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NBI Technical Reports: Wetlands and Biodiversity Series

# Nile Basin Wetlands TEEB Synthesis Report

WRM/WBS-2020-08

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
of the Federal Republic of Germany

## Document Sheet

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The purpose of the technical report series is to support informed stakeholder dialogue and decision making in order to achieve sustainable socio-economic development through equitable utilization of, and benefit from, the shared Nile Basin water resources.

| **Document** | |
|---|---|
| Citation | NBI Technical Reports- WRM /WBS -2020 - 08 Nile Basin Wetlands TEEB Synthesis Report |
| Title | Nile Basin Wetlands TEEB Synthesis Report |
| Series Number | Wetlands and Biodiversity Series 2020-08 |
| | |
| **Responsible and Review** | |
| Responsible NBI Center | Nile-Secretariat |
| Responsible NBI | Dr. Abdulkarim Seid and Mr. Leonard Akwany |
| Document Review Process | Nile Basin Initiative Wetlands Task Team and Lead Consultants (November 2020) |
| Final Version endorsed | Nile Basin Initiative Wetlands Task Team and Lead Consultants (November 2020) |
| | |
| **Author / Consultant** | |
| Consultant Firm | Individual Consultants |
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| | |
| Project | |
| Funding Source | German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) |
| Project Name | Biodiversity Conservation and Sustainable Utilization of Ecosystem Services of Wetlands of Transboundary Relevance in the Nile Basin |
| Project Number | Please confirm this |

# Executive summary

This document is a **synthesis report of the Nile basin wetland TEEB**. "TEEB" stands for The Economics of Ecosystems and Biodiversity: a global initiative seeking to mainstream the value of biodiversity and ecosystem services into decision-making at all levels. The Nile Basin Wetlands TEEB study is coordinated by the Nile Basin Initiative (NBI.

The report seeks to **bring wetland ecosystem services values to the attention of river basin planners and managers**, and to thereby promote better-informed, more effective, inclusive, equitable and sustainable conservation and development decision-making in the Nile River Basin.

Currently, **wetland ecosystem services are undervalued in decision-making** in the Nile Basin. Not only does this encourage policies and plans that lead to wetland degradation and loss (thereby causing costs, damages and losses by undermining the provision of economically-valuable ecosystem services), but it also leads to missed economic and development opportunities (by overlooking the contribution that wetlands make to water-related and other ecosystem services).

The Nile Basin TEEB synthesis report has two components. The first component of this report is concerned with **reviewing the existing knowledge base on wetland ecosystem values, the Nile basin economies, wetland ecosystems, examples of wetland case studies in the Nile basin, identifying key river basin planning and management priorities where valuation could play a key role in guiding or informing decision-making, and thus defining the purpose, focus, approach and methodology** of the Nile Basin Wetlands TEEB study.

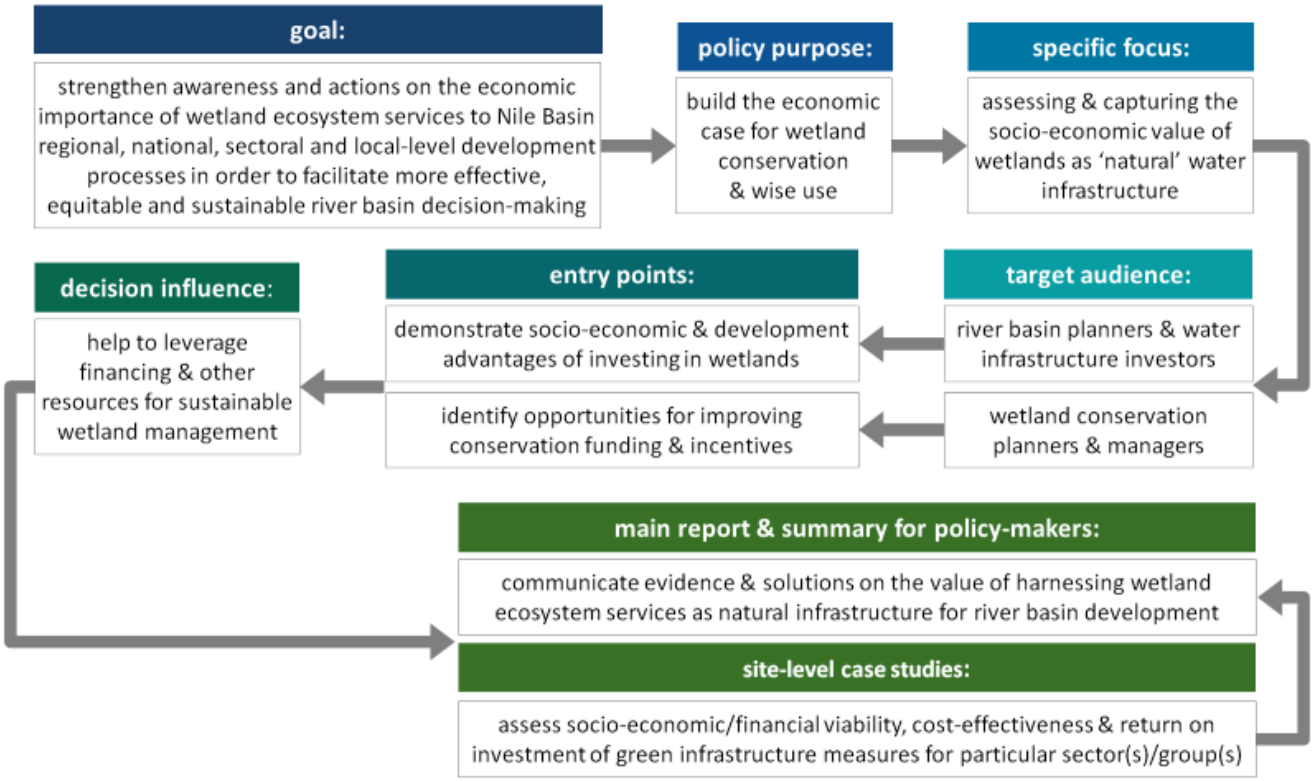
The scoping of research and knowledge repositories found that there is already a **fairly sizeable and growing literature on wetland (and other related) ecosystem values in Nile Basin countries.** In excess of 300 published documents and research articles on ecosystem services valuation were identified, covering all of the riparian countries. More than two thirds refer to water-based ecosystems, including freshwater wetlands, coastal and marine systems, and watersheds.

Yet, although incorporating a wide range of wetland types, the **geographical distribution of the studies is patchy**. The vast majority refer to Kenya, Tanzania and Uganda. Only a handful of studies have been carried out in Egypt, Sudan or (especially) Burundi, Democratic Republic of Congo, Eritrea and South Sudan, and very few investigate transboundary, regional or multi-country ecosystems. Wetland valuation is also **constrained by a lack of biophysical data, and limited technical capacity**.

Perhaps most seriously, the **decision-making influence, impact and uptake of ecosystem services valuation studies also remains very limited**. There is as yet little evidence and few documented examples of the findings of valuation studies actually being acted on by decision-makers in the agencies, sectors and industries that depend and impact most on wetland and water ecosystem services.

The Nile Basin Wetlands TEEB study **was initiated to play a key role in overcoming these information gaps**, including expanding the regional coverage and biophysical/socioeconomic evidence base on wetland values and – importantly – providing practical, policy relevant and management-oriented advice to river basin planning and wetland decision-makers.

To these ends, based on an assessment of decision-making needs and priorities for Nile River basin planning and guided by the NBI Regional Wetlands Expert Working Group, and a regional Expert Panel on Ecosystem Valuation convened specifically to support the TEEB process, the **broad architecture for the study was developed and presented in the following figure.**




The goal of the Nile Basin Wetlands TEEB study is to **strengthen awareness and actions on the economic importance of wetland ecosystem services** to Nile Basin regional, national, sectoral and local-level development processes in order to facilitate more effective, equitable and sustainable river basin decision-making.

It serves the policy and practical purpose of building the economic case for wetland conservation and wise use, and has a **specific focus on assessing and capturing the socio-economic value of wetlands as 'natural' water infrastructure**. The first target audience is **river basin planners and water infrastructure investors**. The entry point is to demonstrate the socio-economic and development advantages of investing in wetlands. The second target audience is **wetland conservation planners and managers**. The entry point is to identify opportunities for improving conservation funding and incentives.

Overall, for both target audiences, the **intended area of decision influence is to help to leverage financing and other resources for sustainable wetland management.**

The second component of the TEEB synthesis report 'the main TEEB study' is based on a **series of site-level economic valuation case studies** in priority Nile Basin wetlands. These seek to assess the socio-economic and financial viability, cost-effectiveness and return on investment of green infrastructure measures for potential stakeholders at the selected sites. The main goal is to support wetland conservation measures, management plan and development options to enhance wetland ecosystem services benefits related to food access, regulation of micro climate, energy security, social and economic values, and sustainable society, environment and economy.

**The Nile Basin Wetlands TEEB synthesis report consolidate the Nile basin wetland case studies in order to support wetland policy and planning, and point to economic solutions and instruments** that can be used to capture wetland ecosystem values in support of more effective, equitable and sustainable river basin development, particularly by considering the economic case for wetlands conservation and wise use through investments on wetlands management plan as well as assessment of wetlands development options.

## Key Messages

- The wetland areas in the Nile basin are one of the most degraded parts of the Nile, which covers 5% of the basin and vulnerable to various problems, such as infrastructure development close to water resources, conversion to agricultural land, increasing population, overexploitation of wetland resources, expansion of invasive species, extraction of minerals and oil, and climate change.

- The Nile Basin wetlands TEEB study seeks to bring wetland ecosystem values to the attention of river basin planners and managers, and to thereby promote better-informed, more effective, inclusive, equitable and sustainable conservation and development decision-making in the Nile River Basin.

- The review of literature and knowledge gaps makes it clear that there is a fairly sizeable and growing literature on wetland (and other) ecosystem values in Nile Basin countries. Most of the ecosystem valuation approaches and techniques that are commonly used in other parts of the world are also being applied in the region.

- Although the overall scope and coverage of the ecosystem valuation studies and literatures are fairly good as regards different biomes, wetland types, ecosystem services and valuation techniques, their geographical spread remains very uneven in the Nile basin.

- Wetland valuation also appears to be seriously constrained by a lack of data. This, coupled with often limited technical capacity, training and experience in ecosystem valuation, has often resulted in incomplete, unreliable (or in the worst case biased) value estimates.

- The major challenges to manage wetlands sustainably is that wetland users and decision-makers have insufficient understanding of the consequences of alternative management and policy regimes on wetland functioning, ecosystem services and human well-being.

- To reap the optimal benefit from the wetlands while ensuring their sustainability at the same time, better to conserve them earlier than trying to restore them after more damage has occurred to them. In this regard, the preparation and implementation of wetland management plans is instrumental not only in protecting the wetlands but also creates new opportunities from the preservation of them.

- An effective wetland management plan provides a crucial basis for maintaining the biological characteristics of a wetland, a dynamic ecosystem, and allowing to use resources economically. However, this could be possible if proper procedure is followed in the preparation of the plans.

- The wetland management plans should include the description of the study site, the evaluation of the status and threats to the wetland, management goals and strategy, operational action plan, annual work plan, and budget requirement for each operational action plan. Transparency has to be ensured through the engagement of all stakeholders including the local communities. The stakeholder engagement is also vital in mitigating the inadequate funding for implementation of the conservation and management goals.

- For wetlands of transboundary nature in the basin, the focus should be on an integrated wetland conservation plan than a standalone conservation plan. That is, by focusing on integrated planning, it enables the plan to bridge different agency programs and geographic boundaries, maximize areas of

expertise, build collaborative partnerships, and organize multi-objective visions while building consensus. Moreover, collaboration among two or more countries is also needed to facilitate inter-agency communication for integrated efforts to incorporate wetland elements into their existing planning framework.

- The sustainable development and management of wetlands requires that development options for wetlands should be an integral part of the overall development interventions of the countries.

- The sustainable development option for the wetlands also requires green infrastructure planning where any infrastructural planning and investment should be dealt without compromising the integrity of the wetlands and their ecosystem services which are the basis for the livelihood of the local communities and beyond.

- Accounting for the economic value of wetlands ecosystem servicers as well as total costs and benefits of development scenarios, before proposing any development option, is important for coming up with plausible wetland development options.

# Table of contents

# List of boxes



# List of figures



# List of tables

# List of acronyms

| | |
|---|---|
| BMUB | German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety |
| GDP | Gross domestic product |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit (German International Development Cooperation) |
| HDI | Human development index |
| IKI | International Climate Initiative |
| NBI | Nile Basin Initiative |
| PPP | Purchasing power parity |
| TEEB | The Economics of Ecosystems and Biodiversity |
| TEV | Total Economic Value |

# 1. Introduction

The concept of ecosystem services has become of considerable interest to both environment and development policy communities at local, national, regional and international scales especially since 2005 following the publication of the Millennium Ecosystem Assessment (MA)(MA 2005); 18 of the 24 ecosystem services assessed in the MA study were found to be deteriorating. Wetland is one of them. Although globally wetlands provide services estimated to be worth US$4.9 trillion annually (Ramsar 1971), the earth wetland coverage decreased by 50% since 1900.. Wetlands provide multiple direct ecosystem services, for example food, grazing land and fish for poor who lives in the surroundings. So as to eradicate poverty and to conserve the ecosystem many countries draw different strategies to conserve wetland and most of them sign the Ramsar agreement (Ramsar 2011). Similarly, ecosystem degradation currently taking place in Africa (AEO 2013) is comparable to that which took place during the industrial revolution of the 19th century in Europe (Gafta & Akeroyd 2006). Wetlands degradation is also one of the major causes for ecosystems deprivation. The poor, who are relatively highly dependent on wetlands ecosystem services, were found to be disproportionately affected compared to the non-poor. Because wetlands provide multiple benefits of ecosystems that many of the locals in developing countries rely on for their livelihoods (Turyahabwe & Johnny 2013). Although interventions to restore wetlands ecosystem were not designed as poverty reduction mechanism but primarily as means of improving natural resource management, proponents argue that interventions to improve wetlands degradation can improve the welfare of the poor through the provision of in-cash or in-kind flow (by participating in conservation efforts and practices), and as a means of household income diversification and create incentive for continued benefits (Kakuru *et al.* 2013; Mulatu 2014).

Wetlands have multidimensional contribution for the ecosystems. While covering only 6% of the Earth's surface, wetlands provide a significant number of ecosystem services and amongst the Earth's most productive ecosystems (Cherry 20011), providing divers array of important ecological functions and services, ranging from flood control and flow control to ground water recharge and discharge, water quality maintenance, habitat and nursery for plant and animal species, biodiversity, carbon sequestration and other life support function (Birol *et al.* 2006). Wetlands provides provisioning, regulating, supporting and cultural ecosystem services, notably related to tourism, recreation, and research (Smakhtin 2012; Mitsch & Gosselink 2015). However, in contrast to their international importance, many wetlands have been treated as wasteland and drained or otherwise degraded (Barbier. E.B *et al.* 1997; Zedler & Kercher 2005). Note that the major challenges to manage wetlands sustainably is that wetland users and decision-makers have insufficient understanding of the consequences of alternative management and policy regimes on wetland functioning, ecosystem services and human well-being (Jogo & Hassan 2010).

According to wetland international[1] report, currently about 131 million hectares of the African continent is covered by wetland areas and about 18.3 million hectares of wetland area is located in the Nile Basin. Wetlands in different Nile basin countries have significant role for the hydrology of Nile River and the global community as well (Lisa-Maria & Matthew 2012). Despite the fact that Nile has productive ecosystem, the Nile's land and water are underutilized and degraded at an alarming rate. The wetland areas in the basin are one of the most degraded parts of the Nile, which covers 5% of the basin and vulnerable to various problems, such as infrastructure development close to water resources, conversion to agricultural land, increasing population, overexploitation of

[1] http//www.africa.archive.wetlands.org

wetland resources, expansion of invasive species, extraction of minerals and oil, and climate change. However, these wetlands' have important role on sustaining the livelihood of million households by furnishing provisioning ecosystem services. Currently, wetland ecosystem services are undervalued in decision-making in the Nile Basin. Not only does this encourage policies and plans that lead to wetland degradation and loss (thereby causing costs, damages and losses by undermining the provision of economically-valuable ecosystem services), but it also leads to missed economic and development opportunities (by overlooking the contribution that wetlands make to water-related and other ecosystem services). Research works are also limited on the current ecological benefits of the wetland, current wetlands' degradation level and alternative way of intervention to restore the wetlands (Wood 2000; Teferi *et al.* 2010). Therefore, conducting economic valuation of biodiversity and ecosystem services to inform potential wetlands development options is vital for better understanding of sustainable wetland management in Nile Basin (Smakhtin 2012).

## Why look at the economics of ecosystems and biodiversity in the Nile Basin?

The Nile Basin accounts for an enormous physical area, a substantial population and has an exceptionally rich natural resource base – as well as containing some of the poorest human communities and most fragile ecosystems on earth. Natural, social and economic processes across the eleven riparian countries of Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania and Uganda (Figure 1) are variously enabled or hindered by water resource availability and access. In the face of a rapidly growing population, progressive urbanisation and industrialisation, increasing market integration and steeply rising needs for food, energy and raw materials, massive questions remain about how best to use and manage the river basin and its water resources.

Natural ecosystems, particularly wetlands, play a central role in the functioning of this massive water economy (and the people and industries that are involved in it). From an economic perspective, they form a key part of 'natural' water infrastructure in the Nile Basin – the stock of equipment, facilities and services that is required for the region's societies and economies to survive, grow and prosper (Emerton and Bos 2004). Wetland ecosystem services, "the benefits people obtain from ecosystems" (Millennium Ecosystem Assessment 2005a), range from water storage, flow and quality regulation, through watershed protection, drought mitigation, flood control and disaster risk reduction, to the generation of a wide range of goods and services, products and raw materials that underpin local livelihoods, large-scale industrial production and even international trade flows.

Yet, paradoxically, both economists and water planners have long been perceived natural ecosystems as having little value. Calculations of the returns to different land, resource and investment options in river basins have for the most part failed to take account of ecosystem costs and benefits. It is therefore perhaps hardly surprising that, across the Nile Basin, wetlands and other natural ecosystems have long been modified, converted, over-exploited and degraded in the interests of other more 'productive' alternatives which appear to yield much higher and more immediate profits. Experience shows that such omissions have however often proved extremely costly, because they result in huge losses, damages and missed opportunities due to the loss of these vital ecosystem, services – for water investors and river basin managers, as well as for the industries and households that depend on clean and regular water supplies. For the most part, the calculations that underpin water management and river basin development decisions therefore remain fundamentally incomplete – and potentially misleading in their conclusions and recommendations to decision-makers.

In reality, the problem is not that water-related ecosystems have no economic value, but rather that this value is poorly understood, rarely articulated, and as a result is frequently omitted from decision-making (Emerton 2007,

2009). In turn, economic valuation can provide a powerful tool for placing ecosystems on the agenda of river basin planners – and, in consequence, for helping to promote better-informed and more inclusive conservation and development decisions and outcomes. It is against this background that the current study is taking place. The Nile Basin Wetlands TEEB seeks to improve and correct the calculations that guide and inform river basin planning in the Nile Basin, by explaining and articulating the economic value of wetland ecosystem services and their role in effective, equitable and sustainable growth at local, national and basin-wide levels.


Figure 1: Nile Basin countries

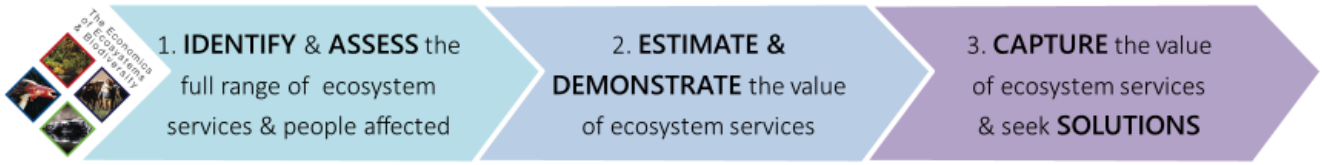
*Source: NBI 2016*

## What is TEEB – The Economics of Ecosystems and Biodiversity?

The Economics of Ecosystems and Biodiversity (TEEB) is a global initiative focused on "making nature's values visible" (TEEB 2008). Its principal objective is to mainstream the value of biodiversity and ecosystem services into decision-making at all levels. It proposes a structured approach to valuation that helps decision-makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms and, where appropriate, capture those values in decision-making.

While TEEB is not a new approach – it primarily serves to synthesise and bring together others' work and insights into a consolidated framework – it represents an important effort to target work on biodiversity and ecosystem valuation towards on-the-ground decision-making needs and challenges, and to communicate the resulting information to decision-makers in a practical and policy-relevant form. As such, it offers a particularly useful (and increasingly widely-applied) framework for integrating ecosystem values into policy and planning. TEEB proposes a three-tiered approach which begins by understanding the ecosystem and stakeholder context, goes on to assess values, and then seeks to identify instruments and measures that can be used to strengthen decision-making in the real world (TEEB 2010, Figure 2).

Figure 2: TEEB's three-tiered approach to integrating ecosystem values into policy and planning




*Source: Adapted from TEEB 2010*

The initial phases of TEEB, implemented between 2008-10, laid a broad foundation which collated evidence and examples of valuation, and identified the elements of a biodiversity and ecosystem valuation framework. A series of publications were produced, aiming to communicate this approach to researchers, policy-makers and the business community. Building on this momentum, the initiative is now focusing on applying "the TEEB approach" at different levels of policy-making.

Various studies have been initiated since 2010, spanning a number of different biomes, sectors, regions and countries. These include several initiatives in Nile Basin countries. Tanzania is currently undertaking a pilot TEEB country study as part of the project "Reflecting the Value of Ecosystems and Biodiversity in Policy-Making". This aims to inform land use policies in the Rufiji River Basin (Box 1). Kenya and Tanzania are both conducting TEEB country studies under the BMUB/IKI-funded project "Supporting Biodiversity and Climate-friendly Land Management in Agricultural Landscapes". A TEEB for the Tana River Basin was undertaken by Wetlands International, UNEP and the Institute for Environmental Studies of the Free University of Amsterdam in 2015-16, and a TEEB for wetlands is currently being planned in Ethiopia by Wetlands International.

In addition, at the global level, TEEB for water and wetlands and TEEB for Oceans and Coasts have been carried out, and a study on TEEB for Agriculture and Food is underway. TEEB regional and country studies have also been initiated in Armenia, the Arctic, ASEAN countries, Azerbaijan, Belgium, Bhutan, Brazil, Colombia, Czech Republic, Ecuador, Finland, Georgia, Germany, India, Japan, Liberia, Mexico, Netherlands, Nordic Countries, Norway, Philippines, Poland, Portugal, Republic of Korea, Slovakia, South Africa, South Pacific, Thailand and the UK.

### Box 1: The TEEB Tanzania study - managing ecosystem services in the Rufiji River Basin

The TEEB Tanzania study sought both to improve awareness of the environmental, social and economic impacts of land use on communities and ecosystems, and to inform land use policies in the Rufiji River Basin. Many agriculture and water projects are being planned in the basin as part of the government's Big Results Now Initiative. Yet there are also many competing demands over its land and water. Activities such as timber plantation development, sugarcane farming, dam construction for irrigation, expanding pastoral livestock systems and mangrove deforestation make it a challenge to sustainably manage the watershed.

The study examined land use trade-offs in the Kilombero sub-basin, and carried out a scenario analysis which compared business as usual with the Southern Agriculture Growth Corridor of Tanzania (SAGCOT) initiative. To do this, it divided the basin into three regions, and carried out biophysical and economic modelling of key ecosystem services in each:

- In the mountain highlands, it looked at the afforestation of grasslands with timber plantations;
- In the midlands, it looked at land use change from natural woodlands and forests into tea and fruit plantations; and
- In the lowlands, it looked mangrove conversion to traditional shifting paddy cultivation.

The overriding conclusion was that there is a need for a balanced development path that will maximise social and economic benefits while minimising externalities to the environment. The study demonstrated that, under both scenarios, the expansion of agriculture runs the risk of over-exploiting surface water, especially during dry months. There is thus a clear need to invest in water-efficient agricultural technologies, and to identify drought-tolerant and dry season crops. A the same time, any future development in the basin should be accompanied by a water budget assessment, so as to enable proper planning, and it will be essential to reduce land conversion and ensure the conservation of natural woody vegetation in order to enhance carbon sequestration and $CO_2$ absorption capacity.

The national focal point for the TEEB Tanzania study was the Vice President's Office, and the host institution was the University of Dar es Salaam. Other engaged actors included the Ministry of Natural Resources and Tourism, Ministry of Agriculture, Food Security and Cooperatives, President's Office Planning Commission, Ministry of Livestock and Fisheries Development, Ministry of Water, Tanzania Wildlife Research Institute, Tanzania Forestry Research Institute, Ardhi University, UNDP, Tanzania Forest Services Agency, and Ministry of Land, Housing and Human Settlement Development. The project was financed by the European Commission.

*Source: IRA undated, http://www.teebweb.org/areas-of-work/teeb-country-studies/tanzania/*

## What will the Nile Basin Wetlands TEEB study deliver?

A "TEEB-inspired study[2]" has been initiated in the Nile Basin, coordinated by the Nile Basin Initiative (NBI), and carried out under the auspices of the Biodiversity Conservation and Sustainable Utilisation of Ecosystem Services of Wetlands of Transboundary Relevance in the Nile Basin project with the technical support of GIZ and financial support from the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB).

The Nile Basin wetlands TEEB study seeks to bring wetland ecosystem values to the attention of river basin planners and managers, and to thereby promote better-informed, more effective, inclusive, equitable and sustainable conservation and development decision-making in the Nile River Basin. To these ends, the intention is to deliver both 'product' and 'process' aspects of wetland ecosystem valuation, including:

- **Accessible and relevant data and indicators** on key wetland economic costs, benefits, stakeholders and impacts of change;
- **Credible and convincing evidence** of the economic gains and value-added from conservation and costs and losses from degradation;
- **Practical and policy-relevant decision-support information** on wetland economic opportunities, options, synergies and trade-offs;

[2] The global TEEB initiative distinguishes "TEEB country studies" from "TEEB-inspired studies" (TEEB 2013). The former are closely aligned to the TEEB Secretariat in terms of project design, fundraising, technical assistance on ensuring that the project follows the TEEB approach, and formal endorsement as a "TEEB Study" by the TEEB Advisory Board. The latter may take place at national, sub-national or regional levels, are financed and managed by governments or other development partners, and may or may not have direct involvement with the TEEB Secretariat.

- **Strengthened capacity, dialogue and collaborative platforms** to undertake wetland ecosystem valuation and apply its results; and
- **Identified practical needs, niches and mechanisms** to promote wetland investment, incentives and finance.

The study has two main phases. The first comprises a scoping of available information and issues. The 'main TEEB study' component will then involve carrying out site-level wetland valuation case studies, documenting the findings, and formulating and communicating recommendations for integrating wetland ecosystem values into river basin planning, and wetland conservation and development options.

The Nile Basin Wetlands TEEB study is designed to be as inclusive as possible, and is based on a consultative, collaborative approach to knowledge generation and communication. A panel of regional technical experts on wetland valuation play a lead role in the process. The panel comprises around 30 individuals drawn from Nile Basin countries with expertise and experience in wetland ecosystem valuation. These include academics, researchers, government staff, consultants, members of NGOs and other organisations, as well as representatives from the NBI's Regional Wetlands Expert Working Group (comprised mainly of officials from Ministries of Water and Environment in riparian countries). Their role is to guide the policy focus and technical design of the study, advise on valuation methods, contribute and review technical information, and case studies, and formulate policy recommendations and conclusions for regional river basin decision-making.

## What is the content of the synthesis report?

The first component of the synthesis report intention is to examine the background, investigate the issues and pose the key challenges relating to the use of wetland ecosystem valuation for river basin planning in the Nile Basin. Following global TEEB guidance, the scoping phase has four main objectives: to review the state of knowledge on wetland ecosystem services and their values, identify the highest priority concerns, economies and wetland ecosystems in the Nile basin, scoping TEEB in the Nile basin to determine the study focus and objectives, and bring on board relevant stakeholders. (TEEB 2013). The second component of the report 'the main TEEB study' phase covers two chapters that involve carrying out site-level wetland ecosystem services valuation studies, documenting the findings, and formulating and integrating wetland ecosystem values into river basin planning for wetlands conservation and wise use through investments on wetland management plan and to assess alternative wetland development options.

To these ends, the report contains six chapters (in addition to this introduction, a reference list, and an annex listing ecosystem valuation studies carried out in Nile Basin countries):

**Chapter 2: Reviewing the evidence** summarises the current knowledge base on economic valuation in Nile Basin countries, including both informational and methodological aspects. It looks at what evidence is available on ecosystem values, how it was generated, and to what (where, and whom) it refers. A picture is built up of the economic dependence and impacts of different activities, sectors and stakeholders on wetland ecosystem services.

**Chapter 3: Economies, wetland ecosystems and example TEEB Case Studies in the Nile Basin:** It begins by describing the socioeconomic and biophysical features of the Nile River Basin, including the main development and conservation priorities and threats. The emphasis is on explaining how wetland

ecosystems and their services fit into the broader natural, human and economic landscape. It follows by providing details on wetland case studies in Nile basin as an experiment.

**Chapter 4: Scoping TEEB in the Nile Basin:** elaborates the specific decision-making issues, needs, constraints or opportunities that will be addressed by the Nile Basin Wetlands TEEB study. The policy/practical purpose of the study is stated, in line with current regional priorities in river basin conservation and development planning. It outlines the broad architecture of the main phase of the Nile Basin Wetlands TEEB study. It defines the study scope and coverage. including its objectives, intended outcomes, target audience and area of decision influence. The basic storyline, questions to be answered and assumptions are laid out, and the methodology is described.

**Chapter 5: Building the economic case for wetlands conservation and wise use through investments on wetlands management plan**. This chapter deals with building the economic case for wetlands conservation and wise use through investments on wetlands management plan/conservation investment plan: The field case studies on Sio-Siteko and Semliki Delta Transboundary Wetlands and other wetland case studies that provide evidence on economic or business case for investment on wetlands management plan and associated conservation investment plan that leads to wetlands conservation and wise-use.

**Chapter 6: Assessing wetland development options**. This chapter deals with assessing the development options for wetlands by mainly focusing on Sudd and Machar Marshes wetlands and other case studies on Virunga national park, Tana River Basin, and Kano floodplain are also consulted to complement the discussion on the development scenarios for wetlands.

**Chapter 7: Conclusion and Recommendation**. This chapter deals with concluding remarks, recommendations and the way forward.

Note that three additional knowledge products have been produced, and are published separately: an annotated bibliography of literature on wetland ecosystem valuation in Nile Basin countries; a searchable database of ecosystem valuation studies; and a set of two-page briefs summarising wetland valuation studies of particular interest to regional decision-makers.

# 2. Review of Economic Valuation Studies in the Nile Basin: the current state of knowledge on the value of wetland ecosystem services in Nile Basin countries

## Scope of the review

The literature review of ecosystem valuation studies covers all eleven riparian countries. Although placing a particular emphasis on inland, freshwater wetlands, the review does not limit itself to them. It deliberately spans a wide variety of biomes and landscapes (with a primary focus on natural ecosystems), considering valuation studies carried out in agroecosystems, coastal and marine zones, forests and woodlands, freshwater systems, grasslands, rangelands and watersheds.

This broad scope reflects both the wide-ranging nature of wetlands according to the Ramsar Convention definition (and as found in the Nile Basin), and the diverse literature on ecosystem valuation. It is also based on a recognition of their close biophysical and socioeconomic links to, and dependency on, other habitats and natural processes. Wetland areas often overlap with (or are partially occupied by) a variety of vegetation types and land uses, and water ecosystem services typically arise from the interactions between multiple habitats. Likewise, many of the ecosystem valuation studies that have been carried out in Nile Basin countries deal with sites or administrative areas that incorporate a number of biomes, or are concerned with human use and management systems that touch on a range of different services, systems and issues.

Thus, in reality, it is rarely possible (or useful) to separate studies on the economic value of "wetland" areas, species and services from those dealing with other components of the landscape. It can also be somewhat counterproductive to do so, given their complementarity and interconnectedness in social, economic, biological, ecological, hydrological and other terms as well as in how they are used, managed and form a part of people's livelihood and production processes. There is a particular danger of excluding key water-related ecosystem services by taking too narrow a focus.

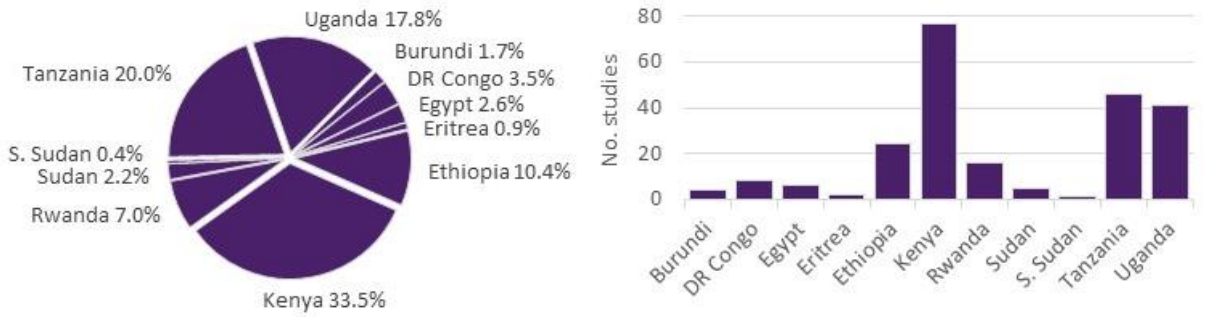
It should also be noted that the literature review is not confined only to ecosystem valuation studies in sites located within the boundaries of the Nile Basin. It looks at all studies carried out in Nile Basin countries. This is to ensure that as broad a range as possible of ecosystem services, methodologies, issues and topics are covered. Even studies carried out in other river basins can generate useful information and lessons learned for the Nile Basin.

More than 300 published studies were identified and collected, including articles, book chapters, technical reports, working papers and policy briefs. These were screened for technical credibility and methodological robustness, after which 209 'useable' studies were selected to be part of the review. A list of the reviewed ecosystem valuation studies is presented as an annex to this document. These have been collected and compiled into an annotated bibliography and searchable electronic database, presented separately. The bibliography contains a one-paragraph summary of each study, while the database allows the literature to be searched according to author, country, biome/habitat, ecosystem service and valuation method applied. In addition, fifteen wetland valuation studies of particular interest to regional decision-makers have been prepared as two-page briefs. The briefs summarise the aim and focus, methods, findings and conclusions of each of the selected studies.

## Geographical, ecosystem and methodological spread

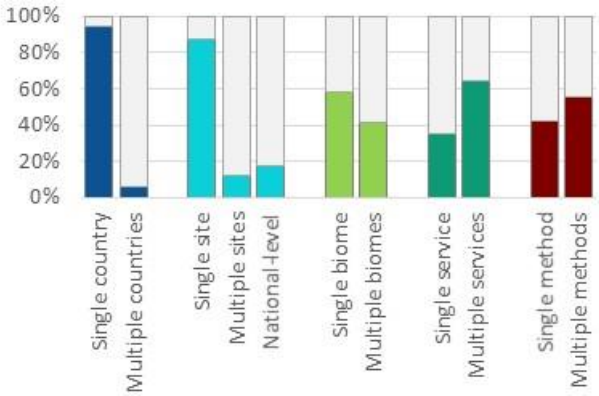
Although the literature covers all of the Nile Basin countries, its geographical distribution remains patchy. The vast majority of valuation studies — more than 70 per cent — were carried out in Kenya, Tanzania and Uganda (**Error! Reference source not found.**). Ethiopia and Rwanda account for 10 per cent and 7 per cent of the total respectively. Only a handful of documents refer to Egypt, Sudan or (especially) Burundi, Democratic Republic of Congo, Eritrea and South Sudan. While this geographical distribution to some extent reflects the large variation in environmental economics technical capacity and experience across the region, it is worth noting that the review was confined to English language documents. Materials in Arabic and French were not included. This may have had some influence on the apparent availability of studies on Burundi, Democratic Republic of Congo, Egypt and Sudan.

Figure 1: Geographical spread of ecosystem valuation studies




Most studies focus on a single site and country (**Error! Reference source not found.**). Only a minority investigate transboundary, regional or multi-country ecosystems (just 12 out of the 209 studies). In contrast, almost half of the documents reviewed look at ecosystem values across several different biomes, and two thirds assess multiple ecosystem services. This indicates a general interest in landscape-level linkages and benefits (and also supports the decision to extend the scope of the literature review beyond only freshwater ecosystems). Almost 60 per cent of the studies apply more than one valuation method. This reflects common practice in ecosystem valuation, and is also no doubt also linked to the focus on multiple biomes and services.

