Nile Equatorial Lakes Subsidiary Action Program

FEASIBILITY STUDY AND PREPARATION OF AN INTEGRATED WATERSHED MANAGEMENT PROGRAM AND INVESTMENT PROPOSAL FOR SIO-MALABA-MALAKISI SUB BASIN

Final Report

Investment Project Proposal

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ACRONYMS AND ABBREVIATIONS

CA	Conservation agriculture
CAAC	Catchment Area Advisory Committee
CBO	Community-Based Organisation
CFA	Community Forest Association
CIDV	Centre for Integrated Development (of Tororo District)
CMU	Catchment Management Unit
DEA	Directorate of Environmental Affairs (Uganda)
DED	German Development Service
DFD	Department of Farm Development
DLG	District Local Government
DRSRS	Department of Resource Surveys and Remote Sensing, Ministry of Environment
DSS	Decision Support System
DWD	Directorate of Water Development (Uganda)
DWO	District Water Office
DWRM	Directorate of Water Resource Management (Uganda)
EAC	East African Community
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act (Kenya)
ENR	Environmental and Natural Resources
ESMF	Environmental and Social Management Framework
FMH	Farm Management Handbook
GEF	Global Environment Facility
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
ICRAF	International Centre of Agro-Forestry
ILM	Integrated Lake Management
INRM	Integrated Natural Resources Management
IUCN	International Union for the Conservation of Nature
IWM	Integrated Watershed Management
IWRM	Integrated Water Resource Management
JCC	Joint Commission of Cooperation
KARI	Kenya Agricultural Research Institutes
KEFRI	Kenya Forestry Research Institute
KFA	Kenya Forest Authority
KKV	Kasi kwa Vijana" (work for youth program)
KWS	Kenya Wildlife Service
LAKIMO	Lake Kyoga Integrated Management Organisation
LVB	Lake Victoria Basin
LVBC	Lake Victoria Basin Commission
LVEMP	Lake Victoria Environment Management Project
LVNCA	Lake Victoria North Catchment Area
LVNCMS	Lake Victoria North Catchment Management Strategy
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries, Uganda
MAR	Mean Annual Runoff
MERECP	Mount Elgon Regional Ecosystem Conservation Project
MEMR	Ministry of Environment and Mineral Resources (Kenya)
MFPED	Ministry of Finance Planning and Economic Development

MKEMP	Mount Kenya East Environmental Management Project
MoU	Memorandum of Understanding
MOV	Means of Verification
MTTI	Ministry of Trade, Tourism and Industry (Uganda)
NAADS	National Agricultural Advisory Services (Uganda)
NALEP	National Agricultural and Livestock Extension Program (Kenya)
NBI	Nile Basin Initiative
NBSAP	National Biodiversity Strategy and Action Plan (Kenya)
NELSAP	Nile Equatorial Lakes Subsidiary Action Plan
NEMA	National Environment Management Authority (Kenya and Uganda)
NEMP	National Environment Management Policy (Uganda)
NFA	National Forest Authority (Uganda)
NFP	National Forest Plan
NGO	Non Governmental Organisation
NIB	National Irrigation Board (Kenya)
NLUP	National Land Use Policy
NRA	National Roads Authority (Uganda)
NRM	Natural Resource Management
NSWCP	National Soil and Water Conservation Programme (Kenya)
NWP	National Water Policy
NWRMS	National Water Resources Management Strategy (Kenya)
NWSC	National Water and Sewerage Corporation (Uganda)
PMU	Project Management Unit
PEAP	Poverty Eradication Action Plan (Uganda)
PES	Payments for Environmental Services
PMA	Plan for Modernization of Agriculture (Uganda)
PQP	Project Quality Plan
RCMRD	Regional Centre for Mapping of Resources for Development
SCAP/MCAP	Sub-Catchment or Micro-Catchment Action Plan
SCMP	Sub-Catchment Management Plan
SIDA	Swedish International Development Agency
SMM	Sio-Malaba-Malakisi
SFM	Soil Fertility Management
SWAT	Soil and Water Assessment Tool
SWCB	Soil and Water Conservation Branch (Kenya)
SW/SWD	Solid waste/ Storm water drainage
ToR	Terms of Reference
TEMC	Trans-boundary Ecosystem Management Committee
UWA	Uganda Wildlife Authority
UNRA	Uganda National Roads Authority
WAP	Water Allocation Plan
WAP	Water Action Plan (Uganda)
MWE	Ministry of Water and Environment (Uganda)
MWI	Ministry of Water and Irrigation (Kenya)
WKIEMP	Western Kenya Integrated Ecosystem Management Project
WMZ	Water Management Zones
WPC	Water Policy Committee
WREM	Water Resource and Environmental Management
WRMA	Water Resources Management Authority
WRUA	Water Resource Users Association

CHAPTER 1.Introduction

The Consortium EGIS-CAS Consultants Ltd has been committed by the SMM River Basin Project – Project Management Unit to provide a feasibility study and preparation of an integrated watershed management program and investment proposal for Sio-Malaba-Malakisi Sub Basin, in Kenya and Uganda.

According to the terms of reference, the study objective is to propose an investment project for Integrated Watershed Management through a sector development program modality for priority watersheds.

> *The project must contribute towards addressing catchment degradation issues optimal and sustained production of the integrated use of natural resources of the watersheds with minimum damage to the environment for the benefit of the inhabitants of the watershed and the communities linked to them.*
>
> *Beside, in developing the investment project, the consultant must ensure that there are linkages to country Poverty Reduction Strategy Papers (PRSPs) and Country assistance strategies; as well as nationally implemented programs and identify mechanisms to implement nationally while retaining transboundary coordination/collaboration.*

The principal requested output is an **Investment Project Proposal** presented as the study **Final Report** developed with, in Annexes: the following documents:

(i) Details of the sector projects involved in the process/
- integrated watershed management
- community based wetlands management
- Solid waste management and storm water drainage plans for Bungoma and Lwakhakha

(ii) An Environmental Social Management Framework

(iii) An Integrated Watershed Management Investment Project

(iv) An Institutional set up for Project Implementation

The present **Final Report** is the final output of the consultancy services. The report is composed with a Main Report and 6 Annexes presenting respectively the different Investment Projects, the Environmental and Social Management Framework (ESMF), a synthesis of the Integrated Watershed Management Investment Project and a proposal for an institutional set up for Project Implementation:

The Final Report has been preceded by an Inception Report and an Interim Report containing the project basic information i.e. a watershed characterisation, including a hydrological modelisation, a sector assessment for water, agriculture/agroforestry, forestry, an assessment of the extent and severity of land degradation, the institutional and legal framework for the develppement of the project and an analysis if the main stakeholders. The main elements of the Interim Report are presented again in the Final Report for easy understanding.

The present Volume is the Main Report of the overall Final Report, whereas each project proposal will be presented in a separate volume.

IWMP FINAL REPORT

Main report	Investment Project Proposal
Annex 1	Catchment rehabilitation and management and investment plan
Annex 2	Community based wetlands management and investment plan
Annex 3A	Solid waste management plan for Bungoma and Lwakhakha and investment plan
Annex 3B	Storm water drainage plan for Bungoma and Lwakhakha and investment plan
Annex 4	Environmental Social Management Framework
Annex 5	Integrated Watershed Management Investment Project
Annex 6	Institutional set up for Project Implementation

CHAPTER 2.The Project

2.1 Project background

The Sio-Malaba-Malakisi (SMM) River Basin Management Project is one of the three transboundary integrated water resources management and development projects being implemented within the framework of the Nile Equatorial Lakes Subsidiary Action Program (NELSAP), an investment program of the Nile Basin Initiative. The SMM project targets economic growth opportunities through co-operative management of the shared water resources amongst Nile Equatorial Lakes countries, to alleviate poverty, enhance economic growth and reverse environmental degradation. It also contributes towards the wider Nile Basin Initiative (NBI) goal of achieving sustainable socio-economic development through equitable utilization of, and benefit from, the common Nile Basin water resources.

The SMM basin consists of the Malaba-Malakisi catchment, which originates from the southern slope of Mount Elgon and drains towards Lake Kyoga, and the Sio catchment, which originates from hills south of Mount Elgon and drains into Lake Victoria. These catchments have experienced significant land use changes over the past years due, in particular, to increasing population pressure, as local inhabitants continue to clear forests and drain wetlands to create new agricultural land and establish new settlements.

The fast population growth in the SMM basin has led to excessive land fragmentation and has pushed farming activities into marginal areas that are vulnerable to soil erosion and nutrient loss; it has also led to increased encroachment of ecologically fragile areas such as wetlands, riverbanks and protected forests for farming purposes. The SMM basin is also experiencing water resources quantity and quality challenges as a result of over-abstraction of surface water; poor land use management practices; encroachment on river riparian lands and wetlands; flash floods; increased sediment loads in the water courses and water storage facilities. Further, poorly controlled effluent discharges from industry and sewage outflows, and the excessive nutrient and agro-chemical pollution from diffuse sources have negatively impacted surface water and groundwater quality.

An Integrated Watershed Management Project is therefore necessary to address the above issues and contribute towards reversal of the current trend of catchments degradation, without losing sight of the need to ensure livelihood for the whole population.

The proposed project will address critical trans-boundary problems of pollution and soil erosion but also enhance collaboration between communities across the common border between Kenya and Uganda and more so strengthen regional cooperation.

2.2 Project Development objective

The project development seeks to address the catchment degradation and allow optimal and sustained use of natural resources of the watersheds with minimum damage to the environment and for the benefit of the inhabitants of the watershed and the communities linked to them.

The proposal for investment projects is linked with the country Poverty Reduction Strategy Papers (PRSPs) and Country assistance strategies; as well as nationally implemented programs and is expected to identify mechanisms to implement nationally while retaining transboundary coordination/collaboration.

The project arises as a major challenge to pursue and make effective into one objective the different interests and the goals at different horizons of the different stakeholders, such as:

- The improvement of living conditions, and first of all economic incomes, of the mostly rural population of the area; this improvement must be prepared to cope with the rapid increase in population which is currently observed and is expected to continue in the medium term;
- Other aspects of living conditions directly linked to watershed management, such as quality of alimentation and hygiene conditions, must also be taken into account;
- Social dimensions that must be included in the project, such as the role of women in decision making and in management, the specific place of the increasingly numerous youth in the communities, the general process of decentralisation in both Kenya and Uganda leading to the establishment of farmers' associations at local level…
- The direct environmental protection of the watershed by improvement of the forest cover and other tree plantation, and the improvement of agricultural practices, all measures tending to decrease the amount of soil lost each year to surface runoff, causing loss of soil fertility in the slopes and impeded drainage in the lower lands;
- The induced effects of environmental degradation, such as lower river water quality, and local erosion in the river banks and along the roads;
- The protection of wetlands to conserve their role in the ecosystem and in the economic and social organisation.

To achieve these goals, it is necessary to promote a balance between the three basic action lines, from project design to implementation process: environmental protection and reasonable use of natural resources; provision of income opportunities for each family in mostly rural areas, on another side; and support to organisation and management level. Efforts to improve environmental conditions (biodiversity, erosion control, wetlands protection) can be proposed to the communities and farmers if, within the same project, real opportunities for a better livelihood are included through increased production, diversification of products and activities, and

improved access to market for the products… Only under such conditions will the local communities make a commitment towards measures leading to a sustainable development, leaving behind the short-sighted actions sometimes observed now to ensure immediate subsistence production.

2.3 Objectives of the Project

Global Environment objective

The global environment objective of the project is to promote a set of integrated watershed management interventions so as to achieve local and global benefits. These benefits include reduction of land degradation, of pollutants emission in the water bodies and of erosion on watersheds that feed into rivers down to lake Victoria in Kenya and Lake Kyoga in Uganda, reduced greenhouse gas (GHG) emission in atmosphere, improved carbon storage in forests and woodlands and in-and off-farm biodiversity.

Specific objectives

The specific objectives to reach by implementing the IWMP are the following:

- Land and natural resources degradation is stabilized in the watershed
- Livelihoods, incomes and welfare of populations have improved
- Flow regimes in streams have improved
- Flooding and landslide risks have decreased
- Water pollution of surface water and groundwater has decreased
- Wetland management has improved
- Water resource management has been enhanced

2.4 Project Implementation Process

The process to prepare the current Investment Project Proposal reflects the process designed for implementation: in both cases an important role is given to the local stakeholders. Successive discussions with government officers al local level and with farmers associations to establish the proposal and to confirm the findings have opened the way for a process of project/sub-projects implementation through the existing farmers associations or through other users groups which may be formed soon.

Group strengthening, capacity building, and advice to individuals through the groups: most actions are meant to be channelled through the different types of farmers associations and other Community Based Organisations. Indeed these groups are often existing, have started developing initiatives in line with Integrated Watershed Management, but are sometimes

struggling against constraints that can be overcome by the SMM Project: low awareness of many community members, lack of knowledge on precise technical matters, lack of exposure to experiences realised elsewhere, lack of funds for operation of community centres (tree nurseries, fish ponds, crop storage…), difficulty in taking the crops (and particularly new products) to the market for sale in good conditions.

Within the groups and the communities, a specific space will be given to women and to the youth. Indeed most first-sight decisions may fall on activities usually run by men, such as agriculture or forestry. Yet sustainable development will be effective if based on new activities leading to a higher diversity in sources of income, and these new sources of income can be, to a wide extent, entrusted to women (because of their organisation and capacity) or to young persons (because of their enthusiasm). Note that the new sources of income that can be added and financed, including such activities as fish ponds, other animals farming, beekeeping, growth or collection of medicinal plants, can easily remain under the responsibility of women and be a source of activity for the youth.

CHAPTER 3.Main Watershed Features

3.1 Study Area

The area to be studied for the Integrated Watershed Management Program (IWMP) includes the whole Sio river watershed basin, tributary of the Lake Victoria in Kenya and the upstream part of the Malaba-Malakisi river watershed basin tributary of the Lake Kyoga in Uganda.

The Sio River catchment occupies an area of about 1,448 km^2 while the Malaba-Malakisi catchment (including Mpologoma) covers an area of 3,782 km^2; thus the total study area amounts to 5,230 km², in accordance with Table 1 below.

ADMINISTRATIVE UNITS

The administrative division of the watershed in both countries is presented below, with the updated names for each unit. Several changes have been occurring, and may still occur in the near future; this point brought some difficulty in data collection, and implementation phase will require a particular attention to stick to the valid units at the time of action.

Table 1: Administrative units in the study area

DISTRICT	TOTAL AREA (KM^2)	AREA IN SMM (KM^2)	HEADQUARTERS	DIVISIONS (K) /SUB-COUNTIES (U) COVERED OR TOUCHED BY SMM
KENYA WESTERN PROVINCE				
Bungoma South	666.4	450.7	Bungoma	Kanduyi
Bungoma West	445.5	173.4	Sirisia	Sirisia, Malakisi, Lwandanyi
Busia	681.0	681.1	Busia	Matayos, Busia Township
Mt. Elgon	956.6	292.4	Kapsakwony	Cheptais, Kopsiro, Kaptama
Teso North	223.6	223.6	Amagoro	Amagoro, Angurai
Teso South	331.8	331.8	Amukura	Amukura, Chakol
Mumias	590.2	101.3	Mumias	
Samia	265.1	92.3	Funyula	
Siaya	NA	5		Approx. for small area
SUBTOTAL		**2351.6**		

UGANDA EASTERN REGION				
Bududa	250.8	17.5	Bududa	Bubiita
Bugiri	1453.0	692.3	Bugiri	Nabukala, Iwemba, Buluguyi, Bulesa, Budhaya, Muterere, Kapyanga, Bugiri TC
Busia	763.3	635.4	Busia	Busitema, Buteba, Bulumbi, Dabami, Masaju, Masaba, Lunyo, Lumino, Buhahe, Busia TC
Butaleja	652.8	234.0	Butaleja	Budumba, Busolwa, Busaba, Nawanjo
Manafwa	602.0	246.5	Manafwa	Buwabwala, Bupoto, Bumbo, Bumwoni, Bubuto, Butini
Namutumba	813.7	246.6	Namutumba	Magada, Namutumba, Bulange
Tororo	1195.9	805.8	Tororo	Paya, Kirewa, Nagongera, Petta, Mukuju, Kwapa, Kisoko, Merikit, Molo
SUBTOTAL		**2878.1**		
TOTAL		**5229.7**		

3.2 Physical features

Topography

The Sio-Malaba-Malakisi (SMM) basin lies between latitude 1° 13’ 30” N to 0° 19’ 30” S and longitude 33° 67’ 30”E to 34° 57’ 10” E.

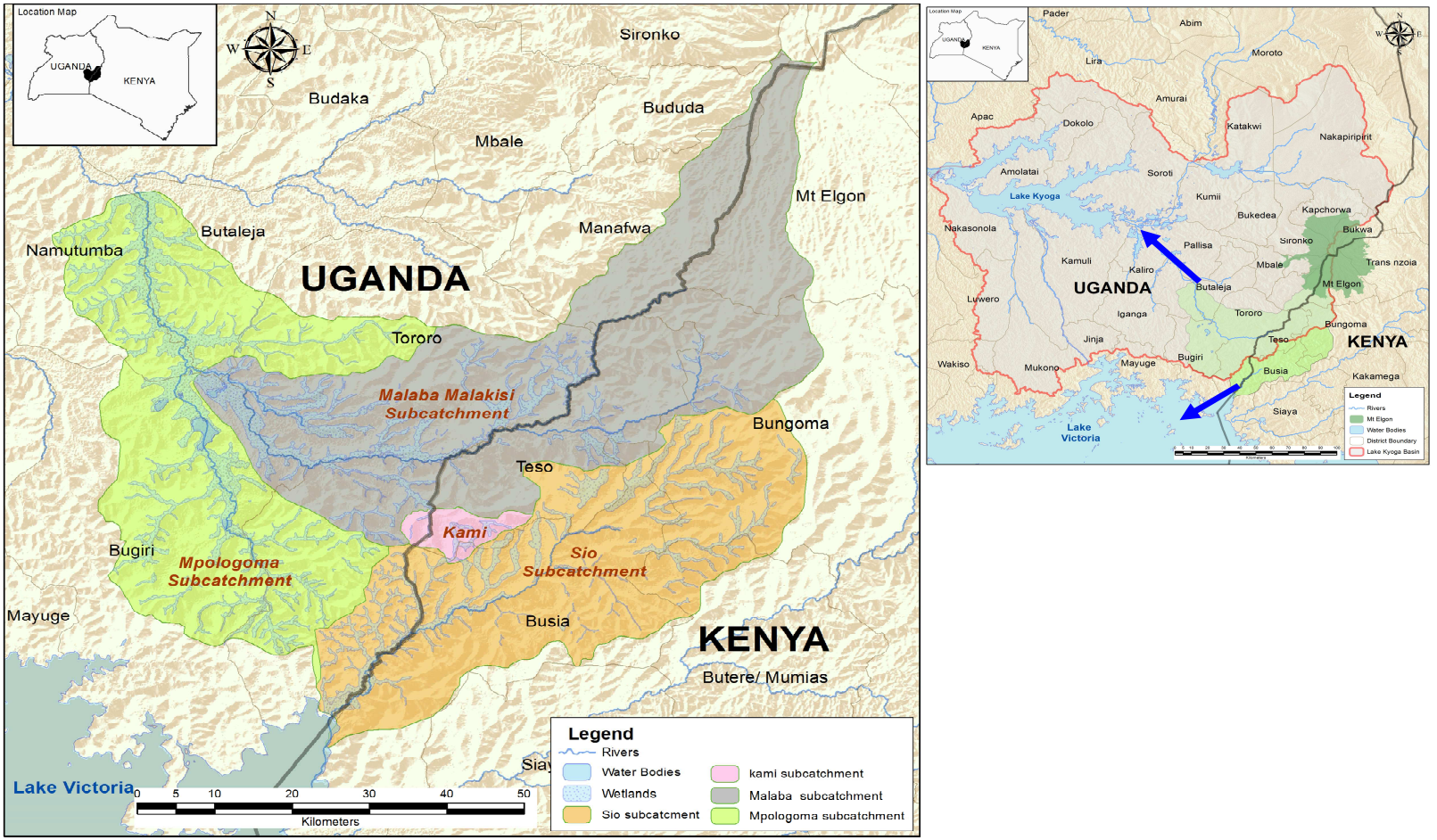
The Sio-Malaba-Malakisi (SMM) basin is 4 km wide at its top increasing to about 18 km at the southern edge of Mount Elgon Forest Reserve on the Kenyan side and Mount Elgon National Park on the Uganda side. It widens to about 100 km, and covers a total of **5,230 km^2** with the Sio catchment covering 28% of the area.

The Malaba River originates as Lwakhakha River at about 4,240 masl, only 2.5 km west of the source of the Malakisi River, both starting just below the southern edge of the Mount Elgon crater. The Lwakhakha River forms the Kenya-Uganda border before its name changes to Malaba River when it joins Malakisi River some 15 km west of Malaba town. The Malaba River is further named as the Mpolongoma River when it flows into the swamps towards **Lake Kyoga** in Uganda at about 950 masl.

Kenya and Uganda have 1,067 km^2 (28%) and 2,715 km^2 (72%) of the Malaba-Malakisi catchment respectively. In the upper parts of this catchment, impacts from unfavourable watershed functions (pollution, erosion induced sediment, peak floods) are produced on either side of the border and are noticeable all along the main streams.

The Sio River originates at an altitude of about 1,450 masl west of Bungoma town south of Mount Elgon and flows into Berkeley Bay in **Lake Victoria** Basin in Kenya at 1142 masl. The main stream of the Sio is approximately 78 km long with much of its length being along the Kenya-Uganda border. Approximately 1,285 km^2 (89%) and 163 km^2 (11%) of the Sio River is in Kenya and Uganda respectively.

SIO-MALABA-MALAKISI AREA	MALABA-MALAKISI WATERSHED TO LAKE KYOGA	SIO RIVER WATERSHED TO LAKE VICTORIA
KENYA	1,067 km² (28%)	1,285 km^2 (89%)
UGANDA	2,715 km^2 (72%)	163 km^2 (11%)



MAP 1: Location of the SMM Area

Local Climate

Observed characteristics

The climate of the SMM catchment area is categorized as humid and sub-humid that is primarily affected by the movement of the Inter-Tropical Convergence Zone (ITCZ) but the effects are modified by the presence of Lake Victoria and the local topography. Lake Victoria dictates the distribution of rainfall over its peripheral areas in Uganda and Kenya where average annual rainfall ranges between 1460 – 1600 mm. Further away from the shoreline, orographic effects play a dominant role: mean annual rainfall increases from 1250 mm in the plains to over 2000mm on the medium slopes (up to 4000 masl) of Mt. Elgon, then decreasing again towards the summit, where 1750 mm/year is recorded.

In the Sio catchment, rainfall varies from 1800 mm in the upper areas to 1590 mm in its outfall reaches. Parts of Busia and Teso districts have microclimates with low rainfall of about 700 mm annually.

For Kenya, the SMM basin is considered as part of Lake Victoria basin, which is one of the two river basins with a water surplus (Kiai and Mailu, 1995). However, rainfall is highly variable, with the deficit or excess potentially reaching 50% on an annual basis. This makes the SMM basin prone to both floods and droughts.

For temperatures, the most relevant feature is the orographic influence experienced within the SMM. Mean maximum temperature is about 27.5^{o}C around low-lying areas and about 5 degrees lower around the slopes of Mt. Elgon. Evaporation is greatest during the dry months of January and February when 175 mm are evaporated monthly over open water bodies on the foothills; then decreasing with altitude to 125 mm in the higher areas.

Climate Change

Incorporating the comprehension of global Climate risks trends is crucial to the sustainability of of the integrated watershed management project activities, focusing on objectives of mitigation (emission reduction, carbon sequestration, etc.) and of adaptation (i.e. promoting climate proofing investment and techniques) strategies to climate change.

Climate analysis using the Regional Global Climate Model (GCM model) indicates that Kenya and Uganda are likely to experience the following climate changes between the late 2020 and 2100:

- Average annual temperature will rise by between 1℃ and 5C, typically 1℃ by 2020s and 4℃ by 2100.

- Climate is likely to become wetter in both rainy seasons, but particularly in the Short Rain (October to December) even by 2020. Global Climate Models predict increases in northern Kenya (rainfall increases by 40% by the end of the century), whilst a regional model suggests that there may be greater rainfall in the West. The rainfall seasonality i.e. Short and Long Rains are likely to remain the same while rainfall events during the wet seasons will become more extreme by 2100. Consequently flood events are likely to increase in frequency and severity.
- Droughts are likely to occur with similar frequency as at present, but to increase in severity. This is linked to the increase in temperature.

Physiography

The main physical features of the SMM basin include: steep volcano slopes, escarpments, rolling hills, undulating hills, gently undulating plains, and wetlands.

The top parts of the basin at the cone of Mt. Elgon consists of steep slopes of about 20-30% with straight parallel streams in steeply incised valleys of about 40-50% slope. The topmost area is the Chepkitale National Reserve on the Kenyan side and Mount Elgon National Park on the Uganda side and consists of heather vegetation.

Below this is the Mount Elgon forest between about 2,000 and 3,000 masl with more irregular slopes of gradient between 15 and 30% with rivers found in parallel gorges. This zone has distinguishable sub-units with Tropical High Forest, Encroached Tropical Forest, Woodland and Grass/Heather/Moorland. The bottom of the volcano slope is marked by escarpments. Below the escarpments, rolling and undulating hills have slope range of 5-15%; the main rivers start meandering from here.

Towards the south, plains and valleys gently undulate with slope less than 5%. Some valleys have seasonal wetlands. Main streams have incised beds but strongly meander. The Sio sub-catchment is almost exclusively covered by this almost flat or gently undulating landscape.

Soils

There is a wide range of soils types in the catchment that vary considerably in fertility, drainage characteristics, and agricultural potential. On the upper slopes of Mt. Elgon, there are essentially three soil types: Andosols (eutrophic soils of tropical regions), Nithosols (or ferrisols) and the Histosols (hydromorphic soils).

Soils of moderate to high fertility are confined largely to the mountainous parts. These are volcanic in origin, young and rich in minerals. On the upper parts of Mount Elgon, the soils are developed on recent volcanoes and are clay loam, well-drained, shallow to moderately deep, dark reddish brown, friable, humid, rocky and stony.

On the undulating lower slopes of Mt. Elgon, the soils are formed on granite and they are well-drained, extremely deep, dark reddish brown to dark brown, friable clays with acidic humid topsoil. The soils in the middle and lower part of the catchments are well-drained, moderately deep to very deep, reddish brown to yellow brown, friable clay over basement rock.

Along the river valleys, the soils are a complex and imperfectly drained to poorly drained, very deep, very dark grey to brown, mottled, friable to firm, sandy clay to clay, often underlying a topsoil of friable sandy clay loam.

