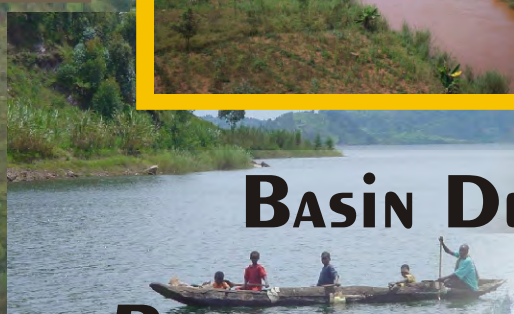
Nile Basin Initiative
Nile Equatorial Lakes Subsidiary Action Programme

Kagera River Basin Transboundary Integrated Water Resources Management and Development Project

KAGERA RIVER BASIN MONOGRAPH

MONOGRAPHIE DU BASSIN DE LA KAGERA



Basin Development Report

Rapport sur le Développement du Bassin

Final Report : 15th July 2008

BRL Ingénierie

Kagera River Basin

Transboundary Integrated Water Resources Management and Development Project

Kagera River Basin Monograph

Basin Development Report

15 July 2008

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Abbreviations and Acronyms

BFP	Basin Focal Project
CBSI	Confidence Building and Stakeholders Involvement Project (NBI)
CITES	Convention on International Trade on Endangered Species
CGIAR	Consultative Group on International Agricultural Research
CGISNUR	Geographic Information Systems and Remote Sensing Training and Research Centre, University of Rwanda, Butare
DANIDA	Danish International Development Agency
DFID	UK Department for International Development
DRC	Democratic Republic of Congo
DSS	Decision Support System – numerical computer-based modelling tool(s)
EGZ	Economic Growth Zone
EIA	Environmental Impact Assessment
ENTRO	Eastern Nile Technical Regional Office, NBI, Addis Ababa
FAO	Food and Agriculture Organization of the United Nations, Rome
GDP	Gross Domestic Product – estimate of the size of a national economy – usually expressed in USD
GEF	Global Environment Facility
GNI	Gross National Income – estimate of the size of a national economy – a GDP calculation method favoured by the World Bank – usually expressed in USD
GIS	Geographic Information System
GWP	Global Water Partnership
HDI	Human Development Index
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immuno-Deficiency Syndrome
HYDROMET	WMO/UNDP Hydrometeorological Survey. 1967. Egypt, Kenya, Sudan, Tanzania and Uganda. Rwanda and Uganda joined 1977. Ethiopia was not involved.
ICCON	International Consortium for the Cooperation on the Nile (donor consultative group)
ICRAF	International Centre for Research in Agroforestry
IDIS	Integrated Database Information System
IFAD	International Fund for Agricultural Development, Rome
IGEBU	Institut Geographique du Burundi, Gitega
ISABU	Institut des Sciences Agronomiques du Burundi
ISAR	Institut des Sciences Agronomiques du Rwanda
IUCN	International Union for Conservation of Nature and Natural Resources
IWMI	International Water Management Institute, Colombo, Sri Lanka
IWRM	Integrated Water Resources Management
KBMP	Kagera River Basin Trans-boundary Integrated Water Resources Management & Development Project
KBO	Organization for the Management and Development of the Kagera River Basin

km^3	1 km^3 = 1 billion m^3 = 1000 Mm^3 = 1,000 Gigaliters (Gl) = 1 million Megaliters (Ml)
LVBC	Lake Victoria Basin Commission
LVDSS	Lake Victoria Decision Support System
LVEMP	Lake Victoria Environmental Management Programme
m amsl	metres (elevation) above mean sea level – ground surface elevation
MDGs	Millennium Development Goals of the United Nations
NBCBN	Nile Basin Capacity Building Network
NBI	Nile Basin Initiative, 1999
NEL-CU	NELSAP Coordination Unit (NBI)
NELSAP	Nile Equatorial Lakes Subsidiary Action Programme (NBI)
NEMA	National Environment Management Authorities
NHDR	National Human Development Report
Nile-DSS	Nile Decision Support System – numerical modelling tools presently under development by the Water Resources Planning and Management Project, NBI
Nile-DST	Nile Decision Support Tool – numerical modelling tools developed with FAO support
NORAD	Norwegian Agency for Development Cooperation
NTEAP	Nile Trans-boundary Environmental Action Project
ORTPN	Office Rwandais du Tourisme et des Parcs Nationaux
PAIGELAC	Le Projet d'Appui à l'Installation Intégrée et à la Gestion des Lacs Intérieurs - Integrated Installation and Interior Lakes Management Support Project, Rwanda
PGNRE	Projet de Gestion National des Ressources en Eau - National Water Resources Management Project, Rwanda
PMU	Project Management Unit
PRSP	Poverty Reduction Strategy Paper
RBO	River Basin Organization
RPSC	Regional Project Steering Committee
SIDA	Swedish International Development Cooperation Agency
SWOT	Strengths, Weaknesses, Opportunities, Threats
TECCONILE	Technical Committee for the Promotion of the Nile Basin, 1992. Egypt, Sudan, Rwanda, Tanzania, Uganda and Congo. Ethiopia, Kenya and Burundi were observers
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNDUGU	*Brotherhood* in Swahili: an early (1983) collaborative effort on the Nile involving Burundi, the CAR, Egypt, Rwanda, Sudan, Uganda and Zaire
USD	United States Dollars
WHO	World Health Organization
WRMD	Water Resources Management Development

Kagera River Basin

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Executive Summary[1]

Introduction

Overview

The Kagera River is the largest of the 23 rivers that drain into Lake Victoria. The river basin covers some 60,500 km² and is estimated in 2007 to have a population of nearly 15 million people. The basin covers portions of the four countries of Burundi, Rwanda, Tanzania and Uganda.

Country	Country Area[2] Total (km²)	Land area in Kagera River basin (km²)	National basin area / national area (%)	National basin area / total basin area (%)
Burundi	27,834	13,790	53%	23%
Rwanda	26,338	21,630	85%	36%
Tanzania	945,087	20,680	2%	34%
Uganda	241,038	4,400	2%	7%
Basin		**60,500**		**100%**

The water and related resources are under threat, yet their sound management and development provide opportunities to enable the peoples of the Kagera River basin to move from poverty to improved standards of health and economic well being. The challenge facing the equatorial lakes region, including the Kagera River basin *"…clearly involves a concerted and broad-based reconstruction that would consist of population flows, economic growth, security, **environmental management**, and real democratic practice. The **institutional forms this will take are waiting to be invented**, and they might **cut across current borders** without necessarily redrawing them."* (Chrétien, 2000) [emphasis ours].

Integrated management and development of the Kagera River basin's water and natural resources through effective national and transboundary institutions and targeted investments has the potential to contribute to this effort, facilitating investment and thus building social and economic capital of the region for the benefit of all its residents.

This monograph is intended to set the stage for future activities in the basin in a manner which *optimises* the development of the resources in a mutually beneficial manner and which *minimises any possible negative impacts* within the Kagera River basin as well as the wider Lake Victoria and Nile River basins. We sincerely wish that all readers will be inspired by the strengths and opportunities in the Kagera River basin region, and that decision-makers will be constructively guided by the recommendations and conclusions.

[1] Résumé en français, voir p. ix

[2] Official country land areas, including water surface areas, etc.

IWRM – including IWRM Strategic Directions

Transboundary water and related resources management today is being carried out through application of Integrated Water Resources Management (IWRM) principles. IWRM as defined by the Global Water Partnership (2007) is *"a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems".* As the name suggests it is an *integrated* approach:

- IWRM considers not only the *bio-physical* interdependencies within ecosystems, such as the Kagera River basin, but also the related *economic* and *social* interactions and demands;
- IWRM is *participatory*, with an emphasis on *stakeholder involvement*, including *women*, in water development and management; and
- IWRM considers *water as an economic good* which cannot continue to be freely available to all competing users and uses.

The scope for the subject is the *ecosystem* defined by the Kagera River basin encompassing, among other subjects:

- The *bio-physical* aspects of the water and related resources, including the geography, hydrology, land use, agriculture, hydropower, environmental, fisheries, navigation, tourism, etc.);
- *Social* aspects, including essential demographic, social development, livelihood, health and gender/youth information; and
- *Economic* aspects and trends, including present trade, industry, economy, tourism, and links of water and related resources development and management to poverty reduction, also understood in the context of the term water poverty – i.e. that part of socio-economic well-being, particularly amongst the poor, which is attributable to water and related management and development.

To implement IWRM, it is desirable that stakeholders, represented by decision-makers within the Kagera River basin, have a shared strategic vision for water resources management and development. In spite of the fact that the details on the legal and institutional arrangements are presently under discussion we believe it is not premature to put forward strategic principles that are already commonly understood within the Kagera River basin as expressed by existing commitments and institutions. These are for example:

- The UN Millennium Development Goals – especially those related to water and resources management;
- The principles of international water law;
- The vision and mission statements of the East African Community;
- The statements of cooperation o the Lake Victoria Basin Commission;
- The vision of the Nile Basin Initiative; and
- The objectives of the Kagera Transboundary Integrated Water Resources Management and Development Project.

On the basis of these and principles of IWRM, the following *strategic directions* for IWRM for the Kagera River basin are proposed for discussion.

Proposed "Strategic directions for IWRM for the Kagera River basin"

The declarations and commitments summarized above elicit many consistent aspects. On the basis of these, we are proposing the following *"Strategic Directions for IWRM for the Kagera River Basin"* for consideration by its stakeholders:

- Economic development and poverty alleviation: To promote economic growth through use and development of joint water resources in a manner that significantly alleviates poverty.
- Integration through basin planning: To implement a participatory, multi-sectoral basin planning process which integrates economic, social and environmental concerns across the basin.
- Social development and equity: To ensure equity in the allocation of water resources and services across different economic and social groups; to reduce conflict and promote socially sustainable development.
- Regional cooperation: To integrate and coordinate water resource development and management between countries to optimise benefits from the joint resource and to minimise the risk of water-related conflicts.
- Governance: To further and implement open, transparent and accountable institutions and regulatory frameworks that will promote IWRM at all levels.
- Environmental protection: To protect the environment, natural resources, aquatic life and conditions and the ecological balance of the basin from harmful effects of development.
- Dealing with climate variability: To prevent, mitigate or minimise people's suffering and economic loss due to climate variability.
- Information based management: To ensure that water resource management decisions are based on best available information.

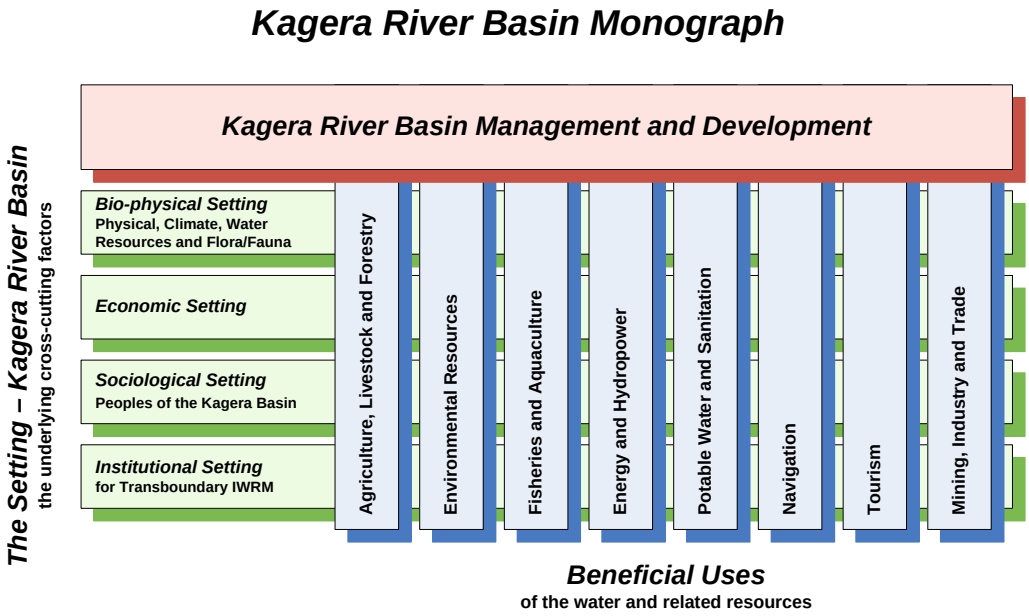
Monograph structure

Consistent with IWRM and the principle of reasonable and equitable use, the monograph also puts forward the approach to *benefits-sharing* of the uses of water and related resources in a transboundary and multi-sectoral context. The monograph has been structured into three major sections as follows:

Setting – the Kagera River basin (Sections 2 through 5): a description of the bio-physical, macro-economic, social and institutional setting of the Kagera River basin;

Beneficial uses (Sections 6 through 13): an analysis of the constraints to and opportunities for development related to the main uses by people of the water and related resources of the basin including: agriculture, livestock and forestry, environmental resources, fisheries and aquaculture, energy and hydropower, potable water and sanitation, river transport and navigation, tourism, mining, industry and trade; and

Kagera River basin development (Sections 14 and 15): a review and analysis of transboundary integrated water resources management and development in the Kagera River basin, with a view to providing direction to decision-makers and other stakeholders on the opportunities for development and investment leading to achieving the overall objective of the Project: *"…to improve the living conditions of the people and to protect the environment."*



Section 16 of the monograph provides an overview of the database and GIS developed during the course of carrying out this consultancy.

A number of Kagera basin maps and other diagrams and graphics were prepared in the course of preparing this monograph. These have been provided in a separate accompanying volume entitled *Kagera River basin Atlas*.

IWRM Analytical Framework

The *strategic framework* for the integrated management and development of the water and related resources of the Kagera River basin proposed in Section 14 has been based on *integrated management and development of the water and related resources in a manner that alleviates poverty while sustaining the environment*. However, regional human and economic development within the context of natural resources management is a much more complex subject.

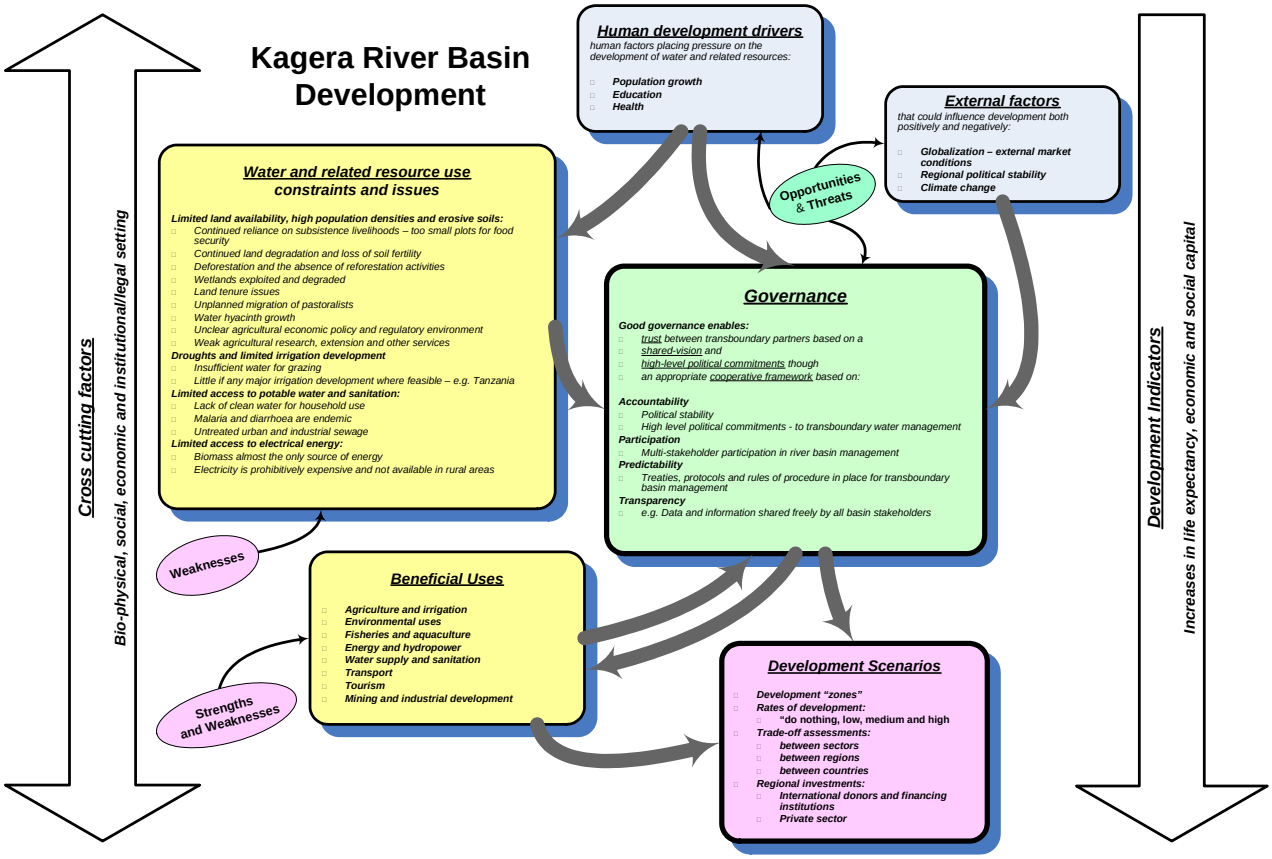
There are many factors related to water and resources management that are within the capacity of water managers stakeholders to influence - and decisions about these can be based on an assessment of the *strengths and weaknesses* of the relevant water and resources sectors. However, there are also many *external factors* which influence development, some positively and other negatively, and we categorize these here as *opportunities and threats.*

This section of the monograph seeks to identify and discuss these various factors and inter-relationships on the basis of an analysis of these *strengths, weaknesses, opportunities and threats* (SWOT), finally focussing on those that are relevant to Kagera River basin water resources management and development. This framework, summarized in the following figure, describes:

- The *cross-cutting factors* underlying development in the Kagera basin presented in Sections 2 to 5 of this monograph;
- *Opportunities and Threats*: external conditions that are helpful and/or harmful to achieving the development objectives:
  - The main human driving forces underlying development;
  - Other external factors, beyond the control of decision-makers and leaders within the basin;
  - The enabling governance environment for integrated water resources management;

- *Strengths and Weaknesses* : attributes of the water and resources sectors that can help and/or limit achieving the development objectives:
  - The main water and resource use constraints and issues of relevance to the Kagera basin;
  - The main opportunities for management and development of the *beneficial uses* discussed in Sections 6 through 13 of this monograph;
  - Key *development indicators* enabling us to monitor the progress towards achieving sustainable development in support of poverty reduction; and
  - Possible *Kagera River Basin Development Scenarios* pointing the direction for future investment.

This framework may be summarized in the following figure.



As the subject of this monograph is the water and related resources management and development of the Kagera River basin, we continue with a discussion of 1) the cross-cutting factors – i.e. the Kagera River Basin Setting, 2) the main beneficial uses – the strengths opportunities available to achieve the development objective of the project, and 3) definition of one or more development scenarios and opportunities for investment in water resources management.

Cross-Cutting Factors – The Kagera River Basin Setting

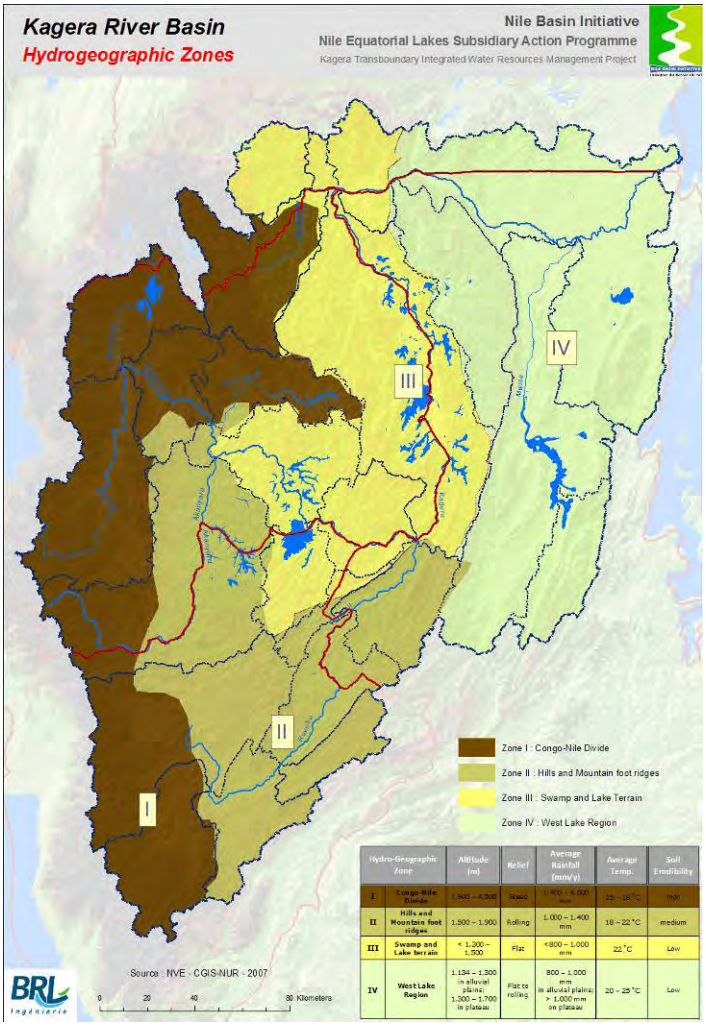
Biophysical features

The Kagera Basin drains the headwaters of the White Nile, and is a sub-basin of the Nile Basin. The Kagera is indisputably the single largest river in the Lake Victoria basin. The Kagera contributes roughly 34% of the total river inflow. It follows that differences in Lake Victoria are attributed mainly by rainfall and runoff in the upper catchments, of which the Kagera Basin has the largest contribution.

Based on similarities in the underlying geology, soils, characteristic landforms with related relief and drainage density, climate and ultimately stream flow characteristics, four hydro-geographical Zones have been distinguished in the Kagera River basin:

- Congo-Nile Divide
- Hills and mountain foot ridges
- Swamp and lake terrain
- West Victoria Lake region

The extent of these hydrogeographical Zones is described in the following map.

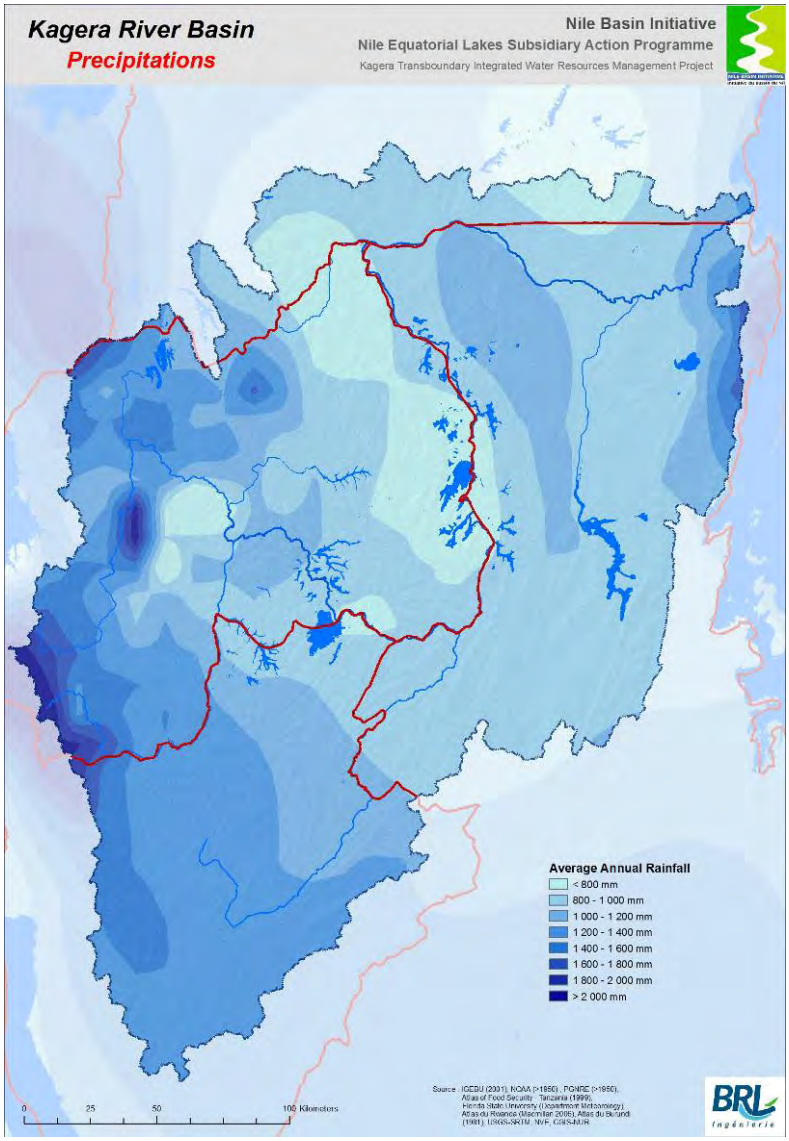


Hydro-Geographic Zone		Altitude (m)	Relief	Average Rainfall (mm/y)	Average Temp.	Soil Erodibility
I	Congo-Nile Divide	1.900 – 4.508	Steep	1.400 – 1.600 mm	15 – 18°C	High
II	Hills and Mountain foot ridges	1.500 – 1.900	Rolling	1.000 – 1.400 mm	18 – 22°C	medium
III	Swamp and Lake terrain	< 1.300 – 1.500	Flat	<800 – 1.000 mm	22°C	Low
IV	West Lake Region	1.134 – 1.300 in alluvial plains 1.300 – 1.700 in plateau	Flat to rolling	800 – 1.000 mm in alluvial plains > 1.000 mm on plateau	20 – 25°C	Low

The Kagera River is fed by three main tributaries: the Nyabarongo River, the Akanyaru River, and the Ruvubu River. All three rivers rise on the Congo-Nile Divide (Zone I), and then run through the hills and mountain foothills of Zone II. The Kagera River basically commences in the Swamps and Lakes area (Zone III), although the change in name from the Nyabarongo to Kagera occurs at the outlet of Lake Rweru.

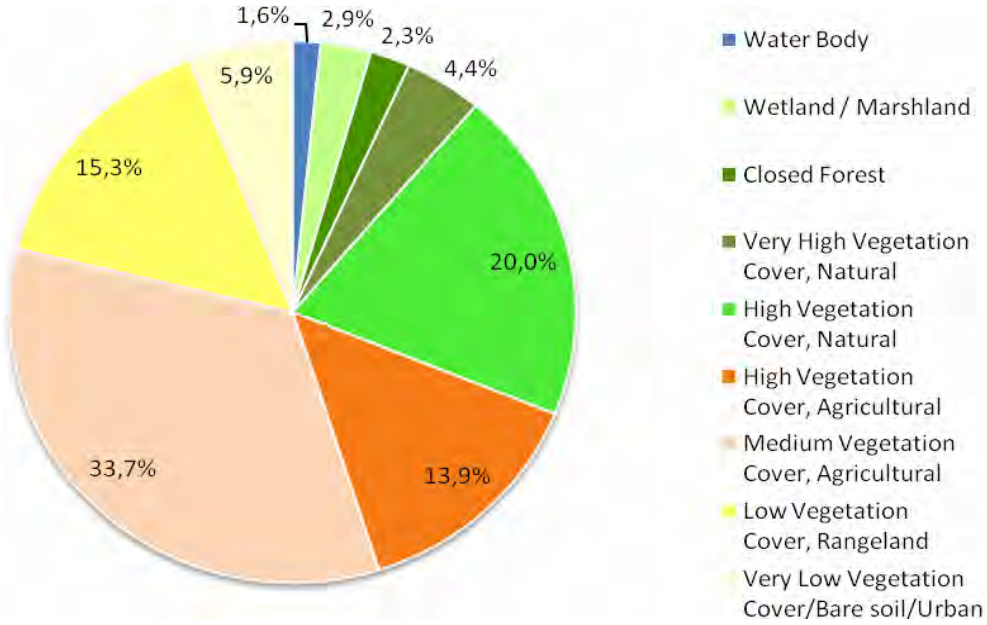
Almost all runoff is generated in the upper half of the catchment, referred to as the Congo-Nile including its related mountains and foot slopes and the hills east to it (Zones I and II).

The river, swamps, lakes and open water in Zone III are closely related. Maximum levels in the upper reach are attained in May and minimum levels occur between mid-August and mid-October. Downstream of Rusumo, only one perennial river exists, Kagitumba, which drains the extreme SW area of Uganda. Near the western shore of Lake Victoria is a belt with rainfall of over 2,000 mm.



The weather pattern of the Kagera Basin is characterized by a wide range of climatic variations due to topography, latitudinal position and the presence of water bodies. Rainfall varies from less than 800 mm over the central part of the basin up to 1,600 mm in the west, where most of the runoff is generated, as well as the western shoreline of Lake Victoria.

There are a wide variety of flora and fauna due to the diversity of topography and climate. The most significant part of the basin is occupied by cultivated / agricultural lands (48%), followed by natural vegetation (26%), of which 2% is covered by closed forest vegetation. Rangelands / pasture lands occupy about 15% of the total area in the basin. The marshlands (wetlands), including the open water bodies occupy about 5%, whereby marshlands form only about 3% of the total land area in the basin.



A number of important biodiversity *hotspots,* protected areas and wetlands have been identified and are providing important value to the people of the Kagera River basin. The careful management of these in the context of basin development is proposed in order to ensure that the goods and services provided are maintained and sustained in an acceptable manner and in balance with the development of other uses for the benefit of the people of the basin.

Macro-economic trends

The economies of the Kagera River basin countries are predominantly based on agriculture. According to the UN Human Development Report the four countries of Kagera River basin, Burundi, Rwanda, Tanzania and Uganda, were ranked in the last 30 of 173 countries of the world[3]. The general features of the macro-economy of the countries of Kagera Basin are marked by the following:

- Steady growth of economy
- Small size of the Gross National Product (GNP)
- Low Gross National Income per capita (GNI/capita)
- Predominance of the agricultural sector in the economy
- A slowly growing industrial sector
- A persistent deficit in the trade balance
- Lack of economic diversification
- High inflation rates

The recent economic growth of all four countries of the Kagera basin was due to several factors of different nature in each country. Positive factors that have influenced these economies include the following:

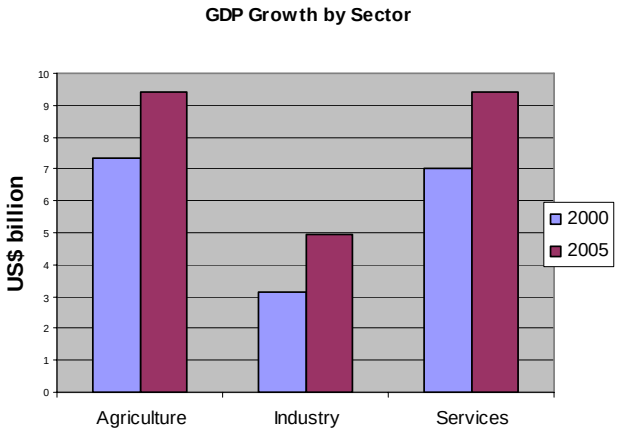
- Macro economic policies that are promoting investments
- Medium and short term development plans that focus on poverty reduction and community participation
- Improved governance and political stability providing an enabling institutional framwork
- Favourable weather for agricultural production
- Increasing industrial and agricultural productivity and the evolution of regional markets

Factors that have caused a negative impact on the economies include the following:

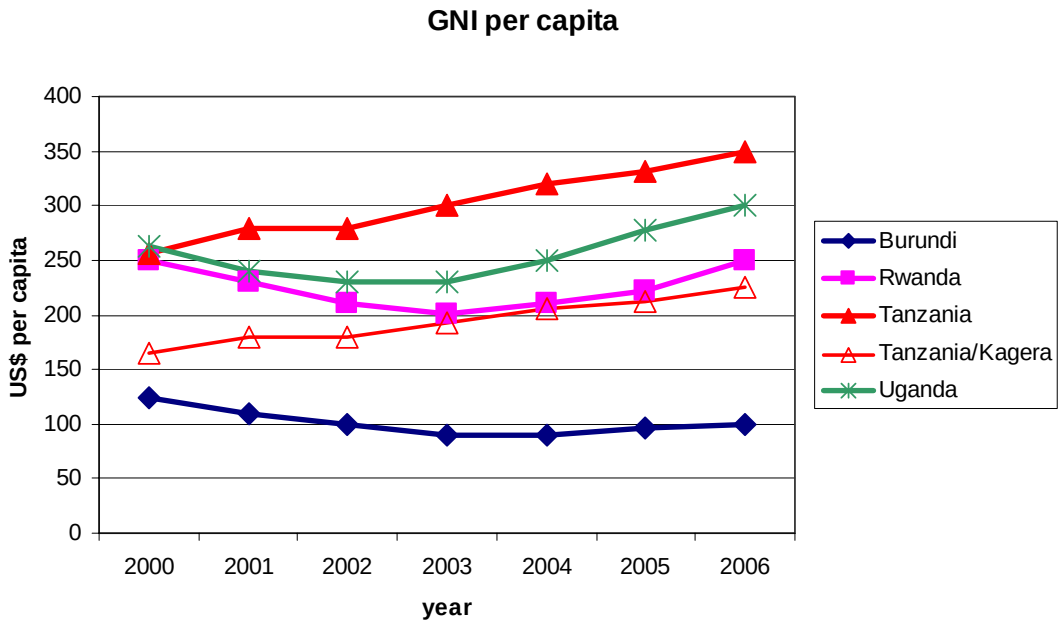
- Political and social crises – from time-to-time - in all countries
- Unfavourable terms of international trade
- Volatile agricultural prices
- Inadequate investment funds
- Insufficient participation of the private sector
- Insufficient information about local, regional and international markets
- Limitations in available technologies
- Limited personal savings

Overall, during the period 2000 to 2005, the total GDP grew in all Kagera River basin countries in all sectors (ref. following Figure). Agriculture is the most significant source of income, rivalling the services sectors, and can be expected to be an even higher proportion of the income in the Kagera basin region itself.

[3] UNDP. 2006. Human Development Report.



The GNI per capita for the four countries is presented following. There has been a steady increase since 2003 albeit more slowly in Burundi.



The picture of this promising economy is due to many factors, the most important of which are certainly the availability of natural resources, and increasingly, good economic policies, planning focussed on poverty reduction, improved good governance and external financing. The positive factors that have influenced economic growth should be sustained to ensure steady growth. The evolution of an effective transboundary cooperation framework in the Kagera Basin is one of the factors that could further influence economic sustainability.

The Peoples of the Kagera River Basin

The four countries in the Kagera River basin are among the world's poorest countries. Their situation is roughly the same as the average situation in sub-Saharan Africa (though the per capita GDP is much lower in the Kagera River basin countries).

	HDI rank (177 countries)	Human Development Index (HDI)	Life expectancy at birth (years)	Adult literacy rate (% ages 15 and older)	Combined gross enrolment ration for primary, secondary and tertiary schools (%)	GDP per capita (PPP USD)
Uganda	145	0.502	48.4	66.8	66	1 478
Rwanda	158	0.45	44.2	64.9	52	1 263
Tanzania	162	0.43	45.9	69.4	48	674
Burundi	169	0.384	44	59.3	36	677
Kenya	152	0.491	47.5	73.6	60	1 140
Sub-Saharan Africa		0.472	46.1	63.3	50	1946
World		0.741	67.3	…	67	8 833

Source: Poverty HDI ----> UNDP 2007

The per capita GDP in the Kagera River basin is very low since agriculture there is mainly subsistence farming (cf. chapter on Agriculture). The small mean cultivable area per household (0.8 ha) and the low agricultural productivity means that there is not even enough food to satisfy nutritional needs of most of the households, so that in most of the case, no monetary surplus from off-farm sales are possible.

Life expectancy of about 45 years in the Kagera River basin is low. It is slightly below 46 years which is the average for sub-Saharan Africa and well below the world average, i.e. 67 years. The children, adult and maternal mortality rates are high in the Kagera riparian countries, especially in Rwanda and Burundi.

Disease is the top life-expectancy reducing factor in the Kagera River basin. Disease is prevalent as health and hygiene conditions are not satisfactory and cause numerous diarrhoeal diseases, malaria and cholera. HIV/AIDS is the top cause of death in the Kagera River basin. Many deaths are due to water-related factors. Diarrhoea and malaria are the main water-borne diseases in the Kagera River basin.

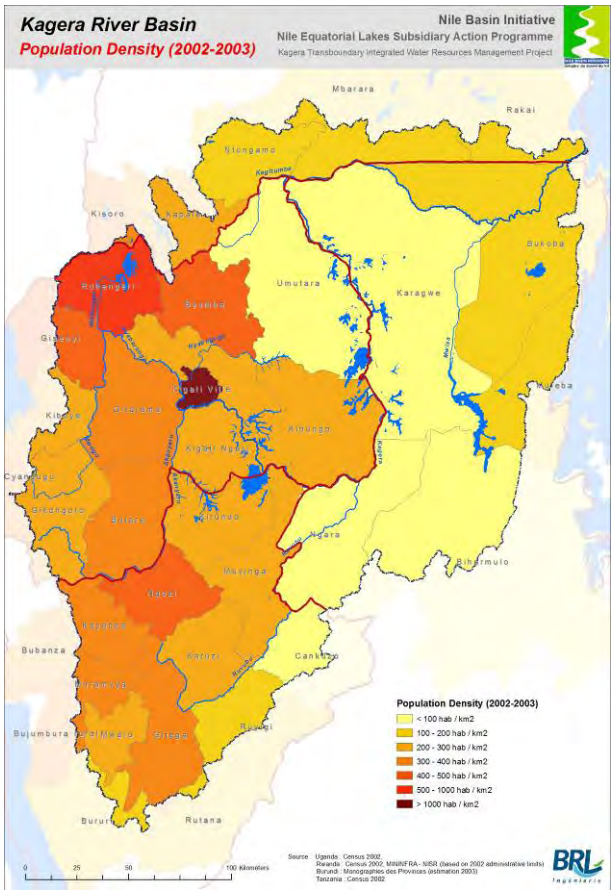
The lack of water, especially safe potable water is responsible for precarious health conditions in some parts of the basin. Sanitary infrastructure is insufficient, often lacking equipment and understaffed with under-qualified personnel. This is particularly the case in the rural world, where purchasing power is very low and general living standards (basic socio-economic infrastructure such as drinking water, energy, markets, schools, health care centres and leisure centres, etc.) do not encourage the professionals to settle there.

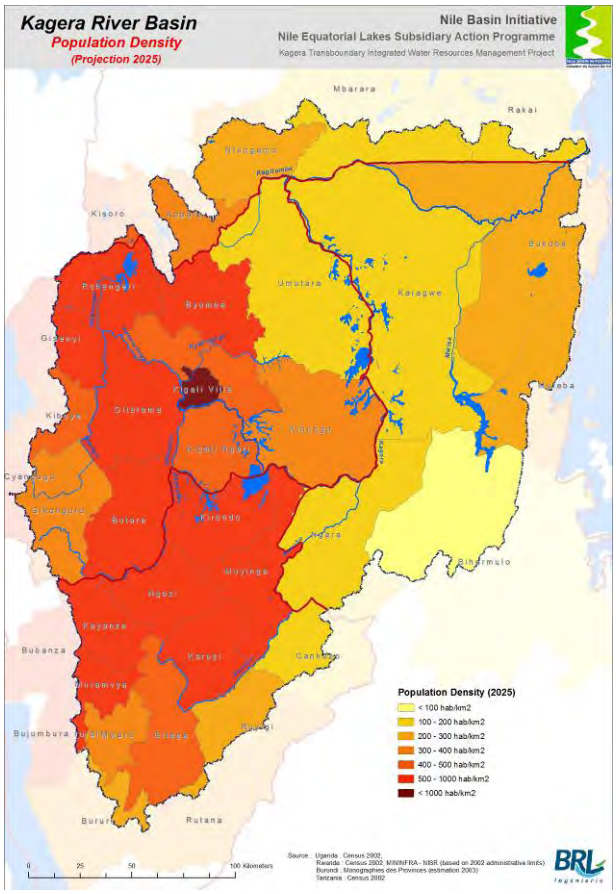
In the Kagera River basin countries, the literacy rate is approximately the same as the average for sub-Saharan Africa: it ranges from 58.9 % in Burundi to 69.4 % in Tanzania.

The mean annual demographic growth rate in the Kagera River basin is 2.7% and the fertility rate per woman is 6. These rates are higher than in Sub-Saharan where the mean population growth rate is 2.5% and the mean fertility rate is 5.4

The mean estimated density is 248 peoples/km² in June 2007, which is more than 8 times the 28 peoples/km² in Sub-Saharan Africa (according to the demographic growth rate, this gap is even getting bigger every year). However, this density is not equally shared on the Kagera River basin: the population density is 4 times higher in Burundian and Rwandan hills (those two countries share the highest population density in Africa) than in Tanzanian lowlands, as shown on the following maps.

If one considers that the mean annual growth rate will not change during the following decades, the population density on the Kagera River basin will be 388 peoples/km² in 2025 (close to the Rwandan population density today) and the Burundian and Rwandan population densities will be more than 540 peoples/km². The population densitied in 2003 and 2025 (est.) are shown on the following maps.





As we have seen from the discussion in Section 4 of the monograph, the people of the Kagera River basin in common:

- their culture and history, even fissured by globalization,
- their languages,
- their family and clan relations,
- their economical activities (mainly agriculture, livestock and forestry),
- the population displacements, still ongoing, and
- the same rich natural environment.

Integrated management and development of the Kagera River basin's water and natural resources through effective national and transboundary institutions has the potential to contribute to this effort building social and economic capital of the region for the benefit of all its citizens.

Institutional and Legal Framework for Transboundary Cooperation in the Kagera River Basin

The history of the Kagera River basin is intricately linked to the history of the Nile River basin to which it belongs. The historical agreements on water-related issues are listed here chronologically for the Nile Basin as a whole, as well as for the Kagera River basin:

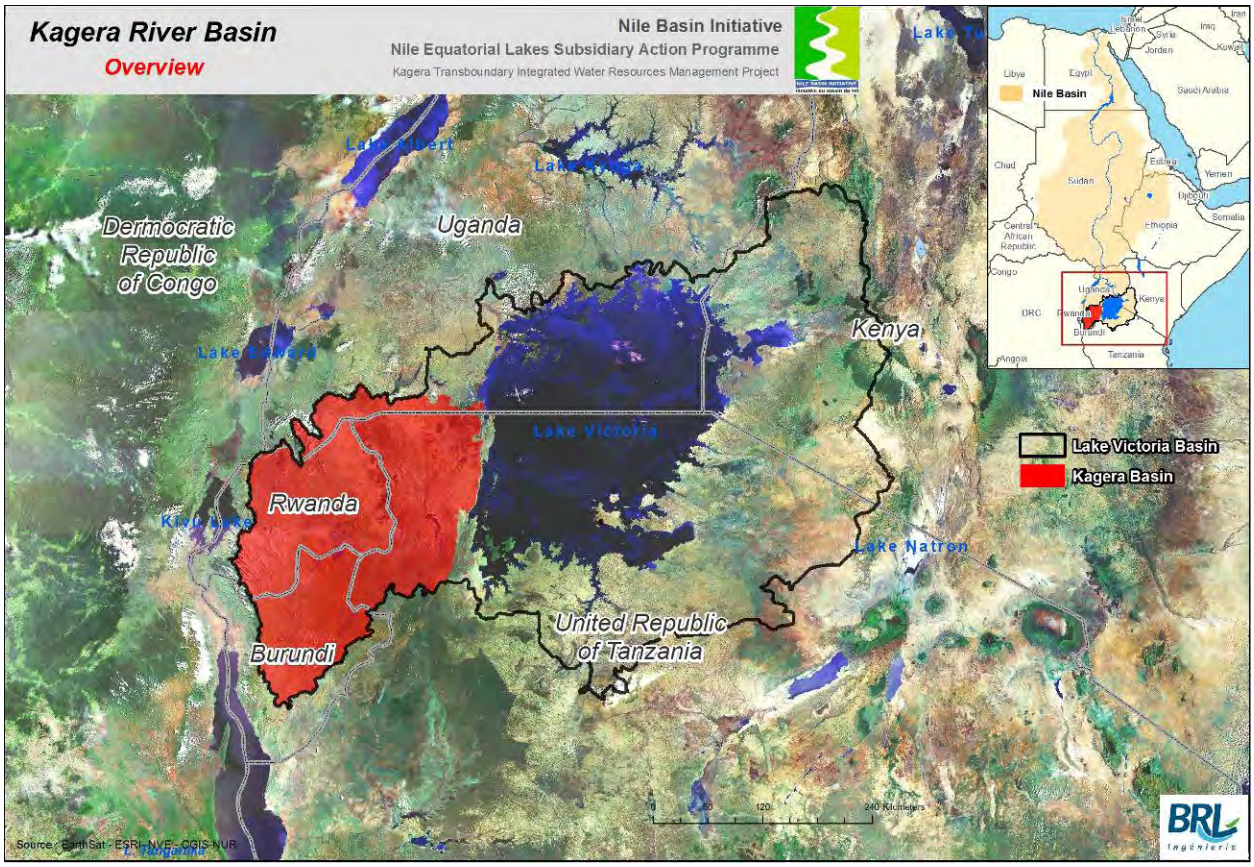
- An exchange of notes between Great Britain and Ethiopia dated 1902 and relating to the Blue Nile and other watercourses;
- An agreement between Great Britain, France and Italy of 1906 relating to Abyssinia, modified and extended by an exchange of Notes between the United-Kingdom and Italy in 1925;
- The 1929 agreement between Egypt and the Sudan, represented by the United Kingdom, including extensive technical detail and pertaining to the use of the Nile waters for both irrigation and navigation;
- An agreement between the United Kingdom and Belgium dated 1934 concerning trans-boundary river flows and water rights in Tanzania, Rwanda and Burundi;
- An exchange of Notes and memoranda between the United-Kingdom, representing Uganda, and Egypt between 1946 and 1953;
- The Agreement of 1959 between Egypt and the Sudan on the utilization of waters of the Nile River;
- An agreement between Burundi, Rwanda and Tanzania in 1977 to form the Kagera River Basin Organisation (KBO), which Uganda joined also in 1981;
- An agreement from 1994 between Kenya, Tanzania and Uganda on the establishment of the Lake Victoria Environmental Management Program;
- The Protocol for Sustainable Development of the Lake Victoria Basin, signed by Kenya, Tanzania and Uganda in November 2003.

These historic relationships between key actors in the Nile Basin form the point of departure of the co-operative framework. In March 1998, in Arusha, Tanzania, the Council of Ministers in charge of Water in Nile Basin Countries came to agreement on the joint management of the Nile.

In 1999, pending a convention to instate a cooperative entity, the same countries set up a transitional mechanism doted with its own legal identity — the Nile Basin Initiative (NBI), formed by the formed by the Governments of Burundi, the Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda

On 14 February 2002, during the 9th Council of Ministers in charge of the Waters of the Nile Basin (Nile-COM), a declaration was signed investing NBI with the task of *"creating a legal framework for cooperation for joint management of the water resources from the Nile".* The NBI is supposed to be a transitional arrangement until its members come to an agreement as to the permanent institutional and legal framework for the basin's development (Swain, 1997). It was the first time that all the Nile Basin countries expressed the desire to work together.

The Kagera River Basin is a sub-basin in the Lake Victoria Basin (LVB) which in turn is a sub-basin of the Nile River Basin (ref. following figure). If the natural resources in these three cross-boundary basins are to be managed sustainably with reasonable and equitable use of their water resources, cooperation between the riparian States is a must.



The countries of the Kagera River basin established a transboundary river basin organization in 1977. Unfortunately, after completing much good work in the form of numerous studies and comprehensive basin plans, many of which form the basis for the discussions in this monograph, due complex circumstances in the region during the period, the organization was dissolved in 2004.

In the meantime, other regional institutional and legal frameworks were being created encouraging regional integration through entities linked either to the East African Community (EAC) or the Nile Basin Initiative (NBI). The Lake Victoria Basin Commission (LVBC) was created under the initiative of the EAC, and is now responsible for coordination of natural resources and environmental management, water resources management and water and sanitation. Under the NBI, the NELSAP was created to focus on the Lake Victoria basin sub-basin of the Nile River basin. NELSAP has a water resources management and development mission to facilitate the countries in joint implementation of projects in order to promote social economic development and reverse poverty.

With these initiatives in place, and through consultations carried out in preparing this monograph, we see clear national and regional interest and consensus expressed by many levels of government, donors and civil society favouring establishment of some stronger forum for institutional cooperation at the Kagera River basin level. We have examined three possible options for formalizing a stronger and more permanent cooperative institutional framework for water and resources management in the Kagera River basin, namely:

Establishing a separate legal and institutional cooperative framework to manage the Kagera River basin in either a completely independent manner (such as the former KBO), or in a similar manner to the LVBC, through the Sectoral Council of the EAC;

Through an organization to be established at some time in future, under a completely new legal entity once the negotiations on the Nile River Basin Commission are finalized. i.e. The legal and institutional arrangements in support of management and development of the Kagera River basin would be integrated into this new framework; and

Institutional arrangements which build on the existing institutional frameworks already in place under the EAC and the LVBC;

As for Option 1, we do not see today the political will to establish a new river basin organisation specifically to support the management and development of the Kagera River basin and do not recommend this approach.

As for Option 2, it is unclear how soon the negotiation process in establishing a Nile River Basin Commission will be completed, if at all. Therefore, in the short and even medium-term, given the need to move forward now with improved transboundary management of the water and resources in the Kagera River basin, this option has not been seriously considered.

Our recommendation is to move forward with Option 3. Building on the existing mandate and institutional arrangements of the EAC and the LVBC, as it appears to offer the best opportunities for the near future. We make this recommendation for the following reasons:

The LVBC's mandate covers the entire Lake Victoria sub-basin of the Nile River basin, including the Kagera River sub-basin, (as well as other Lake Victoria sub-basins). Therefore the Lake Victoria basin defines a logical ecosystem management unit for the water and related resources in the Lake Victoria basin and the Kagera River sub-basin.