Figure 3: Scope of ecosystem valuation studies




## Distribution of studies between different biomes

Studies on the economic value of forest and woodland ecosystem services account for the largest share of the literature: just under a third, or 110 documents (**Error! Reference source not found.**). Eighty studies (22 per cent) focus on freshwater wetlands, and 64 documents look at other wetland or water-based ecosystems (coral reefs,

mangroves and watersheds). A total of 64 studies address the value of rangelands/grasslands, and 50 concern agroecosystems.

Figure 4: Distribution of ecosystem valuation studies between different biomes


*Note: total exceeds 209 (the number of documents reviewed), because many valuation studies cover multiple biomes.*

## Freshwater wetland valuation studies

The literature on the value of freshwater wetland ecosystem services covers 55 individual sites, as well as several national-level studies (**Error! Reference source not found.**). These span all of the Nile Basin countries. The geographical distribution largely mirrors that of the wider literature review: Kenya, Tanzania and Uganda each account for 30 per cent or more of the wetland valuation studies, Ethiopia 11 per cent, Rwanda 5 per cent, and other countries 3 per cent or fewer.

The study sites reflect a fairly broad range of wetland types, spanning riverine, lacustrine and palustrine systems, and covering both seasonal/intermittently and permanently-inundated areas. Wetlands in both urban and rural locations are included (with the exception of watersheds, the majority of valuation studies in other biomes focus on rural sites and beneficiaries). This reflects the key role of wetlands in human settlements, providing basic infrastructural services such as clean and regular water supplies, flood control, disaster risk reduction and recreation (a theme that is further elaborated in the following chapter of this report).

Table 1: Nile Basin freshwater wetland sites in which ecosystem valuation studies have been carried out

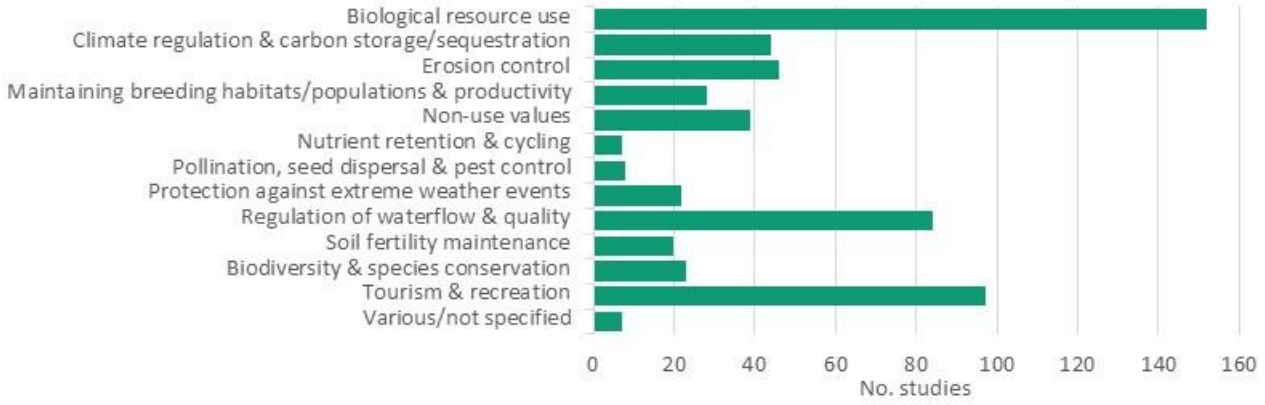
| Country | Sites |
|---|---|
| Burundi | Lake Victoria Basin |
| DR Congo | Virunga National Park rivers |
| Egypt | Lake Burullus |
| Eritrea | Included in national-level biodiversity assessment |
| Ethiopia | Bale Eco-Region, Blue Nile basin, Boye wetland, Kitto wetland, Lake Tana, Lake Ziway, Meteka wetland |
| Kenya | Chyulu Hills, Ewaso Ng'iro Basin, Kano floodplain, Lake Naivasha, Lake Nakuru National Park, Lake Victoria, Lake Victoria Basin, Mara River Basin, Mara-Serengeti ecosystem, Ndaikini Dam, Nyando wetlands, Ondiri Swamp, Shompole wetland, Tana River Basin, Yala Swamp |
| Rwanda | Cyabayaga and Rugeramigozi wetlands, Lake Victoria Basin, Nyabarongo River System, Rugezi Wetlands |
| South Sudan | Sudd wetland |
| Sudan | Dinder National Park |
| Tanzania | Bahi and Manyoni Districts, Ihefu Wetland, Kilombero Valley Ramsar Site, Lake Manyara, Lake Victoria Basin, Mara River Basin, Mara wetlands, Mara-Serengeti ecosystem, Moshi District, Musoma Municipality, Pangani Basin, Rufiji floodplain and delta, Selous Game Reserve, Sigi river basin, Tabora Region |
| Uganda | Bujagali Falls Recreational Park, Kampala- Mukono Corridor, Kiyanja-Kaku wetland, Lake Bunyoni, Lake Mburo National Park, Lake Nabugabo Wetland Complex, Lake Nakivale Wetland, Lake Victoria Basin, Mabamba Bay Wetland, Mpigi |

| | |
|---|---|
| | District, Murchison Falls Conservation Complex, Nakivubo Swamp, Namatala Wetland, Pallisa District, Sango Bay, national-level |

## Ecosystem service focus

The literature covers a wide variety of ecosystem services. A large proportion of studies (more than 150, or almost three quarters of the total) value biological resource use (**Error! Reference source not found.**). The most common area of focus is on local livelihoods. This reflects a general concern with making the economic and development case for conservation and sustainable use, underlining the importance of community-based management approaches, and demonstrating the socioeconomic impacts of ecosystem degradation and loss at the local level. Resource utilisation is however rarely the sole focus: more than 80 per cent of studies also look at other ecosystem services.

Figure 5: Ecosystem service focus of valuation studies




A relatively large number of studies (almost 100, or around half of the total) look at the value of tourism and recreation. In most cases these studies are concerned with strengthening conservation financing mechanisms, either seeking to inform protected area pricing, or to improve revenues and income-generation for local communities and government agencies.

Waterflow and water quality regulation services are also a popular subject for valuation (40 per cent or 84 studies). One reason for this is the widespread problems of water scarcity and water-related natural disasters that have emerged over recent years across the region, especially for urban populations, hydropower and commercial irrigated agriculture. Many watershed valuation studies appear to be at least partially driven by a growing interest in developing payments for watershed services schemes, and the consequent need to assess water users' willingness to pay for these services, and ecosystem service providers' willingness to accept compensation or rewards (Emerton 2017b).

## Application of different ecosystem valuation methods

Most of the methods in the standard ecosystem valuation 'toolbox' are applied, reflecting common practice in other parts of the world. All of these methods are well-known, and generally-accepted by environmental economists (**Error! Reference source not found.**). Ample guidance exists on these valuation methods (see, for example, Barbier et al. 1997, de Groot et al. 2006, Emerton and Bos 2004), including a range of toolkits and guidelines targeted specifically at wetland ecosystems, some of which have been developed for the Eastern,

Central and Southern Africa or Nile Basin regions (Emerton 1999, 2014, 2017, Emerton and Nherera 2006, Nile-Eco-VWU 2015). It should be noted that this toolbox represents a suite of methods that are variously used or combined in different ecosystem valuation exercises. In this sense it can be considered to be standardised. There is however no hard and fast rule or one size fits all approach as to which valuation technique should be applied to a given site, sector or planning process – or, indeed, should be applied in the Nile Basin. This depends on the study purpose, topic and target audience, on the services being valued, and on other issues such as data availability, time, resources and technical capacity. In other words, valuation methodologies usually follow the study design and purpose, not *vice versa*.

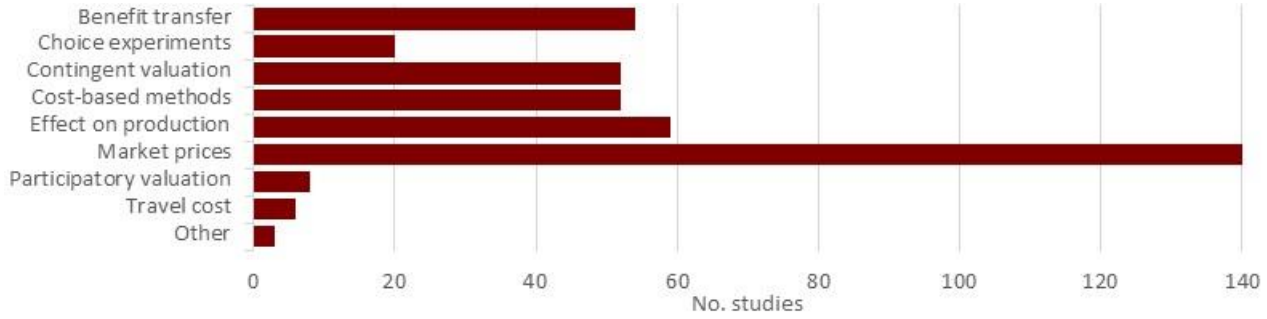
Table 2: The standard ecosystem valuation toolbox

| Technique | Brief description |
|---|---|
| Market prices | Look at how much goods and services cost to buy, or are worth to sell *e.g. the traded price of fish* |
| Production function approaches | Relate changes in the output of a marketed good or service to a measurable change in the quality of quantity of ecosystem goods and services by establishing a biophysical or dose-response relationship between ecosystem quality, the provision of particular services, and related production *e.g. the contribution of wetlands fish breeding and nursery habitat to lake fisheries catch* |
| Surrogate market approaches | Look at the ways in which the value of ecosystem goods and services are reflected indirectly in people's expenditures, or in the prices of other market goods and services. *e.g. travel costs and expenditures made on visiting a wetland protected area* |
| Cost-based approaches | Assess the market trade-offs or costs avoided of maintaining ecosystems for their goods and services. They assess the expenditures that are saved by not having to invest in physical infrastructure and measures to replace, mitigate or remediate ecosystem service loss, or the physical damages that are avoided. *e.g. the cost of establishing engineered flood control measures, the flood damages resulting from the loss of wetlands, the amount spent on providing relief and resettlement to flood-affected populations* |
| Stated preference approaches | Rather than looking at the way in which people reveal their preferences for ecosystem goods and services through market production and consumption, these valuation techniques ask consumers to state their preference directly. *e.g. tourists' willingness to pay to visit a wetland park, urban dwellers' preferences for wetland management regimes that will secure a package of wetland attributes and functions* |
| Revealed preference approaches | *The revealed preference (RP) (i.e., indirect) approach infers value indirectly by observing individuals' behavior in actual or simulated markets. RP methods are only restricted to estimating use values, it includes hedonic pricing method, travel cost method, dose response function, averting behaviour approach and market prices.* |
| Benefit-transfer approaches | Involve the transferral of value estimates from studies which have been carried out elsewhere to the service or site that is of current interest. *e.g. extrapolation of the per hectare results of a wetland valuation study in Morocco to an Egyptian site.* |

*Source: adapted from Emerton and Bos 2004, Emerton 2014.*

Market price techniques look at what it costs to buy or sell a particular good or service, and relate this to the quantity consumed or produced. These are by far the most commonly-applied ecosystem valuation method in the Nile Basin, used in two thirds or 140 studies. This is consistent with the large number of studies which assess the value of biological resource use (market price techniques are usually considered to be most appropriate for this purpose). It is also likely due to the fact that market price techniques are typically cheaper, simpler and less data-intensive to apply and analyse than other valuation methods. They usually require only rudimentary surveys, or rely on secondary sources.

Figure 6: Application of different ecosystem valuation methods




Benefit transfer, too, represents a fairly straightforward technique that can be applied in situations where technical capacity, data, time and other resources are limited. It transfers the findings of studies carried out elsewhere to the service or site that is of interest. Benefit transfer is used in 54 per cent of the Nile Basin valuation studies. It is however noticeable that in many cases, the method has been applied incorrectly or incompletely. This sometimes brings the credibility of the resulting figures into question. Of particular concern is the failure to adjust data from earlier studies for the effects of inflation, or to account for differences in purchasing power parity when using value estimates from different countries. In several cases, the values that are extrapolated refer to such different socio-economic or biophysical conditions to those of the study site (even, in some cases, to markedly different biomes or habitat types) as to render them invalid.

Cost-based methods and effect on production techniques are also relatively common, each used in around 50 studies or a quarter of the literature. They are most commonly applied to ecosystem regulating services. Cost-based methods assess how much an ecosystem service saves people in terms of reduced expenditures, decreased losses or lower damages. Effect on production techniques establish a dose-response relationship which traces the contribution of ecosystem services to marketed outputs or production processes. As with benefit transfer, certain serious shortcomings in the regional literature are evident. In many cases, credible biophysical data is lacking, or studies rely on unsubstantiated (and in some cases apparently mistaken) assumptions. Again, this raises questions about the reliability of the value estimates that emerge.

A similar number of studies (52, or 25 per cent) apply contingent valuation methods, mostly to assess recreation and tourism, or to gauge willingness to pay and accept compensation for the provision of ecosystem services. Contingent valuation methods ask people directly what they would be willing to pay for an ecosystem service, or how much they would need to be compensated for its loss. Choice experiments are a related technique which weigh up people's preferences for different ecosystem attributes and features. Although they account for a relatively minor share of studies overall (just 20 applications or 10 per cent of the total), they have become much more widespread over recent years. Almost 40 per cent of the ecosystem valuation studies carried out in the region since 2015 use choice experiments.

## Key information gaps

The review makes it clear that there is a fairly sizeable and growing literature on wetland (and other) ecosystem values in Nile Basin countries. Most of the ecosystem valuation approaches and techniques that are commonly used in other parts of the world are also being applied in the region. In addition to the several hundred published references sourced as part of the current review, there are a large number of unpublished documents and 'grey' literature. The total knowledge base on ecosystem values in Nile Basin countries is thus relatively large. However, as described in the paragraphs below, significant information gaps remain.

### Geographical coverage

Although the overall scope and coverage of the ecosystem valuation studies are fairly good as regards different biomes, wetland types, ecosystem services and valuation techniques, their geographical spread remains very uneven. A relatively wide variety and large number studies have been carried out in Kenya, Tanzania and Uganda. The literature on Ethiopia and Rwanda is considerably smaller, although not insignificant. Very few examples of ecosystem valuation however exist for Burundi, Democratic Republic of Congo, Egypt, Eritrea, Sudan and South Sudan. The wetland ecosystem valuation literature is therefore not representative of the full range of socioeconomic and ecological conditions across the Nile Basin region, and major gaps remain in terms of country coverage. This leaves important gaps to be filled.

### Data and assumptions

Wetland valuation also appears to be seriously constrained by a lack of data. This, coupled with often limited technical capacity, training and experience in ecosystem valuation, has often resulted in incomplete, unreliable (or in the worst case biased) value estimates. The paucity of reliable biophysical data on ecosystem functioning poses a particular challenge. Little is known about the relationship between ecosystem area, status and the provision of a given quality or quantity of services to a particular beneficiary population.

In consequence, many of the valuation studies that were reviewed therefore remain highly speculative, and rely on a series of often unfounded (and sometimes erroneous) assumptions, rather than being based on proven evidence and relationships. Not all of the published information on ecosystem values can be deemed to be reliable in either technical and methodological terms; in the worst case, some may even be misleading in their conclusions. Major factual or theoretical inconsistencies, questionable use of data, and even basic calculation errors were identified in more than a quarter of the studies reviewed. In particular, four common areas of weakness or shortcomings can be identified, which cut across the literature:

- The sustainability of wetland land and resource uses. In many cases, it is not certain (and is not investigated) whether the benefits that are being claimed can, in fact, be maintained and upheld without negatively influencing other ecosystem values, or undermining wetland conservation status.
- The attribution of regulating services to a particular site, management regime or ecosystem status. This is especially evident in valuation studies using cost-based and effect on production techniques. In all too many cases, it is automatically assumed that the wetland under study generates (for instance) flood control, nutrient cycling or fish breeding functions, without any scientific evidence of whether, or to what extent, these services are actually being provided (or used).

- The assumption of fixed, area-based ecosystem service values. Average or standardised per hectare values (often 'borrowed' from other studies or sites) tend to be simply applied across entire wetland systems, regardless of whether all parts of the wetland actually generate the service in question or are used for that particular purpose. In addition, a direct linear relationship is usually assumed between changes in wetland area and the value of ecosystem services. This is clearly unrealistic, and does not account for non-linearities or threshold effects.
- The direct generalisation of data estimates from other sites or countries. Benefit transfer techniques are widely-used in the region, likely prompted by the lack of data, scarce resources and limited technical capacity to apply more complex techniques. They however tend to be applied somewhat indiscriminately — even where socioeconomic, ecological or other conditions in the reference site are quite different to those in the study site. It is also common for studies to fail to adjust for inflation, purchasing power parity and other differences between the reference and study sites. Unit provisioning, regulating or even cultural values appear to often be extrapolated quite unthinkingly (and inappropriately) from other biomes, countries or parts of the world.

## Decision-making impact

Perhaps the most important gap to emerge from the literature review concerns decision-making influence and uptake. This point has also been noted in other reviews of the ecosystem valuation literature in Nile Basin countries (see, for example, Emerton 2017b). There is as yet little evidence, and few documented examples, of the findings of valuation studies actually being acted on by decision-makers in the agencies, sectors and industries that depend and impact most on wetland and water ecosystem services. This is the case even though ecosystem valuation appears to have become a recognised approach and accepted planning tool in conservation agencies and environmental organisations across the region, and is slowly starting to be acknowledged in other sectors and in Ministries of Finance and Economic Planning.

One of the reasons for this limited impact is that many valuation exercises are designed and implemented as 'pure' research. This in itself should not be seen as a problem. It is undoubtedly important to build an academic literature base – particularly in a region where both valuation methodologies and information are still relatively undeveloped, There however also remains an urgent need to attempt to mainstream ecosystem valuation (and ecosystem values) into decision-making, through carrying out applied research, and studies which have been formulated and designed to guide and inform concrete decision-making processes.

It is noticeable that even the valuation studies that do explicitly seek to address real-world conservation and development challenges are often unfocused, and tend to be oriented more towards highlighting the broad possibilities that wetland conservation and sustainable use might potentially offer — rather than offering specific information or concrete solutions in response to an actual decision-making process or decision-maker audience. Particularly notable is the body of literature generated by conservation organisations which seek to make the case for wetland conservation. Here, there is a tendency to focus on generating large, aggregated numbers, assuming that these will somehow convince decision-makers to reform policies, reallocate budgets or reorient development programmes. In very few cases are these studies targeted towards a clear policy and planning purpose or audience, or deal with the practicalities of how ecosystem values might be harnessed in order to achieve a given set of conservation or development goals. It is, perhaps, therefore hardly surprising that their decision-making relevance and impact remains limited.

# 3. Economies, Wetland Ecosystems and TEEB Case Studies in the Nile Basin

## Biophysical features of the Nile River Basin

It is useful to begin with a brief overview of the physical setting within which wetland ecosystem services are generated, used and have value in the Nile Basin. It is however beyond the scope of the current document to provide an in-depth explanation of the geographical, hydrological and climatic features; these details can be found elsewhere (see, for example, Awulachew et al. 2012, FAO 2011, NBI 2016, Sutcliffe and Parks 1999). The following paragraphs seek only to summarise the salient points, and to describe the broad context to the TEEB study.

The River Nile runs for a distance of some 6,700 km, with a basin that spans eleven countries[3], covers in excess of 3 million km$^2$, and accounts for around 10 percent of the area of the African continent (NBI 2016). Its principal tributaries are the White Nile, which begins in the Great Lakes region of Central Africa, and the Blue Nile and the Atbara, both flowing from the highlands of Ethiopia (FAO 2011). The basin comprises two main sub systems: the Equatorial Nile and the Eastern Nile, further divided into ten major sub-basins (Table 3, Figure 7). Compared to the size of its basin, the Nile's total flow is relatively modest. Average annual runoff is very low at about 30 mm, although this varies substantially across the basin. The areas which contribute significant volumes to river flow are comparatively small and isolated, and are largely confined to the East African lakes region where rainfall is high and distributed between two rainfall seasons, and to the Ethiopian highlands where high rainfall within a single season and steep topography give rise to relatively high and concentrated runoff (Sutcliffe and Parks 1999).

Table 3: Nile sub-basins

| Sub-basin | Area (km$^2$) |
|---|---|
| Equatorial Nile sub-system | |
| Lake Victoria | 241,893 |
| Lake Albert | 96,807 |
| Victoria Nile | 85,521 |
| White Nile | 258,803 |
| Bahr el Jebel | 185,364 |
| Bahr el Ghazal | 604,746 |
| Eastern Nile sub-system | |
| Main Nile | 958,872 |
| Tekeze-Atbara | 232,374 |
| Blue Nile | 304,656 |
| Baro-Akobo-Sobat | 204,288 |
| Total | 3,173,324 |

*Source: NBI 2016*

The Nile Basin extends over an exceptionally wide band of latitude: from 4°S to 32°N. The climate varies correspondingly. The humid rainforests of the Equatorial lakes in Central and East Africa, parts of southern Sudan and Ethiopia have a tropical climate, characterised by well-distributed rainfall and little variation in mean temperature depending on the locality and altitude (UNEP 2015). The climate gradually changes as one goes northwards progressing through subtropical, semiarid to a desert-type climate in in Egypt and northern parts of Sudan, with a dry atmosphere and significant seasonal and diurnal temperature variations. In total, it is possible to distinguish five climatic zones – Mediterranean, arid, semi-arid, subtropical and tropical (UNEP 2013).

As further described below, this broad climatic and spatial gradient also supports a diverse array of natural ecosystems. The Nile Basin includes a number of biogeographical zones and biomes ranging from high altitude mountains through tropical forests, woodlands, savannas, freshwater wetlands, arid lands and deserts, eventually draining into the Mediterranean Sea through a delta system covering 20,000 or more km$^2$ of farmland, sand dunes, salt marshes, sand sheets, lakes and lagoons (Awulachew et al. 2012).

[3] Riparian states include Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Uganda and United Republic of Tanzania.

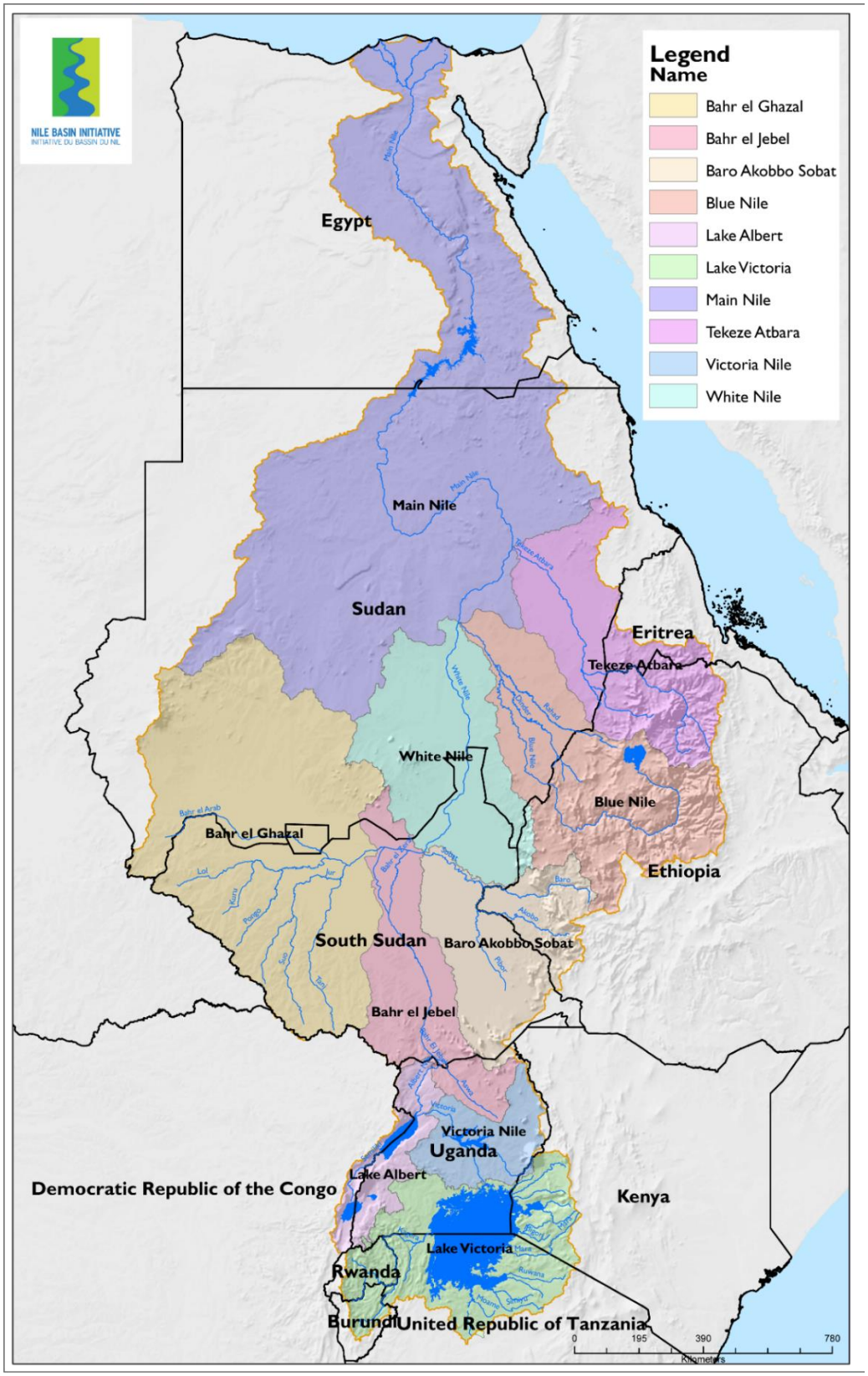



Figure 7: Sub-basins of the Nile Basin

*Source: NBI 2016*

It is also important to understand the broader socio-economic conditions and circumstances that people face in Nile Basin countries, that shape their livelihood opportunities and constraints and determine how and what they produce, consume, trade and invest. These factors also influence the ways in which wetland ecosystem services are managed, used and valued in different ways by different people. As with the biophysical summary provided above, A brief snapshot of socio-economic and development processes in the Nile Basin is presented in this sub-section. More detailed information can be found (see, for example, Coniff et al. 2012, NBI 2016, Karimi et al. 2012, Kinyangi et al. 2012, UNEP 2013).

In 2015, it was estimated that 53 per cent of the population of Burundi, DR Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania and Uganda lived within the Nile Basin boundary (NBI 2016). With 503 million people estimated to be living in these countries in 2018 (IMF World Economic Outlook 2017), this translates into a current Nile Basin population of just under 266 million people (Table 4).

Table 4: Area and population in the Nile Basin

| Country | Area in Nile Basin ($km^2$) | % of country in Nile Basin | Population in Nile Basin (persons) | % of country's population in Nile Basin |
|---|---|---|---|---|
| Burundi | 13,860 | 49.3% | 5.70 | 50.9% |
| DR Congo | 21,796 | 0.9% | 3.59 | 4.0% |
| Egypt | 302,452 | 30.3% | 90.94 | 93.8% |
| Eritrea | 25,697 | 21.1% | 0.26 | 4.2% |
| Ethiopia | 365,318 | 31.9% | 35.61 | 37.8% |
| Kenya | 51,363 | 8.7% | 19.21 | 40.0% |
| Rwanda | 20,625 | 84.0% | 10.05 | 82.9% |
| South Sudan | 620,626 | 97.7% | 12.87 | 99.2% |
| Sudan | 1,396,230 | 74.9% | 36.52 | 87.0% |
| Tanzania | 118,507 | 12.7% | 12.85 | 25.2% |
| Uganda | 240,067 | 99.5% | 38.37 | 98.8% |

*Source: area figures from NBI 2016; population figures from IMF 2018, using percentages given in NBI 2016*

In terms of absolute numbers, more than a third of the Nile Basin's inhabitants live in Egypt, and just over 40 per cent in Ethiopia, Sudan and Uganda. These four countries also account for some 72.5 per cent of the Nile Basin's area, and South Sudan occupies another 19.5 per cent. The remaining 8 per cent of the basin and 19 per cent of the population are spread across Burundi, Democratic Republic of Congo, Eritrea, Kenya, Rwanda and Tanzania. Population density varies greatly across the basin. The area surrounding Lake Victoria in Kenya and Uganda, the Ethiopian highlands surrounding the Blue Nile and Nile valley and delta in Egypt contain a particularly striking concentration of human population – within the Nile Basin, and in Africa as a whole (UNEP 2015).

With Nile Basin countries accounting for more than 40 per cent of Africa's human population and some 35 per cent of GDP[4] (World Bank 2018, IMF 2018), the region has immense significance in social, economic and development terms. The combined GDP of the riparian states is estimated to be worth just under just under USD 2.3 trillion in 2018. GDP has been growing substantially in real terms over the last decade in all countries except South Sudan (which has suffered protracted unrest over this period). Since 2010, the combined GDP of Nile Basin countries has grown by more than 60 per cent or an average of 6.7 per cent a year – more than one and a quarter times the rate for Africa as a whole (IMF 2018). Ethiopia, Rwanda and Tanzania show particularly impressive annual growth rates over this period, at an average of 10 per cent or more. This growth looks set to be sustained, albeit at a more modest rate averaging 5.5 per cent a year, to 2020.

[4] Unless otherwise stated, GDP is expressed at purchasing power parity rates, measured in 2018 international dollars. This allows for comparison and aggregation across countries. Establishing purchasing power equivalence means that one dollar purchases the same quantity of goods and services in all countries, thereby overcoming the price and exchange rate distortions that make market-based price estimates incomparable. An international dollar buys a comparable amount of goods and services in the reference country to what a U.S. dollar would buy in the United States.

Yet, at the same time as accounting for some of the highest growth rates in Africa, there is a huge variation – and glaring inequities – in socioeconomic development indicators, both within and between Nile Basin countries (Table 6). The whole-basin per capita GDP[5] of USD 4,571[6] in 2018 is some 16 per cent less than that for Africa as a whole (IMF 2018). These figures however differ greatly between countries, from just USD 651 in Burundi and USD 725 in DRC to USD 3,079 in Tanzania, USD 3,366 in Kenya, USD 4,230 in Sudan and almost USD 12,000 in Egypt (IMF 2018).

Table 6: Socio-economic development indicators

| Country | Per capita GDP 2018 (PPP Intl USD) | Human Development Index 2017 | Multidimensional poverty | |
|---|---|---|---|---|
| | | | % population | Headcount (million) |
| Burundi | 651 | 0.417 | 81.8 | 9.2 |
| DR Congo | 725 | 0.457 | 72.5 | 64.7 |
| Egypt | 11,872 | 0.696 | 4.2 | 4.1 |
| Eritrea | 1,472 | 0.440 | n.d. | n.d. |
| Ethiopia | 2,103 | 0.463 | 88.2 | 83.1 |
| Kenya | 3,263 | 0.590 | 36.0 | 17.3 |
| Rwanda | 1,982 | 0.524 | 53.9 | 6.5 |
| South Sudan | 1,265 | 0.388 | 89.3 | 11.6 |
| Sudan | 4,208 | 0.502 | 53.1 | 22.3 |
| Tanzania | 3,079 | 0.538 | 66.4 | 33.9 |
| Uganda | 2,189 | 0.516 | 70.3 | 27.3 |

*Source: IMF 2018, UNDP 2018, World Bank 2018*

Nile Basin countries also generally rank low on the Human Development Index[7] (HDI) scale, ranging between 115 (for Egypt) and 187 (for South Sudan) on the HDI scale, out of a total of 188 countries (UNDP 2018). The majority of the region sits firmly in the "low human development index" bracket – only Egypt and Kenya are considered medium development countries[8]. On a positive note, HDI growth has been positive in all of the Nile Basin countries since 2010, except for South Sudan.

Table 5: Measures of inequality

| Country | Coefficient of human inequality | Palma ratio | Gini coefficient |
|---|---|---|---|
| Burundi | 32.8 | 1.7 | 0.39 |
| DR Congo | 30.2 | 2.1 | 0.42 |
| Egypt | 28.3 | 1.3 | 0.32 |
| Eritrea | n.d. | n.d. | n.d. |
| Ethiopia | 27.3 | 1.8 | 0.39 |
| Kenya | 26.3 | 2.9 | 0.49 |
| Rwanda | 29.8 | 3.2 | 0.50 |
| South Sudan | 36.3 | 2.7 | 0.46 |
| Sudan | 34.5 | 1.4 | 0.35 |
| Tanzania | 24.8 | 1.7 | 0.38 |
| Uganda | 28.2 | 2.0 | 0.41 |

*Source: UNDP 2018*

The region also contains almost half of the African continent's poor. There are an estimated 280 million people (or 56 per cent of the population) living in multidimensional poverty[9] in Nile Basin countries, nearly 60 per cent of whom face severe poverty (UNDP 2018). The incidence of poverty is particularly high in South Sudan, Ethiopia, Burundi, Democratic Republic of Congo and Uganda, where 70 per cent or more of the population are recorded as living in multidimensional poverty, and a third or more in severe poverty. By similar token, wealth and earnings are distributed unequally within Nile Basin countries. For the period 2010-17 the Palma ratio[10] is 2.07 and the Gini coefficient[11] is 0.411,

[5] As with total GDP, per capita figures are expressed at purchasing power parity rates, measured in 2018 international dollars.

[6] Calculated as total GDP across all Nile Basin countries divided by total population. Average country GDP is even less than this at USD 2,983.

[7] The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income per capita. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean.

[8] According to the UNDP classification, countries with a HDI of 0.350–0.554 are considered as low human development, while those with a HDI of 0.555-0.699 are designated medium human development (UNDP 2018).

[9] The Multidimensional Poverty Index complements monetary measures of poverty by considering overlapping deprivations in education, health and living standards suffered by individuals at the same time. People are defined as being multidimensionally poor when they suffer deprivations in 33 per cent or more of the weighted indicators. Indicators include nutrition, child mortality, years of schooling, children enrolled in school, cooking fuel, type of soilet, water source, electricity, floor and assets.

[10] The Palma ratio is the ratio of national income shares of the top 10 per cent of households to the bottom 40 per cent. Thus, for example, A Palma ratio value of 5.0 can be directly translated into the statement that the richest 10 per cent earn five times the income of the poorest 40 per cent of the nation. In 2017, world values ranged between 0.58 to 7.01.

[11] The Gini coefficient measures the extent to which the distribution of income or wealth within an economy deviates from a perfectly equal distribution. A higher Gini coefficient represents a more unequal distribution: a value of zero expresses perfect equality, while a value of 1 expresses maximal inequality. In 2017, world values ranged between 0.166 to 0.630.

both suggesting substantial income inequality (UNDP 2018). Rwanda, Kenya and South Sudan show particularly high rates of income inequality as compared to other countries. A similar picture holds for other dimensions of development. The region returns an average coefficient of human inequality[12] in 2017 of 29.84 (similar to Africa as a whole), indicating relatively high levels of inequality. Again, this varies greatly between countries: South Sudan, Sudan, the Democratic Republic of Congo and Burundi all show relatively higher rates of inequality with coefficients of 30 or more. It should however be noted that, aside from Egypt, most of the Nile Basin countries[13] show improvements over the last 3 years.

## Land and water use

Patterns of land and water use in the Nile Basin are inextricably linked to the status and integrity of the region's wetlands, because they depend and impact so heavily on wetland ecosystem services. A short summary overview is provided below (for further information, see Coniff et al. 2012, FAO 2011, Karimi et al. 2012, NBI 2016, Peden et al. 2012, Sutcliffe and Parks 1999, UNEP 2015, Whittington et al. 2005).

The vast majority of the human population lives in rural areas – just under 70 per cent overall, rising as high as 80 per cent or more in Burundi, Ethiopia, South Sudan and Uganda (World Bank 2018). The main means of livelihood and land use is agriculture (FAO 2011), providing a primary occupation for more than 75 per cent of the labour force (Karimi et al. 2012), and an average of half of household income (NBI 2016). Both arable and livestock production are key components of farming systems, both at the rural subsistence level and in the commercial agricultural sector. In 2011 almost 354,000 km$^2$ was under crops, about 86 per cent rainfed and 14 per cent irrigated (Table 7). In 2000 the Nile Basin was estimated to contain about 45 million sheep, 42 million goats and 67 million cattle,; by 2030, this figure is projected to have risen by 59 per cent, from 272 million to about 434 million livestock units (Peden et al. 2012).