Land use and land cover

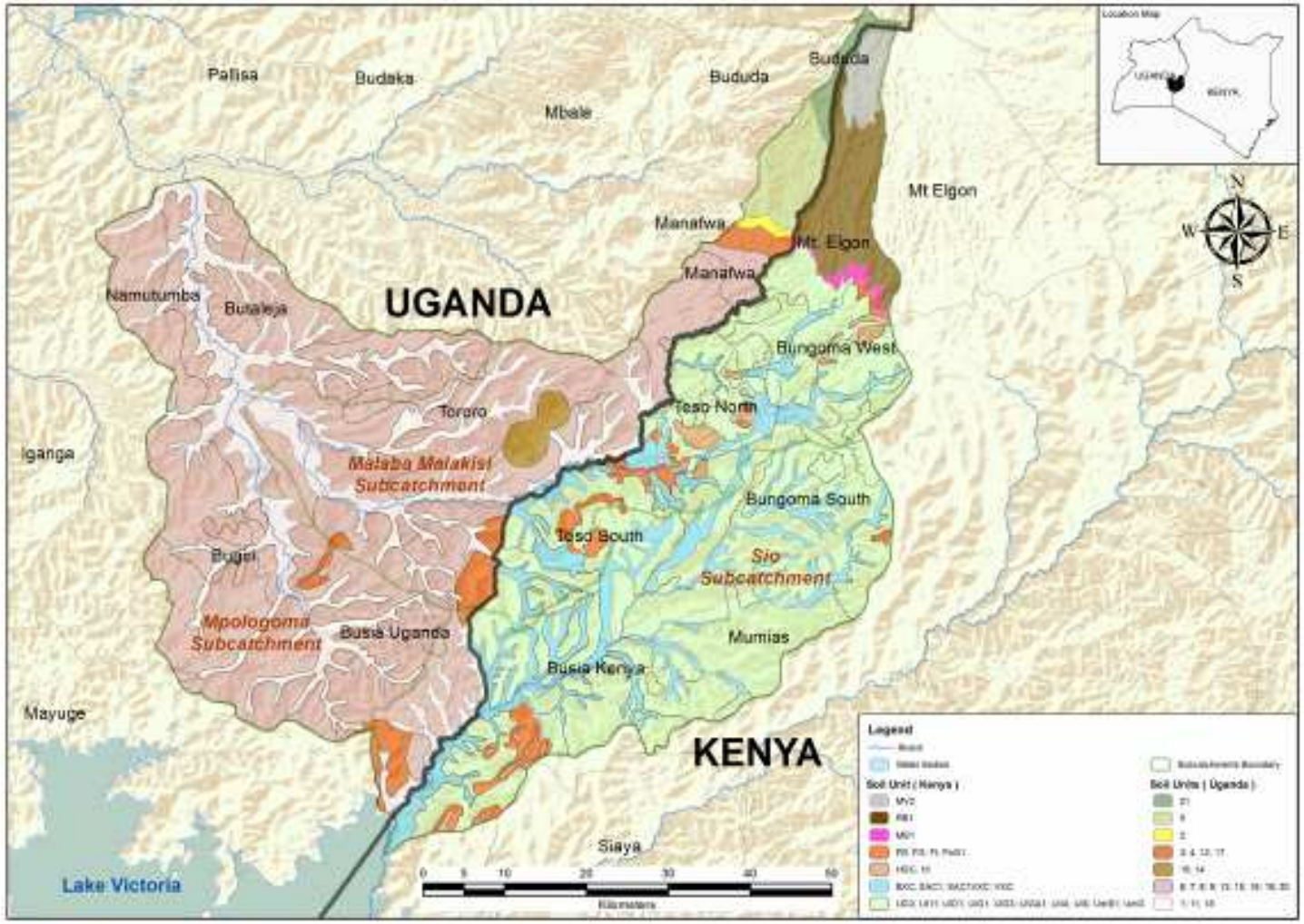
A land cover map has been elaborated using data from the FAO Africover web site: **http://www.africover.org/system/africover_data.php** and has been used to describe the land cover in the watershed.

The whole basin, outside the Mount Elgon forest area, is divided into agricultural cultivated land, but also including grassland, fallow land, and isolated woodlots or orchards. In the land cover maps this is all grouped under 'Rainfed herbaceous crops'. On sloping land, this pattern follows the contour lines as in the upper Malakisi-catchment. This pattern is more distinct with increasing slope gradients, and more distinct on the Kenyan than on the Ugandan side. In the valleys however fields run perpendicular to the drainage.

Together with the Busitema forest reserve in Busia district, Mount Elgon forest is the only substantial remaining area of natural forest. The highest areas of Mt. Elgon are covered by moorland and heather. In the rest of the basin, large areas of natural forest cover including riparian zones and some seasonal wetlands have been converted into agricultural use, leading to further degradation of the catchment areas and an increase in soil erosion and sedimentation. Nevertheless, numerous small private woodlots and scattered tree planting are also widespread.

The main part of the watershed is thus covered with rainfed small herbaceous fields, with more abundant areas with shrubs or sparse trees in the upper and middle catchments.

Inundated wetlands including locations with aquaculture are concentrated much more in the south western part of the basin (Tororo-Busia area and further west). Near Bugiri, rice fields are well developed.



MAP 2: Soil Map SMM Basin

Legend Soil Map Uganda

1	River alluvium; Black and grey clays often calcareous
2	Brown to reddish brown stony and rocky, gravely to very gravely sandy loam to sandy clay loam
3	Dark brown to dark greyish brown clay
4	Dark red, friable clay
5	Dark reddish brown to dark brown, friable and slightly smeary clay
6	Dark yellowish brown to strong brown clay loam to clay
7	Deep red clay loam over laterite
8	Grey-brown and brown sandy loams over laterite
9	Greyish and yellowish brown sands
10	Greyish brown to very dark grey and black clay to cracking clay
11	Peat or peaty sands and clays
12	Red and brown sandy loams over murram and ironstone
13	Red sandy - sandy clay loams
14	Reddish-brown sandy clay loams occasionally lateritized
15	Reddish brown sandy loam on red clay loams
16	Reddish brown sandy loams and loams on laterite
17	Shallow grey brown sandy loams over laterite
18	Very dark grey to brown sandy loam and sandy clay
19	Yellowish brown sandy clay loams
20	Strong brown to dark brown Clay
21	Dark reddish brown, friable, stony clay loam

Legend Soil Map Kenya (Farm Management Handbook Western Province)

MV1	Imperfectly drained, shallow to moderately deep, greyish brown, friable loam to clay loam, with an acid humic to peaty topsoil; in places very shallow or rocky: dystric HISTOSOLS, predominantly lithic phase; with LITHOSOLS and Rock Outcrops
MV2	Well drained, shallow to moderately deep, dark reddish brown, friable, stony clay loam, with an acid humic top soil; in places very shallow and rocky: humic CAMBISOLS, stony and partly lithic phase; with LITHOSOLS and Rock Outcrops
MB1	Well drained, very shallow to moderately deep, dark reddish brown, friable and slightly smeary, gravely clay; in places with humic topsoil, deep and/or rocky: ando-eutric CAMBISOLS, with ando-haplic PHAEOZEMS, predominantly lithic phases, and with LITHOSOLS, and Rock Outcrops
BXC1	Well drained, deep to extremely deep, dark reddish brown to dark brown, friable and slightly smeary clay, with an acid humic topsoil; in places shallow and rocky: ando-humic NITISOLS and humic ANDOSOLS, partly lithic phases; with Rock Outcrops
HGC	Complex of: Somewhat excessively drained, shallow, stony and rocky soils of varying colour, consistency and texture: dystric REGOSOLS and RANKERS, with ferralic and humic CAMBISOLS, lithic, rocky and stony phases, LITHOSOLS and Rock Outcrops
UmB1	Well drained, extremely deep, dark red, friable clay: dystric NITISOLS
UmG1	Well drained, deep, reddish brown, friable, gravely sandy clay to clay, with an acid humic topsoil: Humic ACRISOLS, with humic CAMBISOLS
UmG2	Well drained, deep, dark yellowish brown to dark brown, friable sandy clay to loam ; * in places gravely in deeper subsoil: Ferralo-orthic ACRISOLS
UmG3	Well drained, deep to very deep, red to dark brown, friable sandy clay to clay: ferralo-orthic/chromic ACRISOLS
UmG6	Well drained, shallow to moderately deep, dark yellowish brown, friable sandy clay: orthic ACRISOLS
UIG1	Well drained, deep to very deep, yellowish red to strong brown, friable clay; in places moderately deep, over petroplinthite or rock; in places rocky: Orthic ACRISOLS, with Rock Outcrops

UIGA1	Association of: well drained, deep to very deep, dark yellowish brown to strong brown, friable clay loam to clay; in places with an acidic humic top soil; in places stony; on straight side slopes (50%): Orthic ACRISOLS, with humic ACRISOLS, partly stony phases, and: Well drained, shallow to moderately deep, dark yellowish brown to brown, friable sandy clay loam; over petroplinthite; in places excessively drained and sandy; on interfluves, convex slopes and near fringes to bottomlands (50%): (Ferralo-)orthic ACRISOLS, petroferric phase, with ferralic ARENOSOLS
UIG3	Well drained, shallow to moderately deep, dark yellowish brown to strong brown, friable sandy clay; over petroplinthite; or rock; in places very shallow, stony or rocky: Orthic and ferralo-orthic ACRISOLS, petroferric and partly stony phase, with LITHOSOLS and Rock Outcrops
RB1	Well drained, deep to extremely deep, dark reddish brown to dark brown, friable and slightly smeary clay, with an acid humic topsoil; in places shallow and rocky: ando-humic NITISOLS and humic ANDOSOLS, partly lithic phases; with Rock Outcrops
MV2	Well drained, shallow to moderately deep, dark reddish brown, friable, stony clay loam, with an acid humic top soil; in places very shallow and rocky: humic CAMBISOLS, stony and partly lithic phase; with LITHOSOLS and Rock Outcrops

Figure 1: Description of soil Units of Map 2

Surface Water & Ground Water Resources

SURFACE WATER

The Sio and the Malaba-Malakisi river catchments composing the study area drain two adjacent areas on the southern slopes of Mt. Elgon. The Malaba and Malakisi Rivers originate from the slopes of Mt. Elgon while the Sio River originates from wetlands in hills to the west of Bungoma Town.

The rivers are transboundary with some of their reaches forming the boundary of the two countries. The Sio River discharges into Lake Victoria while the Malaba River flows westwards into Lake Kyoga after it is joined by the Malakisi River. Thus, the SMM catchments are part of the Lake Victoria and Lake Kyoga catchments, which in turn are part of the Nile River basin

The Malaba River originates from the southwest slopes of Mt. Elgon where it is known as Lwakhakha and flows along the common border between Kenya and Uganda. Upstream of Malaba town, the Lwakhakha river becomes Malaba. The Malakisi River which flows entirely in Kenya rises from the southern slopes of Mt. Elgon. The river discharges into the Malaba River along the Kenya/Uganda border to the south of Tororo town. The Malaba River then turns west , then north-west, changes its name to Mpologoma and flows into Lake Kyoga.

The Sio River originates from a marshy land to the south-west of Bungoma town. A Sio tributary, the Walatsi, originates from the south of Malakisi market. The two rivers join near Nambale market and flow southwest toward the Uganda border. Subsequently, the river flows along the Kenya-Uganda border until it discharges into Lake Victoria. The majority of the Sio River catchment is in Kenya and consists of rolling plains.

GROUND WATER

Groundwater resources in the upper SMM catchment constitute a safe domestic water supply source for rural communities, particularly when developed through shallow wells. However, the abundance of surface water resources and the expense involved in the development of groundwater wells has resulted in minimal groundwater utilization. The groundwater aquifer system in the upper catchment comprises of various geological formations. In the Mt. Elgon region, it includes decomposed tertiary volcanic phonolites and agglomerate tuffs, supporting good inter-granular and fracture-flow aquifers with yields from 5 to over 20 m^3/h. In the Mumias and Kavirondian granites, borehole yields vary from below 1.5 m^3/h to over 5 m^3/h.

In Teso district, the northern side of Angurai Division has a low groundwater table where deep wells/boreholes of between 60-150 m are recommended. The southern side has high water table, where shallow wells of about 20 m to 35 m depths are found. Shallow wells in Malaba Town are highly prone to contamination due to poor sanitation.

Hydrogeological conditions in the catchment are typical of Precambrian Basement terrain where aquifers occur in the weathered overburden (regolith) and in the fractured bedrock. In Tororo and Busia, boreholes are typically drilled into fractured bedrock, which is required to provide sufficient transmissitivity, but with the main storage still being provided by the overlying saturated regolithic soil.

The hydrogeological regime in the Basement rock terrain of Eastern Uganda is thus characterized by relatively low yielding boreholes that frequently tap aquifers both in the regolith and the underlying fractured bedrock.

FLOOD INCIDENCES AND DAMAGE

No flood prone areas with long inundation periods exist within the SMM basin, with the exception of the area at the Malaba-Malakisi rivers confluence where simultaneous high water in both rivers may cause backwater flooding with longer durations than the common flash floods in the rest of the area.

3.3 Biological environment

Biodiversity

Kenya is home to 25,000 species of animal and 7,000 species of plants, while Uganda has an occurrence of about 19,000 species in both terrestrial and aquatic habitats. But in the two countries this high biodiversity is diversely conserved depending of the considered area. Western Kenya and East Uganda have a variety of forests, grassland and wetland habitats that include both common and endangered species.

Several ecologically sensitive sites are under threat from agricultural induced encroachment. Although the SMM basin has a number protected areas (see next section), including large forest habitats in the upper catchment (Mount Elgon), several smaller reluctant forest fragments, grasslands and wetlands that are home to threatened or endangered species but are not necessary protected.

Forest fragments, grasslands, wetlands and riparian areas are critical natural habitats that serve as important refuge for a variety of endemic and threatened species.

Wetland areas play an important role as water filters, fish nurseries and migratory and endemic bird habitats. Traditional groves and other forest fragments are among the last remaining areas outside of protected forest reserves where a high density of endemic plant species can be found. SMM Basin also has a number of small riparian zones around the major rivers and their tributaries. Riparian areas often form unique ecosystems that do not extend beyond the narrow boundaries of the river and are home to species not found in the general catchment zone.

Grass or shrublands are easy targets for conversion to agricultural lands but are also important ecosystems for small mammal and bird species. Agriculture related threats to critical biodiversity habitats in the SMM basin include clearing or drainage of land for cultivation, overgrazing, tree removal for local fuel wood use, sedimentation of wetlands, and destruction of riverbanks through cultivation or removal of tree and plant vegetation. Many of the critical habitats are in densely populated areas and are under threat from agricultural induced encroachment. Habitats are in densely populated areas and are under threat from agricultural induced encroachment.

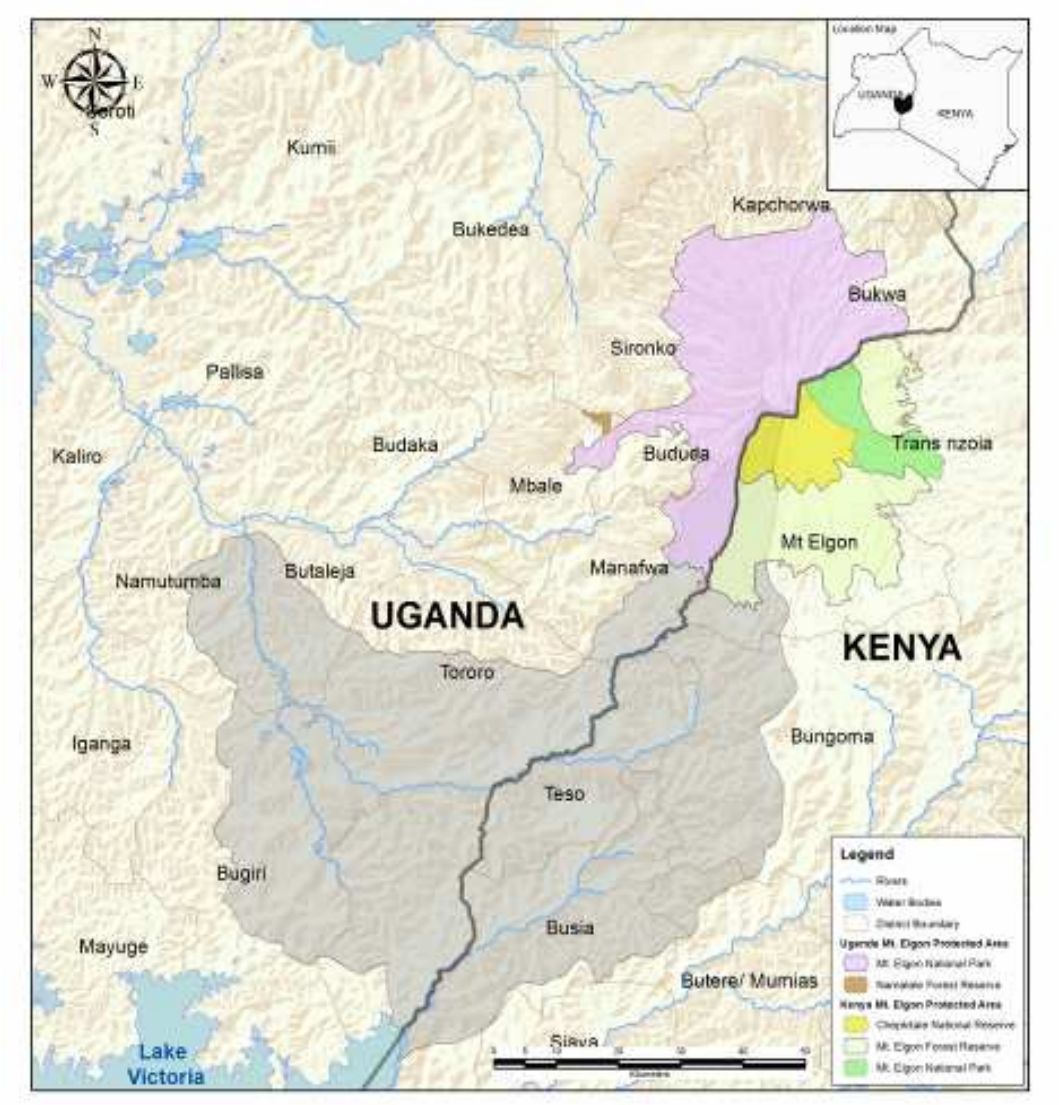
Protected area

Protected areas in the SMM area include:

- The forested Mount Elgon slopes on the Ugandan side of the SMM Basin being part of a National Park stretching out over the western and northern slopes of Mount Elgon;
- The forested Mount Elgon slopes within the Kenyan part of the SMM Basin being part of a National Forest Reserve;
- Mount Elgon National Park in Kenya covering only part of the forest reserve, located outside the SMM basin, just beyond the boundary of Western Province, in Rift Valley Province; and
- The whole of Mount Elgon is a UNESCO-MAB Biosphere Reserve. In Uganda, Mount Elgon also qualifies as Cloud Forest site.

Mt. Elgon National Park and Forest Reserves have an additional Protected Area status because of their water tower function: reserved and legally protected for purposes of water catchment. They form headwaters for a number of rivers and have high rainfall potential. Such areas also act as groundwater recharge areas. The highest areas of Mt Elgon, under moorland and heather, are part of the Uganda National Park or the Kenyan Forest Reserve, and they do not need special consideration for the management of the water resource.

The lower Sio wetland is classified as an Important Bird Area (IBA), a conservation area for biodiversity; IBAs are protected by the UN convention on biodiversity which therefore gives a head-start in protecting and conserving them as water resources and conservation areas.



MAP 3: Location of the Mt Elgon Biosphere Reserve

Forests

The natural vegetation cover from the mountain top to the lowlands consists of:

- High altitude moorland and heath
- High altitude forest
- Moist savannahs
- Dry savannahs
- Farmlands

UPPER CATCHMENT FORESTS

The main forest resources in the SMM region are found around the Mt Elgon ecosystem (**MAP 4**). Mount Elgon is a solitary extinct volcano straddling the border between Uganda and Kenya.

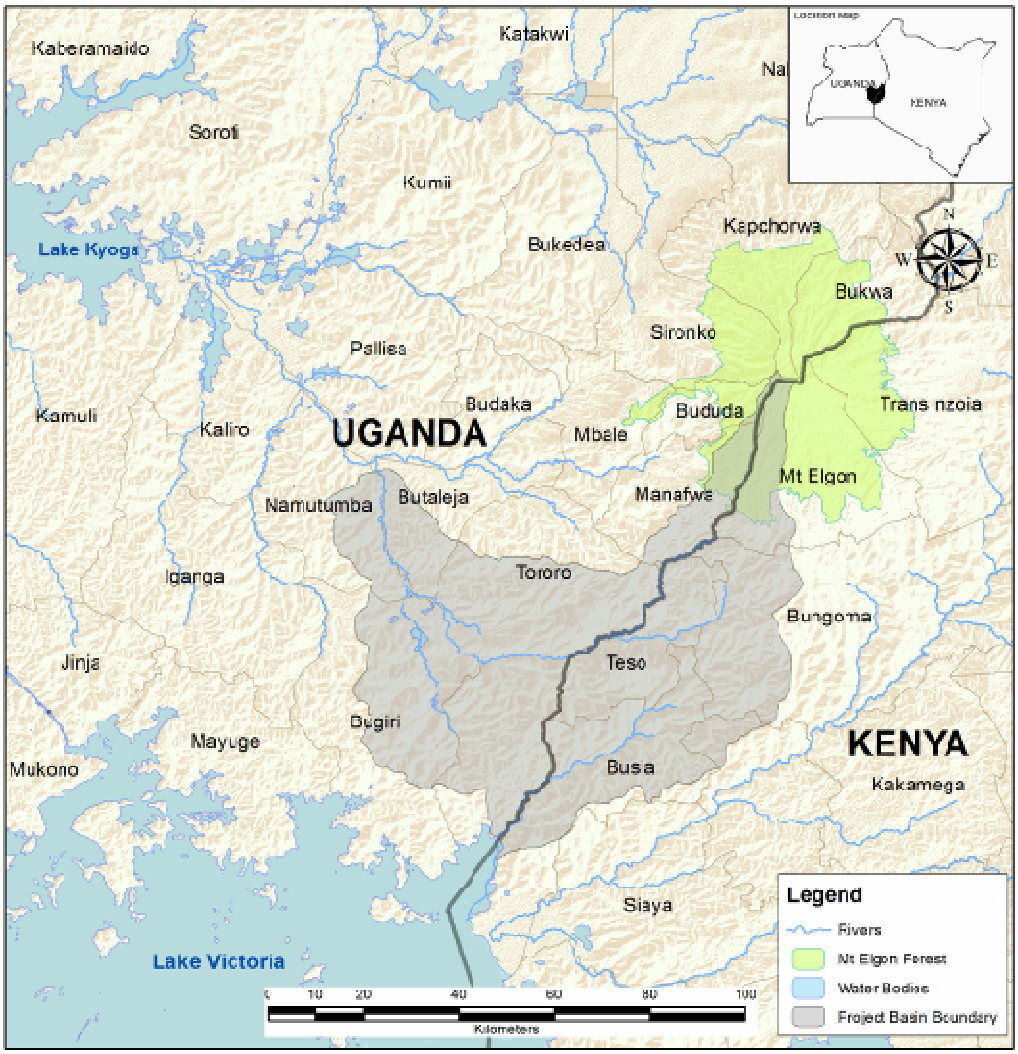
Mt. Elgon is an extremely valuable ecosystem with unique biodiversity, a set of precious component ecosystems and habitats including 180,000 ha of forest and supports thousands of people-directly and indirectly. It is also catchment for important water systems contributing to the Turkwel River and Lake Turkana, to the Lake Victoria basin and to the Nile River basin via Lake Kyoga.

Despite its importance, the Mt. Elgon forest faces a number of threats which includes: agricultural encroachment and settlement in forest protected areas, unregulated use of forest products and hunting of wildlife, soil erosion, and landslides. There has been a long history of forest utilization by the local community of Mount Elgon and natural resources still provide the means of livelihood of the people. The collection of forest products and grazing of livestock within the forest are important sources of livelihood. Beyond the forest provides religious and cultural values to the local communities who often use it for circumcision ceremonies and spiritual gatherings.

The conservation of Mount Elgon ecosystem is vital to the economic functioning of an extensive surrounding area. The ecosystem plays a crucial role as a water catchment, supplying approximately one million people to the north and west with fresh water (Howard, 1991).

In Uganda, much of Bududa district is located in the tropical highland forest area (**MAP 3**) while Bulucheke and Bukigai sub-counties lie at the border with Mt. Elgon National Park. The mountain region is one of the major biodiversity hotspots of Uganda and as such the vegetation in the National Park is well guarded by the Uganda Wildlife Authority (UWA). The restrictions imposed by the Uganda Wildlife Authority (UWA) on the access of the Mountain Elgon National Park and the surrounding forest reserves have however, limited the number of ecosystem services the nearby communities derive from the forests.

In the mid-1990s, a Collaborative Forestry Management (CFM) scheme was introduced to increase access albeit with forest conservation objectives by the communities. However, these schemes have only been partially successful as considerable encroachment of Mount Elgon area took place and biodiversity degraded. However, since the late 1980's there have been more efforts to replace the degraded forest areas and slowly the ecosystem is being restored.



MAP 4: Extent of Mt Elgon forest in Kenya and Uganda. Source: Soini, 1997

LOWER CATCHMENT FORESTS

In most of the lower SMM catchments, natural forests have been cleared since the turn of the last century for agricultural land and livestock grazing. Most forests in the Malaba and Mpolongoma river catchment have been degraded; in the Tororo and Busia districts, trees have recently been cut down for lime burning and charcoal making.

In the Busia District, the West-Bugwe Forest Reserve is the only gazetted reserve in the area. The reserve covers an area of 38.7 km^2 and consists of three blocks. This is a medium altitude semi-deciduous forest and is highly degraded because of agricultural encroachment, illegal timber harvesting, and charcoal burning and grazing. This forest is highly valuable and supports two important tree species and one butterfly (*Belenois robrosignate*) that are not found elsewhere in Uganda. The reserve also has good recreation potential being the only available natural reserve between Iganga and Busia.

Wetlands

WETLAND OCCURRENCE

Most wetlands occur in the lower reaches of the Malaba, Malikisi and Sio rivers. The Malaba has an average discharge of about 30m^3/s in the lower part, the lower Malakisi an average of about 11 m^3/s, and the Sio has a mean of about 11 m^3/s with a maximum of about 50 m^3/s in a flood. The combined flows of the Malaba and Malakisi only provide about 10% of the drainage to the Lake Kyoga wetlands. The Sio only provides 1.5% of the drainage to Lake Victoria.

Table 2: Types of Wetlands in the SMM basin Kenya and Uganda

NATURAL FRESHWATER WETLANDS		
Riverine	Permanent	• River banks • Inland deltas
	Temporary	• Seasonal rivers • River floodplains
Lacustrine	Permanent	• Lakes >10 ha • Ponds <10 ha
	Temporary	• Seasonal lakes >10 ha • Seasonal ponds <10 ha
Palustrine	Permanent	• Herbaceous swamps • Woody swamp forest
MAN-MADE FRESHWATER WETLANDS		
Aquaculture	Fish ponds	
Agriculture	Farm ponds Rice fields, irrigation	

These rivers feed wetlands that would normally be classed as predominantly seasonal. But the discharge information above would suggest that the pattern of floodplain cover is more irregular and more randomly distributed throughout the year making the seasonal signal less distinct. Most of the Kenya part of the SMM area has only small floodplain areas or none at all in the upper reaches. Significant wetlands in the courses of all the rivers only begin at about the stage of the international border with Uganda. The wetlands in the Uganda part of the SMM area are very substantial and lead into the western part of the Kyoga wetland complex.

There are few natural permanent open waters and these are small, but open waters appear seasonally in the larger more westerly floodplains. Man-made open waters occur, some of which are for fish farming and some cleared patches for papyrus harvesting.

WETLAND CONDITIONS

In the upper parts of the SMM catchments in Kenya, wetlands are mostly riverine. Significant seasonal wetlands begin to form near the Ugandan border with large permanent wetlands forming further inside the Uganda portion of the SMM basin.

A large part of the areas indicated as wetlands between Mumias in Kenya and the Uganda border are planted in sugar cane (out-growers for processing companies) while substantial areas of wetlands have been converted to rice fields in Uganda. There are two major man-made wetlands for rice cultivation at Doho and Kibimba.

Un-encroached wetlands in the Uganda part of the SMM area are substantial particularly on the eastern part of the Kyoga wetland complex as encroachment decreases downstream westwards with little wetland modification in the western margins of the SMM basin. Here, the seasonally changeable zone is a relatively small as the wetlands are largely too wet and deep to be encroached for cultivation.

Although the wetlands are of permanent papyrus type throughout, they contain large enough areas with mixed vegetation of valuable biodiversity. This gradation of features indicates that management options for the wise use of the wetlands must change emphasis with the degree of wetland permanence and highlights the importance of management plans having to be location-specific.

Where it has not been converted by cultivation, the natural wetland vegetation can be classified botanically as mixed herbaceous lacustrine typical of variably flooded zones, but the permanent wetland is mostly floating papyrus. As the water becomes shallower and less permanent the vegetation changes progressively to other species. Tree species typical of swamp forest are in patches in the outer margins of the herbaceous zones where the period of the seasonal flood is less.

EXISTING WETLAND USES IN THE SMM BASIN

Over 80% of the residents of the SMM catchments are subsistence farmers, and a variety of generally rain-fed food crops are grown both in and out of the seasonally flooded zones. Encroachment into the wetlands has increased the area for this purpose.

Fish are caught in the wetlands for home consumption. Types of fish are typical of a riverine derived assemblage of benthic and surface feeders mostly caught in set nets. This is carried out in patches of open waters particularly where papyrus has been harvested. Papyrus is harvested for a wide variety of uses such as roof thatching, mats and other sheeting uses, construction and fuel. It is also shredded and twisted into rope. Reeds are used for baskets, binding construction, mulching, fodder and pasture. Trees yield firewood, charcoal, construction timber and medicine.

3.4 Population and socio economic features

Population distribution and density

Population densities within the SMM basin range from **240** to over **600 persons per km^2** with high population growth rates of between **2.4 and 3% per year**. Highest population densities exist in the northern Districts in the basin of both Kenya and Uganda (except Mt Elgon) i.e. Bungoma West and South, Teso North, Bududa and Manafwa. Bungoma South District that hosts Bungoma town has the highest density of 613 persons/km^2.

