute for Waste Management (SETEMU)

Institution	
Rwanda	• Ministry of Infrastructure (MININFRA) • Energy, Water Supply and Sanitation Authority (EWSA)
Tanzania	• Semi-private companies
Uganda	• Directorate of Water Development (DWD), Ministry of Water and Environment (MWE)
Water for agriculture – hillside & marshland development, drainage & irrigation, livestock, aquaculture	
Burundi	• Ministry of Agriculture and Livestock (MOAL)
Rwanda	• Ministry of Agriculture and Animal Resources (MINAGRI) • Rwanda Agricultural Board (RAB)
Tanzania	• Ministry of Agriculture, Food Security and Cooperatives (MAFSC) • Ministry of Livestock and Fisheries Development (MLFD) • National Irrigation Commission (NIC)
Uganda	• Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)
Water for energy – HEP generation	
Burundi	• Ministry of Energy and Mines (MEM)
Rwanda	• Ministry of Infrastructure (MININFRA) • Energy, Water Supply and Sanitation Authority (EWSA)
Tanzania	• Ministry of Energy and Minerals (MEM)
Uganda	• Ministry of Energy and Mineral Development (MEM)