Table 7: Agricultural land use

| Portion of country in Nile Basin | Rainfed harvested area (km2) | Irrigated harvested area (km2) | Total harvested area (km2) |
|---|---|---|---|
| Burundi | 5,621 | 32 | 5,653 |
| DR Congo | n.d. | n.d. | n.d. |
| Egypt | - | 39,270 | 39,270 |
| Eritrea | 587 | 41 | 629 |
| Ethiopia | 29,783 | 142 | 29,925 |
| Kenya | 22,049 | 417 | 22,466 |
| Rwanda | 11,592 | 156 | 11,748 |
| South Sudan | n.d. | n.d. | n.d. |
| Sudan | 140,448 | 11,567 | 152,016 |
| Tanzania | 19,710 | 1 | 19,712 |
| Uganda | 81,886 | 332 | 82,218 |
| Nile Basin | 311,677 | 51,959 | 363,636 |

*Source: FAO 2011*

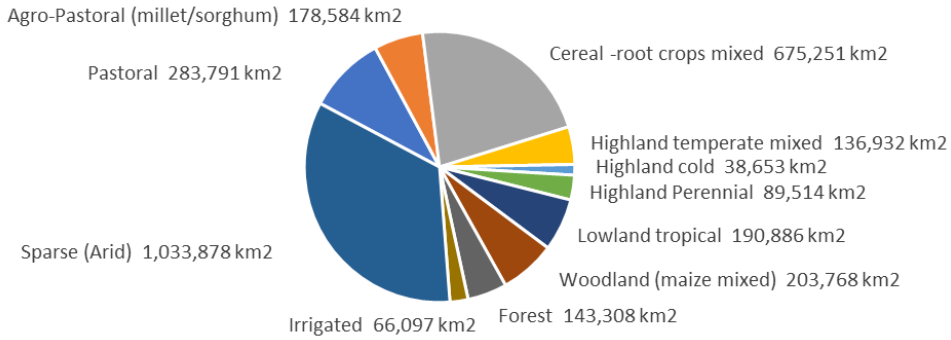
Agriculture also plays a substantial role in national income. It is estimated to contribute some 21 per cent of the combined GDP of Nile Basin countries in 2017[14] (World Bank 2018). The region accounts for some 90 million tonnes or 44 per cent of the African continent's cereal production (World Bank 2018) and almost 3 million tonnes or 46 per cent of the inland waters fisheries production (FAO 2018), of which around 57 per cent comes from capture fisheries in lakes and rivers (NBI 2016). Farming systems in the Nile Basin are highly variable in terms of their size, distribution and production characteristics. Nine main systems can be distinguished (Box 2). Around a third of the basin is under sparse arid systems which, together with limited irrigation around the main river channels, dominate across the northern half of Sudan and Egypt, transitioning to pastoral, agro-pastoral and mixed cereal-root crop systems through South Sudan, and highland perennial, highland temperate, mixed maize-forest and lowland tropical systems into Ethiopia and the equatorial lakes region (Figure 8).

[12] The coefficient of human inequality is a simple average of inequalities in health, education and income.

[13] No data are available for Eritrea, South Sudan or Sudan.

[14] Excludes Eritrea and South Sudan, as disaggregated GDP figures not available.

## Box 2: A typology of farming systems in the Nile Basin




### Irrigated farming system (66,097 km$^2$ or 2.1%)

Comprises large scale, traditional, small scale traditional and commercial. In many cases, irrigated cropping is supplemented by rainfed cropping or animal husbandry (the Gezira is one notable exception). Crop failure is generally not a problem, but livelihoods are vulnerable to water shortages, scheme breakdowns and deteriorating input/output price ratios.

### Forest farming system

Farmers practice shifting cultivation; clearing a new field from the forest every year, then cropping it for 2 to 5 years. Cattle and human population density are low. Physical isolation plus lack of roads and markets pose serious problems. Agricultural growth potential is moderate but development requires careful management of environmental risks, including soil fragility and loss of wildlife habitats.

### Highland perennial farming system (89,514 km$^2$ or 2.8%)

Found in Ethiopia, Uganda, Rwanda and Burundi, and supports the highest rural population density in the region. Based on perennial crops such as banana, plantain, and coffee, complemented by cassava, sweet potato, beans and cereals. The main trends are diminishing farm size and declining soil fertility.

### Highland temperate mixed farming system (136,932 km$^2$ or 4.3%)

Located at altitudes between 1800 and 3000 metres in the highlands and mountains of Ethiopia and Eritrea. Small grains such as wheat and barley are the main staples, complemented by peas, lentils, broad beans, rape, teff and Irish potatoes. Typically a single cropping season, although some parts of Ethiopia have a second season. Soil fertility is declining because of erosion and a shortage of biomass; and cereal production is suffering from a lack of inputs. There is major potential for diversification into higher-value temperate crops.

### Cereal-root crops mixed farming system (675,250 km$^2$ or 21.3%)

Found mainly in the dry sub-humid zone, characterised by lower altitude, higher temperatures, lower population density, abundant cultivated land, higher livestock numbers per household, and poorer transport and communications infrastructure. Cereals such as maize, sorghum and millet are widespread, wherever animal traction is absent root crops such as yams and cassava are more important. Intercropping is common, and a wide range of crops is grown and marketed. The main source of vulnerability is drought but the agricultural growth prospects are excellent.

### Maize mixed farming system (203,768 km$^2$ or 6.4%)

The most important food production system in Kenya, Tanzania and Uganda, also found in Ethiopia and South Sudan. Most areas have uni-modal rainfall (with a single harvest), but some areas bimodal (two cropping seasons). Contains scattered irrigation schemes, but these are mostly small-scale. The main staple is maize and the main cash sources are cattle, tobacco, coffee and cotton, plus the sale of food crops such as maize and pulses. The main source of vulnerability is drought.

### Agro-pastoral millet/sorghum farming system (178,584 km$^2$ or 5.6%)

Mainly found in Sudan, South Sudan, Ethiopia and Eritrea. Crops and livestock are of similar importance. Rainfed sorghum and pearl millet are the main sources of food and are rarely marketed, sesame and pulses are sometimes sold. Livestock are kept for subsistence (milk and milk products), breeding, transportation (camels, donkeys), land preparation (oxen, camels), sale or exchange, savings, bride wealth and insurance against crop failure. The main source of vulnerability is drought. Agricultural growth potential is modest and presents important challenges.

### Pastoral farming system (283,791 km$^2$ or 8.9%)

Located in the arid and semiarid zones extending from Sudan, Ethiopia and Eritrea. During the driest period of the year, pastoralists move south to the cereal-root crop mixed system areas and return north during the rainy season. Main source of vulnerability is the great climatic variability and consequently high incidence of drought.

### Sparse (arid) farming system (1,033,878 km$^2$ or 32.5%)

Mainly found in Sudan and Egypt, this system is of limited significance from the point of view of production. Because the wadis and their surrounding areas are considered part of the Pastoral Farming System, grazing within the actual Sparse (Arid) System is limited. There are some scattered irrigation settlements in these arid areas, in most cases used by pastoralists to supplement their livelihoods.

*Source: Adapted from NBI 2016*

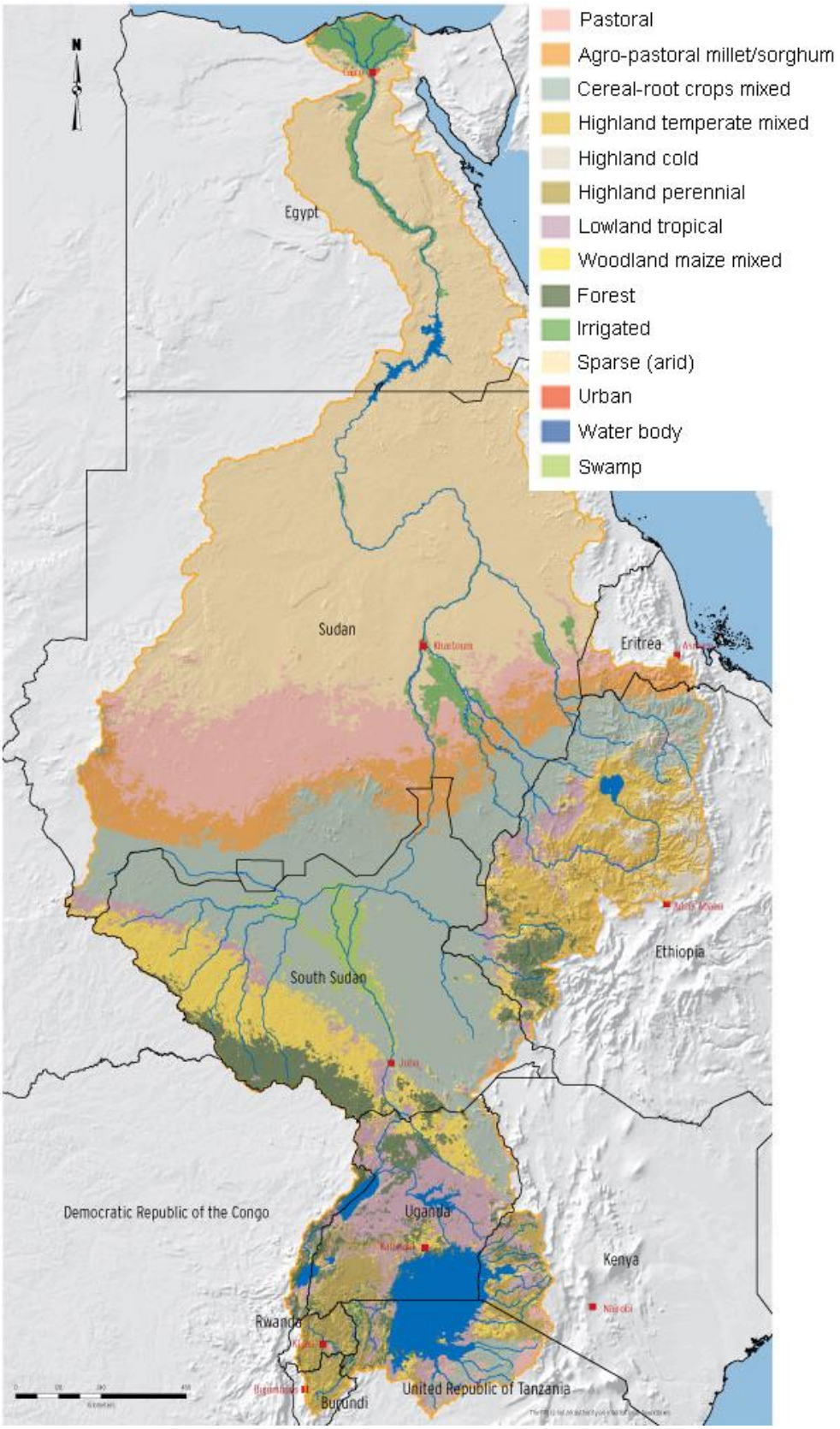



Figure 8: Farming systems in the Nile Basin

*Source: NBI 2016*

Unsurprisingly, human settlement patterns across the region are (and have long been) heavily influenced by the availability of water and water-related infrastructure. Much of the Nile Basin's economy is water based: both surface and groundwater resources underpin agriculture, energy, fisheries, water supply and navigation activities. Available water resources are used heavily, and intensively. It is estimated that the Nile basin countries together utilise almost 90 per cent of the region's renewable water resources, and that most of the stream flow of the Nile is allocated – each year, on average, 12-14 billion cubic meters or less reaches the Mediterranean (NBI 2016), which is considered the minimum requirement for environmental purposes (FAO 2011).

Irrigated agriculture accounts for by far the largest share of water consumption, at almost 90 per cent of the total (UNEP 2015). With only just over 17 per cent of potentially irrigable area currently utilised, this demand looks set to rise sharply in the future – from an estimated 99 trillion cubic metres in 2005 to 107 trillion cubic metres in 2030, and as much as 115 trillion cubic metres by 2050 (FAO 2011). Hydropower is another important economic activity that depends on water. While the current installed capacity is estimated at some 5.66 GW (40 per cent of which is located in Egypt, 28 per cent in Sudan and 18 per cent in Ethiopia), this represents only just over a quarter of the potential capacity (NBI 2012). Meanwhile, municipal and industrial water demand across the entire Nile Basin is estimated at 12.9 billion cubic metres (97 per cent of which is extracted in Egypt), with domestic water demand expected to grow five to six-fold to 2030 (NBI 2016).

A network of hydraulic infrastructure exists to support these water uses and water-based industries. Reservoirs are operated for flood control, water supply, hydropower, and conservation of wet year flows for use in dry years (UNEP 2015). As of 2014, there were basin-wide 14 storage dams, with a total capacity of about 203 billion cubic metres (NBI 2016). Water-based infrastructure continues to expanding rapidly, both to keep pace with steeply rising demand and, as described further below, to help address and cope with the vagaries of climate change.

Water shortage and stress is common across the Nile Basin. In all of the riparian countries except for the Democratic Republic of Congo and South Sudan, water availability per capita is already less than the recommended annual water security threshold of 1,700 $m^3$ (UNEP 2013). This figure however varies widely both within and between countries; for example, the volume of renewable internal freshwater resources ranges from more than 12,000 $m^3$/capita/year in the Democratic Republic of Congo, 2,255 $m^3$ in South Sudan, through 1,000-1,600 $m^3$ in Burundi, Ethiopia, Tanzania and Uganda, 840 $m^3$ in Rwanda, 450 $m^3$ in Kenya, to 102 $m^3$ in Sudan, and just 20 $m^3$ in Egypt (World Bank 2018). As population grows, industry expands, agriculture becomes more commercialised, and shifts in people's lifestyles and aspirations are accompanied by rising consumption and growing demands for food, energy and water, per capita availability has been declining steeply, and looks set to continue to do so into the future.

These challenges are intensifying with climate change. Much of the region already faces severe water stress, and is marked by climatic extremes and uncertainty, meaning that water resources are critically sensitive (and vulnerable) to any further changes in climate (UNEP 2015). Recent climate modelling exercises suggest consistent increases in temperature for both the near future (2020-2049) and the far future (2070-2099), while rainfall projections – although predicted to change – are generally less reliable and exhibit greater variability (UNEP 2015). Temperature increases affect the rates of evaporation and evapotranspiration and thus influence water balance, while any changes in precipitation have impacts on lake levels and river discharges (UNEP 2013).

At the same time, these climatic shifts are already influencing natural vegetation and species distribution, and altering land productivity and agricultural potential. The socio-economic consequences and implications are immense, for example greater disease and health risks, crop and livestock failure, changes in food security and

nutrition, livelihood decline and even collapse, diminishing income and employment prospects, shifting settlement patterns and wide-scale migration. The increased risk and incidence of extreme events and natural disasters, too, places additional stresses on human settlements and water infrastructure, and on economies and livelihoods that are in many cases already vulnerable and marginal. Examples include the likelihood of more frequent and severe dry periods, droughts, floods and storms, as well as sea level rise (NBI 2013a,b).

## Wetland ecosystems and their services

Covering such a huge area and diverse gradient of altitudes and climatic conditions, the Nile Basin also contains a great variation in natural vegetation and ecology as well as a striking latitudinal gradation of flora and fauna species. It can be divided into sixteen terrestrial ecoregions, ranging from the miombo woodlands, bushlands and thickets and forest-savannah mosaic and montane forests of the equatorial lakes region, through the grasslands, woodlands and lowland forests of Ethiopia, to the Sahelian acacia savannah, woodlands and steppe of Sudan and the Sahara desert and flooded savannah of Egypt (Figure 9).

Wetlands cross cut these ecoregions. Defined by the Ramsar Convention on Wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres", wetlands are found in all of these ecoregions. They encompass a broad range of different habitats in the Nile Basin, including a variety of swamps, marshes, seasonally inundated grasslands and sedge-lands, swamp forests, floodplains, deltas and the wetland edges of lakes and rivers. Various figures are cited regarding their extent, ranging from an upper estimate of 10 per cent of the basin being under wetlands and lakes (Rebelo and McCartney 2012) to slightly lower figures of three percent or 100,000 $km^2$ for wetlands (NBI) and at least 81,500 $km^2$ for lakes (Bekele et al. 2012).

More than 70 major wetlands of relevance for the Nile system have been identified by the riparian countries, concentrated in two areas: The Equatorial Lakes region and the Sudd area in South Sudan (NBI 2013c). Seventeen sites across the basin have been designated as Wetlands of International Importance (Ramsar Sites), in recognition of their global significance (Box 3, Figure 10). Most also play a key biological, ecological, hydrological, economic or socio-cultural role at local and national levels. Other significant water-based ecosystems in the Nile Basin include the 9,000 $km^2$ Machar Marshes in the eastern part of Sudan and western Ethiopia and the 22,000 $km^2$ Nile Delta in Egypt, as well as Lake Tana in the north-western Ethiopian highlands, and the Equatorial Lakes of Victoria, Albert and Kyoga (Rebelo and McCartney 2012), The water towers of the Albertine Rift of south-western Uganda, western Rwanda and north-western Burundi, Mount Elgon on the Uganda-Kenya border, and the Ethiopian Highlands are also considered to be key, in terms of their role in contributing to stream flow of the major rivers in the basin (NBI 2016).

As described in the introductory chapter to this report, ecosystem services are “the benefits people obtain from ecosystems” (Millennium Ecosystem Assessment 2005a). Wetlands provide a particularly critical set of ecosystem services (Maltby 2009, Millennium Ecosystem Assessment 2005a), which are of central importance to social, economic and natural systems and processes in the Nile Basin (Box 4). They form a key part of its complex hydrology, which is characterised by a high level of interconnectivity between floodplains, wetlands, swamps, lakes, highlands and the river’s drainage networks (NBI 2016). Use of wetland areas for farming and grazing, and harvesting of their resources and products, also underpins the livelihoods of much of the region’s population.

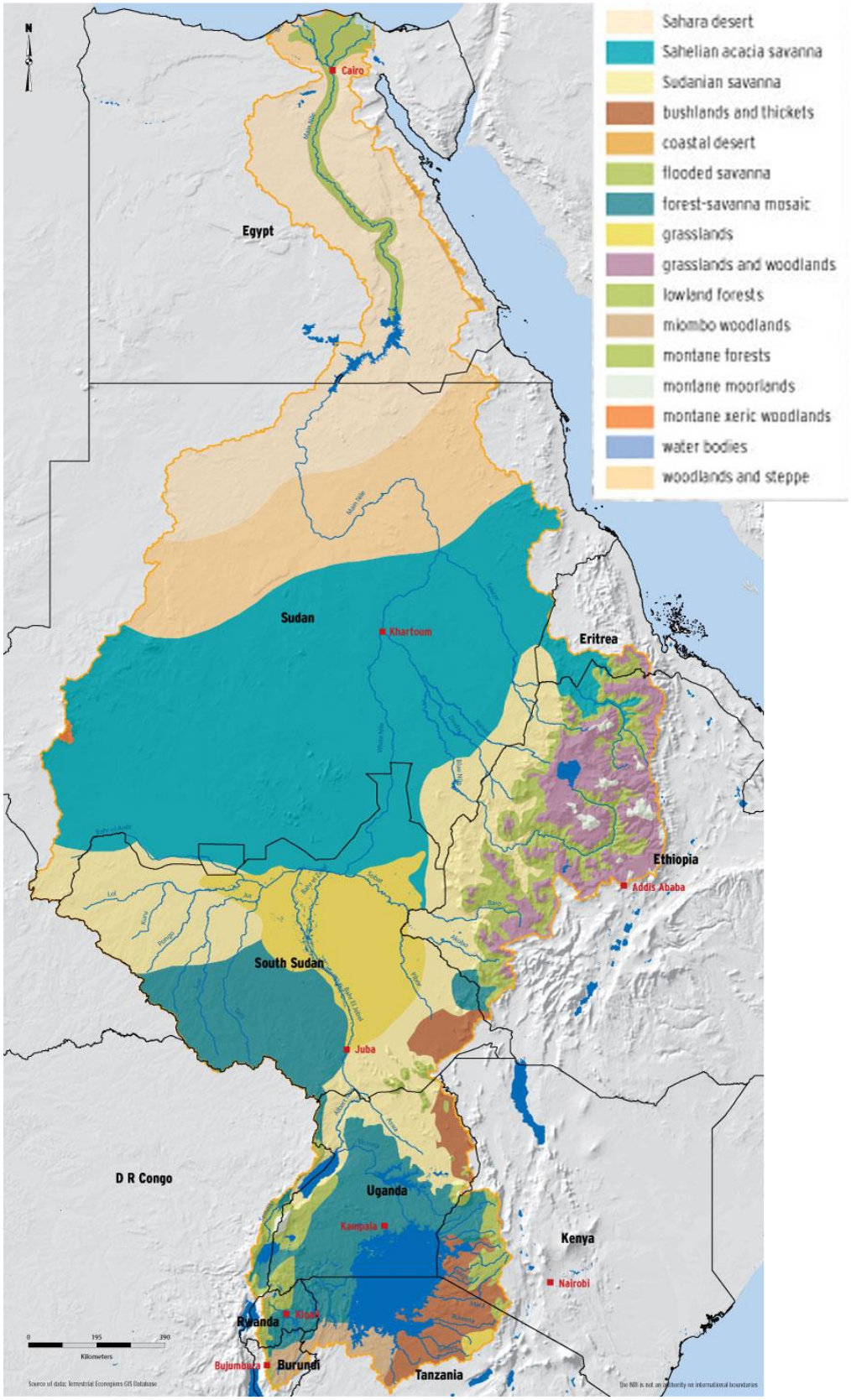



Figure 9: Nile Basin ecoregions

*Source: NBI 2016*

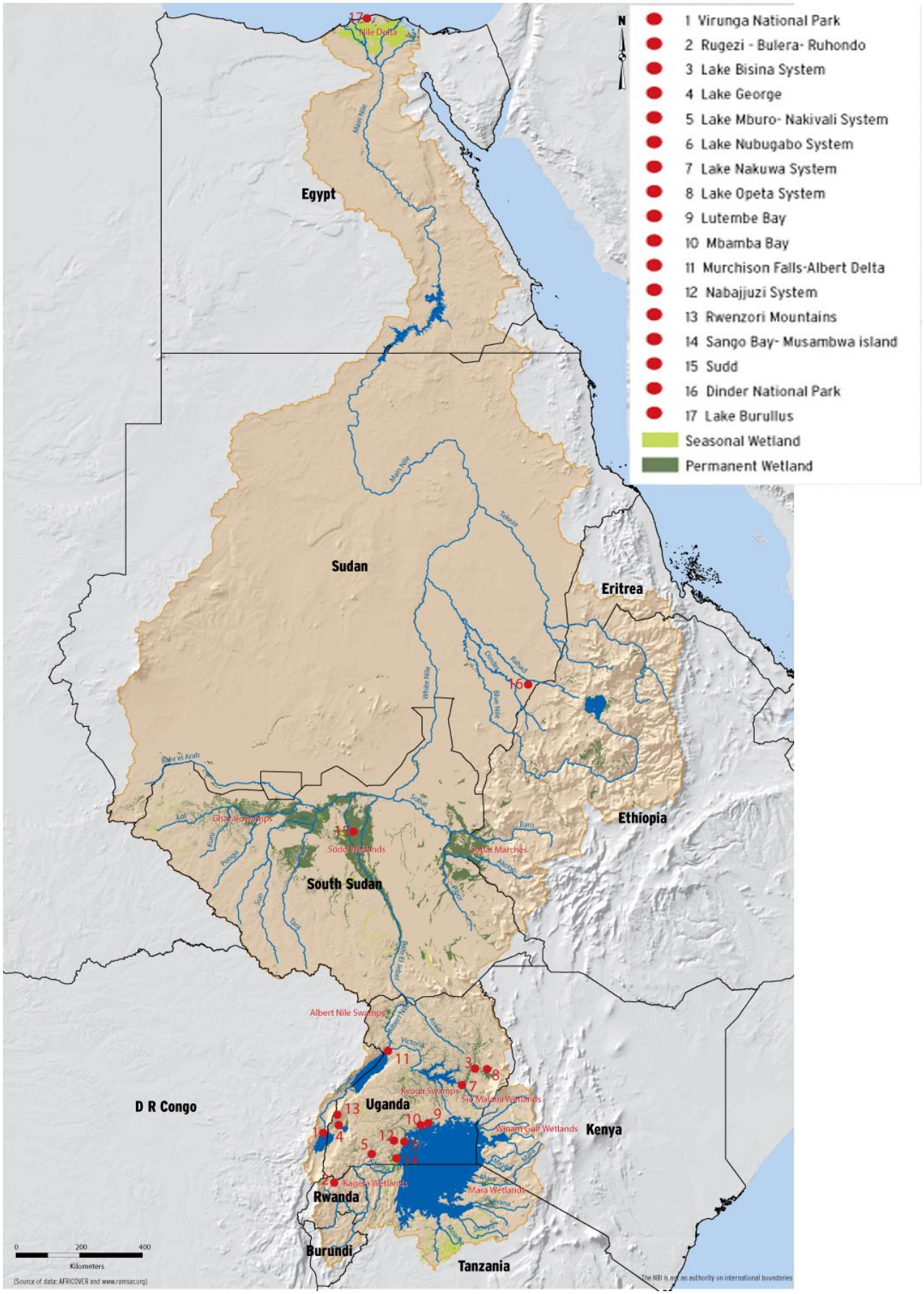



Figure 10: Wetlands and Ramsar Sites in the Nile Basin

*Source: NBI 2016*

## Box 3: Wetlands of International Importance (Ramsar Sites) in the Nile Basin

Virunga National Park (800,000 ha, Democratic Republic of the Congo) Lying astride the equator, the site contains most tropical biotopes and boasts some of the most substantial concentrations of wild mammals in Africa, or indeed in the world. It provides important feeding and wintering grounds to migratory birds and is one of the few places where mountain gorilla can be found in their natural environment.

Rugezi - Bulera- Ruhondo (6,736 ha, Rwanda) Rugezi Marsh is located in a flooded valley near Rwanda's northern border with Uganda at an altitude of 2,050 metres, and feeds Bulera and Ruhondo lakes. The site is a unique and important ecosystem which covers part of an Important Bird Area. The marsh is an important headwater of the Kagera and Nile river systems, and is very significant to the national economy as it enables downstream hydro-electric power generation.

Lake Bisina System (54,229 ha, Uganda) A shallow freshwater lake with a thin strip of fringing papyrus swamp, part of the Lake Kyoga Basin lakes. It is used as a feeding ground by wading birds, and is also important as a refuge for fish species that have gone extinct in the main Ugandan lakes. The lake is important for local communities in terms of fishing, transport, water supply and famine foods.

Lake George (15,000 ha, Uganda) A complex of river systems originating in the Rwenzori Mountains spply a system of permanent swamps located on Lake George. The site supports large mammals, including elephants, hippopotamus, and antelope, and is important for numerous species of wintering waterbirds as well as various notable resident birds.

Lake Mburo- Nakivali System (26,834 ha, Uganda) A system of open and wooded savanna, seasonal and permanent wetlands, and five lakes, of which Lake Mburo is by far the largest. It forms a unique habitat, lying at the convergence of two biological zones, giving it very high biodiversity. The site is also of immense socio-economic value as a source of water for domestic use, livestock and wildlife; pasture for the local herds during droughts; fish; and materials for crafts and thatching. The area is a popular tourist destination.

Lake Nabugabo System (22,000 ha, Uganda) A shallow freshwater lake with three smaller lakes, separated from Lake Victoria by a sand bar. There are no surface outflows from the lakes, only seepage through the sand bank. The lakes contain several endemic fish that have become depleted or extinct elsewhere, and have long supplied local communities with fish, water and handicraft materials.

Lake Nakuwa System (91,150 ha, Uganda) A permanent wetland with a number of satellite lakes and a swamp system dominated by dense papyrus. In addition to supporting the Sitatunga and the Nile Crocodile, the system contains the most diverse cichlid species assemblage and is a haven for a number of non-cichlid species no longer found in the large lakes of Kyoga and Victoria.

Lake Opeta System (68,912 ha, Uganda) Probably most important wetland marshe in Uganda, of great importance for the conservation of birds. The site is also important as a refuge for fish species that have gone extinct in the main lakes. During the dry season the site provides the only refuge for animals from the Pian-Upe wildlife reserve, and is used by local Karimojong and Pokot for livestock grazing.

Lutembe Bay (98 ha, Uganda) Supports globally threatened species of birds, endangered Cichlid fish, and over 100 butterfly species, including three rare ones. The system plays an important hydrological role, with the swamps surrounding the Murchison Bay acting as natural filters for silt, sediments and excess nutrients in surface run-off, wastewaters from industries, and sewage from Kampala City.

Mabamba Bay (2,424 ha, Uganda) The site is part of a wetland system which hosts approximately 38% of the global population of the Blue Swallow and other birds of global conservation concern. It supports a lucrative fisheries activity as well as of raw material for local crafts, building materials, water for domestic and livestock use, and non-wood products.

Murchison Falls-Albert Delta (17,293 ha, Uganda) Stretches from the top of Murchison Falls, where the River Nile flows through a rock cleft some 6m wide, to the delta at its confluence with Lake Albert. The lower parts are important for waterbirds, while the delta is an important spawning and breeding ground for Lake Albert fisheries. Murchison Falls are one of the main tourist attractions and recreation areas in Uganda, and the site is of social and cultural importance to the people of the area.

Nabajjuzi System (1,753 ha, Uganda) Provides a spawning ground for mudfish and lungfish, supports globally threatened bird species and the endangered Sitatunga. Certain species are closely associated with cultural traditions of the Buganda Kingdom, especially the totems. Also plays an important role in stabilizing the banks of River Nabajjuzi, groundwater recharge, flood control and as a natural filter for silt and sediments in the runoff. It is the source of water for nearby townships and provides fish, clay, papyrus, medicine and game meat to local communities.

Rwenzori Mountains (99,500 ha, Uganda) The entire Afro-alpine ecosystem (between 1,600 and 5,100 meters asl.) is unique; with the contribution of high rainfall and the melting of snow from the peaks, various wetland types are present such as peatlands, freshwater lakes, and tundra, amongst others. The mountains are known to support numerous species of global conservation concern.

Sango Bay-Musambwa Island-Kagera Wetland System (55,110 ha, Uganda) A mosaic of wetland types including the biggest tract of swamp forest in Uganda, papyrus swamps, herbaceous swamps interspersed with palms and seasonally flooded grasslands, sandy, rocky and forest shores, and three rocky islets. It lies in the transition between the East and West African vegetation zones, resulting in rich biodiversity. The system supports huge congregations of waterbirds, and hosts globally endangered mammals such as Elephant, Black and White Colobus Monkey and a subspecies of the Blue Monkey.

Sudd Wetland (5,700,000 ha, South Sudan) One of the largest tropical wetlands in the world. The site is composed of various ecosystems, from open water and submerged vegetation to floating fringe vegetation, seasonally inundated woodland, rain-fed and river-fed grasslands, and floodplain scrubland. It is an important wintering ground for birds, and home to some endemic fish, birds, mammal and plant species. The size of the wetland is variable, consisting of permanent swamps during the dry season (November until March) and seasonal swamps, created by flooding of the Nile (Bahr el Jebel), in the wet season (April until October).

Lake Burullus (46,200 ha, Egypt) A shallow, saline lagoon containing numerous islands and islets connected with the sea by a narrow channel. The area provides important wintering, staging and breeding habitat for birds.

Dinder National Park (1,084,600 ha, Sudan) A very large complex of about 40 wetlands and pools formed by meanders and oxbows that are part of the seasonal Rahad and Dinder river drainage systems. The wetlands are vital as a source of water and of the most nutritious grasses for herbivores, especially during the most severe part of the dry season. the site is visited by a large number of species of migratory birds, and some of the areas contain quantities of fish throughout the dry season.

*Source: compiled from Rebelo and McCartney 2012, Ramsar Convention Secretariat 2018*

| Box 4: Key wetland ecosystem services in the Nile Basin | | |
|---|---|---|
| Provisioning | Food | Wild fish, insects, wild game, fruits, vegetables and grains, as well as provision of fodder and pasture for livestock production and farmland for crop cultivation, supporting both subsistence-level and commercial-industrial production and consumption |
| | Fresh water | Storage and retention of water for domestic, industrial, agricultural and hydropower uses. |
| | Fuel and fibre | Timber, polewood, fuelwood, thatch and handicraft materials, supporting both subsistence-level and commercial-industrial production and consumption |
| | Medicinal products | Wild plant and animal products used as traditional remedies as well as providing the raw materials for the pharmaceutical industry |
| | Genetic materials | Materials used for medical, pharmaceutical, agricultural, nutritional, cosmetic and other applications; resistance to plant pathogens; ornamental species; etc. |
| Regulating | Waterflow regulation | Stabilisation of flows, groundwater recharge/discharge |
| | Water purification and waste treatment | Retention, recovery, and removal of excess nutrients and other pollutants |
| | Erosion regulation | Control of runoff, soil stabilisation, sediment and silt trapping |
| | Maintenance of soil fertility | Retention of soil moisture, maintenance of soil structure and quality, supply of soil nutrients required to support plant growth and agriculture. |
| | Natural hazard regulation | Drought mitigation, flood control, storm protection, landslide control, etc. |
| | Climate regulation | Source of and sink for greenhouse gases, moderation of local and regional temperatures, precipitation, and other climatic processes |
| | Pollination | Habitat for bird, bat, mammal and insect pollinators important for cultivated crops and wild species |
| | Biological control | Control of pests and diseases through the activities of predators and parasites such as birds, bats, flies, wasps, frogs and fungi |
| Supporting | Soil formation | Sediment retention and accumulation of organic matter |
| | Nutrient cycling | Storage, recycling, processing, and acquisition of nutrients |
| | Habitat for species | Space, materials and conditions that flora and fauna need to survive or are essential for key stages of their lifecycle (breeding, feeding, migratory, etc.), including rare, endangered and endemic species and those of special cultural or commercial importance |
| | Maintenance of genetic diversity | High numbers of plant and animal species, enhancing the robustness of the system as well as providing the basis for well-adapted cultivars and livestock, and a gene pool for further local-level and industrial product development. |
| Cultural | Cultural, spiritual and inspirational | Source of traditional knowledge, sacred sites, customary practices and knowhow; spiritual and religious significance and inspiration; national or international heritage and iconic status |
| | Recreational | Opportunities for leisure and tourism |
| | Educational and research | Space, species and natural processes to support and inform formal and informal education and training, generate knowledge and learning |
| | Aesthetic | Visual and artistic beauty and appreciation of wetland landscapes, species and cultural elements |

*Source: compiled from NBI 2013c, Rebelo and McCartney 2012, Russi et al. 2013 and other sources (see Annex list of ecosystem valuation studies carried out in Nile Basin countries), based on categories provided in MEA 2005b and TEEB 2018.*

For example, not only do wetlands provide a wide range of natural products (such as fish, fuel, fodder, pasture, timber, thatch, fibres, clay, sand, wild foods and medicines) that are harvested for income and subsistence, or used as raw materials in industrial production, but they have an important impact on flow regimes in the Nile basin (Sutcliffe and Parks 1999). They help to store water, stabilise waterflow, improve water quality, trap silts and sediments, cycle nutrients, maintain land productivity and soil fertility, and reduce the risk of natural disasters, especially droughts and floods. In many places, wetlands are closely linked to cropping and livestock management, particularly as a source of floodplain or flood recession agriculture and dry season grazing; they also often provide the only year-round source of water for domestic use (Rebelo and McCartney 2012). In addition, the Nile Basin's wetlands provide breeding grounds and habitat for an exceptional range of wild fauna and flora species, some commercially important (such as to the fisheries or tourism sectors) and many of which have global conservation significance. Finally, they have an important influence on the local microclimate, and large wetlands (such as the Sudd) even impact regional rainfall patterns (UNEP 2015).

Wetlands have multidimensional contribution for the ecosystems. Wetlands provides provisioning, regulating, supporting and cultural ecosystem services, notably related to tourism, recreation, and research (Smakhtin 2012; Mitsch & Gosselink 2015). Currently numerous empirical and case studies verify the importance of wetland for the ecosystem and livelihood (Jogo & Hassan 2010; Turpie *et al.* 2010; Lisa-Maria & Matthew 2012; Mulatu *et al.* 2014), but most of studies focused on valuation of developed country wetland and are very limited in developing countries. On those studies carried out in developing countries, African wetlands are clearly underrepresented. At the same time, African wetlands are facing serious threats, but the importance of their protection for the survival of local people is increasingly recognized (Schuyt 2005). Despite such endeavours and success at global scale, much is still left with the challenge of bringing useful approaches and information to bear at different ecological scales ( i.e. global, biome, landscape, ecosystem, plot and plan level) and institutional scales (i.e. individual, family, community, local, regional, national and international scales)(Hein *et al.* 2006). Particularly to support assessments at local scales where most decisions are made, by considering the social, economic and bio-physical contexts of values associated with alternative ecosystem services (Tallis & Polasky 2009). In addition, wetlands are at risk from a arrange of stress factors. Practical application of wetland ecological risk assessment will result in a better understanding of how wetland biophysical pressures impact on wetlands and will provide a framework for sensible wetland management (Malekmohammadi & Rahimi Blouchi 2014).