The LVBC shares the same goals and objectives as affirmed in the protocol now agreed by all five EAC member countries. The same national ministries of the four Kagera River Basin countries are members of the LVBC Sectoral Council.

Under the present circumstances, it does not seem necessary or appropriate to dilute tasks nor have overlapping responsibilities. On the contrary, decision-making, human resources and finance need to be aligned if at all possible. One short term option therefore is to create a *Management Unit* (or *Agency*[4]) to facilitate and coordinate the management and development of the water resources in the Kagera River basin within the context, and under the legal and institutional authority, of the LVBC[5]. It would be further recommended to physically establish and locate this *Kagera River Basin Management Unit* within the river basin.

Under this option, the Kagera River basin institutional framework would look something like this:

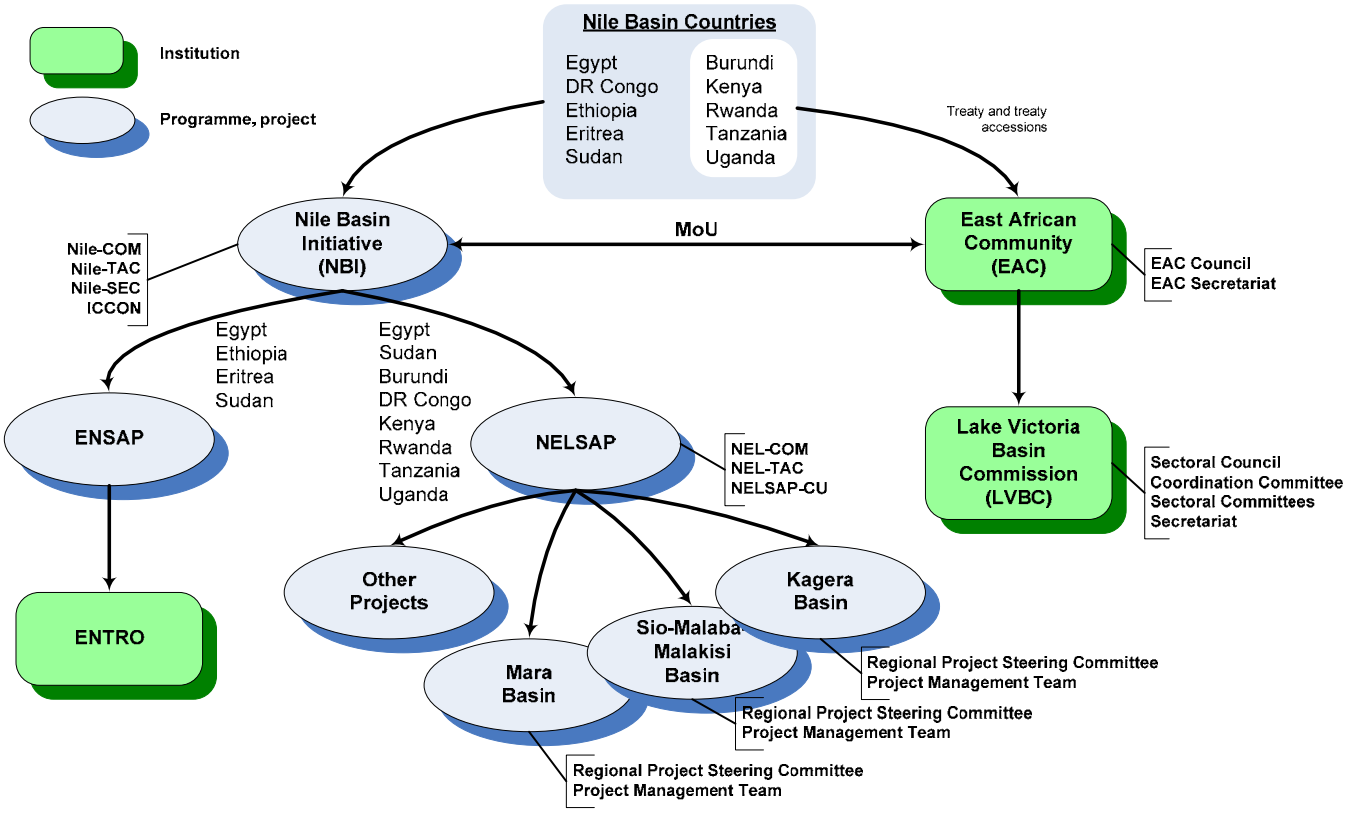
- The **LVBC** provide the overarching legal and institutional framework, and would be the umbrella decision-making entity for the projects and programmes in the basin. It would be in charge of developing a planning and scheduling tool for the whole of the Lake Victoria basin. The mechanism (something like a *rolling master plan for the development and management of water resources in the Lake Victoria Basin)* would provide the sub-basins with guidelines and the main trends of the basin's management policy.

[4] In the sense of creating a technical unit within an existing legal and institutional framework – i.e. the LVBC.

[5] The capacity of the LVBC is still growing. However, we believe that a proposed Kagera River Basin Management Unit established within the LVBC legal and institutional framework could further strengthen and improve its effectiveness.

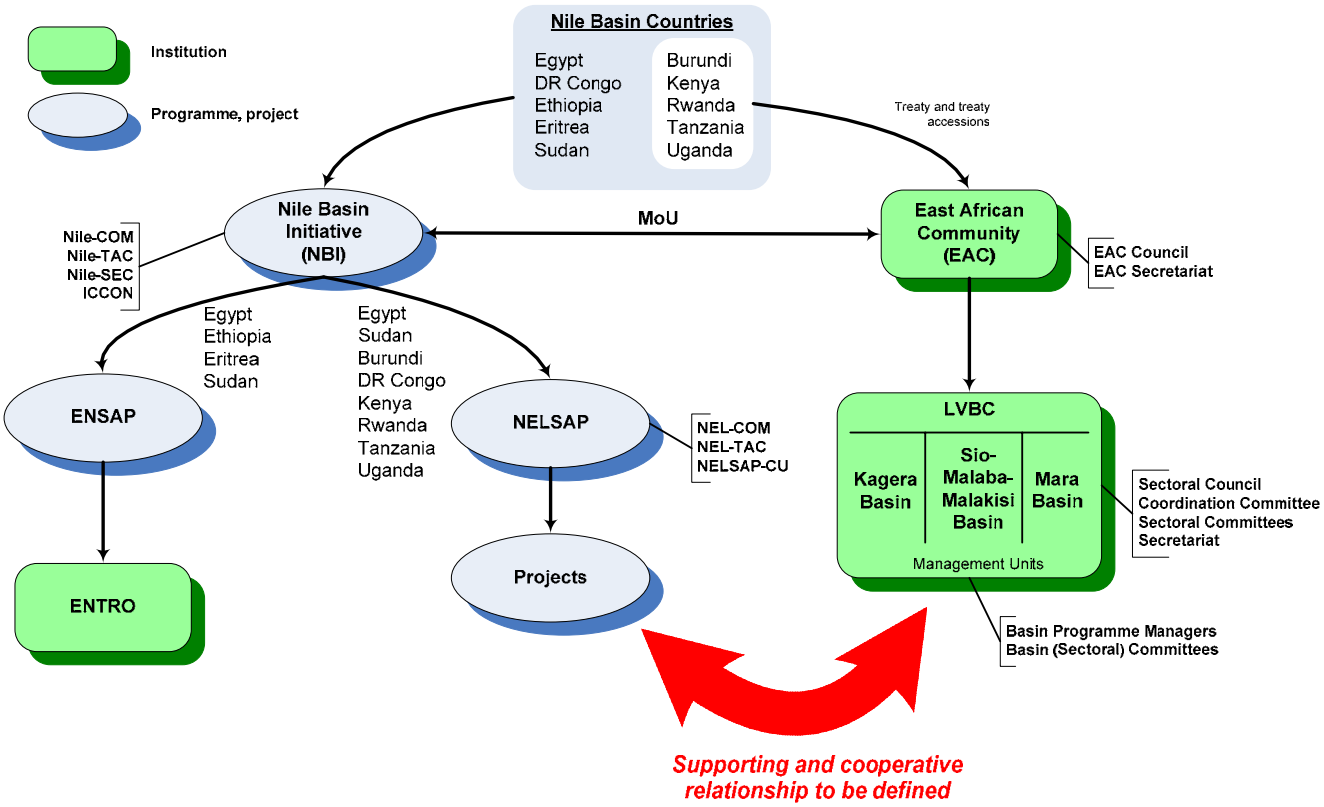
- A **Kagera River Basin Management Unit** would be established under the existing LVBC Secretariat[6]. It would be in charge of developing and planning for the Kagera River basin, but in the overall context of the plans and activities of the LVBC. The Unit would be coordinated by a Programme Manager working under the LVBC Secretariat and reporting to its Executive Secretary. A Sectoral Committee for the Kagera River basin representing appropriate government and civil society bodies, user associations, etc. (to be discussed and agreed) would provide overall direction.
- The **NELSAP** would continue as a programme under the NBI for the meantime. In any case, the 2007 MoU between the NBI and EAC must be made operational. NELSAP may be expected to continue to provide links with the broader NBI initiatives until such time as a *Nile River Basin Commission* is established. NELSAP projects and programmes could be implemented through the overall guidance or in association with the projects and programmes of the LVBC. The details of the working relationships between the NELSAP and the LVBC would need to be studied, discussed and agreed in the context of the evolving institutional relationships in the Nile River basin region.

The existing and proposed cooperative programmes, projects and institutional arrangements are summarized on the following figures:



6 Under this approach, we expect that similar, parallel, *Management Units* would be established for the two other Lake Victoria sub-basins: 1) Mara, and 2) Sio-Malakisi-Malaba.

Existing institutional framework for cooperative programmes, projects and Institutional arrangements in the Nile River basin



Proposed institutional framework for cooperative programmes, projects and Institutional arrangements in the Nile River basin

We believe that a strengthened cooperative framework for the Kagera River basin is important at the regional transboundary level for various reasons:

- It would identify a unique basin management entity, taking its specificities, the different usages and the needs of its peoples into account;
- It would facilitate the establishment of a long-term *Vision of the Basin* and their implementation through application of IWRM principles;
- It would enable effective linkages with national and local structures involved in the basin's water resources management;
- It would provide a framework for consultation and participation for the local governments and for civil society in the basin;
- It would bring a renewed vision for the Kagera River basin in the context of the Lake Victoria and Nile River Basins, linking these countries with their different challenges, but still sharing common concerns and interests. *"If successful, Kagera could become a model for more integrated cooperation throughout the Nile Basin"*[7].

[7] United Nations Human Development Report. 2006. p. 226.

Development of the beneficial uses of water and related resources in the Kagera River basin

In discussing and assessing the beneficial uses of water and related resources (sections 6 though 13 of this monograph), we have identified a number of priority action, projects and programmes requiring investment – either private or public – to enable these resources to be developed in a way which has a positive influence on human development.

In summary, the Kagera River basin is characterised by limited land availability, high population densities and erosive soils with:

- Continued reliance on subsistence livelihoods – too small plots for food security.
- Continued land degradation and loss of soil fertility
- Deforestation and the absence of reforestation activities
- Wetlands exploited and degraded
- Land tenure issues
- Unplanned migration of pastoralists
- Soil erosion leads to increased nutrient load encouraging water hyacinth growth and eutrophication in Lake Victoria
- Unclear agricultural economic policy and regulatory environment
- Weak agricultural research, extension and other services

There are frequent occurrences of droughts and limited irrigation development including:

- Insufficient water for grazing
- Little if any major irrigation development where feasible – e.g. Tanzania

There is limited access to potable water and sanitation:

- Lack of clean water for household use
- Malaria and diarrhoea are endemic
- Untreated urban and industrial sewage

There is limited access to electrical energy:

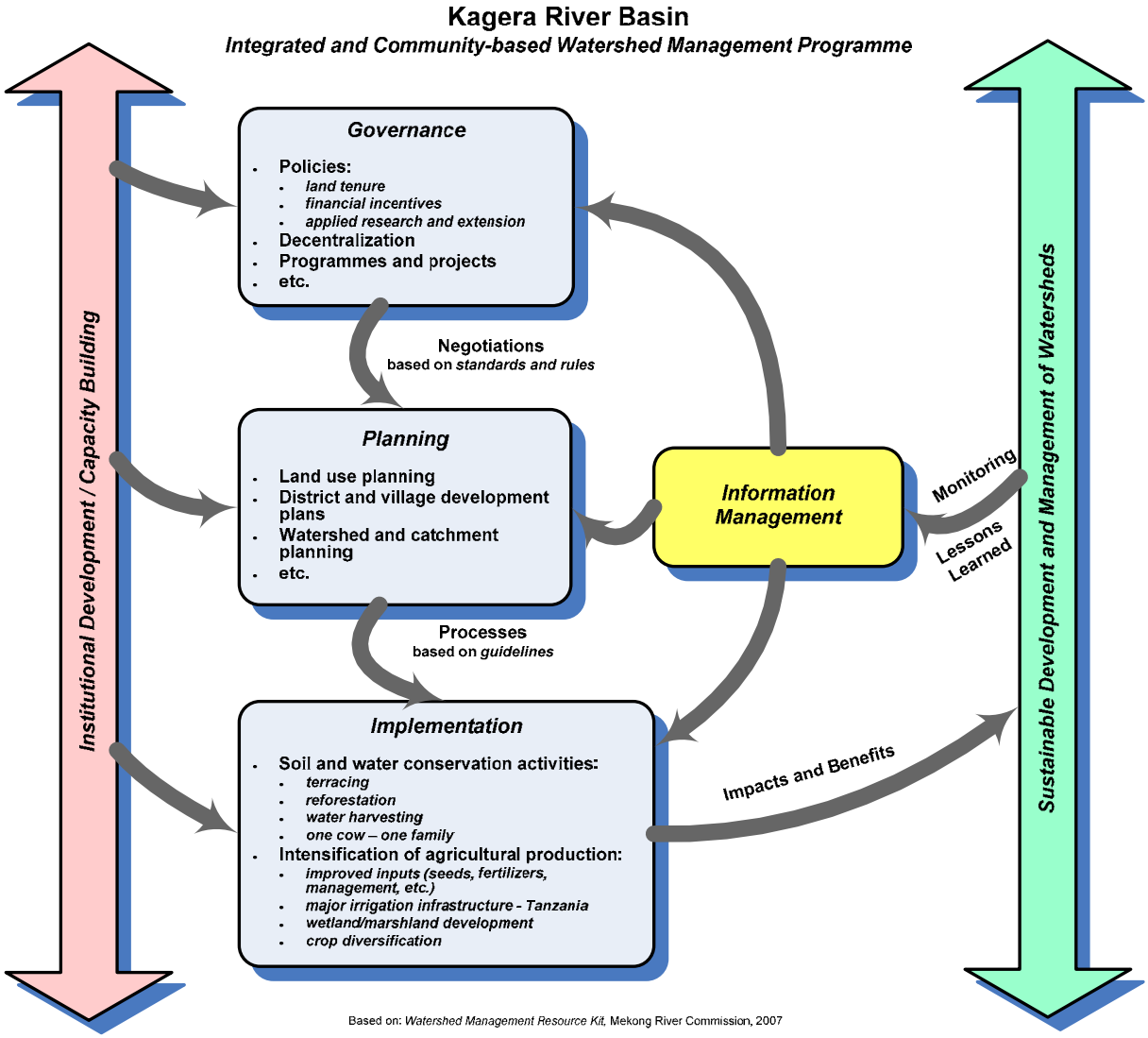
- Biomass is almost the only source of energy
- Electricity is prohibitively expensive and not available in rural areas

A summary of the proposed investment programmes and projects in a development scenario follows:

Agriculture, Livestock and Forestry (Section 6)

We believe the most effective approach to supporting improved agricultural development for the Kagera River basin is through an *Integrated and Community-based Watershed Management Programme* summarized below. The key elements of such a programme include:

- governance and policy making,
- institutions and institutional development/capacity-building,
- planning,
- implementation, and
- monitoring and evaluation.



The types of interventions proposed in such an integrated and community-based programme would include proposed activities and investments in:

- **Soil and water conservation:** including terracing, water harvesting and reforestation/agroforestry;
- **Intensification of agricultural production:** including use of improved and modern inputs (seeds and fertilizers, etc.) implementation of irrigation and water management schemes, and livestock development and rural incomes diversification schemes; and
- **Policy support, including training and capacity-building activities and programmes:** for agricultural research, agricultural extension, agricultural market development and rural financial systems and agricultural credit development.

This programme would be by far the most significant group of development activities in the Kagera basin representing more than two-thirds of the investments over the next 20 years.

Environmental Management (Section 7)

The environmental resources of the Kagera River basin are an asset to be carefully managed to enable their sustainable utilization today and in the future. In support of their sustainable management, the following activities have been proposed for investment and implementation:

- **Environmental Management Information System for the Kagera River Basin:** In the context of whatever basin management institutional and legal framework is finally agreed, this will include establishment of a water resources development and environmental monitoring programme responsible for surface and groundwater surveys and water quality monitoring. The programme will support the following studies:
  - A detailed survey to develop inventory of the existing protected areas / biodiversity hotspots and establish their legal status and boundary demarcations to prevent future encroachment into these areas. In addition, all important wetlands must be surveyed documented and declared protected areas.
  - Environmental economic valuation of the existing environmental resources such as pasture / rangelands, wildlife, water resource, wetlands, etc., to determine / establish their real economic values. This information should be used as one of the criteria for economic investment in the basin.
- **Harmonization of Regional Environmental Management and Quality Standards:** Develop and harmonise policy, legal and institutional mandates regarding implementation of environmental management and economic investments in the basin. This should include environmental quality standards and Environmental Impact Assessment (EIA) guidelines for all investment projects in the basin. An effective river basin organization or management unit for the Kagera River basin could facilitate the negotiation of agreed transboundary EIA guidelines.

As a cross-cutting factor, the environmental management initiatives will also support investment programmes put forward under other beneficial uses notably the Integrated and Community-based Watershed Management Programme presented in Section 0 and the implementation of the Potable Water and Sanitation Programme presented in Section 10.4.

Fisheries and aquaculture (Section 8)

Although in comparison to agriculture, an important food resource is presently available and can be exploited in a sustainable manner for food production and poverty alleviation within the Kagera basin. The following programmes and proposed to enable development of this resource:

- **Aquaculture development programme:** Numerous small lakes / wetlands are available throughout the basin, but fish scarcity is currently high due to over-exploitation of the natural fish stock in most of the existing lakes. A programme of developing aquaculture ponds and associated facilities is proposed. The benefits of such a programme could be:
  - Increased availability of food protein for the local communities.
  - Increased income by selling fish.
  - Creation of employment.
  - Protection of aquatic environment of the existing lakes – which could lead into increase in fish stock in the basin lakes.
  - Time saving by local people, which is usually lost in capture fisheries by local people
- **Fisheries management in association with multi-purpose dams:** The reservoirs created by the proposed hydropower dams in the Kagera River basin (Rusumo Falls and Kakono) offer the possibility to develop fisheries production. The fisheries management facilities associated with these dames could include boating facilities (docks, etc.) ice production, service centres, refrigeration, pisciculture, fish processing (e.g. smoking) facilities, etc. which are estimated to cost approximately USD1 million per dam.

Energy and hydroelectricity (Section 9)

The hydropower potential of the Kagera River basin is about 490 MW of which only about 44 MW, or less than 10% has been developed to date. Given present day economic, social and environmental constraints, only about 216 MW of the remaining potential is considered feasible, including about 36 MW of small and mini hydropower projects, mostly in Rwanda. The development scenario presented herein recommends proceeding as soon as possible with the following:

- **Kagera River Mainstream Hydroelectric Projects:** The Rusumo Falls (61.5 MW) and Kakono (53 MW) Projects have been identified as necessary and sound investments under the SSEA (2007) and are recommended to proceed soon.
- **Small and Mini Hydropower Development:** Small and mini hydropower development appears to offer a solution to remote communities in the Kagera River basin with a total capacity of about 36 MW appearing to be feasible.

Hydropower development alone is not sufficient to meet long-term Kagera basin demands. A regional, transboundary and multi-sectoral (i.e. hydro, thermal, geo-thermal, methane and wind) approach will be required to provide electricity necessary for transformational development in the region in the long-term.

Water supply and sanitation (Section 10)

Improving access to and use of water and sanitation facilities is an important requirement for sustainable human development in the basin as it will likely significantly improve the health and wellbeing of the population. A number of programmes and projects are proposed in the context of the discussion of development scenarios:

- ***Rehabilitation of existing non-functional water sources***: To minimise the actual and future potable water deficits in the most cost-efficient manner, first of all the non-functioning water supplies in the basin need to be rehabilitated, initially focused on the areas with lowest water supply coverage.
- ***Construction of new and improved water sources***: A next step would be to develop the groundwater resources in the areas where cheaper spring water supply is not feasible. The initial focus should be on the urban centres. Assuming that rehabilitation of existing sources has led to an average increase in the basin-wide coverage to 65% based on the existing population in the basin, it means new sources will be constructed to arrive at the 2015 MDG targets. This additional coverage will need to be ensured through shallow wells and boreholes, as it can be assumed that the spring potential will have been largely exhausted.
- ***Sanitation and hygiene awareness campaigns***: The national policies in the Kagera basin are to promote the building of latrines by the population. Therefore, no subsidies are provided for household sanitation. However, extensive sanitation awareness campaigns will need to be held to convey the message that sanitation saves lives.
- ***Institutional strengthening, capacity-building and sector management:*** In the whole of the basin, decentralisation is a key policy, but the capacity at the provincial / district level is still weak. The component is intended to increase both i) the institutional and technical capacity at provincial / district level, and ii) the level of advocacy, promotion, and public awareness of the need for potable water and adequate sanitation as a means to get out of poverty.

Navigation (Section 11)

Although indications from previous studies indicate that the potential for navigation as a commercially viable means of transport in the Lower Kagera River basin are not encouraging, this conclusion is made without the benefit of an objective feasibility study.

- **Kagera River Navigation Feasibility Study:** Such a study is estimate to cost USD 500,000, and is proposed to be carried out in 2010 as part of the investment development scenarios for the basin.

Pro-Poor Tourism (Section 12)

As summarized in Section 12.1, *pro-poor tourism* development offers opportunities to alleviate poverty in the Kagera basin. Developing these opportunities will involve partnerships with governments and the private sector.

- **Kagera River Basin *Pro-Poor* Tourism Development Study:** It is recommended that a comprehensive, basin-wide Kagera River Basin Pro-Poor Tourism Development Programme be developed and implemented within the context of the responsible river basin organization finally established.

Development Scenarios for the Kagera River Basin

In developing the descriptions and analyses of the *setting* and the *beneficial uses* of the water and related resources of the Kagera River basin, we have identified a number of opportunities for development and investment. These potential areas for investment have been described in the conclusions and recommendations of each of the sectors and are summarized in this section for consideration by basin stakeholders and decision-makers.

We stress this is a preliminary proposal with very rough *order of magnitude*-type estimates. However, we feel that by putting these forward now, we will stimulate discussion and also begin the process of attracting investors keen to approach transboundary development in this region in a an integrated and comprehensive manner.

The opportunities are briefly summarized following according to sector. We have used a 20-year time horizon (2008 – 2027) for these investments, recognizing that as time passes uncertainty increases. The details underlying the estimated values noted above are provided in the respective sections of the monograph. A proposed overarching Kagera Basin IWRM – Institutional Development and Capacity Building Programme is discussed in the following section.

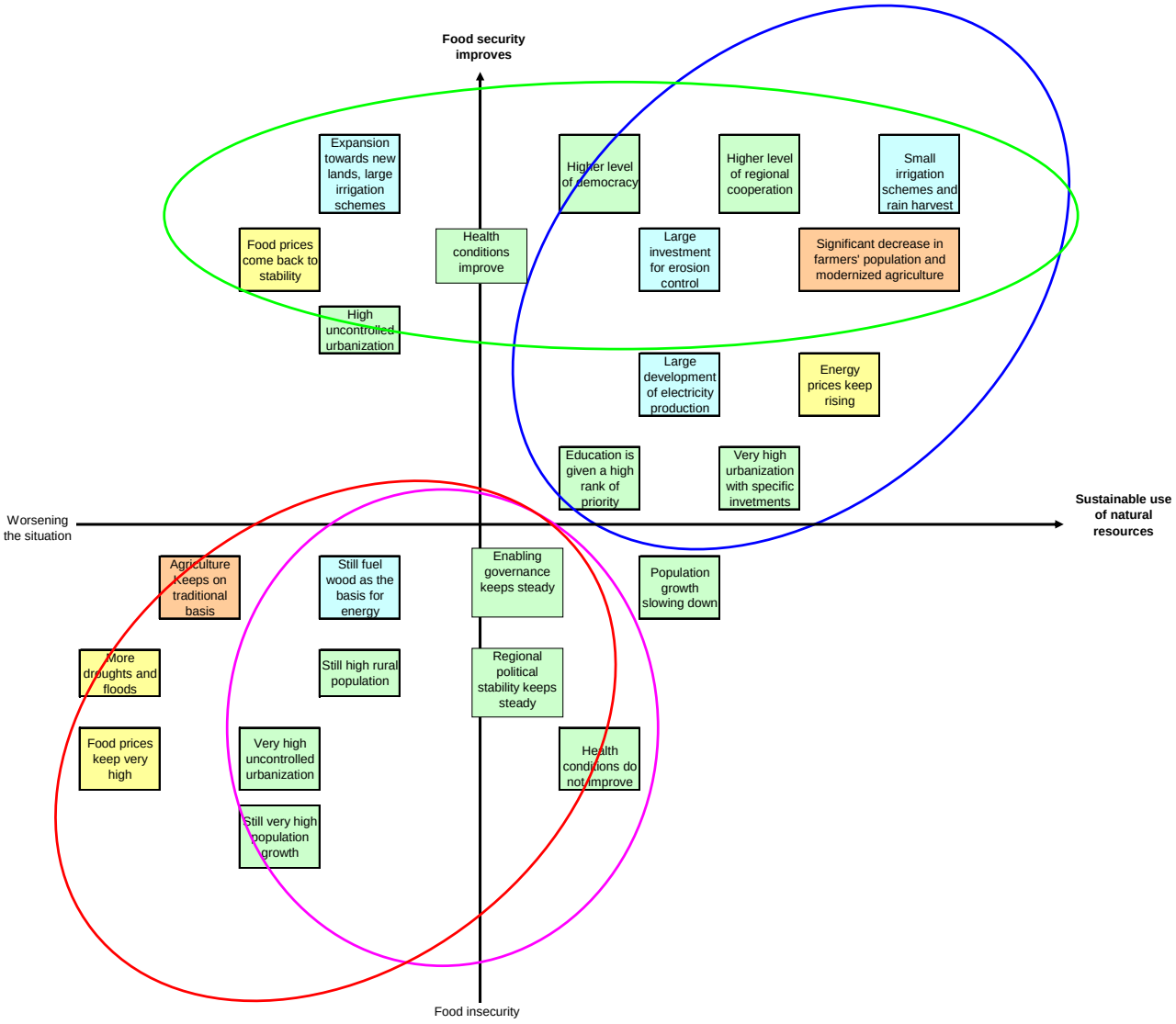
In the case of the Kagera River Basin, we will proceed with three different scenarios, such as:

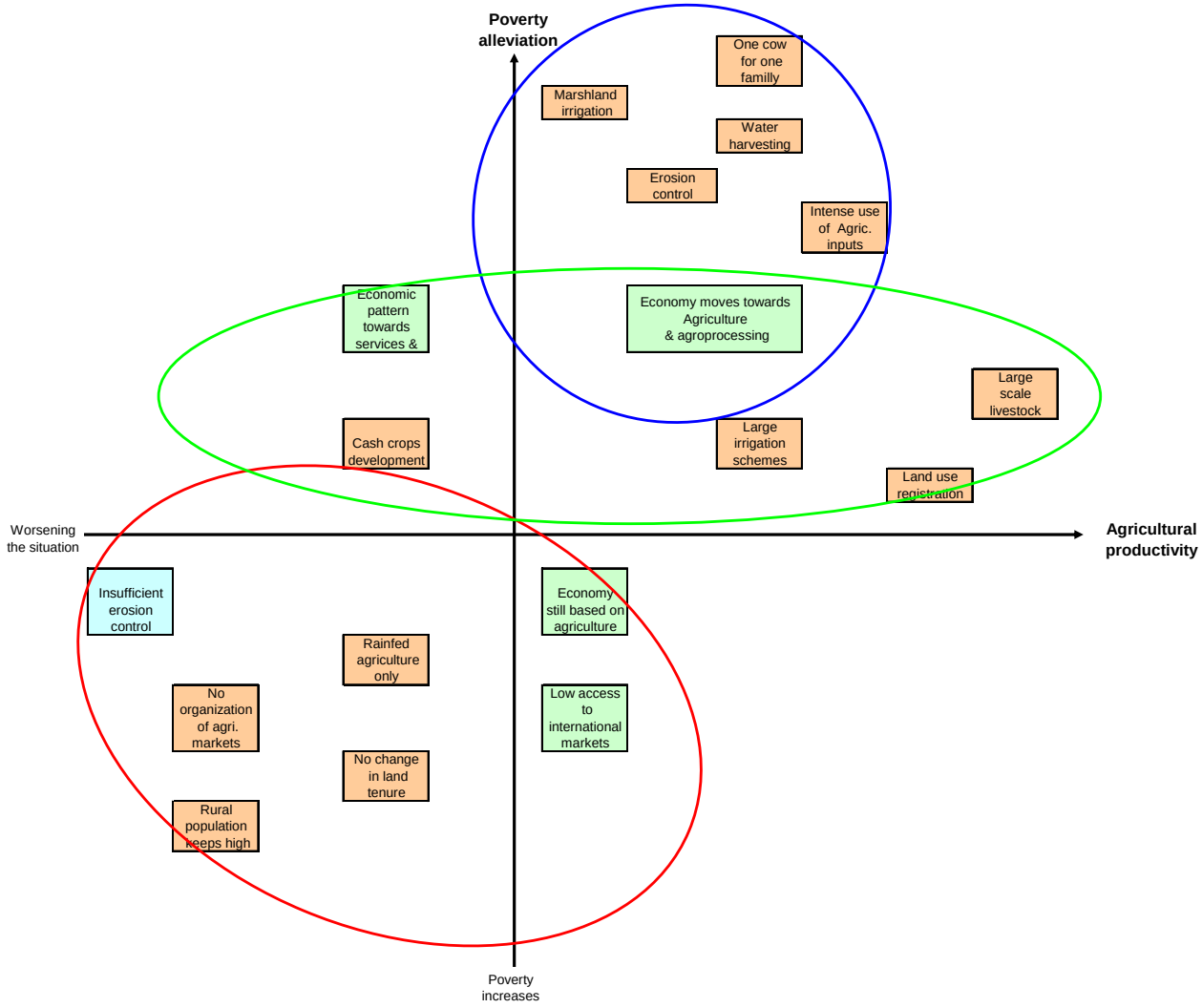
- Scenario 1, explanatory, which is based on the current observed trends, could be called also “business as usual”,
- Scenario 2, scenario of anticipation strongly based on agriculture, due to the rural majority of the population, search for food security, fight against the major threat represented by erosion and loss of fertility,
- Scenario 3, scenario of anticipation, mostly based on specific efforts paid for alternate economic developments and drivers, higher development in electricity production,

In this purpose, we will consider three main axes which represent the key objectives for IWRM in the Kagera river basin, namely:

- Poverty alleviation
- Food security and agricultural productivity
- Sustainable use of natural resources

The distribution of the various drivers and their possible situation can then be summarized on two sketches:





On these two sketches, each ellipsoid represents a possible combination of the drivers in the future, and then constitutes the skeleton for scenarios.

The red ellipsoid represents a bad situation, more or less the continuation of current negative trends.

The blue one represents the ambition for a new development based on agriculture and the presence of a large rural and farmers population. The priority is given to poverty alleviation.

The green one represents a much higher level of ambition, based on a drastic change in economic pattern and high level of investment.

Transboundary Integrated Water Resources Management - the Kagera River Basin

In addition to investments in support of management and development of the beneficial uses noted above, several programmes and projects are proposed to support the establishment and operation of an appropriate institutional arrangement to enable effective Kagera River basin management and development.

- **Kagera River Basin Management Unit:** In section 5 we recommend the establishment of a Kagera River Basin *Management Unit* within the context of the existing LVBC institutional and legal framework. A preparatory study (USD 1 million), and 4 years of technical assistance (USD 10 million) with the establishment and capacity-building of this *Unit* or whatever alternative is finally determined and agreed to be the most appropriate is provided for this estimate
- **Support to the LVBC in Elaborating Water Management Rules and Procedures:** The LVBC is a relatively *young* organization with a noble mandate agreed upon in the *Protocol* by the five riparian countries. Enabling rules and procedures are required to be negotiated, agreed and put in place to facilitate the implementation of the various administrative and technical provisions of the *Protocol* including, but not limited to: procedures/rules for notification, data exchange and sharing, and flow and water quality management. A provision budget of USD 1.5 million over 3 years is included.
- **Kagera River Basin – Decision Support Modelling:** A simple, yet appropriate set of numerical tools should be available to the Kagera Basin Management Unit to enable staff to assess the impacts of development on changes in flow and water quality in the Kagera Basin. These should preferably be linked to existing and planned tools such as the Nile DSS which is under development at this time. A provision budget of USD 1 million is provided.
- **Kagera River Basin Development Programme:** Once operational, the main role of the Kagera Basin Management Unit will to facilitate a process of basin development. A variety of activities have been proposed, also in this monograph, and need to be formulated in greater detail in a participatory and basin-wide manner. It is envisaged that such a program would be executed in the context of a Kagera River Basin Development Programme, funded externally with appropriate technical assistance provided over a period of 4 years at USD 1 million/year.

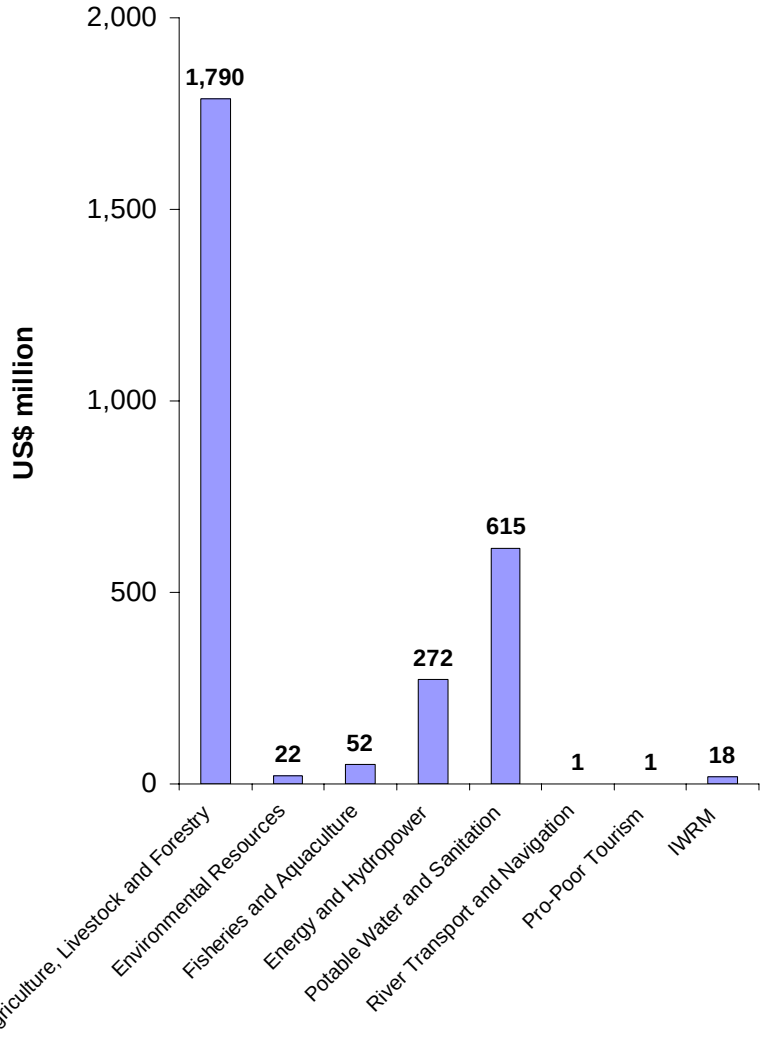
Kagera River Basin Development Scenarios

Priority to food security and poverty alleviation

Overall investments in the Kagera River basin, including all four countries, over this 20-year period have been estimated at more than USD 2.7 billion (ref. following tables and figures). The investments proposed are which are considered to be essential to the sustainable development and management of the water and related resources. Implementation rates could be scaled either up or down depending on availability of financing. And the priorities attached to each sector. The estimated values should be considered as *order-of-magnitude* costs and do not necessarily imply relative priorities. For example, even through hydropower is a relatively smaller total value for investments in the basin, it is well recognized that improved access to electricity is critical for sustainable development. As well, all the proposals included in these scenarios require further more detailed studies and analysis to ensure optimal implementation. The details underlying the estimated values noted above are provided in the respective sections of the monograph.

Kagera River Basin development scenario - summary of proposed investments in 'basic scenario' (2008 – 2027)

Monograph Section	Kagera River Basin Development	US$ (million)	%
6	**Agriculture, Livestock and Forestry**	1,789.8	65%
7	**Environmental Resources**	21.5	1%
8	**Fisheries and Aquaculture**	52.0	2%
9	**Energy and Hydropower**	272.0	10%
10	**Potable Water and Sanitation**	615.0	22%
11	**River Transport and Navigation**	0.5	0%
12	**Pro-Poor Tourism**	1.0	0%
15.6.2	**Kagera Basin IWRM - Institution and Capacity Building**	17.5	1%
	Total:	**2,769.3**	**100%**



Kagera River Basin development scenario - summary of proposed investments in 'basic scenario '(2008 – 2027) by sector

Business as usual – slow development despite large efforts

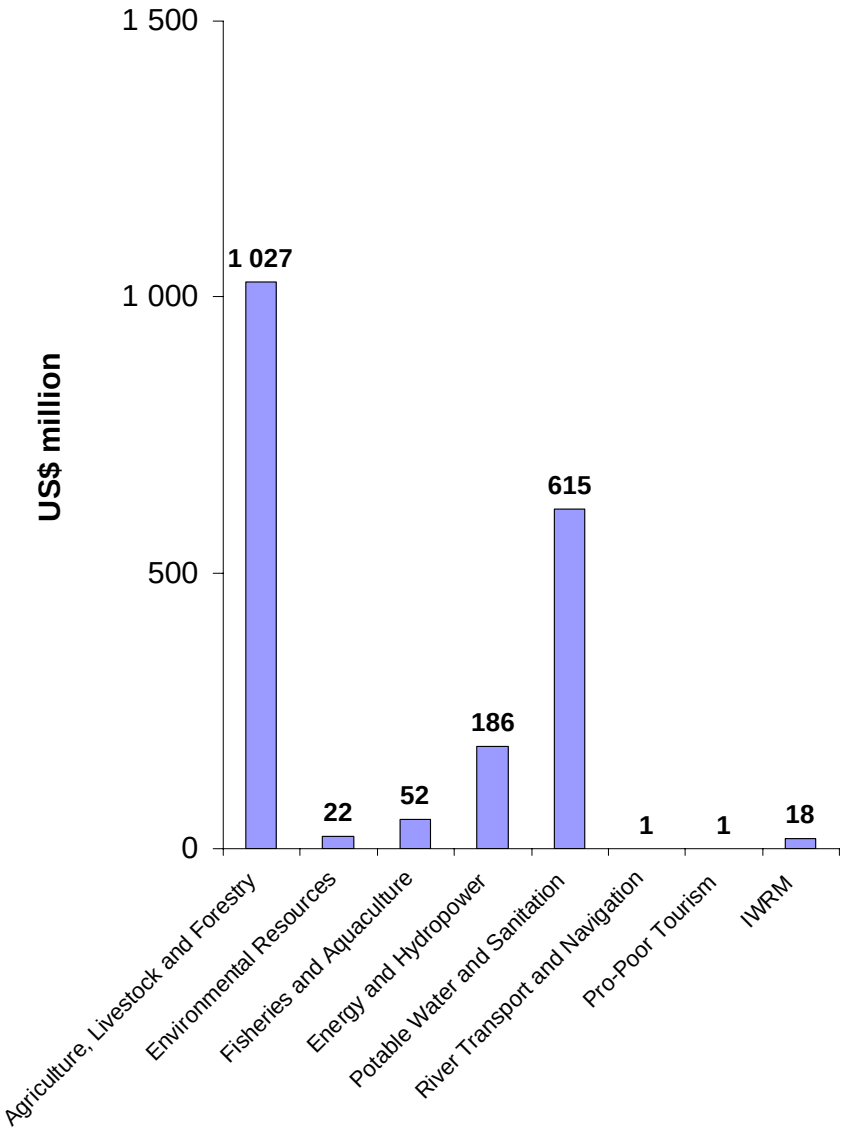
Despite a real willingness expressed in sector policies (water, agriculture…), some major problems are not successfully tackled. The socio-economic pattern does not change significantly, with still very small farms, slow development of irrigation, still high rural population densities.

The intensity of investment in rural areas is kept low, except regarding water supply and sanitation, but on a much longer period that previously expected. The main effort made by the countries is therefore more in urban areas and out of the scope of IWRM.

Overall investments in the Kagera River basin, including all four countries, over this 20-year period have been projected at USD 1.9 billion, at a lower level compared to the first scenario. The major difference with the previous scenario lies also in slower pace of investment, which results in less impacting positive effects.

Kagera River Basin Development Scenario – Summary of envisaged investments in 'business as usual scenario'

Monograph Section	Kagera River Basin Development	US$ (million)	%
6	**Agriculture, Livestock and Forestry**	1 027,3	53%
7	**Environmental Resources**	21,5	1%
8	**Fisheries and Aquaculture**	52,0	3%
9	**Energy and Hydropower**	186,0	10%
10	**Potable Water and Sanitation**	615,0	32%
11	**River Transport and Navigation**	0,5	0%
12	**Pro-Poor Tourism**	1,0	0%
15.6.2	**Kagera Basin IWRM - Institution and Capacity Building**	17,5	1%
	Total:	**1 920,8**	**100%**



The higher ambition

The construction of several hydropower schemes also allows for the development of large scale irrigation in the marshlands. These will be the Nyabarongo scheme and the Kishanda valley scheme, provided that impacts are properly mitigated and resettlement also done. In addition, a specific attention will be on electric lines in order to reach as much as possible medium cities in the basin and significantly expand the rate of people connected to the grid.

In this scenario, we will consider 60,000 Ha of new irrigated marshland schemes.

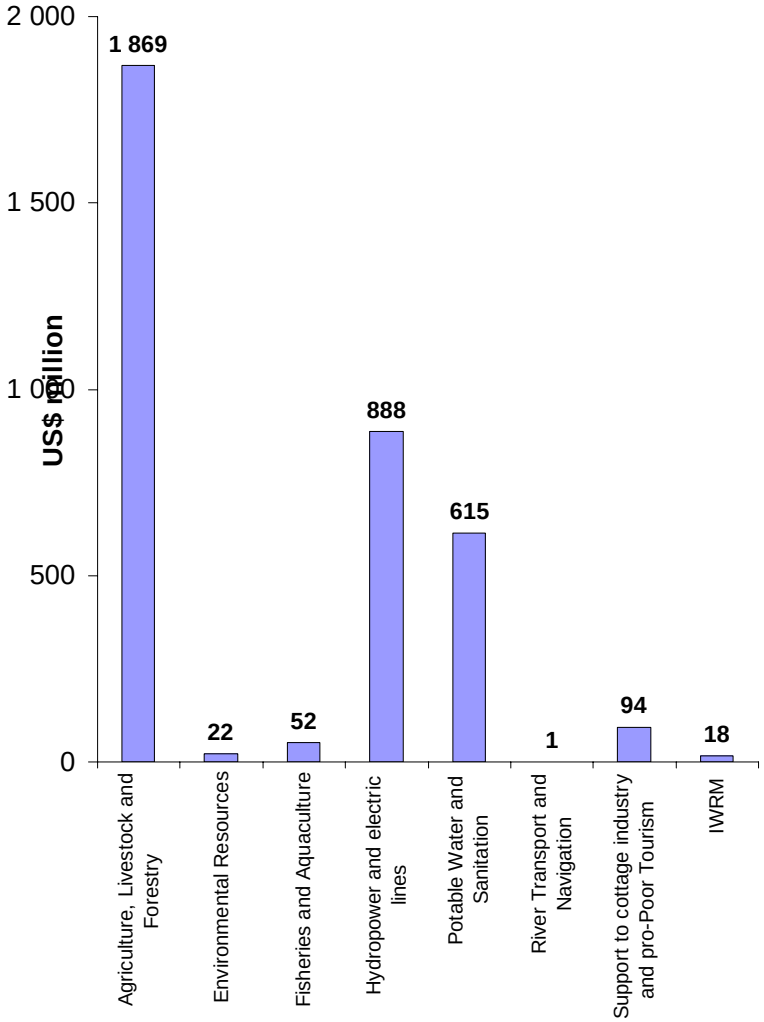
A holistic large scale approach regarding soils management is now possible with global improvement in socio economic conditions. This includes physical fight against erosion and also securing the land tenure through land use registration. This allows to stop fertility losses and improve the global food production as well as farmers' income. We will consider 60,000 ha of radical terracing as well as specific means for land use registration.

Finally, in the meaning to value the agricultural products, and develop cottage agro processing, it is proposed that a specific revolving fund would be created and accompany actions relating to pro poor tourism development.

Overall investments in the Kagera River basin, including all four countries, over this 20-year period have been estimated at more than USD 3.5 billion. The investments proposed are still those which are considered to be essential to the sustainable development and management of the water and related resources. The implementation rate is escalated and a specific effort is put on energy production and distribution. Various feasibility studies remain to be started or updated.

Summary of proposed investments in 'higher ambition' scenario

Monograph Section	Kagera River Basin Development	US$ (million)	%
6	**Agriculture, Livestock and Forestry**	1 869,0	53%
7	**Environmental Resources**	21,5	1%
8	**Fisheries and Aquaculture**	52,0	1%
9	**Hydropower and electric lines**	888,0	25%
10	**Potable Water and Sanitation**	615,0	17%
11	**River Transport and Navigation**	0,5	0%
12	**Support to cottage industry and pro-Poor Tourism**	94,0	3%
15.6.2	**Kagera Basin IWRM - Institution and Capacity Building**	17,5	0%
	Total:	**3 557,5**	**100%**



Bassin de la Kagera

Projet de gestion et de valorisation intégrées des ressources en eau transfrontalières du bassin de la Kagera

Monographie du bassin de la Kagera

Rapport sur le développement dans le bassin

15 juillet 2008

Résumé

Introduction

Synthèse

La Kagera, plus grande des 23 rivières qui alimentent le Lac Victoria, est un affluent du Nil. Son bassin s'étend sur une superficie de 60 500 km² et compte une population estimée à près de 15 millions d'habitants en 2007. Quatre pays se partagent le bassin de la Kagera : le Burundi, le Rwanda, la Tanzanie et l'Ouganda.

	Superficie totale par pays (km²)	Superficie située dans le bassin de la Kagera (km²)	Pourcentage du territoire national (%)	Pourcentage de la superficie totale du bassin (%)
Burundi	25 834	13 790	53%	23%
Rwanda	26 338	21 630	85%	36%
Tanzanie	945,087	20 680	2%	34%
Ouganda	241 038	4 400	2%	7%
Bassin		**60 500**		**100%**

Les ressources en eau et les ressources associées sont menacées. Toutefois, une bonne maîtrise de la gestion et de la valorisation de ces ressources génère des opportunités permettant aux populations locales de s'éloigner de la pauvreté grâce à l'amélioration de leurs conditions de vie, de santé et de bien être. Le défi à relever par la région des grands lacs équatoriaux, région qui comprend le bassin de la Kagera, « *implique évidemment une reconstruction concertée à tous les niveaux : gestion des flux de population, de la croissance économique, de la sécurité et de l'environnement, ainsi que la pratique de la démocratie. Les formes institutionnelles nécessaire à cette évolution sont encore à déterminer et devront dépasser les frontières sans nécessairement les redessiner.* » (Chrétien, 2000)

La gestion et la mise en valeur intégrées des ressources en eau et des ressources naturelles du bassin de la Kagera par des institutions nationales et transfrontalières opérationnelles peuvent contribuer à relever ce défi en favorisant l'investissement, de façon à constituer un capital socio-économique régional, qui bénéficiera à tous les habitants du bassin.

Cette monographie doit ouvrir la voie aux activités futures du bassin. Elle doit permettre *l'optimisation* de la mise en valeur de ses ressources à travers un processus qui, au lieu de privilégier un aspect au détriment de l'autre, assurera des bénéfices réciproques. Par ailleurs, elle doit *minimiser tout impact négatif* sur le bassin de la Kagera, et à plus grande échelle, sur le

Lac Victoria ou sur les bassins du Nil. Nous espérons que les forces et les opportunités du bassin de la Kagera inspireront nos lecteurs et que les recommandations et conclusions de cette étude fourniront des orientations concrètes et positives aux décideurs.

La GIRE et les orientations stratégiques de la GIRE

La gestion des ressources en eau et des ressources associées transfrontalières se base actuellement sur les principes de la Gestion Intégrée des Ressources en Eau (GIRE). La GIRE, telle que définie par le Partenariat Mondial de l'Eau ("GWP" : *Global Water Partnership*) (2007) est "*un processus qui favorise le développement et la gestion coordonnés de l'eau, des terres et des autres ressources connexes, en vue de maximiser le bien-être économique et social qui en résulte de façon équitable sans compromettre la pérennisation des écosystèmes vitaux*." Comme son nom l'indique, il s'agit d'une approche *intégrée* :

- La GIRE prend en compte non seulement les interrelations *biophysiques* internes aux écosystèmes tels que le bassin de la Kagera, mais également les interactions et les besoins *économiques* et *sociales* qui y sont associés.
- La GIRE est une approche *participative*, qui met l'accent sur *l'implication de tous acteurs, y compris les femmes*, dans la gestion et la valorisation des ressources en eau.
- La GIRE considère que *l'eau est un bien économique* qui ne peut plus être mise à la disposition des différents usagers aux besoins concurrents sans contrainte aucune.