Population growth has resulted in heavy and increasing pressure on the catchment natural resources rendering their current rate of exploitation unsustainable. It has also resulted in encroachment of gazetted forests and wetlands for additional agricultural land. Because the population growth rates in the catchment are much higher than the rate of expansion of infrastructure and social services, it is becoming increasingly difficult for the authorities to meet their development targets in terms of service delivery (e.g., water supply and sanitation coverage) under current investment levels.

Demography, environmental degradation and poverty

The primary livelihood strategy for about 80% of the population in the SMM catchments is mixed farming. Livestock forms an important part of the household asset base for farmers. Traditional land management in western Kenya region and eastern Uganda has relied on fallowing of unproductive fields to restore fertility and decrease pest problems. The rapid increase in population density makes this practice untenable and has led to wide scale abandonment of fallowing. High rural population growth coupled with stagnating urban job growth has accelerated the search for new agricultural land, resulting in a high rate of woodlands, forests, grasslands and wetlands conversion for agricultural use.

Poverty and scarcity of productive resources cause desperation, which leads to over-extraction of natural resources, increased resource scarcity and further degradation until communities exhaust the resource base. This is the situation in much of the SMM area. Access to social and economic amenities is limited. For example, about 95% of the inhabitants have no access to electricity and alternative sources such as solar are very expensive. Fuel wood (firewood and charcoal) are the main sources of energy for cooking in more than 90% of the households. The search for firewood has led to encroachment into forest resources and cutting down of trees.

Table 3: District Socio-economic key figures

DISTRICT	POP > 2 YRS	HH	EXT. KM^2	INHAB. /KM^2	LITE-RACY RATE	POVERTY INDEX	SW* %
KENYA							
Mt Elgon	153,178	32,412	957	180	57	56	91
Bungoma W	216,829	47,632	446	547	89	56	83
Bungoma S	334,308	83,213	666	613			91
Teso N	105,392	23,424	261	452	67	56	81
Teso S	122,833	27,256	230	460			79
Busia	293,021	68,770	681	481	66	66	91
TOTAL	**1,225,561**	**282,507**	**3,241**	**378.1**			
UGANDA							
Bududa	124,368		251	450	63	30-40	75
Bugiri	426,522		1,453	284	59	50-60	35
Busia	228,181		763	325	63	50-60	69
Butaleja	160,927		653	245	78	40-50	60
Manafwa	140,015		602	493	67	30-40	47
Namutumba	169,156		801	242	34	40-50	80
Tororo	398,601		1,196	313	57	40-50	75
TOTAL	**1,647,970**		**5,732**	**287.5**			

*SW=Safe water coverage

Source: Source: Kenya census 2010, Uganda Census 2002 for Districts and counties for Population, other information from Water Sector Performance Report 2010.

Note that data for the 7 Ugandan districts could not be obtained from the Uganda Bureau of Statistics website (www.ubos.org) because the last census dates back from 2002 and the districts of Bududa, Butaleja, Manafwa, Namutumba and Tororo have been either created or significantly modified between 2005 and 2007. In some more months, when the 2012 Census is completed, data similar to those collected for Kenya will be available.

Agricultural production

Agriculture is the primary source of income for most Ugandans and Kenyans, accounting for around 40–50% of GDP, up to 90% of exports, and employing approximately 80% of the labour force in both countries in 1996 (World Bank 2002b).

On average, rural households derive nearly three-quarters of their income from crop farming. Smallholders dominate the agricultural sector with over 90% of crop production being produced on farms averaging **less than 2 hectares**.

However, smallholders in Uganda have difficulties obtaining credit for investment and for improvement of farming techniques. Hence, improving credit access and farmer extension are key recent interventions for boosting agricultural development in Uganda (FAO 1998).

Both sides of the border have similar agro-ecosystems and cropping systems, with eastern Uganda through to western Kenya representing a gradient with changing soil types, from the lowland ferrisols to highland nitisols in Uganda to humic nitisols in western Kenya, with increasing agricultural production and increasing population densities from west to east. This has resulted in a range of land use systems that respond to this gradient.

The main crops grown in the SMM basin are maize, beans and groundnuts with maize being a subsistence and cash crop at the same time. Other crops include millet, beans, sesame, sweet potatoes, potatoes, bananas, and cassava, etc. In downstream areas in Uganda with wetlands along Rivers Malaba and Mpologoma, rice is widely grown as a commercial crop.

Commercial crops include sugarcane, grown in large scale in the eastern and south-eastern part of the basin; tobacco, a common cash crop in the eastern/north-eastern part around Bungoma in Kenya. Coffee is historically an important cash crop in Bududa district, Uganda, and is found as an additional income source in many other areas.

The existing subsistence agricultural practices within the basin are not sustainable. Soil fertility is reduced by low fertilizer input and poor farming practices. Cultivation on steep slopes in combination with degraded soil structures due to poor farming practices has exacerbated soil erosion. There seems to have been an increase in crop diseases and pests in recent years requiring use of pesticides even on smallholder farms. There is also unregulated pesticide use by small vegetable farmers in plots established in wetlands. Despite low input levels, agricultural chemicals can pollute water. Large amounts may be flushed to rivers in rains or floods after drought periods during which chemicals can be accumulated and incompletely inactivated in the soil.

When farm size becomes too small to be viable, there are negative impacts on agricultural production, food security and social welfare, which lead to limited investments in land improvement. The SMM average farm size is very small; in Bududa and Tororo it is 0.5 acres (MFPED, 2006) and in Bungoma 0.33 acres.

The National Agricultural Advisory Services (NAADS) in Uganda and the National Agricultural and Livestock Extension Project (NALEP) in Kenya have replaced the traditional agricultural extension services. Both programmes are demand-driven with more focus on food and commercial crops production but less on soil and water conservation. However, there has been a decline in agricultural extension services in both countries.

Livestock production is mainly concentrated in the northern part of the basin although cattle, goats, sheep and chicken are kept all over the region. The major livestock kept are cattle, goats and sheep with modest herd sizes (10 in Sio-Kenya and 5 in Sio-Uganda). Traditionally, the

seasonal wetlands were used for grazing. But the massive encroachment by crop production has strongly reduced the amount of grazing land, resulting in reduction of stock numbers. As a result, animal husbandry systems have changed considerably from open grazing to zero-grazing.

Irrigation and aquaculture

Irrigation is very limited in the basin and does not seem to be popular even when communities live on riverbanks. It is however more widespread on the on the Ugandan than on the Kenyan side of the SMM basin, where existing irrigation in the mid-and upper parts of the catchment is limited to scattered small plots on which farmers use local streams for traditional micro-irrigation. In the lower parts of the SMM basin, small-scale irrigation is being practiced within the wetlands.

Aquaculture is a relatively new sector in the area, but is gaining interest as a real income source. It is currently practiced at a small scale mainly in wetlands. During field visits, highly profitable examples of integrated aquaculture/aqua-forestry were observed; some with a goat-shed constructed over a fish pond and providing very affordable manure to grow fish feed, whereas the bunds of the pond were planted with fodder crops for the goats. The SMM River Basin Project has also supported small-scale community fishpond development near Busia.

The Ministry of Fisheries (MoF) in Kenya has recently been promoting aquaculture in typically 'upland' Districts such as Bungoma West and Teso through the Economic Stimulus Programme (ESP). The ministry acts as the entrepreneur by installing fish ponds (standard size 15x20m and about 0.8 m deep), providing Tilapia fingerlings as well as food and nets during the first year, and linking the farmer with the market. By 2010, a total of 93 fishponds had been established in Bungoma west and about 200 in Teso district of Kenya.

3.5 Soil degradation

Soil degradation in the SMM basin is linked to soil fertility depletion and soil erosion, long-term cultivation with diminishing fallow periods, limited crop rotation practices and low fertilizer inputs. This causes low soil stability and particles are easily transported during rain. Although farmers are aware of reduced soil fertility and its effects, their capacity and to address the issues is limited leading to poor yields. Other factors that affect yields include short validity for good quality seeds, and unreliable and variable rainfall in some areas of the basin, especially during the short rains.

Much of the SMM Basin is considered to have good potential for agriculture, with medium elevations (1100 to 1600 m above sea level) having deep, well drained soils, and relatively high rainfall (1200 - 1800 mm per year) that permits two cropping seasons in some parts. Currently, crop productivity is very low with typical output from a 'good' rainy season being less than 1 ton of maize per hectare, although the potential is as high as 5 to 6 tons.

Soil erosion

Soil conservation in the eastern Africa region has a long history going back almost 70 years. In the two East African countries of Uganda and Kenya, the colonial authorities used coercive approaches to introduce new land-use and conservation methods, such as terracing and forced destocking, resulting in negative attitudes to conservation. This led to widespread neglect of conservation work after independence in the early 1960s. By the end of the 1960s, these countries were experiencing increasing land degradation.

Soil conservation measures include terracing, contours, strip cultivation, ridge and tie ridging, grass strips, and bands. These methods, introduced during the colonial times, have since been largely abandoned. In some areas like Mt. Elgon and Manafwa, farmers are destroying the terraces to expand their cultivation areas, and this has led to disastrous effects on soil erosion.

Recent soil conservation activities in the SMM basin

The approach followed in soil conservation activities is demand-driven but in practice there is a compromise between farmers' request and awareness about what is best for them and the environment. There is no approach of systematic rehabilitation of degraded catchments as was in the past time and the range of issues and extension staffing is much reduced.

Farmers' appreciation of soil conservation varies because of conservation conviction, required labour inputs, uncertainty about ownership of planted trees, competition for resources and loss of land (due to terraces). Despite awareness of its importance, river bank protection is sporadic (including pegging and planting of buffer zones), e.g., in Cheptais and Mt. Elgon District. Planting of riverbanks is only 66% of the pegged areas

Implementation rates are modest. It is estimated that a total length of terraces of different type of about 300 km corresponds to a total treated area of about 600 to 900 hectares, distributed over four districts, which is less than 1% of the total area. The estimate assumes that the average terracing is about 300 to 500 meters per hectare, corresponding to intervals of 20 to 00 m, not considering trash lines (of stubble and organic residue). These are valuable for conservation (cheap, contributing to soil enrichment) but their impermanency makes them a poor index and they add to the competition for resources (cattle feed and fuel).

Constraints other than staffing capacity include:

- Limited operational resources (transport, equipment, extension tools).
- Land ownership uncertainty.
- Political and community natural resources competition.
- Culturally determined natural resource uses.
- Lack of public awareness of soil and watershed values.
- Limited awareness among social leaders and decision makers.

Better implementation recording is necessary and monitoring and evaluation training is required for Districts officers. In Kenya, field implementations are reported annually to national level (MoA) using standardised tables. But only the items of work completed are given not the areas treated, a strategy followed or costs per unit area. There are no maps showing work done relative to planned treatment. In Uganda, formal recording does not exist and depends on individual commitment of officers.

3.6 Soil conservation and erosion assessment

As is the case with soil fertility deterioration, soil erosion occurs everywhere in the SMM basin, even in undulating terrains. Soils on steeper upper slopes have been cultivated for long without adequate soil conservation measures and clean weeding farming practices. As a result the soil structure within the upper slopes is more deteriorated leading to more soil erosion than elsewhere in the basin.

The upper catchment areas of Manafwa District and part of Tororo District on the Uganda side, and the rolling upper catchment areas of Mt. Elgon, Teso North and Bungoma West Districts on the Kenyan side are the most severely affected areas. However, land on the Kenyan side is less eroded because of more intensive soil conservation practices in the past that adhered to the Agriculture Act (see extract).

In these areas, but also around Busia and Malaba, the regularly occurring pockets with relatively sandy soils (coarse sandy loam-gravelly sandy loamy) originating in basement rocks, are especially sensitive to erosion. Erosion decreases towards the south and east, following slope classes. Isolated hills with relatively steep slopes are also severely affected. These occur mostly in Teso North and South, in Bungoma, Tororo and some parts of Busia Districts.

ACCORDING TO THE AGRICULTURE ACT:

- On gentle slopes up to 12% terracing is not mandatory, but it is usually desirable on slopes exceeding 5%. In semi-arid areas and in areas with erodible soils, even slopes of 2-5% usually need to be terraced.
- On slopes between 12% and 55%, terraces (preferably developed bench terraces) should be used if the depth of the soil is more than about 0.75m. For very steep slopes modified bench terraces are recommended, i.e. narrow ledges cut into the slope, suitable for fruit trees, fodder trees, forest trees and coffee.
- Slopes exceeding approximately 55% should be covered with grass and/or forest, or used to cultivate tea, sugar cane or bananas with a layer of trash on the ground.
- Soils which are rocky, stony or shallow, should be used for pasture or forest, or else they should have stone terraces

An inventory of places severely affected by erosion has been made, resulting in an erosion evidence map (**MAP 6**): The erosion hazard map is shown in **MAP 7**.

Table 4: Severely erosion-affected areas per district (km^2)

KENYA				UGANDA			
DISTRICT	AREA IN SMM	ERODED AREA	%	DISTRICT	AREA IN SMM	ERODED AREA	%
Busia	773.3	15.9	2.1	Bududa	17.4	0	0
Bungoma S	450.7	5.6	1.2	Bugiri	692.3	0	0
Bungoma W	173.4	42.6	24.6	Busia	635.4	0	0
Mt Elgon	292.4	30.2	10.3	Butaleja	234.0	0	0
Teso North	223.6	54.6	24.4	Manafwa	246.5	1.9	0.8
Teso South	331.8	39.8	12.0	Namutumba	246.6	0	0
Mumias	101.3	0	0	Tororo	805.8	56.8	7.0

Riverbank erosion

Expansion of farmland to the riverbanks, coupled with depletion of riverine vegetation, has made riverbank erosion more severe. There is evidence of erosion in most banks within the basin, as well as undercutting on outer meander curves where flow velocity is highest. Undercutting is less widespread than erosion on banks, due to vegetation cover or bedrock in many places, but where it occurs, it can cause sudden slumps with substantial contribution to sediment load.

Within the SMM basin, degradation in upper watershed areas has led to an increase in sediment load and intensity of flash floods. Coarse fractions have caused siltation of incised riverbeds. This in turn has increased flooding intensity and hence riverbank erosion, which has further contributed to siltation of beds. The current regulations for riverine buffer zone protection or replanting prescribe a width of 20-30 m in both Kenya and Uganda (200 m for lake shores in Uganda), but enforcement of these regulations is poor. Uncontrolled sand collection from riverbeds and banks in some areas has also led to an increase in erosion.

NEMA has prepared for Kenya in 2007 a document on National Guidelines for Sand Harvesting, to provide for a system of permits for sand collection to mitigate uncontrolled operations and defining safe practices. In reality, this document has never been gazetted and the technical and regulatory arrangements have never been enforced.

All main rivers are in need of riverbank protection, and at least the marking out of non-cultivatable buffer zones. But identification of separate priority zones is not clear because the boundary between degraded (encroached) and non-encroached riverbanks is not defined.

This is similar to wetland degradation that shows increasing encroachment moving upstream from the permanent wetlands in Uganda towards the seasonal wetlands in mid catchment, and then to the completely cultivated tributary areas.

Roads-induced erosion

Roads are an important and underestimated source of concentrated water flow causing severe erosion. Erosion either originates along unpaved roads, or in adjacent areas onto which road drainage spills high velocity runoff. The rolling hills in Teso North (Kenya) and in Manafwa (Uganda) have typical examples of severe roadside erosion. But roadside erosion in less severe forms occurs nearly everywhere along unpaved roads.

Rural unpaved roads are built by contractors hired by the Uganda National Roads Authority (UNRA) and the Kenyan Rural Road Authority, under the Ministry of Roads, or by town councils. Once drainage water with its sediment load is in a stream, it falls under responsibility of WRMA in Kenya and directorate of water Development in Uganda. This transition in responsibility from road management to water management has not been regulated so far.

A road design should have proper drainage provisions, and every road project is supposed to submit an environmental Impact Assessment (EIA) report to NEMA before commencing on any work. Such requirements are the same in Kenya and Uganda. However, the roads policies do not put liability on the contractor for damages. In practice, contractors may economise on the work, enforcement of quality standards may be insufficient and work may be signed off without adequate quality control. In addition, repair or maintenance is not available.

The situation for feeder and minor roads is similar but ownership and responsibility for rehabilitation is blurred. Erosion due to high velocity flow from field tracks causes similar problems.

Environmental implications of erosion

Soil erosion causes water pollution leading to deterioration of aquatic habitats, increases water treatment costs and clogging of water distribution systems. The washing of nutrients and organic matter from the rich top soil into streams and rivers is a major cause of eutrophication. Furthermore, excessive deposition of sediments in rivers, lakes and wetlands has caused destruction of fish spawning areas. Sediment is also a major pollutant of surface water while at the same time it is a major carrier of agricultural chemicals into the water systems.

Soil erosion also leads to alteration of landforms, changes in microclimate and interference with natural habitats. This is a common feature in the highlands of Kenya. On the other hand, high losses of calcium suggest that erosion is one of the most important factors contributing to the increase in acidity of soils.

3.7 Priority areas for catchment rehabilitation

Soil erosion evidence / degradation map

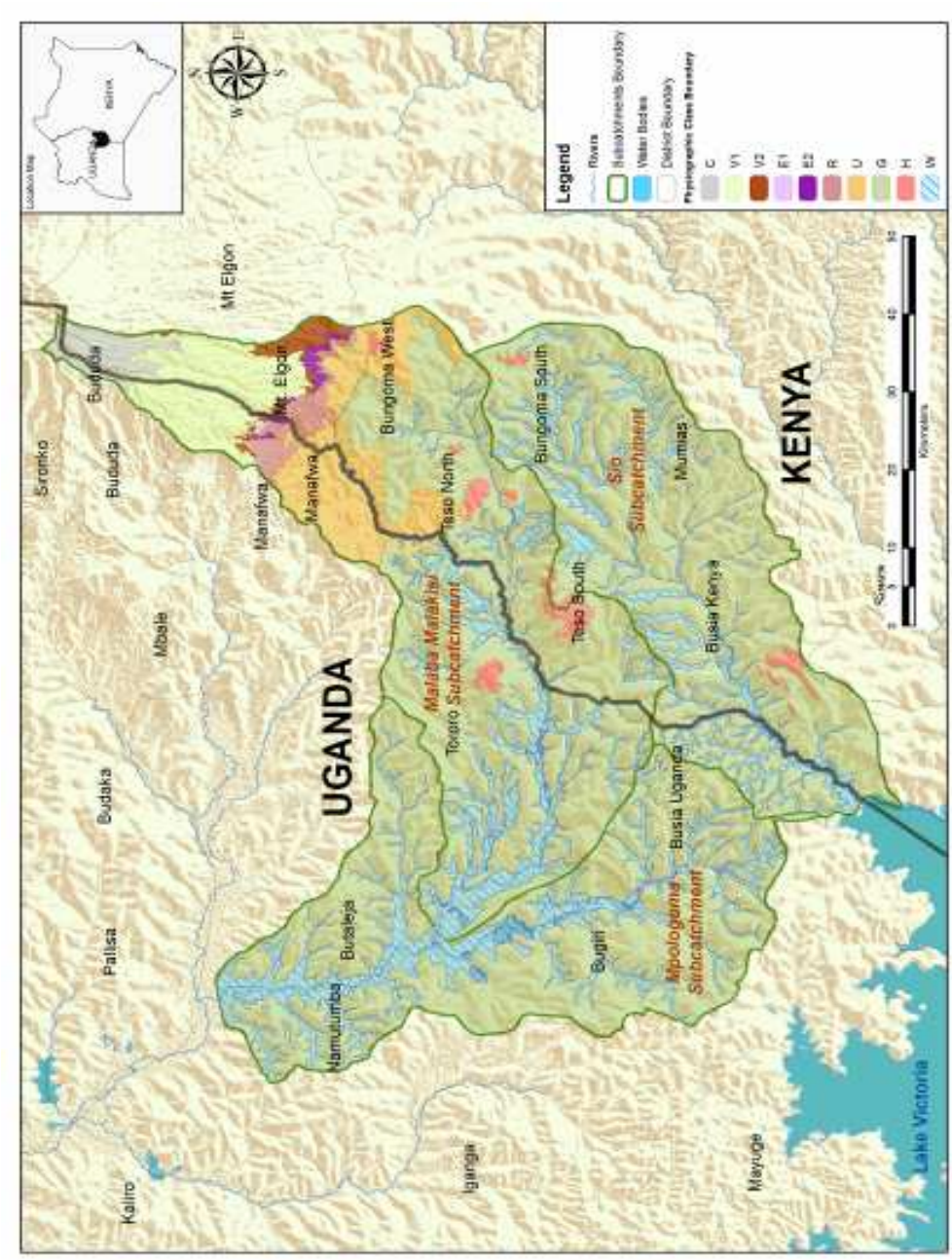
An inventory of places severely affected by degradation was made, resulting in an erosion evidence map, based on information given by district officers. District staffs in the most affected districts were asked to identify hotspots of erosion and land degradation during a workshop focused on land degradation. The distribution of the severely erosion-affected areas is given in Table 6

Soil erosion hazard

A soil erosion hazard map has been prepared by GIS, through superposition of layers for the basic factors determining erosion hazard: relief and slope class, land cover/land use and soil erodability.

- Relief and slope class and generalized land cover are taken from the Physiographic Map showing homogenous units in terms of slope, land cover, land use, watershed management challenges.

For the SMM basin, the different units distinguished are shown in Map 7 hereafter.



MAP 5: Physiographic Map

The following physiographic units were distinguished (See **MAP 5**):

C: Very steep volcano slopes (20-50 %), under heather
V1: Steep to very steep volcano slopes (20-50 %), under forest
V2: Steep to very steep volcano slopes (20-50%), deforested
E1: Escarpment (> 50% slopes), bare rocks or forest
E2: Escarpment (> 50% slopes), cultivated
R: Rolling Hills (10-20% slopes), under cultivation
U: Undulating (5-10% slopes), under cultivation
G: Gently undulating (0-5% slopes), under cultivation
H: Isolated Hills (varying, steep slopes with rock outcrops, often bare)
W: Wetlands (seasonal and inundated)

Table 5: EXTENT OF PHYSIOGRAPHIC UNITS (CMU) IN KM2

	C	V1	V2	E1	E2	R	U	G	H	W
KENYA										
Bungoma S	0	0	0	0	0	0	11.5	369.4	5.6	64.3
Bungoma W	0	0	0.2	0	0.8	1.9	74.0	90.3	5.0	1.2
Busia	0	0	0	0	0	0	0	626.9	16.8	129.6
Mt Elgon	53.4	121.5	34.7	0.5	14.7	30.6	36.2	0.9	0	0
Mumias	0	0	0	0	0	0	0	85.6	0	15.7
Teso N	0	0	0	0	0	0	52.4	148.1	14.0	9.0
Teso S	0	0	0	0	0	0	0	266.5	27.1	36.2
UGANDA										
Bududa	13.6	3.8	0	0	0	0	0	0	0	0
Bugiri	0	0	0	0	0	0	0	541.3	0	151.0
Butaleja	0	0	0	0	0	0	0	170.6	0	63.4
Busia	0	0	0	0	0	0	0	487.0	0	148.4
Manafwa	0	91.7	5.7	2.8	3.8	24.3	118.1	0.2	0	0
Namutumba	0	0	0	0	0	0	0	161.5	0	85.1
Tororo	0	0	0	0	0	0	8.4	622.1	12.2	163.1
TOTAL	**67**	**217**	**40**	**3**	**19**	**56**	**300**	**3 570**	**80**	**866**

- **Soil erodibility has been rated in three classes according the soil texture :**

1: highly erodible: sand, loamy sand

2: medium erodible: loam, sandy loam, gravelly loam

3: moderately erodible: sandy clay loam, clay loam, clay

Then, the soil Erosion Hazard Map results from superposition of the catchment management units and the soil units with their erodibility rating. The Erosion Hazard Map is shown in **MAP 7**. The interpretation Key to determine erosion Hazard is given in Table 9 below.

Table 6: Interpretation Key to determine Erosion Hazard

	PHYSIOGRAPHIC UNIT / LAND COVER	EROSION HAZARD BY SOIL TEXTURE CLASS		
		Sand, Loamy Sand, Erodibility Class 3	Loam, Erodibility Class 2	(Sandy) Clay Loam; Clay, Erodibility Class 1
C	Very steep volcano slopes (20-50%), under heather	**2**	**1**	**0**
V1	Steep to very steep volcano slopes (20-50 %), under forest	**0**	**0**	**0**
V2	Steep to very steep volcano slopes (20-50%), deforested	**3**	**2**	**1**
E1	Escarpment (> 50% slopes), bare rocks or forest	**0**	**0**	**0**
E2	Escarpment (> 50% slopes), cultivated	**4**	**3**	**2**
R	Rolling Hills (10-20% slopes), under cultivation	**3**	**2**	**1**
U	Undulating (5-10% slopes), under cultivation	**2**	**1**	**0**
G	Gently Undulating (0-5% slopes), under cultivation	**1**	**1**	**0**
H	Isolated Hills (varying steep slopes)	**3**	**2**	**1**
W	Wetlands (seasonal and inundated)	**1**	**0**	**0**

Key: 0 = No Risk; 1 = Slight Risk; 2 = Moderate Risk; 3 = High Risk; 4 = Severe Risk

Comparison of erosion hazard and erosion evidence

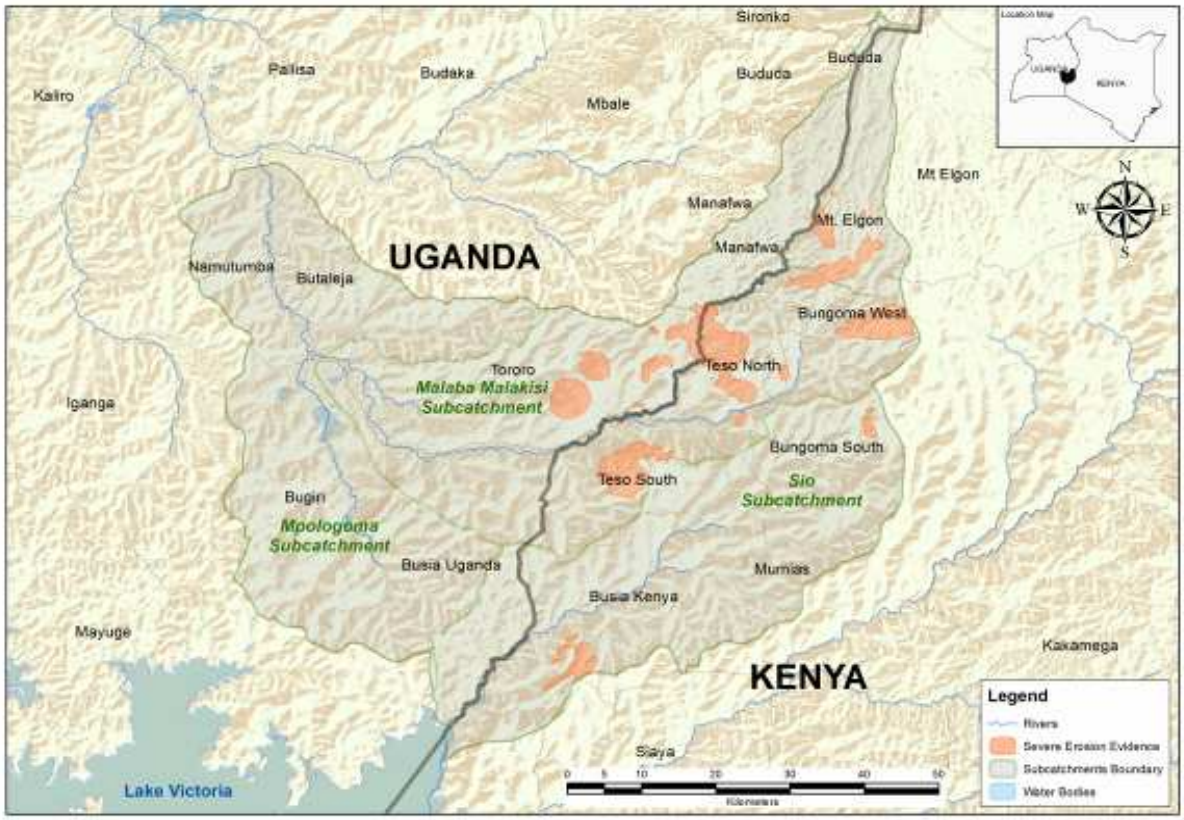
Erosion hazard and erosion evidence follow similar patterns, with slope class and deforestation as the two dominant factors increasing severity of erosion. The erosion hazard map shows areas with highest sensitivity to degradation by erosion while the erosion evidence map shows areas most affected by erosion and therefore having a priority for rehabilitation.