Policy and decision-makers at many institutional scales are also not well- informed about the connections between wetland condition and the provision of wetland services and the consequent benefits and economic values. This limited understanding and recognition leads to ill-informed decisions on management and development, which contributes to the continued rapid loss, conversion, and degradation of wetlands-despite the wetland natural economic value is often greater than other alternative land uses (de Groot *et al.* 2016). Currently, wetland ecosystem services are undervalued in decision-making in the Nile Basin. Not only does this encourage policies and plans that lead to wetland degradation and loss (thereby causing costs, damages and losses by undermining the provision of economically-valuable ecosystem services), but it also leads to missed economic and development opportunities (by overlooking the contribution that wetlands make to water-related and other ecosystem services). The protection of wetlands reflects the protection of numerous wetland ecosystem services that has an economic value not only to the local population living in their periphery but also to communities outside these wetland areas (Baral *et al.* 2016). The public nature of wetlands, users externalities and policy intervention failures are threatened wetlands all over the world (Skourtos *et al.* 2003). In addition, the major challenges to manage wetlands sustainably is that wetland users and decision-makers have insufficient understanding of the consequences of alternative management and policy regimes on wetland functioning, ecosystem services and human well-being (Jogo & Hassan 2010). However, the management of the wetland in the Nile basin often does not get a priority, mainly due to poor realization of the economic value of the wetlands. Therefore, to highlight on how the wetland situation can provide complementary insights into sustainable and welfare-optimizing wetland management, development and policy implications in the Nile basin, twenty one selected Nile basin TEEB case studies that enhance policy decision, wetland management and development options are presented below.

# Case Study 1: Burundi

### What was the study aim and focus?

The study seeks to overcome the problems associated with undervaluation that lead to ecosystems not being adequately considered in decision-making and mechanisms for sustainable harvesting. As other parts of the Albertine Rift, unprotected ecosystems in Burundi are threatened by poverty and high local reliance on the forest products, unregulated use and weak enforcement of laws and regulations. at local level and limited evidence of their contribution to the economy and social well-being of the population. By generating information on the value of ecosystem services in the Kibira-Rusizi landscape, the aim is to provide sufficient arguments for increased protection of the forest and actions to address on the damaging activities currently taking place.

### Which methods were used?

The study relies on market prices and benefit transfer valuation techniques. Market prices are mainly applied to local resource uses, while the latter are used to calculate regulating and cultural services. The main sources of data were focus group discussions and field observations among the communities living in and around Rusizi and Kibira forests, as well as a review of literature and statistics. Before field data collection, planning workshop has been conducted and aimed at building capacity for the data collection team on the key economic valuation concepts and approaches to be used during data collection.

### What were the findings and conclusions?

The study underlined the high value of forest and wetland ecosystem services, many of which would not traditionally be considered in decision-making because of their non-market nature. Analysis shows that Kibira forest generates goods and services with a gross value of USD 30.9 million in total, equating to annual net benefits (less management costs, opportunity costs and crop damage by wild animals) of up to US$ 642 per hectare. For Rusizi, the figures are USD 7.65 million and US$ 1,139 per hectare respectively. In Kibira just over 40 per cent of the total figure comes from local resource uses such as water, timber, woodfuel, medicines, wild foods, pasture, fodder, handicrafts and construction materials, and in Rusizi 65 per cent. The remainder is comprised of regulating and cultural services such as carbon storage, flood control, pollination and ecotourism. These high figures are used to justify the need to invest resources for the conservation and sustainable management of the ecosystem.

Kakuru, W., Kanyamibwa, S., Nsabagasani, C., Nsengiyumva, P., Ndengera, M. and J. Ntukamazina (2014) The Total Economic Value (TEV) of Rusizi-Kibira Lanscape, Burundi. Albertine Rift Conservation Society (ARCOS) Network, Kampala, Kigali and UK.

# Case Study 2: Democratic Republic of Congo

### What was the study aim and focus?

In 2007, oil concessions were granted covering 85 per cent of Virunga National Park. In response, WWF launched a campaign to raise awareness of Virunga's economic value and the implications of oil development for local communities and the environment. As part of the campaign, this study is commissioned to look at Virunga's current and potential social and economic value and to indicate the implications of oil exploration and exploitation.

### Which methods were used?

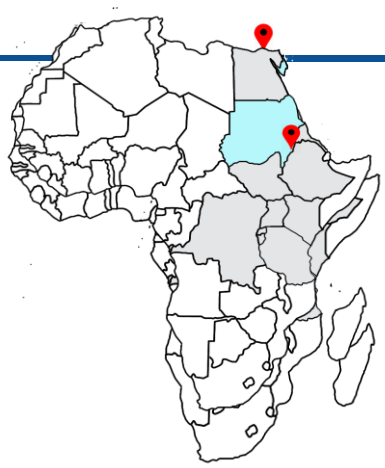
The study is based around a total economic value framework, classifying all social and economic benefits from an ecosystem into three categories: direct-use, indirect-use and non-use values. Different valuation techniques were applied to various benefit types, including market values, travel costs, effect on production, replacement costs, damage costs avoided and benefit transfer methods. Valuation was carried out using a combination of primary and secondary data.

### What were the findings and conclusions?

Under present circumstances, Virunga's estimated annual economic value is US$48.9 million. In a stable situation characterized by the absence of conflict, secure access to the park and sufficient resources to protect the ecosystem, this value could increase to more than US$1.1 billion per year, including providing more than 45,000 jobs. These values incorporate three components. Potential future direct use of Virunga's ecosystem could generate US$348 million per year and help diversify DRC's economy. The main contributors to this value are tourism at a potential value of US$235 million, fisheries at a potential value of US$90 million, and hydropower at US$10 million. Potential future indirect use of the park through the provision of ecosystem services can generate US$63.8 million. The main contributors to this value are carbon sequestration at US$55 million, water supply at US$1 million, and savings from erosion control at US$7.8 million. Non-use value, or the value represented by knowing that park's resources can be used in the future, could be as high as US$700 million per year. These findings are used to argue that immediate steps should be taken to protect the park from oil exploration, and to work towards unlocking its potential as a sustainable source of direct income for local communities, the park management and the government.

WWF (2013) The economic value of Virunga National Park. A report to WWF by Dalberg Global Development Advisors2

# Case Study 3: Egypt



## What was the study aim and focus?

The case study is carried out as part of the Nile Ecosystems Valuation for Wise-Use (Nile Eco-VWU) project, which developed and tested integrated tools for economic valuation of wetland ecosystems services that can be applied at local and regional scales within the Nile Basin. It sought to fill knowledge gaps about how the values of wetlands are perceived, what tools can be used to estimate those values, and what the role of communities is in wetland values and management. The intention is that a better understanding of the consequences of decisions for ecosystem services will help optimise wetland use for total economic value, and ultimately contribute to improved local and regional policies and enhanced livelihoods for local communities.

## Which methods were used?

The study used various questionnaires, administered to families (looking at the socio-economic background and local context), women and men (livelihoods and knowledge), and young people (perceptions, activities and future plans). A standardised, stepwise valuation methodology was applied (developed by the project), which involved benefit transfer, market price, replacement cost, travel cost and contingent valuation methods.

## What were the findings and conclusions?

The study finds a wide variety of economically important ecosystems services. In addition to generating a variety of useful plant products (used, for example, for grazing, fuel, medicines, food, and timber), Lake Burullus acts as a buffer zone between the Mediterranean Sea and the Nile Delta, preventing saltwater intrusion into the low-lying and productive agricultural lands of the Nile Delta. It also supports a substantial fishery, supporting an annual catch of around 60,000 tonnes. The findings underline the need for regional policies and strategies to develop a unified model for valuing ecosystem services which includes both market and non-market values. These are required to generate the information needed to inform and promote a more integrated approach to wetland management and use which recognises and addresses key trade-offs.

Nile-Eco-VWU (undated) Case study brief: Lake Burullus, Egypt. Nile Ecosystems Valuation for Wise-Use (Nile-Eco-VWU), CGIAR Research Program on Water Land and Ecosystems and Nile Basin Capacity Building Network, Cairo; Nile-Eco-VWU (undated) Policy brief: why valuing wetland ecosystem services within the Nile Basin is important for wise use. Nile Ecosystems Valuation for Wise-Use (Nile-Eco-VWU), CGIAR Research Program on Water Land and Ecosystems and Nile Basin Capacity Building Network, Cairo.

# Case Study: Sudan

## What was the study aim and focus?

The case study is carried out as part of the Nile Ecosystems Valuation for Wise-Use (Nile Eco-VWU) project, which developed and tested integrated tools for economic valuation of wetland ecosystems services that can be applied at local and regional scales within the Nile Basin. It sought to fill knowledge gaps about how the values of wetlands are perceived, what tools can be used to estimate those values, and what the role of communities is in wetland values and management. The intention is that a better understanding of the consequences of decisions for ecosystem services will help optimise wetland use for total economic value, and ultimately contribute to improved local and regional policies and enhanced livelihoods for local communities.

## Which methods were used?

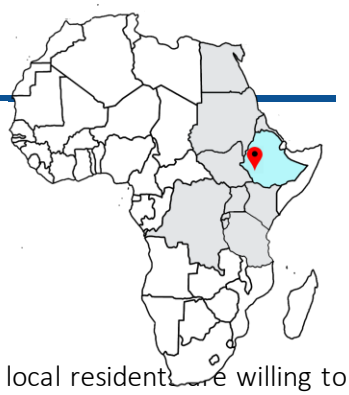
A standardised, stepwise valuation methodology was applied (developed by the project), which involved benefit transfer and market price methods in Dinder National Park. Estimates from other sites and studies were used to assess the value of the wetland for water purification, recharge and supply and to measure its flood attenuation, habitat and breeding services. Market prices are applied to estimate of the value of locally-used wetland and woodland products (such as clay, bricks, wild food and medicinal plants, game meat, fish, honey, charcoal, handicraft items and wetland crops).

## What were the findings and conclusions?

The study finds that the wetlands of Dinder National Park support a huge variety of provisioning, regulating, supporting and cultural ecosystem services. The value of wetland products, land uses and functions is calculated to be USD 805,223. Yet, despite the importance of these locally-used and non-market wetland goods and services, they are not always fully reflected in protected areas management approaches. Biodiversity conservation, recreation and tourism opportunities are considered to be particularly important issues in future plans for the sustainable management of the National Park.

Nile-Eco-VWU (undated) Case study brief: Dinder National Park, Sudan. Nile Ecosystems Valuation for Wise-Use (Nile-Eco-VWU), CGIAR Research Program on Water Land and Ecosystems and Nile Basin Capacity Building Network, Cairo; Nile-Eco-VWU (undated) Policy brief: why valuing wetland ecosystem services within the Nile Basin is important for wise use. Nile Ecosystems Valuation for Wise-Use (Nile-Eco-VWU), CGIAR Research Program on Water Land and Ecosystems and Nile Basin Capacity Building Network, Cairo.

# Case Study 5: Ethiopia



### What was the study aim and focus?

The study is concerned with assessing the trade-offs that inevitably occur regarding the management and allocation of the two key resources, water and land, that together determine the status of wetland ecosystems and the potential flow of benefits to human wellbeing. It also seeks to provide information that can be used to make the economic case for wetland conservation, based on the important role that wetlands play in both rural livelihoods and national economic processes. The study site, Boye, is close to the town of Jimma, and exemplifies many of the pressures that wetlands currently face in Ethiopia: for example, pollution, resource over-exploitation and land conversion.

### Which methods were used?

The study uses travel cost and contingent valuation methods. This involved conducting separate visitor surveys to assess direct use values (measured via visitors' travel costs) and non-use values (contingent valuation among local community members). Semi-structured questionnaires are used to assess how much visitors and local residents are willing to pay for an improvement in wetland quality. An individual travel cost approach is followed. The contingent valuation survey is based on double bounded dichotomous choice questions with different starting bids, followed by lower or higher bids depending on their initial response.

### What were the findings and conclusions?

The study finds that Boye wetland yields significant values. Local residents recognise a wide range of non-use benefits, and also feel a strong sense of stewardship responsibility towards maintaining the wetland. Average willingness to pay is ETB 75 per person per year, giving a total local value of ETB 11.3 million. Meanwhile, the average recreational value is calculated at ETB 480 per visits, or ETB 2.2 million in total. The study makes the point that the wetland generates many economically valuable services in addition to tourism and non-use values, such as habitat and biodiversity conservation, livestock fodder production, nutrient cycling and regulation of greenhouse gas fluxes. There is reported to be a general consensus that recreational and other non-extractive values often outweighs extractive wetland resource uses. This is used to argue that the protection of wetland ecosystems is a key responsibility of today's politicians, resource managers and of the people who depend and impact on wetlands.

Emiru, R. and A. Gemechu (2017) Valuing the Benefits of Recreational Wetland Ecosystem: An Application of Contingent Valuation and Travel Cost Methods: The Case of Boye Recreational Wetland, Jimma Zone, Oromia National Regional State, Ethiopia. Journal of Resources Development and Management 29: 78-

# Case Study 6: Ethiopia

### What was the study aim and focus?

The study is prompted by the increasing pressure on wetlands caused by conversion to other land uses, especially livestock grazing and crop farming. This is a particular problem in the study sites, Kitto and Boye wetlands, which are located near the rapidly-expanding Jimma town in South West Ethiopia. Lack of information and awareness on environmental benefits are posed as being major reasons for wetland degradation and loss. The study thus seeks to generate knowledge and information that decision-makers require to make informed decisions about wetland management and use.

### Which methods were used?

The study applies choice experiment techniques, based on household level data collected from randomly-selected respondents. These are used to investigate whether local households are willing to pay for conservation intervention, estimate the value of major wetland attributes, and identify attributes of the wetlands need to be improved. Key attributes identified for valuation and included in possible interventions to improve wetland quality include fish stock and water purification Electricity bills were selected as the payment vehicle. The survey questionnaire had two main sections. The first section was about socio-economic and demographic characteristics. The second section was the choice experiment, which presented six alternative choice, each formed by the status quo plus two management alternatives.

### What were the findings and conclusions?

The study finds that local communities are highly concerned about the environmental problems associated with wetlands degradation, and are willing to pay for the improvement of selected wetlands attributes. The most preferred attribute is fish stock, showing a marginal willingness to pay of a one-off payment of just over ETB 5. The value is some ETB 2 for water purification attributes of the wetland. The compensating surplus, which reflect the overall willingness to pay of respondents for changes from the status quo to alternative improved scenarios, show that community members are willing to contribute almost ETB 40 each towards conservation interventions that will help to improve key wetland attributes. Various strategies are highlighted that may help to halt wetland degradation in the study area, with an emphasis on approaches that fully involve local households at all levels of the implementation.

Abebe, T., Seyoum, A. and D. Feyssa (2014) Benefits of wetland conservation interventions to local households in southwestern Ethiopia: empirical evidence from attributes -based valuation. Journal of Environmental Science and Water Resources 3(3): 60-68.

# Case Study 7: Kenya

### What was the study aim and focus?

The study is prompted by need to mainstream ecosystem services into development plans to utilise the waters of the Tana River (for example for water supply for Nairobi City and for the proposed and on-going Lamu port/city, to produce food using irrigation and to develop hydropower. Any change in the Tana's water availability and hydrological regime affects the potential to deliver ecosystem goods and services. The TEEB study seeks to understand the economic values of positive and negative externalities of different water-flow regimes, both upstream and downstream in the Tana River basin, and the temporal dynamics of changes varying between short- and long-term effects, as well as seasonal fluctuations. The intention is to help to ensure that water allocations are better tailored to actual water needs, contribute to decisions that result in the efficient utilization of public resources and result in maximum societal utility, and encourage evidence-based assessments of the distributional consequences of water decisions. Note that we present this case study as a good leaning experience but not part of the Nile Basin.

### Which methods were used?

The study models four scenarios representing the most important planned river basin developments. These include a natural state without any water interventions, and scenarios incorporating various combinations of hydropower schemes and large-scale irrigation. A GIS-based rainfall-runoff model (STREAM) is set up to simulate river discharges for each scenario. Each changing hydrological regime is associated with a seasonal flooding pattern and different levels of ecosystem services, which are valued mainly through market prices and effect on production techniques. The consequences of the different intervention scenarios relative to the baseline are modelled through an extended cost-benefit analysis.

### What were the findings and conclusions?

The study demonstrates that flood-based ecosystems in the Tana Basin provide various services to people, ranging from floodplain agriculture, grazing and pasture, water supply and quality, habitat and ecotourism possibilities. The study finds that while dam construction generates abundant benefits for the upstream region in terms of electricity, potable water and agricultural outputs, the downstream region incurs net losses from reduced agricultural productivity and increased health complications. While increased irrigation creates significance on-site agricultulral benefits, it is likely to cause serious water shortages which will lead to substantial declines in health, potable water availability, fisheries and livestock options.

van Beukering, P. and H. de Moel (eds) (2015) The Economics of Ecosystem Services of the Tana River Basin Assessment of the impact of large infrastructural interventions. Report number R15-03, IVM Institute for Environmental Studies, Amsterdam.

# Case Study 8: Kenya

### What was the study aim and focus?

The study addresses the topic of multifunctionality in relation to floodplains. They are widely utilised for agricultural production, and also contain a variety of other ecosystems that provide a wide range of economic, social and environmental benefits to society. A concern is that wetlands are threatened by degradation due to over-exploitation and conversion to agriculture, which can compromise or even reduce the generation of ecosystem services, due to conflicting demands on water resources and land. The study seeks to value and compare provisioning and cultural ecosystem services in Ombeyi natural wetland and Kore Irrigation Scheme rice fields (both on the Kano floodplain of the Nyando River Basin), so as to demonstrate how information can be generated with which to provide a basis for informed land and water decision-making.

### Which methods were used?

The study collected data through a household questionnaire survey of randomly-selected farmers and a focus group discussion. It considers a variety of provisioning services (fibre, papyrus mats, reeds, thatching grass, fish and rice) and cultural services (religious/spiritual, eco-tourism, educational excursions and recreational use). Both monetary and quantitative valuation techniques are used. Provisioning services are quantified in terms of biophysical quantities and market values, while cultural services are graded by level of utilisation as low, medium and high.

### What were the findings and conclusions?

The study finds that that rice fields have enhanced food production, in addition to giving a higher value in terms of provisioning services of rice (USD 602.49), fish (USD 1039.50), and cultural services of religious/spiritual and recreational use. In the natural wetland, both provisioning and cultural services have declined over the past 20 years, due to land conversion, over-exploitation, change in flood patterns, climate change and other factors. Annual monetary values of USD 397.40 and 683.50 were observed for papyrus mats and fish production. Yet, although rice fields seem to have a higher value compared to the natural wetland and to have at least partially compensated for the loss of ecosystem services they have caused in terms of greater food values, they cannot generate other provisioning, cultural and regulating services provided by wetlands. It is evident that sustainable utilisation of both natural wetland and rice cultivation systems is crucial for maintaining and enhancing livelihoods in the floodplain area.

Ondiek, R., Kitaka, N. and S. Odour (2016) Assessment of provisioning and cultural ecosystem services in natural wetlands and rice fields in Kano floodplain, Kenya. Ecosystem Services 21: 166-173.

# Case Study 9: Rwanda

### What was the study aim and focus?

The study seeks to help to overcome the threats to wetlands arising from an inadequate appreciation of their economic importance, and especially of the key role that wetland goods and services play in local livelihoods in many African countries. It highlights that the impacts of agriculture and water management in wetland areas pose particular threats, and so focuses on this topic. The study presents information to assist in better understanding current threats to wetland ecosystems in Rwanda, and to identify opportunities for increasing the sustainability of both wetland use and farmer livelihood.

### Which methods were used?

A variety of survey methods are described, including participatory rural appraisal techniques, a formal household questionnaire survey, and the monitoring for quality improvement toolbox. As well as yielding qualitative information on agricultural management and production systems, this provides detailed quantitative and monetary data on output and financial indicators based on market price expressions of gross margin and net farm income.

### What were the findings and conclusions?

The study underlines the crucial role that wetlands play in maintaining household food security and income. It finds that while household dependency on wetlands varies due to both socio-economic and biophysical conditions (such as wealth, field size, soil fertility and input use), they form a significant component of local farming systems in both Cyabayaga and Rugeramigozi wetlands. Wetland farming is also closely linked to hillside farming, as each provides different and complementary opportunities, and together provide a mechanism to spread risk and increase cropping diversity. In Cyabayaga, wetland cultivation contributes 74 per cent to gross margins and to 80 per cent net farm income, and in Rugeramigozi 25 per cent and 18 per cent respectively. Surveys also highlight that wetlands are being degraded, fertility and productivity is declining, water levels are decreasing, and the incidence of both seasonal droughts and floods is increasing. Poor maintenance of drainage and irrigation channels as well as inappropriate wetland cropping systems are shown to undermine sustainability and have repercussions for farmers' income and livelihoods

Nabahungu, N. and S. Visser (2011) Contribution of wetland agriculture to farmers' livelihood in Rwanda. Ecological Economics 71: 4-12.

# Case Study 10: Rwanda

### What was the study aim and focus?

Rugezi wetlands were valued as part of a bigger exercise to demonstrate how resources and ecosystem services make significant contribution to economic growth and poverty reduction at the national level in Rwanda and that, conversely, failure to conserve the natural environment will result in costs of degradation that will compromise medium and long-term sustainable development. As well as seeking to develop a methodology that could capture the value of environment and natural resources in the context of the Rwandan economy and policy making process, the study aimed to generate evidence to raise the awareness of decision-makers about the importance of these linkages.

### Which methods were used?

This Study uses both qualitative and quantitative methods to assess the value of Rugezi wetlands, including household surveys, market prices, replacement cost and effect on production techniques as well as a review of secondary data sources and literature

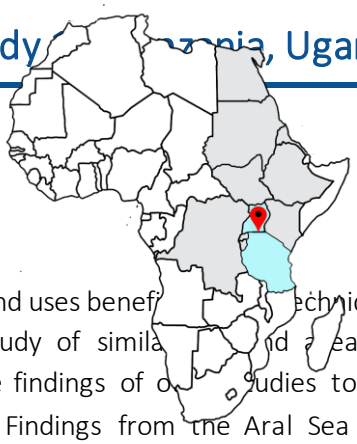
### What were the findings and conclusions?

The study showed that, within the last three decades, wetland degradation has resulted in falling water levels in the two lakes that supply Ntaruka and Mukura hydropower stations. This has resulted in shortages of power supply, and necessitated the purchase of diesel generators. In turn, electricity prices have increased by some 250 per cent and the government is having to spend up to USD 65,000 a day to operate the generators. In addition, the livelihoods living in and around Rugezi wetlands have been severely impacted by environmental degradation, due to the diminution or complete disappearance of products such as wild meat, medicinal herbs, fish, pasture, thatching grass, reeds and clay. Almost two thirds of local households depend on these products. The incidence of flooding has also increased, and women have to walk much further to collect water. While these local-level effects are not valued in monetary terms, various quantitative indicators are presented to illustrate the magnitude of these damages and losses. The study is able to present evidence of the important role that environment and natural resources have to play at the policy-level, as part of national economic development and poverty reduction strategies and in efforts to achieve the aspirational goals embodied in Vision 2020, the Millennium Development Goals and other global processes.

Musahara, H., Musabe, T. and Kabenga, I. (2008). Economic Analysis of Natural Resource Management in Rwanda. UNDP/UNEP Poverty and Environment Initiative, National Environment Authority, Kigali.

# Case Study 11: South Sudan





## What was the study aim and focus?

The purpose of the study is to describe the role of the Sudd in supplying the year-round ecosystem services, and to outline a new approach to ecosystem valuation that takes into account the dynamic, evolutionary nature of ecosystems and the human activities they support. It was carried out to generate information on the high economic value of the Sudd's wetland services, in the face of the heavy development pressures which threaten its degradation and major disruptions to the cultures that have thrived for centuries.

## Which methods were used?

The study looks at three dimensions of value: economic, cultural and ecological. Some components of value are expressed in monetary units (for example the potential of Sudd for agriculture, fisheries, forestry, and eco-tourism), while others can be quantified but not easily expressed in monetary units (such as the number of people whose livelihoods depend on the wetland or variety and kinds of species inhabiting the wetland). At the ecosystem level, many critical features of the wetland are described but not precisely quantified (how it functions as a stabilizer of the microclimate, or how it dampens the effects of the seasonality of the flow of the White Nile). Monetary valuation relies entirely on secondary data sources, and uses benef[illegible]echniques and a meta-study of simila[illegible]d a[illegible]eas to extrapolate the findings of o[illegible]udies to the Sudd wetland. Findings from the Aral Sea and Mesopotamian Marsh are used to worst case consequences of wetland loss, while the Serengeti and the Okavango Delta are used to show the benefits of restoring or preserving wetlands.

## What were the findings and conclusions?

The study estimates the potential economic contribution of the Sudd's ecosystem services at more than USD 990 million per year. It emphasises that this represents only a tiny fraction of the total value, which includes non-economic benefits that could not be quantified, such as its potential as a symbol of national identity, its role in climate change mitigation, regulation of the flow of the White Nile, and supporting South Sudan's unique wildlife and cultures. The study concludes that the wetland is potentially the greatest economic asset in South Sudan, arguing that (unlike the country's rapidly depleting petroleum resources) it could, if properly managed, provide income, jobs, and irreplaceable ecosystem services indefinitely. An evolutionary path towards sustainability is recommended, and the advantages of long-range planning and comprehensive public policies are highlighted.

## What was the study aim and focus?

Gowdy, J. and H. Lang (2016) The Economic, Cultural and Ecosystem Values of the Sudd Wetland in South Sudan: An Evolutionary Approach to Environment and Development. The Evolution Institute and United Nations Environment Programme (UNEP), Nairobi.

The study was carried out to provide justification for a series of conservation interventions being planned for the transboundary ecosystem of Sango Bay (Uganda) and Minziro Forest (Tanzania). It assumes that information about the value of biodiversity and ecosystem services can help to make the case for the conservation interventions that are being proposed, and assist in better mainstreaming biodiversity priorities into government and donor policies and budgets. The valuation study was carried out under the auspices of the USAID-funded Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development (PREPARED) project, which worked to develop conservation plans for a number of transboundary 'biologically significant areas' in East Africa.

### Which methods were used?

The valuation study involved a rapid assessment, carried out over a period of just under two weeks. This involved visits, stakeholder and expert consultations at various levels, literature review, collation of existing national and district statistics, data entry, analysis and reporting. Using a total economic value framework, market prices and surrogate market prices for local use values, and benefit transfer for regulating, supporting and cultural services. The data are used to answer three questions: how and for whom does the Sango Bay-Minziro complex generates economic benefits? what is the current value of biodiversity and ecosystem services? and what are the gains, costs-avoided and economic justification for taking steps to invest in conservation?

### What were the findings and conclusions?

The study finds that the Sango Bay-Minziro ecosystem provides services worth about USD 236 million per year, contributed almost equally from each site. These services contribute to livelihoods through income, food and nutrition security and supporting different sub-sectors such as crop and livestock farming and through purification of the water and air. Around 38 per cent of the total economic value of the transboundary site comes from provisioning services (mainly water, fisheries, wood fuel, pasture and other non-wood/non-fish products used by local communities), 60 per cent from regulating and supporting services (such as soil fertility, pollination, regulation of waterflow and quality, flood attenuation, carbon storage and habitat), and 2 per cent from tourism. The benefits provide incentives to local communities that can strengthen conservation efforts. It is argued that these high values provide a clear justification for financing better management and conservation of the ecosystem.

Kakuru, W. (2016) Economic valuation of Sango Bay-Minziro ecosystem. Report by LTS Africa Ltd for Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development (PREPARED) project, Nairobi.

# Case Study 13: Tanzania

### What was the study aim and focus?

The study was carried out to support and justify a management plan that was being developed for the area, as well as to assist in making the case for designating it as a Ramsar Site. The valuation study was carried out under the auspices of the USAID-funded Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development (PREPARED) project, which worked to develop conservation plans for a number of transboundary 'biologically significant areas' in East Africa.

### Which methods were used?

The study was based on a literature review and collation of existing national and district statistics, as well as a rapid field assessment. The primary data were collected via household questionnaires, focus group discussions and other participatory rural appraisal exercises. Using a total economic value framework, the study focuses on agricultural productivity, water supply, capture fishery, wood based energy, timber and non-timber products and non-fish wetland products. The market price method is used to value provisioning services. and benefit transfer techniques are used to estimate the regulating/supporting and cultural services offered by the wetlands. The data are used to answer three questions: how and for whom do the Mara Wetlands generate economic benefits? what is the current value of biodiversity and ecosystem services? and what are the gains, costs-avoided and economic justification for taking st[illegible] invest in conservation?

### What were the findings and conclusions?

The study calculates that the economic value of the Mara Wetlands of TZS 6.3 billion or USD 5 million a year, equivalent to a per capita value of TZS. 130,438 or USD 103 per year. This is composed of a diverse variety of ecosystem services, including crop production USD 1.39 million), water for livestock (USD 671,259), capture fishery (USD 414,393), wood products (USD 556,518O, fodder (USD 359,397), honey (USD 11,140), medicinal plants, bush meat, papyrus and wild fruits and vegetables (USD 133,479), cultural tourism (USD 19,688) and carbon sequestration (USD 835,989). It concludes that wetland ecosystem services make an appreciable contribution to local rural livelihoods both in terms of direct cash income and contributions to food security, through strengthening resilience and assisting in disaster risk reduction, as well as through providing economic diversification opportunities. Because these values tend to be weakly reflected in decision-making, the wetlands remain under threat. There is a need to both develop and adequately finance integrated management plans for efficient and sustainable utilisation of the wetland resources, while conserving critical biodiversity and ecosystem services.

Gichere, S. (2016) Economic valuation of biodiversity and ecosystem services in the Mara Wetlands, United Republic of Tanzania. Report by LTS Africa Ltd for Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development (PREPARED) project, Nairobi.

# Case Study 14: Tanzania

### What was the study aim and focus?

This study is concerned with investigating the linkages between wetland conservation and poverty reduction, and had a special focus on generating information that could assist in integrating environment into Tanzania's National Strategy for Growth and the Reduction of Poverty. Its general objective is to assess the economic value of the Ihefu wetlands and show how community livelihoods and local welfare depend on them. The aim is to generate information on economic analysis and business models that could contribute to tackling under-investment in environmental assets, through stimulating improved mobilisation of government and donor resources.

### Which methods were used?

The study carried out a partial valuation exercise, using primary data gathered through a combination of socio-economic surveys, structured interviews, participatory observation and focus group discussions, as well as a literature review of secondary sources. Using a total economic value framework, selected wetland goods and services are selected for valuation: hydropower production, fishing, agricultural produces, livestock, building materials, woodfuel, bushmeat, mushrooms, medicinal plants and wild foods. In addition, respondents were asked to evaluate the changes in their welfare arising from changes in access to Ihefu Wetland.

### What were the findings and conclusions?

The study finds that Ihefu Wetlands is an important ecosystem to both local communities and the national economy. For example, almost two thirds of national hydropower supplies are generated from waters originating from the area. This provides a powerful argument for watershed and wetland conservation. However, despite these values, it is argued that a more comprehensive approach is still required to manage the catchment area. Many community members perceive that their welfare has worsened since they have lost access to wetland resources since the expansion of the nearby Ruaha National Park. This includes economically valuable woodlands, pasture, floodplain agriculture and fishing areas. It is therefore important that any management strategy takes community livelihood needs into account. Improving sustainable natural resource livelihoods is proposed as a mechanism for poverty reduction, at the same time as improving the efficiency and sustainability of agriculture.

Lokina, R., Mduma, J., Mkenda, A., Hepelwa, A. and Ngasamiaku, W. (2012) Economic Valuation of Ihefu Wetland: Poverty and Environment Linkages. UNEP/UNDP Poverty and Environment Initiative, Dar es Salaam.

# Case Study 15: Uganda

### What was the study aim and focus?

The study was prompted by the widescale drainage, conversion and reclamation of wetlands in Uganda's cities, in the face of rapid urban development. Urban planners and development decision-makers remain largely unaware of the economic and conservation significance of their species and services, seeing wetlands as 'wastelands' that could be better used for more productive and economic purposes such as housing, agriculture and infrastructure development. The study was carried out by the Wetlands Inspection Division of the Ministry of Water, Lands and Environment – the national government agency mandated with wetlands management in Uganda.

### Which methods were used?

The study focused on the focused on the economic value of Nakivubo Swamp's wetland wastewater purification and nutrient retention services. It used replacement costs and mitigative/avertive expenditures techniques to value these functions, looking at the cost of alternative measures to treat the wastes and effluents that are currently processed by the wetland and its vegetation. In addition, the study used market price and effect on production methods to value the wide range of provisioning services provided by the wetland, including harvesting of reeds and grasses, fuelwood, brick-making and crop production.

### What were the findings and conclusions?

The study finds that Nakivubo Swamp functions as a buffer through which much of Kampala's industrial and domestic wastewaters pass before being discharged into Lake Victoria at Murchison Bay, only about 3 km from the intake for all of the city's piped water supply. These are equivalent to the wastes produced by about 40 per cent of the city's population, and up to a third of its industrial enterprises. These wetland services are estimated to be worth between USD 1 and 2 million a year. These figures provide a powerful economic argument against further wetland drainage and reclamation. The study makes the point that, contrary to the dominant development imperative, residential and industrial development in Kampala's wetlands does not necessarily make good economic sense, and cannot be based only on consideration of immediate financial gain. These expectations of private profits also have to be balanced against the broader social and economic costs which arise from urban wetland degradation and loss.

Emerton, L., Iyango, L., Luwum, P., and Malinga, A. (1999) The Economic Value of Nakivubo Urban Wetland, Uganda. Uganda National Wetlands Programme, Kampala and IUCN — The World Conservation Union, Eastern Africa Regional Office, Nairobi;
Emerton, L. (2005) Nakivubo Swamp, Uganda: managing natural wetlands for their ecosystem services. In Emerton, L. (ed) Values and Rewards: Counting and Capturing Ecosystem Water Services for Sustainable Development. IUCN Water, Nature and Economics Technical Paper No. 1, IUCN, Gland.

# Case Study 16: Uganda

### What was the study aim and focus?

The study is based on a realisation that, even though Uganda's wetlands are an important stock of natural capital producing goods and services that have economic value and thus need to be conserved, their loss to unsustainable land and resource utilisation activities has continued because they are considered to have little or no economic value. It therefore seeks to highlight the economic importance of wetlands, and describe the economic consequences of their degradation and loss. The intention is to bring these issues to the attention of decision-makers, and to identify strategic interventions that can be used to support conservation and wise use.

### Which methods were used?

Within the broad total economic framework, the study uses market price, replacement cost and contingent valuation techniques to value goods and services at Lwajjali, Nakiyanja and Namanve wetlands in the Kampala-Mukono Corridor. The study concentrates on four direct use values of wetland goods including crop production (mainly sweet potatoes, and yams), thatch, clay, and water supply, in addition to two indirect use values, namely water purification and flood attenuation. Village surveys were carried out, using purposive sampling techniques to select a representative range of primary harvesters and traders of wetland goods. Open-ended questionnaires were used to elicit information about the production, harvesting and marketing of wetland resources. These were triangulated with in-depth Interviews and focus group discussions with key informants and resource user groups.

### What were the findings and conclusions?

The results reveal that the goods and services covered by the study are worth an estimated USD 3,418 per hectare per year, or USD 1.54 million for all three wetland sites. Extrapolating the findings up to the entire Kampala-Mukono Corridor gives a total annual value of almost USD 140 million. Degradation of these wetlands is shown to imply serious economic costs to the government and local communities, reflected in high expenditures to replace or mitigate the loss of wetland services, foregone incomes, livelihood support and alternative employment. The study recommends several strategic interventions for sustainable wetland management, emphasising the use of economic instruments, promotion of efficient harvesting technologies and community participation in planning and enforcement of regulations.

Wasswa, H., Mugagga, F. and Kakembo, V. (2013) Economic Implications of Wetland Conversion to Local People's Livelihoods: The Case of Kampala-Mukono Corridor (KMC) Wetlands in Uganda. Academia Journal of Environmental Sciences 1(4): 66-77.

# Case Study 17: Kenya

### What was the study aim and focus?

The purpose of undertaking this study was to assess the economic values of wetland ecosystems services into the wetland management planning process for the cross-border wetland of Sio -Siteko located at the border of Kenya and Uganda. The study aimed at generating information on economic value of the wetland ecosystem services to inform the development of conservation investment plans and hence make a case for public and private investment for improved management of the wetland and trade-offs between different development trajectories. Conducting the Economics of Ecosystems and Biodiversity (TEEB) study for Sio-Siteko wetland supports basin planning and investment agenda into the conservation and sustainable use of the wetland ecosystem services. The study was prompted by need of "TEEB-inspired study" focusing on wetland ecosystems. This TEEB study is motivated by the need to address the problem of a lack of a systematically developed potential "green infrastructures" i.e. ecosystem services investment options.

### Which methods were used?

The study relies on market prices and benefit/value transfer valuation techniques. Market Price Method approach applied to value provisioning ecosystem services. Contingent Valuation Method (CVM) was used to assess the economic value of biodiversity conservation, with a focus on plant and animal diversity. Damage Cost Avoided is another method employed to value regulating ecosystem services. Cost benefit analysis applied to assess, value and identify alternation wetland management scenarios.