Cette approche sera donc conduite au niveau de l'*écosystème*, écosystème constitué du bassin de la Kagera dans son ensemble. Elle englobera notamment :

- Les *aspects biophysiques* de l'eau et des ressources associées, notamment la géographie, l'hydrologie, l'aménagement de l'espace, l'agriculture, la production d'énergie hydroélectrique, l'environnement, la pêche, la navigation, le tourisme, etc.
- Un volet *social*, fournissant les informations fondamentales que représentent la démographie, le développement social, les métiers et les moyens de subsistance, la santé, les problématiques liées aux rôles des hommes, des femmes et des jeunes dans la société ;
- Les aspects et les tendances *économiques* et notamment les activités commerciales, l'industrie, l'économie, le tourisme actuels ; la corrélation entre la gestion et la valorisation de l'eau et des ressources associées et la réduction de la pauvreté, qui doit également être abordée sous un angle "privation d'eau", car l'eau, la maîtrise de l'eau et la gestion et la valorisation des ressources en eau agissent sur le bien être socio-économique, surtout parmi les populations pauvres, mais jusqu'où ?

Pour la mise en oeuvre de la GIRE dans le bassin de la Kagera, il est souhaitable que les acteurs, présents aux niveaux décisionnels dans le bassin, partagent la même vision stratégique de la gestion des ressources en eau et de leur valorisation. Malgré le fait que les dispositions juridiques et institutionnelles détaillées sont actuellement en cours de discussion, il ne nous semble pas prématuré de faire état de certains principes stratégiques d'ores et déjà unanimement perçus au sein du bassin de la Kagera. Ces principes sont exprimés dans les engagements déjà pris et les institutions existantes. Il s'agit, par exemple:

- des Objectifs du Millénaire pour le Développement des Nations Unies, surtout dans le domaine de l'eau et de la gestion des ressources en eau ;
- des principes de la législation internationale sur l'eau ;
- des déclarations de vision et la lettre de mission de la Communauté de l'Afrique de l'Est ;
- des déclarations de coopération au sein de la Commission du bassin du Lac Victoria (CBLV) ;
- de la vision de l'Initiative du bassin du Nil (IBN) ;
- des objectifs du projet de gestion et de valorisation intégrées des ressources en eau transfrontalières du bassin de la Kagera.

Partant de ces principes et des principes de la GIRE, les *orientations stratégiques* suivantes en vue de la GIRE du bassin de la Kagera sont proposées.

Proposition d'orientations stratégiques en vue de la GIRE du bassin de la Kagera

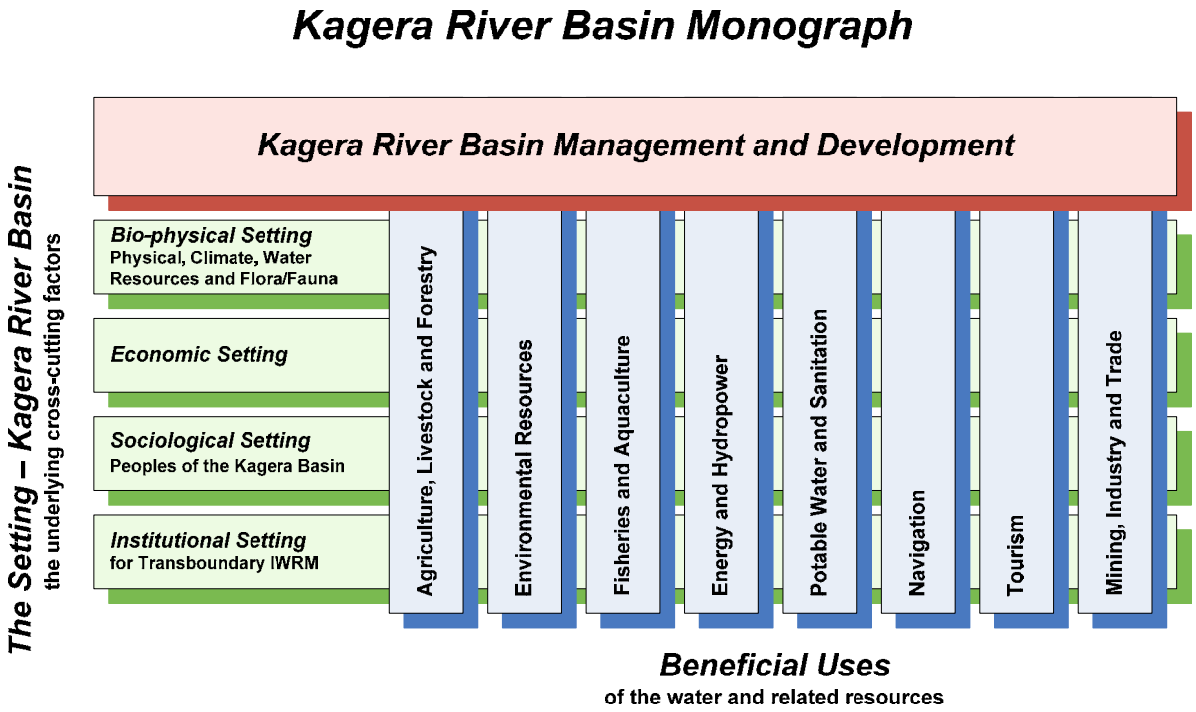
Les différents engagements et déclarations listés ci-dessus soulèvent de nombreux aspects convergents. Sur cette base, nous présentons ici une proposition d'*Orientations Stratégiques en vue de la GIRE du bassin de la Kagera* à étudier par les acteurs du bassin:

- Le développement économique et la réduction de la pauvreté : Promouvoir la croissance économique à travers l'utilisation et la valorisation de ressources en eaux conjointes pour réduire de manière significative la pauvreté.
- L'intégration à travers la planification au niveau du bassin : Mise en œuvre d'un processus participatif multisectoriel de planification à l'échelle du bassin intégrant les enjeux économiques, sociaux et environnementaux du bassin.
- Développement social et équité: Garantir le partage équitable des ressources en eau et des services associés parmi les divers groupes économiques et sociaux ; réduire les conflits; promouvoir le développement socialement durable.
- Coopération régionale : Intégration et coordination par les pays du bassin de la gestion et la valorisation des ressources en eau pour optimiser le bénéfice tiré des ressources partagées et pour minimiser les risques de conflits liés à l'eau.
- La gouvernance : Renforcer et rendre opérationnelles des institutions ouvertes, transparentes et responsables ; élaborer et mettre en oeuvre des cadres règlementaires permettant de promouvoir la GIRE à tous niveaux.
- Protection de l'environnement : Protéger l'environnement, les ressources naturelles, le milieu aquatique, la faune et la flore aquatiques, l'équilibre écologique du bassin pour éviter les impacts néfastes du développement.
- Faire face aux problèmes liés à la variabilité climatique : Prévenir, compenser ou minimiser les pertes humaines et matérielles et la souffrance résultant de la variabilité climatique.
- Gestion basée sur l'information: Garantir que la prise de décision concernant la gestion des ressources en eau sera basée sur la meilleure information qui existe.

Structure de la monographie

En accord avec la GIRE ainsi qu'avec les principes d'utilisation raisonnable et équitable, la monographie plaide également en faveur du *partage des bénéfices* des différents usages de l'eau et des ressources associées en contexte transfrontalier, multisectoriel. La monographie se décline en trois grandes parties :

- Le contexte du bassin de la Kagera (Chapitres 2 à 5): description du contexte biophysique, macro-économique, social, institutionnel du bassin de la Kagera ;
- Usages bénéfiques (Chapitres 6 à 13) : Analyse des opportunités et des contraintes du développement par rapport aux principaux usages de l'eau et des ressources associées du bassin, notamment : l'agriculture, l'élevage, la foresterie, les ressources environnementales, la pêche et l'aquaculture, l'énergie et la production hydroélectrique, l'alimentation en eau potable et l'assainissement, le transport fluvial et la navigation, le tourisme, l'exploitation minière, l'industrie, le commerce ;
- Le développement du bassin de la Kagera (Chapitres 14 et 15) : évaluation de la gestion et de la valorisation intégrées des ressources en eau transfrontalières du bassin de la Kagera pour guider les décideurs et les acteurs quant aux opportunités de développement et d'investissement qui permettraient d'atteindre l'objectif global du projet : soit l'*"…amélioration des conditions de vie des populations et protection de l'environnement."*



Le chapitre 16 de la monographie décrit la base de données et le SIG élaborés au cours de cette étude.

Lors de l'élaboration de cette monographie, un certain nombre de cartes, de graphiques et de schémas relatifs au bassin de la Kagera ont été réalisés. Toutes ces illustrations ont été regroupées dans un document ad hoc, intitulé *L'Atlas du bassin de la Kagera*.

Cadre d'analyse GIRE

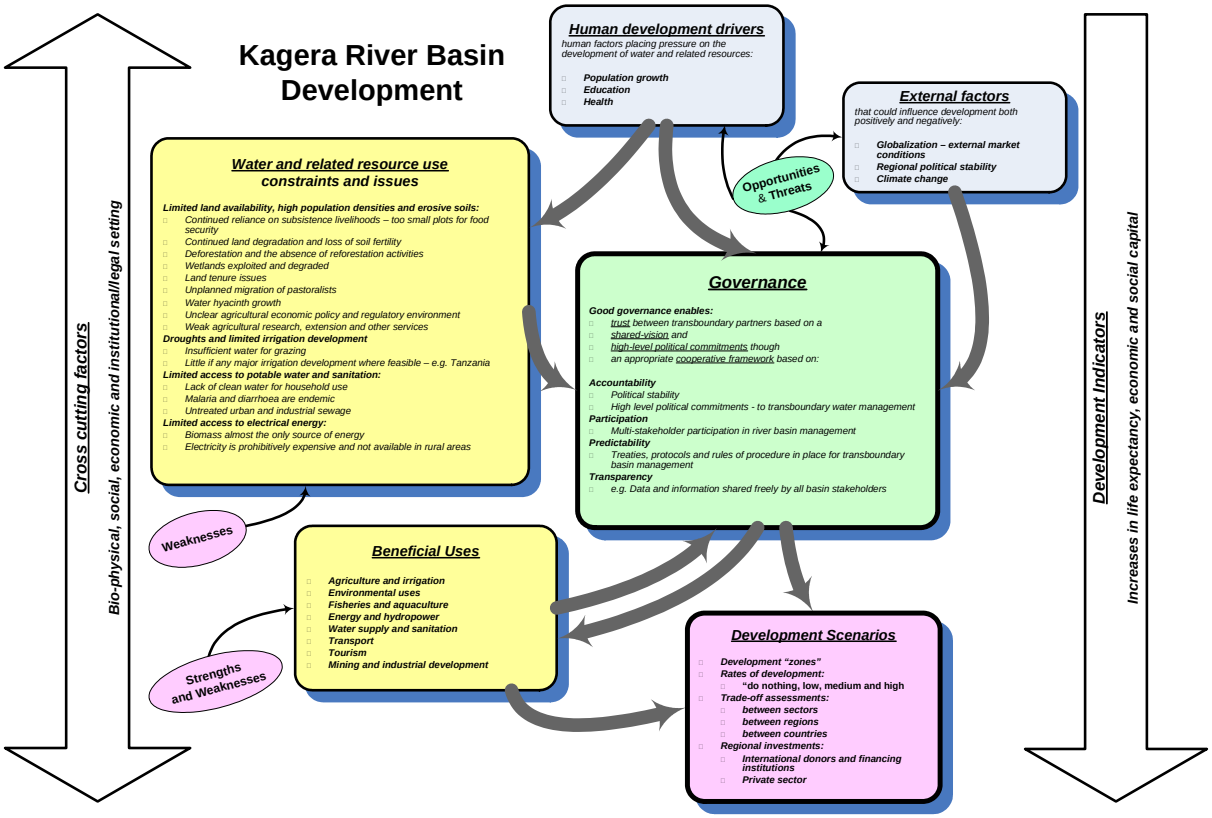
Le *cadre stratégique* de la gestion et la valorisation intégrées de l'eau et des ressources associées du bassin de la Kagera proposé au chapitre 14 est basé sur une *gestion et une valorisation intégrées de l'eau et des ressources associées en vue de la réduction de la pauvreté tout en préservant durablement l'environnement.* Toutefois, placé dans un contexte de gestion des ressources naturelles, le développement humain et économique régional constitue un enjeu bien plus complexe.

Il est nécessaire de jouer sur une multitude d'éléments liés à la l'eau et à la gestion des ressources en eau et qui sont de la compétence des gestionnaires de l'eau / acteurs. Les décisions dans ce domaine peuvent s'inspirer de l'évaluation des *forces et des faiblesses* des secteurs de l'eau et des ressources concernés. Par ailleurs, il ne faut pas écarter tous les *éléments externes* qui agissent sur le développement, certains ayant des impacts positifs, d'autres négatifs. Nous les avons abordés dans cette analyse sous l'étiquette *opportunités et menaces.*

Ce chapitre de la monographie cherche à identifier et à expliquer les différents éléments et leurs interdépendances à travers une analyse des forces, faiblesses, opportunités et menaces (*SWOT*), en insistant sur les aspects applicables à la gestion et la valorisation des ressources en eau du bassin de la Kagera. Ce cadre, présenté dans la figure suivante, différencie :

- Les *éléments transversaux* au développement du bassin de la Kagera présentés aux Chapitres 2 à 5 de la monographie ;
- *Opportunités et menaces :* les conditions externes pouvant influencer positivement et/ou négativement l'atteinte des objectifs du développement :
  - les principales *forces motrices humaines* sous-jacentes au développement;
  - les autres *éléments externes*, autrement dit, les éléments non maîtrisés par les décideurs et les responsables du bassin ;
  - le *schéma de gouvernance propice* à la gestion intégrée des ressources en eau ;
- *Forces et faiblesses :* les caractéristiques des secteurs de l'eau et des ressources qui faciliteront l'atteinte des objectifs du développement et/ou qui constitueront des contraintes :
  - les principaux enjeux et contraintes liées à l'utilisation de l'eau et des ressources applicables au bassin de la Kagera ;
  - les principales opportunités pour la gestion et le développement des *usages bénéfiques* présentés aux Chapitres 6 à 13 de la monographie ;
  - Les *indicateurs de développement* clés permettant un suivi de l'atteinte des objectifs du développement durable et notamment de la réduction de la pauvreté ;
  - les *scénarios de développement du bassin de la Kagera* envisageables, qui serviront de guide pour les investissements à venir.

Ce cadre est représenté sous forme synthétique dans le schéma suivant.



Ensuite, la monographie sur la gestion et la valorisation de l'eau et des ressources associées du bassin de la Kagera procède : 1) à l'exposé des éléments transversaux, c'est-à-dire du contexte du bassin de la Kagera ; 2) à l'analyse des usages bénéfiques principaux ; des forces et des opportunités pouvant aider à atteindre l'objectif du projet ; 3) à la définition d'un ou de plusieurs scénarios de développement et d'opportunités d'investissement dans la gestion des ressources en eau.

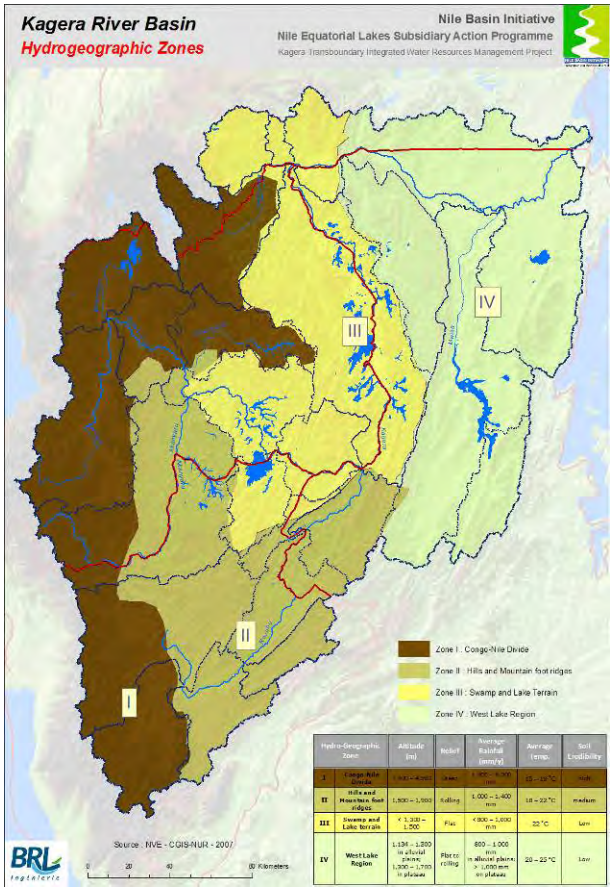
Les éléments transversaux : le contexte du bassin de la Kagera

Caractéristiques biophysiques

Le bassin de la Kagera, sous-bassin du bassin du Nil, reçoit les eaux du cours supérieur du Nil Blanc. La Kagera est incontestablement le cours d'eau majeur du bassin du Lac Victoria. En effet, la Kagera fournit à elle seule environ 34% des apports du Lac. Les différences de niveau du Lac Victoria résultent principalement de la pluviométrie et du ruissellement des bassins versants amont. Là encore, les plus grandes quantités de ruissellement proviennent du bassin versant de la Kagera.

Quatre zones hydrogéographiques ont été distinguées dans le bassin de la Kagera. Le zonage est basé sur la géologie des sites, les sols, les formations caractéristiques, la topographie, la densité de drainage, le climat, les caractéristiques du débit des cours d'eau. Ces zones sont les suivantes :

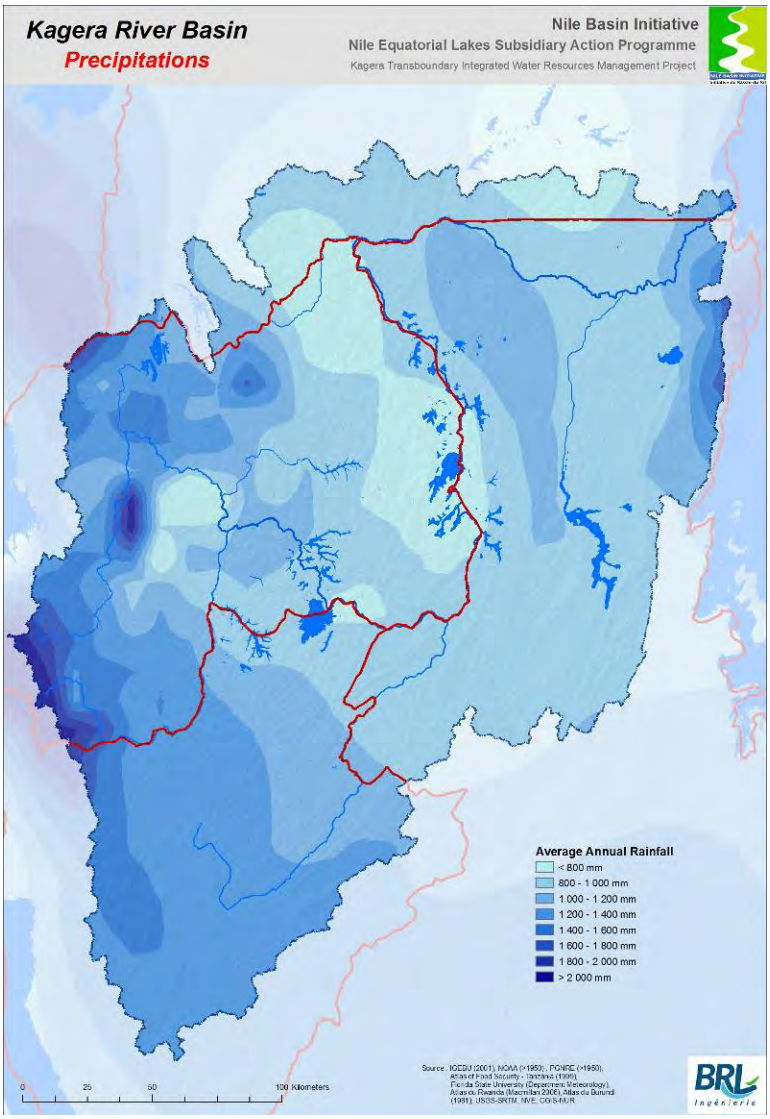
- La ligne de partage Congo-Nil
- Les massifs et les piémonts
- Les zones humides et les lacs
- La région ouest du Lac Victoria
- La carte suivante montre l'étendue de ces zones hydrogéographiques.



La Kagera reçoit les eaux de trois affluents principaux : le Nyabarongo, l'Akanyaru et le Ruvubu. Ces trois cours d'eau naissent sur la ligne de partage Congo-Nil (Zone I). Elles traversent ensuite les massifs et les piémonts de la Zone II. La Kagera naît pour ainsi dire dans la zone humide et des lacs (Zone III). Ici, le cours d'eau s'appelle le Nyabarongo. La Kagera à proprement parler commence à l'exutoire du Lac Rweru.

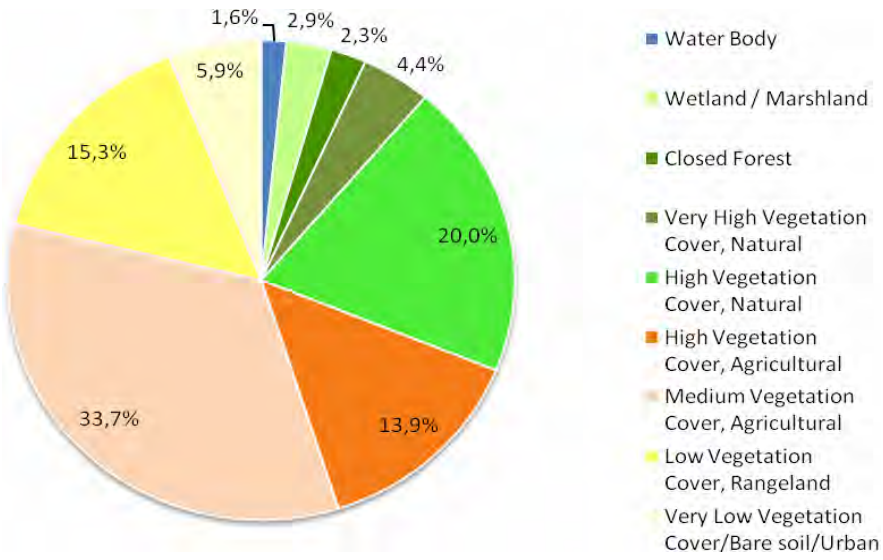
La quasi totalité du ruissellement provient de la moitié amont du bassin versant, qu'on appelle le Congo-Nil, qui comprend les montagnes et les piémonts et les reliefs à l'est (Zones I et II).

Le cours d'eau, les marais, les lacs et les plans d'eau de la Zone III sont très interdépendants. Les niveaux les plus hauts sur les tronçons amont sont enregistrés en mai alors que les niveaux minima s'observent entre mi-août et mi-octobre. A l'aval de Rusumo, il y a un seul cours d'eau pérenne, la Kagitumba, qui collecte les apports de la zone la plus au sud-ouest de l'Ouganda. On trouve une zone affichant une pluviométrie supérieure à 2 000 mm près de la berge ouest du Lac Victoria.



La météorologie du bassin de la Kagera est caractérisée par une grande variabilité climatique liée à sa topographie, à sa latitude et à la présence de plans d'eau. Les précipitations varient entre moins de 800mm au centre du bassin et 1600mm à l'ouest, où la plupart des ruissellements sont générés, ainsi que sur la berge ouest du Lac Victoria.

Le bassin héberge une grande variété de flore et de faune grâce à la diversité de sa topographie et de son climat. La plus grande partie du bassin est constituée de terres cultivées/agricoles (48%). La végétation naturelle couvre 26% de la superficie totale, dont 2% de forêt dense. Les pâturages et les parcours du bétail représentent environ 15% de la superficie totale du bassin. Les zones humides, c'est-à-dire les marais et les plans d'eau libres, occupent environ 5%, tandis que les marais proprement dits ne représentant que 3% de la superficie totale du bassin.



Plusieurs *hotspots* de la biodiversité, aires protégées et zones humides ont été identifiés. Les ressources de ces zones sont utilisées par les populations du bassin de la Kagera pour qui elles ont beaucoup de valeur. Une gestion soignée de ces zones dans le cadre du développement du bassin est proposée pour garantir que les produits et les services y afférents seront correctement et durablement maintenus en harmonie avec le développement d'autres usages pouvant bénéficier aux populations du bassin.

Évolution macro-économique

Les économies des pays du bassin de la Kagera dépendent essentiellement de l'agriculture. Selon le Rapport des Nations Unies sur le Développement Humain (2004), les quatre pays du bassin de la Kagera, soit le Burundi, le Rwanda, la Tanzanie et l'Ouganda, se trouvaient parmi les 30 derniers pays du monde sur un total de 173.[8] Les grandes caractéristiques macro-économiques des pays du bassin de la Kagera sont les suivantes :

- une croissance économique stable
- le produit national brut (PNB) est faible
- de faibles revenus nationaux bruts (RNB) par habitant
- la prédominance du secteur agricole au niveau de l'économie
- un secteur industriel en croissance lente
- un déficit de la balance commerciale qui persiste
- une absence de diversification de l'économie
- des taux d'inflation élevés

[8] PNUD. 2006. Rapport sur le Développement Humain.

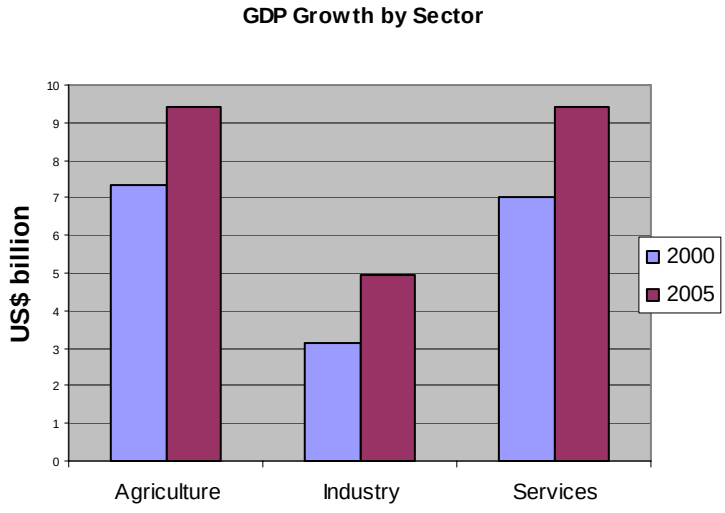
La récente croissance économique des 4 pays du bassin de la Kagera peut s'attribuer à plusieurs facteurs différents dans chaque pays. Parmi les éléments positifs ayant influencé ces économies, on peut citer :

- des politiques macro-économiques propres à promouvoir l'investissement ;
- des programmes de développement à court et à moyen terme centrés sur la réduction de la pauvreté et la participation communautaire ;
- une gouvernance améliorée et une stabilité politique ;
- un climat clément pour l'agriculture ;
- la croisance des productivités industrielles et agricoles et l'évolution du marché régional.

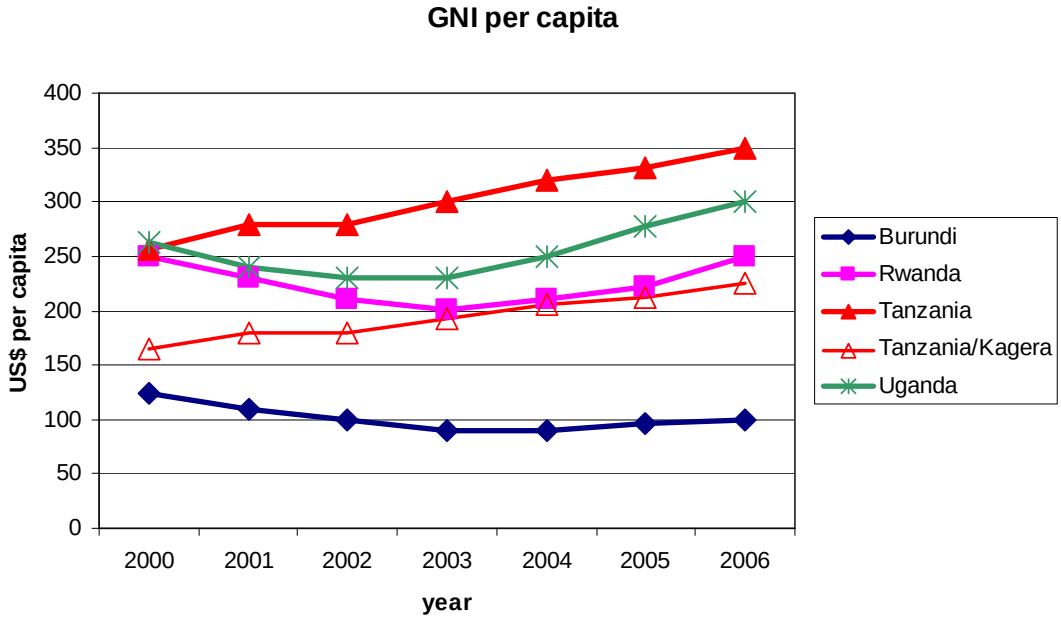
Les éléments ayant exercé un impact négatif sur l'économie sont notamment :

- les crises politiques et sociales dans la région ;
- les conditions défavorables du commerce international ;
- les prix agricoles instables ;
- le manque de financements pour les investissements ;
- une participation insuffisante du secteur privé ;
- l'insuffisance d'information sur le marché local, régional et international ;
- le manque de technologies disponibles ;
- le manque de ressources financières individuelles.

Globalement, le PNB a augmenté entre 2000 et 2005 dans tous les pays du bassin de la Kagera et dans tous les secteurs (cf. figure ci-après). L'agriculture génère la part la plus significative de la recette. Elle rivalise avec le secteur tertiaire mais on peut raisonnablement prévoir que dans le bassin de la Kagera la part du secteur agricole ira croissant.



Le graphique suivant montre le RNB par habitant pour les quatre pays. Il est en augmentation constante depuis 2003, même si la progression est moins rapide au Burundi.



L'image de cette économie prometteuse peut être attribuée à de nombreux éléments. Les éléments les plus significatifs sont sans doute la disponibilité de ressources naturelles ainsi que les politiques économiques de plus en plus efficaces, une programmation axée sur la réduction de la pauvreté, une gouvernance saine et améliorée ainsi que les financements externes. Les facteurs positifs ayant agi sur la croissance économique doivent être maintenus pour garantir une croissance régulière. L'évolution d'un cadre opérationnel de coopération transfrontalière pour le bassin de la Kagera est un élément susceptible d'accroître la durabilité économique.

Les habitants du bassin de la Kagera

Les 4 pays du bassin de la Kagera sont classés parmi les plus pauvres au monde : leur situation est semblable à la situation moyenne des pays de l'Afrique sub-saharienne (avec un PNB par habitant tout de même bien inférieur).

	Classement IDH (sur 177 pays)	Indice du Développement Humain (IDH)	Espérance de vie à la naissance (nombre d'années)	Taux d'illettrisme des adultes (% personnes âgées de 15 ans ou plus)	Taux brut d'inscriptions scolaires – primaire, secondaire, tertiaire (%)	PNB par habitant (PPA, USD)
Ouganda	145	0.502	48.4	66.8	66	1 478
Rwanda	158	0.45	44.2	64.9	52	1 263
Tanzanie	162	0.43	45.9	69.4	48	674
Burundi	169	0.384	44	59.3	36	677
Kenya	152	0.491	47.5	73.6	60	1 140
Afrique sub-saharienne		0.472	46.1	63.3	50	1946
Monde		0.741	67.3	…	67	8 833

Source: IDH Pauvreté ----> PNUD 2007

Le PNB par habitant du bassin de la Kagera est très faible car les activités agricoles sont surtout consacrées à la production de cultures vivrières (cf. chapitre « Agriculture »). Avec une

faible moyenne de 0,8 ha de terres cultivées par famille et des rendements/moyens agricoles faibles, la plupart des familles n'arrivent même pas à assurer leurs propres besoins et de ce fait, il est impossible de générer des revenus supplémentaires.

L'espérance de vie, d'environ 45 ans sur le bassin de la Kagera, est faible. Elle se trouve légèrement en dessous de 46 ans, la moyenne pour l'Afrique sub-saharienne, et largement en dessous de la moyenne mondiale, qui est de 67 ans. Les taux de mortalité infantiles, des adultes et liée à la maternité sont élevés aux pays riverains du bassin de la Kagera, notamment au Rwanda et au Burundi.

Les maladies sont la première cause de la faible espérance de vie dans le bassin de la Kagera. Elles sont d'autant plus présentes que les conditions de santé et d'hygiène insuffisantes occasionnent des maladies diarrhéiques, le paludisme, le choléra. Le VIH/SIDA est la principale cause de décès sur le bassin de la Kagera. De nombreux décès s'expliquent par des causes liées à l'eau. Les diarrhées et le paludisme sont les principales maladies liées à l'eau présentes sur le bassin de la Kagera.

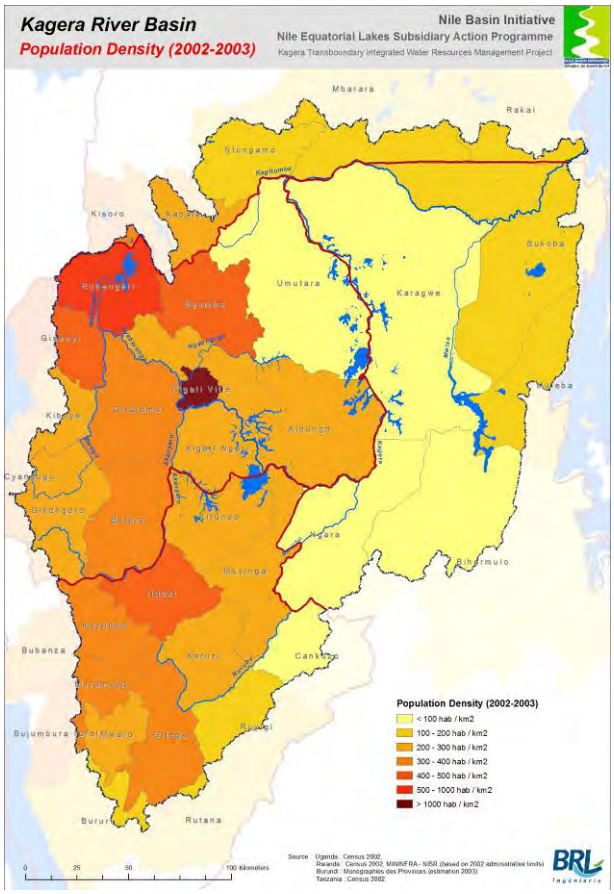
Le manque d'eau et surtout le manque d'eau potable est responsable de la précarité de la santé dans certaines zones du bassin. Les infrastructures sanitaires sont insuffisantes ; elles manquent souvent d'équipements et de moyens humains, à la fois en effectifs et en niveau de qualification. Cette situation s'observe surtout dans le monde rural où le pouvoir d'achat est très faible et où les conditions générales de vie (infrastructures socio-économiques de base comme l'eau potable, l'énergie, les marchés, les écoles, les centres de soins et de loisirs, et…) n'encouragent pas les professionnels à s'y installer.

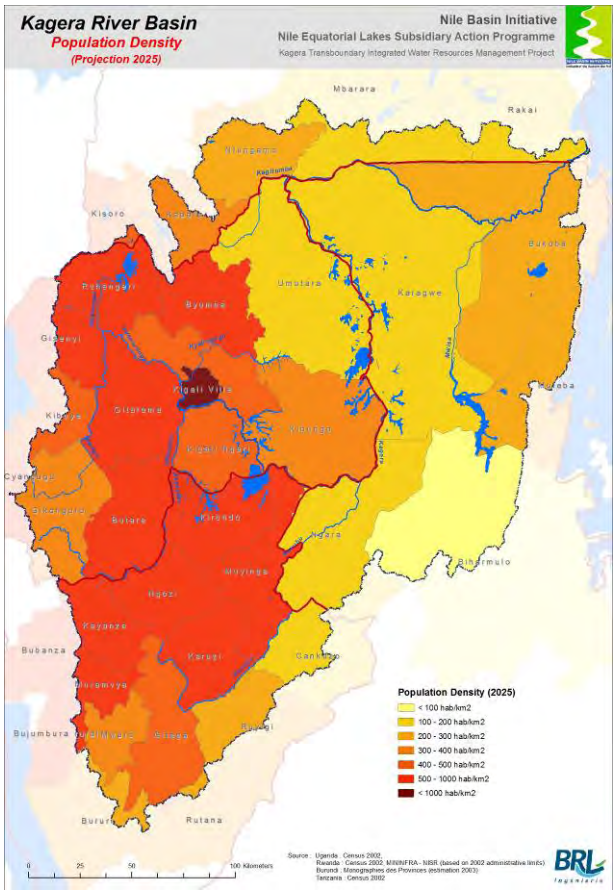
Dans les pays du bassin de la Kagera, le taux d'alphabétisation est autour de la moyenne pour l'Afrique sub-saharienne : allant de 58.9 % au Burundi à 69.4 % en Tanzanie.

La croissance démographique et le taux de fécondité féminine du bassin de la Kagera sont plus élevés que les taux moyens enregistrés pour l'Afrique sub-saharienne. La démographie évolue à un taux moyen annuel de 2,7% avec un taux de fécondité de 6 au bassin de la Kagera, contre 2,5% et 5,4 respectivement pour l'Afrique sub-saharienne.

La densité moyenne est estimée à 248 habitants/km² en juin 2007, ce qui représente plus de 8 fois celle de l'Afrique sub-saharienne avec 28 habitants/km² (vu le taux de croissance démographique, l'écart se creuse d'année en année). Toutefois, cette densité n'est pas homogène sur l'ensemble du bassin de la Kagera: les massifs du Burundi et du Rwanda (les deux pays affichent la densité la plus élevée de toute l'Afrique) sont bien plus peuplés que les plaines de la Tanzanie comme indiqué sur les cartes ci-dessous.

En supposant que le taux moyen annuel de la croissance reste inchangé pendant les décennies à venir, la densité de population du bassin de la Kagera serait de 388 habitants/km² à l'horizon 2025 (proche de la densité actuellement enregistrée au Rwanda) tandis qu'au Burundi et au Rwanda on dépasserait les 540 habitants/km². Les densités de population pour les années 2003 et 2025 (estimations) sont indiquées sur les cartes suivantes.





Le chapitre 4 de la monographie énumère les points communs des habitants du bassin de la Kagera :

- Ils ont une culture et une histoire partagées, malgré les fractures provoquées par la mondialisation,
- Ils parlent les mêmes langues.
- Ils ont la même culture familiale et de clan ;
- Ils exercent les mêmes activités économiques (agriculture, élevage, foresterie) ;
- Ils subissent des mouvements migratoires, encore aujourd'hui ;
- Ils ont un patrimoine commun : un milieu naturel plein de richesses.

La gestion et la valorisation des ressources en eau et des autres ressources naturelles du bassin de la Kagera par des institutions nationales et transfrontalières opérationnelles peuvent contribuer à constituer un capital socio-économique propre à la région et bénéficiant à tous les habitants.

Cadre institutionnel et juridique pour la coopération transfrontalière au bassin de la Kagera

L'histoire du bassin de la Kagera est intimement liée à celui du bassin du Nil, dont il fait partie. L'historique des accords relatifs aux enjeux liés à l'eau dans le bassin du Nil dans son ensemble ainsi que dans le bassin de la Kagera est la suivante (Phillips, 2006) :

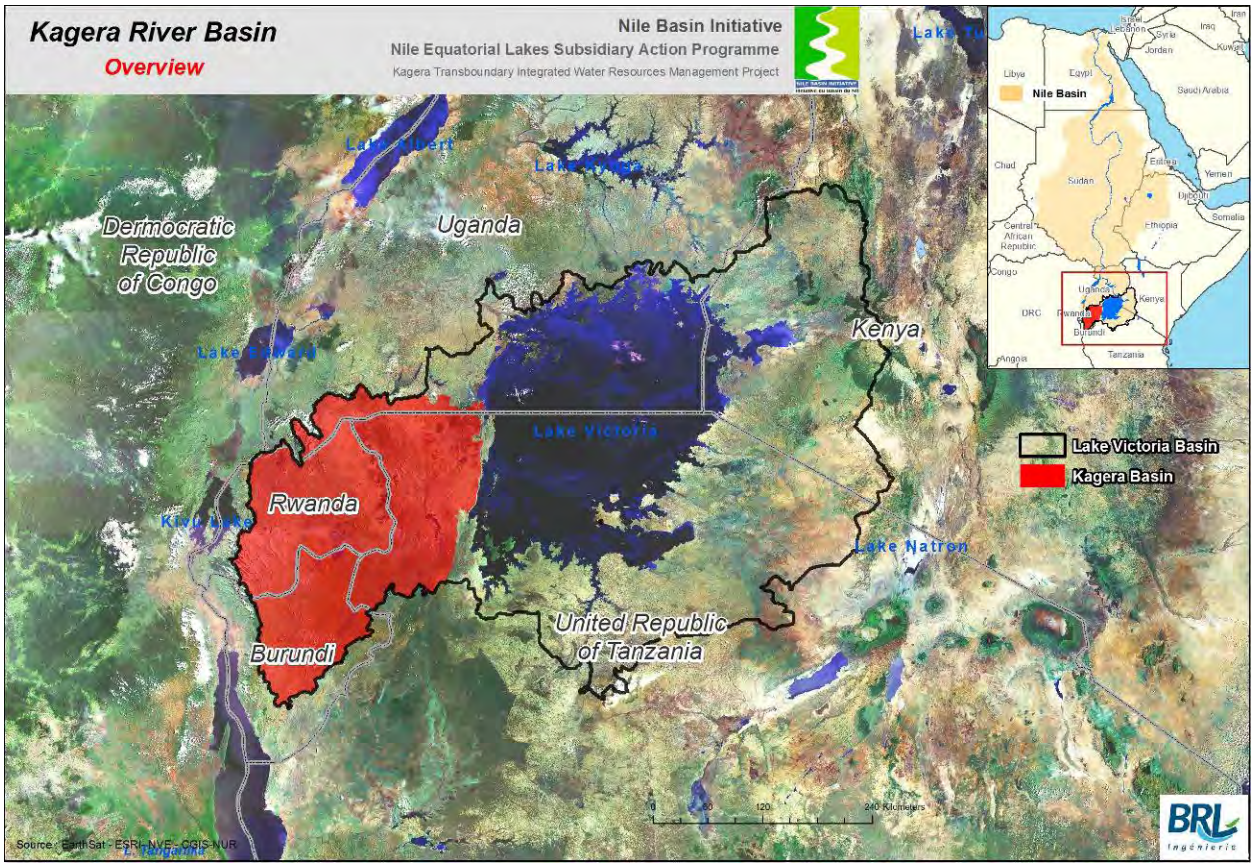
- Un échange de correspondances entre la Grande Bretagne et l'Éthiopie en 1902 concernant le Nil Bleu et d'autres cours d'eau ;
- Un accord entre la Grande Bretagne, la France et l'Italie signé en 1906 sur l'Abyssinie, modifié et étendu par un échange de correspondances entre le Royaume Uni et l'Italie en 1925 ;
- L'accord de 1929 signé entre l'Égypte et le Soudan, représenté par le Royaume Uni, extrêmement détaillé en termes techniques, relatif à l'utilisation des eaux du Nil pour les besoins d'irrigation et de navigation ;
- Un accord entre le Royaume Uni et la Belgique datant de 1934 sur les débits des cours d'eau transfrontaliers et les droits d'eau en Tanzanie, au Rwanda et au Burundi ;
- Un échange d'aide-mémoire entre le Royaume Uni, représentant l'Ouganda, et l'Égypte entre 1946 et 1953 ;
- La Convention signée en 1959 entre l'Égypte et le Soudan concernant l'utilisation des eaux du Nil.
- L'accord entre le Burundi, le Rwanda et la Tanzanie signée en 1977 portant création de l'Organisation du bassin de la rivière Kagera, avec l'adhésion de l'Ouganda en 1981 ;
- L'accord de 1994 signé par le Kenya, la Tanzanie et l'Ouganda pour l'élaboration du programme de gestion environnemental du Lac Victoria ;
- Le Protocole pour le Développement Durable du bassin du Lac Victoria, signé entre le Kenya, la Tanzanie et l'Ouganda en Novembre 2003.

Ces relations historiques entre les acteurs clés du bassin du Nil constituent le point de départ du cadre de coopération. En mars 1998 à Arusha en Tanzanie, le Conseil des Ministres chargés de l'Eau des pays du bassin du Nil arriva à un accord sur la gestion conjointe du fleuve.

En 1999, et dans l'attente d'une convention instituant une structure de coopération, ces États ont mis en place un dispositif transitoire doté d'une personnalité juridique, l'Initiative du bassin du Nil (IBN), constitué par les gouvernements du Burundi, de la République Démocratique du Congo, de l'Égypte, de l'Éthiopie, du Kenya, du Rwanda, du Soudan, de la Tanzanie et de l'Ouganda.

Une déclaration confiant à la NBI la mission de « *création d'un cadre juridique de coopération pour la gestion partagée des ressources en eau du Nil* » a été signée le 14 février 2002, lors du 9ème Conseil des Ministres chargés de l'Eau du bassin du Nil (Nile-COM). La NBI est censée être une solution transitoire pour permettre à ses membres d'établir un cadre institutionnel et juridique pérenne pour mener à bien le développement du bassin (Swain, 1997). Pour la première fois, tous les pays du bassin du Nil exprimaient la volonté de travailler ensemble.

Le bassin de la Kagera est un sous-bassin du bassin du Lac Victoria (BLV), lui-même un sous-bassin du bassin du Nil. Pour garantir une gestion durable des ressources naturelles et une utilisation équitable et raisonnable des ressources en eau de ces trois bassins transfrontaliers, la coopération entre les États riverains est un point de passage obligé.



En 1977, les pays du bassin de la Kagera ont créé une organisation de bassin transfrontalière. Malheureusement, après de nombreux efforts louables, qui se sont concrétisés en études et en programmes intégrés à l'échelle du bassin, et dont grand nombre ont servi de base à l'élaboration de cette monographie, une situation régionale très complexe a conduit en 2004 à la dissolution de cette organisation.

Entre temps, d'autres cadres juridiques et institutionnels ont été créés en vue de l'intégration régionale à travers des structures liées à la Communauté de l'Afrique de l'Est (CAE) ou à l'Initiative du bassin du Nil (IBN). La Commission de bassin du Lac Victoria (CBLV) a été créée à l'initiative de la CAE ; elle est aujourd'hui chargée de la coordination des ressources naturelles et de la gestion de l'environnement, des ressources en eau et de l'eau et l'assainissement. Sous l'IBN, le NELSAP a été créé pour recentrer les efforts sur le bassin du Lac Victoria, sous-bassin du bassin du Nil. NELSAP a également une vocation de gestion et de valorisation des ressources en eau pour assister les pays lors de la mise en oeuvre conjointe de projets ayant pour objectif de favoriser le développement socio-économique et d'atténuer la pauvreté.

A travers les initiatives existantes et la concertation effectuée pour l'élaboration de cette monographie, il se dessine très nettement un grand intérêt consensuel à la fois national et régional, exprimé à divers niveaux d'administration publique, parmi les bailleurs de fonds, ainsi qu'au sein de la société civile. Cet intérêt consensuel privilégie la mise en place d'un lieu d'échange renforcé pour la coopération institutionnelle au niveau du bassin de la Kagera. Nous avons analysé trois options conduisant à la formalisation d'un cadre de coopération

institutionnel plus fort et plus durable pour la gestion de l'eau et des ressources du bassin de la Kagera. Ces options sont :

- L'établissement d'un cadre de coopération juridique et institutionnel pour la gestion du bassin de la Kagera soit entièrement indépendant (à l'image de l'ancienne OBK), soit de type CBLV à travers le Conseil Sectoriel de la CAE ;
- Une organisation dans le cadre d'une structure entièrement nouvelle à créer ultérieurement, après la finalisation des négociations sur la Commission du bassin du Nil. Les dispositions juridiques et institutionnelles pour la gestion et la valorisation du bassin de la Kagera s'insèreraient dans ce nouveau cadre ;
- D'autres dispositions institutionnelles venant renforcer les cadres institutionnels existants de la CAE et du CBLV.

Concernant la première option, nous n'observons à ce jour aucune volonté politique de créer une nouvelle organisation de bassin spécifique à la gestion et au développement du bassin de la Kagera. Nous préférons donc ne pas recommander pas cette approche.

En ce qui concerne la deuxième option, il est difficile de prévoir la durée des négociations en vue de l'établissement de la Commission du bassin du Nile et à quelles conclusions ces négociations aboutiront, si elles aboutissent. De ce fait, nous avons décidé de ne pas accorder trop d'attention à cette option à court voire à moyen terme, car la priorité aujourd'hui semble être d'avancer avec la mise en place d'une gestion transfrontalière de l'eau et des ressources du bassin de la Kagera.

Nous privilégions de ce fait la troisième option, car le renforcement des missions actuelles et des dispositions institutionnelles de la CAE ainsi que de la CBLV semble, dans un avenir proche, offrir le cadre le plus opportun. Les raisons qui ont motivé cette prise de position sont les suivantes :

- La mission actuelle de la CBLV intègre complètement le territoire du sous-bassin de la Kagera River.
- La CBLV a les mêmes objectifs et les mêmes centres d'intérêt comme cela est clairement affirmé dans le protocole voté par les 5 pays membres. De plus, les mêmes ministères nationaux des quatre États du bassin de la Kagera siègent au Conseil Sectoriel de la CBLV.
- Dans la situation actuelle, il ne semble ni nécessaire ni opportun de diluer les rôles et de superposer les responsabilités. Bien au contraire : il faut à tout prix faire converger la prise de décision, les ressources humaines et les financements. L'une des options à court terme serait de créer une Unité de Gestion (ou une Agence [9] pour faciliter et coordonner la gestion et la valorisation des ressources en eau du bassin de la Kagera dans le contexte de la CBLV et sous sa tutelle.[10] Il serait également souhaitable de procéder à la création concrète de cette unité, la basant, par exemple, dans une ville situé dans le bassin.

