Nile Equatorial Lakes Subsidiary Action Program

MARA TRANSBOUNDARY INTEGRATED WATER RESOURCES MANAGEMENT AND DEVELOPMENT PROJECT

Final Report – Annex 1

Watershed Management Plan

***Final Version* – December 2012**

Document Quality Information

General information

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Project title	Feasibility Study for Integrated Watershed Management and Preparation of Investment Project Proposal for the Mara River Basin
Document title	Final Report – Annex 1 Watershed Management Plan
Date	December 2012
Reference	RED 123009 H

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History of modifications

Version	Date	Written by:	Review by:
Version 1	27th Dec 2012	Jean-Marc ROUSSEL, Team Leader France BAILLY-MARION, Environmentalist	Emmanuel DAVAL, Project Director
Version 2	31st Dec 2012	Jean-Marc ROUSSEL, Team Leader France BAILLY-MARION, Environmentalist	Emmanuel DAVAL, Project Director

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List of Abbreviations and Acronyms

a.s.l.	above sea level
ARI	Agricultural Research Institute (Tanzania)
ATC	Agricultural Training Centre
CA-SARD	Conservation Agriculture-Sustainable Agriculture & Rural Development
CBO	Community Based Organisation
CFA	Community Forest Association (Kenya)
CFUG	Community Forest Users Group (Kenya)
CMO	Community Mobilization Officer
CSO	Civil Society Organisation
DTO	District Technical Officer
ESMF	Environmental and Social Management Framework
FBD	Forestry and Beekeeping Development (Tanzania)
FFS	Farmers Field School
GIS	Geographical Information System
GIZ/GTZ	Deutsch cooperation agency
ICRAF	International Center for Research in Agroforestry (Kenya)
IGA	Income Generating Activity
IWMP	Integrated Watershed Management Project
IWRM	Integrated Water Resources Management
KARI	Kenya Agricultural Research Institute
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
LGA	Local Government Authorities
MFW	Ministry of Forest and Wildlife (Kenya)
MNRT	Ministry of Natural Resources and Tourism (Tanzania)
MRB	Mara River Basin
NALEP	National Agriculture and Livestock Extension Program (Kenya)
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NEMA	National Environment Management Authority (Kenya)
NFA	National Forest Authority (Tanzania)
NGO	Non-Governmental Organisation
PMU	Project Management Unit

SA	Sustainable Agriculture
SC	Soil Conservation
TAFORI	Tanzania Forest Research Institute
TASDP	Tanzania Agricultural Sector Development Project
TFS	Tanzania Forest Service
WMP	Watershed Management Project
WRUA	Water Resources Users' Association (Kenya)

1. INTRODUCTION

EGIS has been committed by the Mara River Basin Project – Project Management Unit to provide a preliminary investment project for Integrated watershed management through feasibility type studies.

The present document is the second annex of the Final Report for Mara River Basin IWMP.

FINAL REPORT	
Main report	Investment Project Proposal
Annex 1	**Watershed Management and Investment Plan**
Annex 2	Sustainable Wetlands Management and Investment Plan
Annex 3	Water Quality and Sanitation and Investment Plan
Annex 4	Cross-cutting activities

2. GENERAL PRESENTATION

2.1. GENERAL CONTEXT

Watershed Management is one of the 3 projects of the Mara River Integrated Watershed Management and Investment Plan (MR-IWMP).

The Mara River Basin (MRB) 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 MRB 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 Mara River Basin has been selected by NELSAP for an Integrated Watershed Management Investment Programme, because it presents favourable factors for such action:

- on one side, it is in a generally good condition and conservation is still quite feasible, forestation levels and water quality are acceptable, population is increasing but demographic pressure is still globally tolerable;

- on the other side, much needs to be done now, before the situation turns out of control, to resolve several problems, and particularly: (i) erosion from the upper basin causing a rapid extension of the wetlands downstream in a typical transboundary issue, and (ii) poverty that can be alleviated through better watershed management, particularly in the context of climate change that puts the focus on diversification of income sources and environmental conservation.