### What were the findings and conclusions?

The total estimated economic value of the ecosystem services based on 2019 as the baseline was USD 29 million. The wetland is also undergoing a degradation which will result into an economic loss equivalent to a present value of over USD 166 million in the 25 years. Investing in wetland wise use and conservation will lead to an economic gain equivalent to a present value of over USD 206 million over the next 25 years, and reclamation of the wetland for a more intensive agricultural activities involving intensive rice farming in Uganda and aquaculture in Uganda will lead to positive net present value of USD 296 million over the next 25 years based on 10% discount rate. Alternative wetland management scenario proposed and the result indicated that the flow of the ecosystem services is beyond regeneration rate for the next 25 years then the wetland will be fully reclaimed by 2041 and that would imply that most of the regulatory and provisioning ecosystem services save for crop and fish farming would be heavily degraded.

NBI (2020) Economic Assessment of Wetland Biodiversity and Ecosystem Services as an Input for Development of Wetland Investment Plans: A Case Study of the Sio-Siteko Transboundary Wetland in Kenya and Uganda, Nile Basin Initiative (NBI), Kampala, Uganda.

# Case Study 18: Uganda and Democratic Republic of Congo

### What was the study aim and focus?

The Semuliki Delta Trans-boundary wetland generates several ecosystem services. Key among them are provisioning services like dry season grazing, water supply for domestic and livestock use, and fishing; regulating services like water flow control, waste and climate regulation; supporting services like primary production, nutrient and water cycling and cultural services like spiritual enrichment, recreation and aesthetic values. The ecosystems services from the delta immensely contribute to household incomes and the wellbeing of the people and their livestock. There were however several threats to the long-term supply of these key ecosystem services. The purpose of the study was to identify, quantify and value the key ecosystem services generated by the Semuliki Delta trans-boundary wetland with a view to stimulating management and funding interventions necessary for the maintenance, restoration or even enhancement of the integrity and productivity of the wetland as well as to support the development of Semuliki Delta wetland Management Plan.

### Which methods were used?

Market analysis, effect on production and benefits/values transfer approaches were applied to value ecosystem services of the delta such as fishing, papyrus and other craft materials, medicinal plants and food materials, fuelwood, dry season grazing, water supply, fish breeding and spawning and carbon sequestration. Changes in the productivity of the delta for key ecosystem services was modelled to depict the behaviour of the wetland under a business as usual (BAU) and a wetland conservation and wise use (WCWU) scenario.

### What were the findings and conclusions?

The delta supports many social and economic development activities involving both the public and private sectors. The per capita contribution of the wetland provisioning services to this development effort was 4.01 million Uganda Shilling (Ushs) (USD 1,100) per capita in direct household income. Better than the national GDP per capita value for Uganda estimated at USD770 in 2019. The total and net present value of wetland production under the BAU scenario declined by more than half from about 90.7 billion Ushs to 42.3 Ushs billion in 20 years and cost the economy up to 163.6 billion Ushs in present value terms. This study finding indicated under the WCWU scenario, it is proposed to invest up to 3 billion Ushs per year over the next 20 years starting in 2020 implying a total projected investment cost of 61.5 billion Ushs. The proposed investment options included improving livestock breeds, growing and trade in improved fodder, hay and silage, fish farming, production of high value wetland products, wetland resource marketing, improved local infrastructure including roads, schools and community markets.

NBI (2020) Economic Assessment of the Ecosystem Services of the Semliki Delta Transboundary Wetland in Uganda and the Democratic Republic of Congo, Nile Basin Initiative (NBI), Kampala, Uganda.

# Case Study 19: South Sudan

## What was the study aim and focus?

The Sudd Wetland, one of the world's largest wetlands, is one of the Nile wetlands ecosystems located in South Sudan and recognized under the Ramsar Convention as a Wetland of international importance. Numerous economic valuation studies of wetlands around the world have been carried out; however, most of these studies have focused on wetlands in developed countries and wetlands in Africa in general and that of South Sudan are underrepresented. This study is hence motivated by lack of such studies in South Sudan in particular. Conducting economic valuation ecosystem services of the Sudd wetland to inform green infrastructure planning and development in the face of in-situ and ex-situ development interventions is vital for better understanding of sustainable wetlands management in Nile Basin.

## Which methods were used?

The study mainly employed market price and value transfer approach to estimate the TEV of the wetland. The TEV comprises provisioning, cultural, regulating and biodiversity services. While market price approach is applied to compute some of the provisioning services, all other values are estimate by applying the adjusted unit value transfer approach. The study also benefited from the two meetings held in Kampala, Uganda and Juba, South Sudan. The meeting in Juba helped the study to get the perspective from the stakeholders at different level of management and use of the wetland. The Kampala meeting was with technical experts which helped in refining the objectives, focus, and methodology of the study. Apart from these primary sources, the study also heavily relied on secondary sources; specially to estimate the cultural, regulatory and biodiversity services of the wetland.

## What were the findings and conclusions?

The Land Use Land Cover (LULC) map of the wetland shows that the wetland covers about 32 thousand square km. Different stakeholders have been identified at different scales. The global (external) stakeholders play vital role in providing funding for the protection and conservation of different natural and environmental resources, capacity building initiatives, and conducting different studies. The national level stakeholders focus on broader contexts such as formulating policies, regulations, project design and budget approval while the state and local level stakeholders mobilize and organize local communities for conservation of the wetland. The total economic value of the wetland amounted at about USD 3.3 billion annually. Regulating services account for 55%, biodiversity services for 37%, and provisioning services for 8% of the TEV while the cultural services account for less than 1 percent. The wise utilization and management of the wetland and the green development path are proposed instead of the status quo situation for the wetland.

NBI (2020) Sudd Wetland Economic Valuation of Biodiversity and Ecosystem Services for Green Infrastructure Planning and Development. Final Report submitted to NBI Secretariat, Entebbe, Uganda.

# Case Study 20: South Sudan

### What was the study aim and focus?

Machar Marshes wetland provides multiple ecosystem services, the physical incapability, its remote nature and limited infrastructure development, limited to explore more regarding its biodiversity richness, water-related ecosystem services, provisioning services and contribution to annual flooding control. Thus, this study seeks to evaluate the current economic value of the Machar Marshes wetland ecosystem services in order to support wetland policy formulation and enhancing integrated development decision makings through evaluating alternative wetland conservation and development options.

### Which methods were used?

The study relies on market prices and benefit/value transfer valuation techniques. Market prices is used for provisioning ecosystem services and local resource use. Benefit/value transfer approach are mainly applied to calculate and value regulating, biodiversity and cultural ecosystem services. The main sources of primary data were focus group discussions, field observations, key experts' interview at local and national level among the communities living in and around Machar Marshes wetland, as well as a review of literature and statistics to enhance the secondary data. A planning workshop was conducted involving the data collection team and a validation workshop to discuss on the major findings. In addition to the economic and environmental valuation methods, available remotely-sensed data (satellite imagery) in combination with Geographical Information Systems (GIS) approach were used as analytical methods.

### What were the findings and conclusions?

Machar Marshes wetland provides an estimated economic value of $622 million/year of which $351.8 million/year, $262.8 million/year, $7.35 million/year of provisioning ecosystem services, regulating ecosystem services (carbon sequestration, sediment retention, flood attenuation) and biodiversity ecosystem services, respectively based on the 2015 price as a base year. The local community incurs an estimated $11 million/year cost to maintain the estimated economic value of ecosystem services from the wetland. To maintain and ensure sustainable ecosystem service of the Machar Marshes wetland, alternative wetland conservation and restoration options of foothill and flooded plain conservation, enhance energy mix and sources, permanent wetland restoration and water inflow, are recommended corresponding to potential stakeholder coordination. Therefore, implementation of these alternative wetland restoration options enhances wetland ecosystem services benefits related to food access, regulation of micro climate, energy security, social and economic values, and sustainable society and economy.

NBI (2020), Machar Marshes Wetland Economic Valuation of Biodiversity and Ecosystem Services for Green Infrastructure Planning and Development, Nile Basin Initiative (NBI), Kampala, Uganda.

## Case Study 21: Rwanda and Burundi

### What was the study aim and focus?

The Rweru Bugesera Wetlands Complex is a chain of lakes, marshlands and a river, and their basins, at the headwaters of the Nile River straddling Burundi and Rwanda. It consists of three small sub basins; Rweru - Mugesera, Cyohoha South and North and Akanyaru wetlands; all transboundary ecosystems of the Nile Basin. Compared to other wetlands in the basin it is small covering about 3,889 square kilometres but generally important as containing the first southernmost reservoirs and watersheds of the Nile River.

### Which methods were used?

The study seeks an economic assessment of biodiversity and wetland ecosystem services. It uses both qualitative and quantitative methods to assess the value of Rweru Bugesera wetland, including focus group discussions, market prices, and benefit transfer techniques as well as a review of secondary data sources and literature.

### What were the findings and conclusions?

The assessment involves identification of the ecosystem services and these are standard provisioning, regulation and cultural services. As expected, the values of these ecosystems using available data are far higher than estimates of provisioning goods and services alone and added to about USD 119,622,200. Aquatic resources including lakes and rivers in the sub basins of Rweru Bugesera Wetlands Complex were estimated to have an economic value of USD 10,144,163.6, agriculture 69,404,076 livestock 12,782,400, fish 2,315,789.47 and tourism USD 456,000. Regulation services were estimated to be USD 8,315,740. Despite this case of valuable ecosystem services, the study identified substantial degradation of natural resources mainly admitted as anthropogenic - by human action- but also due to climate change. Natural and Agrobiodiversity degradation is notable and pervasive. The cost of degradation in the area was estimated to be about USD 27,600,000. Although relatively a small fraction of degradation in both Burundi and Rwanda, which together may be having a value, close USD 240 million it is estimated that it is about on average about 1.6 per cent of GDP.

NBI (2020). Economic Assessment of Biodiversity and Wetland Ecosystem Services, Rweru Bugesera transboundary wetland Complex, Nile Basin Initiative (NBI), Kampala, Uganda

A final – and important – point to make is that economic activities in the Nile Basin do not only depend on wetlands, but also impact on them. Looking at the economics of ecosystems and biodiversity in relation to Nile Basin wetlands involves assessing these costs and losses, and investigating trade-offs that arise when balancing options for the conservation and wise use of wetlands with the activities that contribute to their modification, conversion and degradation. Any valuation exercise that does not take a balanced view of these costs and benefits, from both conservation and development perspectives, runs the risk of presenting an inaccurate picture to wetland and water resource decision-makers (Emerton 2007, 2017b). Here, it should be emphasised that there are opportunity costs to both the degradation of wetlands (in terms of lost ecosystem service values) and their conservation and wise use (through the alternative – and often unsustainable – land, resource and development options that are thereby diminished or foregone).

Land drainage and 'reclamation' for agriculture and human settlement represents one such impact – and arguably comprises the single most important cause of wetland degradation and loss to date in the Nile Basin. Wetlands are amongst the most biologically productive ecosystems on earth (and in the region). and because of this they are under great pressure. The Nile Basin has seen massive land use change over recent decades (UNEP 2013). Human-induced pressures changes play a key role in this, including encroachment into wetlands and watershed areas. Between 2005-09 it is possible to discern a decline in forest and wetland cover and an increase in cultivation across almost all of the sub-basins of the Nile Basin (NBI 2016, UNEP 2013).

Alongside the spread of human settlements and cultivation, resource demands have placed increasing pressure on the region's wetlands. Over-fishing, over-grazing, high levels of water abstraction and unsustainable harvesting of timber, non-wood products and buhmeat have all taken their toll. In addition, several of the region's wetlands contain rich reserves of oil and other mineral deposits. For example, the Nile Delta area is currently Egypt's main source of hydrocarbons and natural gas, the discovery and exploitation of oil reserves in the Sudd is currently seen as a major risk to the wetland, while the vast petroleum deposits in the Albertine Graben region also look likely to have a devastating impact on wetland status in Lakes Albert (Rebelo and McCartney 2012).

Hydraulic infrastructure such as reservoir and hydropower operations, too, have a significant impact on flow regimes, and thus on wetlands (UNEP 2015). Any alteration in the hydrological regime that affects the amount or timing of the water reaching wetlands potentially interferes with their functioning – and thus their capacity to generate economically valuable ecosystem services. For example, one likely consequence of increased flow regulation is reduced downstream flooding and dampening of the seasonal flood pulse, both of which will have an impact on the extent and composition of wetlands, and their dependent fauna and flora species (Rebelo and McCartney 2012). Declining water quality, too, is of concern. Wetlands have been heavily affected by pollution from agriculture, industrial effluents, municipal wastes and sewage, as well as increasing siltation and sedimentation resulting from land degradation and erosion in upper catchments. Changing water flows and rising nutrient loads have had a number of effects on the biological, chemical and physical properties of wetlands and the processes they support, including eutrophication, oxygenation, alteration of temperature regimes and microclimates.

# 4. Scoping TEEB in the Nile Basin

## Valuation as a means to an end

As described in the previous chapter, the literature review uncovered a number of key challenges regarding wetland ecosystem valuation in the Nile Basin region, for example: patchy geographical coverage and weak understanding of the biophysical processes and relationships underlying ecosystem service provision. Perhaps the most serious gap however concerned decision-making influence and impact that many valuation studies are not clearly framed or tailored to the decision-making context in which they are being applied, and therefore have limited usefulness (or uptake) for river basin planning.

This highlights a major concern and a key information need, moving forward into the Nile Basin Wetlands TEEB study. All too often, ecosystem valuation is viewed as an end in itself – the generation of "big numbers". Yet, however academically interesting it is to estimate the value of wetland ecosystem services, these figures mean little unless they actually affect how conservation and development processes are planned and delivered in the real world. There is no particular technical or practical merit in describing wetland ecosystem values in a generalised or abstract sense, or even generating a comprehensive array of wetland ecosystem value estimates, if these do not meet decision-making needs. Rather, ecosystem valuation should rather be seen as a means to an end – better-informed decision-making which results in the delivery of more effective, sustainable and inclusive river basin policy, planning, and management solution.

It follows that it is important to be completely clear about the purpose and envisaged outcome of any ecosystem valuation study, so as to be able to align it with the intended use (and users) of its results, and to ensure that it is fit for purpose (Berghöfer et al. 2015, Emerton 2017c). The question of policy and planning purpose is therefore a pressing one, in relation to the Nile Basin Wetlands TEEB study, if it is to achieve its aim of guiding, informing and influencing river basin planning. The primary need is to determine how, why and by whom wetland valuation might be useful. This important point is also recognised, and emphasised, in the guidance issued by the global TEEB initiative (TEEB 2008, 2010, 2013), which underlines the need to use policy makers' priorities and questions as the starting point for identifying the objectives of TEEB studies.

## Nile Basin decision-making issues, priorities, themes and topics

For these reasons, it is necessary to look at decision-making needs and priorities for Nile River basin planning and development options, so as to frame the Wetlands TEEB study focus, approach and methodology. The intention is to design a study that is able to present a coherent body of evidence, diagnosis and review of options, targeted to topics, issues and challenges that are considered a priority by Nile Basin countries. The clearer and more targeted the study is, the more likely it is to generate useful and useable information, yield practical and policy-relevant recommendations for decision-making, and offer findings that will actually be integrated into river basin planning.

Six main policies and strategies set the Nile Basin regional planning framework and development goals, reflecting basin-wide needs and challenges, as well as those of each riparian country. These are: the NBI strategy for 2017-27, the 2011 sustainability framework, the 2013 environmental and social policy, the 2013 wetland management strategy, the 2013 climate change policy and the 2016 strategy for management of environmental flows (see NBI 2011, 2013a,b,c, 2017a,b). The key, priorities that emerge from these documents include:

- Stress on efforts to **improve water storage, enhance water use efficiency and productivity, and increase water quality** across the basin;
- Emphasis on promoting the coordinated and sustainable development of **hydropower and irrigated agriculture** sectors;
- Acknowledgement of the importance of **watershed and wetland conservation and sustainable use** for water services, food and energy security, and in underpinning other socioeconomic development processes in sites, sectors and levels of scale across the basin;
- Recognition of the need to foster an integrated approach to **disaster risk reduction** and to strengthening the resilience and adaptive capacity of natural and human systems in the face of **climate change**;
- Concern with **building infrastructure investments and development financing**, at the same time as scaling up **funding for biodiversity and ecosystem conservation**, **climate adaptation and resilience**-building; and
- Intention to **operationalise and mainstream best practice in social and environmental standards and safeguards** into river basin planning, water resources management and development implementation, at local, national, transboundary and regional levels.

## Policy and practical purposes of wetland ecosystem valuation

Recent work by the global GIZ ValuES programme (a TEEB-related initiative) suggests six main policy and practical purposes for ecosystem service assessment and valuation (Berghöfer et al. 2015): undertaking scoping and situation analysis, enhancing environmental awareness or advocating for/against a policy option, comparing options for planning and development, identifying livelihood, development and investment opportunities, designing environmental policy instruments, and tackling environmental conflicts. The first five of these were considered to have potential relevance to NBI's planning goals and processes, and to the strategic priorities outlined above[15] (Box 5). Based on this context, a shortlist of five possible themes and topics for the Nile Basin Wetlands TEEB study was prepared (Figure 11). This was presented to NBI and the Regional Wetlands Experts Working Group ('the wetlands task team') to select the most useful, relevant and appropriate focus of the Nile Basin Wetlands TEEB study:

Option A. Raise awareness about the broad economic importance of wetlands to development processes,

Option B. Build a financial and economic case for investing in wetlands ecosystems as green water infrastructure,

Option C. Mobilise support for wetland conservation and wise use in a priority development sector,

Option D. Leverage financing and other resources to support wetland management plans, and

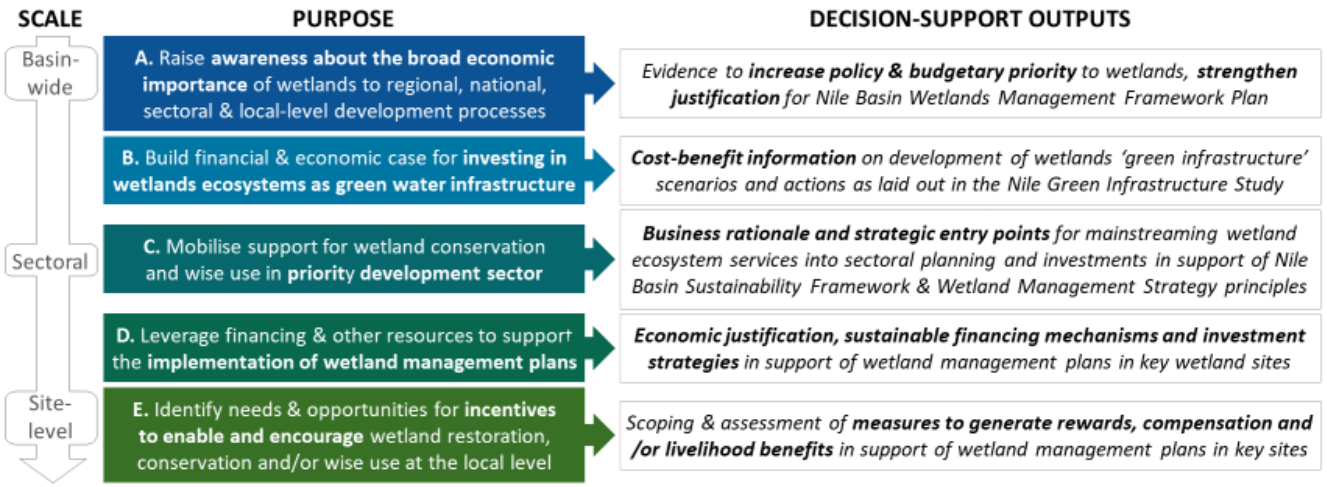
Option E. Identify needs and opportunities for incentives to enable and encourage wetland restoration, conservation and/or wise use at the local level.

[15] The sixth purpose area "tackling environmental conflicts" was not considered to have direct relevance to the NBI mission and mandate, which is concerned with providing a forum for consultation and coordination, and does not extend to conflict resolution.

Box 5: Potential policy and practical purposes for ecosystem valuation to be used in support of NBI planning goals and processes

| | Valuation | Relevance/application to NBI planning goals & processes |
|---|---|---|
| 1 | Undertaking scoping and situation analysis | • Investigating the value of ecosystem services to specified sectors and/or production processes so as to identify strategic entry points for mainstreaming wetland goals and issues;<br>• Assessing wetland ecosystem-economic linkages and values to inform stakeholder consultation and dialogue, develop and agree on site-level wetland management plans in pilot wetland sites or sub-basins;<br>• Assessing conservation funding needs, gaps and potential financing mechanisms to inform the development of financing strategies or conservation investment plans for pilot wetland sites or sub-basins; |
| 2 | Enhancing environmental awareness or advocating for/against a policy option | • Building a business case for the specific wetland actions and their integration into river basin planning, as laid out in the Nile Green Infrastructure Study and Nile Basin Wetlands Management Framework Plan;<br>• Making the case for the initiation of ecosystem restoration, conservation and/or wise use activities in pilot wetland sites or sub-basins;<br>• Raising awareness among water sector, hydropower, irrigated agriculture, climate adaptation and/or disaster risk reduction planners and developers of the value-added and costs avoided of investing in wetland ecosystem services; |
| 3 | Comparing options for planning and development | • Incorporating ecosystem values into cost-benefit analyses (or other project/investment appraisal processes) to compare grey, green and hybrid infrastructure, climate adaptation and/or disaster risk reduction options;<br>• Integrating ecosystem costs and benefits into the strategic environmental assessments or environmental impact assessments carried out for water, hydropower, irrigated agriculture, climate adaptation and/or disaster risk reduction sectors or for specific investments and developments;<br>• Modelling the economic consequences of alternative management and development scenarios for pilot wetland sites or sub-basins; |
| 4 | Identifying livelihood, development and investment opportunities | • Assessing the local-level costs and benefits of ecosystem restoration, conservation and/or wise use activities in pilot wetland sites or sub-basins so as to identify needs and targets for economic incentive, reward or compensation measures;<br>• Finding market niches and opportunities for new sustainable livelihood or business enterprises in pilot wetland sites or sub-basins;<br>• Assisting in the identification of ecosystem-based infrastructure, adaptation and disaster-risk reduction options in wetland sites or sub-basins by addressing cost-effectiveness, economic and financial viability aspects; |
| 5 | Designing environmental policy instruments | • Informing the pricing of environmental charges or fees in pilot wetland sites or sub-basins;<br>• Informing the setting of environmental, taxes, levies, fines or penalties at the national level;<br>• Appraising design models, payment and distribution options for payment for wetland ecosystem service schemes;<br>• Appraising design models, structures and options for wetland funds or financing mechanisms at regional and/or national levels, or in pilot wetland sites or sub-basins. |

Figure 11: Shortlist of options for Nile Basin Wetlands TEEB study



Each of these options deals with a distinct planning or management issue, has a clear purpose, is targeted towards generating well-defined decision-support outputs, and addresses a particular level of scale in river basin planning. Every option involves using valuation to answer questions that are oriented towards informing a specific aspect of river basin planning, and integrating wetland ecosystem values into decision-making, namely:

Option A. What is the economic value of wetland ecosystem services to key development processes and stakeholder groups in the Nile Basin?

Option B. What is the economic and financial viability, cost-effectiveness and return on investment of selected green infrastructure measures, in themselves and as compared to grey and hybrid options?

Option C. How do investments in wetland conservation and wise use and/or ecosystem-based approaches add value and save costs to this sector? What are the economic consequences of wetland degradation and loss on sectoral output and earnings?

Option D. What is the economic value-added and returns from investing in wetland restoration, conservation and wise use? What are the financing needs and gaps?

Option E. What are the local economic costs, benefits and trade-offs associated with wetland management? Who gains and who loses? Are there remaining imbalances or uncaptured values that hinder or discourage conservation?

## Valuing and investing in wetlands as natural water infrastructure

The wetlands task team decided that the Nile Basin Wetlands TEEB study focused on raising awareness about the economic importance of wetlands as green water infrastructure, with a view to promoting actions and investments to support their conservation and wise use. This combines aspects of options A and B in the shortlist outlined above.

This concern with valuing and investing in wetlands as natural water infrastructure accords well with regional priorities in river basin management and development planning. The provision of adequate, accessible and affordable water services underpins livelihood security, economic prosperity and growth across the Nile Basin, and constitutes a major area of emphasis (and resource allocation) in riparian countries' public investment plans and development strategies – as well as in private sector spending and international development funding flows. As described in earlier chapters of this report wetland ecosystems form a key component in the stock of facilities, services and equipment that is needed to deliver water. They generate a suite of ecosystem services which range from water storage, flow and quality regulation, through watershed protection, drought mitigation, flood control and water-related disaster risk reduction. In so doing, they offer a vital complement to the Nile Basin's built or 'grey' water infrastructure portfolio. In addition, wetlands also generate a wide range of other co-benefits, over and above water services, that secure human settlements and production processes, and underpin local livelihoods, large-scale industrial production and even international trade flows in the region.

In recognition of this important role, the NBI has a specific programme of work dealing with 'green' water infrastructure. An initial inventory of wetlands of transboundary relevance is currently being undertaken. Based on the information generated, the hydrological integration of wetlands into the river system is to be modelled in greater detail, as a basis for planning. A series of scenarios and options for the targeted development of wetland ecosystem services into green infrastructure is being prepared, to stand alongside existing and planned grey infrastructure. The intention is that these options and strategic directions will be translated into a consolidated

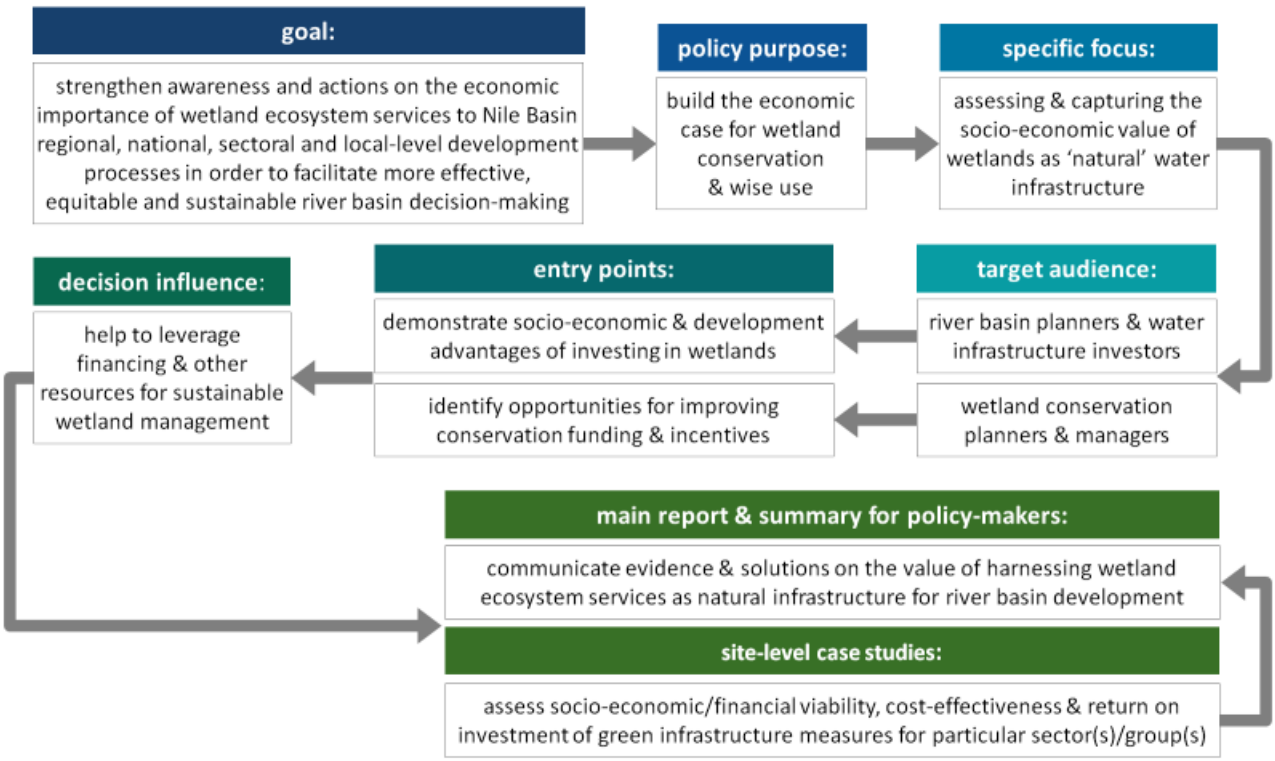
wetlands framework management plan, which will form part of the basin management plan being developed by NBI and member states. The Nile Basin Wetlands TEEB study will therefore feed closely into this process.

The focus on valuing and investing in wetlands as natural water infrastructure also has its roots in the broader ecosystem valuation literature (see, for example, Emerton and Bos 2004, Emerton 2005, 2007, 2009). This basic conceptual and analytical framework rests on the fact that, despite the economic importance of wetlands as a source of water-related goods and services, this role remains hugely under-valued in the calculations that inform river basin decision-making. Wetland values also remain largely absent from the policy, price and market signals that people face as they go about their day-to-day business, and which shape their economic opportunities and constraints.

In consequence, there is seen to be little benefit to conserving wetlands or using them wisely, and few costs or losses associated with their degradation and loss. Non-market wetland ecosystem values have been largely left out of the equation. As a result, decisions have tended to be made on the basis of only partial information, thereby favouring short-term (and often unsustainable) river basin development imperatives that omit to take wetland values into account, and thus fail to optimise economic benefits. The decision-making focus has tended to rest on maximising the commercial, extractive (and often unsustainable) use of wetland land and resources, and channelling investment funds and incentives towards 'grey' infrastructure. Yet, in order to ensure their productivity and continued support to human development, wetlands need to be maintained and improved to meet both today's needs and intensifying demands and pressures in the future — just like any other component of water infrastructure.

## Towards the Nile Basin Wetlands TEEB main study

Figure 12: summary of the Nile Wetlands TEEB study scope and focus



## Goal and purpose

The goal of the Nile Basin Wetlands TEEB study is to strengthen awareness and actions on the economic importance of wetland ecosystem services to Nile Basin regional, national, sectoral and local-level development processes in order to facilitate more effective, equitable and sustainable river basin decision-making. It serves the policy and practical purpose of building the economic case for wetland conservation and wise use, and has a specific focus on assessing and capturing the socio-economic value of wetlands as 'natural' water infrastructure in order to develop management plan and development options for wetland.

## Target audience and entry points into decision-making

The target has two main audiences and entry points into decision-making. The first target audience is river basin planners and water infrastructure investors. The entry point is to demonstrate the socio-economic and development advantages of investing in wetlands. The second target audience is wetland conservation planners and managers. The entry point is to identify opportunities for improving conservation funding and incentives. Overall, for both target audiences, the intended area of decision influence is to help to leverage financing and other resources for sustainable wetland management.

## Methodology and products

The main supplements to the literature review is that a series of site-level valuation case studies in Nile Basin wetlands. These seek to assess the socio-economic and financial viability, cost-effectiveness and return on investment of green infrastructure measures for particular sector(s)/group(s) at the selected sites. The main Nile Basin Wetlands TEEB report consolidate and analyse primary and secondary data on the costs and benefits of harnessing wetlands ecosystem services as natural water infrastructure. It draws conclusions for policy and planning, and point to economic solutions and instruments that can be used to capture wetland ecosystem values in support of more effective, equitable and sustainable river basin development.

## Site-level case studies

Site level case studies has been conducted as 'full' and 'reworked'. The former has been done through primary research and generation of new data for selected wetlands in the Nile basin. The latter envisaged through desk review. The main objective of having case studies is that to strengthen the capacity of the NBI and the riparian countries for the management of wetlands of transboundary relevance. It also aims to increase knowledge base and strengthen capacity to integrate green infrastructure and development options in river basin planning at basin-wide level. Conducting site level case studies also contributes to biodiversity conservation, to ecosystem based natural resources management, to implement market-based ecosystem services conservation, for climate change adaptation, to implement climate change mitigation interventions and to regional cooperation in the Nile region. Eligible case study wetland sites have been identified by NBI and the

**Box 6: Eligible case study sites**

- Aquatic Landscape of North Lakes/Paysage Aquatique Protégé du Nord (Burundi, Rwanda),
- Aswa Wetland (Uganda, South Sudan),
- Dinder National Park (Sudan),
- Enapuiyapui Swamp (Kenya),
- Lake Tana Wetlands/Choke Afroalpine Ecosystem (Ethiopia),
- Machar Marshes (South Sudan),
- Mara Wetlands (Tanzania, Kenya),
- Nyabarongo-Akanyaru (Rwanda, Burundi),
- Rweru-Bugesera Complex (Rwanda, Burundi),
- Sango Bay-Minziro Forest Ecosystem (Tanzania, Uganda),
- Semliki River Valley/Semliki Delta (DRC, Rwanda, Uganda),
- Simiyu Wetland (Tanzania),
- Sio-Siteko Transboundary Wetland (Kenya, Uganda),
- Sudd Wetland (South Sudan), and
- Yala Wetlands (Kenya)

Regional Wetlands Expert Working Group (Box 6Box 7). Among the eligible case study wetlands, four wetlands have been selected to conduct a 'full' case study; Sudd and Machar Marshes wetlands (South Sudan), Sio-Siteko transboundary wetland (Kenya and Uganda) and Semuliki Delta wetland (Uganda and Democratic Republic of Congo).

All case studies are contributed to the broader purpose and focus of the Nile Basin Wetlands TEEB, namely: assessing the socio-economic value of wetland ecosystem services as natural water infrastructure for key sectors, stakeholders and sites. To these ends, a set of criteria and requirements have been laid out concerning the topics and issues that should be addressed. Every case study is expected to generate information the socio-economic value of wetland ecosystem services in relation to one or more specified analytical areas and one or more themes (Box 7). Machar Marshes and Sudd wetland are identified to conduct economic valuation of biodiversity and ecosystem for green infrastructure planning and development. These wetlands case studies findings in line with other similar case studies identified support decisions in wetland policy formulation and enhancing integrated development decision makings through evaluating alternative wetland conservation and development options. Semliki Delta and Sio-Siteko transboundary wetlands are identified to conduct economic assessment and value of the ecosystem services to simulate management and funding of interventions necessary for the maintenance, restoration and enhancement of the integrity and productivity of the wetland. In addition to the selected four wetlands, case studies have been collected through desk review and used to support the development of the 'the main TEEB study' or the second phase of the synthesis report. This part of the report is chapter five that focuses on building the economic case for wetlands conservation and wise use through investments on wetlands management plan/conservation investment plan in the Nile Basin and chapter six with major emphasis of assessing the development options for wetlands in the Nile Basin.

Box 7: Analytical and thematic requirements for site-level case studies

| Analytical areas: | Themes: |
|---|---|
| A. Benefits and costs associated with wetland conservation and wise use;<br>B. Benefits and costs associated with wetland modification, conversion or degradation;<br>C. Trade-offs associated with alternative wetland land / resource uses, management or investment scenarios;<br>D. Return on investment, cost effectiveness, value-added and/or costs avoided associated with ecosystem-based or nature-based water infrastructure solutions, in themselves or relative to more conventional 'grey' or hybrid options. | I. Securing clean and regular waterflow for hydropower production;<br>II. Securing clean and regular waterflow for rural and urban human supplies;<br>III. Securing clean and regular waterflow for irrigated agriculture;<br>IV. Maintaining wetland, floodplain or flood recession agricultural production and productivity (arable and/or livestock);<br>V. Mitigating, attenuating or reducing the risk of floods, droughts and other natural or human-induced hazards and associated disasters;<br>VI. Strengthening the resilience and adaptive capacity of human settlements and production systems in the face of climate variability and change. |

# 5. Building the Economic Case for Wetlands Conservation and Management Plan

## Introduction

Wetlands global importance is recognized and estimated about US$ 15 trillion dollars during the Millennium Ecosystem Assessment report (MA 2005) – entirely free of charge – making a vital contribution to human health and well-being. The world population is expected to be nine billion by 2050, increasing pressure on water resources and the threats posed by climate change, the need to maximise these benefits has never been greater or more urgent. The assessment of the world wetlands conservation status is challenging due to wetland distribution is spatially varied and existing inventories differ greatly in wetland definitions (broad versus restricted scope), special scales (local versus regional scale), and the accuracy of wetland delineations, making it difficult to compare regions to detect broadscale trends in wetland status. Therefore, identifying the specific conservation needs and economic values of the different wetland types considering their variation in space and time, as well as their functions and landscape context, will help to enhance the development of more effective wetland conservation and management plans (Reis *et al.* 2017).

The role of wetland resources in the livelihood of the poor is explicitly important in developing countries (Lamsal *et al.* 2015). In Africa, Wetlands are the main source of water and nutrients necessary for biological productivity and often sheer survival of the local communities. Sustainable management of wetlands is therefore critical to the long-term health, safety and welfare of many African communities(Schuyt 2005).Particularly, the Nile river basin supports a range of wetland ecosystems with different spatial and institutional scale as well as wetlands of various types occur across the Nile basin that contribute in different ways to the livelihood of millions of people (over 200 million people)(Lisa-Maria & Matthew 2012). However, about 17% of the river wetlands and 20% of the inland flood wetlands in Africa have degraded into non-wetlands, and many other wetland types have also degraded. In addition, wetland ecosystems in developing countries have failed to play an essential role in maintaining ecological, food, freshwater and climate security (Xu *et al.* 2019). Therefore, it is imperative for local, regional and national actions and international cooperation to work together continually to strengthen wetland conservation and restoration, as a result, the implementation of the wetland management plans and development options became more effective and integrating wetland conservation policies and local development is also vital (Dahlberg & Burlando 2009; Xu *et al.* 2019). Indeed, wetland management and development plans in different regions still have large space for improvement, especially in Africa.