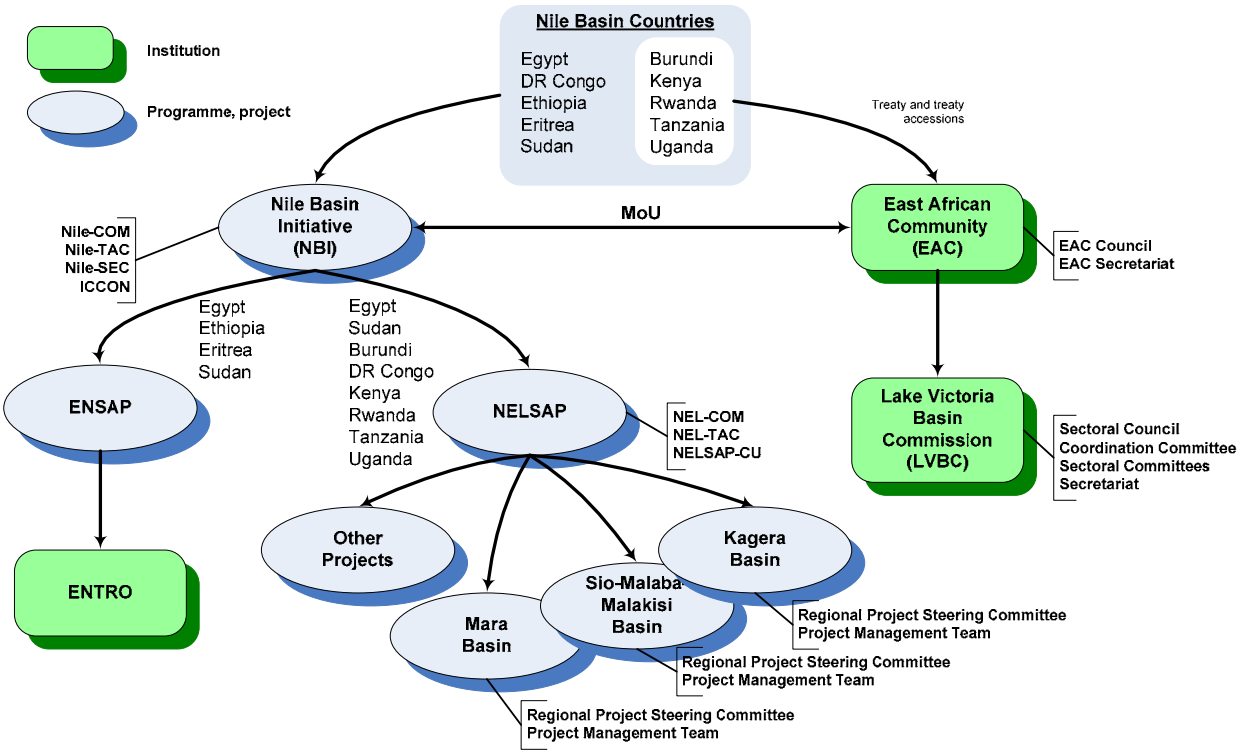
[9] Dans le sens de la création d'une unité technique au sein d'un cadre juridique et institutionnel existant

[10] Les compétences de la CBLV vont croissant. Nous pensons toutefois qu'une unité de gestion du bassin de la Kagera s'insérant dans le cadre juridique et institutionnel de la CBLV viendrait encore renforcer et améliorer son efficacité.

Selon cette option, le cadre institutionnel du bassin de la Kagera serait structuré ainsi :

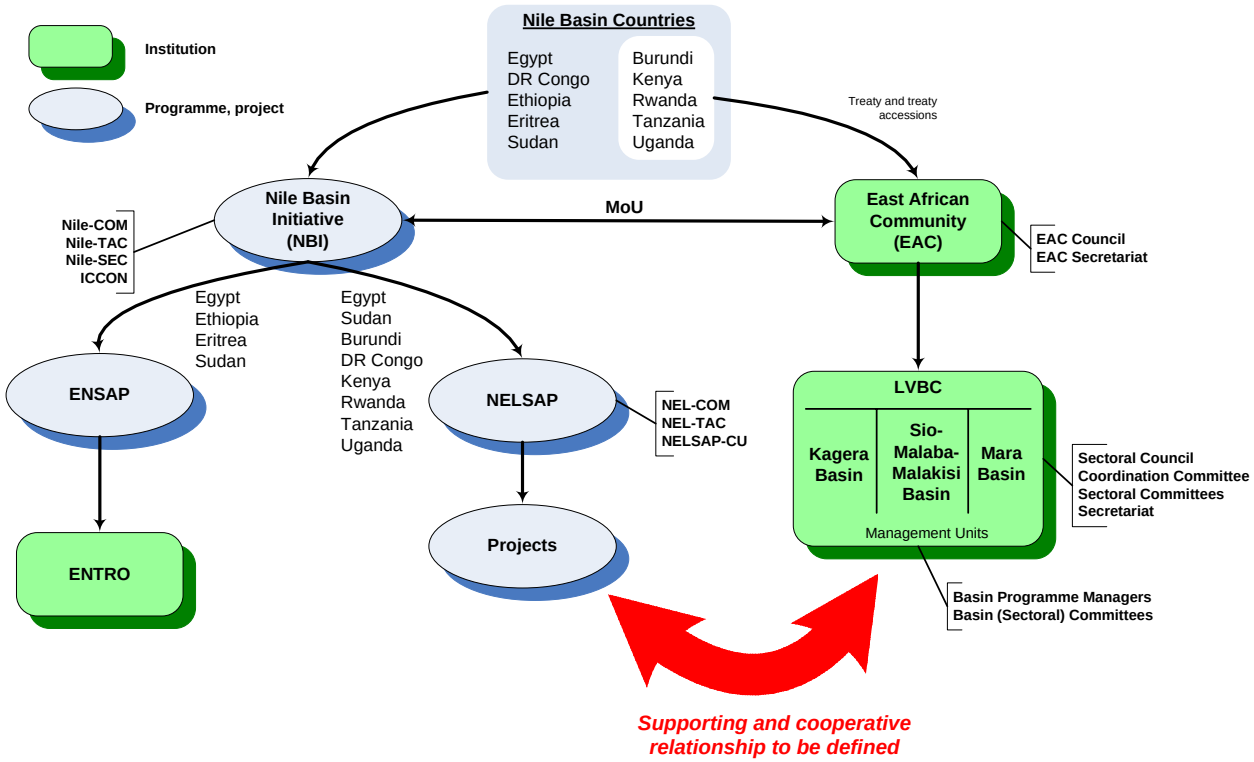
- La **CBLV** fournirait le cadre juridique et institutionnel au niveau supérieur et serait, hiérarchiquement parlant, l'organe décideur en ce qui concerne les projets et les programmes du bassin. Elle serait chargée de l'élaboration d'un outil de planification et de programmation du bassin du Lac Victoria dans son intégralité. Cet outil (de type *schéma directeur de gestion des ressources en eau – SDGRE - du bassin du Lac Victoria*) donnerait aux sous-bassins les orientations et les lignes directrices de la politique de gestion du bassin.
- **L'Unité de Gestion du bassin de la Kagera** serait hiérarchiquement placée sous le Secrétariat du CBLV.[11] Elle serait chargée de l'aménagement et de la planification au sein du bassin de la Kagera dans le contexte plus global des projets et des activités de la CBLV. L'Unité serait coordonnée par un Responsable de Programme sous la hiérarchie directe du Secrétaire Général et du Secrétariat de la CBLV. La direction générale serait assurée par un Comité Sectoriel du bassin de la Kagera, avec la représentation des structures gouvernementales et civiles concernées, des associations d'usagers, etc., (à arrêter d'un commun accord).
- **NELSAP** se poursuivrait en tant que programme de l'IBN en attendant. De toute manière, le protocole d'accord signé entre IBN et CAE en 2007 doit devenir opérationnel. NELSAP peut continuer à assurer des liens avec les initiatives plus larges de l'IBN tant que la *Commission du bassin du Nil* n'aura pas été constituée. Les projets et les programmes NELSAP pourraient être réalisés sous la conduite générale ou en association avec les projets et les programmes de la CBLV. Il faudrait étudier de manière détaillée les relations de collaboration entre NELSAP et la CBLV pour les définir d'un commun accord dans le contexte évolutionnaire des relations institutionnelles dans la région du bassin du Nil.

Les programmes existants et proposés de coopération sur les programmes, les projets et les dispositifs institutionnels ont été schématisés dans les figures ci-après.



Cadre institutionnel existant pour la coopération en matière de programmes, projets et de dispositifs institutionnels du bassin du Nil

[11] Avec cette approche, on peut penser que d'autres *Unités de Gestion* seraient créées pour les deux autres sous-bassins du Lac Victoria : 1) Mara, and 2) Sio-Malakisi-Malaba



Cadre institutionnel proposé pour la coopération en matière de programmes, projets et de dispositifs institutionnels du bassin du Nil

Nous restons persuadés que la mise en oeuvre d'un cadre de coopération renforcé au niveau régional transfrontalier est primordiale pour plusieurs raisons :

- Une entité unique chargée de la gestion du bassin, compte tenu de ses spécificités, des différents usages et des besoins de ses populations serait ainsi clairement identifiée ;
- Un tel cadre favoriserait l'élaboration d'une Vision à long terme du bassin et sa mise en œuvre par application des principes de la GIRE ;
- Il permettrait l'établissement de liens concrets avec chacune des structures nationales et locales impliquée dans la gestion des ressources en eau du bassin ;
- Il offrirait un cadre de concertation et de participation aux gouvernements locaux et à la société civile du bassin ;
- Il re-situerait et renouvellerait la vision du bassin de la Kagera dans le contexte des bassins du Lac Victoria et du Nil, en formant un lien entre les pays et leurs défis respectifs tout en partageant les mêmes préoccupations et les mêmes intérêts. "*En cas de réussite, Kagera pourrait devenir un modèle d'une coopération plus intégrée à travers le bassin du Nil*".[12]

[12] Rapport sur le Développement Humain. 2006. PNUD. p.226 .

Développement des usages bénéfiques de l'eau et des ressources associées dans le bassin de la Kagera

Lors de l'évaluation des usages bénéfiques de l'eau et des ressources associées (chapitres 6 à 13 de la monographie), nous avons identifié un certain nombre d'actions, de projets et de programmes prioritaires nécessitant des investissements, publics ou privés, pour permettre la valorisation des ressources de manière à exercer des impacts positifs sur le développement humain.

En résumé, le bassin de la Kagera se caractérise par une disponibilité restreinte de terres, d'une densité démographique élevée et des sols soumis à l'érosion, avec en plus :

- une dépendance persistante des activités de subsistance, les parcelles étant trop petites pour assurer la sécurité alimentaire ;
- une dégradation constante des terres et de la fertilité des sols ;
- une déforestation et l'absence de reforestation ;
- des zones humides surexploitées et dégradées ;
- des problématiques foncières ;
- une migration non maîtrisée des pasteurs ;
- une érosion des sols qui augmente la charge en nutriments, faisant propager la jacinthe d'eau et conduisant à des phénomènes d'eutrophisation dans le Lac Victoria ;
- une politique agricole et son contexte réglementaire qui ne sont pas clairement définis ;
- peu d'activités de recherche agricole, de vulgarisation, d'autres services ;

Les sécheresses sont récurrentes et les aménagements hydroagricoles sont peu nombreux :

- insuffisance d'eau pour les pâturages,
- peu ou pas d'aménagements hydroagricoles alors qu'ils seraient réalisables, le cas, par exemple, de la Tanzanie,

L'accès à l'eau potable et à l'assainissement est restreint :

- absence d'eau d'une qualité suffisante pour les usages domestiques,
- endémisme du paludisme et des diarrhées,
- absence de traitement des eaux usées urbaines et industrielles,

L'accès à l'électricité est restreint :

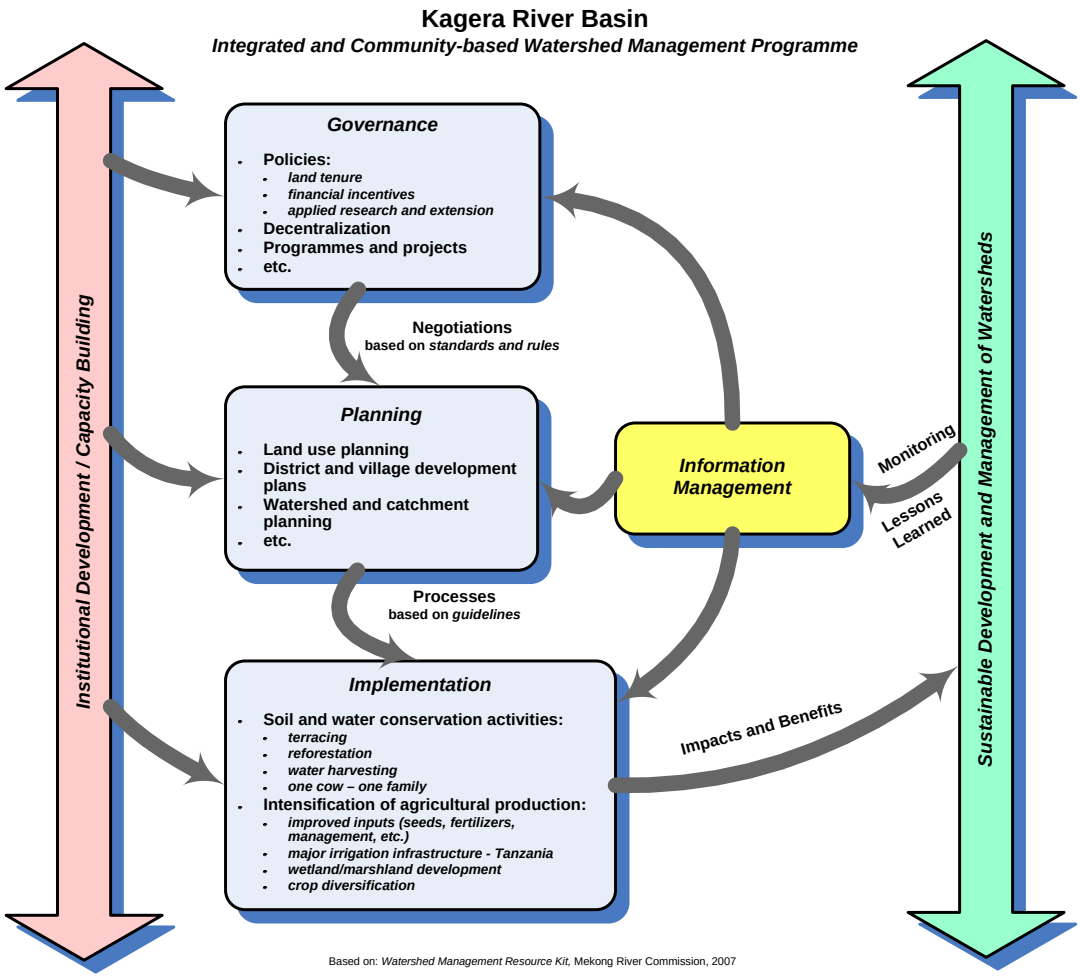
- la biomasse est presque la seule source d'énergie,
- l'électricité a un coût prohibitif et n'est pas disponible en zone rurale.

Les paragraphes qui suivent résument les programmes et les projets d'investissement proposés sous forme de scénario de développement.

Agriculture, élevage, foresterie (chapitre 6)

L'approche la plus efficace à l'amélioration de la mise en valeur agricole du bassin de la Kagera serait, à notre avis, la réalisation d'un *Programme de Gestion de Bassin Versant Intégré et Communautaire*, décrit ci-dessous. Les éléments clés d'un tel programme sont notamment :

- la gouvernance et l'élaboration des politiques,
- les institutions et le développement/renforcement institutionnel,
- la planification,
- la réalisation,
- le suivi-évaluation.



Les interventions proposées dans le cadre d'un tel programme intégré communautaire comprendraient des actions et investissements dans les domaines suivants :

- **Conservation des sols et de l'eau :** construction de terrasses, collecte des eaux de pluie, reforestation et agro-foresterie ;
- **Intensification de la production agricole :** y compris l'utilisation d'apports améliorés et modernes (semences, engrais, etc.), la réalisation de périmètres d'irrigation avec maîtrise de l'eau, le développement de l'élevage et la diversification des revenus du monde rural ;
- **Appui stratégique, notamment sous forme d'activités/programmes de formation et de renforcement des compétences :** en matière de recherche agricole, de vulgarisation agricole, de développement du marché agricole et des dispositifs de financement ruraux, de la mise en place de systèmes de crédit agricole.

Ce programme serait de loin le plus grand ensemble d'actions de développement du bassin de la Kagera, représentant plus des deux tiers des investissements des 20 prochaines années.

Gestion environnementale (Chapitre 7)

Les ressources environnementales du bassin de la Kagera forment un patrimoine qu'il convient de gérer prudemment pour assurer, maintenant comme à l'avenir, une utilisation et une valorisation durables. Pour permettre une gestion durable de l'environnement, les investissements et réalisations suivants sont proposés sous forme d'actions :

- **Un Système de Gestion de l'Information Environnementale du bassin de la Kagera :** Quel que soit le cadre institutionnel et juridique retenu pour la gestion du bassin, il convient d'élaborer un programme de valorisation des ressources en eau et de suivi environnemental. Ce programme serait responsable de l'étude des ressources en eau superficielles et souterraines ainsi que du suivi de la qualité de l'eau. Les informations ainsi obtenues viendront appuyer les études suivantes :
  - Étude détaillée avec inventaire des aires protégées et des *hotspots* de la biodiversité existants ; définition de leur statut juridique et démarcation des limites pour empêcher l'invasion de ces sites. Étude et recensement des zones humides d'importance; classification en zones protégées.
  - Évaluation économique des ressources environnementales existantes : pâturages et parcours du bétail, faune, ressources en eau, zones humides, etc… pour définir leur valeur économique réelle. Cette information doit être utilisée comme critère d'investissement économique dans le bassin.
- **Harmonisation de la gestion environnementale et des normes de qualité** Mettre au point et harmoniser les politiques et les mandats juridiques et institutionnels pour la mise en œuvre d'une gestion environnementale et des investissements économiques dans le bassin. Les normes de qualité environnementale et les directives pour les Études d'Impact sur l'Environnement (EIE) à mettre en œuvre seront également définies pour tous les projets d'investissement dans le bassin. L'existence d'une organisation de bassin ou d'une unité de gestion chargée du bassin de la Kagera favoriserait la négociation des directives EIE transfrontalières.

En tant que thème transversal, les différentes initiatives à venir en matière d'environnement supporteront aussi des programmes d'investissement mis en valeur dans d'autres thèmes, et en particulier au travers du *Programme de Gestion de Bassin Versant Intégré et Communautaire* présenté dans le chapitre 6.4 ou encore au travers de la mise en place d'un programme Eau potable et Assainissement présenté dans le chapitre 10.4.

Pêche - Aquaculture (Chapitre 8)

Bien que faible par rapport à l'agriculture, la pêche fournit une ressource alimentaire non négligeable. Cette ressource peut être exploitée de manière durable pour les besoins en alimentation et la réduction de la pauvreté dans le bassin de la Kagera. Les programmes suivants sont proposés pour permettre le développement de cette ressource :

- **Programme de développement aquacole:** De nombreux petits lacs et/ou zones humides existent dans le bassin, mais les ressources halieutiques sont rares en raison d'une surexploitation des espèces peuplant la plupart des plans d'eau existants. Il est proposé un programme d'aménagement de plans d'eau aquacoles et des équipements associés. Un tel programme aura comme impacts positifs :
  - l'augmentation de la quantité de protéines alimentaires à la disposition des communautés locales ;
  - l'augmentation des revenus à travers la vente de poisson ;
  - la création d'emplois ;
  - la protection du milieu aquatique des plans d'eau existants et ainsi une augmentation éventuelle des populations piscicoles des lacs du bassin de la Kagera ;
  - un gain de temps pour la population, temps habituellement perdu car consacré à la pêche

- **Gestion de la pêche en relation avec les barrages à buts multiples :** Les retenues d'eau des barrages à centrale hydroélectrique dans le bassin de la Kagera (Rusumo Falls et Kakono) permettraient d'accroître la production de la pêche. Les équipements de gestion de la pêche à associer à ces barrages seraient notamment de type portuaires (quais, etc.), usine à glace, centres d'approvisionnement, réfrigération, pisciculture, transformation (fumage par exemple). Le coût estimé est d'environ 1 million de Dollars par barrage.

Energie et production hydroélectrique (Chapitre 9)

La capacité de production hydroélectrique du bassin de la Kagera est de l'ordre de 420 MW, dont seulement moins de 10% sont exploités à ce jour. En raison des contraintes économiques, sociales et environnementales existantes, on considère que seulement 216 MW de cette capacité de production pourra réellement être mise en œuvre, dont environ 36 MW correspondront à des projets de petites et micro centrales, principalement au Rwanda. Le scénario de développement décrit préconise la réalisation des aménagements suivants au plus tôt :

- **Projets de centrales de production hydroélectriques sur le cours d'eau principal de la Kagera :** Les projets des centrales de Rusumo Falls (61,5 MW) et de Kakono (53 MW) ont été identifiés comme étant des investissements nécessaires et fiables dans le cadre de l'évaluation stratégique social et environnementale, "SSEA" (2007) qui préconise une réalisation rapide.
- **Aménagement de petites et micro centrales :** Les petites et micro centrales peuvent apporter une solution dans le cas de communautés isolées du Burundi et du Rwanda, pour une capacité globale de production envisageable atteignant 36 MW.

Le développement de la production hydroélectrique ne suffira pas pour satisfaire la demande à long terme dans le bassin de la Kagera. Une approche régionale, transfrontalière, multisectorielle (énergie hydroélectrique, thermique, géothermique, éolienne) devra être mise en place pour la production de l'électricité nécessaire à l'évolution de la région avec le développement à long terme.

L'alimentation en eau et l'assainissement (Chapitre 10) :

L'amélioration de l'accès à et à l'utilisation d'eau potable et d'assainissement constitue un facteur fondamental du développement humain durable dans le bassin de la Kagera. Il s'agit là d'un facteur susceptible d'améliorer de manière significative la santé et le bien-être des populations. De nombreux programmes et projets ont été proposés dans le cadre de l'élaboration des scénarios de développement :

- ***Réhabilitation des équipements d'alimentation en eau défaillants :*** Pour minimiser le manque d'eau potable actuel et futur de manière viable, il faudra procéder dans un premier temps à la réhabilitation de tous les équipements d'alimentation en eau défaillants à l'échelle du bassin en commençant par les zones les moins bien desservies.
- ***Mobilisation de nouvelles ressources en eau et amélioration des équipements :*** Ensuite, il conviendrait d'exploiter les ressources en eau souterraines dans les zones où une alimentation à partir de l'eau de source, moins coûteuse, n'est pas possible. Dans un premier temps, les centres urbains seraient prioritaires. Après réhabilitation des équipements existants, la desserte à l'échelle du bassin atteindrait 65% sur la base des estimations de la population actuelle du bassin ; cela signifie qu'il faudra installer de nouveaux réseaux d'alimentation en eau pour atteindre les objectifs du millénaire pour l'année 2015. La desserte supplémentaire proviendrait de puits peu profonds et de forages car toutes les ressources superficielles seront déjà en cours d'exploitation, voire surexploitées.

- ***L'assainissement et la sensibilisation à l'hygiène :*** Les politiques nationales des pays du bassin de la Kagera favorisent la construction de latrines par les habitants. De ce fait, les équipements sanitaires domestiques ne sont pas subventionnés. Il faudra mener des campagnes de sensibilisation extensives pour transmettre le message que "l'assainissement épargne bien des vies".
- ***Renforcement institutionnel, développement des compétences, gestion sectorielle :*** La décentralisation est une politique clé à l'échelle du bassin, mais les moyens et les compétences au niveau des provinces et des districts restent faibles. Ce volet s'attachera à accroître à la fois : (i) les moyens et les compétences au niveau des provinces et des districts, et (ii) la défense des droits, la promotion et la sensibilisation de la population au besoin de disposer d'eau potable et d'assainissement comme moyen pour en finir avec la pauvreté.

Navigation (Chapitre 11)

Bien que les résultats des études précédentes indiquent que les potentialités de navigation en tant que moyen de transport commercialement viable dans le bassin aval de la Kagera ne sont pas encourageantes, ces conclusions sont tirées sans passer par une étude de faisabilité impartiale.

- **Étude de faisabilité de la navigation sur la Rivière Kagera** Le coût d'une telle étude a été évaluée à 500 000 USD. Cette étude est proposée en 2010 dans le cadre des scénarios d'investissement pour le développement du bassin.

Tourisme en faveur des populations défavorisées (Chapitre 12)

Le Chapitre 12.1 explique que le développement d'un tourisme bénéficiant aux populations défavorisées contribuerait à atténuer la pauvreté dans le bassin de la Kagera. Pour développer de telles opportunités, il sera nécessaire de travailler en partenariat avec les gouvernements ainsi qu'avec le secteur privé.

- **L'étude de développement touristique en faveur des populations défavorisées dans le bassin de la Kagera :** Il est recommandé de procéder à l'élaboration et à la réalisation d'un programme de développement du tourisme en faveur des populations défavorisées à l'échelle du bassin. L'étude et la réalisation d'un tel programme seraient placées sous la responsabilité de l'organisation de bassin à constituer.

Scénarios de développement du bassin de la Kagera

A travers l'exposé et l'analyse du *contexte* et des *usages bénéfiques* des ressources en eau et des ressources associées du bassin de la Kagera, il a été identifié un certain nombre d'opportunités de développement et d'investissement. Les domaines possibles d'investissement ont été décrits dans les conclusions et les recommandations de chacun des secteurs. Nous les résumerons ici à des fins de prise en compte par les acteurs et les décideurs du basin.

Il ne faut pas oublier qu'il s'agit ici de propositions préalables dont les estimations sont seulement des *ordres de grandeur*. Néanmoins, nous pensons utile à ce stade, d'exprimer ces propositions ainsi, de façon à stimuler la discussion et à entamer un processus permettant susciter l'intérêt d'investisseurs souhaitant se mobiliser pour un développement transfrontalier intégré et global de cette région.

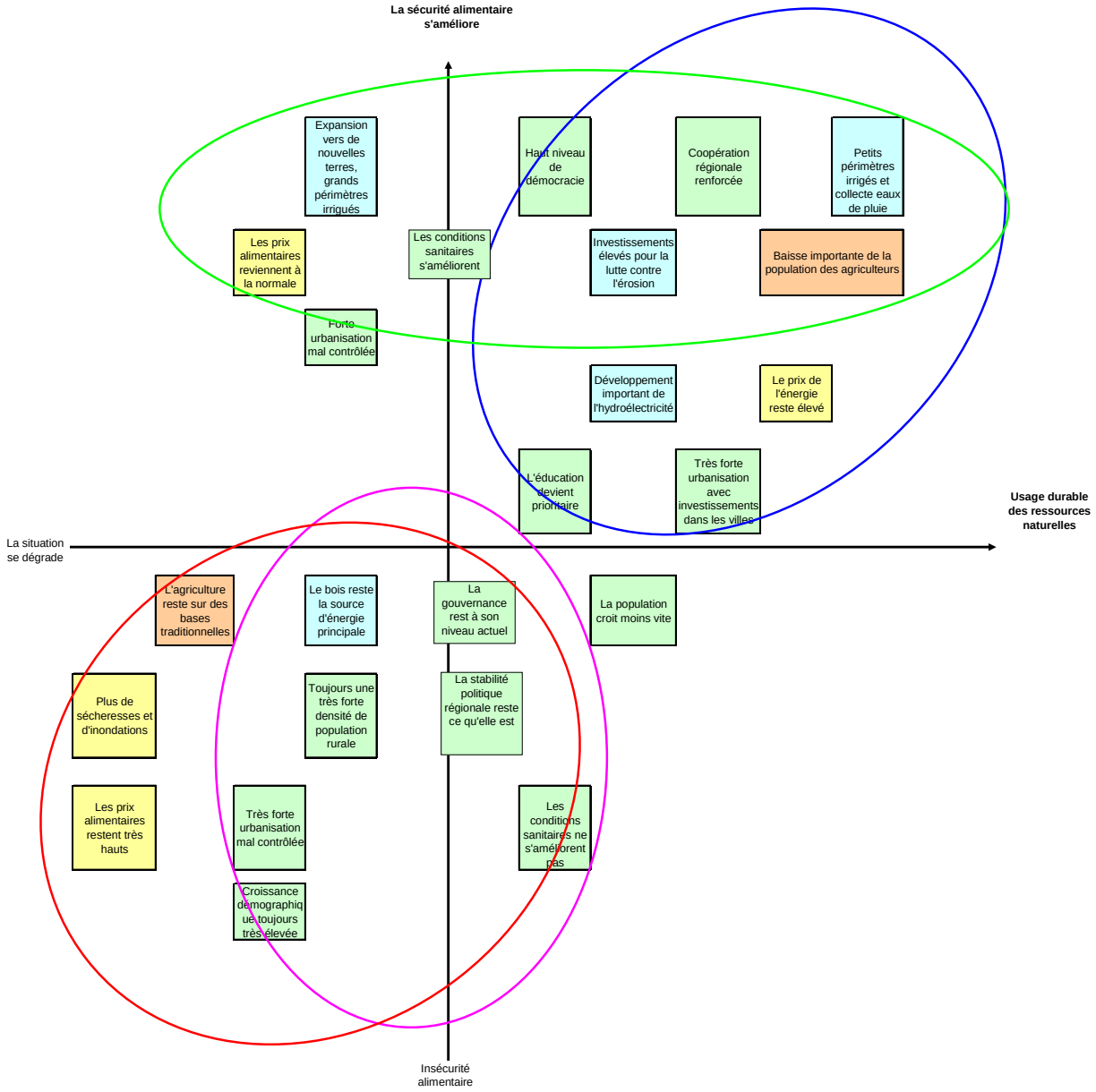
Les opportunités ont été résumées ci-après selon les secteurs. L'horizon pris en compte est une période de 20 ans (2008-2027), sachant toutefois que l'incertitude augmente avec le temps qui passe. Le détail des estimations se trouve dans les sections correspondantes de la monographie. La section suivante décrit le programme GIRE - Renforcement et Appui Institutionnels pour le bassin de la Kagera, proposé en tant que cadre obligatoire pour l'ensemble.

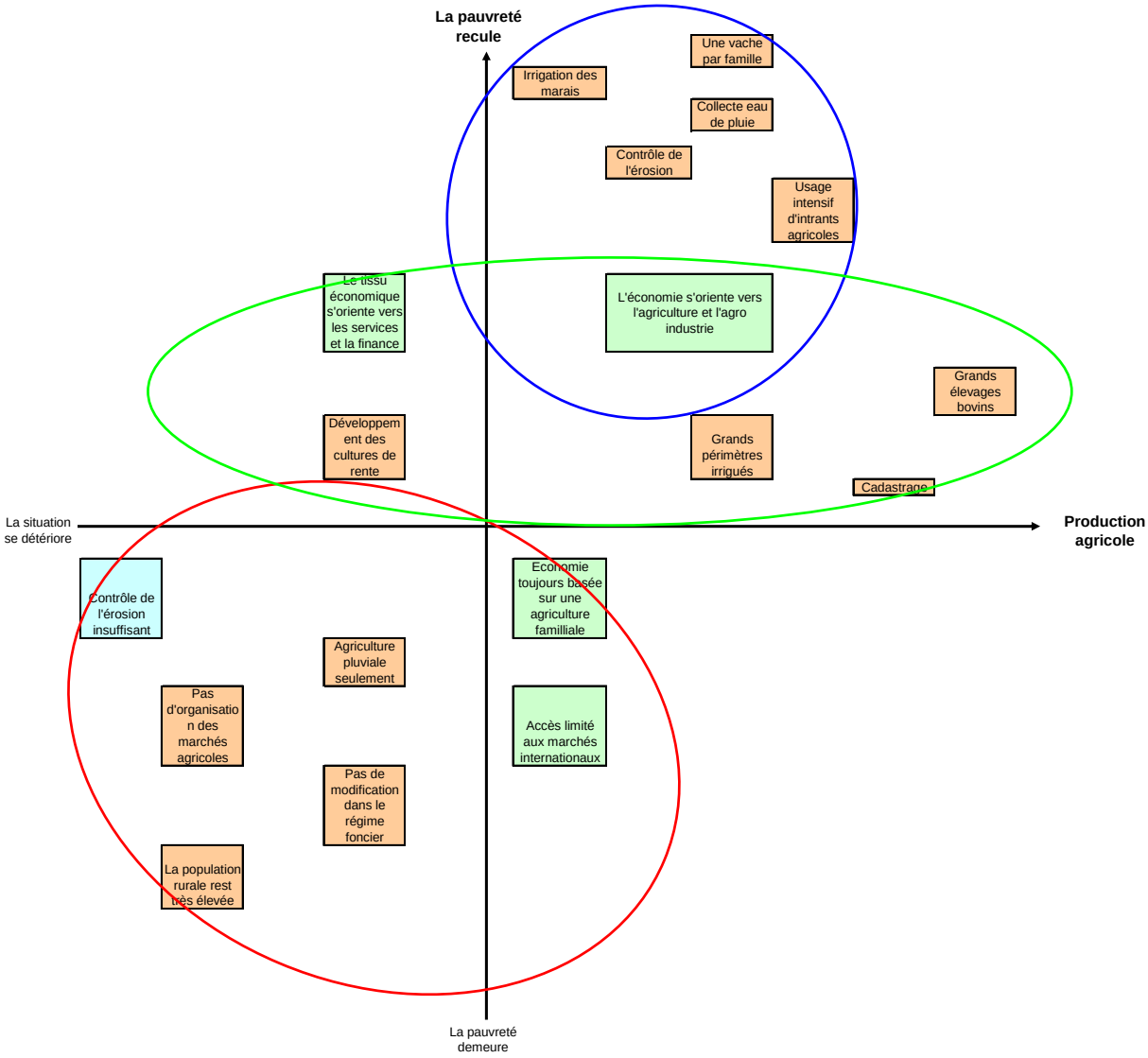
Afin d'explorer plusieurs futurs possibles, on a développé trois scénarios distincts sous la forme suivante :

- Scenario 1, exploratoire, qui est base sur la poursuite des tendances antérieurement observées, et pourrait être dénommé, « business as usual »
- Scenario 2, scénario d'anticipation, fortement base sur l'évolution de l'agriculture, compte tenu du fait que cette activité concerne une grande majorité de la population, de la nécessaire recherché de la sécurité alimentaire et de la lutte contre la menace constituée par l'érosion et la perte de fertilité des sols.
- Scenario 3, scénario d'anticipation, principalement basé sur des efforts particuliers consentis pour un développement économique alternatif (pas seulement fondé sur l'agriculture), avec en particulier un développement plus ambitieux de l'hydroélectricité.

Les scénarios sont déterminés par les composants et les différents états possibles de ceux-ci. On raisonne selon trois axes principaux qui représentent les objectifs d'un développement durable : production agricole améliorée, pauvreté en baisse, usage durable des ressources naturelles, sécurité alimentaire améliorée.

La répartition des différents composants et leurs états possibles peuvent être représentés dans les deux graphiques suivants.


La sécurité alimentaire s'améliore
Expansion vers de nouvelles terres, grands périmètres irrigués
Haut niveau de démocracie
Coopération régionale renforcée
Petits périmètres irrigés et collecte eaux de pluie
Les prix alimentaires reviennent à la normale
Les conditions sanitaires s'améliorent
Investissements élevés pour la lutte contre l'érosion
Baisse importante de la population des agriculteurs
Forte urbanisation mal contrôlée
Développement important de l'hydroélectricité
Le prix de l'énergie reste élevé
L'éducation devient prioritaire
Très forte urbanisation avec investissements dans les villes
Usage durable des ressources naturelles
La situation se dégrade
L'agriculture reste sur des bases traditionnelles
Le bois reste la source d'énergie principale
La gouvernance rest à son niveau actuel
La population croit moins vite
Plus de sécheresses et d'inondations
Toujours une très forte densité de population rurale
La stabilité politique régionale reste ce qu'elle est
Les prix alimentaires restent très hauts
Très forte urbanisation mal contrôlée
Les conditions sanitaires ne s'améliorent pas
Croissance démographique toujours très élevée
Insécurité alimentaire



Chacun des ellipsoïdes rassemble les composants d'un scénario :

- En rouge, le scenario d'évolution tendancielle, où peu d'améliorations sont constatées,
- En bleu, le scénario basé sur un développement important de l'agriculture et de la sécurité alimentaire,
- En vert, un scénario plus ambitieux fondé sur un changement important de la structure économique des sociétés dans la bassin versant.

La gestion intégrée des ressources en eau transfrontalières et le bassin de la Kagera

En plus des investissements sur la gestion et la valorisation des usages précédemment listés, plusieurs programmes ou projets sont proposés en appui à création et au fonctionnement d'un dispositif institutionnel capable d'assurer une gestion et un développement effectif du bassin de la Kagera.

- **l'Unité de Gestion du bassin de la Kagera :** Le Chapitre 5 recommande la création d'une Unité de Gestion du bassin de la Kagera dans le cadre institutionnel et juridique existant de la CBLV. Une étude préliminaire (1 million USD) et 4 années d'assistance technique (10 millions de USD) pour la création et le renforcement de cette Unité ou d'une autre structure, quelle que soit le choix définitif, pourraient être envisagées.

- **Appui à la CBLV pour l'élaboration de consignes et de procédures de gestion de l'eau :** La CBLV est un organisme relativement *jeune* et dont la mission, noble, est définie au *Protocole d'Accord* signé par les cinq pays riverains. Des règles et des procédures d'autorisation doivent être négociées, approuvées et mises en vigueur pour favoriser la réalisation des différentes dispositions administratives et techniques de ce *Protocole d'Accord*, entre autres les procédures/règles de notification, d'échange et de partage d'informations et de données, de gestion des débits et de qualité de l'eau. Un budget prévisionnel de 1,5 millions d'USD est prévu sur 3 ans.
- **Modélisation du bassin de la Kagera pour servir d'aide à la décision :** L'Unité de Gestion du bassin de la Kagera devra disposer d'un ensemble d'outils numériques permettant à son personnel d'évaluer les impacts du développement sur les modifications de débit et de qualité des eaux du bassin. Dans la mesure du possible, ces outils devraient être liés aux outils existants ou projetés, tels que le système d'aide à la décision du Nil, actuellement en cours d'élaboration. Un budget prévisionnel de 1 million USD est prévu.
- **Programme de Développement du bassin de la Kagera :** Une fois opérationnelle, l'Unité de Gestion du bassin de la Kagera favorisera le processus de développement au sein du bassin. De nombreuses actions ont été proposées dans la monographie. Elles doivent être élaborées de manière plus approfondie à travers une approche participative à l'échelle du bassin. On envisage l'exécution d'un programme de ce type dans le cadre d'un schéma de développement du bassin de la Kagera sur financement externe et avec une assistance technique compatible sur une période de 4 ans pour un coût d'un million d'USD par an.

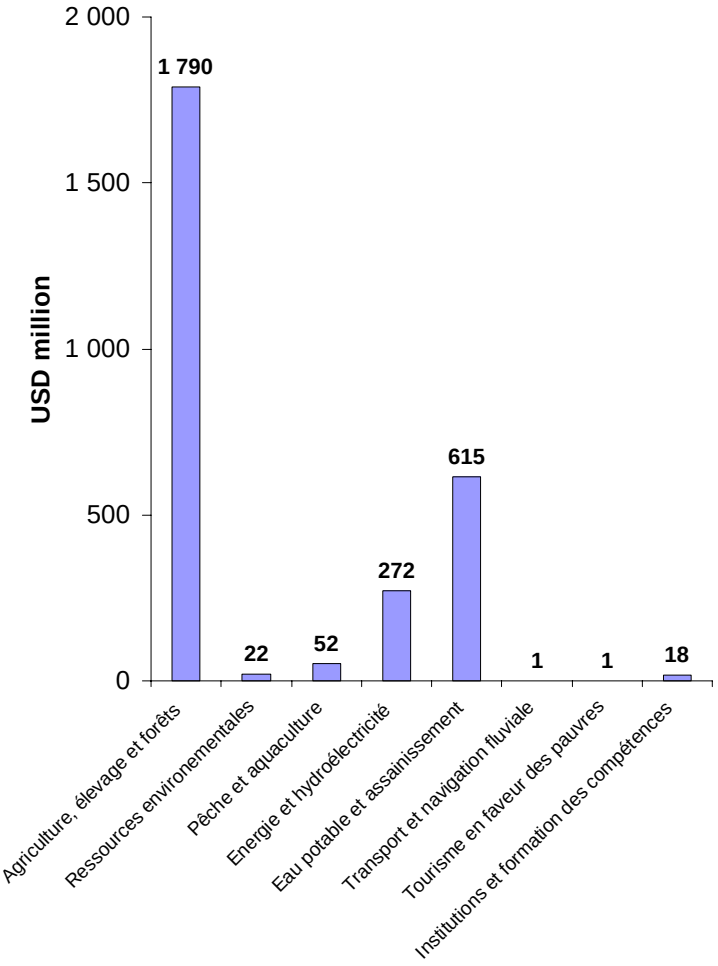
Scénarios de Développement du bassin de la Kagera

Priorité à la sécurité alimentaire et réduction de la pauvreté – scénario de base

L'ensemble des investissements à réaliser sur cette période de 20 ans pour les quatre pays riverains du bassin de la Kagera totalisent plus de 2,7 milliards d'USD (cf. tableaux et graphiques ci-après). Les investissements proposés sont considérés essentiels pour le développement durable et pour une gestion durable de l'eau et des ressources associées. La réalisation peut être soit accélérée soit ralentie selon les disponibilités de financements. De plus, toutes les propositions constituant ces scénarios nécessitent des études et des analyses approfondies pour assurer une réalisation optimale. Le détail des estimations se trouve dans les sections correspondantes de la monographie.

Scénario de développement pour le bassin de la Kagera - Récapitulatif des investissements proposés dans le scénario de base (2008-2027)

Chapitre de la Monographie	Développement du bassin de la Kagera	USD (million)	%
6	**Agriculture, élevage et forêts**	1 789.8	65%
7	**Ressources environementales**	21.5	1%
8	**Pêche et aquaculture**	52.0	2%
9	**Energie et hydroélectricité**	272.0	10%
10	**Eau potable et assainissement**	615.0	22%
11	**Transport et navigation fluviale**	0.5	0%
12	**Tourisme en faveur des pauvres**	1.0	0%
15.6.2	**Institutions et formation des compétences**	17.5	1%
	Total	**2 769.3**	**100%**



Scénario de développement pour le bassin de la Kagera – récapitulatif des investissements proposés par secteur – scénario de base (2008 – 2027)

Scénario « business as usual » - développement lent malgré des efforts importants

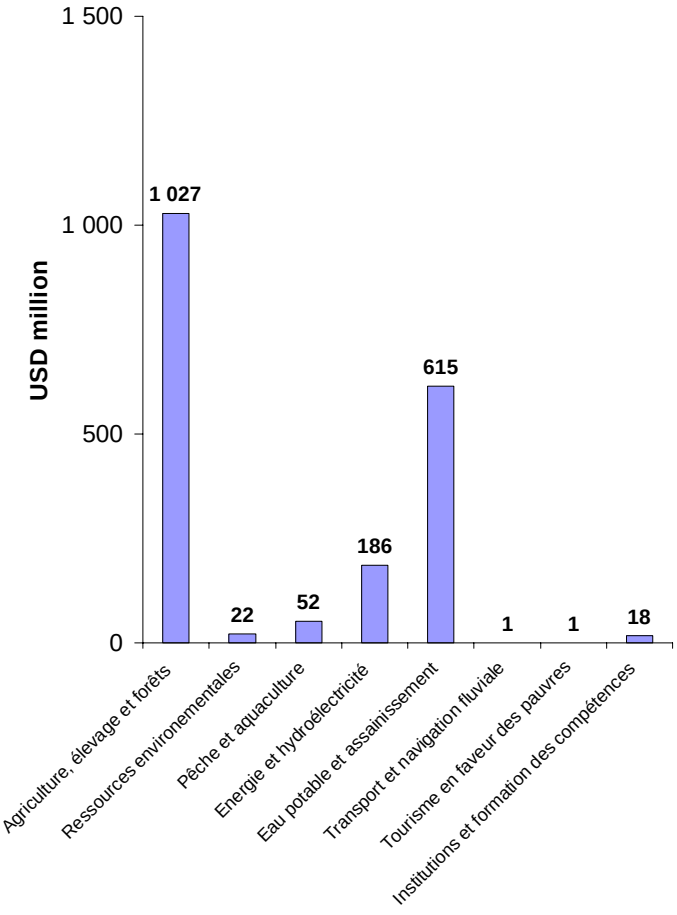
Malgré une volonté sincère exprimée dans les politiques sectorielles (eau, agriculture…), des problèmes importants demeurent. La structure socio économique ne change pas significativement, avec toujours de très nombreux petits agriculteurs, développement lent de l'irrigation et de fortes densités de population rurale.

L'intensité de l'investissement en milieu rural reste faible, sauf en ce qui concerne l'eau potable et l'assainissement, mais ceci prend plus de temps que prévu initialement. Les efforts consentis par les pays sont donc plus concentrés en milieu urbain et hors du champ de la GIRE à proprement parler.

Les investissements totaux dans le basin de la Kagera, pour les quatre pays, sont évalués de l'ordre de 1.9 milliards de dollars sur 20 ans, à un niveau plus faible que le scénario précédent. LA différence majeure avec le scénario précédent consiste en un rythme plus lent des investissements, qui conduit à des effets positifs plus modestes.

Scénario de développement pour le bassin de la Kagera - Récapitulatif des investissements proposés dans le scénario « business as usual » (2008-2027)

Chapitres de la monographie	Développement du bassin de la Kagera	USD (million)	%
6	**Agriculture, élevage et forêts**	1 027.3	53%
7	**Ressources environementales**	21.5	1%
8	**Pêche et aquaculture**	52.0	3%
9	**Energie et hydroélectricité**	186.0	10%
10	**Eau potable et assainissement**	615.0	32%
11	**Transport et navigation fluviale**	0.5	0%
12	**Tourisme en faveur des pauvres**	1.0	0%
15.6.2	**Institutions et formation des compétences**	17.5	1%
	Total:	**1 920.8**	**100%**



Scénario de développement pour le bassin de la Kagera – récapitulatif des investissements proposés par secteur – scénario « business as usual » (2008 – 2027)

Scénario de la haute ambition

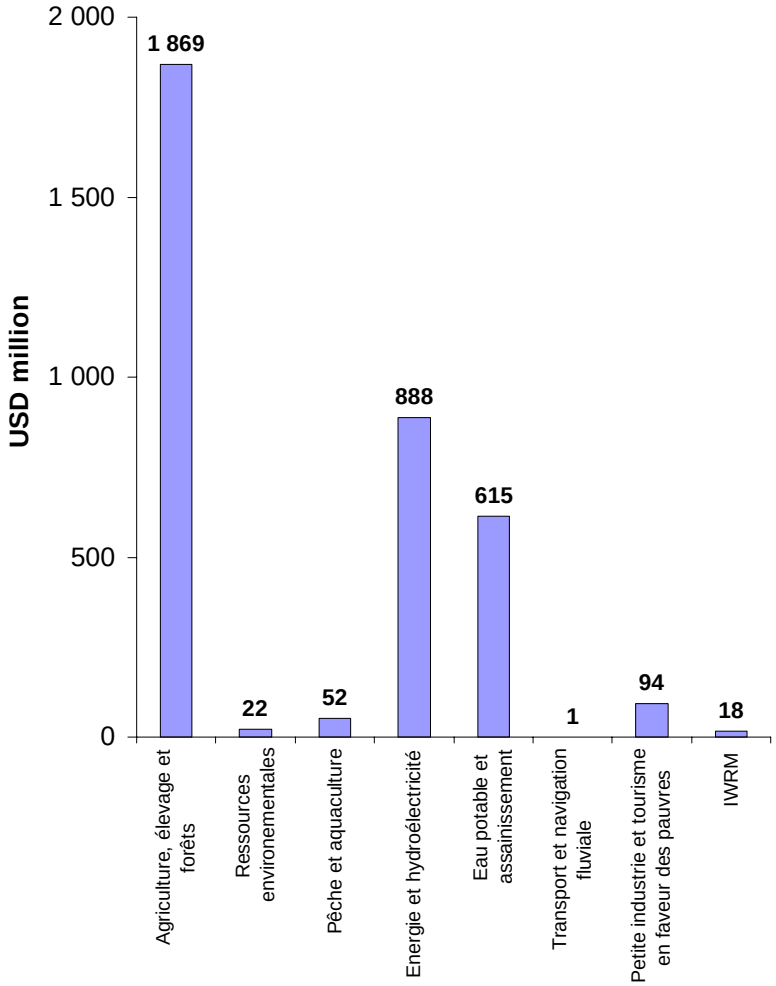
Compte tenu des prix élevés de l'énergie fossile, plusieurs barrages s'avèrent maintenant rentables et leur construction est engagée. Ces barrages permettent aussi le développement accéléré de l'irrigation dans les marais et les plaines. Cela concernera le site de la Nyabarongo et de Kishanda, sous réserve que les impacts potentiels soient soigneusement controlés et atténués. De plus, une attention particulière portera sur le développement des réseaux de distribution électrique vers les villes moyennes de façon à augmenter significativement le taux de desserte dans le bassin. On considérera 60 000 ha de nouveaux périmètres irrigués dans le bassin.

Une approche systèmique de la gestion des sols sera également possible avec l'amélioration globale des conditions socio économiques. Ceci comprend les aménagements physiques contre l'érosion ainsi que la sécurisation foncière par mise en place d'un système de cadastrage des usages des sols. Ceci permettra de réduire significativement la perte de fertilité et d'améliorer la production alimentaire. On considère la réalisation de 60 000 ha de terrasses radicales dans ce scénario.