Table 7: Areas under EROSION RISKS PER DISTRICT (IN KM2)

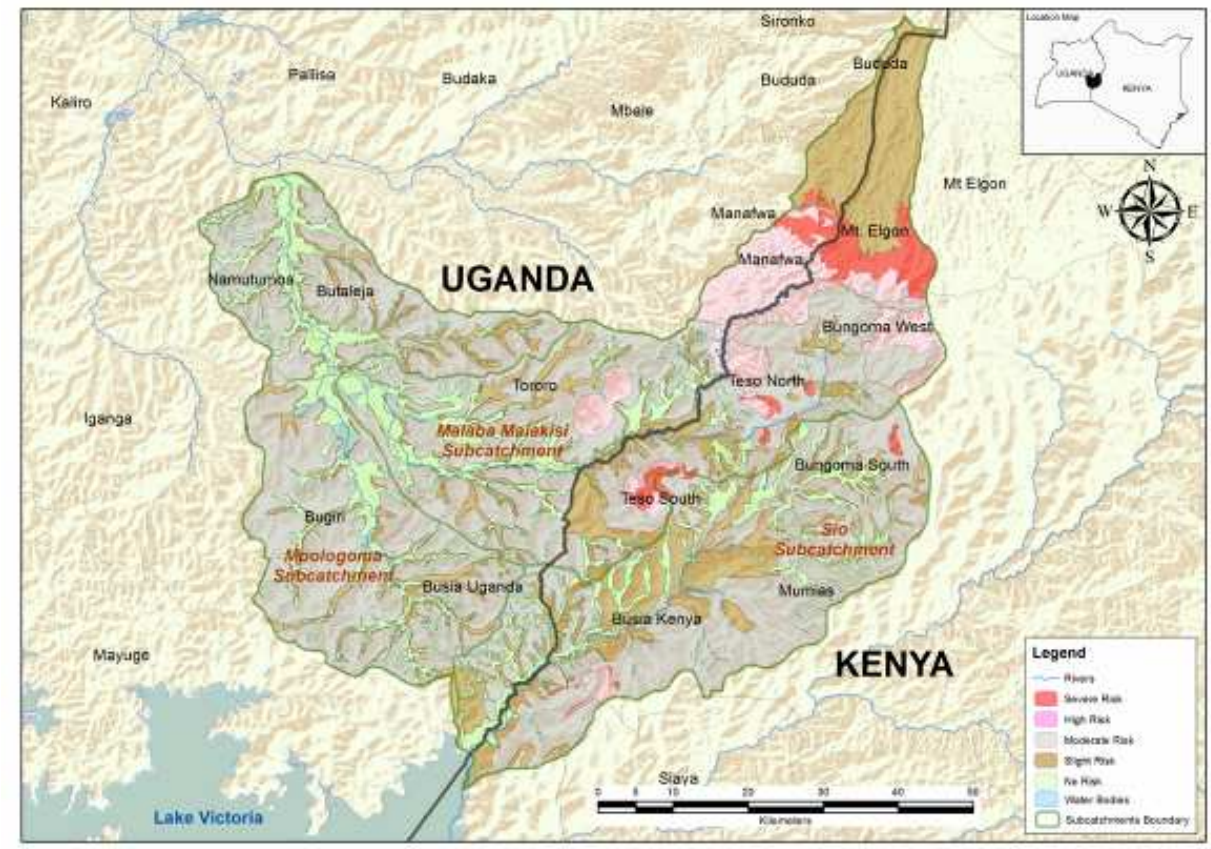
KENYA	EROSION RISK					UGANDA	EROSION RISK				
District	0	1	2	3	4	District	0	1	2	3	4
Busia	99.0	238.4	419.1	14.5	2.3	Bududa	0	17.4	0	0	0
Bungoma S	59.6	68.5	305.5	11.5	5.6	Bugiri	151.8	48.9	490.9	0	0.7
Bungoma W	1.2	4.6	93.1	69.8	2.7	Busia	128.2	110.6	396.6	0	0
Mt Elgon	0	177.2	3.5	33.6	78.1	Butaleja	63.0	28.5	142.5	0	0
Teso N	8.6	23.1	128.0	56.5	7.3	Manafwa	0	94.9	0.3	124.7	26.6
Teso S	38.1	114.2	141.0	19.7	18.9	Namutumba	84.3	13.8	148.4	0	0
Mumias	15.4	0.7	85.2	0	0	Tororo	164.0	113.1	481.0	47.8	0
TOTAL	**221.9**	**626.7**	**1,175.4**	**205.6**	**114.9**		**164.0**	**113.1**	**481.0**	**47.8**	**27.3**

0 = No Risk; 1 = Slight Risk; 2 = Moderate Risk; 3 = High Risk; 4 = Severe Risk

Erosion evidence observed on isolated hills appears to be more severe than the erosion hazard maps would predict. This is probably because in estimating the hazard, soils were considered to be very gravelly on soil-denuded hills, which reduces soil erodibility. Medium to severe erosion evidence also occurs in a few areas where erosion hazard was rated low because of relatively gentle slopes. An example is the area north of Malakisi town (Kolanya and Chagara Hills). Erosion hazard derivations have not identified a few areas on Mount Elgon where in fact deforestation has caused severe erosion.



MAP 6: Erosion evidence map within the SMM basin



MAP 7: Erosion Hazard Map

3.8 Wetland degradation

Wetland degradation in the watershed

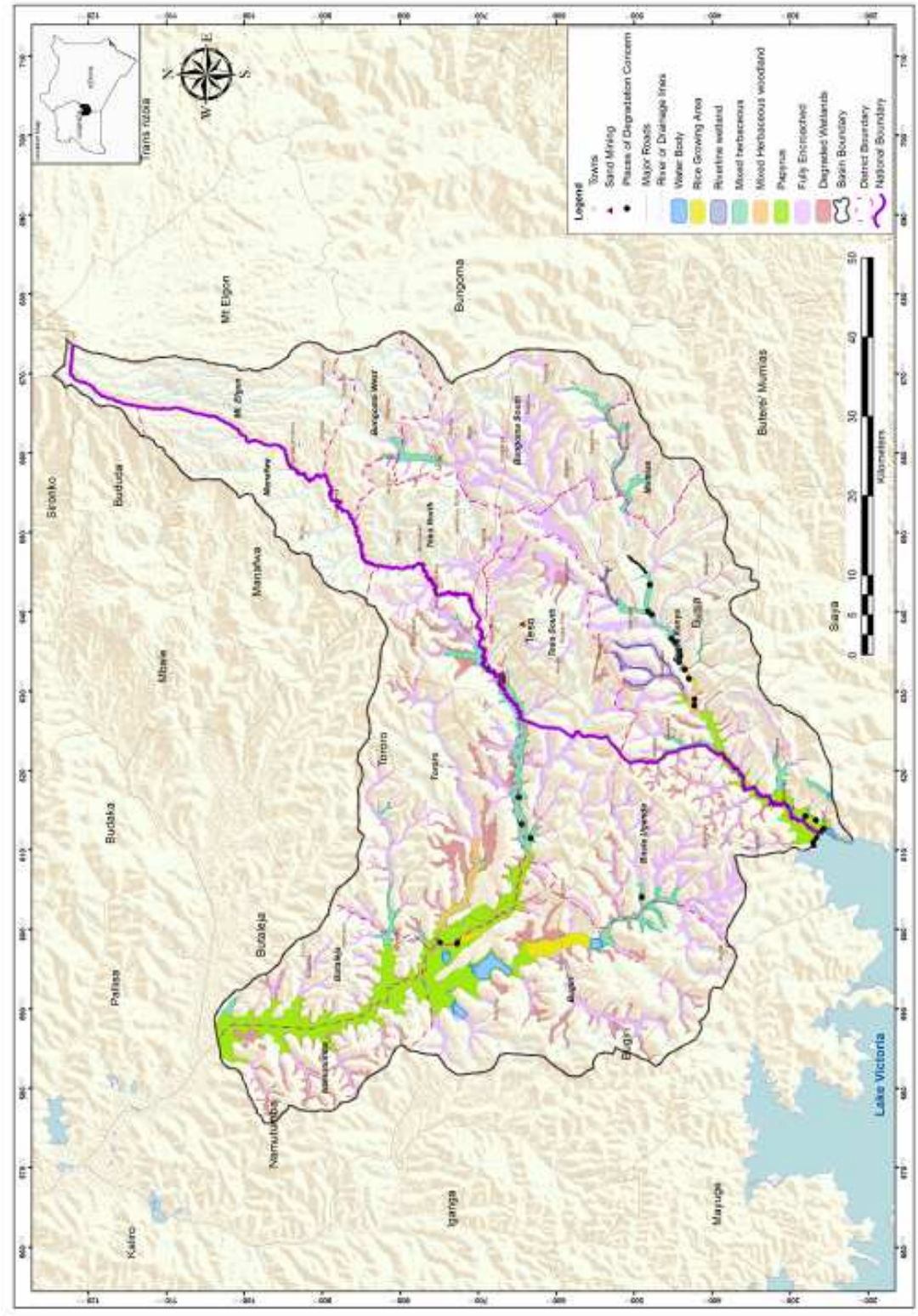
A wetland map has been prepared for the purpose of locating places needing ongoing management (See next page). The map is designed as an ongoing GIS tool that allows for alteration and additions as may be required to keep it up to date. It is difficult to mark precisely the limit between degraded and non-degraded wetlands, especially in the case of seasonal wetlands. This is mainly because the limit between the original natural wetland and uplands is not known anymore, but also because definitions of these limits are not conclusive. For practical purposes, all areas marked as seasonal wetland and now used as farmland (crops or grassland, or substantial irrigated cropland) are considered as degraded wetlands.

For practical purposes all areas marked as seasonal wetland and now used as farmland (crops or grassland, or substantial irrigated cropland) are considered as degraded wetlands.

The extent of wetland types per districts are given in table here after:

Table 8: EXTENTS OF WETLANDS TYPES PER DISTRICT

KENYA									
DISTRICT	PAPY-RUS	FULLY ENCROACHED	FLOOD PLAIN	MIXED HERBACEOUS	OPEN WATER	RICE	RIVERINE WETLAND	MIXED HERB. WOOD-LAND	TOTAL
Busia	23.3	21.5		20.2	1.0		29.5	4.0	99.4
Bungoma S		24.3		16.6					34.9
Bungoma W		0.9		2.6					3.5
Mt Elgon		5.7		0.2					5.9
Teso N									
Teso S		19.6		6.8			1.0		27.3
Mumias		4.4		8.9					13.2
UGANDA									
DISTRICT	PAPY-RUS	FULLY ENCROACHED	FLOOD PLAIN	MIXED HERBACEOUS	OPEN WATER	RICE	RIVERINE WETLAND	MIXED HERB. WOOD-LAND	TOTAL
Bududa									
Bugiri	57.7	37.4	3.1	4.6	12.4	13.7			128.9
Busia	18.2	54.8	5.2	17.2					95.5
Butaleja	49.0	12.3		3.5					64.8
Manafwa									
Namutumba	48.9	13.0							61.8
Tororo	41.5	35.9		26.4			0.01		103.8
TOTAL	**238.3**	**229.8**	**8.3**	**100.9**	**13.4**	**13.7**	**30.5**	**4.0**	**638.9**



MAP 8: Occurrence of wetlands within the SMM Basin

3.9 Forest degradation

Overview of forest degradation

Forest degradation occurs when either large tracks of forest are removed without re-planting, replaced with unsuitable species, or significant alteration of species composition. Forest

degradation indicators are; deforestation, fragmentation and reduced species diversity. Among the major threats to forest ecosystems in Kenya and Uganda are encroachment by settlements or agriculture, illegal logging, excision, charcoal production, livestock grazing and subdivision of land. These factors negatively affect forests provision of goods and services, and their capacity to provide important sources of sustainable livelihoods.

In the Mt Elgon ecosystem, one can identify deforestation either through appearance of clear-cut patches within an existing forest or complete removal of forest cover.

Deforestation (for timber and charcoal) and clearing of natural vegetation to make way for farm land is a serious problem already for a long time. In addition, the majority of the people in the basin depend on biomass for energy and as a result more land areas are being cleared due to over-exploitation of forest products, especially fuel wood and charcoal for cooking. Apart from continued deforestation, the problem of land degradation is also increased by insufficient reforestation activities and/or agro-forestry practice and lack of alternative sources of energy as people continue to depend on fuel wood and charcoal.

An ICRAF study in Nyando River Basin (ICRAF 2005) found that conversion of forest to grass and cropland over the last century has been the major factor contributing to decline in soil fertility and soil physical condition, and increased soil erosion. Compared to forest and bushland, areas dominated by grass and crops are 16 times more likely to be affected by severe erosion.
Compared to stable reference soils, crops grown on eroded soils had an 8% higher chance of crop failure and a 30-40% reduction in crop yields. Depositional areas had lower risk of crop failure and higher yields compared to reference soils. A key contributor to soil degradation is the loss of ground cover. Re-establishment of trees and contact ground cover are needed to control soil erosion in fast eroding areas, and to prevent soil erosion in slowly eroding areas.

Biomass Exploitation is happening all across the basin and is driven by the rapid population growth in the area. The extremely high population density renders it impossible to leave the mandatory 30 m band of land along the river banks for the protection of the rivers, the main drivers being that people do not have alternative land.

In an effort to counteract deforestation, NFA in Uganda and KFS in Kenya are strongly promoting small scale afforestation in woodlots and homesteads, and replanting of degraded

areas in forest reserves (Mount Elgon National Park/Forest Reserve and Busitema forest reserve).

Kenya has even issued a decree prescribing that 10 % of each farm holding should be planted with trees. Enforcement of this decree will be difficult as numerous households with very small land holdings need all of it for their subsistence food production. It is not clarified how homestead planting or living hedges around plots are counted.

NFA in Uganda is trying to mitigate degradation impacts in Busitema forest in cooperation with World Vision. Activities include

- community tree planting to reduce pressure on the reserve,
- sensitising residents on collaborative forest management and on alternative sources of energy like energy-saving stoves, saying this will reduce the use of firewood and charcoal,
- forest rehabilitation by replanting *bathedavia* (Indian Mvule) on the 28 hectares of trees that were cut down in Bulumbi.

Challenges are still remaining as residents' motivation for planting trees appears limited due to the proximity of the forest. Also, guidance on proper use of the forest is said to be insufficient.

Mount Elgon ecosystem degradation

The vegetation of Mt. Elgon reflects the altitudinal controlled zonal belts commonly associated with large mountain massifs. Four broad vegetation communities are recognized i.e. open woodland, tropical moist forest, bamboo and afro-alpine zones that are above the bamboo zone. *Juniperus procera, Hagenia abyssinica, Olea welwitschii, O. hotstetteri, Prunus africana, Podocarpus falcatus* and *P. latifolia* dominate the moist tropical forest. Moorlands, swamps and rocks form a major part of the afro-alpine zone.

The Mount Elgon ecosystem has suffered considerably from overexploitation and depletion of resources. Mt. Elgon Forest is under the threat of destruction caused by unsustainable human activities, including illegal logging, charcoal burning, arsonist fires and clearance of parts of the forest for human settlement. The forest, which used to occupy more than half of the entire Elgon district in Kenya, has now reduced to almost a third of the land surface.

Despite high rates of deforestation in surrounding areas, the southern edge of the Mount Elgon forest massive in the SMM basin has relatively remained in place during the last decades, whereas large-scale deforestation specially occurred on the Ugandan side. The Kenya Wildlife Service (KWS) and the Kenya Forestry Service (KFS) use a system that allows local communities to access the park and to receive non-wood ecosystem benefits from the forest. In Kenya, these arrangements do not allow access to timber or charcoal burning. In Uganda however, there exists a slightly more relaxed policy where the local communities can satisfy

their needs with ecosystem goods and/or services from the park, but only upon signed agreements with the Uganda Wildlife Authority (UWA).

The southern boundary of the Mt Elgon forest reserve (within the SMM basin) is marked by cliff-like escarpments, which are very steep in the Lwakhakha sub-catchment (western side) but becoming less steep in Malakisi sub-catchment (eastern side). Comparison between the topographic maps (made from 1967 aerial photography) and 2003 SPOT imagery of Goggle Earth shows a recession to the north of the forest boundary in many sections, but at a much slower rate than in other parts of the Reserve. In the upper Lwakhakha (Malaba) sub-catchment, the recession varies between 1 and 2 km over a period of about 35 years. In the Malakisi upper catchment, the forest boundary has not changed over a wide area.

The forest boundary has however shifted northwards (i.e. backwards) over a distance of about 6 to 8 km in a large rectangular area of 10 to 11 km wide, starting about 2 to 3 km before the eastern boundary of Malakisi catchment. This block of deforestation translates to an estimated loss of 56-60 km^2 of forest. This area was degazetted and earmarked for resettlement of people living within the forest reserve. This action has had limited success as people have continued encroaching into the forests.

On the Kenyan side, in Cheptais and Mount Elgon Divisions, which contain 50,866 ha of forest land, about 52% (26,639 ha) is still under High forest (productive and protective), and 23% (11,480 ha) under bamboo. Another 17% (8,702 ha) and 8% (4,047 ha) had been deforested in the recent past and have now turned into secondary bushland and grassland respectively In the Ugandan side, the National Forest Authority has prepared a National Land Cover Changes Map, showing that areas west of Mount Elgon have been affected much more by deforestation than other areas within the basin.

CHAPTER 4.Intervention Strategy

4.1 Overall Strategy

The intervention strategy for the integrated management of the watershed is based on the watershed characterization, sector assessment, identification and location of the major land degradation and assessment of the current capacities (in terms of human resources and means) of institutions and diverse stakeholders identified to be potentially involved in the project.

Although the SMM basin is facing a number of challenges, resource degradation in most cases is not irreversible and if timely actions are taken, degradation processes can be mitigated or even put to a standstill. Pollution can be controlled or even avoided. Options remain for both water and land resources development. Management of resources can be improved.

An integrated package of actions is required to rehabilitate and safeguard resources in the watershed and to provide sustained equitable access to these resources for its inhabitants. In addition, important trans-boundary hydrological/ecological services need to be ensured. Sustained access to water resources needs to imply respecting of downstream wetland management interests, both within the SMM basin and in downstream areas (Lake Victoria and Lake Kyoga).

In other words, while using water to meet development needs, reduction of flows into Lake Kyoga and Lake Victoria needs to be minimized.

Achievements to this regard will ultimately affect watershed conditions and hence improve development opportunities in the entire downstream areas in the Nile basin.

A guiding principle should be **conservation-based development**. It underlines that we want to go further than control of resource degradation, since the ultimate goal of investment is to achieve profitable development. Opportunities exist and are exploited to combine the two aspects of degradation control and development. These are most explicit in community-based resource management (CBRM), as to be practiced in catchment rehabilitation and in wetland management. In fact, the combination of resource productivity aspects (as the economic development component) and protection aspects (as the environmental component) is indispensable to motivate local communities to improve their livelihoods in a way that is more profitable to them and in the same time is providing better protection of the resource base.

The integrated package of required actions, together with the guiding principle of conservation-based development automatically lead to the overall objective formulated for the IWMP.

In background to all project activities is the intention to act in **support to local communities and existing groups**, which will be the actors in time to implement the Watershed Management actions. This is why they have been consulted during the project formulation process, with their recommendations and requests taken into account to the major possible extent. The sub-projects have been tailored for strengthening the farmers groups – under the names of Community Forest Associations, Community Forest User Groups, Farmer Field Schools, Wetlands Management Committees and any other Community Based Organisation – and for implementation through them, particularly in rural areas.

The overall objective **for the IWMP** is to:

> ***"Achieve equitable and sustained access to good quality water resources and to productive land resources for the variety of users, as drivers for sustainable development"***

The term integrated is used to emphasize the interrelationship of actions and the subsequent interaction of their results. Different actions could be taken in isolation, but the cumulative profitability will increase if other related actions are taken as well. The following examples are illustrative:

- The profitability of water development will be reduced if water quality can not be put up to standard, and *vice versa*.
- Health risks due to poor sanitation undermine the capacity of people to engage in development activities.
- The profitability of increased water availability through water resource development will be higher if easy access to these new resources is also facilitated.

Actions to be taken considerably vary in character. At one end of the range are the straight-forward, easily quantifiable and well localized, engineering works, which can be implemented rapidly and will have direct results? Solid waste management and storm water drainage systems in main towns are in this category.

At the other end of the range, actions concern larger areas of uplands and wetlands or long stretches of river courses (catchment rehabilitation and wetland management). With increasing population and land pressure, treatment and management of these areas has grown far beyond the operational capacity of government agencies. Conservation on the basis of gazetment or protective regulation has become ineffective as enforcement is highly deficient.

The only alternative is to mobilize the massive human resources available within local communities for community-based resource management. Empowerment, project ownership and participatory planning are indispensable ingredients in this approach. These require a time consuming process of intensive communication, extension, training and community organization efforts as preparation to implementation. Commitment of communities to improved land husbandry has to be based on short term profitability. Subsistence farmers have a conservative attitude towards innovations. Their livelihood security is based on a short term survival strategy, and earlier experiences with innovations brought by “outsiders” have not always been positive. The implication of this will be that, contrarily to the above engineering works, it will take some time before tangible results of improved resource development can be observed. However, once results are tangible and appreciated by local communities, further dissemination will spread in an accelerated way. In addition, the stronger the basis of community organization and commitment to CBRM, the greater sustainability of innovations will be achieved.

The varying character of actions to be taken implies a different approach and implementation strategy for each action. Similarly, different stakeholders will be consulted, sensitized and engaged, and different institutional arrangements will be required for each action. These will be specified for each individual activity and investment proposal.

Concept of integrated watershed management

The issue that needs to be addressed in any integrated Water Resource Management is that of integrating the needs of the people living within the river basin and the environmental needs of the basin. This is complicated by the frequent conflict between private and public goods. In the Sio-Malaba-Malakisi for example we need to reduce deforestation which is leading to increased erosion, soil loss and turbidity of the river; it is clearly good, for both the environment and for everyone living along the river, to reduce the erosion with the consequent soil loss and water turbidity. So to reduce deforestation produces benefits for the general population along the river; this is a public good. For people living in the upper catchment with access to forested land it may well make good economic sense to plunder the forested area for wood and charcoal which can produce an income stream and leave them financially better off; this is a private good and it is perfectly rational for them to do this. They are putting their own economic welfare above that of the greater good. There is nothing odd in this; it is how a free market economy works.

It is the conflict between the public and private goods that is the cause of:

- Deforestation
- Soil erosion
- Pollution of the rivers

- Improper solid waste disposal
- Increased flash floods and landslides
- Loss of wetlands

Regulation of the activities of the population of the river basin and the production of planning documents that fail to recognize the dichotomy outlined above will not solve any of these problems. An integrated approach that identifies mutually desirable goals can be the only way forward. What needs to be addressed is how to improve the livelihoods of the people in a way that also leads to a more environmentally sustainable river basin. Regulation and planning can play a part in this but the individuals involved must see this in the context of improvement in their own welfare.

Agriculture, agroforestry, livelihood and management

In general terms, we are looking at a poor rural population of small farmers, many of whom eke out their on-farm income by fishing, collecting and selling firewood and raising some cattle and goats. Just feeding the family and providing basic needs is the most that the majority of them are able to achieve. One characteristic of small famers living barely above subsistence level is their aversion to risk. To engage in anything, such as trying a new crop or a way of farming they are unfamiliar with carries with it a perceived risk of failure with consequences that can be seen as devastating. This manifests itself within the project area as low yield farming and any increase in output being seen in terms of increasing the area under cultivation rather than an increase in productivity from the existing area of the land or a change of crops.

Experiences from Central Kenya, where there is evidence o f high productivity, high profits, and good land management, indicate that poverty reduction, land degradation, and sustainable agriculture are intricately linked. Adoption of an ecosystem management, approach focusing on: participatory planning of land use and natural resources management at the village, local, district, watershed and county levels; empowerment of communities with proven technology, information and financial resources to make the best investment decisions; and dissemination of a good ecosystem management techniques (e.g. improved soil fertility, erosion control etc,), are crucial to address problems of natural resource degradation and achieve sustainable farming systems.

Better farming practices also provide global environmental benefits. The “Land-use, Land-use change, Forestry Report (2000) of the Inter-governmental Panel on Climate Change (IPCC) has identified the conversion of degraded crop lands into agroforestry as the land-use practice with the largest potential to sequester carbon. Improved practices united under the name of Conservation Agriculture are also known to increase farmers’ resilience to Climate Change.

4.2 Main issues to be addressed

There are a number of problems that apply to the river basin. All these problems are, at least to a certain extent, interlinked, so that one specific problem can hardly be resolved or even properly addressed without facing other related issues. To give a clearer and conceptually better view to these problems, the following sections present the issues, as well as the corresponding proposed activities, sorted out into three basic action lines: actions towards environmental protection, actions towards livelihood improvement, and actions supporting better natural resources management process. Yet of course these three criteria are not independent from one another, and their "boundaries" are not explicitly marked: actions for environmental protection require an organisational and institutional support; livelihood improvement must be attained in the respect of environmental protection; monitoring social progress will involve livelihood status and management process… Even so, the sorting of all the main issues - and corresponding project activities - along the three criteria above appeared as the best solution to prepare for Integrated Natural Resources Management.

ENVIRONMENTAL PROTECTION

Deforestation

One point that has an impact over most of the river basin is the use of wood for fuel and charcoal production. In this moment the largest source of energy for daily life is wood, either from forest areas or from isolated trees and shrubs, and the growing demand endangers the forest cover and biomass in general. The main response to this issue must be reversing the current trend by promoting afforestation of areas with limited agricultural potential (particularly where slope are marked) and agroforestry to combine planting of trees (for wood but also for fruit production) with other crops. This is the central action expected in the context of Integrated Watershed management, because of the combination of actions and outcomes involved.

Additional actions at other levels can also be recommended to moderate the deforestation process. An approach can be found through **alternative sources of energy**. A step forward here would be to **increased electricity coverage** from the 5 percent coverage at present to cover a far greater percentage of the people in the basin, through Kenya Power (KPLC) in Kenya and Rural Electrification Agency (REA) in Uganda. Possible solutions may involve developing the mini-hydro potential of the basin particularly by the utilization of dams that are in existence but may well need rehabilitation. Installation of solar panels at household level may also bring alleviation of the pressure on wood. An additional approach, far easier to implement and indeed already supported by NGOs and other institutions, is to promote the use of fuel efficient stoves. This approach could also reduce the demand for wood and charcoal.

Land and natural resources degradation

Soil degradation in the SMM basin is linked to soil fertility depletion and soil erosion, long-term cultivation with diminishing fallow periods, limited crop rotation practices and low fertilizer inputs. This causes low soil stability and particles are easily transported during rain. Although farmers are aware of reduced soil fertility and its effects, their capacity to address the issues is limited, leading to poor yields.

Much of the SMM Basin is considered to have good potential for agriculture, with medium elevations (1100 to 1600 m above sea level) having deep, well drained soils, and relatively high rainfall (1200 - 1800 mm per year) that permits two cropping seasons in some parts. Currently, crop productivity is very low with typical output from a 'good' rainy season being less than 1 ton of maize per hectare, although the potential is as high as 5 to 6 tons.

As is the case with soil fertility deterioration, soil erosion occurs everywhere in the SMM basin, even in undulating terrains. Soils on steeper upper slopes have been cultivated for long without adequate soil conservation measures and clean weeding farming practices. As a result the soil structure within the upper slopes is more deteriorated leading to more soil erosion than elsewhere in the basin.

The upper catchment areas of Manafwa District and part of Tororo District on the Uganda side, and the rolling upper catchment areas of Mt. Elgon, Teso North and Bungoma West Districts on the Kenyan side are the most severely affected areas.

Water quality degradation and increase of sedimentation

The water quality in the SMM is affected by deforestation, intense cultivation (with increasing removal of vegetation cover and soil loss), cultivation of riverbanks, poor solid waste management, wetland degradation, over-exploitation of biomass, high population density and growth rates, poor sanitation, land fragmentation, water pollution (surface water and groundwater), flooding, widespread extraction of sand and clay for construction, settlement (particularly along the river flood plains) and urban development (where the towns located along the river banks are not provided with sewerage system).

As a consequence of the above pollution sources, the common water quality problems with the SMM Rivers are poor colour, high turbidity and silt load, and high faecal coliform content.