The Nile Basin Wetlands TEEB study seeks to bring wetland ecosystem values to the attention of river basin planners and managers, and to thereby promote better-informed, more effective, inclusive, equitable and sustainable conservation and development decision-making in the Nile River Basin. The study comprises two components: the TEEB study scoping report and the TEEB main study. The scoping report is already produced and presented in the previous chapters. The second phase is the 'TEEB main study' which focuses on carrying site-level wetland valuation case studies, documenting the study findings, and formulating and communicating recommendations for integrating wetland ecosystem values into river basin planning. One of the components of the 'TEEB main study' is the economic case for wetland conservation and management plan, which is the focus of this chapter. For such exercise, about five wetlands[16] in the Nile Basin region have been identified. In alignment

[16] The selected wetland valuation case studies to develop this the economic case for wetland conservation and management plan are annexed.

with the nature of the Nile basin is a transboundary river, which NBI has also given priority for transboundary nature of wetlands, the selected wetlands and the wetland management strategy focuses on transboundary wetlands (wetlands located in more than one country such as Semliki Delta, Sio-Siteko, Sango Bay Minziro transboundary wetlands), as well as wetlands with regional, transboundary relevance for the hydrological system and/or conservation of biodiversity. The latter also includes wetlands located within a single country but whose conservation and management may impact on other countries or require the collaboration of more than one country (Rugezi Marsh in Rwanda and Mara Wetland in Tanzania). By analyzing these selected case studies, an attempt is made to establish the econaanomic case for wetland conservation and management plans in the Nile Basin region. First, the state of wetland conservation and management plans for the wetland case studies is presented followed by discussion on the wetland management plans and then concluding remarks are presented.

## Semliki Delta Transboundary Wetland in Uganda and the Democratic Republic of Congo

The Semliki Delta trans-boundary wetland is a stretch of wetland ecosystem located on the border between Uganda and the Democratic Republic of Congo (DRC). The wetland is associated with River Semliki that drains the western landscape of the Rwenzori Mountains as well as the eastern parts of the DRC including parts of Ituri, Orientale and North Kivu provinces north of Semliki National Park and south of Lake Albert (MoWE, 2016a). The designated study area is 60 kilometers long and 15 kilometers wide and measures about 500 $km^2$ (50,000ha). The area has both seasonal and permanent wetlands and open water in the river and lake. The wetland provides different ecosystem services including provisioning services like dry season grazing, water supply for domestic and livestock use, and fishing; regulating services like water flow control, waste and climate regulation; supporting services like primary production, nutrient and water cycling and cultural services like spiritual enrichment, recreation and aesthetic values.

However, several threats are challenging the sustainable provision of these ecosystem services from the wetland. The major threats include population pressure; unsustainable land use practices like overgrazing, river bank, lakeshore and wetland degradation; siltation of the river and eventually the lake; pollution of the water system and the resultant deterioration of the quality and quantity of the water in the area and invasive plant species. Moreover, the Local Government allocation to wetland management was dismal and therefore left the delta exposed to over-exploitation in view of the large income opportunity in the delta. Weak institutional capacity for water resources management and weak or lack of sound governance for water resources management and cross-cutting issues including climate change and variability; high illiteracy rates and rampant poverty and disease in the area have been identified as main aggravating factors for such threats.

The economic valuation of the wetland considered provisioning, fish breeding and spawning, and carbon sequestration ecosystem services. The total economic value of the wetland is about 25 million USD. The provisioning service account about 95 percent of the TEV followed by the carbon sequestration service with about 3.5 percent and then the fish breeding and spawning service accounts about a percent from the TEV. The baseline distribution of the benefits from the wetland is 89 percent to the local community, 6 percent to the local government, and national and regional government authorities. During the period of the study, there is only very limited (near to zero) investment from the government to the management of the wetland while the local government's resource allocation to the wetland is very dismal. As a result, the wetland is exposed to over-exploitation in view of large income opportunities in the delta. Following the NEMA (2017) estimate, the study applied a 3.74 percent annual decline in wetland productivity. There is also a downside to the opportunities in the area due crocodile attacks that often resulted in the death of human beings and livestock.

### The Business as Usual (BAU) Vs the Wetland Conservation and Wise Use Scenarios (WCWU)

In order to capture the departure from the base line scenario, two wetland management scenarios were analyzed. The first scenario, the Business as Usual (BAU), modelled with continued wetland conversion, degradation and unsustainable exploitation under a regime of zero management intervention and no dedicated ecosystem management plan. This scenario, using the results of this valuation as the baseline saw decline of the ecological functions and values of the wetland as more degradation took place. The second is the wetland conservation and wise use (WCWU) scenario which envisages the development, financing and effective implementation of a trans-boundary wetland management plan that led to the recovery and eventual improvement of the ecosystem and growth in the quantity and quality of the ecosystem services the wetland generates to households and the general public. The WCSU scenario is modelled considering a gradual investment targeting reversal of the wetland degradation rate of 3.74 percent per annum in the medium to long-term. For the delta of 50 thousand hectares therefore, an average of 1334 hectares would need to be restored annually over the next 20 years at a previously computed cost of above Ushs 2 million per hectare.

The BAU and WCWU scenarios are modelled over a 20 years period using a linear decline in the value of wetland ecosystem services of 3.74 percent per annum. Prices are held constant in spite of scarcity pressure and inflation to simplify the analysis. Policies on land tenure and land use classification are also assumed constant to abstract shocks to the ecosystem. The annual loss in wetland production due to degradation is imputed as the cost of degradation. The present worth of the total estimate of degradation over a 20 years period is computed using a 12 percent discount rate which is the social cost of capital in Uganda. Accordingly, the total and net present value of wetland production under the BAU scenario declined by more than half from above Ushs 90 billion to about Ushs 42 billion in 20 years and cost the local, national and even global economy up to Ushs 163.6 billion in present value terms. The large decline in productivity of the wetland and the implied costs to the economy justified a range of management interventions to reverse the situation. Based on recent studies on the cost of wetland restoration in Uganda (Prime Africa Consultants, 2018), the WCWU scenario is the least cost investment allocation of more than Ushs 61 billion over 20 years or about Ushs 3 billion per year to offset the costs of degradation of above Ushs 163 billion over a 20 years period starting from 2020. The proposed cost translated into more than Ushs 25 billion in net present value terms. Both total and NPV costs of restoration were much lower than the respective costs of wetland degradation.

### Providing Incentives for Sustainable Resource Use

The delta may be more sustainably used to supply regulatory ecosystem services as demonstrated by their superior values. This implies that households have to alter the way they graze, fish or harvest water reeds from the delta and adopt practices that reduce their environmental footprint. They can for instance invest outside the delta or improve the sustainability of current wetland activities or introduce new ones. They can engage in fish farming, rearing of improved livestock breeds, growing and trade in improved fodder and silage, the production of high value water reed products and engage in wetland resource marketing. This however, comes with improved management of the delta and investment of government resources to develop infrastructure including roads, schools and markets. Improving the management of the delta however, may imply excluding some users or uses. This will take away current livelihood opportunities from some people. In order to restore their well-being, some economic incentives will need to be provided to cover the opportunity cost resulting from exclusion and to encourage sustainable utilization. Because sanctions against unsustainable or undesirable wetland use are inequitable, and unlikely to be enforceable, the main potential for ensuring local support for wetland management lies in making available alternative, economically preferable, sources of income and subsistence products.

Ultimately it may however be preferable in both conservation and development terms to decrease, rather than increase, local reliance on the wetland. Higher levels of wetland exploitation run the risk of becoming unsustainable. Wetland resources are also often seen as inferior goods by users – they are not preferred activities, but rather provide low return, fallback sources of income and subsistence to groups who have no alternative employment or income opportunities. Efforts may be better directed to diverting local livelihoods away from wetland resources to more profitable and sustainable activities, rather than expanding and adding value to existing utilization.

### Internalizing Costs of Wetland Degradation

The key costs of wetland degradation in the Semliki Delta include lost fish breeding and spawning benefits, lost carbon sequestration, water re-charge and storage and eventually lost fish production, lost livestock production and lost production of useful wetland vegetation including water reeds, papyrus and palms. These changes have serious implications for livelihoods. Hence, it is necessary to urgently address the threats to the wetland system while creating new socio-economic opportunities for local communities to preclude imminent environmental disasters in the delta. It is also necessary to adopt an integrated approach to wetland resource management that recognizes the natural resource potential in the delta including their economic and tourism appeal, catchment wide processes and their impacts, and people's livelihoods. The plan will therefore adopt management strategies that take into account the natural ecological linkages, conservation objectives and needs, investment opportunities, requisite research and development and essential government services and interventions and development partner engagements.

### The Management Plan for the Wetland

The overall objective of the Semliki Transboundary Wetland Management Plan (TWMP) is 'to restore and protect the Semliki Delta and wetland resources and functions through participatory approaches. It has also three strategic objectives and a number of targets under each strategic objective. For each strategic objective, again, key result areas, management actions and expected outputs/outcomes are outlined. Furthermore, for each management actions, overall and annual targets, indicators, responsible institutions both in Uganda and Democratic Republic of Congo (DRC), as well as estimated budget are proposed.

**Strategic Objective 1: To promote ecological restoration of the Semliki Delta wetland for enhanced wetland integrity** - Ecological restoration involves maintaining and improving the ecological character of wetland ecosystem through sustainable management practices. It is an established fact that the integrity of the wetland ecosystems has been interfered with due to the several anthropogenic activities taking place within and around the transboundary wetland landscape.

*Target 1.1*: Enhance the protection and conservation of Semliki Delta wetland water resources for improved water quality and quantity;
*Target 1.2*: Integrate wetland wise-use into Semliki river basin development planning;
*Target 1.3*: Promote sustainable land use practices for improved livelihoods and reduced degradation;
*Target 1.4*: Increase the Semliki Delta fisheries resource base (diversity and abundance) by 10% annually through adoption of sustainable fishing practices;
*Target 1.5*: Rehabilitate and restore 5 ha of degraded wetland biodiversity annually.

**Strategic Objective 2: To promote and support adoption of sustainable sources of livelihoods for the communities' dependent on the Semliki Delta wetland landscape** - The livelihoods of communities adjacent to wetland ecosystems is closely linked to the exploitation of natural resources. If unchecked, this normally leads to degradation of the quality of these resources to levels where they can no longer support their ecosystem and social resilience. Building resilience is therefore important if communities are to continue benefiting from the fragile wetland resources. Sustainable livelihoods through value addition, coupled with outreach and awareness plays a significant role in diverting attention of the local communities from overexploitation of stressed wetland resources.

*Target 2.1*: Promote conservation of birds and wild animals within the wetland landscape for ecotourism development and socio-economic benefits;

*Target 2.2*: Promote adoption of sustainable agricultural practices including climate smart agriculture and paludiculture for improved livelihoods and food security;

*Target 2.3*: Promote adoption of sustainable capture fisheries and aquaculture to improve the fisheries resource base and incomes.

**Strategic Objective 3: To support the establishment and strengthening of governance structures for the management of the Semliki Delta wetland landscape** - Successful management relies heavily on building adequate institutional capacity across relevant sectors with a view of promoting sustainable management. In this TWMP, several governance issues have been incorporated in different components of the implementation framework. The implementation of the plan will be conducted by elected community members and government officials from the grassroots to transboundary level in line with national regulations.

*Target 3.1*: Enhance coordination and cooperation of transboundary wetland institutions;

*Target 3.2*: Enhance communication, education and public participation and awareness.

## Sio-Siteko Transboundary Wetland in Kenya and Uganda

The Sio-Siteko wetland system spans the Kenya-Uganda border. It traverses Busia district in Uganda and Busia County in Kenya and is part of the wider Sio-Malaba-Malakisi catchment. The wetland consists of a number of interconnected secondary and tertiary wetland subsystems that drain into Lake Victoria. According to a 2014 Situation Analysis Report for Lower Sio Sub-Catchment (NBI, 2014), the Ugandan side of lower Sio sub-catchment has wetlands of about 77km$^2$. In this study, however, the wetland's size is regarded to occupy an area of 60 km$^2$ based on the 2019 Sio-siteko wetland monograph which shows that the wetland size is slightly under than 60 km$^2$. The wetland is in close proximity to both Busia towns in Kenya and Uganda. The major socio-economic activity within the twin towns is trade. While in the rural areas surrounding the wetland proper, majority of the people are dependent for their livelihoods on subsistence farming, employment, family support, and business enterprises. Within the Sio-Siteko wetland landscape, people's livelihoods comprise a wide spectrum of activities, including agricultural production, livestock production and fishing, as well as trade.

The major challenges the wetland is encountering include the encroachment into the wetland for crop farming, mass harvesting of papyrus, indiscriminate sand harvesting, overgrazing, decline in freshwater availability, poor water quality due to pollution, decline in fish population due to predation of other fish species, weak policy and law enforcement, sporadic and limited funding jeopardizes the functioning of different institutions. The total economic value (TEV) of the wetland is computed considering the ecosystem services provided by the wetland. The Sio-Siteko wetland provides provisioning, regulatory, flood attenuation, biodiversity maintenance, water purification, and groundwater recharge ecosystem services. Market price approach for provisioning services, contingent valuation approach for the valuation of biodiversity services, avoided damage costs for the value of

flood attenuation service, and replacement cost approach to value water purification and groundwater recharge services are employed to estimate the TEV.

Under the baseline scenario, the TEV of the wetland is about USD 29 million of which 93.6 percent is constituted by the provisioning services followed by the biodiversity services with a 3.4 percent contribution to the TEV. The least contribution to the TEV comes from the flood attenuation services with only 0.1 percent contribution. However, some of the provisioning ecosystem services, even though were providing positive financial benefits to the individual household members of the local community at the current state of use, they were, however, yielding negative economic returns. Such services include: growing of maize and beans, brick making, livestock grazing, mat making, accessing water for domestic use from wetland, and brick making. The rest however, had positive net economic returns.

### Three potential scenarios for Sio Siteko Wetland Management Options

Three potential wetland management scenarios were identified through stakeholder consultations, and they included; business as usual, wetland conservation through a management plan, and agricultural intensification mainly through aquaculture in Kenya and rice farming in Uganda.

### The Business as Usual Scenario (BAU)

In the business as usual scenario, the current reality and practice in wetland use and management (what the policy, legal and regulatory frameworks say not withstanding) will persist into the next 25 years, that is the current drivers of land use and land use change in the wetland will persist, they for instance include; general degradation of wetlands around the Lake Victoria which is said to be at an annual rate of 4%, population growth which is assumed to be directly proportional to demand for certain wetland ecosystem services such as firewood, and domestic water supply. Under this scenario, the present value of benefits over the 25 years period is above USD 193 million while the present value of degradation costs amounts to about USD 352 million. The present value of the opportunity cost, which is defined as the revenue of leasing the land for farming, is about USD 7.7 million. The BAU scenario has a benefit-cost ratio of 0.54 which implies the costs are higher than the costs.

### The Wise Use and Conservation Option Approach

The wise use and conservation management strategy is based on the proposed management plan. The management plan option has the overall objective of seeking to restore the wetland and ensure retention of ecosystem services for the benefit of people.' It has three strategic objectives which include; (1) to promote conservation of the Sio-Siteko wetland ecosystem and its catchment, (2) to promote and support adoption of sustainable sources of livelihoods for the communities' dependent on the Sio-Siteko transboundary wetland, (3) to support the establishment and strengthening of governance structures for the management of the Sio-Siteko transboundary wetland.

In promoting conservation of the Sio-siteko wetland ecosystem and its catchment, the plan proposes five targets namely: to Enhance the protection of wetland water resources for improved water quality and quantity; to integrate wetland wise-use into river basin development planning; to promote conservation of woody and non-woody vegetation in the wetlands for enhanced socio-economic and ecological benefits; to promote adoption of sustainable fishing practices and responsible aquaculture for improved fish diversity and abundance; to rehabilitate and restore 5% of degraded wetland biodiversity annually. For the promotion and support of adoption of sustainable sources of livelihoods for the communities' dependent on the Sio-Siteko transboundary wetland strategic objective, four targets have been proposed in the plan: to promote paludiculture pilots in 60 acres of land for improved ecological integrity and socio-economic benefits; to promote conservation of wetland

resources with natural beauty and cultural heritage within the wetland landscape for ecotourism development; to promote adoption of sustainable agricultural practices for improved livelihoods and food security; to promote value-addition of capture fisheries and aquaculture to improve the value chain.

The third strategic objective of the plan is geared towards supporting the establishment and strengthening of governance structures for the management of the Sio-Siteko transboundary wetland, and it has two targets; one is to enhance transboundary coordination and cooperation of transboundary wetland institutions and two is to enhance communication, education and public participation and awareness. The total present value of benefits, for the wise use and conservation scenario, over the 25 years period is about USD 210 million while the present value of the costs is just above USD 44 million. The benefit-cost ratio for this scenario is 4.75. Compared to the BAU scenario, the wise use scenario resulted in huge decline of costs while the benefits increased significantly.

### The Agricultural Intensification Option Approach

This management option entails introduction of intensive fish and rice farming on the Kenyan and Ugandan sides of the wetland respectively. It is assumed that only farming activities currently taking place in the wetland are the ones to persist, in which crop farmers on the Kenya side will switch to intensive fish farming and their counterparts in Uganda will also switch to rice farming. Economic analyses of both rice and fish farming have been considered, covering both revenues and production costs. In addition, environmental benefits and costs if any on the environmental dimension have been assessed. However, the estimation of the economic values for baseline values, and the subsequent use in business as usual and conservation scenarios have used gross values, it is only the gross values of the intensification scenario has been presented in this report for consistency in the application of the values.

The intensification scenario is a hypothetical scenario since there are no working documents for such programmes, the figures used are therefore based on value transfer from intensification programmes. It is documented that wetlands in the Lake Victoria basin typically undergo an annual degradation at a rate of 4%, it is assumed that this is in relation to reclamation of wetland (which is majorly for agricultural production). Therefore, like in the case for business as usual, there will be a 4% (equivalent to 594 acres) annual expansion of land for both rice and aquaculture. The causalities of this expansion will be shrubs (papyrus), trees landscape, and grasslands, water quality will also deteriorate given active use of fertilizers associated with this option. Assuming that there is a 50-50 share of the Sio-Siteko wetland on both sides of Kenya and Uganda respectively, the proportion of the crop land that will be available for the initial intensive rice farming and aquaculture will be 5997 acres for each, and the entire available wetland landscape on each side is 7213 acres.

The most likely intensification agricultural scenario in Kenya is aquaculture given the discussions with government officials. We take it that it is the current fish farming or crop growing households that are likely to be the initial lot of fish farming households under this intensification programme. It is also argued that there will be new fish farming households' entrants annually whose cumulative entry into fish farming will reclaim 297 acres of land annually consistent with the documented annual degradation rate of the Lake Victoria basin wetlands of 4% per annum. Based on the size of the wetland, it will take only six (6) years under this programme for the available wetland land that can be reclaimed on the Kenyan side to be fully harnessed for fish farming. For the agricultural intensification scenario, the present value of benefits over the 25 years period is about USD 430 million while the present value of costs is about USD 135 over the same period horizon. The benefit-cost ratio is 3.19 which is better compared to the BAU scenario. The present value of benefits is the highest under this scenario while the cost is the second highest, next to the BAU scenario.

The Rugezi Marsh located in the Northern Province of Rwanda, spanning Gicumbi and Bulera Districts covering an area of 6,735ha. The Northern Province is the most densely populated in Rwanda. It is a highland peat bog whose spatial configuration appears as a homogeneous unity of peat bogs and marshes perched at an altitude of 2050m. The marsh appears as a large flooded valley surrounded by a quartzitic ridge. In its natural state, the Rugezi Marsh formed a dense mat over floating peat formation in its deeper waters. From its hydrological aspects, this complex plays major role in the regulation of water flow to Lake Bulera and Ruhondo and Mukungwa River. Rugezi Wetland and the Volcano National Park are of international importance because they are water sources for both Lake Victoria and the White Nile. Ntaruka, located between Lake Bulera and Lake Ruhondo, and Mukungwa situated downstream Lake Ruhondo have been the main sources of hydro power generated electricity in Rwanda. Energy shortages have been attributed to considerable fall of the water level in the lakes. Moreover, Rugezi Wetland is home to 60% of the total world population of Grauer's Swap-Warbler, an endemic bird species that is threatened by the intensive degradation of the area. However, researchers have fears that the survival of this endangered species will mainly depend on the conservation of Rugezi Wetland. Besides, fifty other bird species have been identified and could be an important attraction for tourists with particular interest in birds to come to the area.

The wetland has huge importance in water resources management (flood prevention, biodiversity conservation, water quality management, hydropower production etc.) which impact positively on population livelihood. The wetlands ecosystems play a key role in water quality and quantity management, and vice versa the water resources quantity and quality provide key services to ecosystem health. They water quality and quantity that they provide maintains the habitat for animal and plant biodiversity. The Rugezi Marsh is an important element in Akagera River watershed. It serves as a link between land and water resources and it is the most important water tower of Bulera and Ruhondo lakes.

Apart from the hydrological functions, the availability of water in Rugezi Marsh enabled the existence of socio-economic and ecological activities. The availability of sufficient water level above the peat level was a habitat for fish and other endangered species like *Bradypterus Graueri*. Therefore, the fishing activity was very proper within the marsh. A part from fishing activities, the availability of water at the surface enabled the population to create perpendicular canals in the marsh to allow the crossing of canoes. The transport in the canoes was an activity to occupy a big number of populations. The picking of vegetation species for handcraft was also another activity for women. They were using it in the confection of local mat and other handcraft activities. The tourist value is still now another activity viewed as potential option for the water resources management in the marsh. The biodiversity supported by the marsh ecology are the most important can be a potential for recreation and ecotourism. Not only the tourism, but the marsh has important historical value related to history of the country, the water logging served as refuge for Basebya insurgence against the royal and colonial authority.

## The State of Rugezi Marsh Degradation

The consequences of wetland degradation are related to the loss of hydrological and ecological function which it provided in term of water resources management. The most factual impacts is the alteration of hydrological balance, the drying up and the compaction of peat, the loss of water purification function, the fluctuation of water level, the river bed erosion. The degradation of the Rugezi Marsh began to be evoked from 2000s. The anthropogenic causes of the degradation of the Rugezi Marsh are first bound to the demographic pressure in the catchment which led to its development. The continuous cultivation on the hillsides entailed obviously the impoverishment of the soils of hills and, consequently, decline of the agricultural yield which is the only source of

incomes of the population. To overcome this situation, the population rushed on the swamp to cultivate it particularly after 2000, accentuating situation which had already been affected well before.

Another intervention which deteriorated the already precarious situation of the swamp which had an effect particularly determining in the degradation of the swamp is the drainage of the swamp by the ELECTROGAZ in 2000. This company came to lack some water for running of three turbines at the Ntaruka Power plant during that dry year. As the level of the lake Bulera had dropped down of more than 4 m, ELECTROGAZ began then the works of drainage of the swamp to increase the hydroelectric production of the Power plant. The works consisted of the righteousness, the widening, dredging of Rugezi stream bed and the canalization of water bodies. They also consisted in the destruction of the vegetation riverside vegetation. This intervention entailed the destruction of meanders and anastomosed reaches and water bodies. The drainage of the swamp by ELECTROGAZ was determining fact that led to the complete cultivation of the dried part of swamp. The then reclaimed swamp, offered as new virgin and thus fertile lands to reclaim. Moreover, the authorities of the neighbouring districts of the swamp proceeded to the distribution of the plots of land and collected taxes.

## Restoration Measures on the Rugezi Wetlands

In the early 2000s and parallel to the events leading to the electricity crisis, the Ministry undertook a series of consultations with state institutions, United Nations agencies, and Rwandan civil society to formulate an environmental protection policy. Rwanda's National Environment Policy was subsequently released in 2003, and entails a series of policy statements and options for the restoration of the natural environment through land-use management, natural resource management, and other measures (MLRE, 2003). The policy contains an entire section on wetlands in which a number of commitments are made, including establishing measures to protect wetlands and prevent their further degradation; and establishment of wetlands as state-owned property. Many of these principles were later promulgated in Rwanda's *Organic Law N° 04/2005: "Determining the Modalities of Protection, Conservation, and Promotion of the Environment in Rwanda"* or the Environment Law (GoR, 2005a). Moreover, following publication of the Land Policy in 2004, Rwanda's parliament passed the *Organic Law (N° 08/2005) "Determining the Use and Management of Land in Rwanda*," or the Land Law. Such laws strengthened the legal authority of the government to control activities within the Rugezi Wetlands and along the shores of Lakes Bulera and Ruhondo. Specifically, this law enabled the government to restrict agricultural and pastoral activities to 10 meters away from the banks of streams and rivers and 50 meters away from the banks of lakes. In 2008 the Government also declared the Rugezi Wetlands a protected area.

The most significant challenge facing the Government as it began to act upon its Cabinet decision was the need to gain the support and cooperation of the population living in and relying upon the wetlands, including some large landholders. The introduction of these restrictions naturally had a significant adverse impact in the short-term on the livelihoods of the population that had depended on the wetlands and lake shores for cultivation and grazing purposes; 10 percent increase in the landless population in these areas. Among the first steps taken by the Ministry of Environment to address this situation was to raise local awareness and initiate community engagement by leading community work. This involved engaging the local population in efforts to fill in existing drainage ditches and cut down and remove the roots of eucalyptus trees. This step was followed by a number of initiatives aimed at improving agricultural production, protecting hillsides and diversifying incomes in the Rug ezi-Bulera-Ruhondo watershed. Implementation of these activities involved various government ministries, including those responsible for the environment, agriculture, livestock, forestry and defence.

The Ministry of the Environment provided funding to Helpage Rwanda, a local nongovernmental organization, to undertake a project focusing on reforestation, anti-erosion measures and rehabilitation of the hillsides

surrounding the Rugezi wetlands (REMA, 2009). Through these conservation efforts, the project had created employment for around 13,000 people by March 2009. In addition, the World Agroforestry Centre, OXFAM, Care International and Hydropower International have implemented projects in the Rugezi area aimed at restoring the wetlands, including activities related to agroforestry, sustainable pastoralism, anti-erosion measures and social development. Restoration of the Rugezi Wetlands has further been promoted through the Integrated Management of Critical Ecosystems (IMCE) project which aims to assist farmers around four critical ecosystems, including Rugezi, to implement sustainable agriculture measures and improve their livelihoods. These and other initiatives continue to be implemented in the watershed in an effort to simultaneously rehabilitate the watershed, improve agricultural and land management practices, and enhance the sustainability of local livelihoods.

Over time, the combination of policy interventions and complementary restoration activities initiated by Rwanda in 2004 has contributed to the gradual rehabilitation of the Rugezi Wetlands and an increase in hydroelectricity production in the country. The actions taken within the wetlands enhanced their filtering capacity, reducing siltation rates and increasing water flow into Lake Bulera. Combined with strong rains in 2006-07 and, in particular, restricting generation from the Ntaruka power station by alternating use of one of its three turbines, water levels in Lake Bulera have risen. A key milestone in Rwanda's efforts occurred in October 2007 when the Ntaruka hydropower station again began to operate fully. Rwanda's achievements with respect to restoration of the Rugezi Wetlands were internationally recognized in 2010 when it was awarded the Green Globe Award (Kagire, 2010).

The impact of efforts to restore the Rugezi-Bulera-Ruhondo watershed on the local population is a more challenging question to answer. Initially, the livelihoods of many in the area were adverse affected as households lost access to land for cultivation. Since this time, however, the restoration efforts appear to have started to provide some benefits. Radical terracing and agroforestry activities have increased crop productivity; grasses planted on managed terraces and lake banks are providing fodder for livestock; flora and fauna has increased in the Rugezi Wetlands; and eco-tourists are now visiting the area. Thus, although the local population largely did not benefit from the country's improved production of electricity, these changes have the potential to restore livelihoods that were lost due to the degradation of the Rugezi Wetlands (fishing, handicrafts, honey production, etc.) as well as introduce new opportunities (in the area of tourism, for instance). Efforts to improve agricultural production, combined with the on-going process of land titling, may also further improve livelihoods and increase capacity to deal with future climate shocks and climate change. The full consequences of efforts to restore the Rugezi-Bulera-Ruhondo watershed on the local population will only be known over time and will depend in part on broader population growth and socioeconomic factors within the region.

## Sango Bay Minziro Transboundary Ecosystem in Uganda and Tanzania

The Minziro wetland area for this economic valuation was defined with reference to the Minziro Nature Forest Reserve in Tanzania. Minziro Nature Forest Reserve is located in Missenyi District, in the northern part of Kagera Region and is contiguous with the forests of Malabigambo and Kaiso along the Uganda border. The boundaries of the study area were also defined with reference to the Minziro Important Bird Area. The Minziro IBA includes an area enclosed by the Mutukula (UgandaTanzania border town) through Kyaka to Bukoba Town including the adjacent part of Lake Victoria. The study therefore covered Missenyi District and Rural Bukoba, Kagera Region, north-western Tanzania. While the Sango Bay study area lies in the eastern part of the Rakai District and the southern part of the Masaka District. The boundaries of Sango Bay area for this study were defined using the Sango Bay Musambwa Kagera Ramsar site. Reference points used include Lake Victoria to the east; the main road from Kampala to the Mutukula Tanzania border to the west, and the Uganda-Tanzania border, to the south.

The Sango Bay-Minziro area is situated predominantly in the Lake Victoria Regional Mosaic and is considered to be of high bio-geographic importance because they are located in the transition zone between the East and West African vegetation zones. The Sango Bay-Minziro area therefore has unique features and rich biodiversity due to its bio-geographical ecotone location in the Guinea-Congolian biome. This means that forests in the Sango Bay-Minziro area have plants and animals characteristic of Congo and Guinea, that reach their eastern range limit within the Sango Bay- Minziro area. Most studies of plants and animals have given evidence that the Sango Bay area therefore qualifies as a Pleistocene refugium of the Guinea-Congo lowland forests. Being at the transition zone, the Sango Bay-Minziro ecosystem is home to rare and endemic forest swamp tree species, several of which are known to be relics of the Albertine Rift. The predominant natural vegetation is wooded savanna with medium-low altitude rainforest. The Sango Bay-Minziro forests occurring closer to the alluvial deposits of the mouth of the River Kagera are unique in tropical Africa, as they are composed of an equal proportion of lowland (mainly western Guinea Congolian) forest species and highland (afro-montane) forest species.

A historical management and conservation challenge in the Sango Bay-Minziro area is extensive logging, particularly targeting valuable tree species such as *Podocarpus*, *Beilshchemiedia* and *Baiekia*. This has greatly affected the species composition of the forested areas with these three species having become scarce. However, reports from this study indicate that the forest management authorities in the Sango Bay-Minziro area have been successful in reducing illegal logging with only a few isolated cases being reported in the two countries. However, estimating the scale of the current levels of illegal logging remains a challenge, which makes it difficult for the management authorities to estimate the investment effort required to manage the problem. In addition, reports from technical teams interviewed during this study indicate that the Uganda and Tanzania natural resource management agencies implement their work with minimal interactions between the two country teams. This creates a situation where national boundaries separate the planning, management and law enforcement activities within the area, with activities being implemented in isolation in Uganda and Tanzania. This is a challenge for overall management, as the wildlife and water move across the two countries without recognition of any boundary or border. This strongly justifies the need for trans-boundary cooperation and collaboration for the management of the Sango Bay-Minziro area, which has been initiated by the East African Community through the Lake Victoria Basin Commission and the PREPARED Project.

The characteristic Sango Bay forest blocks of Malabigambo and Kaiso are contiguous with Minziro Nature Forest Reserve, over the Uganda-Tanzania border, without any distinct geographical features separating the ecosystems in the 2 countries. Most of the Sango Bay and Minziro area is a flood zone of Kagera and some other rivers, which pour in the same bay along Lake Victoria. Within the Sango Bay area, the Kagera River flows largely within Tanzanian territory, apart from a small section, which flows through Uganda, where it enters Lake Victoria. The combined total economic value of the Sango Bay – Minziro BSA ecosystem services is about 236 million US$ per year. Out of this, more than 131 million US$ of the TEV constitutes the regulating service, being the highest contribution, followed by the provisioning services with an estimated amount of about 90 million US$. The cultural service which comprises the nature-based tourism and cultural services contributed about 14 million US$ to the TEV. The ecosystem services contribute to livelihoods through income, food and nutrition security and supporting different sub-sectors such as crop and livestock farming and through purification of the water and air. The benefits provide incentives that can strengthen conservation efforts. Results from the economic valuation for Sango Bay – Minziro ecosystem should be used as a clear justification for financing management and conservation of the BSA. A breakdown of the TEV to the two wetlands reveals that while the TEV of the Sango Bay Area is about 117 million US$, for that of Minziro areas it is above 119 million US$.

## The Management Plan for Sango Bay Minziro Transboundary Ecosystem

The management plan for this transboundary wetland is developed with more or less similar approach to the management plan of the Semliki wetland. The overall objective of the Sango Bay - Minziro TWMP is 'to restore the wetland and ensure retention of ecosystem services for the benefit of people.' The plan has also three strategic objectives which includes the promotion of conservation of the Sango Bay - Minziro wetland ecosystem and its catchment; the promotion and support of sustainable sources of livelihoods for the communities' dependent on the Sango Bay - Minziro transboundary wetland; and the support for the establishment and strengthening of governance structures for the management of the Sango Bay - Minziro transboundary wetland which will be implemented over a period of ten years. For each strategic objective key result areas, management actions and expected outcomes are proposed in the plan. Again, for the management actions, overall and annual targets, indicators, responsible institutions both in Uganda and Democratic Republic of Congo (DRC), as well as estimated budget are proposed.

**Strategic Objective 1: To promote conservation of the Sango Bay - Minziro ecosystem and its catchment** - Ecological restoration involves maintaining and improving the ecological character of wetland ecosystem through sustainable management practices. It is an established fact that the integrity of the wetland ecosystems has been interfered with due to the several anthropogenic activities taking place within and around the transboundary wetland landscape.

*Target 1.1*: Rehabilitate and restore 5% of degraded biodiversity sites within the wetland landscape annually;

*Target 1.2*: Integrate wetland wise-use into river basin development planning for improved water quantity and quality;

*Target 1.3*: Promote sustainable land use practices for improved livelihoods and reduce degradation;

*Target 1.4*: Promote sustainable fishing practices for improved fish diversity and abundance.

**Strategic Objective 2: To promote and support sustainable sources of livelihoods for the communities' dependent on the Sango Bay - Minziro transboundary wetland** – The livelihoods of communities adjacent to wetland ecosystems is closely linked to the exploitation of natural resources. If unchecked, this normally leads to degradation of the quality of these resources to levels where they can no longer support their ecosystem and social resilience. Building resilience is therefore very important if communities are to continue benefiting from the fragile wetland resources. Sustainable livelihoods through value addition plays a very significant role in diverting attention of the local communities from overexploitation of wetland resources already under stress.

*Target 2.1*: Promote adoption of aquaculture and sustainable fishing practices for improved fish production;

*Target 2.2*: Promote wise use and value addition to wetland plants for improved livelihoods of 20% of households in the wetland landscape annually;

*Target 2.3*: Promote value-addition of agricultural produce and improve the value chain; and

*Target 2.4*: Promote sustainable eco-tourism for improved livelihoods and nature conservation.

**Strategic Objective 3: To support the establishment and strengthening of governance structures for the management of the Sango Bay - Minziro transboundary wetland** - In a transboundary set up, harmonious governance structures must be sought, guided either by regional or international legal frameworks or mutual agreements through by – laws. Successful management relies heavily on building adequate institutional capacity across relevant sectors with a view of promoting sustainable management. In this TWMP, several governance issues have been incorporated in different components of the implementation framework.

*Target 3.1*: Enhance transboundary coordination and cooperation of transboundary wetland institutions;
*Target 3.2*: Enhance communication, education and public participation and awareness

## Mara Wetlands in United Republic of Tanzania

The Mara Wetlands are found in the Tanzanian part of the wider Mara Basin. The wetland is estimated to cover approximately 205 square-kilometers with an average width of 13 kilometers and length of 37 kilometers, covering a total 51,700 hectares. The wetland covers three administrative districts of the Mara Region, namely: Butiama, Rorya and Tarime. The Mara Basin in its entirety is of global biological significance being home to the Maasai Mara Game Reserve in Kenya and the Serengeti National Park in Tanzania, where it has gained international recognition as a World Heritage Site and Biosphere Reserve. The area's importance may be attributed - to a large extent, on the existence of the Mara River; which originates from the Mau Forest in Kenya and empties into Lake Victoria through the Mara Wetlands. The wetlands are therefore of both global conservation significance and of great economic importance at local, regional, national and international levels. However, the wetland is increasingly under threat from conversion for agricultural cultivation and other activities and over utilization of the wetland resources. The population of the entire Mara Region is estimated at 1.9 million people, based on 2012 national census data, with an estimated population growth rate of 2.5% per annum. Generally, the Mara Region is known to have a high rural population that is largely dependent on the local economy and a high dependency ratio. The total arable land of the Mara Wetlands is 51,700 hectares where only 10,340 hectares are under crop production (i.e. 20% of total arable land). The main food crops grown are cassava, sorghum, maize and finger millet. Crop production is also mainly for subsistence though household surplus (e.g. of tomatoes grown in the wetlands) is sold in the nearby markets, especially in Musoma, Isebania and Bunda.