L'investissement total dans le basin de la Kagera est évalué sur 20 ans à plus de 3,5 milliards de dollars. Les investissements proposés sont toujours ceux qui sont considérés comme essentiels à la gestion durable des ressources naturelles. Le rythme des investissements est acceléré, et un effort particulier est mis sur la production d'énergie et sa distribution. De nombreuses études de faisabilité restent à lancer pour soutenir ce programme.

Scénario de développement pour le bassin de la Kagera - Récapitulatif des investissements proposés dans le scénario Haute Ambition (2008-2027)

Chapitres de la Monographie	Développement du bassin de la Kagera	USD (million)	%
6	**Agriculture, élevage et forêts**	1 869.0	53%
7	**Ressources environementales**	21.5	1%
8	**Pêche et aquaculture**	52.0	1%
9	**Energie et hydroélectricité**	888.0	25%
10	**Eau potable et assainissement**	615.0	17%
11	**Transport et navigation fluviale**	0.5	0%
12	**Petite industrie et tourisme en faveur des pauvres**	94.0	3%
15.6.2	**Institutions et formation des compétences**	17.5	0%
	Total:	**3 557.5**	**100%**



Scénario de développement pour le bassin de la Kagera - Récapitulatif des investissements proposés dans le scénario Haute Ambition (2008-2027)

Kagera River Basin

Transboundary Integrated Water Resources Management and Development Project

Kagera River Basin *Monograph*

Basin Development Report

17 December 2007

Preface

Overview of report preparation – a "discussion paper"

This *monograph* was prepared under the Nile Equatorial Lakes Subsidiary Action Programme (NELSAP) of the Nile Basin Initiative (NBI) as one component of the *Kagera River Basin Transboundary Integrated Water Resources Management and Development Project* (the "Project") under a consultancy with *BRL Ingénierie*, Nîmes, France (the "Consultant"). The overall *development objective* of the Project is to prepare "…tools *and mechanisms ….to prepare for sustainable development-oriented investments to improve the living conditions of the people and to protect the environment".* This monograph and the Database/GIS also provided under the consultancy are *tools and mechanisms* in support of this overall development objective.

A *monograph* is defined as a *"scholarly piece of writing … on a single topic*[13]. The *topic* in this case is the integrated management and development of the water and related resources of the Kagera River basin. We have applied the following sub-title for this *monograph:* ***Basin Development Report*** for the Kagera River, clarifying that it provides a description and analysis of the water and related resources management and development, presented from the perspective of the *basin* as compared to the individual countries. We understand a *river basin* to be the *hydrologically-connected land area draining into the river*, which is visually described by the numerous maps included in this report and the accompanying *Kagera River Basin Atlas.*

The Consultant's Terms of Reference state that: The purpose of the consultancy is to compile relevant existing and project generated primary information on the Kagera River system and its basin in a common format and make the information accessible to the stakeholders in order to facilitate joint planning and development of the basin. (emphasis ours).

It is suggested that this monograph be viewed as a *living document* subject to revision and improvement in future, and in the meantime providing a reference for monitoring the progress in improving the management and development of the *basin* in future.

[13] Microsoft Encarta Dictionary 2006

Approach

This monograph was prepared during a period of about four months from June to September 2007. The Consultant's approach in completing this draft may be summarized as follows:

Following an Integrated Water Resources Management (IWRM) approach "…which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems"

Through mobilization of a multi-disciplinary team comprising experienced international and riparian experts. This team included 9 specialists in fields ranging from water resources management, hydrology, policy analysis, social sciences, water law, institutional systems, ecology and economy; and 4 national focal points from Burundi, Rwanda, Tanzania and Uganda who facilitated local arrangements, communication and collection of data and information in support of the analysis and in building the related Database/GIS. A listing of the names and designations of the team members is provided in the Annex.

Through a *participatory process* applying as much consultation as possible within the time and resources available. This included numerous meetings by the team members with key governmental and basin-related stakeholders. We have also organized regional consultations at the district level: this was particularly successful and useful in the Kagera region of Tanzania. The overall approach, scope and content of the monograph was presented to and agreed at an *Inception Workshop* meeting of the Regional Project Steering Committee (RPSC) and selected representative stakeholders in Dar es Salaam on 1 August 2007. A full list of inception workshop participants, as well as all of those consulted during the preparation of the monograph and database is included as an Annex.

The first draft of this report was prepared by the Consultant's team during the period of August and September with a first draft issued on 28 September 2007. The process of *consultation* continued with the presentation of the draft report by the PMU to the members of the RPSC and other selected stakeholders. During the month of October the Consultant led additional rapid national consultations in selected districts in each of the four countries. Finally a 2-day *Regional Workshop* on the monograph was held in Kigali on 3 and 4 November 2007 attended by some 80 invited stakeholders from the four countries, including the members of the RPSC (ref. listing of participants in an Annex to this report). A training programme for the Database/GIS was held for 40 participants during the period 5 to 7 November 2007. During the workshop and training programme numerous comments, suggestions and recommendations were made. The PMU provided additional official comments to the Consultants on 28 November 2007. This edition of the monograph therefore benefits from the full range of comments and recommendations from all these consultations and reviews summarized and assessed by the Consultant's team with revisions and amendments made as required and within the terms of reference of the Consultancy.

Acknowledgements

We wish to thank the many stakeholders who met with the members of the Consultant's team and freely provided data, information and advice towards its preparation and the building of the Database/GIS. A full listing of the participants and persons met is provided as an annex in this monograph.

We would also like to express special appreciation to the full team at the Project Management Unit of the Kagera TIWRMP based in Kigali including: Mr Isah Kiti Nabide, Dr Gaspard Bikwemu, Mr Emmanuel Olet, Ms. Lillian Muhebwa, Mr Désiré Nzayanga, Mr Pierre Masozera, Ms Emerita Mugorewicyeza, Mr Antoine Sendama, Mr Dieudonné Maniraguha and Ms Carine Mburushimana. We make special note with sincere appreciation the diligent support provided by Ms Marie-Ange Bugingo in facilitating local arrangements and visas, etc. for the various international experts on our team.

Finally, the content of this draft represents the assessments, analyses and conclusions of the Consultants. We apologize for any errors and omissions.

1. Introduction

1.1 Water and related resources development in the Kagera River basin

The Kagera River is the largest of the 23 rivers that drain into Lake Victoria. The river basin covers some 60,500 km² and is estimated in 2007 to have a population of nearly 15 million people. The basin covers portions of the four countries of Burundi, Rwanda, Tanzania and Uganda.

The water and related resources are under threat, yet their sound management and development provide opportunities to enable the peoples of the Kagera River basin to move from poverty to improved standards of health and economic well being. This is the subject of this monograph.

1.2 Water and Resource Management Issues

The Kagera River basin is characterised by limited land availability, high population densities and erosive soils with:

- Continued reliance on subsistence livelihoods – too small plots for food security.
- Continued land degradation and loss of soil fertility
- Deforestation and the absence of reforestation activities
- Wetlands exploited and degraded
- Land tenure issues
- Unplanned migration of pastoralists
- Soil erosion leads to increased nutrient load encouraging water hyacinth growth and eutrophication in Lake Victoria
- Unclear agricultural economic policy and regulatory environment
- Weak agricultural research, extension and other services

There are frequent occurrences of droughts and limited irrigation development including:

- Insufficient water for grazing
- Little if any major irrigation development where feasible – e.g. Tanzania

There is limited access to potable water and sanitation:

- Lack of clean water for household use
- Malaria and diarrhoea are endemic
- Untreated urban and industrial sewage

There is limited access to electrical energy:

- Biomass is almost the only source of energy
- Electricity is prohibitively expensive and not available in rural areas

These are discussed in further detail under section 15.2.3.

1.3 Opportunities for Improved Management and Development

Notwithstanding these and other limitations linked to the present poor state of the water and resources management in the basin, this monograph seeks to show how improved and integrated management of the water and related resources can be harnessed to improve the well-being of the people of the basin and extricate them from poverty. In doing so the report describes:

- the external opportunities and threats,
- the internal strengths and weaknesses surrounding water resources development, and
- a scenario for sustainable management and development in a manner that is also mutually beneficial in alleviating poverty for all people living within the basin.

Foremost amongst the existing *opportunities* is the fact that all four riparian governments at the senior-most levels have put in place top priority policies and plans promoting improved land and water management. These opportunities are being further strengthened by transboundary economic and resources management cooperation initiatives including the widening of the membership of the East African Community; and the continuing evolution of the scope and capacity of the Lake Victoria Basin Commission, the Nile Basin Initiative, the Nile Equatorial Lakes Subsidiary Action Programme and the Kagera Integrated Water Resources Management and Development Project under which this monograph was prepared. As a result international donors and private investors are increasingly expressing confidence and willingness to support regional and local programmes and projects directed at alleviating poverty through improving land and water management. In support of this, political and government leaders and representatives of civil society in all four countries are seeking advice and plans based on sound scientific principles enabling them to make good decisions about policies, programmes and projects to be implemented by their various government ministries and departments to enable mutually beneficial management and development to take place.

There are important intrinsic *strengths* in many of the *beneficial uses* related to the available water and resources in the basin including assessed in further detail under sections 6 through 13 of this report:

- Agriculture and irrigation,
- Environmental resources,
- Fisheries and aquaculture,
- Energy and hydropower,
- Water supply and sanitation,and
- Navigation, transport, tourism, mining and industrial development.
-

1.4 Principles

The following principles were applied in preparing this monograph:

- To keep foremost in mind:
- the overall development objective of the Project – that is: to develop "…tools and mechanisms ….to prepare for sustainable development-oriented investments to improve the living conditions of the people and to protect the environment" and
- the purpose of the consultancy "…to make … information accessible to stakeholders in order to facilitate joint planning and development of the basin."

- To apply Integrated Water Resources Management (IWRM) principles. IWRM as defined by the Global Water Partnership[14] is "a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems". As the name suggests it is an integrated approach:
- IWRM considers not only the *bio-physical interdependencies* within ecosystems, such as the Kagera River basin, but also the related economic and social interactions and demands;
- IWRM is *participatory*, with an emphasis on stakeholder involvement, including women, in water development and management; and
- IWRM considers *water as an economic good* which cannot continue to be freely available to all competing users and uses.
- The scope for the subject is the ecosystem defined by the Kagera River basin encompassing, among other subjects:
- The *bio-physical* aspects of the water and related resources, including the geography, hydrology, land use, agriculture, hydropower, environmental, fisheries, navigation, tourism, etc.);
- *Social* aspects, including essential demographic, social development, livelihood, health and gender/youth information; and
- *Economic* aspects and trends, including present trade, industry, economy, tourism, and links of water and related resources development and management to poverty reduction, also understood in the context of the term water poverty – i.e. that part of socio-economic well-being, particularly amongst the poor, which is attributable to water and related management and development.

1.5 Structure of this monograph

Consistent with IWRM and the principle of reasonable and equitable use, the monograph also puts forward the approach to benefits-sharing of the uses of water and related resources in a transboundary and multi-sectoral context. The monograph is therefore structured into three major sections as follows:

Setting – the Kagera River basin (Sections 2 through 5): a description of the bio-physical, macro-economic, social and institutional setting of the Kagera River basin;

Beneficial uses (Sections 6 through 13): an analysis of the constraints to and opportunities for development related to the main uses by people of the water and related resources of the basin including: agriculture, livestock and forestry, environmental resources, fisheries and aquaculture, energy and hydropower, potable water and sanitation, river transport and navigation, tourism, mining, industry and trade; and

Kagera River basin development (Sections 14 and 15): a review and analysis of transboundary integrated water resources management and development in the Kagera River basin, with a view to providing direction to decision-makers and other stakeholders on the opportunities for development and investment leading to achieving the overall objective of the Project: *"…to improve the living conditions of the people and to protect the environment."*

[14] http://www.gwpforum.org/

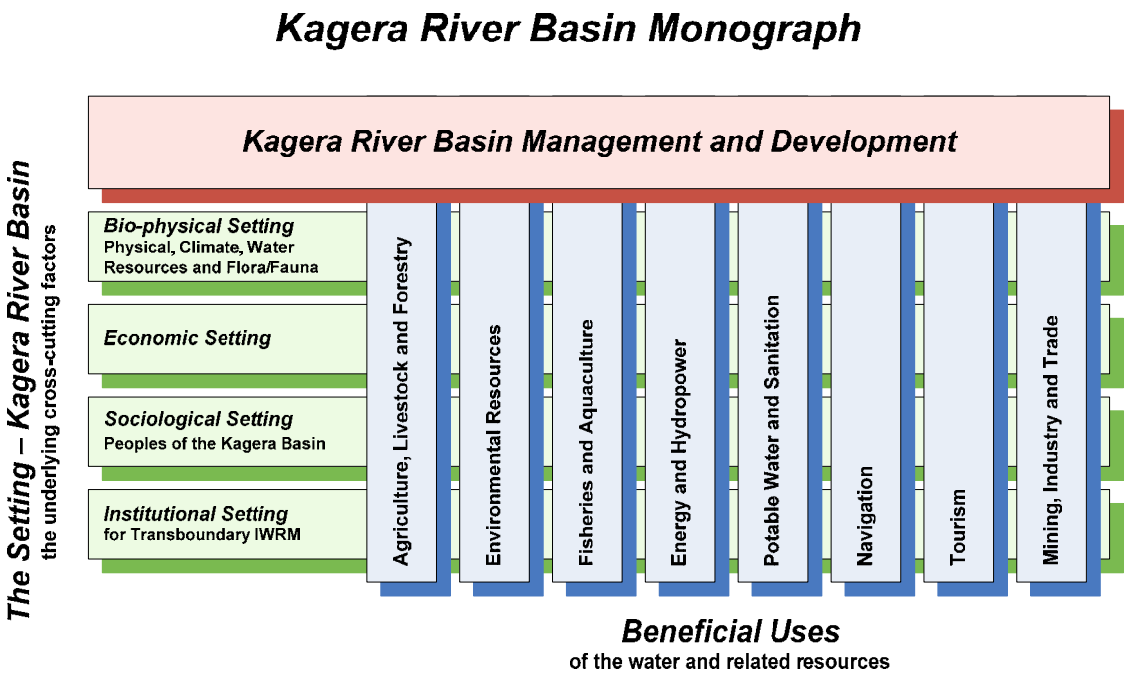


Figure 1.1 – Kagera River Basin Monograph – overall structure and content

Section 16 of this monograph provides an overview of the database and GIS developed during the course of carrying out this consultancy.

A number of Kagera basin maps and other diagrams and graphics were prepared in the course of preparing this monograph. These have been provided in a separate accompanying volume entitled *Kagera River basin Atlas*.

1.6 The Challenge

The challenge facing the equatorial lakes region, including the Kagera River basin "…clearly involves a concerted and broad-based reconstruction that would consist of population flows, economic growth, security, **environmental management**, and real democratic practice. The **institutional forms this will take are waiting to be invented**, and they might **cut across current borders** without necessarily redrawing them." (Chrétien, 2000) [emphasis ours].

Integrated management and development of the Kagera River basin's water and natural resources through effective national and transboundary institutions and targeted investments has the potential to contribute to this effort building social and economic capital of the region for the benefit of all its citizens.

This monograph is intended to set the stage for future activities in the basin in a manner which optimises the development of the resources in a mutually beneficial manner and which minimises any possible negative impacts within the Kagera River as well as the wider Lake Victoria and Nile River basins. We sincerely wish that all readers will be inspired by the strengths and opportunities in the Kagera River basin region, and that decision-makers will be constructively guided by the recommendations and conclusions.

2. Bio-Physical Setting

The Kagera River basin covers the territories of Burundi, Rwanda, Uganda and Tanzania. The total catchment area of the Kagera River basin is some 60,500 km² (ref. Figure 2.1).

Table 2.1 – Kagera River basin – area and coverage amongst riparian countries

Country	Country Area Total (km²)[15]	Land area in Kagera River basin (km²)	National basin area / national area (%)	National basin area / total basin area (%)
Burundi	27,834	13,790	53%	23%
Rwanda	26,338	21,630	85%	36%
Tanzania	945,087	20,680	2%	34%
Uganda	241,038	4,400	2%	7%
Basin		**60,500**		**100%**

The boundary defining Kagera River basin area has been derived from the 2000 Shuttle Radar Topography Mission (SRTM), the most complete available high-resolution Digital Elevation Model (DEM) of the earth[16]. The processing of the DEM has known limitations on flat areas, where manual adjustments are often necessary. For the Kagera River basin, the flat areas in Isingiro/Rakai districts (near the Kagera River mouth), the basin boundary has been adjusted, based on the map of the Kagera basin in Uganda obtained from the Uganda Directorate of Water Resources Management.

The western-most boundary of the Kagera catchment is largely formed by the Congo-Nile Divide. This catchment boundary runs approximately North-South through the whole of Rwanda and the largest part of Burundi. The Kagera River has its outlet in the western side of Lake Victoria in Uganda, just north of the border between Uganda and Tanzania.

Methodological note concerning the table 2.1

However the basin boundaries have been adjusted in the North, the table 2.1 still sticks to official figures and not GIS measurements, because of biases in GIS measurements concerning

- the accuracy of the administrative layer for national boundary;
- the accuracy of the catchment boundary layer (modified manually from information provided by Uganda, not correlated/cross checked from Rwandan information and different from automatic delineation from the DEM);
- the choice of the projection system, which is influencing calculations (there is no “official” regional projection system for the Kagera River basin).

Moreover, the comparison below shows that the differences are small between the “official figures” and our “GIS measurements”. This was a supplementary reason for presenting official figures.

Official figures (see table 2.1)	
Country	**Land area in Kagera River basin (km²)**
Burundi	**13,790**
Rwanda	**21,630**
Tanzania	**20,680**
Uganda	**4,400**

GIS measurements	
Country	**Land area in Kagera River basin (km²)**
Burundi	**13,225**
Rwanda	**20,727**
Tanzania	**20,535**
Uganda	**4,602**

[15] Official country land areas, including water surface areas, etc.

[16] This DEM uses the sequential methodology of the DEM-Hydroprocessing module of the Integrated Land and Water Information System (ILWIS version 3.3).

2.1 Physical landforms in the Kagera River Basin

2.1.1 Introduction

The main physical landforms of the Kagera River basin are shown on Figure 2.1.

The *Precambrian Karagwe-Ankolean* metamorphic system underlies most of the Kagera basin area. The landscape of the Kagera River basin is largely the result of the geologically recent uplift and tilting of an ancient peneplain, which has resulted in very active dissection, strongly influenced by the dominant NNE regional strike, and the NW regional strike in northern part of the basin. As a result of the alternations of arenaceous and pelitic rocks (rocks that before metamorphosis were of sandy and clayey origin, respectively) valleys and ridges have formed trending in the two mentioned directions. In the valleys, quaternary to recent alluvial sediments are found, and colluvial sediments are found locally. Towards the outlet of the Kagera River, quaternary lacustrine sediments are found.

The general elevation in the Kagera basin varies between 1,200 and 1,600 m above mean sea level (m amsl), but rises above 2,500 m in the west, with peaks reaching 4,500 m in the north-western corner, and has an absolute minimum elevation of 1,134 m amsl, corresponding to the average lake level of Lake Victoria.

A physical setting is determined by a variety of factors that are all inter-related. For example, the underlying geology, represented by different lithological[17] units as well as degree of weathering has a considerable influence on the soil characteristics. The quartzitic, and most of the granitoid and gneiss formations produce shallow coarse textured soils with limited nutrient and water-holding capacity. The pelitic metasediments[18] commonly weather to rather better quality soils in terms of agriculture. For this reason, the typical lithology will be described in the following sections - rather than the geology. The lithological units of the Kagera Basin are presented in Figure 2.2. For an explanation of the FAO soil classification, refer to the Annex of this section (p. 9).

Based on similarities in the underlying geology, with corresponding types of rocks (lithology) and related soils, characteristic landforms with related relief and drainage density, climate and ultimately stream flow characteristics, four hydro-geographical *Zones* have been distinguished in the Kagera River basin:

- Congo-Nile Divide
- Hills and mountain foot ridges
- Swamp and lake terrain
- West Victoria Lake region

The extent of these hydrogeographical Zones is described in Figure 2.3.

Detailed descriptions of the main physical attributes of each of these Zones is presented in Table 2.5, section 2.4.6.

The following description of the physical setting is based on these four Zones.

The elevation and soils of the Kagera River basin are summarized on Figure 2.4 and Figure 2.5.

[17] We use the term *lithology* to describe the characteristics of rock formations, and the term *geology* to describe more broadly the study of the Earth's structure including rocks, soils and minerals, their history and origins.

[18] *Rock containing aluminum*: aluminum-rich metamorphic rock formed by the action of temperature and pressure on clay-rich sedimentary rocks. (ref. Microsoft Encarta 2006).

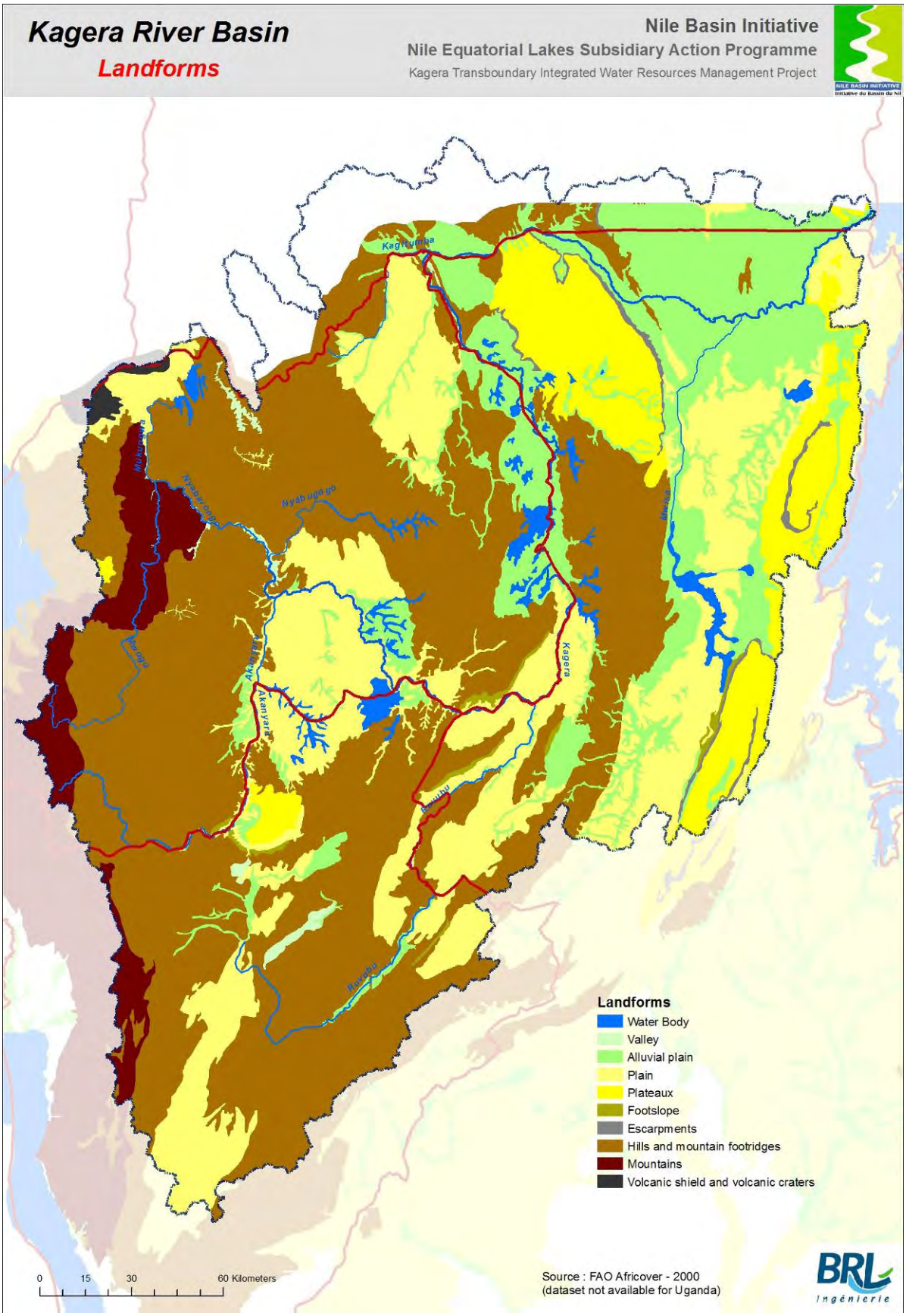


Figure 2.1 – Physical Landforms of the Kagera River Basin

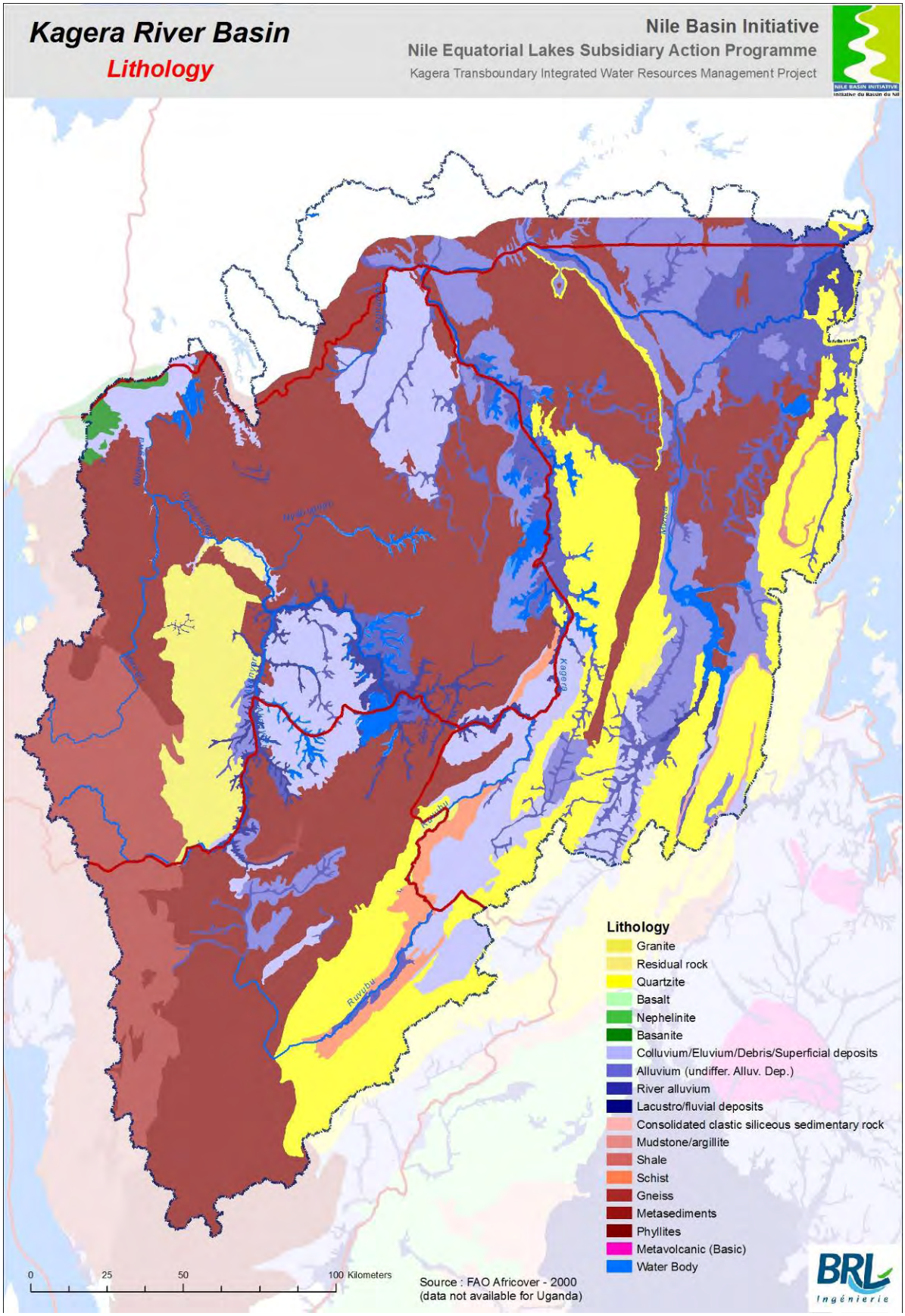
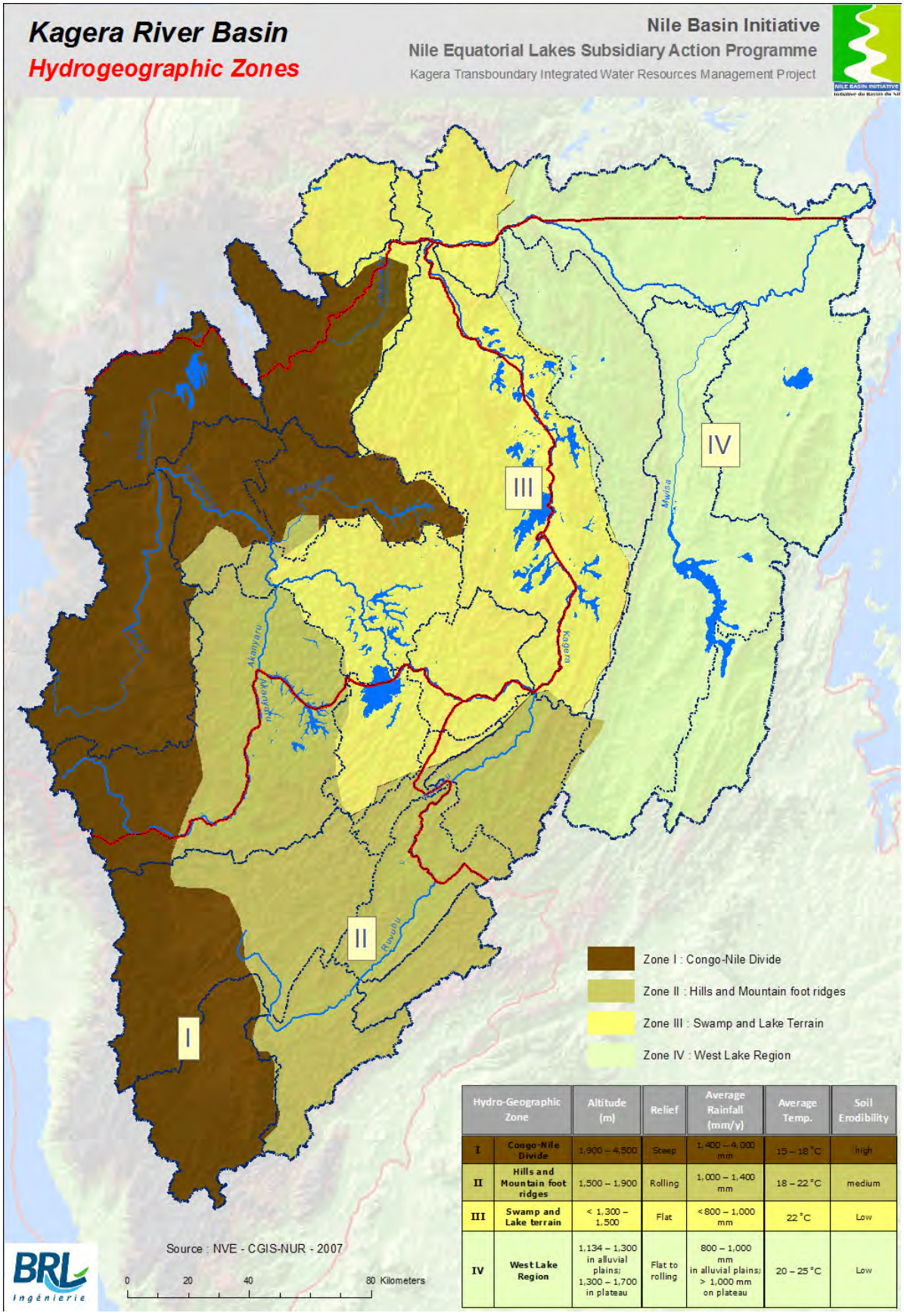


Figure 2.2 – Kagera River Basin Lithology



Hydro-Geographic Zone		Altitude (m)	Relief	Average Rainfall (mm/y)	Average Temp.	Soil Erodibility
I	Congo-Nile Divide	1,900 – 4,500	Steep	1,400 – 4,000 mm	15 – 18 °C	high
II	Hills and Mountain foot ridges	1,500 – 1,900	Rolling	1,000 – 1,400 mm	18 – 22 °C	medium
III	Swamp and Lake terrain	< 1,300 – 1,500	Flat	<800 – 1,000 mm	22 °C	Low
IV	West Lake Region	1,134 – 1,300 in alluvial plains; 1,300 – 1,700 in plateau	Flat to rolling	800 – 1,000 mm in alluvial plains; > 1,000 mm on plateau	20 – 25 °C	Low

Figure 2.3 - Kagera River Basin Hydrogeographic Zones

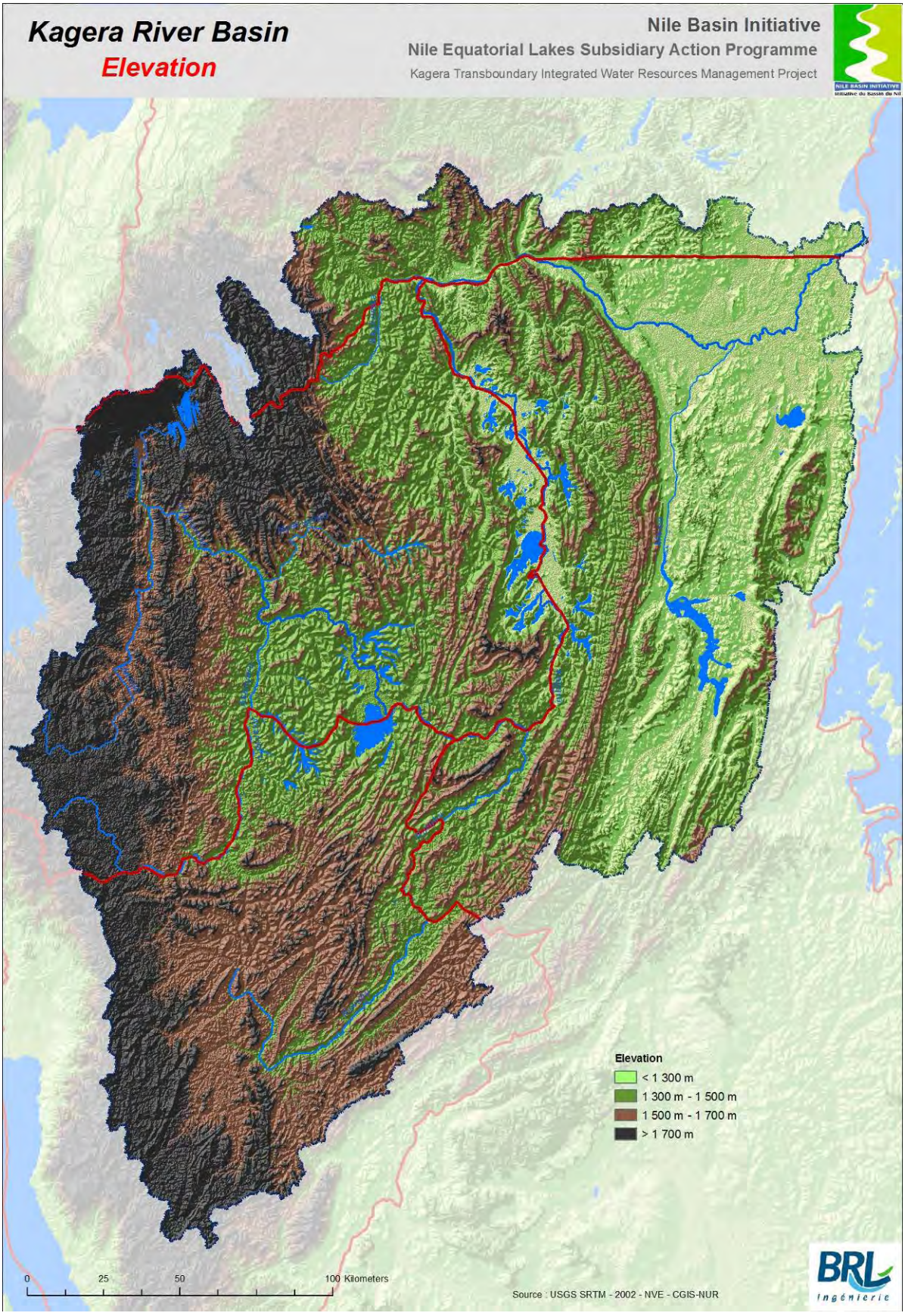


Figure 2.4 – Kagera River Basin Topography (Elevations)

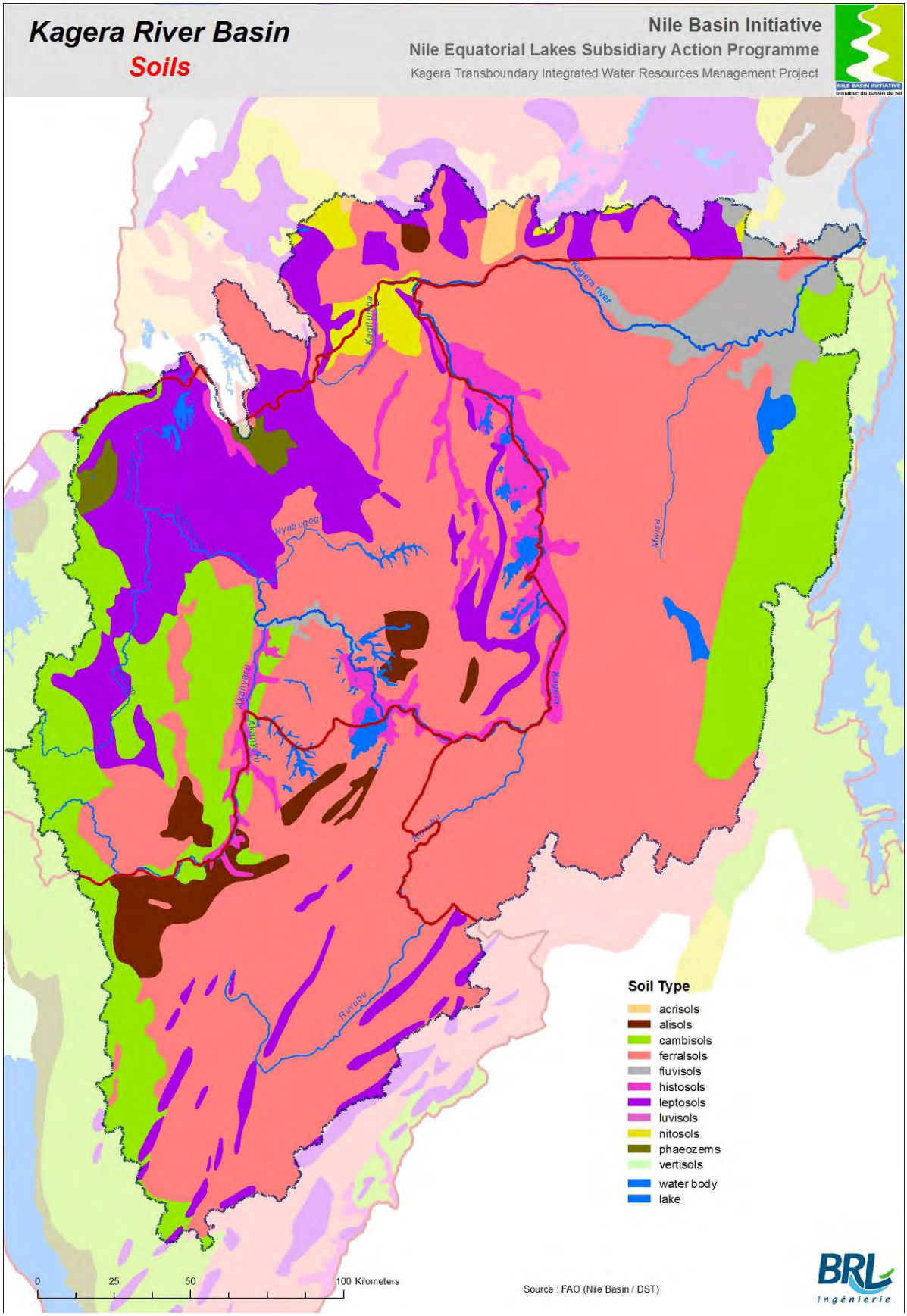


Figure 2.5 – Kagera River Basin Soils (Pedology)

2.1.2 Geology, topography and soils of the Congo-Nile Divide

The Congo-Nile Divide is made up of heavily dissected terrain with summit levels of about 2,300 m amsl, but reaching over 4,000 m amsl on the Congo-Nile Divide, with very steep slopes and outcrops of the harder arenaceous rocks (rocks of sandy origin). The arenaceous rocks of the Precambrian metasediments of the Karagwe-Ankolean system predominate in the north of this zone in Rwanda; whereas the rest of this zone is mostly underlain by schists, phyllites and others of the more pelitic (rocks of clayey origin) facies. The tertiary and recent volcanic formations occur as steep-sided volcanic cones reaching above 4,000 m amsl and an associated gently sloping, undulating lava apron lying at about 2,000 m amsl. The soils on the upper, steepest section of this Zone are *cambisols* (moderately developed soils) and leptosols (weakly developed shallow soils). With *ferrasols* on the lower section (soil composed of kaolinite and quartz, enriched in Fe and Al oxides). All soils are characterised by limited fertility.

2.1.3 Geology, topography and soils of the Hills and Mountain Foot Ridges

This zone is mostly underlain by schists, phyllites and others of the more pelitic facies. However, the quartzites have an important effect in controlling relief. The metasediments have produced a ridge and valley topography with steep side slopes. Associated with the metasediments are the, granitoid gneisses which occupy large areas, especially in the Bugesera area and south and west of Butare in Rwanda, and in Burundi to the east of the Akanyeru River, and the north of the Muramvya. The older rocks have been considerably intruded by granite formations which now outcrop over relatively large areas. This is particularly the case between Butare and Gitarama and the Mutara region in Rwanda, and the central part of Burundi. The granites formations are characterized by gently to moderately sloping rounded hills with very broad convex crests and a lack of surface water. Valleys are broad and shallow, largely in filled with colluvial material. Marked pediplain foot slopes occur especially along the Kagera valley.

Most of the hill soils are *ferrasols*. The little weathered recent soils, including alluvial and colluvial soils have a more favourable fertility. The alluvial soils are of limited extent and in most cases present considerable drainage problems. The granite formations have produced *cambisols*. Most of the soils are acid except for the residual soils on the basic igneous rocks. The pH of the mineral soils from the acid igneous rocks, metamorphic rocks and the metasediments commonly ranges between 4.5 and 5.5, and of alluvium between 5.5 and 6.5. The pH of the organic soils commonly is below 4.5.

2.1.4 Geology, topography and soils of the Swamp and Lake Terrain

The Swamp and Lake Terrain are mostly underlain by the metasediments of the Karagwe-Ankolean system, made up largely of shales but also quartzite formations. In the valleys, quaternary to recent alluvial sediments are found, specifically in the wide Kagera valley, as well as colluvial deposits in the central-northern section of the basin.

Ferrasols have formed on the hill slopes, with some *leptosols* on top of the catchment divides. Much of the valley bottom lands is underlain by organic soils (*histosols*). The pH of the mineral soils from the acid igneous rocks, metamorphic rocks and the metasediments commonly ranges between 4.5 and 5.5, and of alluvium between 5.5 and 6.5. The pH of the organic soils commonly is below 4.5.

2.1.5 Geology, topography and soils of the West Lake Region

The eastern part of the Kagera Basin, referred to as the West Lake Region, is made up of three major geological zones:

- The Tanzanian and Ugandan part of the Kagera Basin are situated largely in the Karagwe-Ankolean System.
- The easternmost geological zone of the Basin in Tanzania is formed by the Bukoban System. Both Karagwe-Ankolean and Bukoban Systems are of Precambrian age.
- The third geological unit, situated close to Lake Victoria and in the zone along the outlet of the Kagera River is made up of quaternary lacustrine and alluvial sediments.

The Precambrian Karagwe-Ankolean metamorphic system is made up of two major units: (i) quartzite, quartzite sandstones and conglomerates originating from sandy deposits, and (ii) phyllites and shales developed from clayey and silt sediments. Some localised outcrops of mobilised granite are found within the Karagwe-Ankolean system. The Karagwe-Ankolean formations are poor in nutrient-releasing minerals.

Strata of the first group appear in near vertical position as high ridges stretching in a north-south orientation, forming the backbone of the area's landforms at elevations above 1,500 m amsl. The highest hill ranges (about 1,500 m amsl) comprise well drained, friable, shallow to deep sandy clay loams (*leptosols* and *ferrasols*) on the plateaux and hills developed on quartzites.

The large part of the Bukoban System occupied by shale parent material appears as intricately dissected hills (*leptosols* and *ferrasols*), and associated foot slopes (*phaeozems*) with dense drainage patterns in the west. Many interfluves of this parent material are gently undulating 'islands' with soil complexes dominated by *aricsols, leptosols* and *ferrasols*, among surrounding deep valleys at elevations above 1,350 m amsl that merge with the highlands in the central-northern area.

The Bukoban sandstone system is characterised by a dissected, gently undulating plateau (1,250 – 1,350 m amsl) representing the erosional product of the Karagwe-Ankolean system, dominated by very deep sandy clay to clay loams with sandy top soils (*ferrasols*). It extends from the Ugandan border, occupying the easternmost part of the Kagera Basin adjoining Lake Victoria in a north south orientation. These rocks are poor to very poor in nutrient releasing minerals. Also present are rock outcrops and pockets of well drained, bouldery sandy loams to sandy clays (*acrisols*).

The metasediments of the Karagwe-Ankolean system consist of argillites, phyllites, schists and quartzites. The geology and physiographic features of these plateaux exert significant influence on slope, aspect and erosional processes. The hills are composed of relatively soft rocks that are easily weathered. The hill tops have been leached to form lateritic caps.

The shorter face-slopes under the Bukoban escarpments comprise both reddish clay soils and brown sandy soils (*acrisols*), giving way to a fringe of almost flat piedmont plains at 1,100 m alms (*ferrasols* and *arenosols*) that separate the uplands from the surrounding swamps in the northeast of Bukoba District.

Late tertiary and quaternary alluvial system: the major valley systems of Kagera and Mwisa Rivers have developed at an elevation of about 1,200 m amsl, being part of the late Tertiary peneplain. Colluvial and erosional foot slopes developed at the base of the higher valley slopes are very important agricultural lands. The lower land surface at the level of the Kagera River is largely occupied by swamps and lakes along the Rwandan border.

An extensive flat sandy river terrace along the Kagera River is made up of well to excessively drained brown loamy sand to sandy loams (*cambisols*), that splits up in a number of delta-arm

levees, spreading out over the lake bed area eastward and comprising *fluvisols, arenosols* and *gleysols*.

The flat to almost flat lowlands farther east comprise the greater part of a lacustrine plain of imperfectly drained silt over clay deposits (*acrisols* and *planosols*) at about 1,130 m amsl (in earlier Quaternary times part of Lake Victoria). These terraces gradually merge into extensive swamps in the down slope direction (*histosols*). Soils developed on these sands, silts and clays have relatively more nutrient reserve.

2.2 Drainage patterns

The density of the drainage patterns reflects the underlying geological formation (Figure 2.6). The drainage density in the catchment areas of the Nyabarongo, Akanyaru and Ruvubu is very high, particularly on the eastern part of the Congo-Nile Crest. On the other hand, the drainage density is low in the central and eastern part of the Basin. The foothills of the volcanoes are also characterized by little runoff.

The upper tributaries, Akanyaru and Nyabarongo are generally steep but include flatter reaches where swamps have formed. The middle course of the river including its tributaries above Rusumo Falls is extremely convoluted, this reach reflecting regional warping and drainage reversal, with some tributaries retaining the appearance of flowing towards the Congo (Figure 2.7). Several side valleys enter the river with their courses filled either with lakes or swamps. At Kigali, the valley is some 500 m wide. The valley widens downstream of Kigali before narrowing again above Rusumo Falls. Between Kigali and Rusumo Falls the river slope diminishes from about 0.3 m/km to 0.05 m/km, and the valley is filled with papyrus swamps. Below the falls, the Kagera flows north for 150 km flanked by a zone of lakes and swamps up to 15 km wide. The river meanders through extensive areas of swamps and lakes both upstream and downstream of Rusumo Falls. The river turns east where the borders of Uganda, Tanzania and Rwanda converge and flows across a plain in an incised channel before entering Lake Victoria through papyrus swamps, the so-called Sango Bay.

The Kagera Basin is thus characterised by the existence of many lakes and swamps. Most of the lakes are very shallow (3-7 m deep). Exceptions are the Rwandan lakes Burera, Ruhondo and Muhazi with depths of 165, 68 and 14 m, respectively (Atlas Geo - demographique du Rwanda, 2002). The river flows are attenuated by these lakes, and in particular by the two sets of swamps and associated lakes above and below Rusumo Falls.

2.3 Climate

2.3.1 Climatic regime

The weather pattern of the Kagera River basin is characterized by a wide range of climatic variations due to topography, latitudinal position and the presence of water bodies. Precipitation is associated with the fairly narrow equatorial trough of low pressure and airflow into the trough from the northern and southern hemisphere high-pressure belts. Convective rainfall as a result of the semi-permanent low-pressure trough over Lake Victoria also leads to increased rainfall on the western shore of Lake Victoria making it the zone of highest precipitation in the Kagera Basin. Rainfall varies from less than 800 mm over the central part of the basin up to 1,600 mm in the west, where most of the runoff is generated, as well as the western shoreline of Lake Victoria (ref. Figure 2.8).