Waste disposal and storm water drainage and wastewater treatment

Solid and human waste disposal polluting the rivers can be divided into two parts, waste from urban areas and waste from rural areas. Dealing with urban waste is most easily dealt with and is largely an issue of finding the money to deal with it and management of the sewerage and waste disposal. Within the Sio-Malaba-Malakisi basin there are already resources being allocated towards this and this feasibility study will recommend the allocation of more. Nothing

in urban waste disposal is inherently complex nor does it require much selling to the targeted population. The one thing that particularly requires more effort is storm water drainage and wastewater treatment.

Pool Rural Sanitation

Within the rural areas open defecation is still practised, causing faecal coliform pollution in the watercourses. The impact of such practices has not been severe during long times, but with the increasing demographic pressure caused by population density growth throughout the basin, combined with the decrease of the vegetal cover to process the organic load, the problem is turning into a serious concern. It should not require too much effort to implement a WATSAN project with the obvious benefit to both health and dignity of the communities involved.

All of the above involves a commitment of resources. If people sense that there is a real interest in their welfare, if subprojects are identified that improve welfare and health and increase income through lower medical expense and lower number of sick person-days, and then implemented with community participation; then areas that require attention but which have benefits outside of the community might be able to attract attention and support. An approach that only emphasises environment and the common good however is almost certainly doomed to failure.

Climate Change

Integrated ecosystem management approaches will draw on agroforestry and other land management techniques that also deliver benefits in the area of carbon sequestration. The PCC estimates of carbon accumulation rates range from 2 to 9 MT/ha/year, depending on the climate and the nature of the agroforestry practice. Although an important factor in reducing global levels o f Greenhouse Gases (GHG), the potential for carbon sequestration is generally ignored at national and local levels in developing countries. Project activities incorporating carbon benefits have the potential to link global climate change priorities to local initiatives. Diversification of crops and sources of income also increase the farmers' resilience to climate change.

INCOME GENERATION

Income and welfare

The project is rated as a poverty alleviation project, so the first issue is one of income; if we are to deal with the issues of natural resources management it has to be in the context of raising individual income and welfare. It is the actions of the people within the basin which are the primary cause of the issues to be addressed. Desirable changes can come about only if

individuals see it as being of direct benefit to them. Any argument about “the greater good” is unlikely to lead to change in behaviour.

The solution to the issue of low output levels from smallholder farming leading to encroachment of ever expanding areas of land must be to shift from extensive **low yield farming** to intensive higher yield farming so the farmer is able to increase the on-farm income without expanding the area of land farmed. In addition, other **sources of income** will need to be identified.

WATERSHED MANAGEMENT

Sharing knowledge

Some knowledge gaps remain, especially in relation to water resources management: These would be alleviated by extension of the water monitoring network (described under Supportive activity 4C).

Action coordination

As explained above, the proposed IWMP will not be unique responsible for all actions actually required in the basin. This is because other parties are already following up prevailing issues. It is stressed again that most actions are interlinked. Omission of certain actions may reduce the profitability of others. Similarly, delayed results in one action may hamper planning of other actions. It is referred to the example of an improved water monitoring network and data base preparation, results of which are needed for planning of water resource management actions, e.g. by WRUAs in sub-catchment management planning.

These constraints can probably be minimized if the same PMU follows up on implementation of awarded investment proposals and can assist in harmonized timing of implementations.

Legal and regulatory framework

The IWMP will be confronted with a few constraints, described in the stakeholder analysis. Both participating countries have shown general preparedness to cooperate in trans-boundary issues. However, implementation activities on the ground touching contiguous areas on either side of the border may be hampered by incompatibility in regulations or incompatibility in directives through national level projects. People being stopped from environmentally damaging activities on one side of the border may move to the other side and cause damage there if regulations are less severe.

If legislation is difficult to change in a short term, the IWMP project could assist in formulating local bye-laws to achieve compatibility in regulations.

Definition of wetland areas

Delineation of wetland units has an intrinsic constraint. Determination of wetland types and their extent is bound to be tentative. A significant proportion of wetlands are classified as seasonal. Under the peculiarities of the climatic regime their seasonality is irregular. Besides, due to long term encroachment, the natural status of wetlands is uncertain. A wetland rehabilitation option would often pose problems, because ecologically it is not clear what it is to rehabilitate. In addition, most gross area estimates of wetlands in both Kenya and Uganda are based on aerial surveys done for topographical maps. The extent of such wetter areas in these maps is often sociologically defined by a local community customary usage rather than by clear ecological features.

For the purpose of this study, delineation of wetlands is done as a compromise between the units shown on the topographic maps, and those identified from Google Earth™ imagery.

Additional sub-sectors

Despite efforts to comprehensively address all watershed issues in the SMM basin, a few sub-sectors remain for which more complete measures are still expected. They can be given a place within the current programme, or be developed separately. These are related mainly to water sanitation and rural water supply, groundwater development and hydropower.

Water supply and sanitation are key development indicators, and are among the highest Government priorities in both countries, with good budgetary allocations. Yet as of now their coverage is still unsatisfactory in the basin, in particular in rural areas and more so in Uganda than in Kenya. Poor sanitation conditions are one of the two main non-point sources of pollution and would deserve much more attention than feasible with the limited time for the study and available specializations in the study team. Inadequate efforts to this regard will jeopardize results of other activities of water pollution control. As a start, stronger lobbying could help to have more towns included in subsequent phases of KfW-funded water supply projects – the border towns of Busia and Malaba are proposed for inclusion in the programme.

In general terms, the basins of Sio and Malaba rivers are not endowed with important groundwater resources because of the geology and soils types of the area. Yet limited amounts of water are available for local use at household level mainly. Programmes are being implemented for development of groundwater through spring protection and drilling of shallow and deep wells. Part of the shallow groundwater resources is easily threatened by pollution from the common non-point sources of chemical pollution (agricultural chemicals and poor sanitation); deeper ground water reportedly is of good quality in most cases. It appears that the role of groundwater in the overall hydrological system is neither well known nor quantified, which limits their sustainable development in areas in which such possibilities may exist. Additional studies on productivity of ground water resources would help in improving water

balance, e.g. for the purpose of water supply development, or with regard to the potential for groundwater recharge, with the different alternative techniques collected under the general name of Rain Water Harvesting.

Hydro-electric Power (HEP) capacity could probably be increased, as an alternative source of energy to alleviate the pressure on wood and biomass ingeneral. In the “Reservoir Study”, 7 sites for mini-hydropower generation considered in its preliminary list of sites for evaluation (Sono, Muhanda, Malakisi, Kitabisi, Bokimaswa, Bunjosi and Butinga) have been eliminated from further analysis, and could be evaluated in more depth. The only dam site currently under Feasibility Study in the SMM basin is Maira, which does not rank among the most promising for hydropower production as per the Reservoir Study, but for which implementation is much easier, because of the lower investment cost, on one side, and on the limited social and environmental impact (due to the extension of the reservoir) on the other side. Potential for micro-HEP stations may be investigated, together with a regulatory framework for placing these micro-HEP plants under management, operation and maintenance by the local authorities instead of the state-run enterprises.

4.3 Sustainability of achievements

The present proposals are formulated for a limited period of time, i.e. for a first phase of 5 years. It should be noted that activities under the CRMP (project investment 1) and the Wetland Management Project (project investment 4) would have to continue for much longer periods in order to have a noticeable and sustainable impact on the watershed conditions. An agreement in principle from donors on possible longer-term commitments is more or less a prerequisite for successful implementation.

The first phase implementations in CRMP and Wetland Management, are expected to produce noticeable impact at local level, but this will be an impact in a limited area of the SMM basin only, and will not be sufficient to fully achieve the IWM objectives. Implementation in the first phase, with the established institutional network and operational momentum, will act as a lever for up-scaling during following phases. On the contrary, given the magnitude of the problem of degrading resources in the SMM basin as a whole, termination of implementation after the first phase, would very likely have repercussions on stakeholders motivation to carry on without external support in remaining priority areas. In that case, impact in the SMM basin as a whole will not be satisfactory.

The CRMP project and Wetland Management project are therefore proposed as a long term project (15-20 years) with a first phase of five years. The focus of a second and third phase would be on further upscaling of implementations and thus impact on overall environmental conditions. Detailed contents of second and third phases should be based on lessons learned

from the success and failure experienced in the first phase, building on the results of the project Monitoring and Evaluation.

Maintenance of on-site implementations and their impacts on resource conservation would be taken care of by the farmers as increased productivity is, first of all, in their interest.

The Solid Waste Management Master Plans provide for operation and maintenance, in the short, medium and long term.

The Storm Water Drainage Master Plans include recommendations for maintenance responsibilities. These will still have to be materialized by the Town/County Councils.

4.4 Scope of the Project Proposal

The IWMP project proposal is composed as an integrated package of sector projects and sub-projects comprising complementary projects targeting a specific sector of intervention in the watershed:

- Afforestation/reforestation
- Agriculture and Agroforestry practices and
- Soil and water conservation practices
- River bank protection
- Wetland management
- Solid waste and storm water drainage management

Each and every project or sub-project is considered under a triple focus, which aims at realising the objectives:

- A focus on the **Environmental Conservation** of the watershed and wetlands, which is a major long-term concern addressed by the programmes for the Nile Basin in general;
- A focus on **Income Generation**, to address the immediate needs of the inhabitants and also to ensure their participation in the conservation process;
- A focus on **Institutional Strengthening**, including creation and operation of local organisations, capacity building, care of social stability and gender issues, to increase the chances of sustainability of the efforts in conservation and livelihood improvement.

Additional Supportive Activities are presented for funding. These are catering for watershed management actions (studies, fund allocation) deemed necessary for the achievement of specific objectives for the entire IWMP.

Past or current on-going projects are occurring in the watershed and the IWMP has to be implemented in coordination and complementarity with them to ensure a fluent continuity vis-a-vis community involvement.

4.5 Planning Horizons

The first implementation phase for investments, object of the current study, will have duration of 5 years. Proposed costs estimates and breakdown concern only this first investment phase.

Following phases of implementation are also suggested, for which cost estimates have not yet been made, showing that

- the Conservation Agriculture Project would require the longest total input to have full impact on watershed conditions, probably 20 years,
- Catchment Rehabilitation and Wetland Management activities would reach full results with a total investment period of 10-15 years,

Implementation of the physical infrastructure part of the Bungoma town Storm Water Drainage Master Plan can be effectuated in a short time frame; putting into practice the related maintenance procedures would require about two years.

For Lwakhaka town (Kenyan and Ugandan part), an outline has been produced for a Storm Water Drainage Master Plan. Preparation of the final plan requires more detailed topographic surveys. Surveys and final planning can both be undertaken shortly, after which the plan and related maintenance procedures can be implemented.

The Solid Waste Management Master Plan for Bungoma town and Lwakhaka (Kenya and Uganda) provides for implementation and maintenance during the first five years. The plans also include projections for the mid-term (6-10 years) and longer term (11-15 years).

Cost estimates include preparatory action for a few activities: two components of the CRMP and three supportive activities to the IWMP. The duration of eventual implementation is tentatively indicated, but cost estimates depend on findings of these activities.

For the purpose of financial or economical analysis, the benefits have been considered over a period of 20 years compared to the 5 years investment period. If further investments are realised, the additional or marginal benefits will need to be considered separately.

CHAPTER 5.Institutional Setup and Arrangements

5.1 Institutional setup

Transboundary cooperation in watershed management or river basin management is the result of a long term process of consultation and negotiation. In the case of SMM basin, much of the higher level preparatory work has already been done within the NBI framework (SMM Cooperative Framework Studies).

Crucial to the success of transboundary management are:

- political willingness,
- a thoroughly formulated agreement,
- full transparency in data exchange.

Political willingness is proven by the fact that both partner countries are signatory to the NBI, and that several studies are undertaken. On the contrary, at other levels, the stakeholder analysis also observed a contradiction between ambitious policies and very limited budgets to put these into practice, and between elaborate environmental legislation but low enforcement.

Evaluation of previous transboundary projects like MERECP highlight difficulties related to institutional arrangement for an effective implementation on field.

Among others difficulties are linked to:

- The complexity coming from the involvement of several institutions and subsequent heavy bureaucracy with consequent delays;
- A lack of communication between the implementing agencies and the communities who are the most important target group;
- The concentration of management and implementation responsibility at the district level instead of village level.

With its specific characteristics of being transboundary, the Sio-Malaba–Malakisi Watershed project needs to fit in a institutional set-up that can guarantee at the same time a high quality of coordination among the partner countries, and a good level of independence for each of them in their operation and timing, to harmonize regional, national and local objectives and priorities.

Another relevant aspect of the institutional set-up is the intention, from both governments, to support decentralization and local level decision-making.

The sensitivity of the balance between authority of national institutions (Ministries in first place) and strong coordination ensuring transboundary decisions leads the Consultant to propose two alternative solutions to deal with objectives and constraints.

- The first option is more oriented towards using existing institutions at national level and future mechanisms for transboundary watershed management, and integrating the Project in the structure of the governmental agencies from the state level to the district and local level.
- The second option, prioritizing transboundary cooperation for implementation and integrating the governmental agencies in the mechanism, is more focused on effectiveness of implementation at the district/sub-county and lower local levels; the intention is to avoid possible delays due to heavy bureaucratic process through the full scale of administration in each country.

5.2 Stakeholders Mapping

Proposals for project institutional organization are based on a participative identification of main stakeholders to be involved in the investment program by sub-projects.

Identification has been made during workshops with technical officers from the two countries. Stakeholders are ranked in 3 categories of decreasing importance as presented in the tables here-after. Projects being mainly composed with community based activities; CBOs, as important target group, are systematically mentioned as main stakeholders of rank 1.

Table 9: Involvement of main stakeholders in SMM-IWMP in Kenya

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS KENYA			
		Overall	Design	Impl	M&E
1 CATCHMENT CONSERVATION					
Afforestation	Forest rehabilitation programs ; operational capacity building for forest management/rehabilitation	KFS	NEMA KEFRI	WRMA WRUA CBO CFA CFUG MoA	KFS KWS
Soil and Water Conservation	Promotion of biological erosion control measures	MoA	MoA KFS	WRUA MIS CBOs/NGOs	MoA
Conservation agriculture	Promotion of conservation agriculture practices (min soil disturbance, soil cover, crop rotation and association	MoA	MoA MoLD	ICIPE / ICRAF/ ACT CBO	MoA MoLD

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS KENYA			
		Overall	Design	Impl	M&E
Permanent wetlands management	Promotion of conservation + promotion of improved and diversified practices: improvement of fish capture techniques; ridge and furrow agriculture methods; extend fish culture system; fish farm integrated units; establishment of papyrus coup areas	WRMA	NEMA MoF LBDA	MoF MoA, local bodies, CBO	WRMA
Seasonal wetlands (floodplain) management	Promotion of improved and diversified practices: Ditches dug for water retention; optimum use of seasonal grazing; type and extent of fuelwood and fodder production	NEMA	WRMA MoA	MoA MoF, local bodies, CBO	NEMA
2 INCOME GENERATION					
Afforestation	Development of private /community nurseries, non-timber products and handicraft	KFS	NEMA KEFRI	WRMA WRUA CBO CFA CFUG MoA	KFS KWS
Soil and Water Conservation	Development of private /community nurseries, non-timber products and handicraft Improved marketing for products Access to micro-credit to support initiatives	MoA	MoA KFS	WRUA MIS CBOs/NGOs	MoA
Conservation agriculture	Development of new crops for better nutrition and cash marketing Improved marketing for products Access to micro-credit to support initiatives	MoA	MoA MoLD	ICIPE / ICRAF/ ACT CBO	MoA MoLD
Permanent wetlands management	Improved cattle breeding by optimum use of seasonal grazing; Development of fodder production; eco-toilet promotion; beekeeping, handicraft	WRMA	NEMA MoF LBDA	MoF MoA, local bodies, CBO	WRMA
Seasonal wetlands (floodplain) management	Improved cattle breeding by optimum use of seasonal grazing; Development of fuelwood and fodder production; eco-toilet promotion; fruit orchard cultivation; beekeeping, handicraft	NEMA	WRMA MoA	MoA MoF, local bodies, CBO	NEMA
3 WATERSHED MANAGEMENT					
Afforestation	Operational capacity building for forest management/rehabilitation; Organisation of private /community nurseries; maintenance	KFS	NEMA KEFRI	WRMA WRUA CBO CFA CFUG MoA	KFS KWS
Soil and Water Conservation	Operational implementation capacity strengthening (extension staff/NGOs) and planning tools for communities	MoA	MoA KFS	WRUA MIS CBOs/NGOs	MoA
Conservation agriculture	Operational implementation capacity strengthening (extension staff/NGOs) and planning tools for communities	MoA	MoA MoLD	ICIPE / ICRAF/ ACT CBO	MoA MoLD

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS KENYA			
		Overall	Design	Impl	M&E
Riverbank protection	Sensitization; capacity building and pilot activity (buffer zones 10 K 30U m; plantations trees, fodders and grasses) (10 hotspots)	WRMA	NEMA MoA	KFS MIS CBO	Local bodies
Promotion of sustainable practices for sand abstraction	Sensitization; capacity building and pilot activity (10 hotspots)	NEMA	WRMA MoLD MoA	NEMA MIS CBO	Local bodies
Permanent wetlands management	Organisation of WMU to support the proposed activities on a sustainable basis	WRMA	NEMA MoF LBDA	MoF MoA, local bodies, CBO	WRMA
Seasonal wetlands (floodplain) management	Organisation of WMU to support the proposed activities on a sustainable basis	NEMA	WRMA MoA	MoA MoF, local bodies, CBO	NEMA
4 URBAN STRUCTURES					
SWD Project – Bungoma / Kenya	Detailed topographic survey; storm water master plan; design and construction of storm water drainage infrastructure; participatory process for storm water management	Bungoma municipal council	NEMA/ WRMA	MPHS/ MoPW	Bungoma municipal council
SWD project - Lwakhakha / Kenya		Bungoma county council	NEMA/ WRMA	MPHS/ MoPW	Bungoma municipal council
SWM Project - Bungoma / Kenya	Start-up stage (Preliminary survey, public awareness-training, cleaning); design of collection and transportation, disposal site system; implementation, administration and supervision	Bungoma municipal council	NEMA/ WRMA	MPHS/ MoPW	Bungoma municipal council
SWM Project - Lwakhakha / Uganda		Bungoma county council	NEMA/ WRMA	MPHS/ MoPW	Bungoma municipal council

Table 10: Involvement of main stakeholders in SMM-IWMP in Uganda

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS UGANDA			
		Overall	Design	Impl	M&E
1 CATCHMENT CONSERVATION					
Afforestation	Forest rehabilitation programs ; operational capacity building for forest management/rehabilitation	MWE	NFA UWA LKWMZ KEFRI	NaFORRI District local Gov. (FS)/ **FSSD** CBO	KWS/
Soil and Water Conservation	Promotion of biological erosion control measures	**MAAIF**	MWE/ District local government	MUIENR CBO	**MAAIF**
Conservation agriculture	Promotion of conservation agriculture practices (min soil disturbance, soil cover, crop rotation and association	**MAAIF**	MWE/ District local government	NARO CBO NGO	**MAAIF**
Permanent wetlands management Project	Promotion of conservation + promotion of improved and diversified practices: improvement of fish capture techniques; ridge and furrow agriculture methods; extend fish culture system; fish farm integrated units; establishment of papyrus coup areas	**MWE**	MAAIF NEMA District local Gov.	MAAIF NaFIRI CBO	**MWE**
Seasonal wetlands (floodplain) management	Promotion of improved and diversified practices: Ditches dug for water retention; optimum use of seasonal grazing; type and extent of fuelwood and fodder production	**MWE**	MAAIF NEMA District local Gov.	NaFORRI MUIENR NARO CBO	NEMA
2 INCOME GENERATION					
Afforestation	Development of private /community nurseries, non-timber products and handicraft	KFS	NEMA KEFRI	WRMA WRUA CBO CFA CFUG MoA	KFS KWS
Soil and Water Conservation	Development of private /community nurseries, non-timber products and handicraft Improved marketing for products Access to micro-credit to support initiatives	MoA	MoA KFS	WRUA MIS CBOs/NGOs	MoA
Conservation agriculture	Development of new crops for better nutrition and cash marketing Improved marketing for products Access to micro-credit to support initiatives	MoA	MoA MoLD	ICIPE / ICRAF/ ACT CBO	MoA MoLD
Permanent wetlands management Project	Improved cattle breeding by optimum use of seasonal grazing; Development of fodder production; eco-toilet promotion; beekeeping, handicraft	**MWE**	MAAIF NEMA District local Gov.	MAAIF NaFIRI CBO	**MWE**

PROJECT/SUB-PROJECT	MAIN ACTIVITIES	MAIN STAKEHOLDERS UGANDA			
		Overall	Design	Impl	M&E
Seasonal wetlands (floodplain) management	Improved cattle breeding by optimum use of seasonal grazing; Development of fuelwood and fodder production; eco-toilet promotion; fruit orchard cultivation; beekeeping, handicraft	**MWE**	MAAIF NEMA District local Gov.	NaFORRI MUIENR NARO CBO	NEMA
3 WATERSHED MANAGEMENT					
Afforestation	Operational capacity building for forest management/rehabilitation; Organisation of private /community nurseries; maintenance	KFS	NEMA KEFRI	WRMA WRUA CBO CFA CFUG MoA	KFS KWS
Soil and Water Conservation	Operational implementation capacity strengthening (extension staff/NGOs) and planning tools for communities	MoA	MoA KFS	WRUA MIS CBOs/NGOs	MoA
Conservation agriculture	Operational implementation capacity strengthening (extension staff/NGOs) and planning tools for communities	MoA	MoA MoLD	ICIPE / ICRAF/ ACT CBO	MoA MoLD
Riverbank protection	Sensitization; capacity building and pilot activity (buffer zones 10 K 30U m; plantations trees, fodders and grasses) (10 hotspots)	**MWE**	LKWMZ District local Gov.	LKWMZ CBO	District local Gov
Promotion of sustainable practices for sand abstraction	Sensitization; capacity building and pilot activity (10 hotspots)	**MWE**	MAAIF NEMA	MAAIF/ NEMA CBO	District local Gov
Permanent wetlands management	Organisation of WMU to support the proposed activities on a sustainable basis	**MWE**	MAAIF NEMA District local Gov.	NEMA NaFIRI CBO	**MWE**
Seasonal wetlands (floodplain) management	Organisation of WMU to support the proposed activities on a sustainable basis	**MWE**	MAAIF NEMA District local Gov.	NEMA NaFORRI MUIENR NARO CBO	NEMA
4 URBAN STRUCTURES					
SWD project - Lwakhakha / Uganda	Detailed topographic survey; storm water master plan; design and construction of storm water drainage infrastructure; participatory process for storm water management	**MWE**	Lwakhakha town council	Lwakhakha town council	**MWE**
SWM Project - Lwakhakha / Uganda	Start-up stage (Preliminary survey, public awareness-training, cleaning); design of collection and transportation, disposal site system; implementation, administration and supervision	**MWE**	Lwakhakha town council	Lwakhakha town council	**MWE**

5.3 Option 1: Focus on existing implementation channels

National responsibilities

On the Kenyan side, the SMM basin is part of **Lake Victoria North Catchment - LVNC.** MEMR/WRMA for LVNC has started managing databases for water resources monitoring and permits for water abstraction, as inputs for a Water Allocation Plan. WRMA is also coordinating and assisting in creation of WRUAs for decentralized water resource management. In future, based on improved data availability, WRMA should be able and responsible to provide information for important political decisions with regard to equitable water allocation. This concerns water allocation not only within one sector, e.g. irrigation or water supply. In a time with overall water deficits, water allocation between sectors (e.g. industry-agriculture) will become important issues as well. In addition, the SMM basin being a transboundary basin, interests at international/regional level are to be considered.

On the Uganda side, MWE / DWRM will start (July 2011) putting in place a similar structure for decentralized water resource management. The SMM basin will be part of the Lake Kyoga Water Management Zone – LKWMZ (Malaba-Malakisi River) and the Lake Victoria Water Management Zone – LVWMZ (Sio River). The creation of sub-catchments below the level of WMZ, e.g. for the SMM basin, is being discussed.

Since **WRMA** -LVNC and **MWE** - LKWMZ - LVWMZ are or respectively will be, responsible for core tasks in water resource management, it is quite logical that these institutions also take the lead in planning and coordinating IWM activities in their part of the SMM basin. They will be the **implementing institutions** for the IWMP.

WRMA is actually doing this already at the sub-catchment level through their assistance in preparation of Micro-Catchment Action Plans. Catchment plans are being made in consultation with all stakeholders. Implementation of components of the plan is done or coordinated by the first responsible institution in the sector concerned. Implementation is currently financed through the sector agency's own budget lines or through funding lines created for WRUA-identified activities (National Trust Fund).

WRMA and DWRM (or the future two WMZs) would similarly **coordinate planning, implementation and monitoring** of IWM activities at a sub-basin level in their part of the SMM basin.

Planning would be carried out jointly with all stakeholders. For implementation, activities would be "delegated" to the institution(s) most qualified/ most concerned, through **Memoranda of Understanding** (**MoU**), for example with other Ministries or Institutions concerned by the project (NEMA, MoA, KFS, KEFFRI / MAAIF, NEFA,NARO) . The targeted Ministries and Institutions are specified in the tables above for each SMM-IWMP component.

Monitoring during implementation would be the responsibility of the implementing agency. Thereafter, responsibility would be either with the institution which is also responsible for maintenance of the newly created assets, or with the principle institution or interest group exploiting these assets.

In analogy with the WRUA at smaller, lower level catchments, WRMA in Kenya would create a **SMM Watershed Management Unit** for this purpose. Contrarily to the WRUA, the SMM Watershed Management Unit would be part of WRMA, directly responsible to the Head of WRMA and in charge of the watershed management activities in the Malaba-Malakisi and/or Sio sub-basin. In Uganda, a similar unit could be created taking the mandate of the SMM Watershed Management Unit (Sub-catchment Management Committee are planned in the new structure).

In analogy with the WRUA at smaller, lower level catchments, WRMA in Kenya would create a **SMM Watershed Management Unit** for this purpose. Contrarily to the WRUA, the SMM Watershed Management Unit would be part of WRMA, directly responsible to the Head of WRMA and in charge of the watershed management activities in the Malaba-Malakisi and/or Sio sub-basin. In Uganda, a similar unit could be created taking the mandate of the SMM Watershed Management Unit (Sub-catchment Management Committee are planned in the new structure).

The general scheme for institutional arrangement is presented below as Figure 2.

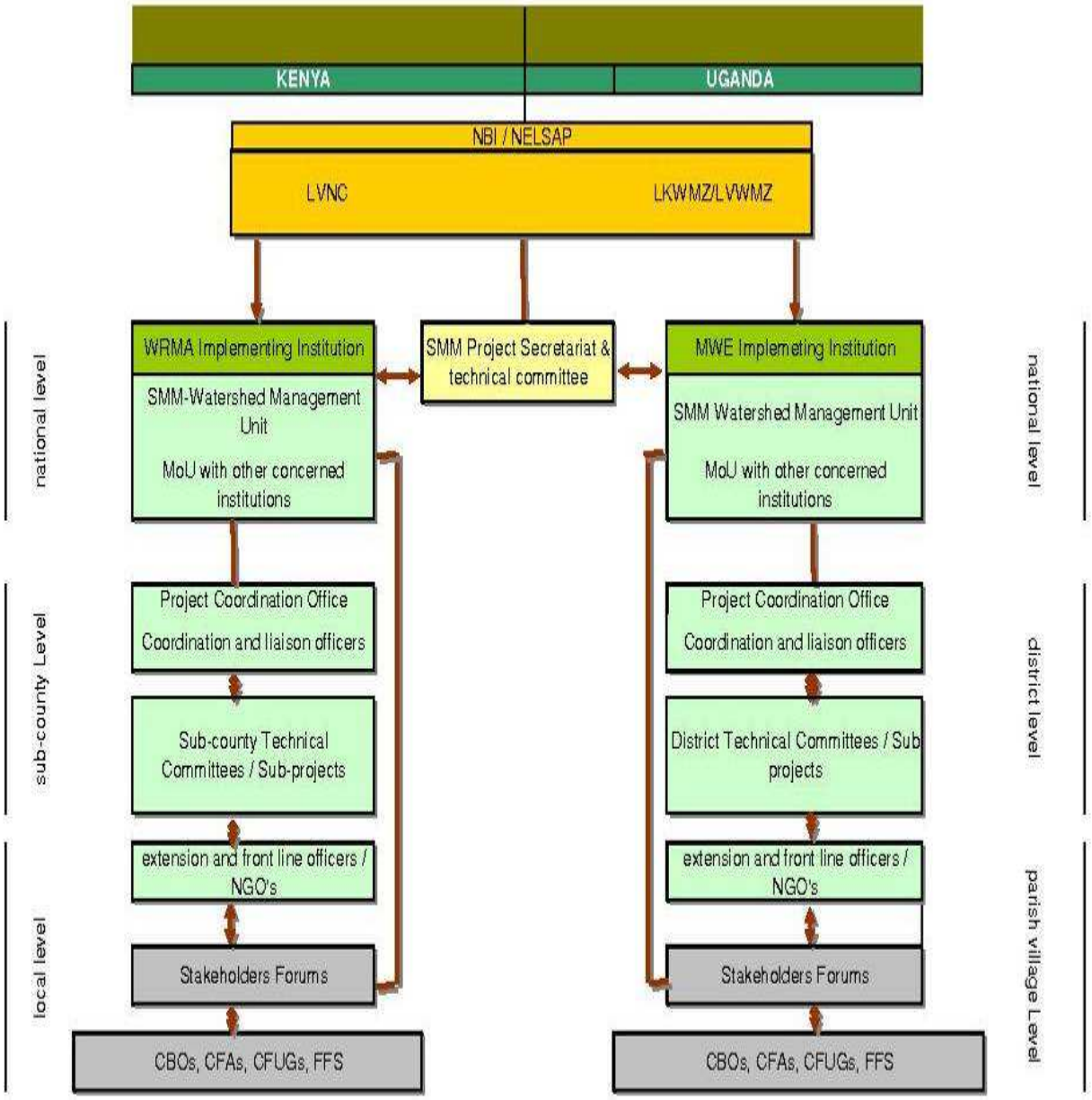


Figure 2: Organization chart: Option 1

Transboundary coordination and agreement

A coordinating body needs to be created for transboundary matters. This body, with a position of **Programme Management Unit**, will initiate, facilitate and encourage keeping the momentum in consultation and joint planning of activities by partner institutions on either side of the border. It will also identify, and try to follow up on, needs of harmonization of approaches, policies and legislation in the two partner countries. Harmonization itself remains a matter for sector specialists and their advisers at national level.