The MRB basin originates from the Mau escarpment and upper swamps in Kenya and drains into Lake Victoria. This catchment 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 MRB 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 and springs, riverbanks and protected forests (Mau forest and woodlands on hills) for farming purposes, charcoal making and illegal lumbering.

These trends threaten the future livelihood of the people and livestock as well as biodiversity and wildlife in the Maasai Mara/Serengeti Reserves. The current degradation of the basin, notably through deforestation and wetland degradation arises new challenges, like the steadily decline of average discharge in rivers during the dry seasons over the years and increased flash floods and high sediment transport during rainy seasons. Water scarcity and growing food insufficiency are some of the major issues facing these basins and the situation is expected to get worse as the population increases and as demand by the different water use sectors outmatches the existing supply and is exacerbated by the imminent effects of climate change.

Further, several sources of pollution like poorly controlled effluent discharges from mining industry (including small scale miners), sewage outflows and solid wastes from the few fast-growing urban centres, the nutrient and agro-chemical pollution from diffuse sources, have negatively impacted surface water and groundwater quality.

The Mara River Basin is also home to the World Renowned Maasai Mara-Serengeti ecosystem. Sustainable wildlife management and tourism development are central to the economic development of the Mara river basin, as well as the countries at large. Without effective and sustainable watershed conservation efforts, there will be inadequate water for wildlife and tourism services thus threatening these conservation areas, with negative consequences on revenue from tourism that supports the economic development of the countries. The ecosystems have potential livelihood opportunities especially for the communities to improve their socio economic standards through strengthening the Wildlife Management Areas (Serengeti) and Wildlife Conservancies Areas (Maasai Mara) in the context of integrated watershed management. Promoting investments in the basin will improve the current living standards of the basin population and allow the poor to tap the benefits from the resources endowment of the Mara River Basin.

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 and also water of good quality and quantity.

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

The present report on Wetland Management, as a sector activity proposal, needs to be read in conjunction with the Main Report, which presents the project components.

2.2. REVIEW OF THE MRB WATERSHED CONDITIONS

The current project, out of the whole Mara River Basin, is considering the areas included in the four priority areas defined in the Situation Analysis Report and in the main volume of the Final Report:

- Mid-Nyangores sub-basin;
- Mid-Amala sub-basin;
- Mara Somoche sub-basin; and
- Lower Tigithe sub-basin.

In the mid-Nyangores and mid-Amala sub-basins, steep slopes in the totality of the area make watershed management a key aspect of the investment project. In the Lower Tigithe sub-basin, on the opposite, watershed management issues apply on the rim of the catchment only, whereas the Mara Somoche sub-basin is in an intermediary condition.

Watershed management in the remaining sub-basin will need to be taken care of, but does not seem to be as critical and can be left for further actions and not in priority.

2.2.1. Watershed Features

Watersheds in the upper and medium basin form the whole of the inhabited and productive area. In the lower basin, watershed management activities will apply to most areas, excluding the permanent wetlands and the seasonally flooded plains. Watersheds in the MRB are subject to:

- Forest exploitation for industrial use of timber and for household level fuel wood; this exploitation is to a certain extent covered by reforestation, but all cut areas are not immediately replanted, and planted species are entirely exotic (mostly *Pinus, Cupressus, Eucalyptus* and *Grevillea*);
- Presence of trees in small plots, and more frequently in lines along the rivers, fields and tracks;
- Tea plantation either in large corporate estates in the eastern side, or in small plots belonging to individual farmers in the rest of the middle basin, and specifically on steep slopes;

- Agricultural use for food crops and cash crops; with the increasing population, pressure on land is building up, leading to extension of cultivated land over previously forested areas, and intensification of the cropping pattern;

- Grazing by cattle in small groups, mostly for dairy purpose, in non cultivated land (rangeland, forest, extreme slopes...);

- Erosion process in areas where the soil cover is not dense (agricultural lands particularly between crops and at early stages of crop cultivation, tea plantations, road side, foot tracks); this erosion translates into heavy sediment load in the rivers;

- Extension of urban and semi-urban areas, as a result of total population increase and sedentarization of previously semi-nomadic groups;

- Pollution by wastewater and solid waste, particularly in urban and semi-urban areas.