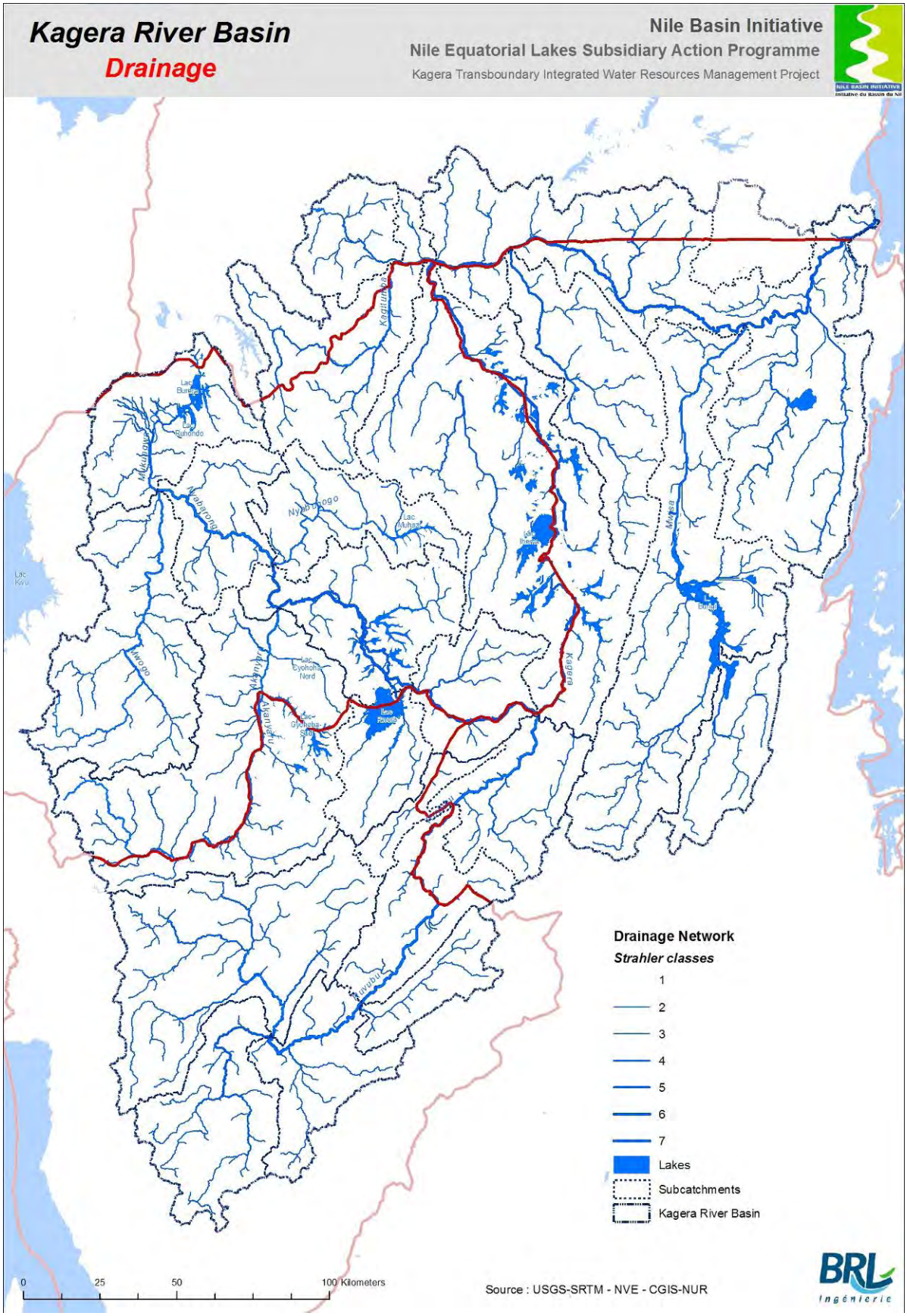


Figure 2.6 – Kagera River Basin Drainage System

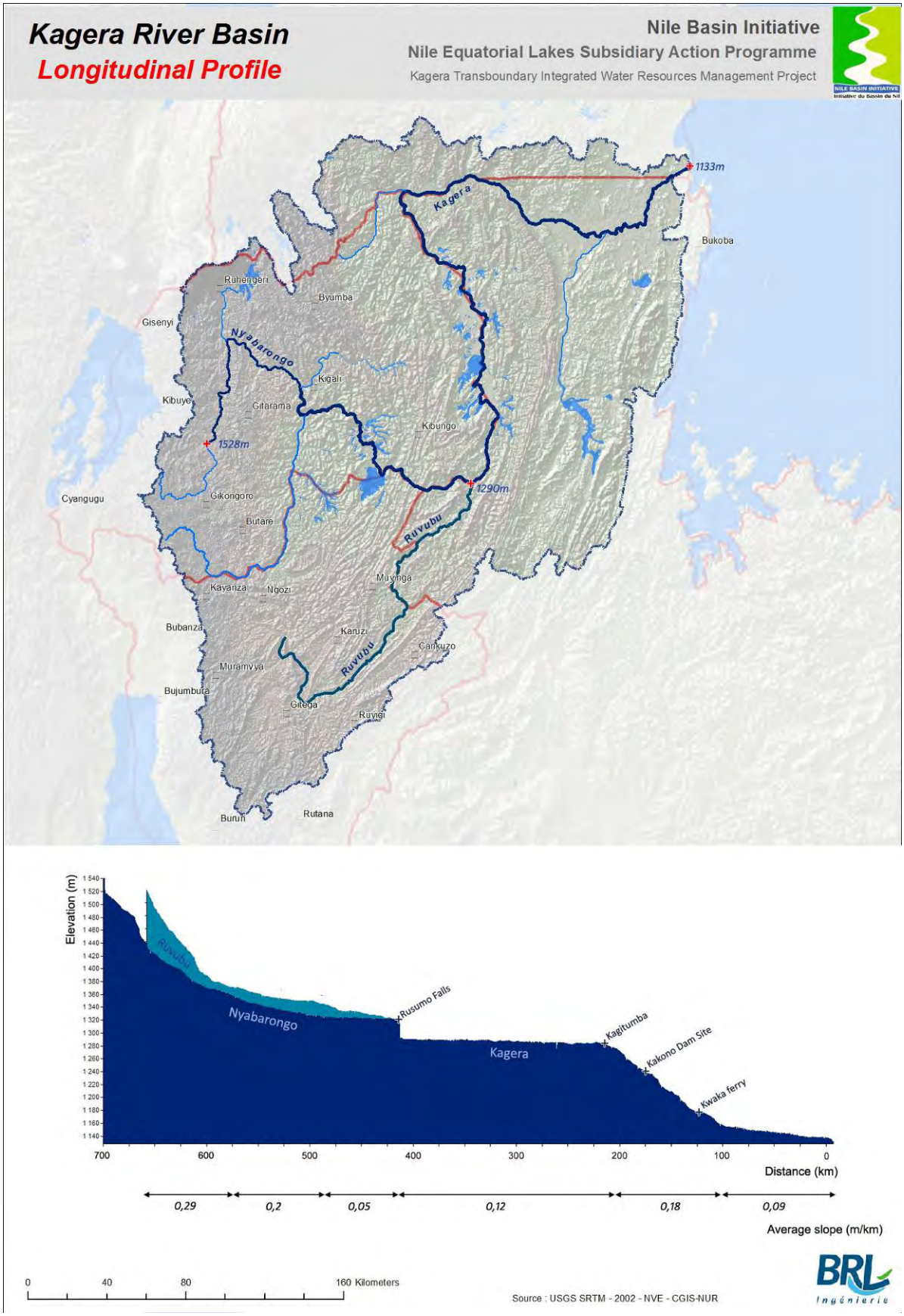


Figure 2.7 – Kagera River Profile

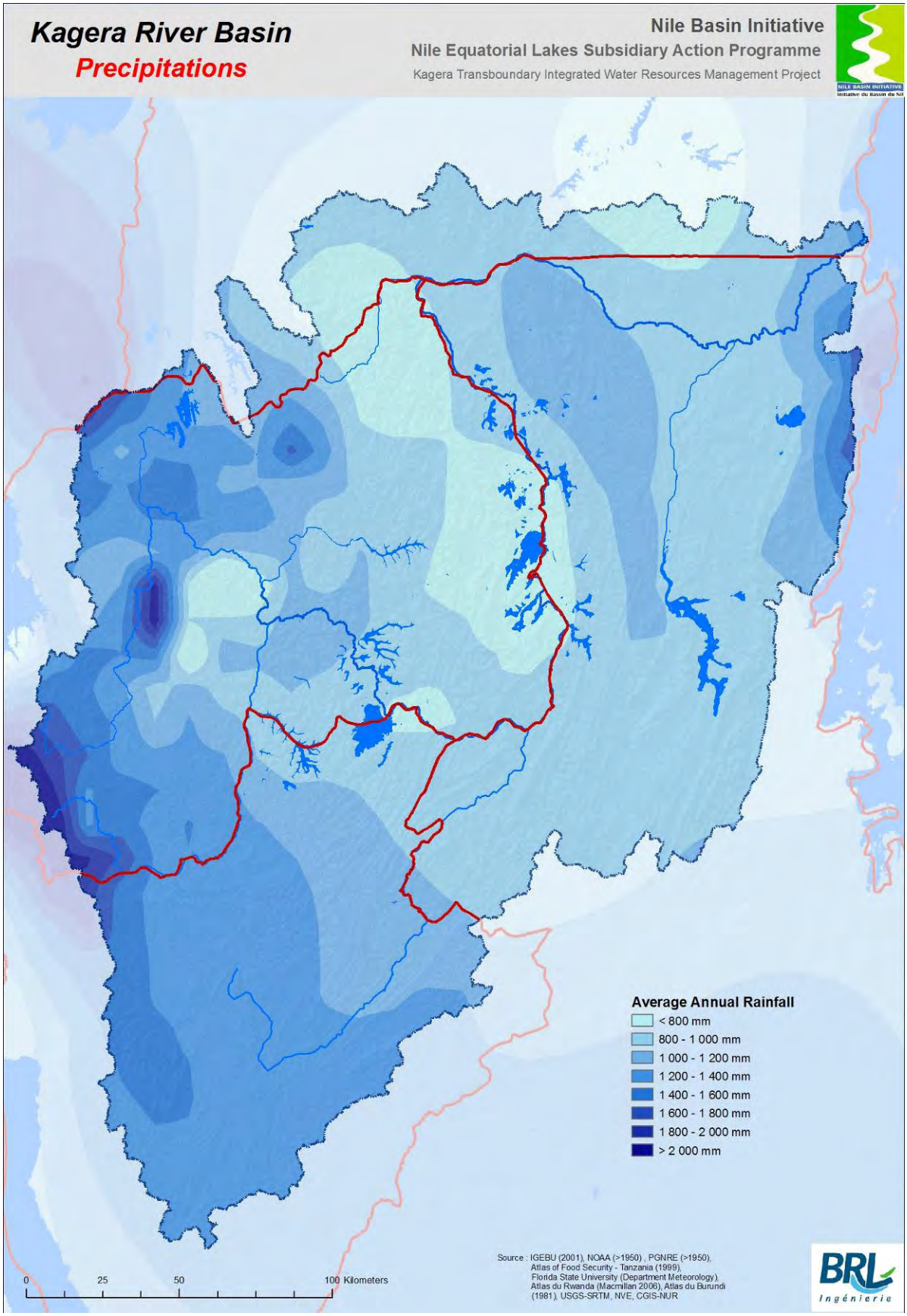


Figure 2.8 – Kagera River Basin Precipitation (Rainfall)

There are two rainfall seasons, with the longer south-easterly monsoon bringing rain between about February and May, and the shorter north-easterly monsoon from about September to November. The months of June, July, and August are generally dry. Daily precipitation is commonly patchy, with some stations within a general area of rainfall having none.

Average rainfall over the basin amounts to some 1,000 to 1,200 mm per year, characterized by significant spatial and temporal variability. The zoning of annual rainfall is approximately vertical, with high average rainfall up to 1,800 mm per year in the western mountain ranges in Rwanda and Burundi, with a descending gradient towards the east down to 800 mm per year. Precipitation increases again in the vicinity of Lake Victoria in the Ngono river sub-basin, which however represents only a minor part of the total drainage area.

Being near the equator temperatures are very constant. The average annual temperatures are lower in the westernmost and north-western mountain range at 15 to 18^{o}C, and up to an average of 22^{o}C in the central part. The mean minimum reaches 14.5^{o}C and a mean maximum reaches 27.5^{o}C. The average evapotranspiration is some 1,200 mm per year.

The Kagera wetlands fringing Lake Victoria in Uganda, referred to as Sango Bay, have been studied by Haskoning et al. (2002). Lake water level changes are directly translated in a rise or fall of fringing wetland water levels changes. These lake changes are primarily the result of differences in rainfall; for the total Lake level rainfall constitutes about 100 x 10^6 m^3, as compared to 18 x 10^6 m^3 from inflowing rivers. According to the annual water balance of Lake Victoria between 1956 and 1978, the total mean annual rainfall is 125 x 10^6 m^3, and river inflow is 23 x 10^6 m^3 Sutcliffe (1999). Longer term (per annual) influence of lake level change on the fringing wetlands can cause seasonal wetlands to become permanent wetlands, and vice-versa. The actual effect depends principally on the slope and shape of the ground surface above or below the actual water level.

All meteorological factors have an influence on the rate of evaporation. A further complicating factor in mapping evaporation rates over the basin is that in Rwanda and Burundi, Piche atmometers are used, whereas in Tanzania and Uganda, different kinds of pans are in use. The HYDROMET[19] Project updated and installed a fairly dense network of pan devices, again with different results as a consequence of different types of mesh covers. For indicative purposes, the potential evaporation estimated for the West Lake Region according to the Penman formula varies between 1,424 and 1,862 mm per year.

2.3.2 Climate change impacts

Given the current rates of greenhouse gas emissions, it is now widely accepted that global climate will continue to change with global temperatures projected to rise. This will affect climates around the world. However, the nature and direction of changes in climate, particularly at the regional and local scale, are uncertain. In examining the Nile Equatorial Lakes region, it is expected that climate will change, but there are many uncertainties as to exactly how. Temperatures will likely rise, but how much is uncertain. Changes in precipitation are also uncertain.

A number of studies have been carried out on the anticipated changes in climate in the Kagera Basin countries as a result of global warming. As the time series of hydrometeorological data collection in the region are relatively short, it is however difficult to ascertain whether the seemingly different hydroclimatic data collected over the last few years are the result of global warming. The modelling study by PANA (2006, in Ndikumana, 2007) of the water resources vulnerability to the climatologic changes concludes that the water resources availability will decrease when the impacts of the greenhouse gases are neglected. The increasing rainfall and

[19] WMO/UNDP Hydrometeorological Survey. 1967. Egypt, Kenya, Sudan, Tanzania and Uganda. Rwanda and Uganda joined 1977. Ethiopia was not involved.

temperature will lead to an increase in erosion, flooding of cultivated wetlands, and decrease in water quality. However, runoff data processing carried out by TBW (1998, in Ndikumana, 2007) does not confirm this trend. The ratio discharge to rainfall increases moderately, which would indicate that the surface water resources increase. This study concludes that water resources will be available in future, except in watersheds with intensive agricultural exploitation where the water resources will decrease downstream because of an increase in evapotranspiration losses.

Within the framework of their assessment of power development options in the Nile Equatorial Lakes Region, SNC-Lavalin (2007) carried out a climate change study, with a focus on the impact of climate change on runoff characteristics. A specific tool and a number of general circulation models (GCMs) specifically focused on the Nile Equatorial Lakes region were examined to estimate potential changes in temperature and precipitation in these regions for the years 2050 and 2100. Two greenhouse gas emission scenarios were studied, the main one assuming a world with rapid economic growth and a mix of high carbon and low carbon emitting technologies, resulting in CO_2 concentrations of approximately 700 ppm by 2100; the alternative scenario being a more extreme scenario assuming a rapidly growing economic world with high use of fossil fuels, resulting in a CO_2 concentration of 960 ppm by 2100.

On average, the models project increased temperature (similar for both scenarios), and an increase in precipitation in the Kagera River basin region, both annually and for each season (much larger for the extreme scenario). The largest percentage increase is projected for the dry months of June through August. Since there is little precipitation in those months, even a large increase will have a relatively small absolute effect on precipitation. It is interesting that wettest *and driest* models project an increase in precipitation. The range on an annual basis is a 4-14% increase in precipitation by 2050, and much larger increases by 2100 for the main scenario, and 11-23% by 2050 to 15-50% by 2100 for the more extreme scenarios.

One of the most significant impacts of climate change is likely to be on the hydrological system, and hence on river flows and regional water resources. To study the impact of climate change on the Nile Equatorial Lakes Region and its implications, a conceptual rainfall-runoff model called WATBAL was applied. The model was calibrated against an existing global runoff dataset developed by the UNH and the Global Runoff Data Center. The runoff, precipitation, temperature, potential evapotranspiration, and aridity indexes were generated for 1961-1990 with input data from the Climate Research Unit at the University of East Anglia. Three regions were selected, of which one (basically the whole of Rwanda) is in the Kagera Basin. In general, the scenarios project an increase in runoff as a result of the projected climate change.

The analysis of potential impacts of climate change on runoff shows that the whole area, including the Kagera River basin exhibits an asymmetric, non-linear relationship between precipitation and runoff. The basin will have a runoff multiplier of up to 3 times the precipitation change at +50% (e.g., a 25% increase in precipitation would lead to an approximate 75% increase in runoff) and 1.5 times the precipitation change at -50%. A linear relationship exists between temperature and runoff.

The model average climate change scenario for 2050 results in a 23% increases in runoff for the Kagera River basin for the average greenhouse gas emission scenario, and 42% for the extreme scenario. For the year 2100 a larger increase in runoff has been modelled, of 55, and 107% respectively. One possible negative outcome from such increased runoff could be increased soil erosion.

2.4 Water

2.4.1 Hydrogeology

The greater majority of the Kagera River basin is made up of *Precambrian*[20] *Basement*[21] rocks, characterised by localised discontinuous aquifers. Groundwater in Basement formations generally occurs in the weathered rock, and in the fractured rock. The weathered rock may have a good transmissivity and storage abilities to provide some yield; generally, however, the better aquifers are found in the contact zone between the overburden and the fresh rock. Ultimately, the higher yielding aquifers can be expected in the fractured bedrock. Large and deep, fractured aquifers may be recharged through an interconnected system of fractured zones. The recharge of shallow aquifers, found in the overburden or in the fractured upper part of the bedrock is generally dependent on the size of the catchment area and the lithological character of the overburden.

Alluvial infills in major valleys and the lake sediments in the extreme north-eastern corner of the basin provide continuous aquifers of higher potential than boreholes drilled in the Precambrian Basement. Another high-potential area for groundwater is constituted by the volcanic formations.

The big number of springs in Zones I and II in Rwanda and Burundi, though individually low-yielding is a good indicator of the shallow (perched) groundwater potential.

The groundwater potential of the different geological formations can be described according to their lithological characteristics as occurring in the four identified zones.

Apart from in Zone IV, mainly discontinuous aquifers exist in the Kagera basin, in the lower part of the overburden and in locally fractured bedrock. Numerous springs occur especially in the steeper Zones I and II, where the groundwater exits at the contact of an impermeable layer and the ground surface. Typical yields of the springs are in the range of 0.9 m^3/hr.

The small percentage of continuous aquifers in Zones I, II, and III are:

- the small unit of volcanic deposits in the NW corner of the Basin in Zone I,
- the sandy sections of the alluvial deposits situated in the valley bottoms of the main tributaries in Zones II and III, and
- pockets of colluvial deposits on the lower foothills.

Based on the baseflow of the rivers, the total groundwater recharge in Rwanda is 66 m^3/s, of which 9 m^3/s is released through springs (PGNRE, Composante B, 2005).

Too few boreholes have been drilled in the basin to give reliable information on sustainable yields. For example, the first boreholes in Rwanda were drilled in 1985, and data are available for 404 boreholes only. However, indications of characteristic yields based on these data are given below.

Aquifers in the Precambrian schists have yields of 1 up to 8 m^3/hr, depending on the degree of fracturation, whereas the quartzites occurring in the same formation, when fractured have higher typical yields of 2 to 25 m^3/hr. Granite formations are characterised by low yields of 0 to 3 m^3/hr. Aquifers in the volcanic formation in the extreme north-western corner of the basin are characterised by high yields; 10 boreholes were drilled in this formation with yields of 110 m^3/hr (PGNRE, Composante B, 2005).

[20] Span of time starting at the beginning of geologic time, when rocks first formed, and extending to the beginning of the *Cambrian* Period about 542 million years ago, when multicellular life first became abundant. (ref. Microsoft Encarta 2006.)

[21] *Basement rock* usually refers to the thick foundation of the ancient and oldest metamorphic and igneous rock that forms the crust of continents, often in the form of granite (ref. http://en.wikipedia.org/wiki/Basement_rock)

Zone IV has a substantial unit of alluvial infills and lacustrine deposits. These deposits produce an almost continuous aquifer, whereas the yield depends on the transmissivity of the sediments. Fluvial beds within the lacustrine deposits present the best yields. Typical sustainable yields are expected to be in the range of 0.5 to 6 m^3/hr. This unit is also characterised by the presence of numerous springs. The rest of the area consists of Precambrian rocks with discontinuous aquifers as described above.

2.4.2 Hydrology

The Kagera River basin drains the headwaters of the White Nile, and is a sub-basin of the Lake Victoria basin and the larger Nile River basin (ref. Figure 5.1 for the geographical context of these basins). The Kagera River is indisputably the single largest in the Lake Victoria basin. The Kagera contributes roughly 34% of the total river inflow (Sutcliffe, 1999; and International Sweden AB, ERM and BCEOM, 2003). According to Phillips et al (2006), rainfall constitutes 85% of the total volume entering Lake Victoria, whereas of the remaining 15%, 40% is contributed by the Kagera River. 85% of the total outflow of Lake Victoria is constituted by evapotranspiration from the Lake. It follows that differences in Lake Victoria are attributed mainly to rainfall and runoff in the upper catchments, of which the Kagera Basin has the largest contribution. The variability of tributary inflow is much greater than that of direct rainfall on Lake Victoria, which is therefore the main explanation of historical Lake level variations (Sutcliffe, 1999).

The ***Kagera River*** is fed by three main tributaries: the Nyabarongo River, the Akanyaru River, and the Ruvubu River. Figure 2.7 presents the longitudinal profiles of the main branches. All three rivers rise on the Congo-Nile Divide (Zone I), and then run through the hills and mountain foothills of Zone II. The Kagera River basically commences in the *Swamps and Lakes* area (Zone III), although the change in name from the Nyabarongo to Kagera occurs at the outlet of Lake Rweru.

The ***Ruvubu River*** rises in the southern high mountains of the Congo-Nile Divide in the tropical rain forest of Burundi in the province of Kayanza. Its head lies in the Kibira National Park at about 2,000 m of altitude and traverses about 350 km to its confluence with the Kagera River on the border between Rwanda and Tanzania. The Ruvubu River watershed area is around 12,200 km^2. It traverses some slopes of about 150 cm/km upstream and less than 20 cm/km downstream at its confluence with the Kagera. The main tributary of Ruvubu River is the Ruvyironza which runs from southern part of Burundi. Ruvubu is navigable towards the north in its downstream part.

The ***Nyabarongo River*** flows over 300 km from its source in western Rwanda South-eastwards to its outlet to Lake Rweru in south-eastern Rwanda along the border with Burundi. The source of Nyabarongo is Rukarara and is situated in the highlands of Nyungwe National Park on the Congo-Nile Divide along the border between Rwanda and Burundi at an elevation of 2,700 m. The most important tributary of Nyabarongo is ***Akanyaru River*** that flows also from Nyungwe National Park, but flows in south-eastern, and then in north direction until the junction with Nyabarongo at about 50 km south of Kigali (approximately 1500 m altitude).

From that confluence (Kanzenze station), the Nyabarongo River flows eastwards through swampy valleys and small lakes in south-eastern Rwanda. The confluence marks the boundary between Zones II and III. From the Lake Rugweru outlet, the Nyabarongo River changes the name to Akagera and meanders through a swampy terrain for about 60 km and meets the Ruvubu River flowing through the Tanzanian plateaus. At about 2 km downstream from the Akagera-Ruvubu confluence, the Kagera River enters into the gorge of Rusumo Falls and drops about 30 m over a distance of less than one kilometre, marking the end of the comparatively steeper upper reach of the river. The Akagera sub-basin at the location of Rusumo Falls measures some 30,114 km^2, representing 52 percent of the total Kagera River basin.

Below the water falls, the valley widens and the Kagera River is again enclosed by papyrus swamps. For the next 230 km, to within a few kilometres upstream of the junction with the Kagitumba/Muvumba River, the Kagera waters flow northwards through lakes and swampy terrain of the Akagera National Park along the Rwandan – Tanzanian border. Downstream the Kagitumba/Muvumba junction (which marks the border between Uganda and Tanzania), the Kagera changes direction and trends eastwards for 260 km to Lake Victoria. The major streams contributing to the Kagera River downstream of Kagitumba/Muvumba confluence, i.e. Mwisa and Ngono are in Zone IV, the West Lake Region.

The ***Ngono River*** joins the Kagera from its mouth. The West Ngono and the Rubare are the two main tributaries. The catchment is well-defined by steep hills which parallel the west shore of Lake Victoria. The river flows south to north for a distance of about 125 km. Over most of its course it flows on a very flat gradient through swamp and lake terrain.

The runoff in the Kagera River basin responds to seasonal rainfall; the peak flow occurs in April in the upper tributaries, in May at Kigali and Rusumo Falls, where the stream flow is the resultant of half of the total catchment area, and is delayed to July at Kyaka Ferry on the lower Kagera, close to the outlet into Lake Victoria. A comparison of mean monthly flows at Rusumo Falls, marking the boundary between the upper and lower reach of the swamp and lake area, and Kyaka Ferry shows a difference in timing in the peak flow at Kigali of about one month, whereas the period of the peak increases from 1 to 3 months. The lake levels in the lower half of the swamp area experience a mean seasonal difference of 1 metre between peak flow and low flow. The Kagera River flow regime is different from other tributaries to Lake Victoria, mainly because of this wetland attenuation. The monthly flow series of the Kagera River at Kyaka Ferry shows the high baseflow component of the Kagera flow, resulting from the storage in lakes and swamps (Sutcliffe, 1999).

The tributaries to the Kagera in Zones I and II of the basin have a strong response to rainfall, resulting in a monthly average annual level oscillation of 2.08 m for the Nyabarongo River at Kanzenze, and 2.61 m for the Ruvubu River at Muvinga. At Rusumo Falls in Zone III the average level difference has reduced to 0.93 m as a result of the attenuation of flows in the swamps downstream of Kanzenze.

Every year, in the two peak rainfall months of April and May, the stream flow surplus overflows the river banks and floods the marshy valley and the lakes. The river levels of the tributaries reduce between June to September, with annually the lowest levels experienced from August to October (Hakizimana, and Bahama, 2005).

Almost all runoff is generated in the upper half of the catchment, referred to as the Congo-Nile including its related mountains and foot slopes and the hills east to it (Zones I and II). This follows from stream flow data of the stations of the Nyabarongo at Kanzenze (before the commencement of the lakes and swamps situated in the central part of the Basin), the Kagera at Rusumo Falls and Mumwendo Ferry in Ruvubu river, where the average stream flow volumes at Kanzenze station added to these of Ruvubu station are approximately the same as the mean stream flow at Rusumo Falls. This implies that on an annual basis, precipitation in the sub-catchments downstream of Kanzenze and Mumwendo Ferry equals evapotranspiration losses.

The hydrology of Zone III, the swamp and lake terrain was studied in Norconsult and Electrowatt (1975). The river, swamps, lakes and open water are closely related. Water levels in these elements follow roughly the same cycle with extreme levels occurring more or less simultaneously. Maximum levels in the upper reach (between Kanzenze and Rusumo Falls) are attained in May and minimum levels occur between mid-August and mid-October. Throughout the Lower Reach (between Rusumo Falls to just upstream of the Kagitumba/Muvumba junction) maxima occur in June and minima in January demonstrating the much longer recession period. But the absolute annual fluctuations differ greatly, especially for the Lakes of the Upper Reach, where vegetation barriers and catchment area play dominant roles. At Lake Mugesera in the

Upper Reach, papyrus barriers are sometimes breached causing great variations of levels. The maximum range of levels in the lakes is 3.5 m and average annual fluctuation is 1 m. On the Nyabarongo River the range of levels reduces downstream from a maximum of 4.10 m at Kanzenze and 1.20 m at Rusumo Falls. In the Lower Reach the annual range of levels on Lake Ihema varies from 1.0 to 1.8 m. The system is very dynamic, and owing to the growth and disappearance of vegetation the local conditions are constantly changing. The two reaches behave in the same manner, but in the Lower Reach the swamps and lakes are more intimately interconnected with each other and with the Kagera River.

Downstream of Rusumo, only one perennial river exists, the Kagitumba/Muvumba, which contributes to a small extent to the Kagera flow. The Kagitumba/Muvumba River drains the extreme SW area of Uganda (after Norconsult & Electrowatt, 1975). Near the western shore of Lake Victoria is a belt with rainfall of over 2,000 mm. The Ngono River, draining this area of heavy rainfall, contributes a highly seasonal flow to the lower Kagera (WSP International Sweden AB, ERM and BCEOM, 2003).

For the whole Kagera River basin, it may be assumed that the groundwater inflow is negligible.

In the upper half the basin, rainfall and runoff are strongly related and dominant as compared to evapotranspiration, whereas in the lower half of the basin, the dominant hydrological factors are rainfall, evapotranspiration and the storage in, as well as release of wetlands. Sango Bay, the area around the Kagera Bay of Lake Victoria, has been studied by Haskoning et al (2002). Here, rainfall and evapotranspiration are about 10 times the absolute value of the runoff. For modelling purposes, the wetland catchment was subdivided in drylands, seasonal wetlands and permanent wetlands. The increase in precipitation and evapotranspiration is about double from the dryer lands towards the permanent wetlands. The wetlands prove to be effective in reducing the amount of water entering Lake Victoria. The dry lands are sensitive to changes in total rainfall, whereas the riverine and permanent wetlands are little sensitive for changes in rainfall quantities, but depend on the water quantities coming from upstream.

2.4.3 Hydrometeorology

Hydrometeorology is defined in this section as that part of meteorology that is of direct concern to hydrological responses in a basin, particularly to flood control, hydroelectric power, irrigation, and similar fields of engineering and water resources. A water balance is a very useful tool to understand the hydrological behaviour of a basin, and the impact that water abstractions or regulations will have. Hydro-meteorological data series are required to establish a water balance for the basin and the different hydro-geographical zones. Meteorological data include rainfall, temperature, humidity, wind, sunshine, evaporation and evapotranspiration.

For a water balance approach, temperature, humidity, wind and sunshine are of little relevance, and these data will therefore not be discussed in this Section. Similarly, as discussed in Section 2.3, evapo(transpi)ration has been measured using different types of equipment in the four countries of the basin, and various methods have been applied with big differences in resulting evaporation rates. These stations will not be discussed further in this section.

Rainfall stations

A map of the existing rain-gauge and flow measurement stations in the Kagera River basin is shown in Figure 2.9.

In Rwanda, before 1994 rainfall was recorded at 190 meteorological stations, with a good distribution over the country. Currently, only 7 rain gauges are properly operational, of which 3 are in the basin. Data are available for 70 stations.

In Burundi, the situation is similar: There were over 150 rainfall stations up to 1992, with currently only 16% being operational. Data are available for 107 stations.

The University of Dar es Salaam has an inventory of rainfall stations located in and around of the Lake Victoria basin which contains about 158 rainfall stations, in monthly totals, that have at least ever been operated. The spatial distribution of the stations indicates a dense network around the communities and less dense network in poorly accessible areas such as wetlands, government forests and game reserves. Moreover, the available monthly rainfall records indicate variable length, period of record and level of missing data. In all, only 53 records were sufficiently long with less than 15% of missing data that allowed for determination of long-term monthly, seasonal and annual rainfall average amounts (Valimba, 2005, in Lugomela and Sanga, 2007). Nine of these stations are situated in the Kagera basin.

Stream flow stations

Between 1933 and 1952, the first river gauges were installed in the Kagera basin. Flow measurements in the East African lake basin was stimulated by the establishment in 1967 of the WMO/UNDP Hydrometeorological Survey (in short HYDROMET), which measured inflows in Lake Victoria within Rwanda, Burundi, Tanzania, Uganda and Kenya. From 1967 to 1992, collaboration between the countries of the Nile basin has been focused on the work of HYDROMET, which produced reports in 1974 and 1982. Although often referred to in documents, both reports have not been traced during the research carried out for this Monograph. From 1980 the project was administered by its Technical Committee and financed by the participants. After 1979, the political situation in Uganda led to the destruction of most of the equipment and the suspension of much hydrological work. After about 1987, the rehabilitation of the network began, and the hydrological data have been computerized. In 1992, TECCONILE, based in Uganda, was established and took over the work of HYRDOMET. The TECCONILE project reinstalled river gauging stations in the Kagera River at Rusumo Falls and Kyaka Ferry, but no rating curves were established.

Before 1994, 47 hydrometrical stations existed in Rwanda but since then the numbers have decreased. At four stations: Nyabarongo, Akanyaru, Kanzenze, Rusumo, automated monitoring systems have been installed. The data on 32 of these stations are available. In 2000, owing to the decentralisation policy, the Division continued monitoring the key primary rivers, i.e. the main tributaries of Akagera River, and Provincial governments were responsible for the secondary rivers, and the rest were the responsibility of the Districts. Eight stream flow stations are situated in the Tanzanian part of the basin. Burundi possesses the data of 49 stations in the country, and Uganda has two hydrometrical stations in the Kagera basin.

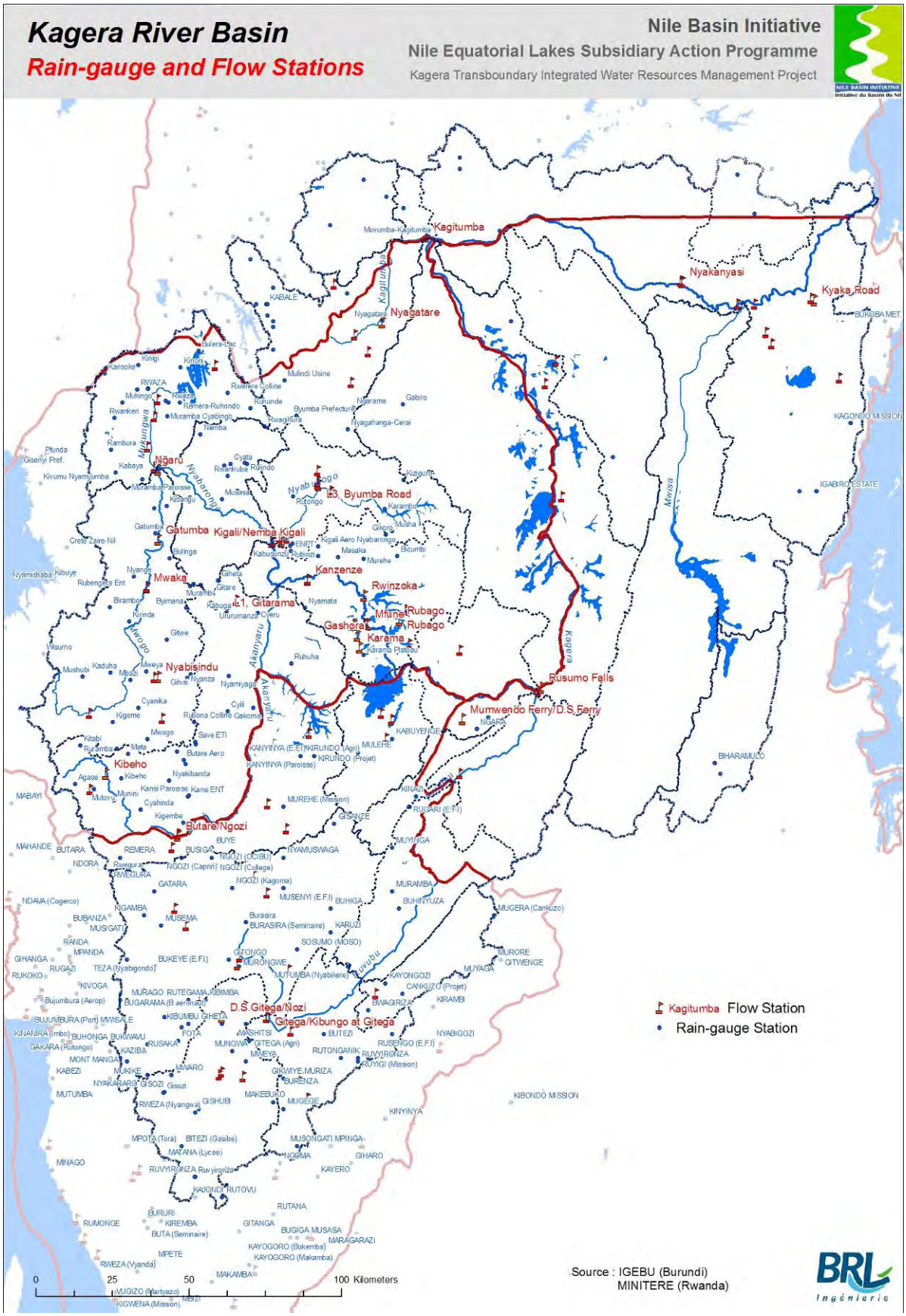


Figure 2.9 – Kagera River Basin – Rain-gauge and flow measurement stations

The accuracy of flow records is largely determined by the frequency with which gaugings have been carried out. The accuracy also depends on the precision and stability of the relation between level and flow at a particular site, the latter being determined by the *rating curve*. Rating curves need to be re-established after events changing the shape of the river bed, for example after floods. In Norconsult and Electrowatt (1975), the rating curves of nine key hydrometric stations in the Kagera basin were evaluated by comparing actual discharge measurements with generated runoff figures. The analysis indicates that the available records are quite reliable. The flows at the different gauging stations on the Kagera River are strongly related to each other. Linear regressions were carried out for all stations on an annual basis, with high correlation coefficients. The hydrometeorological database of Rwanda, as compiled by PGNRE, has been corrected for obvious measuring errors.

The locations of stations in the Kagera basin of which the data have been computerized between 1999 and 2004 by FAO's Project "Capacity Building for Nile Basin Water Resources Management" have been largely retrieved, and are available in the Kagera Database as well as presented on Figure 2.9. A challenge up to present has been to retrieve these data from the individual countries. FAO itself is not authorised to provide data the countries have shared with them. The locations of the stations as listed in the Nile DST database were found to be inaccurate. It is recommended that these locations are cross-checked with the recent Nile DSS baseline reports for the individual countries. This activity was also carried out when preparing the flow distribution map of Kagera basin (Figure 2.10) and the tabular summary (Table 2.2).

A strong correlation exists between the stream flow patterns at the various measuring stations, as indicated in Figure 2.11 (source: PGNRE database, and Sutcliffe (1999) for Kagera mouth). This figure also demonstrates the relationship between the bi-modal rainfall and runoff. Specifically noteworthy is that the response to rainfall is quickest in the upstream part of the basin, in which Mwaka station is positioned, leading to a peak flow in April, whereas for the more downstream stations at Kigali, Kanzenze and Rusumo Falls the peak flow occurs in May. At the mouth of the Kagera River, the peak flow is in July. Interestingly, the flow in the months after the peak flow is higher than at Rusumo, whereas from January to May the mean monthly flow is less than at Rusumo Falls.

On an annual basis, the flow recorded at the mouth (7.5 km^3/year) is not much more than that recorded at Rusumo Falls (7.2 or 7.3 km^3/year). However, one should be cautious about this conclusion. The flow data from Kagera River mouth come from a different source (Sutcliffe, 1999) than the other stations, which are from the PGNRE Rwanda database (2005). The Consultant was informally informed by various sources that the hydrometric station at the Kagera mouth is poorly positioned, and the rating curves and water levels are affected by growth of papyrus plants and backwater effects from Lake Victoria. However, no documentation could be found on this subject. Upstream of the Kagera mouth, before the confluence of the Kagera with the Ngono River, the hydrometric station Kyaka Ferry is positioned in the Kagera River. Theoretically, the annual flow at the Kagera mouth should be close to the sum of the flows at Kyaka Ferry (8.3 km^3/year) and on the Ngono River (0.7 km^3/year), and therefore amount to about 9.0 km^3/year. The fact that the observed annual flow at the mouth is much less (7.5 km^3/year), less than the flow determined for Kyaka Ferry, is an indication, along with the possible sources for error noted above, of the doubtful validity of the data-series of the Kagera mouth station (see also Table 2.2).

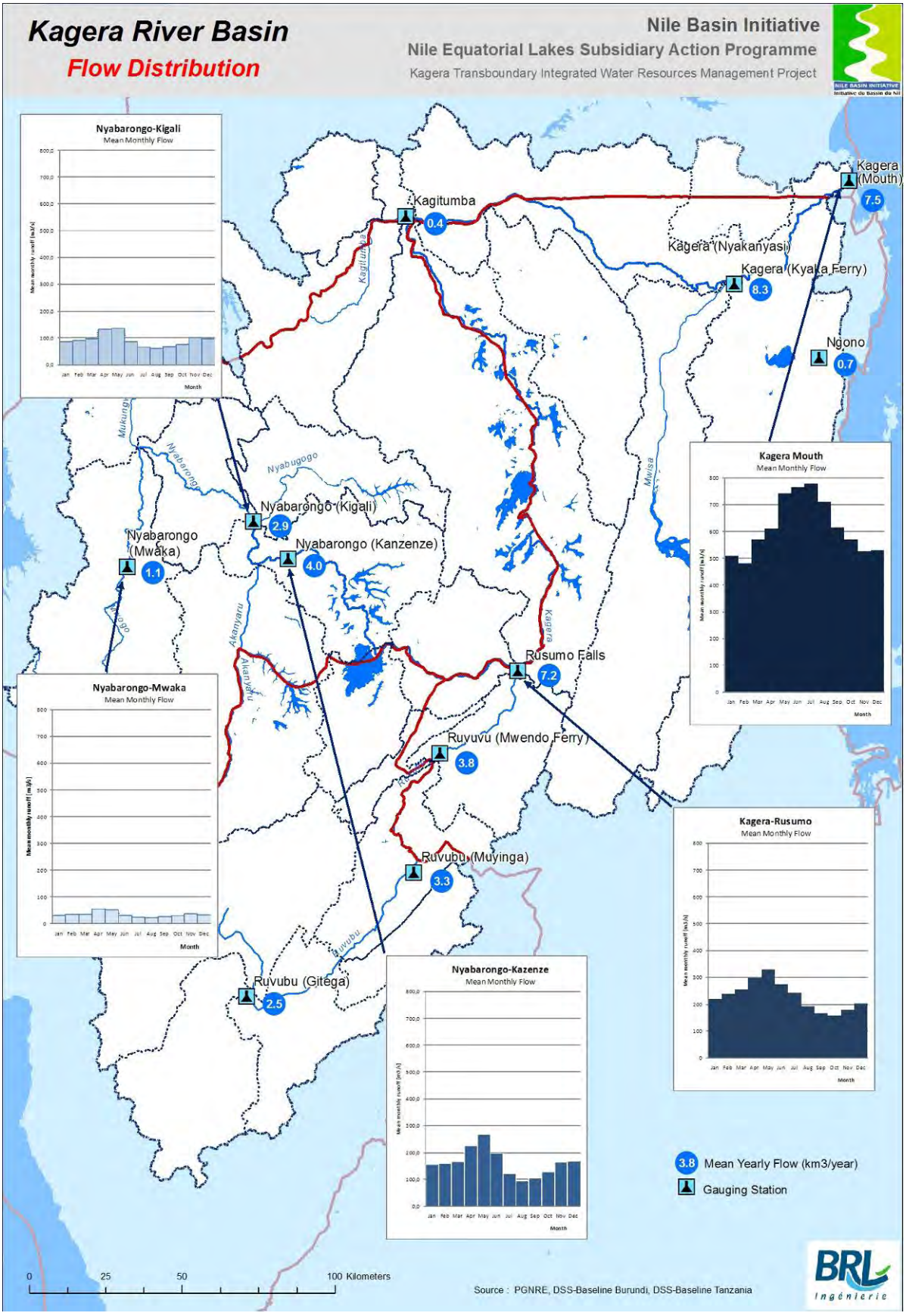


Figure 2.10 – Kagera River Basin Flow Distribution

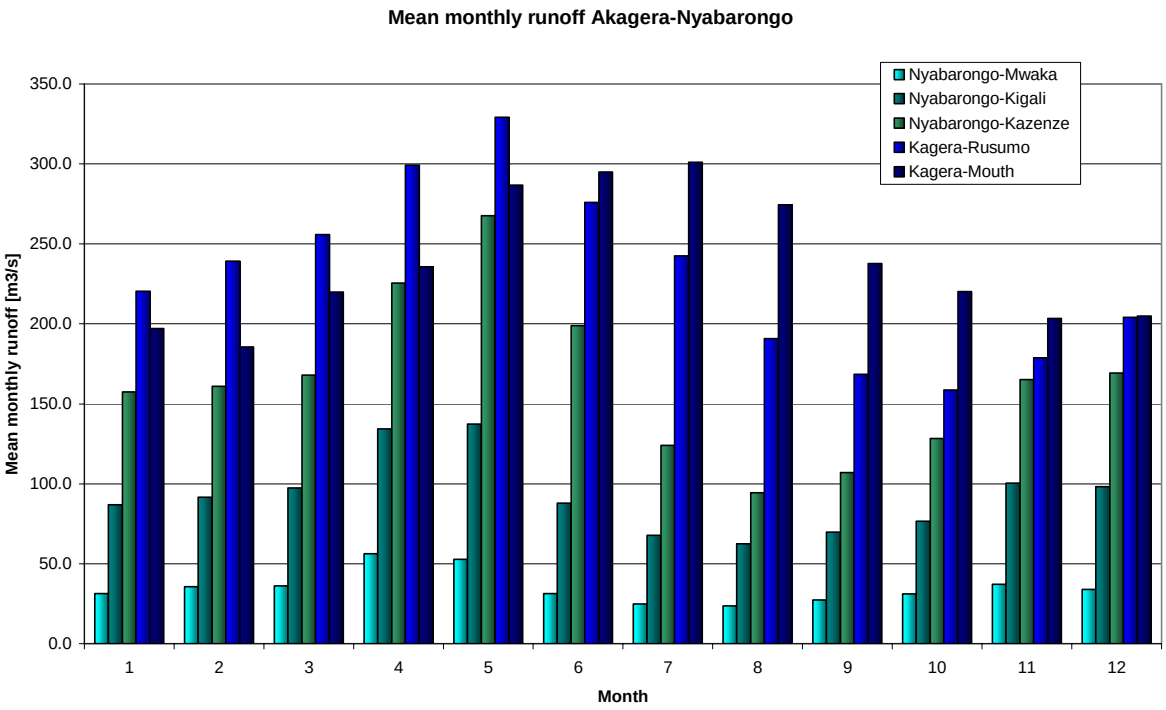


Figure 2.11 – Mean monthly runoff for five key hydrometeorological stations in the Kagera River basin

The following table presents a summary of stream flow information based on data from stations that have been checked for reliability and sufficient length of monitoring.

Table 2.2 – Summary of Kagera River basin flows at key locations

Streamflow Station	River	Zone	Catchment area	Average monthly flow	Mean specific yield	Runoff coefficient	Minimum daily flow	Maximum daily flow	Mean yearly flow		Source of Info
									From literature	Based on mean monthly flows	
			[x1000km²]	[m³/s]	[l/s/ha]		[m³/s]	[m³/s]	[km³/year]	[km³/year]	
Mwaka	Nyabarongo	I	2.8	35.0	13.0		7.0	241.0	1.1	1.1	PGNRE
Gitega	Ruvuvu	I		79.0		0.0				2.5	DSS-Baseline Burundi
Kigali	Nyabarongo	II	8.9	93.0	13.0	0.0	37.0	335.0	3.6	2.9	PGNRE
Kanzenze	Nyabarongo	II	14.6	126.0	11.0	0.0	27.0	517.0	3.9	4.0	PGNRE actualised database
Muyinga	Ruvuvu	II		103.0						3.3	DSS-Baseline Burundi
Mwendo Ferry	Ruvuvu	II	12.3	121.0						3.8	Burundi LVBTDA
Rusumo Falls	Kagera	II	30.2	230.0	8.0	0.0	63.0	622.0	7.2	7.3	PGNRE
Kagitumba	Kagitumba	III	3.5	14.0	4.0		2.0	74.0		0.4	PGNRE
Nyakanyasi	Kagera	IV	48.4								no data
Ngono	Ngono	IV	3.2	22.0		0.12 - 0.15	5.0	106.0	0.7	0.7	Norconsult / Electrowatt rating curve 1970-1974
Kyaka Ferry	Kagera	IV	55.8	263.0		0.0				8.3	DSS-Baseline Tanzania
Mouth	Kagera	IV	59.8	239.0						7.5	Sutcliffe, 1999

Figure 2.12 presents the monthly average discharge for Akagera at Rusumo for the 1956 – 1996 timeframe. It clearly shows the period of high flows in the early 1960s. This phenomenon is attributed to a general wet period in the region, and eventually led to a 3 m rise of Lake Victoria levels. In the 1956 – 1996 time frame, the maximum and minimum annual runoff came to 9.0 and 4.7 km^3 respectively[22], while the average annual flow in this period amounted to 7.0 km^3 (Nile Basin Water Resources (GCP/INT/752/ITA), Mission Report 2001).