The two countries will cooperate on the basis of a **SMM Watershed Management Agreement** and it will be the first important task of the SMM Secretariat to invite both partner countries for

the process of drafting this agreement. A cooperation framework for transboundary water resources management is already being drafted and a watershed management paragraph could be added as an amendment. Both countries are in the process of developing a transboundary water policy (in Kenya, the final draft is ready to be presented to the Cabinet). On the basis of the two policies, a Cooperative Framework Agreement is to be signed, which provides for obligations (pollution control and prevention), and rights (e.g. amounts of possible abstracted water) for each partner. A Joint Commission of Cooperation, with NEMA staff from both countries, will monitor compliance with the agreement, and non-respect is reported back to the respective unit for transboundary water issues or line ministry.

More detailed guidelines will be recommended for the JCC to go with the Cooperative Framework Agreement, stipulating matters like monitoring frequency, possibilities to mutually request additional ad hoc monitoring, and agreed standards to be used for monitoring (internationally accepted standards for water quality, effluents from towns and industries etc.).

The SMM PMU will keep both partner countries alert with regard to strategic decisions to be taken at the transboundary level, and specific attention will be givento the treatment of issues for which interests of the two countries are opposed. Strategic transboundary development decisions will soon be required to this regard. At the basis of these decisions, will be a better knowledge of flow regimes and a quantification of required reserve flow.

For technical issues or specific projects to be carried out, the SMM PMU will call upon technical officers from the sector concerned, to form a **Transboundary Technical Committee**. For water resource issues, these will come from WRMA and the WMZ concerned. For catchment rehabilitation, these will come from MOA/MAAIF, NEMA and KFS/NFA. For urban storm water or solid waste management, these will be engineers from the Municipal Councils concerned. At the level of each technical issue, the Technical Committee and Secretariat will be responsible to the Regional Steering Committee for IWRM/IWM.

The future role of SMM PMU is, in some way, an evolution of that currently played by the **PMU of the SMM River Basin Project.** Before project implementation begins, a gradual transformation/strengthening of the PMU should be considered. The temporary position of the present PMU under NELSAP will then need to be transformed into a permanent position under supervision of an existing international/regional organization. Several options exist to this regard depending on who being the first responsible for transboundary river basin management.

Sio sub-basin is draining into Lake Victoria and a separate Sio sub-basin secretariat could take a place under LVBC of which both countries are signatory partners. The Malaba-Malakisi sub-basin secretariat will have to come under a structure for a different river basin, notably the Kyoga river basin. The options for the Malaba-Malakisi Secretariat will be similar as for a secretariat for the entire SMM basin:

- to come under an institution of which both countries are signatory partner (EAC, NBI),
- to come under LVBC with a broadened mandate, to include also Lake Kyoga,
- to exist as a separate interstate secretariat for Lake Kyoga basin, financed by the two countries.

District / Sub-county level

Based in the project area, two coordination offices in charge of liaising with IWMP PMU will be hosted respectively by WRMA in Kenya and MWE in Uganda, ensuring the sub-county/district coordination of activities in the Watershed. Recommended locations may be Bungoma or Kakamega in Kenya and Tororo in Uganda.

These two offices will ensure the required level of coordination and harmonization of interventions in the area and with all concerned governmental line agencies representatives, gathered in a District**/sub/watershed technical committee**, assuring the needed coordination and harmonization of interventions on field, in liaison with extension and front-line officers.

They will have the general role of pushing forward the Integrated Programme rationale in the middle of the many community-level project activities.

Stakeholders interests

Stakeholder's interests would be respected at different levels. A rather favourable practice of stakeholder involvement in planning activities has already been established in both partner countries. Kenyan WRUAs undertake joint planning of MCAPs with a strong stakeholder involvement. Sector related stakeholder forums are organized at district/division level for ongoing activities and upcoming issues. With the new structure of WMZ in Uganda, technical Management Committees as well as Stakeholder Forums are foreseen at Sub-catchment level. NBI has supported the creation of Nile Discourse Forums at national and regional level to provide a platform where opinions of the broader public can be brought forward.

Because of the multitude of activities to be deployed under IWMP, it would be good to have **Watershed Management Stakeholder Forums** in both partner countries, both at the level of the SMM sub-basin, as well as in districts or SWUs where a number of IWM interventions are foreseen.

Farmer Field Schools

At the level of project implementation, the concept of **Farmer Field Schools** (FFS) will be preferentially applied. This concept, already known and applied in both sides of the border, is described in more details in the Chapter 3 below.

5.4 Option 2: Focus on direct implementation at district and local level

National responsibilities

In the second option, WRMA and MEW through DWRM would be the implementing institutions and are leading a SMM-IWMP Management Committee gathering the different Ministries or other Institutions involved in the Project Implementation.

Unlike the first option, in this case the projects implementation is delegated to a specific **SMM-IWM Project Management Unit** responsible for the technical and financial executive management of the projects and sub-projects

The general scheme for institutional arrangement is presented below as Figure 3.

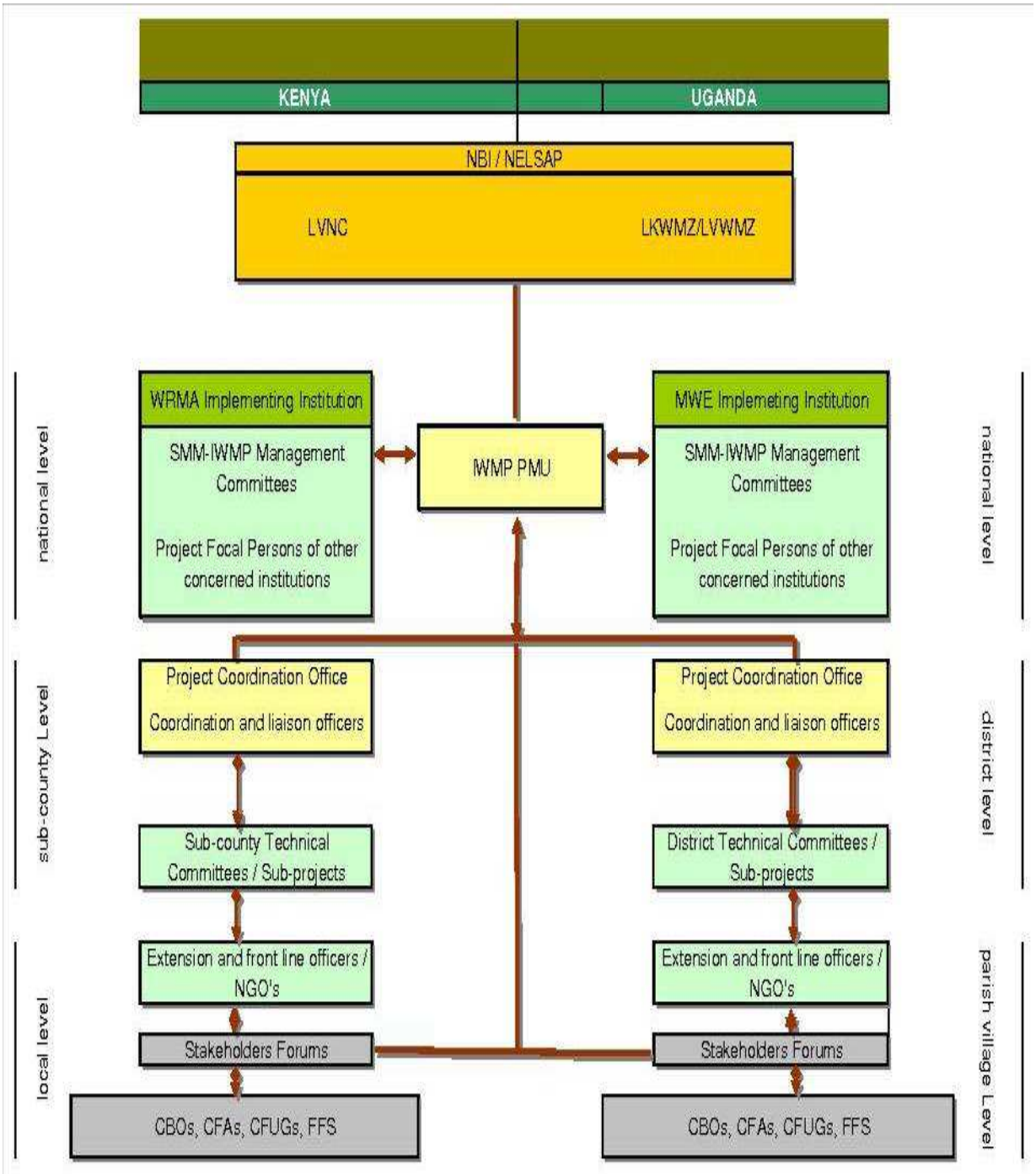


FIGURE 3: Organization Chart: Option 2

Transboundary coordination and agreement

In this option, the transboundary organization would be similar to the one in option 1 except that the role of the actual PMU of the SMM River Basin Project which would become a SMM-IWM Project Management Unit, ensuring the **planning, implementation and monitoring** of the activities.

District / Sub-county level

Based in the project area two coordination offices, responsible for liaising with IWMP PMU, will be hosted respectively by WRMA in Bungoma in Kenya and MWE in Tororo in Uganda, ensuring the sub-county/district coordination of activities in the Watershed.

These two offices will ensure the required level of coordination and harmonization of interventions in the area and with all concerned governmental line agencies representatives, gathered in a District**/sub/watershed technical committee**, responsible for coordination on field, in liaison with extension and front-line officers. The line agencies concerned by the different project components are indicated in the tables above.

Stakeholders interests

The **Watershed Management Stakeholder Forums** would also take place in this option to allow participation of stakeholders in the decision making process, at the level of both the SMM sub-basin, as well as in districts or SWUs where a number of IWM interventions are foreseen.

Farmer Field Schools (FFS)

FFS is described as a platform or 'School without walls' for improving decision making capacity of farming communities and stimulating local innovation mainly for sustainable agriculture, but that can be applied to any other activity proposed by the IWMP like soil conservation and erosion control, wetland management, afforestation, agroforestry.

It is a participatory approach to extension, whereby farmers are given opportunity to make a choice in the methods of production through discovery based approach.

A Field School is a Group Extension Method based on adult education methods. It is a "school without walls" that teaches basic agro-ecology and management skills that make farmers experts in their own farms.

Stakeholders Forum

Stakeholder's interests must be respected at different levels. A rather favourable practice of stakeholder involvement in planning activities has already been established in both partner countries. Kenyan WRUAs undertake joint planning of MCAPs with a strong stakeholder involvement. Sector related stakeholder forums are organized at district/division level for ongoing activities and upcoming issues. With the new structure of WMZ in Uganda, technical Management Committees as well as Stakeholder Forums are foreseen at Sub-catchment level. NBI has supported the creation of Nile Discourse Forums at national and regional level to provide a platform where opinions of the broader public can be brought forward.

At the scale of the watershed the IWMP should contribute linking upstream and downstream communities to better manage the river catchment as a whole. This will be accomplished through planning and financing of proposed interventions to be deployed under IWMP while incorporate cross-community concerns. The creation of a **Watershed Management Stakeholder Forums** in both partner countries at the level of the SMM sub-basin will help reinforce the stakeholder's commitment and link between upstream and downstream resource users.

5.5 Capacity building and projects Implementation at Community level

Depending on the projects, the approach for implementation of the projects through communities will be different. The main objective is to involve communities and generally local stakeholders in the decision process, planning, implementation on field and monitoring. Therefore the Capacity Building process will be mostly based on the **Farmer Field School** concept, with different types of associations included in these FFS according to the project or sub-project component proposed:

- For conservation agriculture component and agroforestry mainly implemented on private plots, the **Farmers Groups** will be targeted.
- For reforestation activities, intervention will be implemented directly with already existing, or newly created for the Project, **Community Forest Associations** (CFAs) or **Community Forest Users Groups** (CFUGs).
- For soil conservation and erosion control interventions, which may concern several private owners and communal lands, activities will be entrusted for implementation to a "**Soil Conservation Committee"** composed with stakeholders concerned by specific degraded areas
- For wetlands management, the creation of sound local institutional structures called **"Wetland Management Committees"** is proposed for implementation and subsequent management and maintenance of newly created assets. Those Groups or Committees will be composed of representatives of the main stakeholders and resource users and charged with management of wetland management units of about 25-30 km²; this size has indeed proved to be adequate in the Sio-Siteko project area.

CHAPTER 6.Outline of Investment Proposal

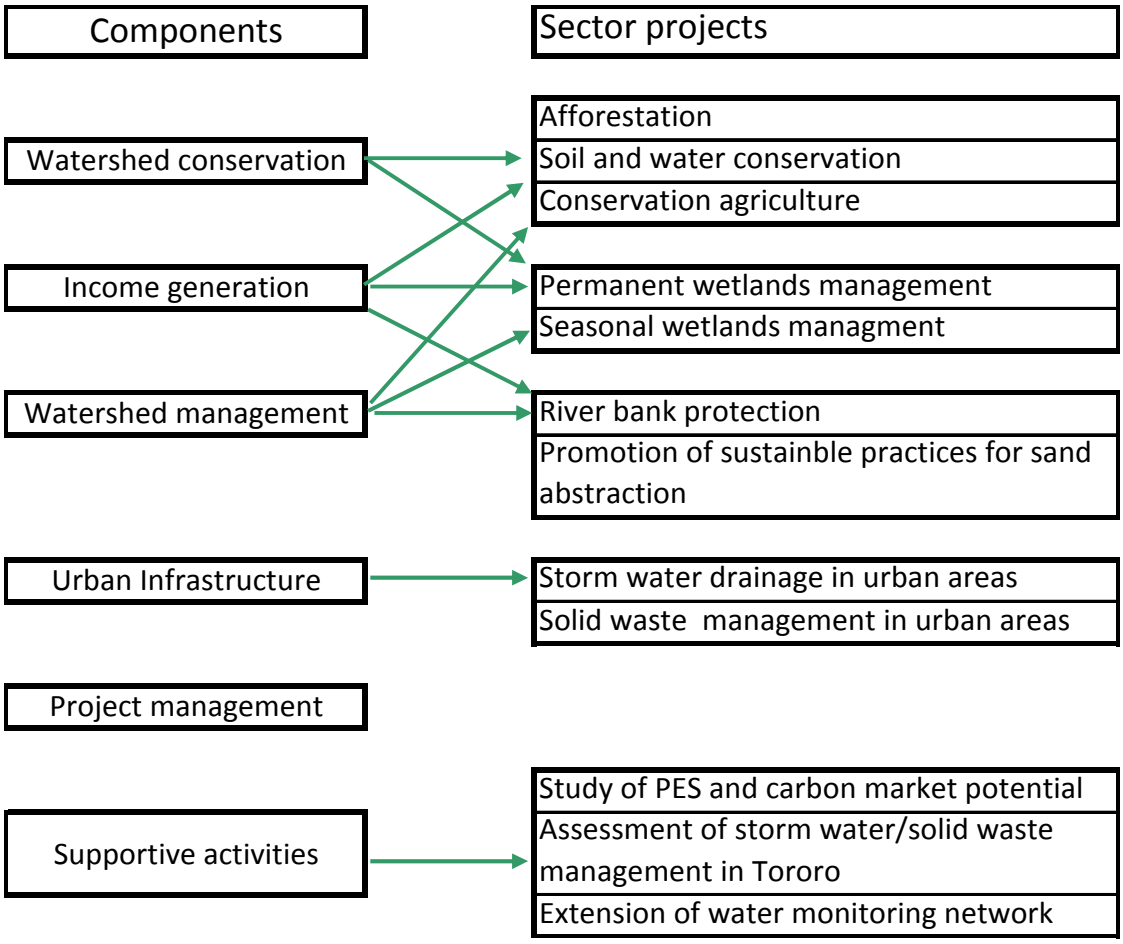
6.1 Components and Projects

The investment proposal is using an integrated watershed management approach and is built around three main components targeting each of them a specific line of intervention in the watershed; in addition, two more components and three supportive activities are included. The components are shortly described below, and the investment sector projects as well as their costs are detailed in Annexes 1 to 4.

Projects are sized for a first implementation phase of **five years.**

The figure below summarizes the main components and the related sector projects, as well as the proposed supportive activities.

Figure 4: IWMP Components and Sector Projects



The structure of the project is based on local projects giving a view to integrated watershed management through introduction of actions responding to the main issues identified in the

basin. To ensure support and effective participation of a maximum number of farmers and farmers' organisation, each local project must bring explicit and visible progress in the fields of:

- **watershed conservation**, environmental protection, mitigation of causes and effects of erosion, support to biodiversity
- **income generation** improvement, livelihood diversification, improvement of agricultural yields, support to access to market for the products and to micro-credit for individual or group initiatives, and
- improvement of the **watershed management** including social aspects, organisational strengthening and capacity building.

Because the projects will be scattered across the whole Sio-Malaba basin, and many similar activities will be repeated in different projects (for example: development of tree nurseries, or plantation of fruit orchards) the report presents them sorted by these three components, for what refers to Integrated Watershed Management *stricto sensu*. The other project components do not range along these three lines: investment in **Urban Infrastructures**, **Project management** and the supportive activities do not need to present a direct outcome towards each of the three components.

6.2 SMM-IWM Project Management

The Project Management Unit

The Project Management is proposed as a separate part of the investment covering the different components.

Separate cost estimation is reserved for the Project Management with a proposed implementation period of 5 years. Although depending of the institutional setting option chosen for the project implementation, the budget includes management costs at the national and transboundary level and the coordination offices in the SMM watershed.

The institutional framework for the PMU is described above in Section 5.1.

Costs for this item have been calculated on the following basis:

- Costs have been established conservatively, i.e. for the most expensive option presented as Option 2 in the Institutional Arrangement section. In case that Option 1 is retained, some costs (PMU staff and operation) will be decreased;
- The PMU is formed by a Project Manager with experts in Financial Management, Monitoring & Evaluation, Procurement?and GIS, with the necessary supporting staff;

- Two Coordination Offices are set up, one in each country, with one Coordinator (with watershed background for one, and wetlands management for the other), one liaison officer, one accountant and one GIS operator who may be contracted on a part-time basis (indicatively: half time), plus the required supporting staff;
- Vehicle running costs and office running costs have been estimated and included;
- All costs have been considered for a duration of 5 years.

Project Management Costs

Investment Project / sub-projects	Cost USD
IWRM Project Management	**USD 2,919,000**

6.3 Project Component No.1: Watershed Conservation

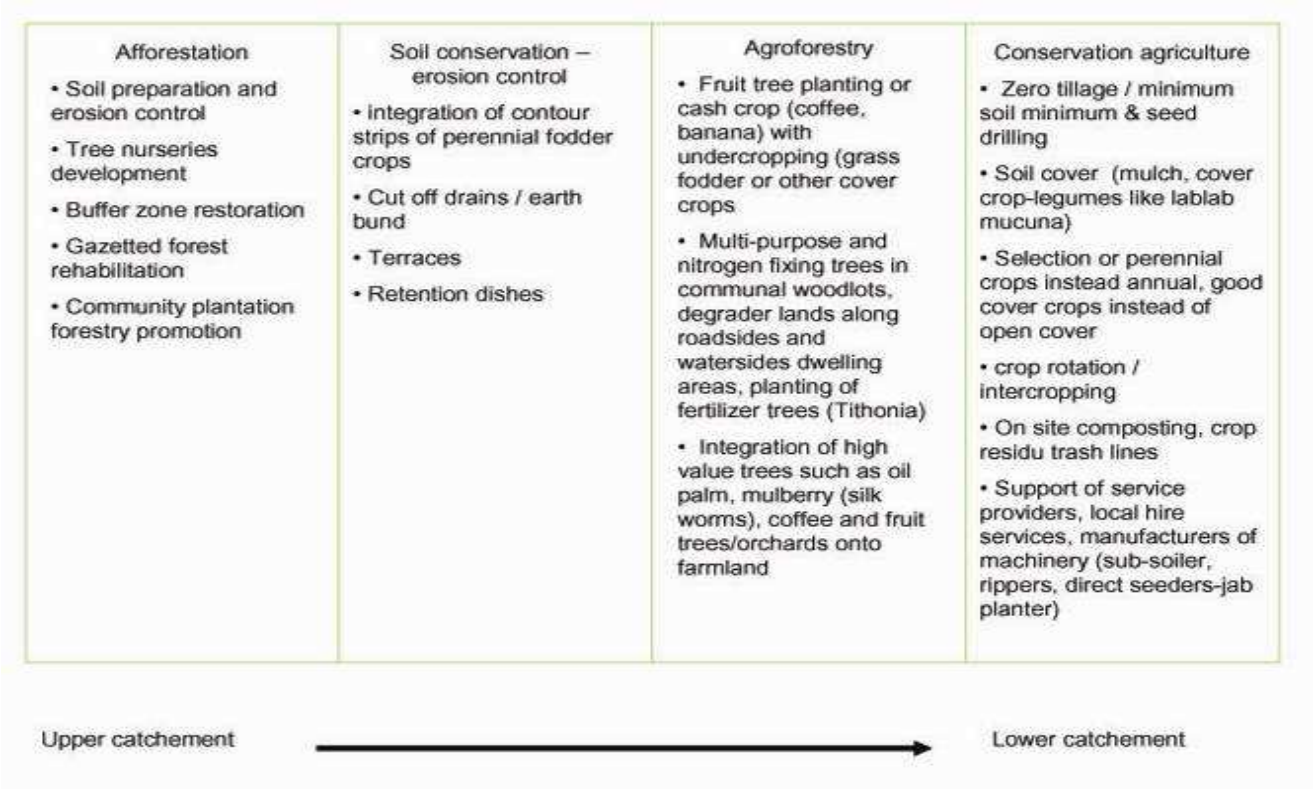
Component Summary

The focus of the Watershed Conservation component will be on actions that will have maximum impact on environmental protection. These actions need of course to be fully compatible with the focuses of the other two components: income generation and watershed management.

The proposed related projects involve activities aimed at reversing environmental degradation through soil improvement (replenishment of soil fertility, conservation of soil, conservation agriculture), enhanced biological diversity on farm and off farm and increased carbon storage.

The proposed sub-projects ensure that land use activities will avoid environmental degradation without compromising the ability for economic activity. These related activities and subprojects are part of an integrated watershed management for the area.

The main Watershed Conservation activities identified by the Consultant and validated through the rounds of consultation held with the stakeholders are indicated in the table below:



The development of Watershed Conservation involves considerable input from the community and key stakeholders; this aspect is dealt with in Section 6.5 below. Whereas the proposed projects will not address all the environmental issues, they are designed to encompass the range of key focus areas identified by the stakeholders, and to implement the larger scale actions required to address the more significant threats to the SMM basin.

It is stressed that the local sub-projects are proposed for different areas and different situations, which differ one from another in terms of erosion hazard, prevailing land use, land cover and land tenure – and also local cultural and social specificities. This means that different approaches and implementation strategies are followed which best suit prevailing conditions.

The Watershed Conservation component also includes the conservation of wetlands, both permanent and seasonal. The actions are designed to address the perceived misuse or degradation of wetlands in the Sio-Malaba-Malakisi (SMM) area. The focus of the Wetland Management Plan will be on activities that have maximum impact on watershed conservation and wetland functions as well as they are compatible with the components of Income Generation and Watershed management. The project under the Wetland Management Plan will be concerned with the two wetland categories:

- Seasonal floodplain wetlands: provide the best opportunities for wetland development in the form of improved livelihoods, as these are not fully encroached yet.

- Permanent wetlands: require a stronger emphasis on conservation because of their important ecological function in the SMM basin as a whole.

Project Component No.1 will contribute to the different sector activities listed above in Section 6.1 for the part directly aimed at Watershed conservation and presented in more details in Annexes to this report:

Cost estimates are made by sub-projects and are given in the respective following sections. Costs include a provision for Environmental and Social Monitoring, tentatively at 2.5% of the sum of other costs. The general cost estimate for Project Component n°1 is given below.

Sector projects	Cost USD
Afforestation/reforestation	**5 368 000**
Soil and Water Conservation and Agroforestry	**3 157 050**
Conservation agriculture	**693 750**
Wetlands Management	**1 379 600**
Riverbank restoration and protection	**1 714 200**
Project Component n°1: Catchment Conservation	**USD 1 2 312 600**

6.4 Project Component No.2: Income Generation

Project Summary

This Project Component is designed to address the aspects linked to improvement of income and generation of varied sources of livelihood through the actions at local level. This component is crucial because livelihood is the first priority for the inhabitants of the basin, and because the success of the whole programme depends on the support from stakeholders that, in turn, depends on the outcome of this component.

In this component, the focus of the watershed management and wetland management activities will be on actions that will benefit the farmers through provision of alternative livelihood activities and improvement of incomes and, at the same time, are likely to have maximum impact on watershed conservation and wetland functions as well.

Introduction of updated techniques in agricultural activities and recommendations on cash and food crops to be incorporated in the cropping pattern will be combined with advice on conservation of harvested products to decrease post-harvest losses, support on access to market with traditional and new products, and access to micro-credit as a support for initiatives for families or small groups of farmers. Activities led by women, in particular, will be given due support.

A loan fund for fish farm pond inputs, establishing of fish-farm integrated units and fruit orchard commercial enhancement is integrated in the budget.

Project Costs

For each Project Component, costs have been calculated for the relevant Sector Projects, and are summarized in the table below. Costs have been rounded to the nearest 50 USD.

Sector projects	Cost USD
Afforestation/reforestation	**1 213 250**
Soil and Water Conservation and Agroforestry	**2 306 900**
Conservation agriculture	**1 557 750**
Wetlands Management	**2 638 600**
Project Component n°2 – Income Generation	**USD 7 716 500**

6.5 Project Component No.3: Watershed Management

Sustainability of the outcomes of the watershed conservation and income generation components depends heavily on improved management process, at all levels and primarily at local level (village, community…). This is why the Management aspects are grouped in a separate component.

In general terms, the actions involved in this component do not require heavy budgets, but they need a smooth management of the funds, including transparency, flexibility and demand-responsiveness.

Sector projects	Cost USD
Afforestation/reforestation	**1 176 200**
Soil and Water Conservation and Agroforestry	**3 329 550**
Conservation agriculture	**2 355 350**
Wetlands Management	**2 689 100**
Riverbank restoration and protection	**425 400**
Promotion of sustainable practices for sand abstraction	**200 000**
Urban Infrastructures (ESMF part only)	**150 600**
Project Component n°3 – Watershed Management	**USD 10 326 200**

6.6 Project Component No.4: Urban Infrastructures

Storm Water Drainage Master Plan for Bungoma

Summary of the sub-project

Bungoma Town drainage problems have compounded primarily due to continued rapid growth, lack of funding for maintenance, rehabilitation of the existing infrastructure and construction of the new drainage system. In addition, the lack of any designed system has contributed to the flooding problems in the Municipality. Most of the drainage channels have developed over a period of time from the natural path taken by the storm water.