The Mara Wetlands is well known as the home to diverse biological resources and offers numerous ecosystem services of international, national, regional and local importance. Some of the key local beneficiaries of the wetlands are women's groups, mainly conducting small-scale agriculture, mat making, beekeeping, water harvesting, and brick making. Local stakeholders of the Mara Wetlands include the district authorities, government agencies, local NGOs, religious organizations and community-based organizations. The major challenges the Mara wetlands ecosystem facing can be attributed mainly to ecosystem degradation and resultant decline in ecosystem services. The degradation and decline in the ecosystem services can be largely attributed to:

i) Land use changes due to conversion, including encroachment on wetlands' floodplains and expansion of agricultural lands into the wetlands;
ii) Soil erosion due to livestock, wildlife and deforestation. Soil erosion is also very common on steep slopes where there is vegetation clearing, intensive cultivation, and poor land management practices. This leads to expansion of wetlands due to siltation.
iii) Pollution (both point source and diffuse);
iv) Water resource allocation i.e. diverting water for irrigation while ignoring environmental flow requirements.

The wetland provides provisioning, cultural, and regulating ecosystem services. the total value of the Mara Wetlands is estimated at Tshs. 6,341 million per year equivalent to US$ 5.0 million per year. This implies a per capita value of Tshs. 130,438 per year or US$ 103 per year. Out of this more than 82 constitutes the provisioning ecosystems services while the cultural and regulating services account 0.04 and about 17 percent, respectively. These enormous economic values cannot (and should not) be ignored. They underline the fact that biodiversity and ecosystems in the Mara Wetlands are far more than a static repository of biological and ecological artefacts. Rather, they offer a productive and lucrative source of natural capital and development infrastructure, which, if

used wisely and managed sustainably, will continue to generate streams of benefits into the future. Clearly, huge economic and development returns spread across many different sectors and stakeholder groups are to be gained from investing in the biodiversity and ecosystems of the Mara Wetlands. Conversely, a failure to invest adequately in wetland conservation and wise use runs the risk not just of undermining local livelihoods and development processes, but also of incurring considerable economic costs and losses across and beyond Tanzania, including transboundary effects arising from changes in Lake Victoria's biodiversity, water flow, and water quality.

## Conservation Plan for Mara Wetland

A detailed and separate conservation plan for wetland is also prepared, unlike the previous cases. This Conservation Investment Plan (CIP) brings together needs and priorities of the various sectors, organizations, and interest groups that manage, depend on, or impact in some way the natural resources of the Mara Wetlands. It presents an integrated set of activities united under the common goal of improved conservation and sustainable management of the Mara Wetlands ecosystem for improved community livelihoods and resilience to climate change. A wide range of partners worked together to develop the CIP and will be involved in delivering it, including both central and local government agencies, non-governmental organizations (NGOs), and civil society, as well as local community members.

The target was potential donors and investors in wetland conservation. It has three main purposes. First, it offers a value proposition that outlines return from investing in biodiversity and ecosystem conservation in the Mara Wetlands. Second, it outlines a strategic plan identifying and integrating the most critical conservation funding priorities. Finally, the CIP also serves as a marketing tool for mobilizing new conservation funding flows. The CIP harmonizes and brings together the various conservation strategies and plans developed for the Mara Wetlands landscape. It specifically seeks to secure funding for implementation of the recently developed five-year Mara Wetlands Integrated Management Plan. The CIP structures the conservation priorities laid out in the management plan into coherent, consolidated, costed sets of mutually reinforcing projects. It offers four bankable investment packages (IP) costing Tanzania shillings (TZS) 10.44 billion or U.S. dollars (USD) 4.64 million over five years.

Investment Plan I: Wetland wise use and sustainable management. To restore, rehabilitate, and conserve wetland biodiversity and ecosystem services. It adopts a bottom-up approach to integrated land use planning that involves partnerships among government conservation agencies, other line ministries, and local land and resource users. A variety of projects are identified that would operationalize wise use and sustainable management concepts, aiming to balance local development and conservation needs in the face of climate change. The targets five project interventions particularly important to biodiversity and ecosystem conservation, addressing critical shortfalls in funding integrated land use planning, landscape restoration and rehabilitation, species and habitat conservation, ecosystem-based adaptation, and sustainable livestock production. The combined cost for the five projects is TZS 2.2 billion or USD 990,000.

Investment Plan II: Conservation awareness, capacity, and governance. To build effective, inclusive, and sustainable systems for wetland management and use. There is a need for a more unified approach to wetland management that would accommodate these different interests and establish a coherent and comprehensive framework for wetland conservation, wise use, and sustainable management. By strengthening wetland governance structures while building awareness and capacity among different stakeholders, the investment plan aims to develop effective, inclusive, and sustainable systems for wetland management and use. It targets three project interventions that would enable/enhance important conditions for integrated wetland management: enhancing institutional and legal frameworks (including government accountability and capacity), fostering

stakeholder collaboration, and raising public awareness. This consists of three projects at combined cost of TZS 0.5 billion or USD 230,000.

**Investment Plan III:** ensuring livelihoods that is resilient to climate change. To strengthen local economic prospects and reduce pressure on wetland resources. By integrating biodiversity and sustainable livelihoods at the local level, the investment plan aims to strengthen economic prospects and reduce pressure on wetland resources. It emphasizes increased access to alternative, sustainable sources of income and production that will not delete or degrade natural ecosystems, and will be resilient and robust in the face of climate change. The plan targets seven project interventions that offer particularly good opportunities to improve economic wellbeing and security within all sectors of the wetland community: agroforestry, fish farming, beekeeping, ecotourism, climate-smart agriculture, energy-saving practices and technologies, and reduction in vulnerability to climate-induced risks and disasters. All of these activities have been and remain chronically under-funded. This consists of seven projects at combined cost of TZS 2.1 billion or USD 960,000.

**Investment Plan IV:** Provision of Water and Sanitation. To improve water quality and sustain a healthy wetland adjacent population. By supporting improved water, waste, and sanitation facilities, the investment plan seeks to improve water quality and sustain a healthy wetland-adjacent population. It focuses on building awareness and capacity at the community level, and on working to empower wetland households to self-improve their own hygiene and waste management. The plan targets four project interventions particularly important to local water quality and health: domestic water supplies, solid waste disposal, sanitation and hygiene, and increased capacity of village health workers. This consists of four projects at combined cost of TZS 5.6 billion or USD 2.46 million.

## Discussion on the Case for Management Plan for Wetlands

The case studies discussed above represent multitude of cases from different countries in the region and some of the wetlands have transboundary nature. For all the case studies, except Rugezi Wetlands in Uganda, the economic value of the ecosystem services provided by the respective wetlands, albeit partially, have been conducted. The valuation exercises are crucial in providing the ecosystem services provided by the wetlands, the beneficiaries of these services, the stakeholders with regard to the wetlands, and, of course, baseline value for developing wetland management/investment plans (WMP). The valuation exercises explicitly show that the wetlands have huge benefit for the local community and beyond. Knowing the values and who is benefiting from them is a first step in decision making and can be used to challenge the decision makers to act for the development and implementation of management plan as well as allocating budget for the same.

Wetland management plans have been also prepared for most of the case studies presented above. Classic management plans have a standard format with contents such as the description of the site, evaluation of the status and threats, management goals and strategies, operational action plan, annual work plan, and budget. It was only for the Semliki Delta and Sango Bay Minziro Transboundary wetlands and Mara wetland in Tanzania that the wetland management plans are prepared based on the classic management plan. Even if no standard management plan is not prepared for the Sio-Siteko transboundary and the Rugezi wetlands, there are important lessons to derive from the restoration practices undertaken in Rugrezi wetlands and the valuation scenarios provided for Sio-Siteko wetland. The management plans used approaches that involve the involvement of a variety of actors – including local government, the private sector, and the surrounding communities using principles such as community-based natural resource management. They also emphasized the importance of interventions in and around protected areas to be guided by management plans and action plans. The provision of sustainable livelihood for the local communities while maintaining the integrity of the wetlands is an issue of

emphasis by the plans. This is in recognition of the fact that the wetland adjacent communities highly depend for their livelihood on the wetlands and livelihoods at the local level will be improved by enhancing income from existing enterprises and diversification of income from other sustainable alternative livelihood sources. This fact has been evidenced with the situation at Rugezi wetland where the restoration measures have to materialize at the cost of the livelihood of the local community especially in the short-term. Precisely, the local communities were benefiting from the virgin land of the wetland after it was drained by the ELECROGAS for its power generation. However, in the long-term, the restoration measures increased productivity which partially compensated the loss at the beginning of the restoration measures. In this particular case, the immediate benefit was the improved electricity generation where the local community has little or no benefit. Hence, the recognition of interdependence between the local communities and the wetlands around them is a crucial step in the wetland management plan designing.

The role of institutions and their integration at different levels is crucial component of wetland management plans. Depending on the circumstances, this includes the formulation of proper laws and regulation aimed at the improvement of wetlands in particular and overall resources in general. Institutional cooperation is also needed among two or more countries for transboundary wetlands such as Semliki Delta, Sio-Siteko, and Sango Bay Minziro. Hence, enhancing communication among different stakeholders, education, awareness creation, public participation are key components of the institutional issue of wetland management plans. The success of the restoration of the Rugezi wetland is partly attributed to the coordination and integration of different actors including the local communities and international actors such as OXFAM, World Resource Institute, Care International, and Hydropower International. The formulation of the Land Law and the Environmental Law has been crucial in creating enabling conditions for the restoration of the Rugezi wetland where they enabled the government to restrict agricultural and pastoral activities to 10 meters away from the banks of streams and rivers and 50 meters away from the banks of lakes.

It's true that ecosystem services from wetlands have significant contribution to the economic growth and poverty reduction endeavour of districts and countries at large. However, failure to manage and conserve wetlands and accompanied resources will result in costs of degradation that will compromise medium – and long-term sustainable development. In other words, maintenance and/or conservation is less costly than restoration. Despite the reasonable success achieved in the partial restoration of Rugezi wetland, it has come at higher costs and much effort. Early action by the government would have reduced both the cost, effort and damage sustained by different actors; especially the local community. The conservation of wetlands not only increases the productivity but also opens new opportunities that hasn't existed before such as eco-tourism. The development of wetland management plans is instrumental in averting delayed actions on the conservation of wetlands. Moreover, in cases like Semliki Delta and Sio-Siteko, it has been shown that the status-quo approach is inferior to the wise or sustainable use option of the wetlands both in terms of value of ecosystem services provided and outcomes on biophysical condition of the wetlands. Hence, preparing management plans play crucial role in unfolding such options by attracting possible funding for the wise use approach of the wetlands.

Consistent with the increasingly recognized approach, historically the focus has been on maximizing provisioning services, wetlands should be managed to meet a wide range of interacting environmental, social and economic objectives, the proposed management plans are envisaged based on this principle. The formulated management plans have a number of strategic objectives with key results in the provisioning of a wider range of ecosystem services, including fishery, preservation, improved water quality, flood control, carbon sequestration and recreation, in parallel with improved biodiversity. This is crucial in addressing the different needs of diversified stakeholders and thereby creating willingness among stakeholders to participate in the materialization of the

plans. Since the plans have financial plans and budget needs for each management actions, that could serve as an economic justification for the case of conservation endeavours. The management plans could also help to attract funds from development partners since the latter prefer target specific plans and interventions. In a way, the plans are also important since they bring together existing planning framework and economic valuation studies to develop concrete planning and fundraising documents while they also assist existing financing efforts in defined conservation areas which have priority funding gaps.

## Conclusions on the Economic Case for Wetland Conservation and Management Plan

The five cases reviewed in this chapter clearly portray the fact that wetlands are ecologically sensitive systems and provide many significant services to the human population. Moreover, the valuation of the wetlands with multidisciplinary perspective, apart from establishing the facts with regard to the values of the wetlands, is crucial component for the development of wetland management plans. Such perspective has created an increased understanding of the processes and problems associated with such strategies. The exercise has confirmed that the wetlands have noteworthy economic value and they are also under severe stress. Among the reasons mentioned for the deterioration and loss of the wetlands include excessive use, land degradation, urbanization, pollution, climate change and invasive species. Hence, to reap the optimal benefit from the wetlands while ensuring their sustainability at the same time, better to conserve them earlier than trying to restore them after more damage has occurred to them. In this regard, the preparation and implementation of wetland management plans is instrumental not only in protecting the wetlands but also creates new opportunities from the preservation of them.

An effective management plan provides a crucial basis for maintaining the biological characteristics of a wetland, a dynamic ecosystem, and allowing to use resources economically. However, this could be possible if proper procedure is followed in the preparation of the plans. The management plans should include the description of the study site, the evaluation of the status and threats to the wetland, management goals and strategy, operational action plan, annual work plan, and budget requirement for each operational action plan. Moreover, transparency has to be ensured through the engagement of all stakeholders including the local communities. The stakeholder engagement is vital in mitigating the inadequate funding for implementation of the conservation and management goals. Talking of stakeholder engagement, for wetlands that have transboundary nature, it is necessary to engage the stakeholders from two or more countries and create coordination of action amongst them.

It is well known that wetlands provide different ecosystem services to the communities around them and beyond. The preparation of management plans should consider this multifaceted service of them and need to have multi-objective management results aimed at the provision of a wider range of ecosystem services. Such approach requires the involvement of different stakeholders and synergy among the different stakeholders. Apart from this, it requires the combination of different instruments and management approaches including improved site management, regulation and spatial planning, and resolving property rights issues. In this regard, the experience of the Rugezi wetland restoration program clearly portrays a good lesson on how the integration and action of different stakeholders and the designing and implementation of different but complementary projects has yielded a positive outcome towards the objective of restoring the wetland.

Early action on the preservation of wetlands help to avoid costly restoration activities. Despite the good progress in the restoration efforts of the Rugezi wetland and thereby improving the hydroelectric generation of the ELECROGAS company in Rwanda, it has occurred at huge costs and serious repercussions on the local communities; especially in the short-run. Hence, the preparation and implementation of wetland management

plans could help in avoiding such costly restoration programs by bringing issues of importance about wetlands to the table of decision makers for their early action. Since the plans are also prepared by engaging the different actors, both national and external, this by itself increases the possibility of providing funding for the implementation of action plans stipulated in the management plans.

# 6. Assessing Wetlands Development Options

## Introduction

Wetlands have often been over-exploited and degraded despite being of high ecological value and providing many important services, particularly to the rural poor (Turner *et al.* 2000). Valuing wetland's biodiversity and ecosystem services to inform green infrastructure planning, wetland management plan and development interventions is vital for better understanding of sustainable wetland management in Nile Basin (Smakhtin 2012). Wetlands in different Nile basin countries have significant role for the hydrology of Nile River and the global community as well (Lisa-Maria & Matthew 2012). Despite the fact that Nile river has productive ecosystem, the Nile's land and water are underutilized and degraded at an alarming rate. The wetland areas in the basin are one of the most degraded parts of the Nile, which covers 5% of the basin and vulnerable to various problems, such as infrastructure development close to water resources, conversion to agricultural land, increasing population, overexploitation of wetland resources, expansion of invasive species, extraction of minerals and oil, and climate change. However, these wetlands' have important role on sustaining the livelihood of million households by furnishing provisioning ecosystem services (i.e. Nile Basin wetlands have vital role to cultivate small scale agriculture and grazing land for livestock by retaining moisture for long time even in time of drought). Perceptive development and management of wetlands can add considerable value to the benefits that wetlands provide. However, the trade-off between environmental protection and development is severe in wetlands (McCartney & Houghton-Carr 2009). Development options for wetland requires a detailed understanding of the physical, biological, human and institutional resources of the areas, the land uses and prevailing livelihood systems of local people, and the pressures placed on the natural resources of the wetlands (Willoughby *et al.* 2001).

The second phase is the 'TEEB main study' which focuses on carrying site-level wetland valuation case studies, documenting the study findings, and formulating and communicating recommendations for integrating wetland ecosystem values into river basin planning. The second components of the 'TEEB main study' is assessing the development options of wetlands, which is the focus of this chapter. To this end among the four wetlands have been selected and commissioned for this exercise[17]. Sudd and Machar Marshes wetlands in South Sudan with the major focus is to come-up with development options/scenarios for wetlands. This chapter deals with assessing the development options for wetlands by mainly focusing on Rweru-Bugesera, Sudd and Machar Marshes wetlands. Case studies on Virunga national park and Kano floodplain are also consulted to complement the discussion on the development scenarios for wetlands.

## Sudd Wetland in South Sudan

The Nile wetlands ecosystems include a wealth and variety of swamps, marshes, seasonally inundated grasslands, swamp forests, floodplains and the wetland edges of lakes and rivers. The Sudd Wetland is one of these ecosystems located in South Sudan and recognized under the Ramsar Convention as a Wetland of International Importance. The Sudd wetland is threatened by both external and internal forces. The most important environmental issues that would affect wetland biodiversity in South Sudan would be the construction of large hydroelectric power dams and other related development schemes like construction of the Jonglei Canal or dykes

[17] The selected wetland valuation case studies to develop wetland development options are annexed.

along the River Nile. Such schemes would divert and effect changes in the water flow regime and irreversibly or partially destroy downstream ecosystems. Contamination of river or subsurface water by discharged pollutants, wastewater and oil spilled from the wrecked or sunken river transport ferries is also inevitable. The Sudd wetlands are also threatened with pollution and eutrophication as a result of either oil spillage during oil exploration or overuse of agrochemicals during agricultural production. Mineral exploitation without adequate mitigating measures (particularly oil exploration in wetlands such as the Sudd wetlands) has been also highlighted as one of the major challenges. All these would severely affect wetland biodiversity including fish which is a critical resource for the communities living in the area. On the other hand, the Sudd wetland has the potential to be of great economic value to South Sudan if it is managed for environmental, economic and social sustainability. The wetland serves as a filter that controls water quality and a sponge that stabilizes water flow. It is the major source of water for domestic, livestock, and wildlife use and an important source of fish for the local communities. The economic value of biodiversity and ecosystem services of the wetland relies on market prices and benefit/value transfer valuation techniques. In addition to the economic and environmental valuation methods, available remotely-sensed data (satellite imagery) in combination with Geographical Information Systems (GIS) approach have been used as analytical methods.

The total economic value (TEV) of the Sudd wetland for the year 2015 is about $3.3 billion per annum. Out of this, the provision services accounts for just about 8 percent, biodiversity 37 percent, and regulating about 55 percent. This clearly depicts more than half of the TEV for the wetland comes from the regulating services which is comprised of services such as microclimate regulation, flood control and water regulation. These services have public good character and the community may not consider them as immediate benefits. This could be a disincentive, from the community perspective, in preserving and conserving the wetland. The detail estimated economic values of the wetland biodiversity and ecosystem services are presented in Figure 13.

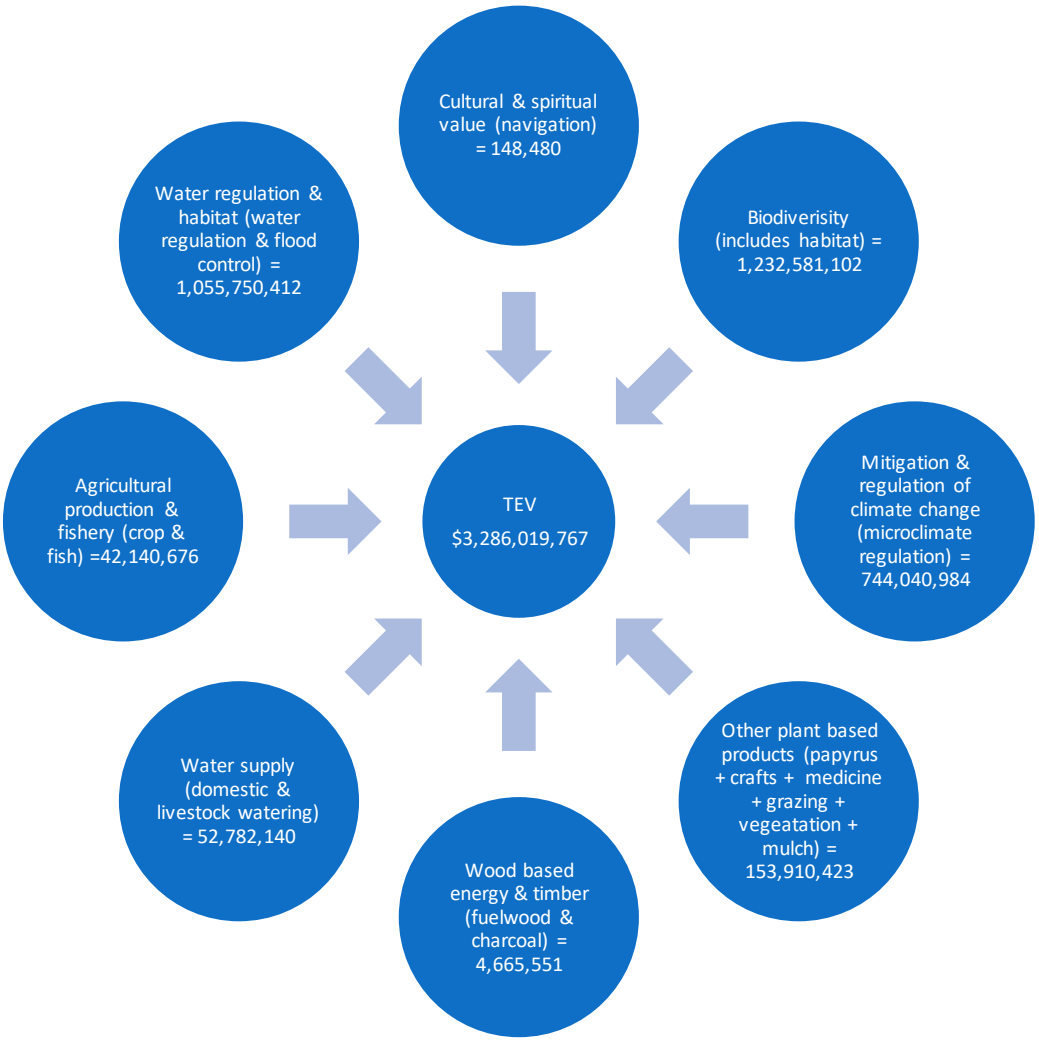



Figure 13: Estimated economic values of Sudd wetland ecosystem services

Wetland ecosystems support a diverse natural biota and provide vital services to people, such as freshwater and food, water purification, and flood prevention. Humans have been using such services for millennia for agriculture, aquaculture, and urban development, among other activities, which often led to widespread wetland degradation. Although wetland restoration is valued and practiced in many regions, conflicts between economic interests of stakeholders, such as developers and conservationists, often hamper restoration progress. A different approach to the status-quo situation should be thought of that enhances the provisioning services (immediate benefits to the community) without jeopardizing the integrity of the wetland's ecosystem. This is where the importance of alternative development options become imminent. Alternative wetland development options are proposed for the wise use and sustainable management of the Sudd wetland. The following are the development options proposed for the Sudd wetland as an alternative to the status-quo situation, the summary of risks, actions and benefits for sustainable management of Sudd Wetland are presented in Figure 14.

### The Wise Management and Utilization of the Wetland Resources Scenario

This scenario proposes sub-interventions to be implemented to change the status-quo situation which includes:

a) Wise utilization of the wetland: the aim is to restore, rehabilitate and conserve the biodiversity and ecosystem services. Hence it is necessary to focus on activities that will help achieve these objectives and the activities may include the development of integrated land use planning, landscape restoration and rehabilitation, species and habitat conservation, ecosystem-based adaptation, and sustainable livestock production. However, such activities require significant amount of financial resources and which is not readily available in South Sudan for now.

b) Sustainable and climate resilient local livelihood: it is important to ensure the sustainable utilization of the wetland while keeping the provision of these services to the community as well. Some of the interventions in this regard include the provision of support for agroforestry and tree-based businesses, developing sustainable fish farming and capture fisheries, enhancing beekeeping, practicing climate-smart agriculture, promoting energy saving practices and technologies, addressing local vulnerabilities to climate change and disaster risk among others. For example, by increasing the productivity in agriculture alone, which is very low even by regional standards, the country can reap significant benefits.

c) Community water, sanitation and hygiene: the aim is to improve water quality and sustain a healthy wetland adjacent population. Securing clean domestic water supplies, planning and establishing solid waste disposal and collection points, developing improved sanitation and hygiene practices and facilities, building capacity and know-how among village health workers are some of the activities to be performed in this regard.

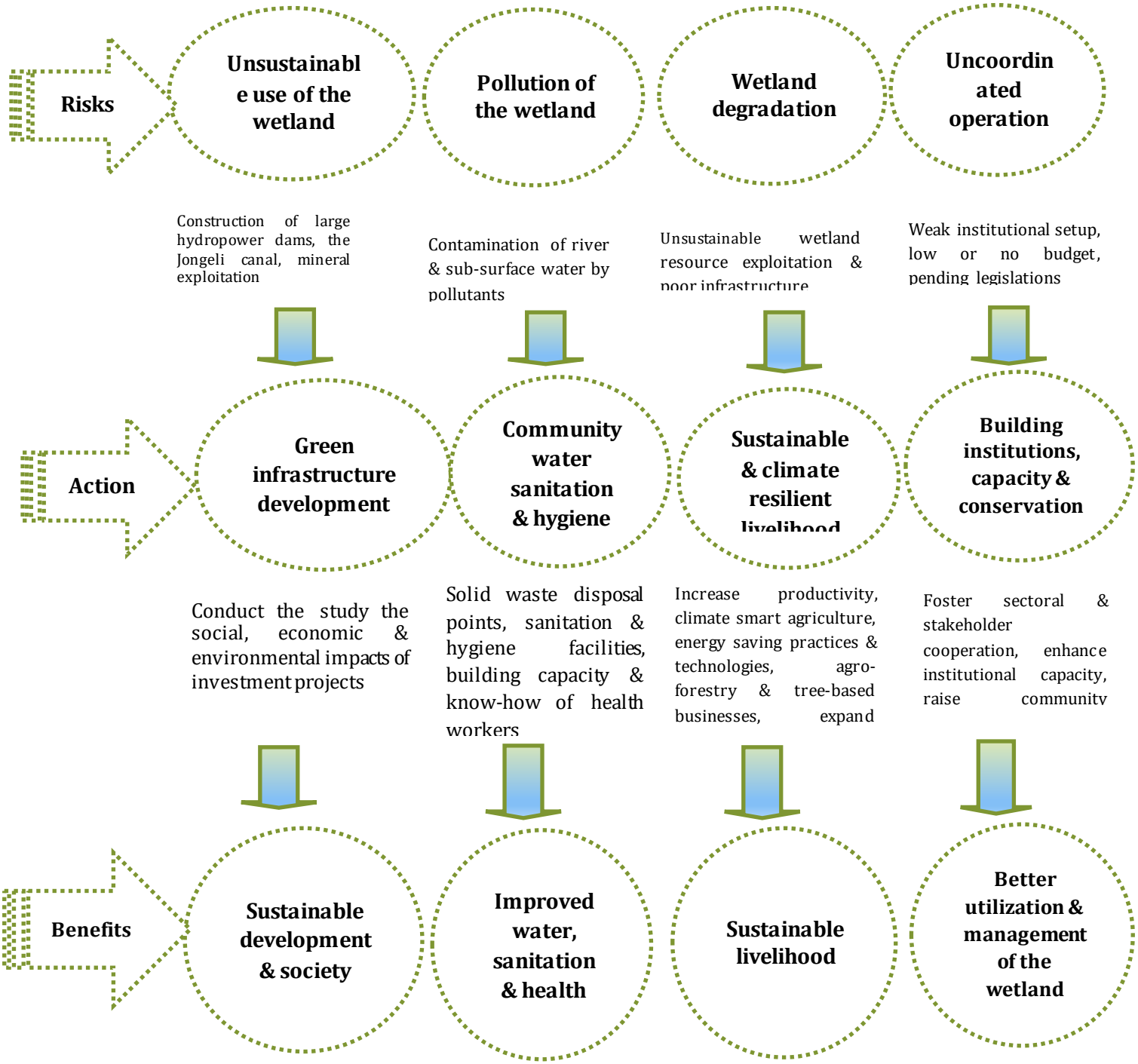



Figure 14: Risk, actions and benefits for sustainable management of Sudd wetland

## The Green Development Path

Being one of the least developed countries, South Sudan is one of the poorest countries in multiple dimensions. The country has a very poor infrastructure and the economy is highly dependent on its oil resource. This could be partly a blessing in disguise as the country can follow the green infrastructure development path in its effort to develop and thereby improve the wellbeing of its population. This is particularly true given the current trend in climate variability and climate change and its wider acceptance in the contemporary world. This approach calls for balancing the development needs of the country and the ecosystem services of its resources and environment. This scenario again comprises the following interventions to be implemented for realizing the such an approach.

a) Building institutions, capacity and conservation awareness: Due to the recurrent war and lack of peace many legislations are yet to be approved by the parliament. Hence, despite the few attempts at early stage of the country's independence, there still remains much to be done for the successful formulation and approval of the different laws and regulations aimed at environmental and natural resources regulations. More than anything else, the youngest county in the world has huge limitations in terms of funding for protecting its resources and during the Juba meeting issues of capacity limitations were boldly highlighted. Lack of integration among the different sectors, conflict over use of the resources, and poor awareness on the benefits of conserving the resources of the wetland were also raised as some of the problems facing the wetland.

   It is, thus, necessary to build effective, inclusive and sustainable systems for wetland management and use. To achieve this fostering sectoral, spatial and stakeholder cooperation in integrated wetland management; enhancing institutional capacity and accountability to address wetland conservation and climate issues; and raising community awareness, support and management for wetland conservation and wise use are very crucial, among others, in this component of the green development. Doing so will enable to strengthen wetland governance structures while building awareness and capacity at the sometime among the different stakeholders. There is also a need for government, community and the private sector cooperating and working together to conserve and sustainably manage the wetland for the better outcomes of efforts exerted on the wetland.

b) Green infrastructure development: The biggest challenge to the Sudd is the construction of the Jongeli canal which results in serious environmental and social consequences. The complex environmental and social issues involved include the collapse of fisheries, dying of grazing lands, a drop of groundwater levels, and a reduction of rainfall in the region pollution and eutrophication as a result of either oil spillage during oil exploration or overuse of agrochemicals during agricultural production, Mineral exploitation without adequate mitigating measures.

   These facts call for the country to adopt green infrastructure development if the country has to achieve sustainable development. The infrastructure of the country has to be built considering the natural and environmental resources which once lost could be difficult to recover, if possible, at all. The application of integrated soil management and the practice of organic agriculture could partly reduce the pollution from the application of chemical fertilizer. Putting in place laws and regulations that compel polluters to internalize the pollution damage as a result of their activities is important. Indulging in afforestation, reforestation and related activities could reap additional source of income to the local community while directly also benefiting from conserving nature at the same time. Sudd wetland registered as wetland of international importance by the Ramsar Convention and the wide availability of flora and fauna could be a great potential for promoting the tourism business.

The country needs to really count on this aspect of the wetland and tourism considered to be smokeless business and promotes the development of other sectors as well. However, doing so requires the country be at peace and the construction of standard roads and other tourism related services.

## Machar Marshes Wetland in South Sudan

The Machar Marshes wetland is one of the largest wetland in Baro-Akobo-Sobat (BAS) sub-basin that covers about 13.2% of BAS sub-basin (Mohamed 2019). It is located in the eastern part of South Sudan and western part of Ethiopia, east of White Nile and north of Sobat river (Negm 2017). This wetland played crucial role related to environmental quality sustaining livelihoods and maintaining biodiversity (NBI 2016). Although Machar Marshes wetland provides multiple ecosystem services, the physical incapability, its remote nature and limited infrastructure development, limited to explore more regarding its biodiversity richness, water-related ecosystem services, provisioning services and contribution to annual flooding control (Mohamed 2019). It is the least known wetland system in South Sudan (NBI 2009). Machar Marshes wetland trees, shrubs, grass and herbaceous land covers as well as the water body are home for native plants and various species. It provides significant economic and environmental benefit in different forms for about 123,117 households that reside around the wetland. The Machar Marshes wetland is rich with its flora and fauna and it is an extensive wetland system (Henry Busulwa 2012). The wetland provide rich habitat that support for about 400 different bird species and more than 100 mammal species as well as habitat close to 92 different fish species (Smakhtin 2012; ENTRO 2016).