[22] 1 km^3 = 1 billion m^3 = 1000 Mm^3 = 1,000 Gigaliters (Gl) = 1 million Megaliters (Ml)

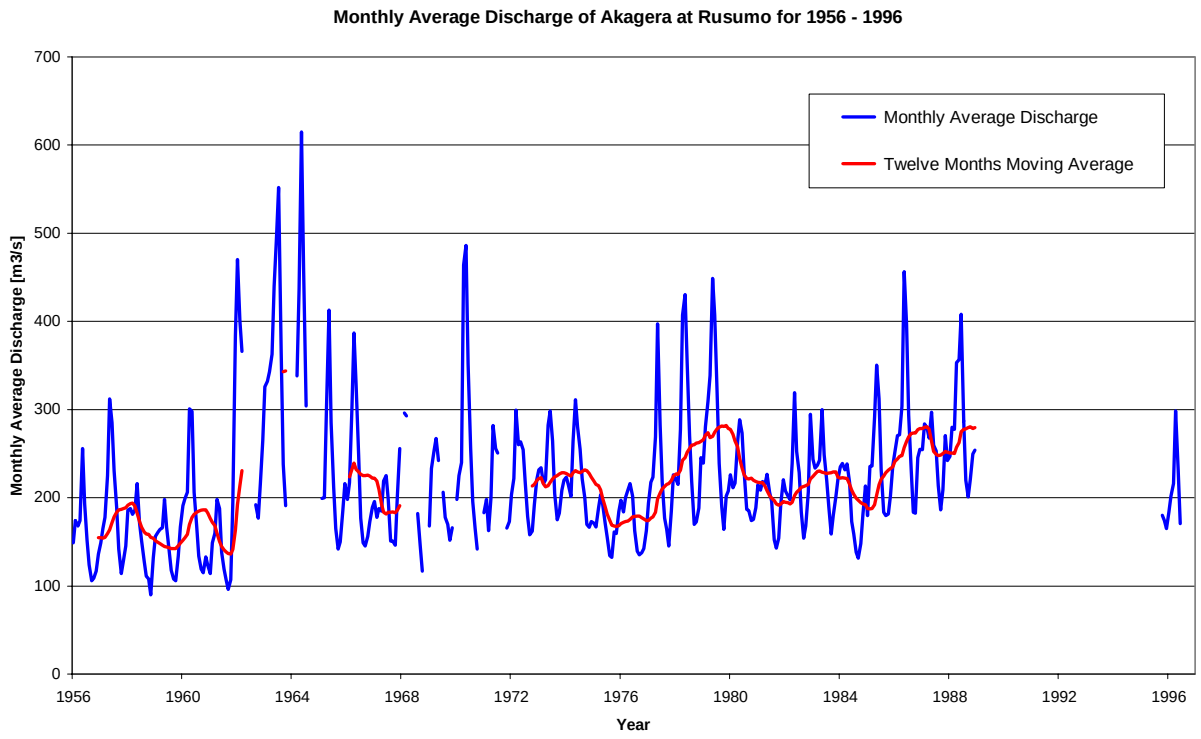


Figure 2.12 – Monthly average discharge of the Kagera River at Rusumo Falls (1956-1996)

Figure 2.13 presents a comparison of Kagera flows at Rusumo Falls and Kyaka Ferry. The latter station is close to the outlet of the river in the Lake Victoria, and is estimated to represent around 93 to 95% of the total Kagera runoff (Hydromet Project, 1974). The figure shows the important contribution of Akagera to Kyaka Ferry flows, averaging 90% in the 1956 – 1986 period. This leads to the conclusion that the greater part of the Kagera stream flow is generated in the upper areas of the watershed. This is further validated by the high correlation coefficient between annual discharges at Rusumo Falls and Kyaka Ferry for the 1956 – 1986 period.

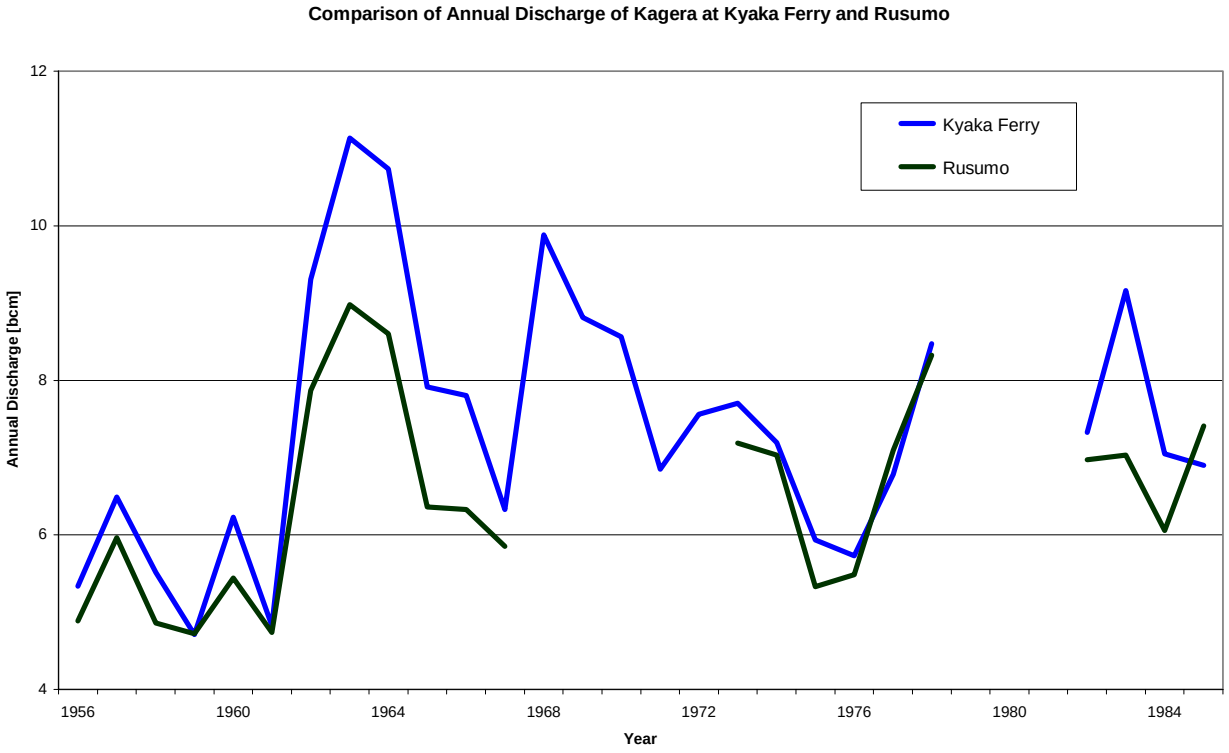


Figure 2.13 – Annual flows of the Kagera River at Kyaka Ferry and Rusumo Falls (1956-1986)

2.4.4 Water quality

Physico-chemical quality

Very little information is available on the water quality of the surface water in the basin. In Rwanda, one study has been carried out by the national university of Rwanda in 2002 (described in PGNRE, Composante B, SHER, 2005). It follows that the Kagera River is generally of good quality, and that the differences in conductivity and the different lithologies of the sub-catchments influence the water quality.

Sekamana (1989) found that the surface water in Burundi has faecal contamination. The water quality suits all water uses. The stream waters are generally warm (between 19 and 26ºC), acid, of relatively low conductivity (< 100 µS/cm), very soft and rich in dissolved oxygen. For 30% of cases, the Fe and Mn contents are above the water potability limits. Nitrogen and phosphorous increase with increasing discharge as a result of leaching of agricultural soils so that, contrary to the dilution effect, their contents increase during the rain events.

Groundwater quality has been analysed to examine potability in a non-systematical manner by analysing spring water and to a lesser extent borehole water samples on 948 samples. The mineralogical water quality is generally within the norms of the World Health Organisation apart from nitrate in 2.5% of the samples taken. However, bacteriological analyses carried out revealed that 44% of the sources, including even boreholes are bacteriologically contaminated.

Sediment transport

For the Hydromet Programme (described in Norconsult & Electrowatt, 1975), about 15 samples each were collected from 3 locations within the basin between March 1971 and August 1972. The locations were Mumwendo Ferry (Ruvubu River), Nyakanyasi (lower end of the Kagera River), and Kyaka Road (Ngono River). The results indicate in the first place that the water is slightly to moderately-mineralized and is suitable for unrestricted use for irrigation, domestic and livestock supply.

Secondly, it was established that the sediment load is low throughout the basin, and that it diminishes downstream. The mean measured annual sediment load was 25 ton/km² for the Ruvubu catchment, 10 ton/km² for the Kagera catchment at Nyakanyasi and 8 ton/km² for the Ngono catchment. The 10 ton/km² can be assumed to have entered Lake Victoria on a yearly basis.

Although the western part of the basin is partly forested, much of the basin has become intensively cultivated and even fragile lands located on steep slopes are cultivated. This has resulted in erosion and sediment load from the high rainfall areas (Sutcliffe, 1999). From the data collected by LVEMP from 2000 to 2005, it was estimated that 4,905 kilo tons per year of suspended sediments load is ultimately deposited in the Lake, of which Kagera catchment contributes 26.1%, equivalent to a basin sediment yield of 21.4 ton/km²/year (Myanza et al, 2005, quoted by Lugomela and Sanga, 2007). These data suggest that the sediment load of the Kagera has doubled since Hydromet's measurements, which is over the last 30 years.

This is however only a fraction of the soil loss due to erosion. Data on erosion rates are scarce, but studies conducted in the mid-1980s found that the average loss of surface soil due to erosion is 10.1 ton/ha/year, or 1000 ton/ km²/year. Soil losses range from 21.5 ton/ha/year in the Congo-Nile Divide to 2.6 ton/ha/year in the Bugesera area (World Bank, 2005). The explanation for the big difference between soil losses and sediment outflow may be that the larger part of the sediment load is deposited within the basin where the valley slope becomes less and/or sediments are retained in the swamp vegetation. This would explain also that the sediment load diminishes towards the outlet.

The content of suspended matter was estimated at 200 mg/l for Ruvubu (Sinarinzi, 2000, in Hakizimana and Bahama, 2005). The suspended sediment load and consequently the water turbidity are very high, notably in rainy seasons, with the highest values after rainfall events.

Major pressures and pollution hot spots

The industry sector is little developed in the Kagera basin, and no major pollution hot spots can be mentioned. Rwanda is expected to be relatively the most industrialised. The industries in Rwanda are farm produce plants, and (para)chemical industries, as well as mining industries. The main point-source of pollution is Kigali, the capital of Rwanda, where 70% of the industrial activities in Rwanda take place. A sample study on 11 industries in Kigali revealed that the industries do not treat their wastewater at all before discharge in the Nyabugogo River. The most polluting industries are UTEXRWA (textile industry), TOLIRWA (iron and chemical production), and SIGMA COLOR (paint industry). It is expected that the industrial sector in Rwanda will increase some five-fold by 2020. This will have a major impact on the surface water quality downstream of Kigali, if the ongoing practice of direct discharge of untreated wastewater will continue.

Water samples of surface water in Rwanda were analysed for several parameters. Fluoride (1.8 mg/l) and copper (1.3 mg/l) are indicative of the pollution by industries located in Kigali; their polluting effects in the Nyabugogo River quickly reduce downstream. Unfortunately, other parameters typical for pollution including arsenic, heavy metals, hydrocarbons, pesticides and fungicides have not been tested (PGNRE, Composante B, SHER, 2005).

The main water quality study carried out in Burundi was done during the hydrological year 1988-1989 through GTZ funding (Sekamana, 1989). The water courses and their water quality are mainly influenced by human activities, including farming without erosion control measures, mining activities, and cultivation of wetlands. The study revealed that the industrial pollution of streams is still insignificant, because of the weak industrialization development and the utilization of chemical inorganic fertilizers. Industrial development in the Burundian part of the Basement is limited to farm-produce plants, including coffee shelling and washing and palm oil manufacture. Some streams receiving urban and farm-produce wastewater are becoming polluted. The pollution consists generally of high suspended sediments load, organic and bacteriological pollution, and high contents of nutrients (nitrogen and phosphorus).

Within the framework of LVEMP, in the period 2000 – 2005 samples were collected from 19 urban centres and 31 industries in the Lake Victoria basin which were considered to be relatively large enough to cause significant pollution. It followed that there are no main urban point sources of pollution in the Kagera basin. Myanza *et al.* (2005) reported that atmospheric deposition is by far the major contributor of nutrients to the lake whereby 84% and 75% of nitrogen and phosphorus respectively are deposited this way (Lugomela and Sanga, 2007).

In NBI's regional water quality report (2005), it is reported that in Burundi, mining causes pollution by heavy metals, toxic substances including arsenic such as the mine of Kabarore, which pollutes Nwogere, a tributary of Kanyaru.

Role of wetlands for water quality improvement

In the lower reaches of Kagera river different types of swamps are encountered. Permanent swamps are mostly found at the river mouths of Kagera and Ngono river systems in the Western part of the lake. S easonal swamps exist along the Kagera River and its main tributaries, including also the upper reaches of Mwisa River, the middle reaches of the Ngono River and Ruzinga swamp associated with lower reaches of Kagera River.

Most of the tree swamps are found particularly along the Kagera River and its tributaries. Open waters are also mostly found in Kagera Region. These include among others, the Lakes of Ikimba and Burigi (Lugomela and Sanga, 2007).

The buffering capacity of wetlands has been studied using a model called DUFLOW which describes the cycling of nutrients and fate of behaviour of heavy metals in wetlands (LVEMP, Vol 1 & 2, 2001). The study revealed that Ngono wetland has a retention capacity of 50-80% for suspended solids and total phosphorus, and 40-60% for total nitrogen.

The role of wetlands and a map locating the major ones is presented in more detail in section 2.5.4.

2.4.5 Floods and droughts

Norconsult & Electrowatt (1975) determined the maximum daily, maximum monthly and annual floods based on the data series at Kagera at Kyaka Ferry, as this station has the longest series of records (35 years) using three different statistical distributions (Gumbel, Log-Pearson Type III and Log Normal distribution). The validity of the so-obtained values was checked with the rainfall records, which were available for a period of 44 years, resulting in a good concordance. The values adopted for the period 1950-73 are given in Table 2.3 which shows that between Rusumo Falls and Kyaka Ferry the flood flow reduces some 20%, as a result of the attenuating effect of the swamps and lakes in between these two points.

Table 2.3 – Maximum monthly and daily flows in the Kagera River basin

Return period [years]	100	200	500	1000
Maximum monthly flows [m^3/s]				
Ruvubu (Gitega)	320	350	380	410
Nyabarongo (Kanzenze)	350	380	410	450
Kagera (Rusumo Falls)	760	830	920	1000
Kagera (Kyaka Ferry)	660	720	800	860
Maximum daily flows [m^3/s]				
Ruvubu (Gitega)	480	530	570	620
Nyabarongo (Kanzenze)	490	530	580	620
Kagera (Rusumo Falls)	870	950	1050	1130
Kagera (Kyaka Ferry)	680	740	815	870

A statistical analysis was used to analyse the minimum monthly flows of Kagera River at Kyaka Ferry for the period 1940-1973, in order to establish drought flows. The corresponding minimum monthly flows are also listed in Table 2.4.

Table 2.4 – Minimum monthly and daily flows in the Kagera River basin

Return period [years]	10	50	100	200
Minimum monthly flows [m^3/s]				
Kagera (Kyaka Ferry)	108	102	99	97

2.4.6 Characteristics of the hydro-geographical zones

Based on the overview of the physical setting of the Kagera basin, a summary has been made of descriptions of all discussed aspects and typical parameter values for the different hydro-geographic zones.

Table 2.5 – Kagera Basin Hydro-geographic Zones – physical characteristics

No.	Development Zone	Dominant Lithology	Altitude	Relief	Soils	Soil erodibility	Average Rainfall [mm]	Average Temp. [oC]	Surface water availability
I	Congo-Nile Divide	Gneiss, phyllites	1,900 – 4,500	steep	Cambisols, Leptosols	high	1400 – 4,000	15 – 18	High (springs)
II	Hills and mountain foot ridges	Phyllites	1,500 – 1,900	Rolling	Ferralsols	medium	1,000 – 1,400	18 – 22	Medium - High (springs)
III	Swamp and lake terrain	Alluvial and colluvial deposits / Phyllites and quartzites	< 1,300 – 1,500	Flat	Histosols, Ferralsols	Low	< 800 – 1,000	22	High (swamps)
IV	Western lake Region	Alluvial and lacustrine deposits / Quartzites and Phyllites	1,134 – 1,300 in alluvial plains ; 1,300 – 1,700 in plateaux	Flat to rolling	Various	Low	800 – 1,000 in alluvial plains ; > 1,000 on plateaux	20 – 30	Low (apart from Kagera river)

No.	Development Zone	Representative hydrometric stations	Minimum flow [m^3/s]	Average flow [m^3/s]	Maximum flow [m^3/s]	Runoff coefficient	Groundwater potential	Potable water coverage [%]	Sanitation coverage [%]
I	Congo-Nile Divide	Mwaka (Nyabaronogo)	7	35	241		low		5 - 35
		Gitega (Ruvuvu)		79		0.26			
II	Hills and mountain foot ridges	Kanzenze (Kagera)	27	126	517	0.17	Low		5 - 35
		Mwendo Ferry (Ruvuvu)		121					
III	Swamp and lake terrain	Rusumo Falls (Kagera)	63	230	622	0.16	medium - high		5 - 10
IV	Western lake Region	Ngono	5	22	106	0.12 - 0.15	medium - high		70 - 100
		Kyaka Ferry (Kagera)		263		0.09			

2.4.7 "Water Scarcity" in the Kagera River Basin

In assessing the availability of water and its development and management in the Kagera River basin, it is useful to look at global assessments of water scarcity and water stress:

Falkenmark Water Stress Indicator

When describing water availability in a country, the Falkenmark Water Stress Indicator — renewable water resources per capita per year, usually determined on a national scale - is one of the most commonly used indicators. Water availability of more than 1,700m³/capita/year is defined as the threshold above which water shortage occurs only irregularly or locally. Below this level, water scarcity arises in different levels of severity. Below 1,700m³/capita/year water stress appears regularly, below 1,000m³/capita/year water scarcity is a limitation to economic development and human health and well-being, and below 500m³/capita/year water availability is a main constraint to life.

Despite its global acceptance, this indicator has numerous shortcomings. First of all, only the renewable surface and groundwater flows in a country are considered. Moreover, the water availability per person is calculated as an average with regard to both the temporal and the spatial scale and thereby neglects water shortages in dry seasons or in certain regions within a country.

Furthermore, it does not take the water quality into account at all nor does it give information about a country's ability to use the resources. Even if a country has sufficient water according to the Falkenmark indicator, these water resources possibly cannot be used because of pollution or insufficient access to them.

The Falkenmark water stress indicators for the Kagera River basin countries are provided in Table 2.6 (extracted from Lawrence et. al. 2002):

Table 2.6 – Water Stress Indicators for the Kagera River Basin Countries

Country	Falkenmark *water stress* indicator (m^3/capita/year)
Burundi	500
Rwanda	800
Tanzania	2,500
Uganda	2,400

These figures underline the already severe physical water scarcity situation of the two upstream Kagera Basin riparians, Burundi and Rwanda. Moreover, if one consider the economical water scarcity of the Kagera River basin (see below), the basin will probably face severe water stress in the following decades and water management will be of a crucial importance.

Projections of Water Scarcity in 2025

In preparing the World Water Vision 2000 (WWC, 2000), the IWMI has carried out projections of global water scarcity in 2025 (Figure 2.14). The distinction between physical and economic water scarcity is as follows:

- Physical water scarcity means that even with the highest feasible efficiency and productivity of water use, countries will not have sufficient water resources to meet their agricultural, domestic, industrial, and environmental needs in 2025. Indeed, many of these countries cannot meet even their present needs. The only options for them are to invest in expensive desalination plants—or to reduce the water used in agriculture, transfer it to other sectors, and import more food.
- Economic water scarcity means that countries have sufficient water resources to meet their needs but will have to increase water supplies through additional storage, conveyance, and regulation systems by 25% or more to meet their needs in 2025. These countries face severe financial and capacity problems in meeting their water needs.

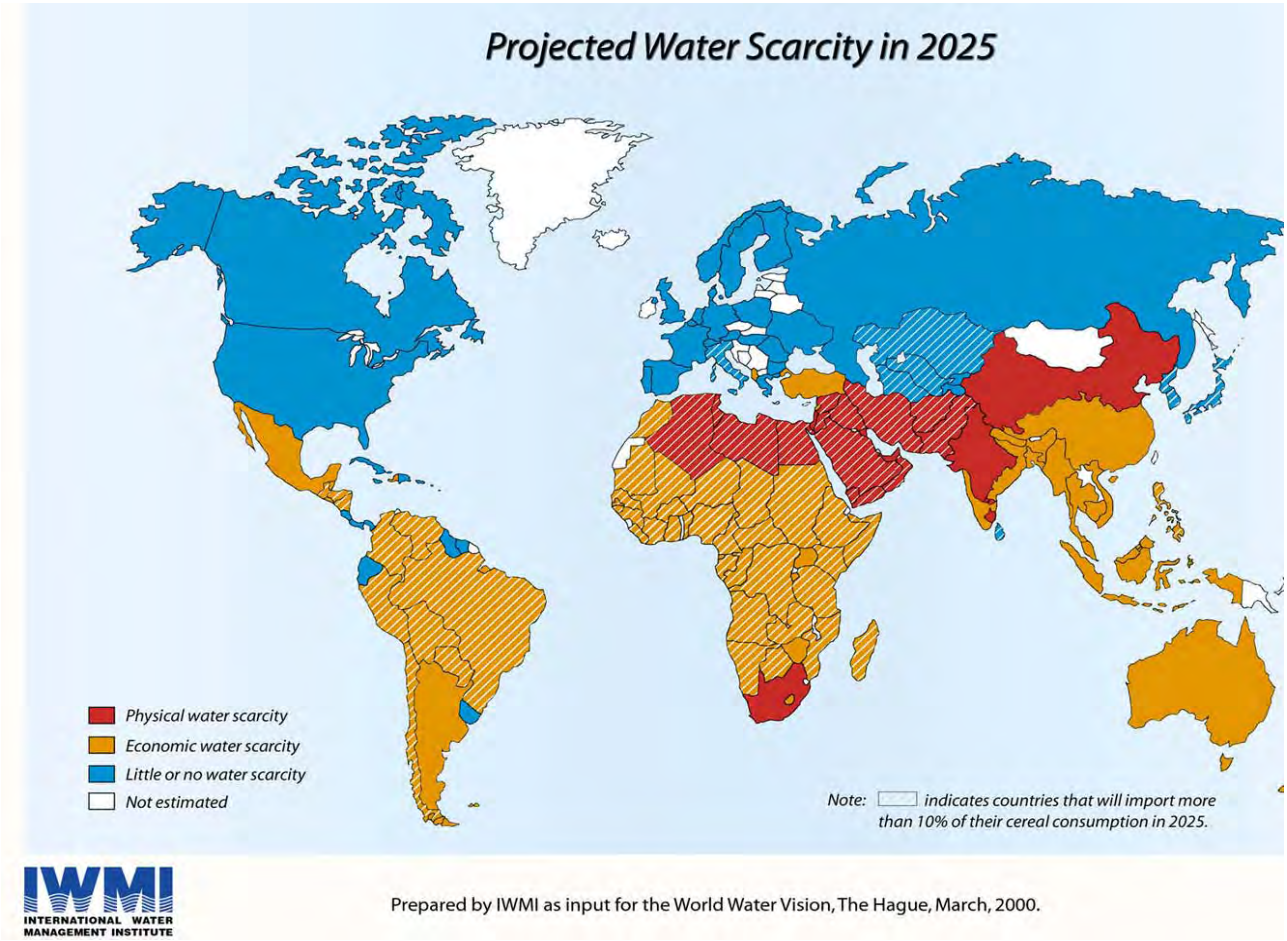


Figure 2.14 – Projected Global Water Scarcity 2025

These projections indicate that the Kagera River basin and the entire region will suffer from severe economic water scarcity – many already are.

2.4.8 Recommendations for further study

The information in the preceding sections has been derived from all data made available in the period of preparing this report. Some information, though available was not provided. The missing data mainly concerns streamflow data and rainfall data. It is recommended that efforts will be made to provide these data, specifically as input for future modeling of the Kagera Basin, and climate change studies.

The locations of the streamflow stations as listed in the Nile DST database were found to be inaccurate. It is recommended that these locations are cross-checked with the recent Nile DSS baseline reports for the individual countries.

Further studies related to the bio-physical setting that would be benefit the development of the Kagera Basin include the preparation of grondwater potential maps for those parts of the Kagera Basin where enough sufficient and appropriate log information is available; and the introduction of a surface water quality monitoring network, incorporating the measurement of (toxic) industrial waste parameters.

2.5 Flora and Fauna

2.5.1 Vegetation and Land Cover

The Kagera River basin is comprised of a wide variety of habitats and species diversity due to its geo-morphological characteristics, which leads into diverse climatic conditions. The land use distribution and vegetation cover for the Kagera River basin are shown in Figure 2.15 and also summarized in Figure 2.16[23]. These indicate that large parts of the basin are occupied by cultivated agricultural lands (48%), followed by natural vegetation (26%), of which only 2% is covered by closed forest vegetation. The rangelands and pasture lands occupy about 15% of the total area in the basin. The marshlands (wetlands), including the open water bodies occupy about 5%, whereby marshlands form only about 3% of the total land area in the basin.

The vegetation cover types in the Kagera River basin are classified as:

- **Marshlands –** permanent or temporary flooded areas with natural vegetation typical of wetlands and marshlands (papyrus).
- **Closed forest –** natural forest (mountain and dry forests) or forest plantation with a canopy density between 60-80%.
- **Very High vegetation cover/ Natural** – combination of trees and shrubs, natural vegetation dominant, vegetation cover density between 40-60%.
- **High vegetation cover / Agricultural –** combination of crops and natural vegetation (trees and shrubs), agricultural dominant, vegetation cover density between 40-60%.
- **Medium vegetation cover /Agricultural –** combination of crops and vegetation (trees and shrubs), agricultural dominant, vegetation cover density between 30-40%.
- **Low vegetation cover / Rangeland –** combination of herbaceous vegetation (savannah), natural vegetation density between 10-20%.
- **Very low vegetation cover / Bare soil / Urban –** very open deciduous herbaceous natural vegetation, close to bare soil or bare soil, artificial surface and urban areas, vegetation cover less than 10%.

The distribution of natural vegetation in the basin is dependent on the climatic and soil conditions. For example, closed forests are found to occur at 1,200 m amsl on alluvial deposits at the outlet of the Kagera River, which is unique to tropical Africa, comprised of an equal proportion of lowland (mainly western Gunea-Congolian) forest species and highland (Afro-montane) forest species. The eastern part on the Rwanda side is comprised of savannah type of shrubs and trees. The open grassland savannah is dominated by common species of grass such as *Themerda, Hyperhenia* and *Cymbopogon.* The wooded savannah is dominated by Acacia tree species such as *Acacia Senegal* and *Acacia siberiana*.

The Kagera River floodplain also influences the groundwater forests in the Tanzania side (Minziro, Munene and Ruarian Forest Reserves). The forest vegetation is known to be unique for its biodiversity and from an important ecological component of the floodplain ecosystem that helps to regulate the flow of water throughout the Kagera River System. The dry forests comprise tree species that provide an important source of medicinal plants and harbour important species of mega-fauna such as elephants, Uganda kobs, oribis, waterbucks, topis, giraffes, impalas, zebras and leopards.

[23] Adapted from Lasry, et al., 2007.

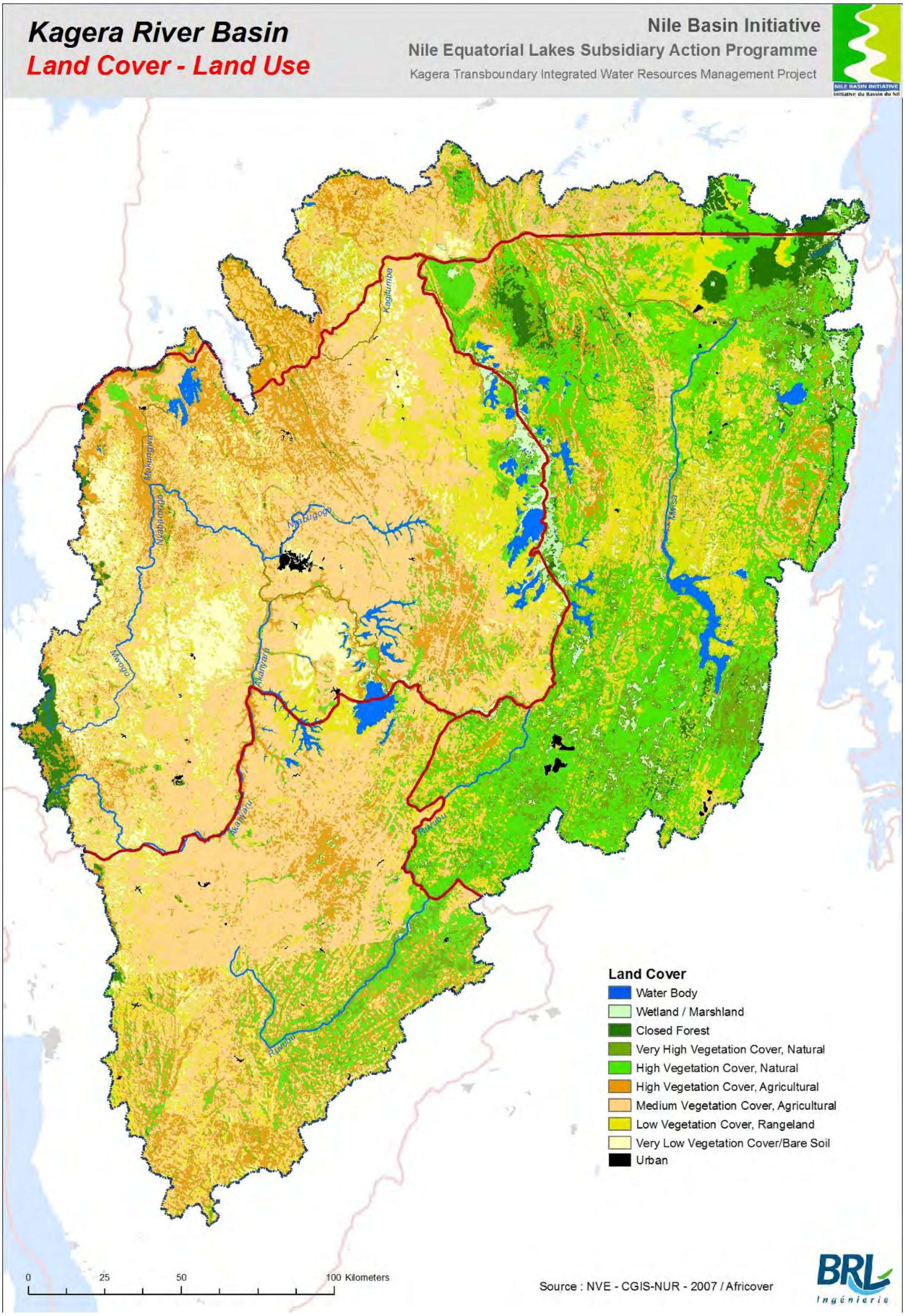


Figure 2.15 – Kagera River Basin - Vegetation and Land Use Cover

The swampy areas with papyrus grass largely occur on the Rwanda side of the River basin and in the north, providing an important water regulation and buffering functions. The diverse ecosystem is also an important home to a variety of macro and micro-organisms, mammals, birds and reptiles of global significance.

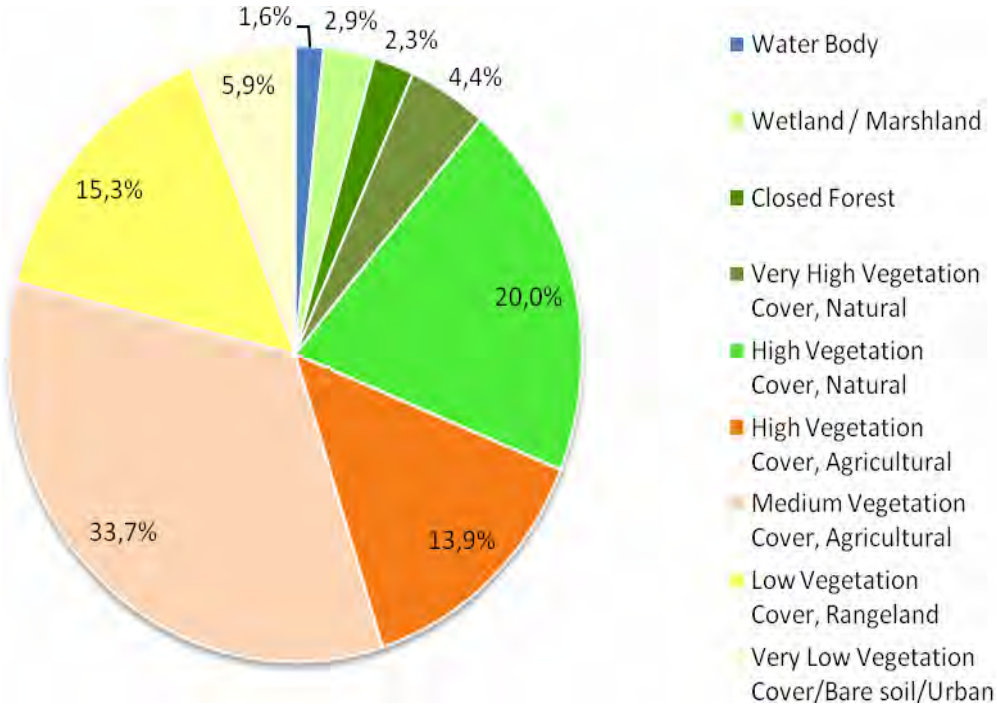


Figure 2.16 – Vegetation / Land Use Cover Distribution

2.5.2 Biodiversity Hotspots in the Kagera River Basin

Biodiversity means the variability of life expressed at ecosystem, species and genetic levels. It is the source of life and the basis for existence of all life forms. British ecologist Norman Myers defined the biodiversity hotspot concept in 1988 to address the dilemma that conservationists face: *what areas are the most immediately important for conserving biodiversity?* Biodiversity hotspots hold especially high numbers of endemic species, yet their combined area of remaining habitat covers only 2.3 percent of the Earth's land surface. Each *hotspot* so defined faces extreme threats and has already lost at least 70 percent of its original natural vegetation.

The biodiversity hotspots areas so far identified in the Kagera River basin cover a wide variety of areas with some of them containing endangered or unique species that have been listed under Convention on International Trade on Endangered Species (CITES) and the World Conservation Union-IUCN (MINITERE, 2004). The occurrence of biodiversity hotspots in the Kagera River basin is shown in Figure 2.17:

The Rugezi Wetland contains several species listed under CITES, these include marsh grass such as *Cyperus latifolius, Cyperus papyrus* and *Miscanthus violceus*. This wetland is also comprised of 19 animal species**,** which are associated with marsh plants like Grauer's scrub-warbler *(Bradypterus graueri)*. About 3000 species of animals in this wetland are considered to be endangered, hence need protection. Rugezi is estimated to have more than 10,000 species

of birds and some of the bird species such as *Bostrichia hagedesh, Aonyx capensis* and *Threskion thides aethiopius* are listed by CITES as protected species.

Akagera is known to support important unique biological diversity in the basin. It constitutes an important reservoir for biological diversity with more than 500 species of birds, 9 amphibians and 23 species of Reptiles. The site contains species of marsh buck or sitatunga *Tragelaphus spekii,* which are also listed under CITES. Four species of mammals that have been listed under CITES include African elephants *(Loxodonta Africana),* buffaloes *(Sincerus caffer),* leopards *(Panthera leo)* and marsh buck *(Tragelaphus oryx).*

Mugesera/Rweru Complex is an important principal habitat of endemic species, including *Bradypterus caupalis, Laniarius mufumbiri, Casticola carruthersii* and other protected species of marsh bucks or sitatunga *(Tragelaphus spekii* and spotted-neck otter *(Lutra maculicolis)*-which are fish–eating small mammals.

Lake Ihema, Hago and Ruanyakiziga contain large number of wild pigs *(Potamochoerus porcus)* and marsh bucks *(Tragelaphus spekii)*, which are considered to be important species listed under CITES and IUCN. There are some carnivorous animals like blotched / spotted genet *Genetta tigrina)*, which are also listed under IUCN. The Ihema Lake is comprised of 34 species of Reptiles with 21 Genera and 9 Families. The lake also contain some fish species *(Astatoreochromis alluandi)*, which that are also listed by CITES as protected species.

In the Ugandan side, the important biodiversity hot spot include the Mgahinga Gorilla National Park and Sango Bay Forest Reserve. The Mgahinga National Park is important for the endemic species of montanous gorilla *(Gorilla gorilla berengei)*. The Sango Bay seasonal swamp forest ecosystem contains biodiversity of global significance (Davenport & Howard 1996), with endemic species of fish *(Oreochromis esculantus* and *O. variabilis),* dragon flies *(Macromia bispina)* and numerous butterflies *(Tametheria orientalis, Elymnias bammakoo ratrayi* and *Charaxes imperialis ugandacus).* The Forest Reserve also contains some endangered hard wood species *(Podocarpus Sp).* The forest reserve is said to have a high conservation value for butterflies, large moths and birds (Davenport & Howard, 1996).

The Ruvubu National Park is comprised of about 98 species of mammals, 20 species of insects, 8 species of bats *(Chiropterus),* 10 primates *(Cercopithecus mitis dogetti)* and 6 species of arthropods[24]. Some of the important mammals in the national park include baboon *(Papio anubis)*, hippopotamus *(Hippopotamus amphibious)*, marshland kob / water buck *(Kobus defassa)* and gray duiker *(Sylvicapra grimmia),* buffaloes *(Syncherus caffer)* and bushbuck *(Tragelaphus scriptus)*. The gray duiker and bush buck are in the 1994 IUCN Red List of Threatened species (IUCN, 2007). The Ruvubu National Park is also highly diverse with numerous indigenous tree species of socio-economic importance (e.g. construction, handicrafts, medicinal, fuel wood, charcoal, etc).

[24] Ministère De La Planification du Développement et de la Reconstruction Nationale. Monographie des Communes du Burundi. Programme d'Appui à la Gouvernance. Septembre 2006. République du Burundi.

2.5.3 Protected Areas in the Kagera River Basin

The protected areas in the Kagera River basin include: 4-National Parks, 3-Game Reserves, 1-Game Controlled Area, 3-Nature Reserves and 21-Forest Reserves. The locations of the protected areas in the Kagera River basin are shown on Figure 2.18. Some of the protected areas have been 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). These include the Akagera NP, Ruvubu NP, Nyungwe NR, Minziro FR, Ibanda GR and Rubondo GR.

Akagera National Park (NP): The Akagera NP (85,000 ha) is located in eastern Rwanda along the Tanzania border. The northern portion of the park is sharing border with Ibanda Game Reserve, which is in the Tanzania side. The Park contains Lakes Rwanyikizinga, Mihindi, Hago, Kiyumbo and most parts of Lake Ihema. The national park is also important for supporting unique biodiversity in the area. The national park has been reduced to one third of its original size due to resettlement of returning refugees into Rwanda in 1996.

Ruvubu NP: The Ruvubu National Park (50,000 ha, established in 1982), containing papyrus wetland with over 400 bird species is located in the North-eastern region of Burundi sharing a border with Tanzania. The national park has been affected by poaching, whereby local people carry out illegal hunting and trapping of animals. There is also a conflict between neighbouring communities with the national park authorities due to destruction of crops by wildlife in adjacent farms.

Nyungwe NP: The Nyungwe NP (90,000 ha, established as a NR in 1999, and as a NP in 2004) is located in the south-western region of Rwanda and shares common border with Kibira National Park in the Burundi side. The reserve has been affected by clearing of land for agriculture, bush fires, over-exploitation of forest resources. Gold washing and saw milling activities has been found (NBI, 2001) to be another problems leading into serious environmental degradation in the national park. Rumanyika Game Reserve (80,000 ha, established in 1970), is located in the northeast side of the basin. The reserve faced problems of poaching and illegal harvesting of timber and uncontrolled bush fires.

Minziro Forest Reserve: The Minziro Forest Reserve (25,000 ha, established in 1974), is a semi– swamp area that shares border with Uganda and a home to rare species, including the *mangabay* monkeys. The forest reserve has been impacted due to cutting trees for building materials, extraction of medicinal plants, fuel wood collection and charcoal making.

Ibanda Game Reserve: The Ibanda Game Reserve (20,000 ha, established in 1974) is located in the extreme north-western region of Tanzania, shares border with Uganda and Rwanda. Another portion of the game reserve is sharing border with northern portion of Rwanda's Akagera National Park. The game reserve is under pressure due to poaching and illegal harvesting of timber and uncontrolled bush fires.

Rubundo GR: Rubondo GR (45,000 ha, established in 1980) is in the north-eastern region of Tanzania, just south of Lake Victoria near border of Rwanda and Burundi. The game reserve has been affected by wildlife poaching and bushfires.

Kibira NP: Kibira National Park, in Burundi, is estimated at 40,000 ha. However, a small part of the Park is situated in the Kagera River Basin (most of the Park is situated at the North East of the Kagera River Basin Burundian part).

2.5.4 Wetland Areas

These areas can be defined as areas of land that are regularly saturated by surface water or groundwater and are characterized by vegetation that is adapted for life in saturated soil conditions. Those areas include swamps, bogs, fens, marshes and estuaries (USEPA, 1994), and they generally support a rich biological diversity with many endemic and rare flora and fauna (UNEP, 1999).

Because of their important functions, wetlands have been seen to be similar with kidneys of the landscape or as biological supermarkets because of the important role they play in the food web and their richness in biological diversity. The human beings also benefit from wetlands in terms of nutrient cycling, sediments and pollutant loads retention, flood mitigation and ground water recharge.

Socio-economically, wetlands areas are known to provide immense benefits to the local and national economies and they form a basis for the livelihood of the poor peoples in the world (Darwall *et al.*, 2005). The important uses of wetlands may include hunting, fishing, cultivation, grazing, brick making and harvesting of raw materials for construction and/or handicrafts. The environmental values of wetlands have also been quantified economically in terms of floods protection and nutrient retention services (IUCN, 2003). Thus, apart from providing socio-economic benefits, wetlands also provide important ecological and hydrological functions, such as sediment loads and nutrients / toxins retention, stabilization of hydrological cycles and maintenance of micro-climatic conditions (NEMA, 2000).

In the Kagera River basin, wetland areas are associated with open lakes and river systems that are covered by vegetation, mainly papyrus grass and tree swamps. The distribution of important wetland areas in the Kagera River basin is shown in Figure 2.17. The wetland areas have been described as important habitats for protection of birdlife in the Kagera River basin. These include **Mugesera, Kagera, Nyabarongo, Rugezi and Akanyaru Wetlands**. These wetlands support a number of globally threatened species and restricted range of species such as water turtles, crocodiles, monitor lizards, snakes, otters and variety of water birds, including herons, egrets, ducks, warblers and weavers. In addition, some 180 bird species have been identified in the wetland habitats, including six European migrants (FAO, 2000).

The **Rugezi wetland** provides hydrological functions by regulating flow of water to Lake Kivu. It provides ecological function by acting as a reservoir for important biological diversity. It is an important habitat for scrub-warbler *(Bradypterus graueri).* As a tourist attraction in the area, it is a socio-economic benefit to the region.

Lake Ihema vegetation is dominated by giant marsh grass *(Cyperus papyrus, Potamogeton Sp.*and *Phragmites)*, which constitute an important source of detritus to the Akagera River. The littoral vegetation is characterized by herbaceous plants *(Aeschynomena elasphroxylon* and giant grass species *(Poaceae* and *Cyperaceae)*, which provide an important habitat and potential source of nutrients to fish. The hippopotamus *(Hippopotamus amphibious)* also the dominant large mammals in the Lake.

Other important wetland areas include: **Lake Rwihinda (Burundi), Ruvubu Wetlands and Akanyaru Valleyon on the Burundian side; The Rusumo Swamps (Upstream of Rusumo Falls), Lake Ihema, Lake Cyohoha, Lake Rugweru, Lake Mugesera, Bugesera Wetlands on the Rwanda side; and Minziro-Sango Bay Swamp Forest in Uganda**.

So far no wetland areas in the basin have been declared Ramsar Sites. However, recently the Govermemt of Rwanda has shown intention to carry out inventory of wetland areas and declare the qualified ones as Ramsar Sites. It could be useful if the exercise will be carried out for the whole basin even under the Kagera River Basin IWRM Project.

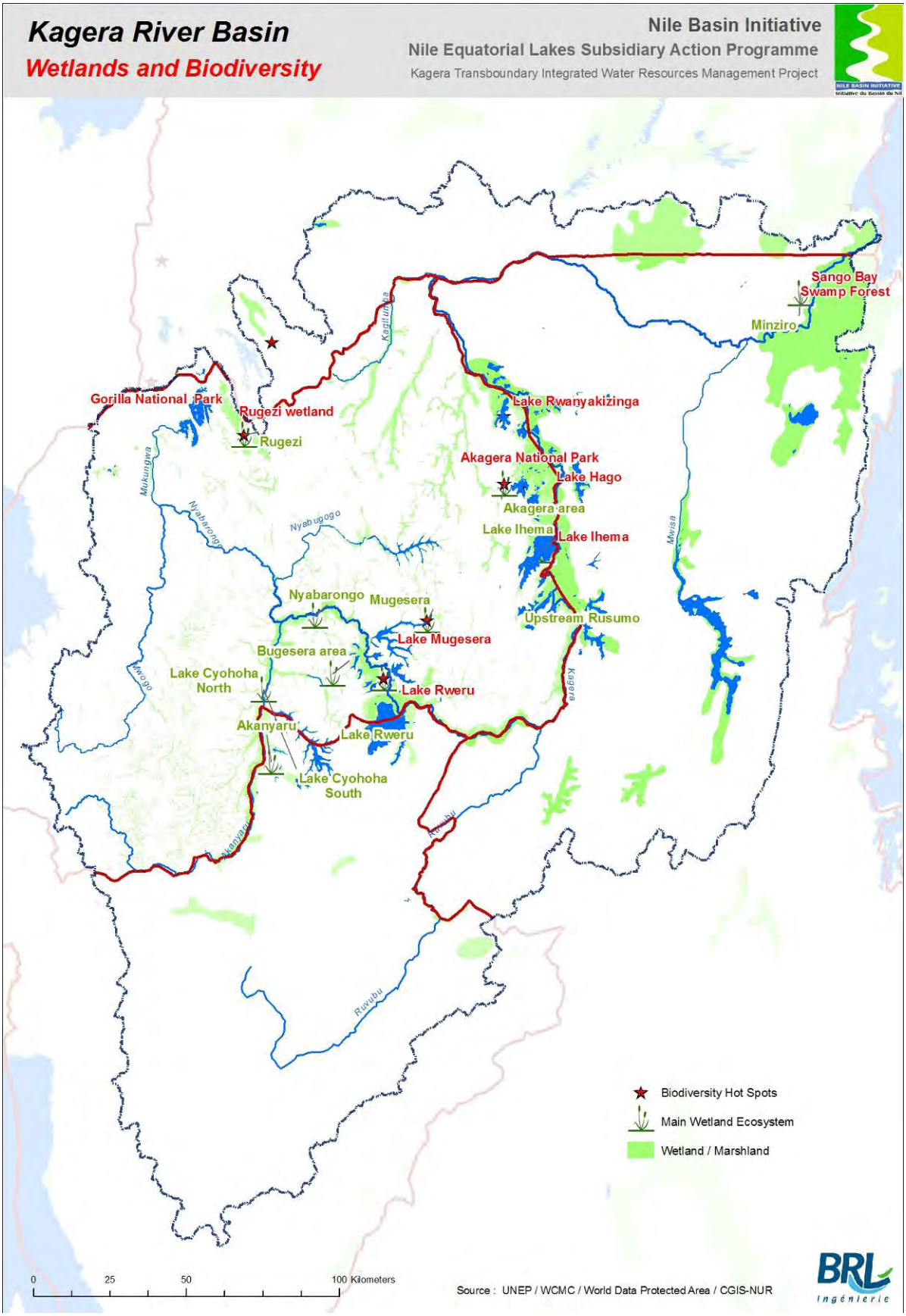


Figure 2.17 – Kagera River Basin – Wetlands and Biodiversity *Hot Spots*

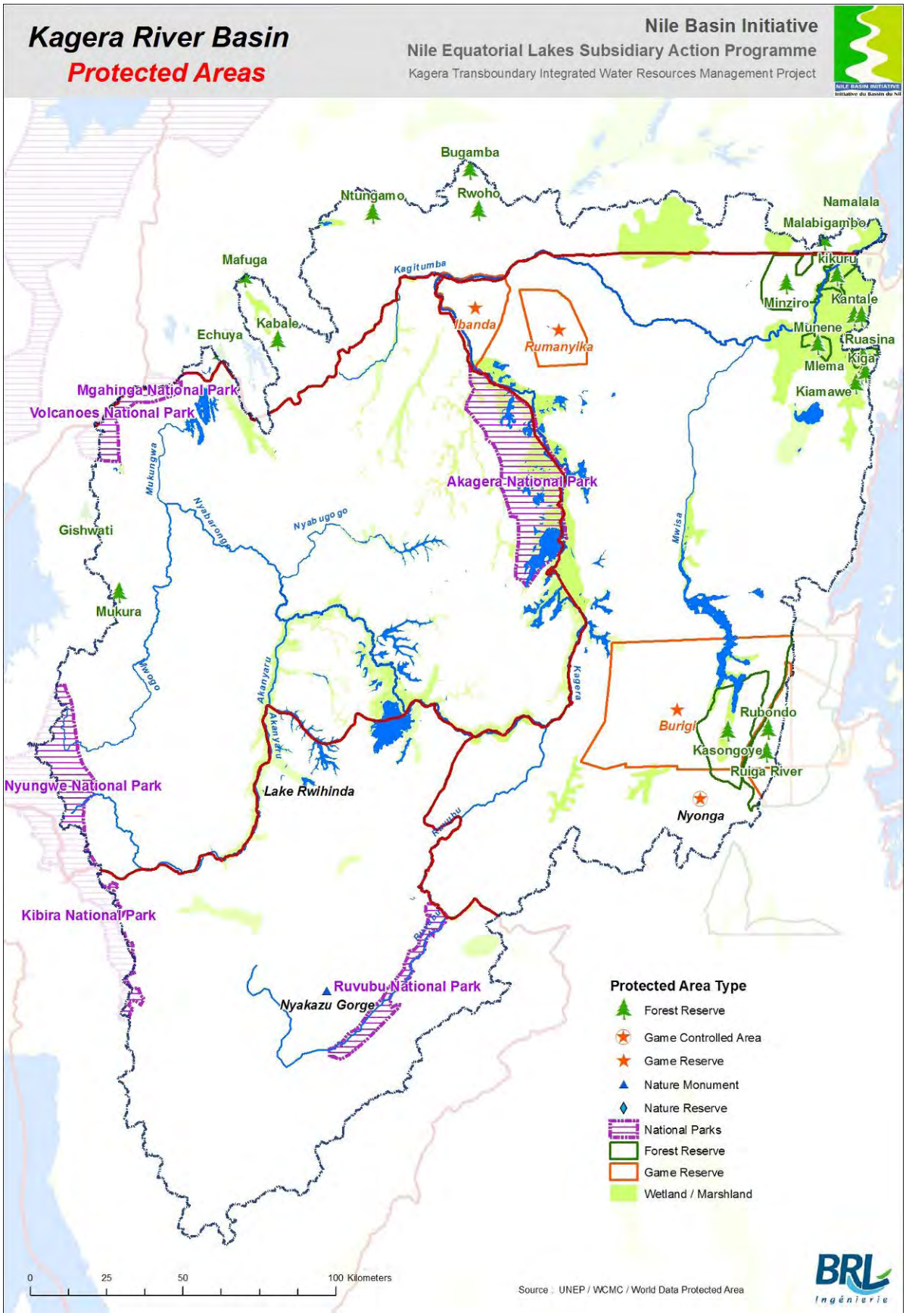


Figure 2.18 – Kagera River Basin - Protected Areas

2.6 Annex to Section 2 - Key to the FAO soil units

Extract from "Legend of the Soil Map of the World", 1974, UNESCO, Paris.