The Master Plan addresses the assessment of the performance of existing drainage system, and outlines strategies for storm water management. It provides a long term management plan for the storm water management strategies which minimize problems associated with flooding while ensuring that water quality and pollution control in Khalaba and Sio Rivers is maintained to acceptable standards. The plan will help the municipality manage storm water resources and identify, evaluate, improve the existing drainage infrastructure and provide a future plan for the expansion of the drainage systems in line with the Municipality's growth. This Master plan is developed in line with the challenges the Municipal Council is facing in managing storm water in its area of jurisdiction.

The mandate of the management of storm water is under the Ministry of Local Government and by extension the Bungoma Municipal Council. Bungoma Municipal Council will therefore be

responsible for overseeing the operation, routine maintenance and rehabilitation of all Storm Water facilities in both Central Business District and the outlying Wards. It shall establish performance standards, clearly describing the Storm Water facilities, and explain how each facility is intended to function and operate over time governed by the laws, regulations and Acts of Parliament of the Republic of Kenya that directly and indirectly touch on drainage aspects.

Sub-project Costs

Investment Project / sub-projects	Cost USD
SWD-MP Bungoma	**USD 2,966,000**

Storm Water Drainage Master Plan for Lwakhaka- Kenya/ Lwakhaka - Uganda

Summary of the sub-project

The mandate of the management of storm water in Lwakhaka- Kenya is under the Ministry of Local Government and by extension the Bungoma County Council. Limited drainage channels are available within the Kenyan side of the town. All the drainage channels on the Kenyan side have developed over a period of time from the natural path taken by the storm water with the exception of the main drainage channel that runs alongside the main road towards the border crossing and the river.

On the Ugandan side, the Lwakhakha Town Council is responsible for the management of storm water. The town boosts of a fairly elaborate drainage system consisting of both lined and unlined channels that is well maintained.

Solution to the issue of storm water drainage cannot be addressed separately by the authorities on each side of the border, because problems are linked within the transborder urban area. It has then been found necessary to establish one sub-project including both Lwakhakha Kenya and Lwakhakha Uganda.

Both Lwakhakha towns are lacking a comprehensive overview of the situation as a Physical Development Plan for the two twin towns is lacking at this stage. Therefore, an outline for storm water drainage is prepared as a general guideline from which the town can prepare a Master Plan and implement both short and long term development plans.

Sub-project Costs

Investment Project / sub-projects	Cost USD
SWD-MP Lwakhakha Kenya & Uganda	**USD 242,000**

Solid Waste Management Master Plan for Bungoma

Summary of the sub-project

The rapid increase in population has resulted in the increase in solid waste generation rate which is estimated at 28 tons/day based on the core urban population whereas about 13 tons/day is generated from the peri-urban areas of the municipality. About 80% of the present waste generation in the core urban areas of Bungoma Municipality is left uncollected or illegally dumped within the town, while the remaining 20% is carried to the final disposal site daily. The site is an open dumpsite and this, therefore, has a detrimental effect on the surrounding environment. The dumpsite is located within the catchment of Sio River which originates from wetlands west of Bungoma town and eventually drains into Lake Victoria. Since this situation is an eminent risk on the environmental, health, hygiene and aesthetic conditions of the people of Bungoma town, solid waste management is an issue requiring urgent intervention.

The Integrated solid waste management initiative seeks to maximize resource use efficiency by taking a strategic approach to the sustainable management of solid waste considering all aspects including sources of wastes as well as all stages namely generation, segregation, sorting, treatment, recovery and disposal in an integrated manner.

Solid waste management study in the Municipal Council of Bungoma included evaluating aspects of waste characterization, environmental and health impacts and solid waste management systems. The waste characterization includes the determination of quantities of waste generated and the generation rates in relation to the collection and transportation services within the municipality. Waste management system on the other hand highlights the gaps in institutional framework, legal and policy framework, financing mechanisms, waste management technologies and the stakeholders' participation in solid waste management in Bungoma Municipality. The evaluation of environmental and health impacts of solid waste management was based on literature review citing areas under similar conditions. The proposed solid waste management strategies were determined through consultations between the study team and officials from the Municipal Council of Bungoma.

Sub-project Costs

Investment Project / sub-projects	Cost USD
SWD-PM Bungoma	**USD 2,090,000**

Solid Waste Management Master Plan for Lwakhaka-Uganda

Summary of the sub-project

Solid waste is emerging as a challenge to public health and environmental concern in Lwakhakha town Council. The town has a total population of about 13,000 persons according to the 2002 population census. The rapid increase of population in the town centre has resulted in an increase in solid waste generation rate which is estimated at 3 tons/day. Many studies in developing countries indicate that about 50% of solid waste generated in urban areas is not collected nor properly dumped off hence causing widespread indiscriminate dumping.

Lwakhakha town council was responsible of handling and delivering all waste management services in Lwakhakha town, but it emerged that waste management services are nonexistent in the town and the only solid waste management services were the collection of wastes from the street cleansing. Even though the services are not regular and the town council has no proper designated solid waste disposal point the waste is indiscriminately dumped and burned by the local residents. The current waste disposal sites are less than 1000m from the residential, commercial and water source, notably Lwakhaka river, being conflicting with Ugandan environmental provisions.

Prevailing land ownership conditions made it impossible for the County council to acquire a waste disposal site. In addition, the council is both understaffed and under financed to effectively manage the wastes making it cumbersome to have the necessary equipments for solid waste management. This in part has been attributed to the council being relatively new and the town council has other more pressing needs than solid waste management.

Most of the waste generated is organic and recycling as compost can reduce waste volumes significantly, if the inorganic and organic components were not mixed.

The council has a new market which is expected to generate waste that will require regular disposal services. This waste will be better managed if the council will have the necessary tools and equipments.

The solid waste management study has proposed an investment plan for Lwakhaka town council which was determined through consultations between the study team and officials from the council based on the existing situation.

Sub-project Costs

Note that the figures below refer to the costs for solid waste management over 5 years

Investment Project / sub-projects	Cost USD
SWM-PM Lwakhakha Uganda	**USD 737,000**

Solid Waste Management Master Plan for Lwakhaka Kenya

Summary of the sub-project

Solid waste is emerging as a major public health and environmental concern in Lwakhaka Market Centre. Lwakhaka has a population of about 1000 persons and the rapid increase of population in the market centre has resulted in an increase in solid waste generation rate which is estimated at 0.7 tons / day.

Bungoma County council is responsible of handling and delivering all waste management services in Lwakhaka, but waste management services are actually non-existent in Lwakhaka and the only solid waste management services are the collection of wastes from the Banana Market. The county council has no proper designated solid waste disposal point, the waste is indiscriminately dumped and burned by the local residents. It was also observed that some of the current waste disposal points are along river Lwakhaka. Waste collected at the banana Market is dumped on people's farms on request and this highlights the need to acquire land for waste disposal facilities in Lwakhaka.

Most of the waste generated is organic and recycling as compost could reduce waste volumes significantly, if the inorganic and organic components were not mixed.

The council has no solid waste management staff in the market centre while at the same time there is a proposal to build a new market which is expected to generate waste that will require regular disposal services.

The solid waste management study in Lwakhaka included evaluating aspects of waste characterization, environmental and health impacts as well as solid waste management systems. The waste will only be better managed if the council will have the necessary tools and equipment.

An investment plan for Lwakhaka market centre has been formulated through consultations between the study team and officials from the council.

Sub-project Costs

Investment Project / sub-projects	Cost USD
SWM-PM Lwakhakha Kenya	**USD 359,000**

6.7 Additional Investment Proposal: Supportive Activities

The project related to supportive activities comprises the 3 following components:

Component A: Study of PES potential, carbon market and REED funds

- Investigate potentialities for development and access to PES, carbon market and REED funds;
- Training sessions, workshops and production and dissemination of technical and communication support

Component B: Rapid Assessment of storm water/solid waste management in Tororo

Component C: Extension of Water Monitoring Network

- Monitoring of river levels and velocity measurements
- Monitoring of sediment transport at river measuring stations
- Monitoring of water quality (organic and chemical parameters)
- Campaigns for river parameters assessment at key model nodes (outlets of the subwaterhed units) for M&E of the Project

Supportive activity Costs *

Investment Project / Supportive activity	Cost USD
Sub-project A - Study of PES potential	**USD 30,000**
Sub-project B - Rapid Assessment of SWD and SWM in Tororo	**USD 25,000**
Sub-project C - Extension of Water Monitoring Network	**USD 200,000**
Additional Investment Project : Supportive activities	**USD 255,000**

6.8 Total cost of the IWMP proposal

The total budget for the Integrated Watershed Management and Investment Project is summarized below.

Project Component	Cost
Watershed Conservation	USD 12 312 620
Income Generation	USD 7 716 520
Watershed Management	USD 10 335 490
Urban Infrastructure	USD 6 394 000
Project Management	USD 2,919,000
TOTAL IWMP	**USD 39 677 620**

CHAPTER 7.Monitoring and Evaluation System

7.1 General process for M&E

A monitoring and evaluation (M&E) system will be established to serve as a tool to control and manage the program effectively. Used as an integrated reflection and communication system within the Project, it must be planned, managed and resourced.

The objective of M&E is to provide reliable and timely information on the implementation of the program and facilitate decision making to guide the program to improve its impact on beneficiaries.

7.2 Concepts for M&E indicators

The M&E system proposed for the SMM-IWMP is based on impact indicators and outcome indicators.

According to IFAD (2002), “impact” in the frame of M&E is defined as changes – positive or negative, intended or unintended – in the lives of the rural people as they and their partners perceive, as well as sustainable enhancing change in their environment, to which the Project has contributed.

Impact could be used to the highest goal-level achievements of a project such as improved food security and increased household income; but any significant effect on poverty takes several years to emerge, and frequently longer than most Project activities.

Accordingly indicators of Project’s impact must refer to a wide range of changes that help reduce poverty, protect or improve environment. For example adoption of improved farming techniques is an important intermediate impact. Local ownership and building capacity are also important impact that encourages self-management for development among the poor. So is the reduction of vulnerability and participation in decision making process.

On the contrary, outcome indicators reflect how well the Project has been implemented and how the immediate actions have been correctly completed – without any consideration to the real effect of the actions on resolution of initial issues.

These indicators are detailed in the log frame presented below. This proposed logframe which is the tool for planning, monitoring and evaluation activities should be reviewed in the first year of implementation of the program and adapted to the needs of the beneficiaries. At this time it will be set up with a participatory approach involving various project stakeholders. Involve

stakeholders and beneficiaries in reflecting critically, builds stakeholder's understanding and ownership about the Project and starts creating a learning environment.

It will thus be enriched with new impact indicators and/or results allowing stakeholders to better understand the monitoring and evaluation of outcomes and impacts of the Program.

A set of studies, surveys and evaluations are planned to enable the Programme to inform the different indicators (baseline survey, mid-term assessments and final program, thematic surveys, self-assessment sessions, tracking accounts farms, etc.).

District technical officers, extension staff and additional NGO's staff recruited for the implementation of some activities will be required to provide the PMU's M&E officer reports quarterly and annually on activities under their responsibility.

The PMU's M&E officer will consolidate these reports into semi-annual and annual presentations and analysis of program results (incorporating financial monitoring information and activities under the PMU) which will be forwarded to the SMM-IWMP implementing agencies, transboundary organizations and cooperatives institutions.

These reports will incorporate the results of Environmental and social Performance Assessment (EPA) (*see ESMF* annex 4) of the projects and sub-projects.

A mid-term and a final external audit will be undertaken by an independent consultant. Evaluations will be based on participatory methods, where representatives of all categories of stakeholders will have the opportunity to express themselves.

The logical framework below proposes some possible indicators for project performance evaluation.

7.3 Logical Framework

This logical framework has been established to prepare for monitoring and evaluation of the program progress keeping the focus on the different components, detailing part of the activities involved in these components and proposing indicators and sources of verification whenever possible.

Table 11: Logical Framework for Sio-Malaba-Malakisi Watershed Development Program

Results Hierarchy	Verifiable Indicators	Means of Verification	Assumptions
Goal			
Reduced poverty among the communities of the Sio-Malaba-Malakisi river watersheds.	Number of village HHs living below the poverty line reduced	Official statistics Baseline and impact assessment studies	Both Governments of Kenya and Uganda maintains and pursues pro-poor policies. No extreme economic or climatic shocks.
Development Objective			
Improved livelihood and natural resources management in the Sio-Malaba-Malakisi watershed.	• Increase in vegetative cover in treated micro-catchments, three years after project completion (include tree survival rate). • Improved livelihood for participating families (nutrition, income, reduced workload). • Reduction in governments' expenditures on rehabilitation of public works damaged due to floods and landslides.	• GIS–based data collection on land use and land cover including photos. • Socio-economic survey including financial income, nutritional income and women workload as indicators. • District financial records.	Existing forestry and natural resource policies for Kenya and Uganda are sustained & enforced.
Components/Outcomes			
1	**Investments in Environment and Natural Resources Protection**		
	Rehabilitation of soil and vegetation • Soil erosion reduced. • Vegetative/forest cover increased • Improvements in farmland and grazing land. Conservation of wetlands	• Reduction in sediment load from selected micro catchments (MC) • Reduction in erosion from treated areas • Increase in vegetation cover in rangelands • Arrested decrease in permanent wetland areas and in seasonal flood plains	• Sediment traps. • Erosion field plots. • Vegetation field plots. • Districts records.	Physical conditions (soil, rainfall) and management practices (firewood collection, livestock rearing) adequate for soil and vegetation rehabilitation

2	**Investments in Improved Livelihood**			
	Diversified and more efficient use of energy. • Fuel wood consumption reduced. • Energy saving technologies adopted Improved agricultural productivity. • Output from horticulture, fruit orchards, forage and field crops increased. • Increased access to irrigation for horticulture/agriculture, forage and orchards).	• Reduction in annual HH fuel wood use. • Increase in number of HH using renewable technologies. • Increase in rainfed crop production and yields per ha. • Increase in overall value for irrigated crop. • Increase of number of households with access to irrigation.	• Districts records	
3	**Investment in Natural Resources Management**			
	Environmental awareness enhanced in MC communities. Modalities for participatory & sustainable natural resource management operational.	• Agreement among villagers in targeted micro catchment areas on MC management plans. • Consensus in planning and management decision-making is reached through participatory processes with equal gender representation and inclusion of vulnerable groups.	• Districts records. • Baseline survey. • Impact assessment. • Meeting attendance and minutes	• Awareness raising effective • Existing village structures for decision making allows for the establishing effective modalities for NR co-management.
4	**Investments in Pollution Control Infrastructure in Urban Areas**			
	Stormwater and solid waste management infrastructure assets in Bungoma and Lwakhakha improved, and under study for Busia and Malaba.	• Infrastructure constructed, maintained and operational • Reduction in pollution levels of water bodies • Direct project beneficiaries, of which 20% female, involved in implementation.	• Municipal records • Water analysis	

	Outputs			
1	**Investments in Environment and Natural Resources Protection**			
	• Soil conservation works (4000 ha). • Forest rehabilitation and afforestation (4000 ha). • Community-owned tree nurseries completed (20). • Erosion measurement field trials installed (10).	• Soil conservation investments effective. • Forests rehabilitated (% increase vegetation cover), afforestation (number of trees/survival rate). • Rangelands rehabilitated (ha. and % increase in vegetation cover): • Public nursery developed (production increase). • Erosion field plots and gully erosion (stick measurement) operational and participatory.	• Erosion/sediment measurement. • Audits. • Data collected for river and sediment discharge at hydrologic stations.	• Both countries pursue best practices for NRM and erosion control • Effective collaboration in operation and data handling • Basin Communities willing to invest in natural resource management.
2	**Investments in Improved Livelihood**			
	• Demonstrations and farmer training events (400). • Farmer exposure visits (100). • Improved rice production (400 ha). • Improved forage crops (200 ha). • Improved horticultural production (200 ha) including 80 ha of new fruit orchards. • Water storage ponds rehabilitated and related irrigation canals built (20). • Fishponds constructed and stocked (100ha) • Energy saving stoves installed (2000 hh's) • Activity starting in new income sources: bee keeping, handicraft, ecotourism at private level (20 individuals or groups)	• Demonstration and farmer training program conducted (number of participants). • Farmer exposure visits carried out (number of participants). • Sustained increase in grain yields • Increase in forage crop production • Increase in horticultural production • Water storage ponds functioning (increase in water collection); • Increase in number of fish ponds • Increase in crop yield and value from irrigated land • Energy saving technologies reducing fuel consumption.	• Supervision reports. • District records. • Audits. • Number of trees in orchards and survival rate (records). • Agricultural production records. • Number of seedlings produced/ revenues. • Sales record for fuel-saving stoves • Fuel consumption (record/ survey).	• Village communities interested in participating in training/exposure. • Sufficient land available for pioneering in new technologies. • Basin Communities ready to attempt and adopt new technologies • Basin Communities are active and interested in irrigated agriculture

3	**Investment in Natural Resources Management**			
	• NRM awareness raised in Micro catchment communities. • MC plans produced with operational modalities for participation (20). • Staff of GOK and GOU trained in participative approach to NR and socio-environmental management • Capacity building and workshops for FFS and community leaders on: NR economics; carbon sequestration; energy efficiency and alternative energy sources	• Percentage of villagers in MC area taking part in preparing MC plans. • Selected elements in the MC plans are NRM oriented. • Numbers of plans produced (pro-poor/gender sensitive/ participative). • Number of Technical Assistance contracts, workshops and training. • Districts staff and Technical teams' attendance and results.	• Supervision reports. • Districts records. • Audits. • Post training test & evaluation charts.	• Procurement systems in place and functioning. • Sufficient Government counterpart funds available in a timely manner. • No community segment excluded from participating. • Beneficiaries accept terms of cost sharing. • Communities willing to participate in natural resource management.
4	**Investments in Pollution Control Infrastructure in Urban Areas**			
	• Bungoma Pollution Control Infrastructure implemented • Lwakhakha Cross Border Pollution Control Infrastructure implemented • Busia Cross Border Pollution Control Infrastructure designed and agreed upon • Malaba Cross Border Pollution Control Infrastructure designed and agreed upon	• Infrastructure subprojects completed on time according to agreed quality and with maintenance arrangements in place (percent). • EMPs and RAPs are implemented in a timely manner. • 80% People in Bungoma and Lwakhakha Urban Councils protected from periodic flooding • 80% Area of Bungoma and Lwakhakha Urban Councils covered by drainage system • 80% People in Bungoma and Lwakhakha urban areas provided with access to regular solid waste collection under the project • Projects for Busia and Malaba established and support for their implementation from Urban Councils and other local bodies ensured	• Town/Municipal Council reports • M&E Reports • Physical infrastructure construction reports • Environmental Audit Reports • Reports for Busia and Malaba ready for funding and implementation	• Affected stakeholders, if any, agree to be resettled • National/Local Governments have sufficient resources allocated for pollution control investment projects; • Development partners committed and willing to support pollution control infrastructure development in the SMM Basin

5	**Project Management and Coordination**			
	• Effective project management with timely monitoring and evaluation	• Project implemented according to schedule; • Timeliness in submission of performance and financial reports; • Signed minutes of governance meetings; • Audit, Monitoring and evaluation reports. • Country level stakeholders involved in project activities	• Project completion reports • Progress reports • Meetings reports • Annual audit reports	• Continued country and development partners support. • Continued sustained funding of project activities. • PMU adequately staffed with permanent members • Political stability prevails within the basin

CHAPTER 8.Economic and Socio-Environmental Analysis

8.1 Methodology

The analysis of the costs and benefits of a project aims to evaluate the economic rationality of a possible investment decision. Cost-Benefit Analysis (CBA) is basically a decision-making tool that has been widely applied in project evaluation. CBA is carried out from a perspective of 'with' or 'without project' comparison to capture net incremental benefits that arise from implementation of a project or activity. In this particular case, the 'with project' is with the IWMP to be implemented in the watershed while 'without project' will be the 'status quo' scenario where the IWMP is not implemented.

It is important to note that depending on the perspective from which it is carried out, CBA can take two forms: financial or economic.

The technical structures of the two models are very similar but there are two fundamental differences between them: firstly, the kind of costs and benefits that are included and, secondly, how cost and benefits are quantified.

- Financial CBA is carried out from the perspective of an individual stakeholder e.g. the local communities and market prices are applied for valuing costs and benefits. At the firm or household level, a financial analysis can be undertaken.
- Economic CBA is carried out from a societal point of view and costs and benefits are valued at their shadow values at a regional or national level.

The project doesn't lend itself easily to classic economic CBA, and financial analysis because most of the expected benefits can hardly be precisely quantified in monetary terms.

The demand driven nature of investments also leaves undetermined the specific investments that will be made under the project, thereby making difficult any rigourous estimation of costs and benefits for the entire project. It is possible however with reasonable assumptions, to assess the profitability of the various types of investments that are likely to be made under the project.

Given the difficulty of quantifying certain interventions, the analysis has been confined to a sub-set of activities, namely the profitability of various agricultural or forestry enterprises in which the communities and farmers groups are likely to invest in through adoption of sustainable soil fertility and land management technologies. Two types of analysis have been then carried out:

- A financial cost-benefit analysis to assess profitability of some of the technologies or alternative livelihoods introduced at the farm level, mainly for private financial benefits;
- A social and environmental cost-benefit analysis for other sub-projects for hardly quantified benefits.

8.2 Basic Concepts

The particular case of the SMM Watershed Management Project makes it necessary to put the economic and socio-environmental analysis back into its context, as a project preparing for a programme of actions, aimed at environmental protection, poverty reduction and sustainable management, and proposing actions of very diverse nature. These different components will need to be analysed from different points of view, because:

- Component 1: Watershed Conservation aims essentially at medium and long term benefits through improvement of environmental conditions;
- Component 2: Income Generation is directed towards quick economic results to fight poverty and to ensure farmers support to the other components;
- Component 3: Watershed Management intends to set the bases for sustainability of Watershed Conservation and Income Generation activities, but by itself it is not supposed to create quantifiable benefits;
- Component 4: Urban Infrastructures is expected to generate significant environmental and social positive impact, but most of the benefits can hardly be assessed in financial or economic terms;
- Project Management bears costs with no corresponding benefits at catchment level;
- This is why it appeared more relevant to evaluate benefits through the sector projects, which contain activities responding to the different components.

The way the analysis is realized needs to take into account these different situations for the projects and sub-projects.

To understand the economic and financial analysis, it is necessary to admit that the type of actions from the different levels and their costs are highly dissimilar:

- Costs attributed to the Project funds are spread over the basins area, in a series of local applications of the sector projects pursuing the three components; it is not intended to concentrate in one area, so that local projects will not be capital-intensive;
- A large part of the project input, in terms of cost, is formed by work force of the local farmers. This work force is not supposed to be increased or decreased because of Project implementation, but to be re-oriented and supported towards more effective methods and practices for results in the short and long term. In an overall analysis, this work force cannot be accounted for, only the results in terms of production can;
- Other intermediate consumption items are usually incorporated in the analysis ("analysis of effects") such as water, fertilizers, pesticides… Here again, the central focus of the project on sustainable development led to an emphasis on avoiding high uses of these inputs: they will not be incorporated in the analysis.

These different elements led to evaluation results which are not very frequent in development projects: profitability is very high. Developing good value forest with early income from agroforestry, or changing from traditional crops to new ones with better sales prospect, can give good economic results with low investment: limited capital investment, and use of the existing manpower. This is why in most cases calculation of EIRR has not been done because it was not possible (no balance of initial losses with further benefits) and only NPV has been provided.

8.3 Financial analysis

The financial CBA of this project should be carried out from the perspective of the local communities and be based at the household level. It considers costs that households incur and the benefits they obtain from the project, valued at the local market prices. Some of the most important benefits that local people will obtain from the project would include:

- Increased agricultural production
- Improved agricultural product marketing and prices
- Improved efficiency and effectiveness in fertilizer use and thereby reduced fertilizer requirement
- Improved incomes from livelihood diversification
- Employment creation from the project

Local people also face several categories of costs in the implementation of the project. Chief amongst these is the reallocation of resources. These costs consist of labour costs, transaction costs (mainly bargain and information search costs between buyers and sellers

of products), conservation agriculture costs (mainly time spent on the project), and access fees paid to authorities when marketing outputs.

Local people generally have a higher discount rate than the wider society, especially because the benefits directly accrue to them today and the future is uncertain.

8.4 Economic Analysis

The analysis of costs and benefits of the different projects and sub-projects shows in general terms a very high ratio of profitability, for the following reasons among others:

- Costs are directed to soft or preparatory activities: supporting consultancies, capacity building, creation of nurseries… and not in heavy construction works;
- No long preparatory process are involved such as land acquisition, resettlement, major civil works, so that benefits can begin early;
- An important part of the works costs will be apported by the resident farmers, who will be at the end the first beneficiaries of the project, under the form of unskilled/low skilled labour.

Two different analyses were performed, both of them with a 20 years horizon:

- one ("Stakeholder analysis") comparing the costs and the earnings at plot level; calculations were made for a unit plot of one ha or for one Wetland Management Unit, and then extrapolated for the full project development;
- the other one ("Project analysis") comparing the Project investment over 5 years against the total benefits of the corresponding project/sub-project along 20 years.

In these analyses, only the main expected results have been taken into account. It is expected that other livelihood initiatives will add up to these, and lead to a better result with improved income for many inhabitants. The revolving funds prepared within the different sub-projects should also support these initiatives to develop unaccounted for activities: handicraft, medicinal plants, ecotourism… The Capacity Building effort will participate in encouraging endeavours in those areas.

Additional benefits deriving from social and environmental impact are presented in more detail in Section 8.5 below.

The synthetic results of the "Project analysis" process are shown in the Table below, whereas more details are given in Annex 5 IWM Investment Project (figures in USD '000):

Table 12: Cost-benefit results

Sector project	Investment Costs	Benefits (NPV @12%)	Benefits/Costs
Afforestation	7 757	19 246.00	2.48
Soil & Water conservation / Agroforestry	8 793	166 249.00	19.4
Conservation Agriculture	4 607	84 386.00	18.8
Integrated Wetland Management	6 707	18 899.00	2.89

8.5 Social/environment Analysis

The project, as designed, is inherently an environmental project. It is designed to protect water quality, improve land management, reduce erosion and degradation, and improve livelihoods. Thus it addresses all aspects of the environment: ecological, social and economic.

The project expects to intervene across the whole watershed allows meaningful beneficial changes at a landscape scale, rather than localised impacts. This should be especially beneficial for habitats and biodiversity, as well as for management of soil erosion and water quality, at least in terms of turbidity and sediment load.

Besides, the main activities to be pursued under the project, such as, conservation agriculture, afforestation, agroforestry and wetlands management, riverbank restoration make it an effective instrument to mitigate climate change through carbon sequestration, enhance biodiversity conservation on- and off-farm, and reduce sediment loading in waterways.

Community involvement is a key aspect of proposed project, which seeks to bring lasting improvements in the livelihoods of people that in turn could lead to better use and protection of natural resources.

Improved social and economic conditions may be expected to have a positive feedback on the environment. Indeed, communities which are socially and financially secure are better able to sustainably manage their environment without over-exploiting the environment for survival.

Overall, the environmental impact of the project is expected to be positive. The potential increased use of pesticides is the sole significant environmental issue that needs to be carefully managed in the frame of changes of agricultural practices.

The following analysis highlights environmental and social externality benefits that should considered in addition to the economic benefits: such as benefits arising from carbon sequestration, biodiversity and reduction in sediment loading into water catchments and into Lake Victoria and Lake Kyoga.

Biodiversity, Natural habitats and Wildlife

The Project will contribute to stabilize or decrease forest degradation process and improve forest status and coverage, wildlife habitats and corridors, particularly in the upper watershed

As such, habitats will be improved for a range of wildlife, both plants and micro- and meso-fauna. However, caution is required that these gains not be offset by increased use of agro-chemicals, especially the use of herbicides, fungicides and pesticides that are inherent in no-till approaches. In principle, properly applied, conservation agriculture should improve weed control, reducing the need for herbicides. Farmers, however, may be slow to fully adopt the system, especially when faced with 'available' forage for feeding livestock. This will be mitigated to some degree by the efforts within the project to increase forage cover crops throughout the farming system, including under coffee and as the basis for soil and water conservation measures.

The better protection and restoration of riverbanks will decrease sediment load in the river and also allow development of diversified riverine vegetation potential habitats, nesting, breeding and feeding sites for aquatic fauna.

Afforestation mainly in the upper catchment and development of agroforestry in the whole area while fighting against erosion will improve income for population, through wood availability but also numerous other non timber products.