The total estimated economic value of the wetland for provisioning ecosystem services is about $351.8 million/year, it includes water supply both for human and livestock, fishery, crop, pasture, honey, papyrus and mat production, and as a source of wild food. The major regulating ecosystem services of the wetland that include carbon sequestration, water attenuation, sediment retention have economic value that worth about $262.8 million/year and the biodiversity ecosystem service estimated about $7.35 million/year. Machar Marshes wetland provides more than half a billion US dollar value annually, estimated about $622 million/year of ecosystem services value that benefits both local and international communities. The wetland ecosystem services economic value is equivalent to almost 4.26% South Sudan the total GDP (MoFEP 2016). The finding revealed that the local community livelihood is highly dependent on the Machar Marshes wetland ecosystem services. Thus, engaging the locals should get prior attention in wetland development options and wetland conservation intervention are vital[18]

[18] For detail of this case study please refer NBI (2020), Machar Marshes Wetland Economic Valuation of Biodiversity and Ecosystem Services for Green Infrastructure Planning and Development, Nile Basin Initiative (NBI), Kampala, Uganda

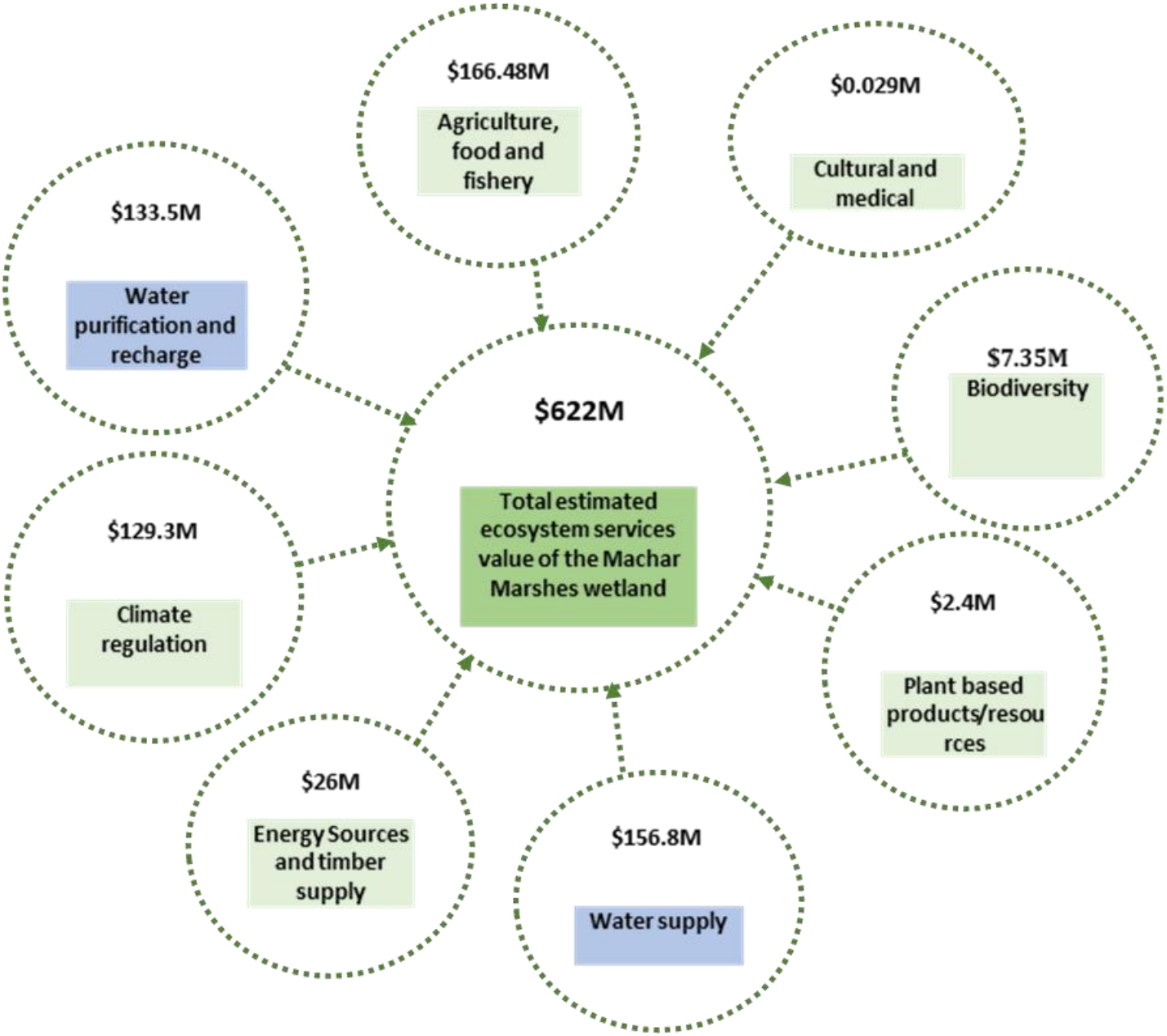


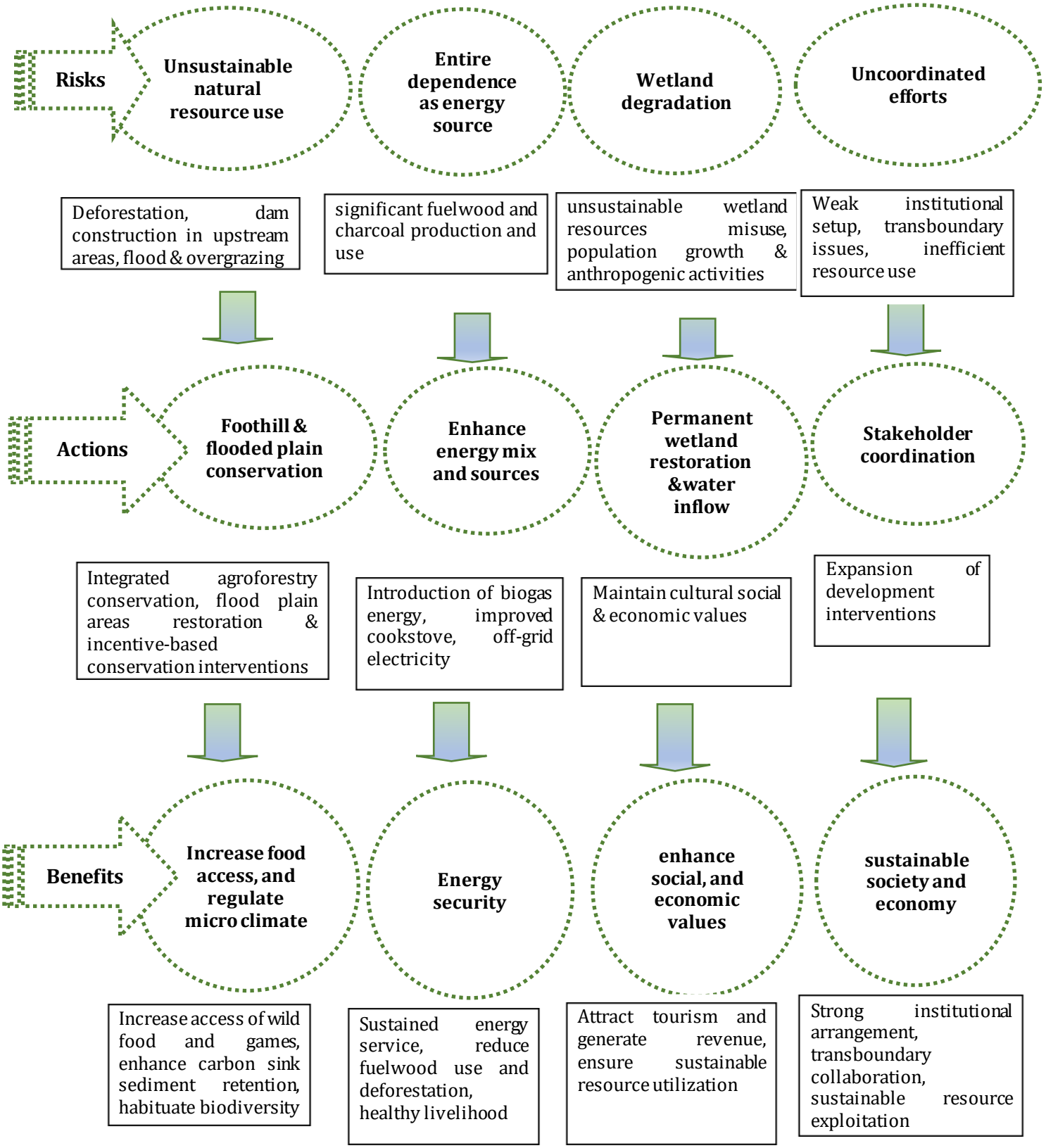

Figure 15: Estimated economic values of Machar Marshes ecosystem services

To maintain and ensure sustainable ecosystem service of the Machar Marshes wetland, alternative wetland conservation and restoration options such as foothill and flooded plain conservation, enhance energy mix and sources, permanent wetland restoration and water inflow, and stakeholder coordination are recommended. Risks, actions and benefits associated with Machar Marshes wetland development planning and restoration options are presented in Figure 16. The implementation of these alternative wetland restoration and development options enhances wetland ecosystem services benefits related to food access, regulation of micro climate, energy security, social and economic values, and sustainable society and economy.

### Conserving the Foothill of the Wetland

Conserved foothill enables to create productive farms, healthy watershed, rich biodiversity and it is important for wildlife habitat. Restoration of the flooded and degraded area is required to ensure sustainable livelihood particularly to the local community. The foothill and integrated agroforestry conservation intervention can be undertaken on the flood suspected area as well as degraded crop lands and flooded herbaceous areas by providing compensation to the local farmers. This would in turn increase wild food, water supply and enhance the ground water recharge. Moreover, it will increase the forest biodiversity and this in turn improve the livelihood of the local community (example: increasing of timber, fodder, firewood and quantity of honey) coupled with controlling air quality (for example. carbon stock, water regulation, soil protection). However, such interventions would demand implementation, opportunity, and transaction costs. Realization of the wetland foothill conservation needs commitment from the state (dealing with land acquisition) and the local community/land owners (providing their land for conservation and accept compensation) in the form of long-term and short-term contract.

Figure 16: Risk, actions and benefits for sustainable management of Machar Marshes Wetland



### Increasing the Energy Mix and Reduce Dependence on Fuelwood Consumption

Given that 98% of the population in South Sudan use fuelwood as a primary residential energy source. This hugely creates pressure and damage on the wetland. to partially mitigate such pressure, efforts should be made to promote and adopt improved energy saving stoves and other utensils aimed at saving energy. Given the large cattle population around the wetland, it is necessary to promote biogas as an alternative source of energy. Introducing off grid renewable energy sources (solar, wind, thermal) could also help towards reducing the pressure on the wetland.

### Conserving the Flooded Plain of the Wetland

The rate of Machar Marshes wetland flooded plain degradation increases through time due to disputed use of natural resources (e.g. overgrazing) and climate change impacts such as flood. Conserving floodplain areas and managing economic activities around these areas have enormous environmental value. Preserving the natural habitats on the floodplain area play an important role by controlling flood especially for the downstream parts of community during high runoff. If the floodplain conserved, it can also serve as a natural flood storage reservoir. In general, conserving flooded plain areas of the wetland could significantly increase wetland's regulating ecosystem services.

### Restoring the Permanent Wetland part of the Wetland

Conservation of permanent wetland areas has significant contribution for regulating ecosystem services (i.e. increase the wetland's water purification, sediment retention, and carbon sinking capacity of the wetland), provisioning service (increase the access for fish resources) and biodiversity ecosystem services of the wetland. We noted that the wetland resource and its cultural value has a huge potential to attract tourist, however, the wetland has zero visit at the moment. However, with improvement in the local context of the country, the wetland could be a good source of income both to the local community and the nation at large since it has huge tourism potential.

### Interventions to Maintain the Water Flow of the Wetland

Ensuring sustainable water inflow is very essential intervention and vital to maintain the overall benefits of the Machar Marshes wetland ecosystem service. This intervention may require the collaborative initiative between countries of eastern African that shares river basin like NBI that works on river basin and wetland conservation. Maintaining water inflow to the wetland requires trans-boundary collaboration among neighbouring countries for a viable benefit of the ecosystem services of the wetland.

### Develop Stakeholder Coordination Framework

Coordination of all relevant stakeholders coupled with strong institutional arrangement will help to push forward the sustainable development agendas. A stakeholder coordination framework by considering the role of internal (government and local community) and external stakeholders (NGO and civil societies) is necessary in this regard. For instance, Ministry of Forest and Natural Resource design policy and strategy that controls and manages the wetland resources; Ministry of Finance allocate budget for the wetland conservation; local municipality closely control the wetland's conservation; NGO's and environment advocators involve on wetland conservation either by allocating budget or by increasing the local communities' awareness on what, how and when to conserve the wetland resource.

## Virunga National Park in Democratic Republic of Congo (DRC)

Located in eastern Democratic Republic of the Congo (DRC), Virunga is Africa's oldest national park. One of DRC's five United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites, the park is known for its wildlife-rich network of forests, savannas, rivers, lakes, marshlands, active and dormant volcanoes and permanent glaciers. It is also famous for being home to about 200 critically endangered mountain gorillas. In December 2007, the DRC government granted oil concessions covering 85 per cent of the park. To date, Soco International PLC (Soco) is the only oil company that has indicated that it will explore for oil within park boundaries. Despite DRC's law prohibiting environmentally harmful activities in protected areas, Soco's exploration license exploits an exemption in that law that allows for "scientific activities" in protected areas. Plans to develop oil expose the social and economic value of the park to risks, the likelihood and impact of which is demonstrated by cases such as the Bas Congo and Niger Delta. Oil development could also threaten the park's status as a World Heritage Site, which if lost, could in turn have negative effects on the value of the park (WWF, 2013).

World Wildlife Fund (WWF) have launched a campaign to raise awareness of Virunga's economic value and the implications of oil development for local communities and the environment. As part of the campaign, a study was commissioned in 2013 to look at Virunga's current and potential social and economic value and to indicate the implications of oil exploration and exploitation. Virunga's estimated annual economic value is US$48.9 million. However, this value could increase to more than US$1.1 billion per year, including providing more than 45,000 jobs if the contemporary circumstances changed. The potential values are computed based on the assumption that the status-quo situation changes and development options on the national park (fisheries, tourism, hydro-electric power, pharmacological use, education and research, carbon sequestration, forest conservation, water supply, erosion control) are implemented.

### Sustainable Management Systems for Fishing

By introducing sustainable management systems for fishing, such as boosting fish populations through rebuilding the hippopotamus population and enforcing policies like those controlling net mesh size, the current yield could triple. The water quality is related to the quality of forests and soils, and is affected by human activities on and off shore. If sustainable fishery management regimes are adopted in the park, these will have a direct impact on the quality of water, on fish stocks and consequently on the fishery industry's growth potential across the entire lake, regardless of national borders.

### Promote the Tourism Industry

Virunga could become the most valuable asset for the country and a lure to attract tourists to other parks in DRC. Specific benefits are generated by the creation of employment opportunities for rangers, guides and eco-guards, among others. The conservation of the park's integrity is directly linked to the development of local communities through the provision of sustainable employment opportunities and revenue sharing schemes that enable communities to benefit from education, access to water, electricity and improved health care. Revenue sharing schemes help ensure that local communities take responsibility for the protection and conservation of the park, and recognize its value. However, setting appropriate rules is mandatory especially for the proper control of the gorilla tourism.

### Sustainable Management of Energy Production

If a more stable situation is achieved within the park and its proximity, two additional projects could be developed in Lubero and Rutshuru. These stations would more than double the production of electricity in the area up to 20 MW per year and generate more than 10,000 jobs for local communities. Maintaining stable sale price and monthly salary which will again limits threats to the park due to population increases and their associated demand for energy.

### Integrating forest conservation into national decision making

If properly maintained, the forest offers an opportunity to sell carbon credits and to supplement the funds needed to carry out reforestation activities within the park and its surroundings. Creating plantations to provide an alternative to the park's natural forests will, in effect, make it possible to reduce deforestation and degradation of Virunga's forests, a good complement to REDD+ initiatives. Given its role as rainmaker and mitigator of climate change, the case for forest conservation and for good forest management of Virunga is strong. Forests also play a good role in controlling erosion and ensuring water quality which again affects the livelihood of the community; for example, in fishing and farming activities.

The potential value scenario illustrates a situation where the park is sustainably managed, where stability and security are guaranteed, where an effective law system protects the integrity of the ecosystem, and where resources are made available to assure its sustainability over the medium to long term. More specifically the potential value scenario is based on assumptions that44 per cent of the park is covered by forests and the deforestation rate is reduced from 0.25 per cent annually to zero.

## Kano Floodplain of the Nyando River Basin in Kenya

Kano floodplain is located in the larger River Nyando Basin; one of the sub-catchments of the Lake Victoria Basin in Kenya which covers an area of 3600 square km. The floodplain covers approximately two thirds of the lower half of the basin (Raburu et al., 2012a) and it extends from Miwani, Nyando, Lower Nyakach and Kisumu East sub-County. The topography of the plain varies with highest point (altitude of 1801 m above the sea level) in Muhoroni and lowest point having the same altitude as Lake Victoria at 1134 m above the sea level (Raburu et al., 2012b). Kano floodplain is frequently inundated by floods as a result of River Nyando overtopping its banks. The river originates from the Mau Forest Complex situated on the eastern part of the Kenyan Rift Valley (MWENR, 2012; Raburu et al., 2012b). It passes through the floodplains before draining into Lake Victoria. The flooding in the plains is an annual evident attributed to the high discharge of the river in April and May as a result of accumulation of run-off in the upper reaches coupled with the alluvial soil that has poor drainage. River Nyando is also laterally confined in the southern end of the floodplain at Ahero. In addition, the Kano floodplains are surrounded by steep hills such as Tinderet Hills to the East and Nandi Escarpment to the North (MWENR, 2012).

This study was conducted in two sites within Kano floodplain in Ombeyi location. The study assessed provisioning and cultural ecosystem services (ES) provided by natural wetlands and rice fields in two Kenyan wetlands; Ombeyi natural wetland and rice fields in Kore Irrigation Scheme. The study finds that that rice fields have enhanced food production, in addition to giving a higher per farmer per annum value in terms of provisioning services of rice (USD 602), fish (USD 1039), and cultural ecosystem services while the natural wetland has higher annual monetary value in terms of fish and papyrus mats production. In the natural wetland, both provisioning and cultural services have declined over the past 20 years, due to land conversion, over-exploitation, change in flood patterns, climate

change and other factors. Annual per farmer monetary values of about USD 397 and 683 were observed for papyrus mats and fish production. The recreation, ecotourism, aesthetic, and religious/spiritual services are rated based on liker scale than conducting a real valuation. Although rice fields seem to have a higher value compared to the natural wetland and to have at least partially compensated for the loss of ecosystem services they have caused in terms of greater food values, they cannot generate other provisioning, cultural and regulating services provided by wetlands. Hence it is proposed that sustainable utilization of both natural wetland and rice cultivation systems is crucial for maintaining and enhancing livelihoods in the floodplain area. By doing so it is possible to create synergy in the ecosystem provision in both systems than opting for one of them only.

## Rweru-Bugesera Transboundary Wetlands Complex in Rwanda and Burundi

The Rweru-Bugesera Wetlands Complex is a chain of lakes, marshlands and a river, and their basins, at the headwaters of the Nile River straddling Burundi and Rwanda. It consists of three small sub basins; Rweru - Mugesera, Cyohoha South and North and Akanyaru wetlands; all transboundary ecosystems of the Nile Basin. Compared to other wetlands in the basin it is small covering about 3,8891 square kilometres but generally important as containing the first southernmost reservoirs and watersheds of the Nile River.

The study involves identification of the ecosystem services and these are standard provisioning, regulation and cultural services. As expected, the values of these ecosystems using available data are far higher than estimates of provisioning goods and services alone and added above USD 119 million. Aquatic resources including lakes and rivers in the sub basins of Rweru-Bugesera Wetlands Complex were estimated to have an economic value of about USD 10 million, agriculture more than USD 69 million, livestock about USD 13 million, fish more than USD 2 million, and tourism USD 456,000. Regulation services were estimated to be USD 8,315,740.

Despite this case of valuable ecosystem services, the study identified substantial degradation of natural resources mainly admitted as anthropogenic - by human action - but also due to climate change. Natural and Agrobiodiversity degradation is notable and pervasive.

Three development scenarios are considered in the study – linear development scenario (business as usual scenario), the best and worst scenarios.

The linear development scenario (BAU): The current practices persist into the future and assuming the endowments outlined are used as a basis for future development. All anthropogenic activities continue and traditional use of environmental natural resources are assumed. That is, the narrow economic objectives of rapid economic growth and operating from a localized approach of managing the Rweru-Bugesera Wetlands is assumed to continue.

The best-case scenario: is achievement of development plans while sustainably using natural resources. By 2050 agriculture is modernized and productive with use of fertilizers, mechanized and accessing irrigation, forest cover is at least 30 per cent, energy use shift to LPG and biogas. There is watershed protection, soil fertility, forests and regulations are well implemented. Wise use of wetlands is important in ensuring future generations reap benefits from the wetlands.

The worst-case scenario: weak implementation of development plans, limited use of sustainable use of resources, agriculture is still traditional in 80 per cent of land, fertilizer use remain low, increase population raises demand for biomass, pressure on land continues, electricity is in every household but demand for wood fuels goes up

radically, demand for wetlands leads to further degradation and getting food and energy at expense of ecosystem leads to serious problems in fall in productivity, food deficits and conflict.

The paper, after considering the current circumstances, both the busines as usual and the worst-case scenarios are not good alternatives for the wetland and the communities and hence recommends for the implementation of the best-case scenario for the better outcomes both to the communities around the wetland and the conservation of the wetland.

## Discussion on the Development Options for Wetlands in the Nile Basin

The case for development options for a handful of cases of wetlands in the Nile Basin has been presented above. Despite a difference in the detail and manner of presenting the options, the issues covered are more or less similar for the wetlands. The case studies in South Sudan (Sudd and Machar Marshes) and Democratic Republic of Congo (DRC) (Virunga National Park) stressed the importance of peace and security in the countries for materializing the development options and the resultant benefits from their implementation. All the three case studies have huge potential for tourism business, which is more or less non-existent especially for the cases in South Sudan and in some regards in the DRC during the time of study. The Sudd wetland in South Sudan, for example, is registered by Ramsar Convention as site of international importance and it is also rich in flora and fauna while the Virunga National Park is registered as a world heritage site by UNESCO which is a huge potential both for domestic and international visitors.

The finding of the study on the Nyando River basin in Kenya has implication for wetlands in the Nile basin at large. The rice fields are found to have higher value, though the study didn't include regulating and biodiversity services in its valuation, but it can only provide provisioning services not regulating and biodiversity services. Its true that wetlands should serve the communities around them. But, the valuation of the benefits and costs should consider all the ecosystem services provided by the wetlands. An attempt should also be made to boost the immediate benefits from the wetlands while maintaining the ecological integrity of the same. In this regard, the Sudd wetland in South Sudan has a relatively low provisioning services (about 8% of the TEV) compared to other ecosystem services of the wetland while provisioning services of the Kano Floodplain in Kenya have been on decline over past 20 year. Such fact could be a treat for the integrity of the wetlands since human beings tend to value direct and immediate benefits than otherwise. This is consistent with the anthropocentric view of human beings to resources around them. The communities can only preserve the wetlands only if they see higher benefits to alternative land use practices. In addition, almost all the studies emphasized the importance of increasing the provisioning services from the wetlands through investments aimed at boosting them. Notable among these is the increasing the productivity of crop, livestock and fishery. Since all the wetlands are treated by the increasing demand for agricultural land, this could be partially mitigated by the increase in productivity of agricultural practices around the wetlands. In South Sudan, for example, which has low productivity by even Sub-Saharan standard, by only increasing the productivity of its agricultural sector, the country can significantly improve the food security situation of its people.

The green (sustainable) development path has been explicitly highlighted in the studies for the Wetlands in both South Sudan and DRC. Through afforestation and reforestation measures, the wetlands could not only generate higher immediate provisioning services benefits but also can fetch additional income from the international carbon market. the carbon sequestration value of the Virunga National Park has been shown to increase by more than 50 folds with the sustainable development option of the wetland. The sustainable development approach could even help diversity the economies of the countries since their economy is currently dependent on few

natural resources. This path also includes green infrastructure planning and development. The wetlands of study in South Sudan and DRC are threatened by oil exploration and extraction activities withing them. The green development path requires such exploration and extraction activities be sustainable and should be practiced without jeopardizing the integrity of the ecosystems of the wetlands.

A sizable proportion of the TEV of the wetlands come from the regulating and biodiversity services. These services have benefits beyond the areas where the wetlands are found. Recognizant of this situation, the development options proposed for the wetlands have left a portion of the option for external actors. Unless duly compensated, the continuation of such services may not be guaranteed partly because they have a public good nature. That is why external actors are considered among the stakeholders for the wetlands considered in this study. Actually, they have been contributing to the conservation and development of the wetlands in different ways. But a clear and transparent mechanism is needed in place to further enhance their engagement in developing the wetlands. This is particularly important since the countries where the wetlands of study are located are poor. Apart from the low income, the issue of conserving wetlands has been a low priority among the leaders of these countries and low or no budget is allocated for the same purpose. The public good nature of some of the ecosystem services has definitely contributed for the low motivation and this gap has to be filled by external actors.

The development options for the wetlands cannot be a standalone approach. Rather, it should be thought as part of a comprehensive national development endeavour where wetland development is an integral part of the overall national initiative for sustainable environment and development. This is to mean that wetlands belong not to just a single entity or institution. Rather they require the integration and coordination among different stakeholders and it is only through such mechanism the desired outcome can be foreseen and achieved. However, lack of integration among different stakeholders have been reported in almost all the wetlands case studies. Hence, any development option has to seriously consider this challenge and thereby come-up with plausible recommendation on how it can be addressed. The development options proposed for Sudd and Machar wetlands as well as Virunga National Park have clearly highlighted the importance of not only institutional coordination but also the need for skilled manpower. Setting the appropriate policy agenda and striving for its implementation is also part of the institutional requirements that have to be emphasized and exercised for better planning and execution of the development of the wetlands. However, lack of peace and recurrent war is deterring from ratifying some of the drafted policy and strategy documents particularly in South Sudan.

## Concluding Remark on Development Options for Wetlands

About five case studies were explored to establish the case for development options of wetlands in the Nile Basin. The diversity of presenting the development options implies that there is no a single approach to present the options. Rather, since the local circumstance vary depending on the nature of the wetland, the spatial dimension of the wetland, potential stakeholders of the wetland and since the challenges encountered also somehow vary among the wetlands of study, it is not unexpected to present the options in diverse approaches. Hence further attempts to propose development options for wetlands in the Nile Basin and beyond has to customize the options to the local circumstances of the wetlands and the development needs of the community and the country at large.

Though the manner of presentation is not identical, most of the options focused on the need for harmonizing the conservation options of the wetlands to the livelihood security of the local communities and beyond. The conservation option is also found to be boosting the livelihood aspiration of the communities around the wetlands and can even help to diversify the economies of the countries where the wetlands are located. Notably, the

countries of studies are currently dependent on only few natural resources and by choosing the conservation option for the wetlands, they can somehow diversity their economies. Moreover, the perpetuated provision of the different ecosystem services is guaranteed with the conservation option while the alternative options may boost the provisioning services in the short to medium terms, there is no guarantee that the other ecosystem services will continue to be provided. At times, the alternative options, such as oil extraction or construction of big hydroelectric dams, could even wipe out most, if not all, of the ecosystem services from the wetlands.

The sustainable development and management of wetlands requires that development options for wetlands should be an integral part of the overall development interventions of the countries. This is implied in the development options and interventions meant to achieve the options. The development options forwarded include interventions such as the conservation, afforestation, reforestation, increasing productivity, capacity building, as well as institutional coordination among others. The multitude of tasks require the participation and contribution of different stakeholders each stakeholder adding value to the sustainable development of the wetlands. In effect, the development options should be considered as part and parcel of the bigger development agenda for bringing about the required change. To give an example, the ministry of foreign affairs is in charge of signing agreements with external actors while ministries related to agriculture, environment are the ones concerned with technical components of wetlands, the minister of finance allocates budget for wetland related activities, ministry of education is in charge of producing skilled manpower, the legislators draft and ratify different policies and regulations, and so on. The sustainable development option for the wetlands also requires green infrastructure planning where any infrastructural planning and investment should be dealt without compromising the integrity of the wetlands and their ecosystem services which are the basis for the livelihood of the local communities and beyond.

# 7. Conclusion and Recommendation

## The State of TEEB in Nile Basin wetlands

In Africa, about 17% of the river wetlands and 20% of the inland flood wetlands in Africa have degraded into non-wetlands, and many other wetland types have also degraded. In addition, wetland ecosystems in developing countries have failed to play an essential role in maintaining ecological, food, freshwater and climate security (Xu *et al.* 2019). Therefore, it is imperative for local, regional and national actions and international cooperation to work together continually to strengthen wetland conservation and restoration, as a result, the implementation of the wetland management plans and development options became more effective and integrating wetland conservation policies and local development is also vital (Dahlberg & Burlando 2009; Xu *et al.* 2019). Indeed, wetland management and development plans in different regions still have large space for improvement, especially in Africa.

Despite the fact that Nile river has productive ecosystem, the Nile's land and water are underutilized and degraded at an alarming rate. The wetland areas in the basin are one of the most degraded parts of the Nile, which covers 5% of the basin and vulnerable to various problems, such as infrastructure development close to water resources, conversion to agricultural land, increasing population, overexploitation of wetland resources, expansion of invasive species, extraction of minerals and oil, and climate change. However, these wetlands' have important role on sustaining the livelihood of million households by furnishing provisioning ecosystem services (i.e. Nile Basin wetlands have vital role to cultivate small scale agriculture and grazing land for livestock by retaining moisture for long time even in time of drought). Perceptive development and management of wetlands can add considerable value to the benefits that wetlands provide. However, the trade-off between environmental protection and development is severe in wetlands (McCartney & Houghton-Carr 2009).

The Nile Basin wetlands TEEB is guided by the principle that ecosystem service valuation (and the TEEB approach) should not be seen as an end in itself, but rather a means to an end: better-informed, more inclusive, equitable and sustainable river basin planning and decision-making in the Nile Basin. To develop TEEB for water and wetlands in the Nile Basin and to inform the development of options for the envisaged Nile Basin wetlands management plan, first a comprehensive review of existing knowledge and information was undertaken to develop abroad architecture having goal, policy purpose and specific focus that allow to identify target audience, entry point and decision influence. The broad approach enables to harnessing wetland ecosystem services as a natural infrastructure for river basin development by conducting socioeconomic and financial viability through cost benefit analysis on investment on green infrastructure.

The major challenges to manage wetlands sustainably is that wetland users and decision-makers have insufficient understanding of the consequences of alternative management and policy regimes on wetland functioning, ecosystem services and human well-being (Jogo & Hassan 2010). However, the management of the wetland in the Nile basin often does not get a priority, mainly due to poor realization of the economic value of the wetlands. Therefore, to highlight on how the wetland situation can provide complementary insights into sustainable and welfare-optimizing wetland management, development and policy implications in the Nile basin, selected Nile basin TEEB case studies that enhance policy decision, wetland management and development options are presented in this report. In addition, to address some of the knowledge gap particularly for Nile Basin wetland ecosystem service valuation, selected site level wetland case studies have been done to support wetland development options, and building economic case for wetland conservation management plan in the Nile Basin.

Given the different threats and challenges wetlands in the Nile Basin are facing, including climate change, wetland management is today receiving far greater attention within the framework of both general and specific policies. In this regard, understanding the full value of the ecosystem services provided by the wetlands is a first step in preparing and implementing specific management activities and wise use of the wetlands. Also, information on the current status of wetlands, the extent of wetland loss and degradation, conservation procedures and the success of monitoring strategies is required. Management actions also require monitoring to ensure their effectiveness while monitoring, in turn, requires the support of management procedures to ensure it is effective in that the outcomes are interpreted and acted upon. Hence, this necessitates a management plan for wetlands which provides such procedures and ensure that the available information is presented in a from that can be readily used for management actions.

Despite such common procedure, the management plans should be tailored to the unique challenges and opportunities of the wetlands and the communities around them. It is also a common fact that there are different stakeholders that have stake one or more stake in the wetlands. This emanates from the complex nature of the wetlands as well as the multitude of ecosystem services provided by the same. For the successful identification of wetland management actions and to raise necessary funding and cooperation for the plans, it is necessary to seriously consider the engagement of the different stakeholders. For example, the successful consultation of the local communities in the Rugezi wetland restoration effort has yielded positive cooperation from the communities. The formulation and revision of the environmental and land laws has created enabling conditions for the restoration efforts. Different local and international NGOs participated in the funding and implementation of the different restoration programs.

Early action on the preparation of management plans and thereby its implementation is less costly than restoration efforts after the wetlands have sustained more damage as is evidenced in the Rugezi wetland experience. Despite the reasonable success achieved in the restoration efforts, it has come at huge cost and serious repercussions to the local communities in particular. Hence early action on the preparation of wetland management plans could partially mitigate such heinous effort by using them as a communication tool to gain broad support for wetland protection and conservation efforts. In a way, the management plans help people in the leadership or other interested stakeholders to get the proper information about the status of the wetlands and the conservation needs for their action and funding. Since funding requirements are included for each management action, this not only increases the possibility of funding the plans but also enables the funding possibilities from multiple sources. The plans also, by clearly stipulating interventions aimed at improving the livelihood situation of the local communities around them, prove that conservation means ensuring sustainable livelihood for the local communities.

For wetlands of transboundary nature such as Semliki Delta, Sio-Siteko, and Sango Bay Minziro, coordination of efforts and programs is essential for successful execution of management plan

preparation and implementation. For such wetlands, the focus should be on an integrated wetland conservation plan than a standalone conservation plan. That is, by focusing on integrated planning, it enables the plan to bridge different agency programs and geographic boundaries, maximize areas of expertise, build collaborative partnerships, and organize multi-objective visions while building consensus. Moreover, collaboration among two or more countries is needed to facilitate inter-agency communication for integrated efforts to incorporate wetland elements into their existing planning framework.

## Development Options for Wetlands

Accounting for the economic value of wetlands ecosystem services as well as costs and benefits of wetland development scenarios, before proposing any development option, is important for coming up with a plausible development option proposal. Failure to do so will either underestimate the relevance of wetlands or promotes development options that compromise the integrity of wetlands. The high economic value of the rice fields in Nyando River basin in Kenya is a typical example of such exercise where failure to account the regulating and biodiversity services led to such results. It should also be noted that for some of the wetlands, such as Sudd in South Sudan, the biodiversity and regulating services account for much of the total economic value of the wetland. Even if the contributions of non-provisioning ecosystem services of the wetlands vary depending on the circumstances and locations of the wetlands, a plausible assessment of development options could be more appropriate with the better understanding of their values.

To bring about sustainable development and change on the wetlands, development options should be part and parcel of the overall development endeavours of the countries. That is, even if piecemeal approaches could be used to address immediate and site-specific challenges, sustainable change could be achieved by integrating them with the development agenda of the countries. Since wetlands provide multitude of ecosystem services including the provision of water (domestic and livestock), fodder, and other provisioning, regulating, biodiversity and cultural services, they also involve different stakeholders. It has also been shown that a sizable proportion of the TEV of the wetlands come from the regulating and biodiversity services. These services have benefits beyond the areas where the wetlands are found; that is, they have public good nature. Hence, the integration of the different stakeholders is essential for better and efficient outcome. One way to do this is to integrate the development options of the wetlands into the overall development agenda of the different actors and thereby the countries. This approach could also help to partially overcome the lack of integration among different stakeholders in wetlands of the case studies. Integration of the stakeholders again helps to reduce duplication of effort and thereby reduce costs while sharing expertise. Integration among the different stakeholders could also help to identify the gaps with regard to laws and regulation, skills, manpower, as well as funding and thereby work towards addressing them.

The wise use and the green developments paths have been the most commonly proposed development options to the wetlands. Since all the wetlands are treated by the increasing demand for agricultural land, under the wise use option, this could be partially mitigated by increasing productivity of agricultural

practices around the wetlands. Given the countries in the Nile Basin have poor infrastructural and skill development, any development effort towards improving this condition could pose a serious threat to the wetlands. Hence, to mitigate this challenge, the development options commonly proposed is the green development path which allows development without compromising the integrity of the wetlands. The sustainable development approach could even help diversity the economies of the countries since their economy is currently dependent on few natural resources. This path also includes green infrastructure planning and development. The wetlands of study in South Sudan and DRC are threatened by oil exploration and extraction activities withing them. The green development path requires such exploration and extraction activities be sustainable and should be practiced without jeopardizing the integrity of the ecosystems of the wetlands. Some of the wetlands are registered under the Ramsar Convention and rich in flora and fauna which have huge potential for tourism. Hence creating the necessary infrastructure to promote tourism is part of the sustainable use of wetlands.

## Mainstreaming TEEB into Planning

It has been shown that wetlands provide multitude of ecosystem services for different stakeholders. It is evident that the transformation of the environmental resource base has contributed substantial gains in human well-being and economic development. However, wetland degradation and thereby the reduction in the ecosystem services they provide is threatening human development. Damage to natural ecosystems is undermining the ability to provide goods and services, with considerable economic and social consequences. As highlighted above, it is necessary to integrate both conservation/management plans as well as development options to wetlands into development planning practices of the countries since they are essential to equitable and sustainable growth and development.

Following the GIZ (2012) publication on the process of integrating ecosystem services into development planning, we propose a six-step procedure for mainstreaming TEEB into the planning process of the NBI countries:

**Step 1:** Defining the scope of assessment and setting the stage – this is more of a preparatory stage where the objectives and scope of the assessment will be defined which, again, depends on the specific development plan that is being considered. The aim is to understand the dependence and impact of development goals and measures on ecosystem services; to provide information about how to avoid negative trade-offs and achieve beneficial ones; and to identify concrete options to maximize positive linkages and synergies between ecosystem services and development goals.

**Step 2:** Screening and prioritizing ecosystem services – identification of the most ways in which the development depends on and impacts ecosystem services is undertaken in this step. The major focus is on the stakeholders that will be affected, and on the distribution of costa and benefits between different groups. Listing of priority ecosystem services that are relevant to the assessment will be identified in order to help reduce the complexity, time and cost of the assessment. It should be noted, however, it is not possible (and not necessary) to consider each and every ecosystem services. A development plan is considered to have an impact on an ecosystem service if actions associated with it alter the quantity or quality of a service.

Step 3: Identify ecosystem service conditions, trends and trade-offs – the status and main trends in the supply and demand for ecosystem services will be analysed in terms of both the causes and effects. The key stakeholders involved will be reviewed in detail. Aspects such as the quantity, quality, and timing of the supply and demand for ecosystem services will be considered, paying particular attention to the spatial relationships between production and consumption. Analysis of the drivers of ecosystem change is an important aspect of this step. A particular concern is to identify where there may be trade-offs: measures to balance between the provision services and development objectives or activities, or between stakeholder groups.

Step 4: Appraising the institutional and cultural framework – in this step an appraisal of institutional, policy, legal, and cultural frameworks, and the resulting incentive structures will be conducted. These factors and arrangements mediate and influence how people mange, use and impact on ecosystems and their services. They may also act as drivers or either ecosystem degradation or ecosystem conservation, and are also key to negotiating any trade-offs that occur. It is also in this step that we should have a clear idea of what underlies people's behaviour as regards ecosystem and their services, and have identified where potential areas of conflict or cooperation exist. Moreover, a wide range of incentives should be considered, including de facto and de jure rights, markets, prices, taxes and subsidies that relate to ecosystem services and the lands and resources that generate them.

Step 5: Preparing better decision making – appraising the policy options and instruments that can be used to improve the way in which ecosystem services are used in support of development goals, and to ensure that development activities in turn provide a solid basis for sustainable and equitable ecosystem management and use. It involves identifying the main risks and opportunities that ecosystem services pose to the development plan. Identification of entry points into the decision-making process surrounding the development plan, and selected suitable policy options and instruments to avoid development risks and capture development opportunities. This may also involve identifying new policy tools and instruments, so as to fill key gaps in existing frameworks.

Step 6: Implementing change – setting up implementation strategy and operational workplan is the final step. The implementation strategy lays out the process, guiding principles and intended outcomes for the policy measures and instruments to integrate ecosystem services into development actions. The operational workplan sets out tasks, timelines, responsibilities and stakeholder involvement, and shows the financial resources and other inputs that are needed for successful delivery. The identified measures and instruments need to be properly resourced and funded. Ideally this should be as part of the overall development plan, but in some cases, it may be necessary to secure additional funds or to work through partnerships with others or as part of other initiatives that are already underway.

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# 9. ANNEX: List of Ecosystem Valuation Studies Carried Out in Nile Basin Countries


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