ACRISOLS (A): Other soils having an argillic B horizon; having a base saturation which is less than 50 percent (by NH4OAc) in at least some part of the B horizon within 125 cm of the surface.

ARENOSOLS (Q): Soils of coarse texture consisting of albic material occurring over a depth of at least 50 cm from the surface, or showing characteristics of argillic, cambic or oxic B horizons which, however, do not qualify as diagnostic horizons because of the textural requirements; having no diagnostic horizons other than (unless buried by 50 cm or more new material) an ochric A horizon.

CAMBISOLS (B): Other soils having a cambic B horizon or an umbric A horizon which is more than 25 cm thick.

FERRASOLS (F): Other soils having an oxic B horizon.

FLUVISOLS (J): Other soils developed from recent alluvial deposits, having no diagnostic horizons other than (unless buried by 50 cm or more new material) an ochric or an umbric A horizon, an H horizon, or a sulfuric horizon.

GLEYSOLS (G): Other soils showing hydromorphic properties within 50 cm of the surface; having no diagnostic horizons other than (unless buried by 50 cm or more new material) an A horizon, an H horizon, a cambic B horizon, a calcic or a gypsic horizon.

HISTOSOLS (V): Soils having an H horizon of 40 cm or more (60 cm or more if the organic material consists mainly of sphagnum or moss or has a bulk density of less than 0.1) either extending down from the surface or taken cumulatively within the upper 80 cm of the soil; the thickness of the H horizon may be less when it rests on rocks or on fragmental material of which the interstices are filled with organic matter.

LUVISOLS (L): Other soils having an argillic B horizon.

NITOSOLS (N): Other soils having an argillic B horizon with a clay distribution where the percentage of clay does not decrease from its maximum amount by as much as 20 percent within 150 cm of the surface; lacking plinthite within 125 cm of the surface; lacking vertic and ferric properties.

PHAEOZEMS (H): Other soils having a mollic A horizon.

PLANOSOLS (W): Other soils having an albic E horizon overlying a slowly permeable horizon (for example, an argillic or natric B horizon showing an abrupt textural change, a heavy clay, a fragipan) within 125 cm of the surface.

VERTISOLS (V): Other soils which, after the upper 20 cm are mixed, have 30 percent or more clay in all horizons to at least 50 cm from the surface; at some period in most years have cracks at least 1 cm wide at a depth of 50 cm, unless irrigated, and have one or more of the following characteristics: gilgai microrelief, intersecting slickensides or wedge-shaped or parallelepiped structural aggregates at some depth between 25 and 100 cm from the surface.

3. Macroeconomic Trends of the Kagera River Basin

3.1 Introduction

The economies of the Kagera River basin countries are predominantly based on agriculture. According to the UN Human Development Report the four countries of Kagera River basin, Burundi, Rwanda, Tanzania and Uganda, were ranked in the last 30 of 173 countries of the World[25]. The general features of the macro-economy of the countries of Kagera Basin are marked by the following:

- Steady growth of economy
- Small size of the Gross National Product (GNP)
- Low Gross National Income per capita (GNI/capita)
- Predominance of the agricultural sector in the economy
- A slowly growing industrial sector
- A persistent deficit in the trade balance
- Lack of economic diversification
- High inflation rates

The recent economic growth of all of the four countries of the Kagera basin was due to several factors of different nature in each country. Positive factors that have influenced these economies include the following:

- Macro-economic policies that are promoting investment
- Medium and short term development plans that focus on poverty reduction and community participation
- Improved governance and political stability providing an enabling institutional framwork
- Favourable weather for agricultural production
- Increasing industrial and agricultural productivity and the evolution of regional markets

Factors that caused a negative impact on the economies include the following:

- Political and social crisis – from time-to-time - in all countries
- Unfavourable terms of trade
- Volatile agricultural prices
- Inadequate investment funds
- Insufficient participation of the private sector
- Insufficient information about local, regional and international markets
- Limitations in available technologies
- Limited personal savings

The economies of the countries of the basin have been growing, albeit it unequally, because of differences in geographic size, endowment of natural resources, investment capability, economic policies, governance and social stability.

In assessing the macro-economy and trends for the Kagera River basin, we have necessarily relied on country-wide economic data. Where basin-wide data are available, we have been able to assess more localized status and trends, and have done so wherever possible.

The following assessment has relied heavily on data available through the World Bank's *World Development Indicators* for the Kagera basin countries for the period 2000 to 2006.

[25] UNDP. 2006. Human Development Report.

3.2 Key indicators and trends

3.2.1 Key indicators

Relevant macro-economic indicators for the years 2000 and 2005 of the countries of the Kagera River basin are summarized in Table 3.1[26]. There are clear inequalities in the economies of the four countries, both in terms of gross domestic products and growth rates. These inequalities are a result of inequalities in natural resources endowment, different economic policies, political history and stability, and socio-economic crises in Burundi and Rwanda. For example, the GDP annual growth rates was 6% or above in 2005, except for Burundi where the growth rate was only 0.9%.

In 2005, the GDP of the countries of Kagera Basin differed in magnitude from country to country from USD 0.8 billion in Burundi to USD 12.1 billion in Tanzania. Tanzania had the highest GDP growth rate of 7%, while Burundi had the lowest rate of 0.9% per annum. The GNI per capita[27] in the countries of Kagera Basin varied from USD 124 in Burundi to USD 332 in Uganda.

In all the countries of the basin, there is a major contribution of the agricultural sector in the economy. During 2005, the proportion of the agricultural value in the GDP was 34.8% in Burundi, 42.3% in Rwanda, 44, 5% in Tanzania and 32.7% in Uganda. Industries contribute a small added value to the GDP in all the four countries. The contribution of the industrial sector in the GDP varied from 17.8% (Tanzania) and 24.8% (Uganda).

3.2.2 Economic Trends

Gross Domestic Product (GDP) and Gross National Income (GNI)

Overall, during the period 2000 to 2005, the total GDP grew in all Kagera River basin countries in all sectors (Figure 3.1). Agriculture is the most significant source of income, and can be expected to be an even higher proportion of the income in the Kagera basin region itself.

[26] Ref. The World Bank. April 2007. World Development Indicators database. http://go.worldbank.org/3JU2HA60D0

[27] The World Bank estimates different countries' Gross Domestic Product (GDP) and Gross National Income (GNI) per capita expressed in a common currency - usually the USD - for operational and analytical purposes. Gross National Income (GNI) is adopted in the System of National Accounts 1993 (93SNA) to replace the term Gross National Product (GNP), which was used in earlier versions of the SNA and in World Bank documents. (ref. http://go.worldbank.org/LZMNR5EI50 for more information on this subject and *the World Bank Atlas Method* etc.). The World Bank favours the Atlas method and the GNI for comparing the relative size of economies as it uses three-year average of exchange rates to smooth the effects of transitory exchange rate fluctuations. We have therefore adopted the GNI per capita in our macroeconomic comparisons within the Kagera River region.

Table 3.1 – Key Economic Indicators of the Kagera Basin Countries (2000 and 2005)

Economic Indicator	Burundi		Rwanda		Tanzania		Uganda	
Year:	2000	2005	2000	2005	2000	2005	2000	2005
Total population (million)	6.5	7.5	8.0	9.0	34.8	38.3	24.3	28.8
Population growth rate (%)	1.7	3.6	6.8	1.7	2.1	1.8	3.1	3.5
GDP (current US$ billion)	0.7	0.8	1.8	2.2	9.1	12.1	5.9	8.7
GDP growth rate (per annum)	-0.9	0.9	6.0	6.0	5.1	7.0	5.6	6.6
GNI, Atlas method (current US$ billion)	0.8	0.7	2.0	2.0	8.9	12.7	6.4	8.0
GNI per capita, Atlas method (US$)	124	97	250	222	256	332	263	278
Agricultural value (% GDP)	40.4	34.8	41.4	42.3	45.0	44.5	37.3	32.7
Industrial value (%GDP)	18.8	20.0	20.5	20.5	15.7	17.8	20.3	24.8
Services value (%GDP)	40.8	45.1	38.1	37.3	39.2	37.6	42.4	42.5
Agricultural gross value (US$ billion)	0.29	0.28	0.75	0.93	4.10	5.38	2.20	2.84
Industrial gross value (US$ billion)	0.13	0.16	0.37	0.45	1.43	2.15	1.20	2.16
Services gross value (US$ billion)	0.29	0.36	0.69	0.82	3.57	4.55	2.50	3.70
Export of goods and services (%GDP)	7.7	8.5	8.3	10.6	14.4	17.1	11.2	13.1
Import of goods and services (%GDP)	21.2	36.3	24.6	31.0	22.7	26.3	23.0	27.2
Inflation, GDP deflator (annual %)	13.2	16.7	3.3	7.1	7.5	3.7	3.8	7.8
Foreign direct invement, net inflows (BoP, current US$ million)	11.7	0.6	8.3	8.0	463.4	473.4	160.7	257.1
Long-term debt (DOD, current US$ billion)	1.0	1.2	1.1	1.4	5.8	6.2	3.1	4.3
Total debt service (% of exports of goods, services and income)	39.4	41.4	24.1	8.1	12.8	4.3	7.8	9.2
Official development assistance and official aid (current US$ million)	92.6	365.0	321.5	576.0	1,000.0	1,505.0	817.1	1,198.0

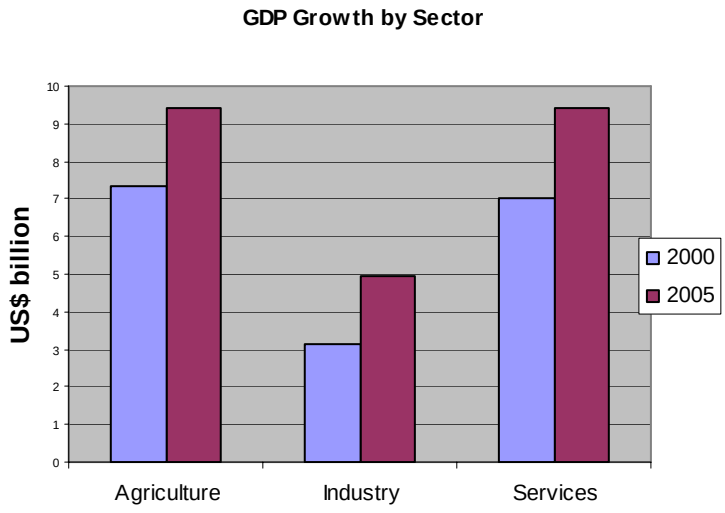


Figure 3.1 – Total GDP Growth by Sector – 2000 and 2005

The 2000 and 2005 GDP figures by country are shown in Figure 3.2 indicating the relative sizes of the economies of the four countries.

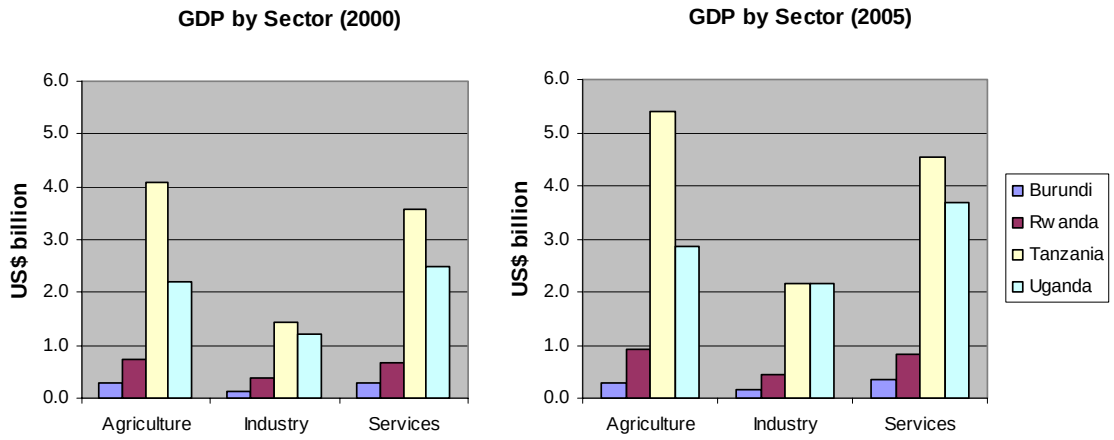


Figure 3.2 - GDP by sector – 2000 and 2005

The relative proportion of the GDP values in each country for 2000 and 2005 are shown in Figure 3.3 indicating maintenance of the overall relationships and proportions between these sectors during this period, but also indicating a slight shift from agriculture to service sectors in Rwanda and Uganda.

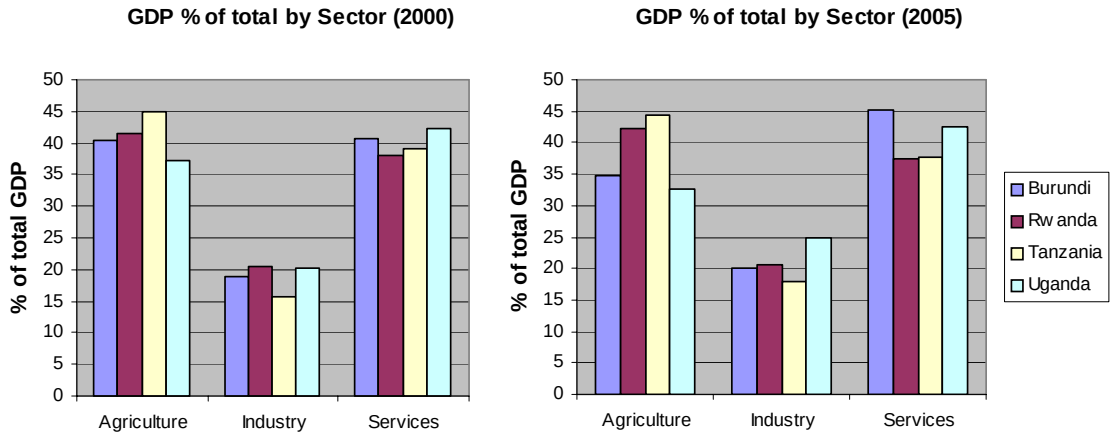


Figure 3.3 - GDP proportion by sector – 2000 and 2005

The annual GDP growth rates have shown different patterns in the four countries of Kagera Basin (Figure 3.4). From 2000 to 2002, all the countries showed an increase in their growth rates. While the growth rates dropped in all the four countries in 2003, a steady increase of the growth rates characterized the countries from 2003 to 2006, although the magnitude and variability differs from country to country. The drop of the GDP in 2003 was due to bad weather which caused a dramatic decrease of food and cash crop as well as agricultural revenues while there were some social crises in Burundi and Rwanda. Before 2002, Rwanda had the highest growth rates. Between 2003 and 2005, Tanzania had the highest growth rates, and reached 6.8% in 2005. From 2000 to 2005, Burundi had consistently the lowest growth rates of the four countries.

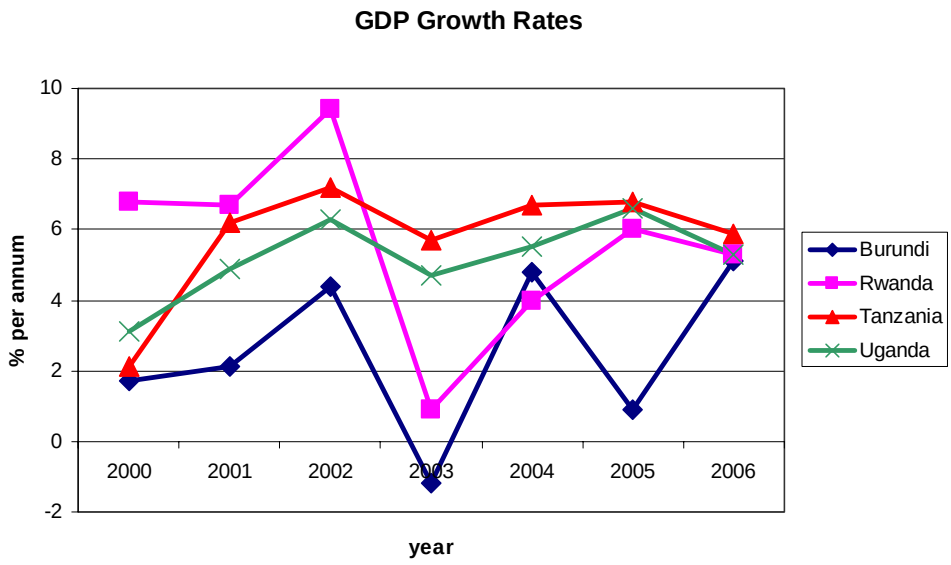


Figure 3.4 - GDP Growth Rates - 2000 to 2006

The GNI per capita for the four countries is presented in Figure 3.5. There has been a steady increase since 2003 albeit more slowly in Burundi.

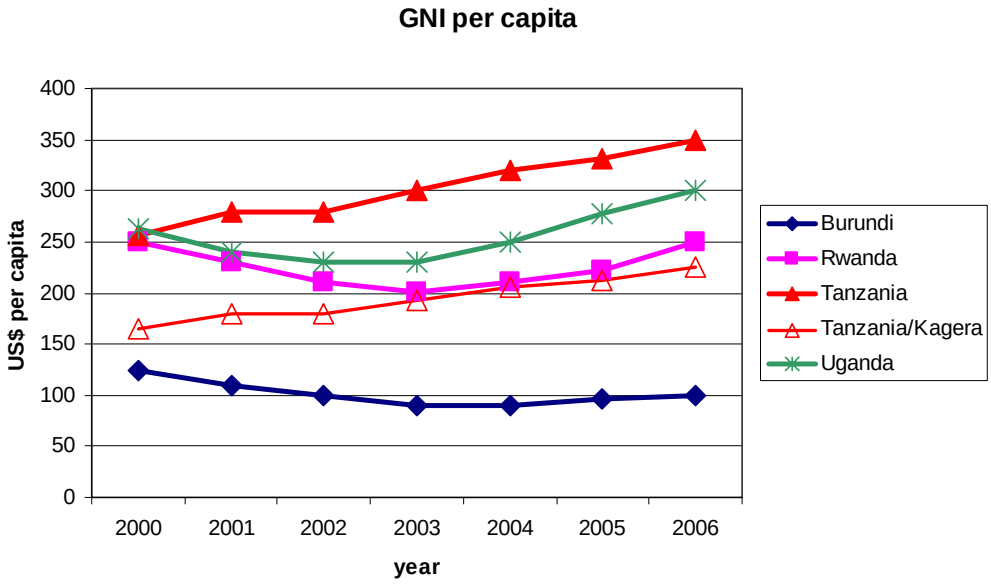


Figure 3.5 – GNI per capita – 2000 to 2006

For the countries of Burundi, Rwanda and Uganda, given our understanding of the relative socio-economic status of the portions of the basin in these countries relative to the countries as a whole, we believe the country GNI per capita values noted in Figure 3.5 are representative for the Kagera basin itself. However for Tanzania we have provided an estimate of the GNI per capita for the Kagera Region based on the available GDP per capita figures for this region (Table 3.2). These figures indicate growth from USD 114 in 1995 to USD 166 in 2001. During this period, the contribution of Kagera region averaged about 3.8% of the national GDP. In 2000 the comparable GDP per capita value for the Tanzanian Kagera Region was USD 175 while the National GDP of Tanzania was USD 273. From this we have made the assumption that the GNI per capita of the Kagera basin region of Tanzania is about 64% of the national value – bringing the values for the Kagera Region in Tanzania lower than the national values and closer to those of the other three basin countries.

Table 3.2 – Tanzania: Kagera Regional GDP per capita and contribution to national GDP (1995 - 2001)[28]

Year	Per capita GDP (USD)	Contribution to national GDP (%)
1995	114	3.80
1996	136	3.80
1997	156	3.81
1998	165	3.76
1999	166	3.75
2000	175	3.90
2001	166	3.80

Inflation

Review of the annual inflation figures (Figure 3.6) indicates that all basin countries suffer from relatively high and in some cases quite extreme fluctuations in annual inflation one year to the other. Factors that influenced an increasing inflation rate include food shortages due to bad weather, and increased price of fuels. The inflation rate was at times mitigated by monetary policies, especially in Uganda, and is relatively stable in Tanzania for the same reason.

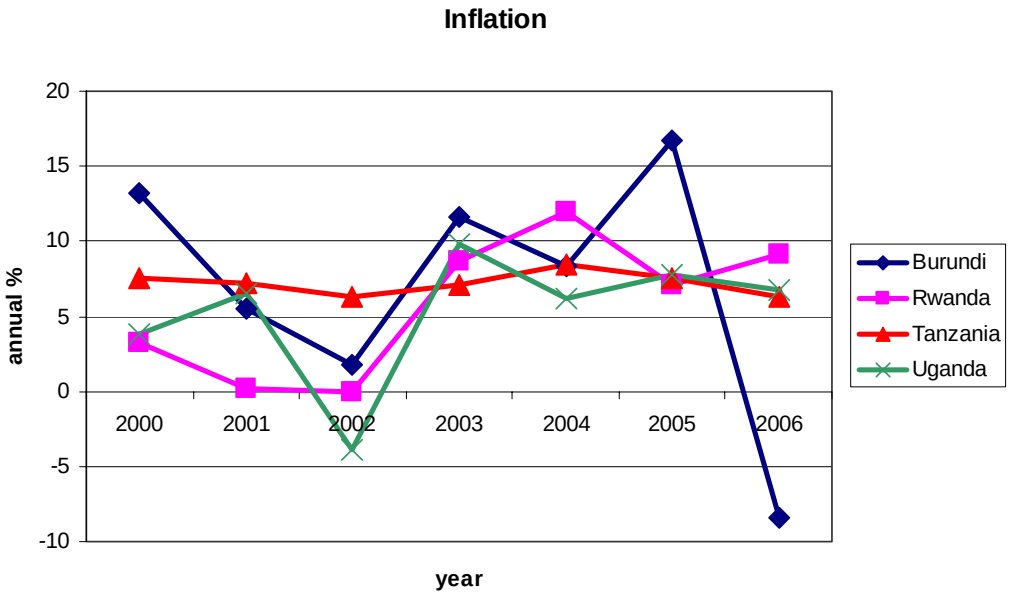
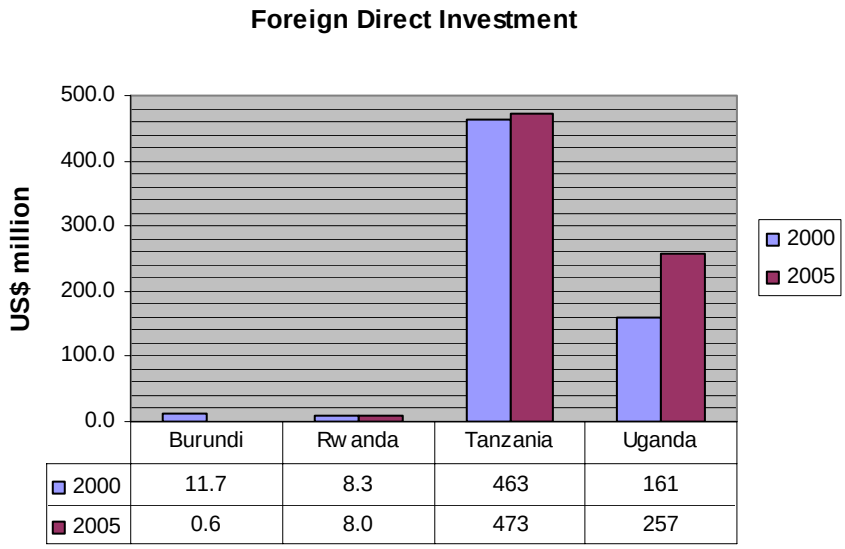


Figure 3.6 – Inflation - 2000 to 2006

[28] Sources: Kagera Region Socio Economic Profile. National Bureau of Statistics and Kagera Region Commissioner's Office.

Foreign Direct Investment

Foreign direct investment has decreased in Burundi, been stable in Rwanda and Tanzania and increased significantly in Uganda in the period 2000 to 2005 (Figure 3.7).



	Burundi	Rwanda	Tanzania	Uganda
2000	11.7	8.3	463	161
2005	0.6	8.0	473	257

Figure 3.7 – Foreign Direct Investment - 2000 and 2005

Official Development Assistance

Between 2000 and 2005, all the countries of the Kagera River basin benefited increasingly from substantial development assistance (Figure 3.8). All countries however claim that foreign support is still inadequate given their huge development needs.

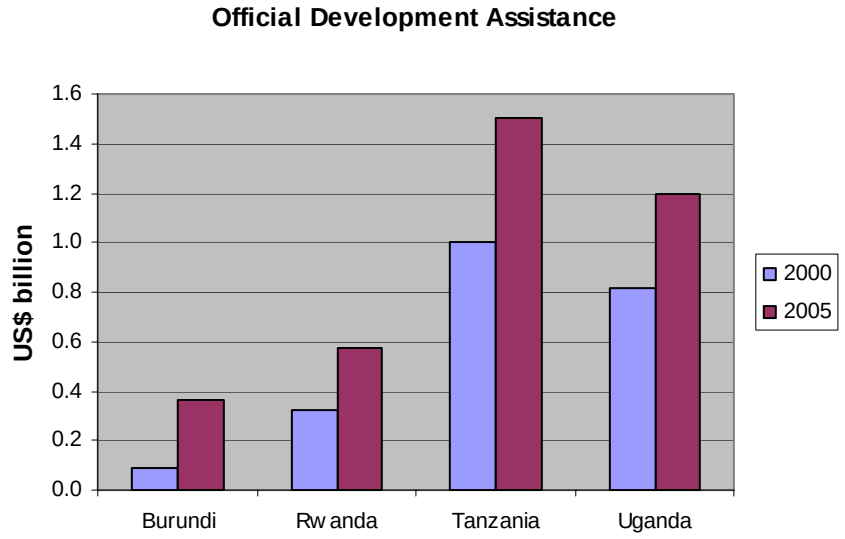


Figure 3.8 – Official Development Assistance – 2000 and 2005

Foreign Debt

Long-term debt has been increasing during the period 2000 to 2005. Total debt service as a proportion of exports of goods, services and income remains extraordinarily high in Burundi (ref. Figure 3.9). The countries of the Kagera River basin had overall about US dollars billion 12.9 long term debts in 2005. Long term debts increased in all the countries of the basin between 2000 and 2005. This is a heavy burden to the economies of the Kagera River basin countries and has a negative influence on the capacity to invest in new projects. The trends of the debt services of the Kagera countries behaved differently. The debt service increased in Burundi and Uganda between 2000 and 2005, while it decreased in Rwanda and Tanzania. The debt service decreased mainly because of debt relief accorded by donors to countries applying good governance and managing satisfactorily external funds. However the level of debt services is still highly alarming in Burundi where it reaches 41% of the exports of goods and services including external income.

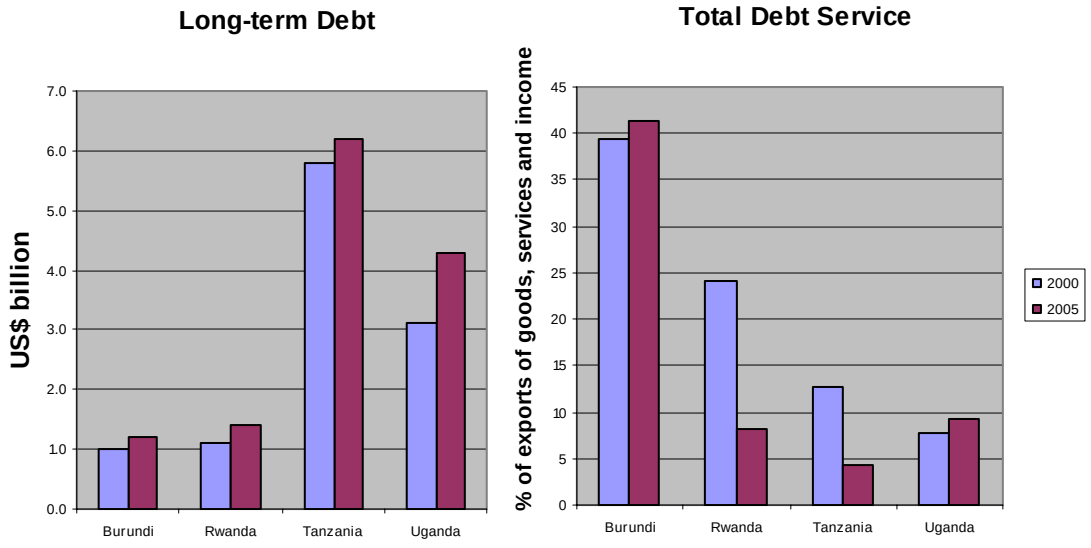


Figure 3.9 – Long-term Debt and Total Debt Service – 2000 and 2005

3.3 Manufacturing

During 2005, the manufacturing sector in the countries of Kagera River basin was rather weak and varied between 7.4% and 9% of the GDP. This level is comparable to the level attained by Sub-Sahara Africa which was 8.8% of the GDP during the same year. The trend of the manufacturing sub-sector between 2000 and 2005 declined in Burundi and Uganda and increased slightly in Tanzania while it remaining stagnant in Rwanda.

Reasons of a weak manufacturing sub-sector include lack of prioritization of manufacturing, inadequate capital, poor technology and insufficient human capacity and skills. There is a need to review sector prioritization and to promote entrepreneurship especially in the manufacturing sub-sector.

Table 3.3 - Indicators of performance of the manufacturing sector

Indicator	Year/Period	Burundi	Rwanda	Tanzania	Uganda	Sub-Saharan Africa	Developing Countries
MVA, average annual real growth rate (%)	1995-2000	0.6	6	5.4	13.2	3.2	4.8
	2000-2005	-2.6	5.2	8	4.8	3.6	5.2
Non-manufacturing GDP, average annual real growth rate (%)	1995-2000	-0.4	10.2	3.8	5.8	3.6	3.8
	2000-2005	3.2	5	6.6	5.8	4.4	4.6
MVA per capita (in constant 1995 US$)	1995	18	26	11	18	29	268
	2000	16	23	13	28	30	326
	2005	14	26	17	31	32	455
MVA as percentage of GDP (constant 1995 prices)	1995	10.6	10.2	6.6	6.2	9.2	21
	2000	10.8	8.6	7	8.4	9	22.4
	2005	9.4	8.6	7.4	8	8.8	23.8

Sources: Extracted from http://www.unido.org/en/doc/3474
MVA = manufacturing value added

3.4 Trade

3.4.1 Trade in the Kagera River basin region

Major exports of the countries of the Kagera basin consist of traditional exports, dominated by agricultural cash crop like coffee, tea, cotton and tobacco. Traditional exports make the majority of export proceeds in the four countries of the basin. Non traditional exports like manufactured products and services have started to increase. These include mining, fish and tourism products. Generally, the balance of trade is characterised by a persistent deficit in all the basin countries. The persistent deficits in trade-balance are a result of three main factors including the volatile prices of agricultural products, reliance on rain fed agriculture, lack of diversification of exports, and deteriorating terms of trade.

Inter-regional trade amongst the Kagera countries remains low and was less than 10% in the years 2000. In 2002, there was inter-trade between Burundi, Rwanda and Tanzania: Burundi imported 6% of its total imports from Tanzania and exported 7.1% of its total exports to Rwanda. Rwanda imported 6.4% of its total imports from Uganda in 2003.

The trade balance deficits will not improve unless these factors are mitigated. Initiatives for export diversification should be taken. These include production and trading of non traditional agricultural products such as plants and flowers, vegetables and fruits; and forest products like honey. Tourism expansion and export of handcrafts are other venues for exports diversification. Investing in mining has improved tremendously the export revenues of Tanzania, and this is an example of the kind of diversification to follow. However such diversification efforts require major changes in existing investment and trade policies.

The following figures summarize the overall trade balances (exports and imports) within the Kagera river basin countries by total values (Figure 3.10) and as a proportion of total GDP for the years 2000 and 2005 (Figure 3.11). These figures demonstrate the relative sizes of these economies and the fact that imports exceed exports in all cases.

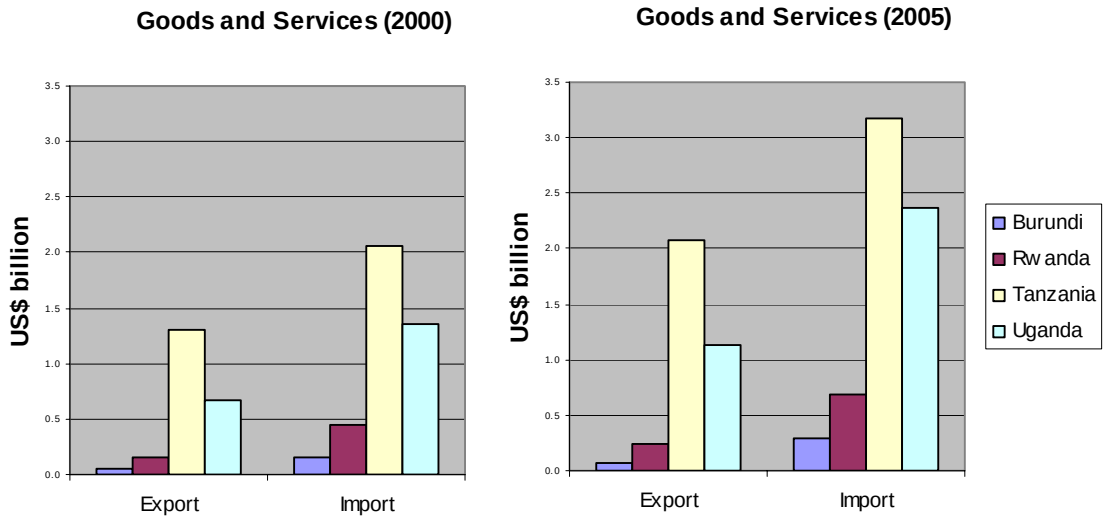


Figure 3.10 – Export and Import of Goods and Services – total values – for the Kagera River basin countries (2000 and 2005)

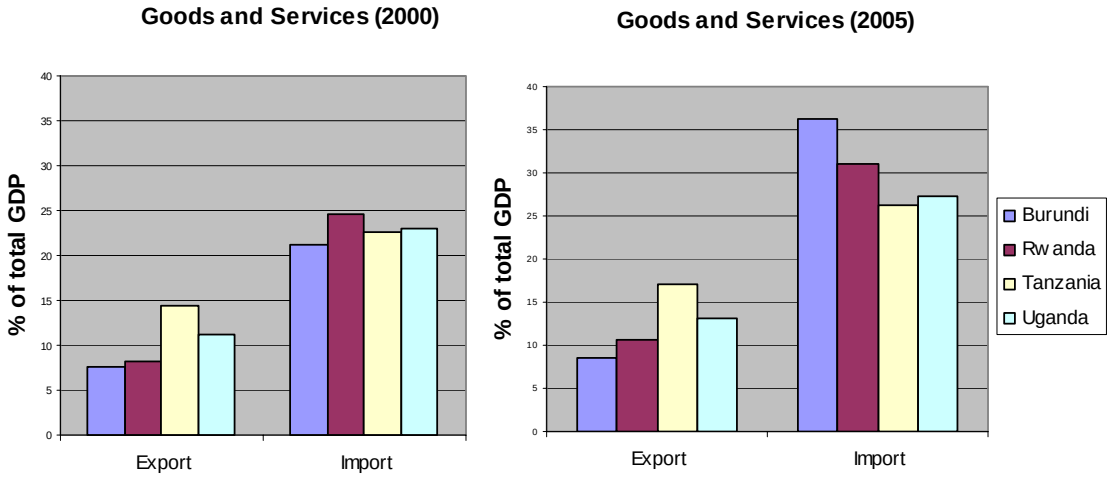


Figure 3.11 – Export and Import of Goods and Services as a percentage of national GDP for the Kagera River basin countries (2000 and 2005)

There are obvious benefits from international trade including the income growth of the people of the countries partners in trading. At national levels, national income increases with the growth of internal and external trade. Another notable benefit of trading is the transfer of technology. Trade serves as a conduct of transfer of technology as well as scientific knowledge, management skills and capital goods. The fact that all the countries of the Kagera basin imports capital and intermediate goods is health, because these goods will be integrated in the production processes, and such integration will result in increased production that will be translated ultimately into economic growth.

Internal trading is however still limited. To stimulate further economic growth and to promote increased wealth of the communities of the Kagera basin, trade within the countries of the basin should be intensified.

3.4.2 Trade in Burundi

Burundi exports the following products: coffee, tea, sugar, cotton, and hides. During 2006, the major export partners were Germany, Switzerland, Belgium, Rwanda and Italy.

Burundi imports the following items: capital goods, petroleum products, and foodstuffs. In 2006, the major import partners were Kenya, Italy Tanzania, Belgium, Uganda, France and India. It is important to note that Burundi trades with Uganda, Rwanda and Tanzania which are Kagera River basin countries. During 2006, Burundi imported 11.1% of its imports from Tanzania, and 5.6% from Uganda. During the same year, Burundi exported 5.5% of its total exports to Rwanda.

Burundi export performance depends heavily on the prices of coffee, its major export. The other exports include tea, sugar, and hides. Total exports were USD 42 million in 2001. Coffee, the major export product represents on average about 70% of all exports from 1995 to 2001. Export of ores and metals accounted for 9% of exports in 2001, manufactured goods for less than 1%. The current balance deficit of Burundi increased from 12.2% of the GDP in 1998 to 15.7% of the GDP in 2002. In 2005, the export of goods and services amounted to 13.1% of the GDP. Imports were 27.2% of the GDP.

3.4.3 Trade in Rwanda

Rwanda exports the following products: coffee, tea, hides, and tin ore. In 2006, its major export partners were China, Germany, and the USA. Rwanda imports the following items: foodstuffs, machinery and equipment, steel, petroleum products, cement and construction material. In 2006, Rwanda imported mainly from Kenya, Germany, Uganda, and Belgium. Rwanda traded imported from Uganda 6.9% of its total exports in 2006.

Rwanda produces and exports quality coffee and tea. Another cash crop that is grown in Rwanda is pyrethrum that is used to produce insecticides. Tea and coffee represent more than 50% of its exports. However, it is a net importer of food. In 2002, cereals, vegetables, oil, sugar, and dairy products accounted for 16.3% of its imports. The mining sector represents only 0.2% and is not significant. The industrial sector represented only 8.6% of the GDP in 2002. The service sector represents 45% of the GDP in 2002. The service sector in Rwanda is characterized by a dominant wholesale and retail sale trade sub sectors. In 2005, exports accounted for 10.6% of the GDP, and imports 31%.

3.4.4 Trade in Tanzania

Tanzania exports the following

- Traditional goods: coffee, cotton, sisal, tea, tobacco, cashew nuts and cloves
- Minerals: gold, diamond, other minerals
- Manufactured goods: cotton yarns, manufactured coffee, manufactured tobacco, sisal products and other manufactured goods
- Fish and fish products
- Horticultural products
- Services exports: transport, travel and other services

Of the Tanzania exports, a proportion of products originate from Kagera basin including coffee, tea and gold.

Tanzania imports the following:

- Capital goods: transport equipment, construction equipment, machinery
- Intermediate goods: oil
- Consumers' goods: food and beverages

Some of the goods are imported to the Kagera basin region. They include road construction equipments, agricultural inputs and spare parts and machinery for coffee and tea industries in Kagera region.

Tanzania exports mainly to South Africa, Kenya, Uganda, Zambia, Malawi, and Comoro. Exports to Burundi and Rwanda were respectively USD 3.2 million and USD 2.9 million during 2006. Tanzania exported goods worth USD 22 million during the same year. Other export partners are China, India, the Netherlands, Japan, and Germany. Imports to Tanzania originate from the following countries: South Africa, China, Kenya, India, the UAE, and the USA.

Trade in Tanzania is characterised by two features. One is the increasing capacity to finance import bills. The other is the decline of the traditional exports to the total exports. The capacity to finance import bills increased from 24% in 1990 to 57% in 2002, and 63% in 2005. The share of traditional exports to the total exports declined from above 50% in 1990s to about 20% in 2002. This shows that the diversification process in the structure of exports from that dominated by traditional exports to one marked by non-traditional exports has started. A vivid example is the increasing contribution of fish, minerals and few industrial products in the total exports.

As far as the Tanzania trade balance is concerned, there is a persistent trade deficit, a domination of primary goods in the export basket and the domination of industrial goods in the import basket.

In 2005, the export of goods and services amounted to 17.1% of the GDP. The contribution of imports to the GDP was 26.3%.

3.4.5 Trade in Uganda

Uganda exports the following commodities: coffee, fish and fish products, tea, cotton, flowers, horticultural products and gold. Its major export partners are Belgium, Netherlands, France, Germany, Rwanda and Sudan. Uganda imports the following goods: capital equipment, vehicles, petroleum, medical supplies, and cereals. Its important export partners are Kenya, UAE, China, India, South Africa and Japan. In 2006, Uganda exported 5.5% of its total exports to Rwanda.

Uganda's main imports include machinery and transport equipment, food products, fuel and chemicals. The contribution of fuel in the total imports increased regularly because of the increasing fuel cost on the world market. Chemicals weighed heavily in the import bill because of the high requirement of medicinal products.

Uganda has traditionally experienced a trade deficit because of the deterioration of the external terms of trade. Export earnings declined from 11.2% of GDP in 1994/95 to 9.5% of GDP in 2003/2004. Imports have been increasing and this has resulted in widening of the trade balance. Traditional exports from Uganda included coffee, cotton, tea and tobacco. A diversification of exports resulted in dropping of earnings from coffee from 76% of total exports in 1976 to 57% of total exports in 2003. By contrast, the contribution of non-traditional exports made an upward trend. Overall, agriculture still account for 90% of Uganda exports. Non traditional exports consist of floricultural products, fruits, vegetables, fish and fish products. During 2005, imports represented 27.2% of the GDP, while exports were only 13.1%.

3.5 Water and Poverty

The UN Human Development Report (2006) summarizes the global problem of water as follows:

“Obviously people need water as surely as they need oxygen: without it life could not exist. But water gives also life in a far broader sense. People need clean water and sanitation to sustain their health and maintain their dignity. But beyond the household, water also sustain ecological systems and provide inputs into production systems that maintain livelihood.”

Water runs through and sustains all life and human activity. Without reliable access to enough water, social and economic development cannot occur. The world has united to combat the scourge of poverty through the UN Millennium Declaration and the consensus reached at the World Summit on Sustainable Development (WSSD) which together place poverty reduction at the top of the international development agenda, presenting a challenge to all sectors to define how they can contribute to this goal. For those of us interested in water, it raises the key issue of what contribution the management of water resources can make to poverty reduction.

Our basic assumption is that water resources are important to the poor – no less so in the Kagera River basin. A review of the Millennium Development Goals (MDGs) shows that the achievement of most of them will have to be underpinned by improvements in water management and development in one way or another. The extent to which it is linked varies from place to place, but poor people depend upon water resources in four ways (ADB, 2003):

1. Water resources are direct inputs to ***production***. Agriculture is the most obvious, and the viability of agriculture is closely linked to reliable access to water. However, there are many other areas of production including fishing; tree and garden cultivation around homesteads; livestock raising; small-scale manufacturing such as pottery, brick making, and tanning; services such as laundering; and others. Water is also vital for many types of manufacturing and other larger economic activities that provide employment for poor people, particularly in cities. The poor often rely on these non-land-based production activities to give essential diversity to their livelihoods and to overcome their lack of assets, such as land.

2. Water resources are a basis for the ***health and welfare*** of the poor, especially of vulnerable groups such as children, the elderly, and women in general. Both the quality and the quantity of water greatly matter in this, and safe and adequate quantities of water are recognized as a precondition for an acceptable standard of development. The UN Millennium Declaration defines a target of halving, by 2015, the proportion of people living in extreme poverty and halving the proportion of people who suffer from hunger and cannot access or afford safe drinking water. A similar target has been agreed upon for sanitation. This is one of the most obvious areas where gender perspectives are of particular importance, as women are the providers of water in the home.

3. Water resources are critical to the viability of the ***ecosystems*** through which the poor gain access to the natural resources that are the basis of many aspects of their livelihoods. Even where water is not a direct input into production, other natural resources (such as forestry, fishing, or grazing) that are contingent on the viability of ecosystem processes depend on the flows of water through these systems. For example, naturally occurring annual floods provide low-cost protein, an important input into the livelihoods of the poor.

4. Water, when there is too much or too little, may also affect the poor, as they are the most vulnerable to ***water-related hazards,*** such as extreme floods, droughts, major storms, landslides, and pollution. This vulnerability can undermine any effort to break the poverty trap and can even cast the not-so-poor into poverty and destroy the basis of their livelihoods through a cataclysm. Low resilience to these water-related vulnerabilities is a defining characteristic of poverty where these threats exist. And it appears such risks may be exacerbated – especially for the poort - with the advent of climate change.

   The need to improve the contribution of water management to economic development and poverty reduction means that there is a need for actions that make water more accessible to poor people. Six key areas have been identified as a framework for action to improve water security for the poor (ref. ADB, 2003):

5. ***Pro-Poor Water Governance.*** Strengthen pro-poor water governance through water policies, laws, action agendas, and better information management. Introduce pro-poor safeguards in integrated water resources management, improve stakeholder consultation and participation, mainstream gender, and empower political support for women to improve water management. Increase public awareness and political support for the water security needs of the poor. In the case of the Kagera River basin, the cooperative framework being established under the Nile Basin Initiative and the Kagera Transboundary Water Resources Management and Development Project are encouraging steps in this direction.
6. ***Improved Access to Quality Water Services.*** Increase the access of the poor to water services: drinking water supply (with hygiene and sanitation), irrigation and drainage, and other areas. Put people at the centre of viable and affordable services, mobilize funds from all sources, increase public awareness, and improve the accountability of service providers. Section 10 of this report attempts to describe a scenario where important progress would be made in this area.
7. ***Pro-poor Economic Growth and Livelihood Improvement.*** Increase investments in agriculture, rural development, and other water-using sectors that generate direct income for poor communities. Strengthen the asset base of the poor and help develop sustainable livelihood diversification opportunities.
8. ***Community Capacity Building and Empowerment.*** Invest in capacity building in poor communities to help them improve the management of their water resources, negotiate better access to water services, and improve their livelihoods through income-generating activities. Ensure gender equity in water management.
9. ***Disaster Prevention and Mitigation.*** Improve the resilience of the poor to water-related disasters through better forecasting, as well as relief and recovery systems, including both structural and non-structural investments in prevention, adaptation, and mitigation interventions. The impacts of man-induced climate change require a IWRM approach to ensuring appropriate mitigation and adaptation plans and mechanisms are put in place.
10. ***Management of the Environment.*** Introduce sustainable natural resource management arrangements with the participation of the poor, particularly in the upper watersheds, wetlands, and other common property resources.

The assessment of *beneficial uses* carried out in this report and the presentation of a *development scenario* (ref. Section 15) puts forward initial views on how water and the related resources of the Kagera River basin could be managed and developed in a manner which enables regional poverty reduction. The concept of a ***Water Poverty Index*** integrating the various components linking water and poverty is discussed in Section 15.2.4.

3.6 Conclusions

The economies of the countries of Kagera River basin all show a growing trend. However the growth of these economies shows inequalities among the countries of the Basin. In 2005, based on the growth rates, the Tanzanian economy was stronger followed by Uganda and Rwanda. The economy of Burundi was the weakest.

The growth rates of the country economies varied between 6% and 12% per annum in 2005, except for Burundi (0.9%). These are promising rates for the future of the basin if they are sustained. The socio-economic and political challenges of Burundi is the main cause of its economic retardation. However, signs are there to indicate the beginning of a steady growing economy.

The Kagera River basin economies are based mainly on agriculture and, in light of continued high populations densities and growth rates, are unsustainable without diversification. Efforts to diversify the economies and to make them less dependent on traditional cash crops like coffee, tea and cotton, are obvious in all the countries of the basin. Other ventures to diversify the economies are being explored. They include mining, tourism, services and production of non-traditional products.

External trade of the countries of the basin has been characterized by persistent commercial trade deficits resulting from heavy imports of manufactured goods and insufficient exports of traditional goods.

The picture of this promising economy is due to many factors, the most important of which are certainly the availability of natural resources, improving economic policies, planning focussed on poverty reduction, improving governance and external financing.

The positive factors that have influenced economic growth should be sustained to ensure steady growth. The demonstrated links between water management and development and economic development and poverty reduction mean that there is a need for actions that make water more accessible to poor people. The evolution of an effective transboundary cooperation framework in the Kagera Basin is one of the factors that could influence economic sustainability.

3.7 Recommendations

It is recommended to develop a common methodology for collection, processing , analysing and updating information on social and economic aspects of the countries of Kagera River basin in order to ensure consistency when dealing with data and information related to basin development.

It is recommended to establish a base line of major social and economic aspects, using an agreed methodology that will be followed to update socio-economic information and to ensure a proper follow up of development initiatives in the countries of Kagera River basin.