The project will also target improvements in the state of wetlands and other critical habitats,

Potential biodiversity benefits from the project can be measured through:

- additional wildlife (plants and animals) extraction benefits that would accrue to households in the project area, as a result of the project;
- wildlife stock accumulation benefits in natural habitats, that would accrue as a result of the project, with estimation based on the stock value of endangered or threatened wildlife species;
- the change in long-term livelihood sustainability or disaster mitigation benefits of biodiversity for food, fiber and human health.

Erosion control, Soil fertility and Water quality

The on-farm interventions proposed, when fully implemented, will decrease soil erosion, improve soil condition both for plant growth and for soil organisms, and increase overall vegetative development and crop productivity, above and below ground carbon sequestration while simultaneously reducing erosion and harmful agricultural runoff into waterways.

The protection and restoration of forests, and dissemination of agroforestry practices will increase carbon sequestration, reduce soil erosion and maintain hydrological cycles thereby having a positive effect on both climate change and downstream land and water users.

Because the combined flows of the Malaba and Malakisi provide about 10% only of the drainage to the lake Kyoga and the Sio river provides 1,5 % of the drainage to Lake Victoria, the intervention on the watershed is unlikely to generate any significant decline in sediment loading that would have a perceptible impact on the global water quality of the Lakes. Nevertheless, the project's activities and particularly those resulting in planting of trees on degraded lands would improve water quality in the catchments where the project is located. I

Potential benefits in terms of water quality from the project can be measured through:

- Decrease of sediment load in the rivers; estimation has been made to potentially reach a decrease of 30 % of the current level of sediments in the watercourses
- Decrease of costs for water purification and hydraulic infrastructure maintenance (for example reduction of silting)

Potential benefits in terms of erosion control and soil fertility from the project can be measured through:

- Conservation of agricultural lands available for agricultural production (crop and agroforestry)
- Improvement of soil fertility and crop yields

Ecosystem Services and Climate change

The project can contribute to incorporate global environmental benefits into local development priorities. Indeed the inclusion of environmental service functions (such as the erosion control provided by reforestation or the conservation of wetlands by a better valorisation of the wetland's products and resources) into project activities would generate a greater development impact by increasing agricultural sustainability and output.

Besides, environmental services, particularly those associated with carbon sequestration also have the potential to generate new types of assets that benefit local communities.

In terms of Climate Change the project's benefits are both in terms of Mitigation and Adaptation.

Mitigation: Although an important factor in reducing global levels of Greenhouse Gases (GHG), the potential for carbon sequestration is generally ignored at national and local levels in developing countries.

Integrated ecosystem management approaches will draw on agroforestry and other land management techniques that also deliver benefits in the area of carbon sequestration. The IPCC estimates of carbon accumulation rates range from 2 to 9 MT/ha/year, depending on the climate and the nature of the agroforestry practice.

Project activities incorporating carbon benefits have the potential to link global climate change priorities to local initiatives.

Adaptation : All project activities are climate proofing investments and will contribute more or less to the watershed adaptation to the forecasted trends in climate change, namely increasing of rainfall extremes - and consequently severe and frequent flood events - and increasing of temperatures.

Among others, improvement of vegetation cover (conservation agriculture, agroforestry, afforestation, riverbank protection and restoration) and conservation of wetlands along the river courses will decreasing the water run-off and then the risk or severity of flood events. Diversification of crops and adoption of conservation agriculture practices will reinforce the food security. As example, most farmers involved in the recent SARD project[1] indicated during the terminal project audit a stabilisation of yields even in below-normal rainfall seasons as a key indicator to adopt conservation agriculture.

Conservation of the Mont Elgon as a regional water tower through forest restoration and protection is also to consider like a strong climate proofing measure.

Potential climate change benefits from the project can be measured through:

- Estimation of Carbon sequestration

Carbon sequestration area under the project is estimated to accrue from 10 000 hectares of forest or woodlands, that would be established by the end of the project period (in 5 years) and would accumulate carbon for up to twenty years. Besides, it's without accounting of the

[1] Conservation Agriculture for SARD and food Security in Southern and eastern Africa (Kenya and Tanzania) June 2004 to August 2006. FAO, 2006.

trees planting for agroforestry practices (mainly fruit-trees), thus 6 640 ha among which around 10% would dedicated to tree planting.

The C and CO_2 Emission reduction (CER) is based on projections made by other projects in developing countries; for Peru projections for afforestation projects are from 2,5 to 4,5 tCO_2/ha/yeart; while in Madagascar it could be evaluated up to 6,5 tCO_2/ha/year.

Hence, it is estimated that 5-year old woodlands would sequester in the projected 10 664 hectares about 36 322 tons of carbon, corresponding to about 133 000 tons of CO_2 emission reduction (transformation ration = 3.67), that would result, for a CER price around 12 €/ton (average price for the three last months in about USD 1,599,600 of carbon revenue for 5 years.

Social benefits

The project, based on a strong community engagement, may be expected to significantly improve the social condition of the concerned communities. Experience shows that such impacts are often amongst the most long lasting and significant. This will be strengthened by the expected financial benefits to be derived by the farmers from engagement with the project. Both the social and economic impacts are expected to be positive. Again, the concentrated focus on a limited, but significant, area is expected to have a greater total beneficial impact than similar investments scattered over a larger area.

Implementation through FFS and other community organisations, stakeholder forums etc. will strengthen social ties and exchanges between farmers of both countries and will then create linkages between upstream and downstream land use practices. It will also participate to create professional networks with service providers and operators.

Furthermore, the project will also contribute to strengthen institutional capacity to implement integrated watershed management and investments based on stakeholder participation to address both domestic and global environment benefits, and the application of a community driven methodology.

The project will increase awareness in environmental degradation and build the capacity of community and other local institutions to identify and manage environmental issues, implement new techniques to combat erosion (lands and riverbanks), use alternative agricultural practices and undertake new activities related to the valorisation of natural resources particularly in wetlands and forests.

Through supporting capacity building, awareness raising, land stabilization and afforestation, improved farm management practices, the project will increase the sustainability of agricultural land use and will protect habitats of critical importance.

Improvement of solid waste and storm water management in towns will have a positive effect on public health, welfare and aesthetic within the towns and will reduce flood risks downstream.

The table here-after summarizes the potential environmental and social benefits of the project.

Table 13: Potential Environmental and Social benefits of the IWM Project

SECTOR PROJECT ACTIVITIES	POSITIVE IMPACT
Afforestation • Afforestation/ Reforestation of degraded gazetted forest • Promotion of community plantation forestry • Community support for sustainable forest management • Support development of private tree nurseries and service providers	• Stabilize or decrease forest degradation process • Rehabilitation of forests and woodlands, and re-establishment of forest tree species • Improvement of forest status and coverage • Increase capability and willingness of communities for the management of forests and woodlands • Increase availability of fire-wood and wood for other uses for communities • Improvement of wildlife habitats and corridors
Soil and Water Conservation - Agroforestry • Promotion of physical and biological soil erosion control measures like integration of contour strips of perennial fodder crops, cut-off drains / earth bunds, retention dishes… • Agroforestry promotion • Support development of private nurseries and service providers • Support restoration of existing small multipurpose dams or other structure for water harvesting	• Reduce surface run-off and soil and nutrient loss • Increase land tenure/use conditions • Decrease of erosion occurrence in the watershed • Soil fertility conservation • Improvement of vegetation cover • Improvement of water retention and harvesting • Improvement of soil drainage • Secure land tenure/use conditions • Increase empowerment process of communities
Conservation agriculture • Zero tillage/minimum soil disturbance and seed drilling • Soil cover (mulch, cover crop-legumes like lab-lab, mucuna) • Selection of perennial crops instead of annual, good cover crops instead of open cover • Crop rotation/inter cropping • On site composting, crop residue trash lines • Support service providers local hire services and manufactures of machinery (sub-soiler, ripper, direct seeder-jab planter)	• Soil fertility conservation and improvement • Enhanced soil moisture and reduction of surface run-off and soil and nutrient loss • Improvement of crop cultivation practices • Diversification crop production, livelihoods and source of incomes • Improvement of food security • Increase capability and willingness of communities • Strengthen social ties and exchanges between farmers by creating new CBOs, FFS, committees, and stakeholder forums • Strengthen capacities and actions of technical officers • Support development and capacities of service

SECTOR PROJECT ACTIVITIES	POSITIVE IMPACT
• Multipurpose and nitrogen fixing tree planting • Furrow contour cultivation • Improved crop production measures • Woodlots, fodder development	providers and operators •
Riverbank protection • Sensitization on utility of riverbank protection, capacity building (guidelines for riverbank protection and restoration) • Implementation of promoted techniques on pilot areas as example purpose • Vulgarization of laws and regulations related to riverbank protection • Awareness on the risks related to deforestation and riverbank erosion (flood events, loss of land…) • Promotion of afforestation and agroforestry on riverbanks	• Improvement of riverbank protection • Improvement of biodiversity along the rivers • Improvement of water quality and decrease of river silting
Promotion of sustainable practices for river sand abstraction • Sensitization, on the risks related to deforestation and riverbank erosion (flood events, loss of land…) • Improvement of knowledge on occurrence, practices and legal/regulatory framework in both countries • Proposition of harmonized regulation for river sand mining for both countries • Promotion of more improved practices for sand abstraction	• Community awareness on utility of riverbank protection • Awareness on the risks related to deforestation and riverbank erosion (flood events, loss of land…) • Improvement of riverbank protection • Improvement of biodiversity along the rivers
Permanent wetlands management project • Promotion of wetlands conservation (ecological functions) • Promotion of diversified livelihoods/income generating activities • Improvement of fish capture techniques • Ridge and furrow agriculture methods • Promote aquaculture, extend fish culture system • Promote fish farms integrated units • Establishment of papyrus coup areas	• Stabilize or improve wetlands protection and conservation of ecosystem functions and services • Introduction of diversified sustainable practices • Diversification of livelihoods and source of income • Wildlife conservation (tourism)

SECTOR PROJECT ACTIVITIES	POSITIVE IMPACT
• Promote eco-tourism and handy-craft development • Promote small scale irrigation schemes out of the wetland areas	
Seasonal wetlands (floodplain) management project • Promotion of diversified livelihoods/income generating activities • Promotion of improved and diversified practices • Ditches dug for water retention • Optimum use of seasonal grazing • Type and extent of fuel wood and fodder production • Eco toilet promotion • Fruit orchard cultivation • Bee keeping	• Increased income levels • Better usage of natural resources and skills • Diversity of income sources • Enhanced environmental functions of wetlands
Storm water management for Lwakhakha and Bungoma	• Improved water quality • Possible improvement in groundwater quality • Reduce soil erosion including soil & nutrient loss • Increased perennial behaviour of streams • Reduced runoff • Reduction in flood occurrence
Solid Waste Management master Plan for Bungoma and Lwakhakha	• Reduced flood risks • Better management of surface water run-off • Improvement of public health conditions, welfare and aesthetic within the towns • Improved air quality • Improved water quality downstream • Availability of compost for use in organic farming • Creation of new job opportunities

CHAPTER 9.Environmental and Social Management Framework

The Sio-Malaba-Malakisi Integrated Watershed Management Program (SMM-IWMP) is anticipated to have beneficial impacts on the environment since its overall objective is to promote sustainable land use and environmentally sound natural resources management through community driven development.

Although the project is expected to produce net benefits in terms of natural resource management and conservation on one hand and increased source of livelihoods, incomes and welfare for communities in other hand, certain project activities may have environmental or social impacts that require mitigation

An Environmental and Social Management Framework is then necessary and is drafted in order to ensure that the proposed financing under the new project design does not result in adverse environmental and social negative impacts, as well as lead to enhancement of positive environmental impacts.

The ESMF identifies main potential environmental issues relating to the project and recommends measures for early integration into the planning and design, as well as a mechanism for screening potential environmental and social impacts. The Framework will be used to avoid, manage or mitigate all potential environmental and social negative impacts associated with the sub-projects, and to enhance the positive ones.

The proposed ESMF is presented in Annex 5.

CHAPTER 10. References

1. Albinus M.P, et al, 2008 : Effects of land use practices on livelihoods in the transboundary sub-catchments of the Lake Victoria Basin

2. Amadalo, B et al., 2003: Improved Fallows for Western Kenya: An Extension Guideline. Nairobi: World Agroforestry Center.

3. Barklund, A., 2004: The VI Agroforestry Programme In Kenya, Tanzania and Uganda: Lessons Learnt on Sustainable Forest Management in Africa. Upplands Väsby, Sweden

4. Development of a Comprehensive Stormwater Drainage Master Plan for Malaba Town Council, Uganda. Draft Design Report

5. Development Partners Sector Review. Agreed Minutes, 13th – 15th October 2010, Kampala

6. Dugan, 1990: Wetland classification system for East Africa

7. Dyson M. *et al.* (eds), 2008: Flow – The essentials of environmental flows, IUCN

8. EAC, 2005: Transboundary Environmental Assessment Guidelines for Shared Ecosystems in East

9. East African Community, 2007: Lake Victoria Basin Commission. Shared Vision and Strategy Framework for Management and Development of Lake Victoria Basin. Popular Version. East African Community Secretariat, Arusha, Tanzania.

10. EDER, G. 2007: Uganda / Water Policy and Reform Process

11. EEA 2008. The European Environment Information and Observation Network (Eionet website) http://www.eionet.europa.eu/

12. Gaustadsaether, T. 2010: Water and Environment Sector. The 2010 Joint Government of Uganda –

13. Giupponi, C. 2002. From the DPSIR Reporting Framework to a System for a Dynamic and Integrated Decision Making Process. International Conference on Policies and Tools for Sustainable Water Management in the EU. Venice, Italy.

14. Government of Kenya, 2000: The Environmental Management and Co-Ordination Act, 1999, No 8 of 1999. Date of Assent: 6th January, 2000. Government of Kenya, Nairobi.

15. Government of Uganda, 2001: *Uganda Forestry Policy,* Kampala: Ministry of Water, Lands and Environment

16. GRK, 2007 : Kenya Vision 2030,

17. GRK/LVBDA, 2005: Lake Victoria Basin Development Authority (LVBDA) Strategic Action Plan 2009-2013

18. Horvath, B., 2006: Vi Agroforestry Programme Annual report for the 2005 fiscal year. Vi Agroforestry Project, Kitale, Kenya.

19. ICRAF**,** 2000: Paths to Prosperity through Agroforestry: ICRAF's Corporate Strategy 2001–2010, Nairobi: ICRAF.

20. Jama, B et al., 1998: 'Sesbania tree fallows on phosphorus deficient sites: Maize yield and financial benefit. Agronomy Journal 90 (6) : 717-726.

21. Kakuru, W. N., 2009.: Sio-Siteko Transboundary Community Based Wetland Management Plan. FINAL REPORT. Nile Transboundary Environment Action Project (NTEAP). Wetlands and Biodiversity Conservation Component

22. Kansiime, F. 2010: Sio-Malaba-Malakisi Transboundary River Basin Management and Development Project. Baseline Water Quality Conditions in the SMM Catchment In Uganda. Draft Report. Makerere University, Institute of Environment & Natural Resources Kampala, Uganda.

23. Kiai, S.P.M, MLRRWD and G.M.Mailu, Min. of Research Technical training and Technology, 1995: Kenya country Paper. Wetland Classification for Agricultural Development in Eastern and Southern Africa.

24. KNBS, August 2010: Kenya Population and Housing Census.

25. Kristensen, P. 2004. The DPSIR Framework. Copenhagen, Denmark, European Environment Agency (http://enviro.lclark.edu:8002/servlet/SBReadResourceServlet?rid=1145949501662_742777852_522)

26. Lado, C., 2004: Sustainable environmental resource utilisation: a case study of farmers' ethnobotanical knowledge and rural change in Bungoma district, Kenya. *Applied Geography* 24 (2004) 281–302

27. LAKIMO, 2004 : Lake Kyoga Management Plan, 2004 – 2007

28. Lang, Chris and T. Byakola, 2006: "A funny place to store carbon": UWA-FACE Foundation's tree planting project in Mount Elgon National Park, Uganda. World Rainforest Movement, Uruguay and U.K.

29. Larsen S. et al., 2008: Mid Term Review of Mount Elgon Regional Ecosystem Conservation Programme (MERECP). Norad Collected Reviews 17/2008

30. Lubovich, K. 2009: Cooperation and Competition: Managing Transboundary Water Resources in the Lake Victoria Region. Working Paper No. 5 - Foundation for Environmental Security & Sustainability

31. M. Obernosterer/Busia Town Council/DED, Sep 2006: Sanitation Master Plan Busia Town Council.

32. MAAIF, NAADS Secretariat, 2006: National Agricultural Advisory Services Programme (NAADS) - Annual Report 2006/07

33. Mercer, D. E., & Pattanayak, S. K., 2003: Agroforestry adoption by smallholders. In Forests in a Market Economy, Sills EO and Abt KL (eds). The Netherlands: Kluwer Academic Publishers: 283–299.

34. MERECP, 2005: Mount Elgon Regional Ecosystem Conservation Programme (MERECP) Programme Document. IUCN, Eastern Africa Regional Office, Nairobi.

35. MFPED, 2006: Uganda Poverty Status Report: Progress in Implementing the Poverty Eradication Plan (PEAP), Ministry of Finance Planning and Economic Development

36. Ministry of Agriculture, 2009. Bungoma West District Annual Report 2009.

37. Ministry of Lands and Urban Development, 2008. National Land Use Policy: modernisation through planned land use, urbanisation, industrialisation and developed service sector

38. Ministry of Water and Environment, 2004: Farm Income Enhancement and Forest Conservation Project FIEFCP

39. Ministry of Water and Environment, 2010: Water and Environment Sector Performance Report

40. Ministry of Water and Irrigation, 2006: Kenya National Water Development Report. Prepared for the 2nd UN World Water Development Report, *'Water: A shared responsibility'.* Case study Keny

41. Ministry of Water and Irrigation, June 2009 : Flood Mitigation Strategy (Kenya)

42. Ministry of Water, Lands and Environment (MWLE), 2002. The National Forest Plan. Kampala, Uganda. 156 pp.

43. Ministry of Water, Lands and Environment (MWLE), Land Sector Strategic Plan 2001-2011.Utilising Uganda's Land Resources for Sustainable Development. Retrieved 7th Feb, 2011 (http://www.mwle.go.ug/LSSP.pdf

44. MoA/GTZ, 2005: Farm Management Handbook for West Kenya, subpart A1 – Western Province

45. Mount Elgon Regional Ecosystem Conservation Programme (MERECP). MERECP Project/Programme Profiles

46. Muhweezi, A.B. et al., 2007: Introducing a Transboundary Ecosystem Management Approach in the Mount Elgon Region. The Need for Strengthened Institutional Collaboration. Mountain Research and Development Vol 27 No 3 Aug 2007: 215–219 doi:1659/mrd.0924

47. MWRMD/APFM, Sep 2004: Strategy for Flood Management for Lake Victoria Basin, Kenya

48. NBI, 2010: Monitoring Strategy for the Nile River Basin

49. NBI, 2010: The Nile Basin - Wetlands Management Strategy (2010 – 2016)

50. NBI, 2010: The Nile Basin - Wetlands Management Strategy (2010 – 2016)

51. NBI/NELSAP, 2006: NBI/NELSAP/SMM-TIWRMDP/RFP02/2006. SMM Investment Strategy. Final Report

52. NBI/NELSAP, 2006: NBI/NELSAP/SMM-TIWRMDP/RFP02/2006. SMM Repackaged investment strategy.

53. NBI/NELSAP, 2008: NBI/NELSAP/SMM-TIWRMDP/RFP02/2006. SMM River Basin Monograph. Final Report

54. NBI/NELSAP, Newplan Ltd., August 2010 : NBI/NELSAP/SMM-TIWRMDP/RFP01/2009. Sio-Malaba-Malakisi River Basin Project. Pre-Feasibility Studies for the Development of Multi-Purpose Storage Reservoirs in the Sio-Malaba-Malakisi River Catchment. Draft Final Report. Volume I: Main Report

55. NBI/NELSAP/WREM, 2008: SMM Policy, Legal, and Institutional Cooperative Framework. Final Report

56. NBI/NELSAP/WREM, 2009: SMM Policy, Legal, and Institutional Cooperative Framework. Synthesis Report

57. NBI-Transboundary Environmental Action Project, 2005: National Nile Basin Water Quality Monitoring Baseline Report for KENYA

58. NBI-Transboundary Environmental Action Project, 2005: National Nile Basin Water Quality Monitoring Baseline Report for UGANDA

59. NEAP, 1995. The Nation Environmental Action Plan for Uganda. Kampala, Uganda: Ministry of Natural Resources.

60. NEMA (Uganda), 2008: Pilot Integrated Ecosystem Assessment of the Lake Kyoga Catchment Area

61. NEMA, 1997: Tororo - District State of Environment Report

62. NEMA, 2004a. State of Environment Report. Kapchorwa district local Government.

63. NEMA, 2004b. State of Environment Report. Mbale district local Government.

64. NEMA, 2004c. State of Environment Report. Sironko district local Government.

65. NEMA, 2007: National sand harvesting guidelines

66. NEMA, 2008. State of Environment Report for Uganda, 2007/08. Kampala, Uganda: National Environment Management Authority

67. NEMA/UNEP, 2008. Integrated Ecosystem Assessment of the National Environment Management Authority, http://www.nemaug.org.

68. Neufeldt H, et al., 2009: Trees on farms: Tackling the triple challenges of mitigation, adaptation and food security, World Agroforestry Centre.

69. Nield, R.et al, 1999: Review of the management of the forest resources of Mt. Elgon ecosystem, Kenya. Prepared for The National Project Steering Committee of Mt. Elgon Integrated Conservation and Development Project. Forest Department, Min. of Environment and Natural Resources & Kenya Wildlife Service, Nairobi (32 pp).

70. Njuguna, S. G., 2004. Environmental and Social Management Framework. Western Kenya Integrated Ecosystem Management Project (WKIEMP). Final Report

71. Nyeko P. and F.M. Olubayo, 2005: Participatory assessment of farmers' experiences of termite problems in agroforestry in Tororo district, Uganda. Agricultural Research & Extension Network Paper No. 143.

72. Obando, J. A. 2007 : A Framework for Integrated Management of Transboundary Basins: The case of Sio sub-catchment in East Africa

73. Okeyo-Owuor, J.B. et al, 2010 : Status, challenges and new approaches for management of the transboundary Mt. Elgon Ecosystem: a review

74. Ongugo, P. O. et al., 2007: 'Emerging Roles of Community Forest Associations in Kenya: The cases of Arabuko-Sokoke Forest Adjacent Dwellers Association (ASFADA) and Meru Forest Environmental and Protection Community Association (MEFECAP). In Proc. International Conference on Poverty Reduction and Forests. Bangkok, Thailand September 2007.

75. Onim, J. F. M., K. Otieno, and B. Dzowela, 1990. The role of Sesbania as multi-purpose tree in small-scale farms in western Kenya. In *Perennial Sesbania species in agroforestry systems*, ed. B. Macklin and D. O. Evans, pp. 167–179. Proceedings of a workshop held in Nairobi, March 27-31, 1989. Hawaii: The Nitrogen Fixing Tree Association.

76. Otsuki, T., and Ogo, T., 2009. Determinants of adoption of agroforestry in Kenya. Osaka University.

77. Pagiola S., 2003: Can Programs of Payments for Environmental Services Help Preserve Wildlife?.*Workshop on Economic Incentives and Trade Policies* Geneva, December 1-3, 2003. Convention on International Trade in Endangered Species of Wild Fauna and Flora

78. Perez C. and H. Tschinkel, 2003 : Improving Watershed Management in Developing Countries: A Framework for Prioritising Sites and Practices. Agricultural Research & Extension Network. Network Paper No. 129

79. Place F. et al., 2005: The Impact of Fertilizer Tree Systems in western Kenya: A study on Impacts of Agroforestry. 3rd External Programme and Management Review. World Agroforestry Centre, Nairobi, 38pp.

80. Pretty, J.N et al., 1995 :. A trainer's guide for participatory learning action. IIED Training Materials Guide No.1. International Institute for Environment and Development, London, U.K. 266 pp.

81. R.Winnegge, 2005: Participatory Approach in Integrated Watershed Management. FWU, Vol. 3, Topics of Integrated Watershed Management – Proceedings.

82. Scott P., 1994: An Assessment of Natural Resource Use by Communities from Mt. Elgon National Park, UNDP/Technical report No. 15, 1994.

83. Scott P., 1998: From Conflict to Collaboration: People and Forests at Mount Elgon, Uganda. IUCN, Gland, Switzerland and Cambridge, UK.

84. Shah, R. 2000. International Frameworks of Environmental Statistics and Indicators. Inception Workshop on the Institutional Strengthening and Collection of Environment Statistics, Samarkand, Uzbekistan (http://www.unescap.org/Stat/envstat/stwes-015.pdf.

85. Stonewall S. Kato and James O. Okumu, 2006: The role of community based institutions in sustainable management of forest, water and soil: A case study of Mount Elgon ecosystem, Uganda. A paper presented at the 11th Biennial Global Conference in Bali, Indonesia- 19th June to 23rd June 2006.

86. Stonewall S. Kato+ and James Okot Okumu, 2006: The role of community based institutions in sustainable management of forest, water and soil: A case study of Mount Elgon ecosystem, Uganda

87. Tamukedde Z. & Hydroflow Services, September 2008: Sio-Malaba-Malakisi Basin Transboundary Integrated Water Resources Management & Development Project.

Consultancy Services for Assessment, Design and Installation of a Sustainable Hydrometric Network in the Sio-Malaba-Malakisi River Catchments. Final Report

88. Tororo District Local Government - Malaba Town Council, June 2008: Consultancy Services for the

89. Transboundary Environmental Assessment for shared ecosystems in East Africa. The East African Community 2005

90. Uganda National Water Development Report 2006:. Prepared for the 2nd UN World Water Development Report, *'Water: A shared responsibility'.* Case Study Uganda.

91. Uganda Wildlife Authority (UWA), (2004). Community Conservation Policy.

92. Uganda Wildlife Authority (UWA), 2000. The Mt. Elgon National Park General Management Plan.

93. Uganda Wildlife Authority (UWA), 2002. Mount Elgon Conservation and Development Project: Bridging Phase II. Kampala, Uganda Wildlife Authority.

94. Uganda Wildlife Authority (UWA), 2008. Contribution of Mt. Elgon Conservation to Improve Livelihoods of the Neighbouring Communities. Uganda Wildlife Authority, Mbale, Uganda

95. UNEP 2007. Global Environment Outlook 4 (GEO 4). Nairobi, Kenya, United Nations Environment Programme.

96. USEPA 2006. Border 2012: US Mexico Environmental Program Indicators Report 2005. (http://www.epa.gov/Border2012/docs/BorderIndicatorsReportApril2006.pdf

97. Volume IA. Population Distribution by Administrative Units

98. Volume II. Population and Household Distribution by Socio-Economic Characteristics

99. Wambugu, C. et al., 2006: Fodder shrubs for dairy farmers in East Africa: making extension decisions and putting them into practice. Nairobi: World Agroforestry Centre and Oxford Forestry Institute.

100. Watson, R. T. et al. (eds), 2000: *Land use, land-use change and forestry*. Special report to the Intergovernmental Panel on Climate Change. Cambridge University Press.

101. WMD/Tororo District, Uganda, 2009: Popera community-Based Wetland Management Plan, Magoola Sub-County, Tororo District.

102. *World Agroforestry Centre Policy Brief 07*. Food security World Agroforestry Centre, Nairobi, Kenya.

103. World Agroforestry Centre, 2005: Improved land management in the Lake Victoria Basin: Final report on the TransVic project.

104. World Agroforestry Centre, 2006 : Improved land management in the Lake Victoria Basin: Final report on the TransVic project

105. World Bank Safeguard Policies . http://worldbank.org/ENVIRONMENT/.../Policy_SEA_WB

106. WRMA, 2008 : Lake Victoria North Catchment Area. Catchment Management Strategy

107. Zake, J. S. et al., 1999: Uganda. In Integrated Soil Management for Sustainable Agriculture and Food Security in Southern and East Africa: Proceedings of the Expert Consultation, edited by H. Nabhan, A. M. Mashali and A. R. Mermut. Harare, Zimbabwe: Food and Agriculture Organization of the United Nations

108. Zhang, J. and A. Fujiwara. 2007. Development of the DPSIR+C Framework for Measuring the Social Capacity of Environmental Management. Discussion Paper Series Vol. 2007-4, Hiroshima University, Japan. (http://home.hiroshima-u.ac.jp/hicec/products/DP2007/DP2007-4.pdf