The areas in which watershed management activities are proposed are not reported as environmental hot spots (home to endemic or endangered flora or fauna species); diffuse pollution from fertilizers or pesticides is not reported as a severe issue.

In those areas, groundwater is taken from shallow wells and commonly used for human needs; important extraction rates are not reported, but groundwater plays an important role to help inhabitants survive through dry spells.

More detailed features about the basin and its agricultural component are presented in an Appendix to this document.

Maps of slopes for the priority areas have been prepared and, combined with land use maps, they will guide the selection of precise locations where activities need to be implemented. These maps are presented below.

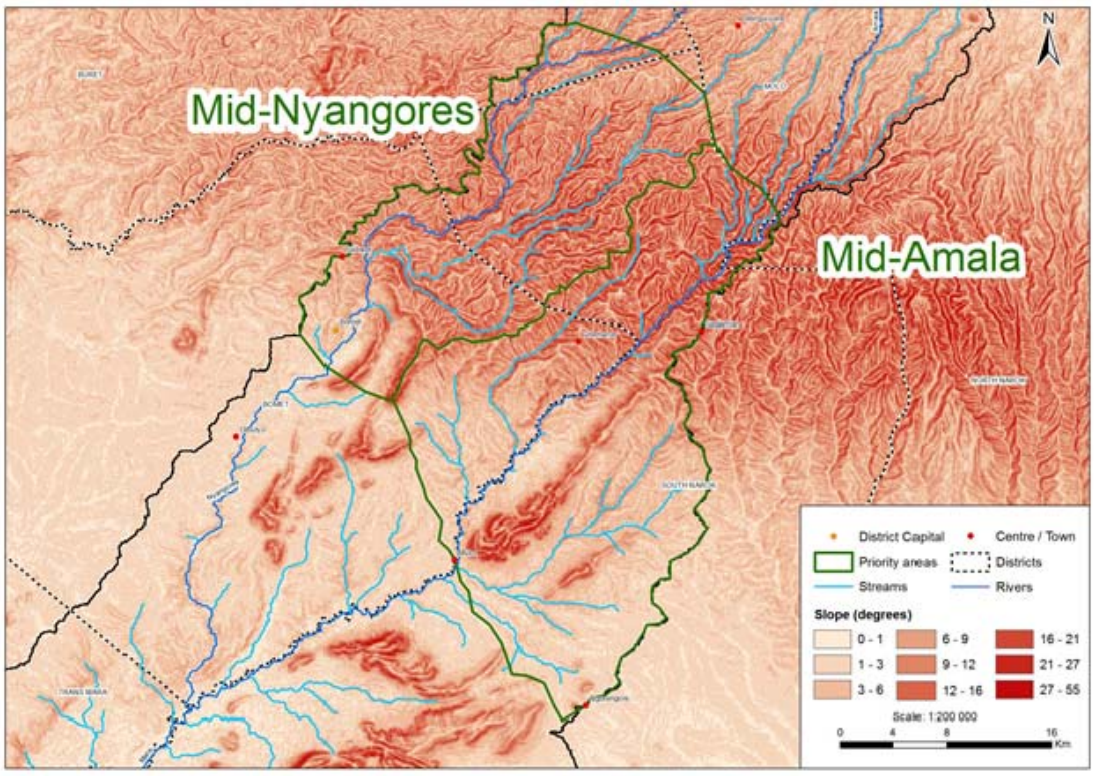

Figure 1: Slopes in Upper Basin

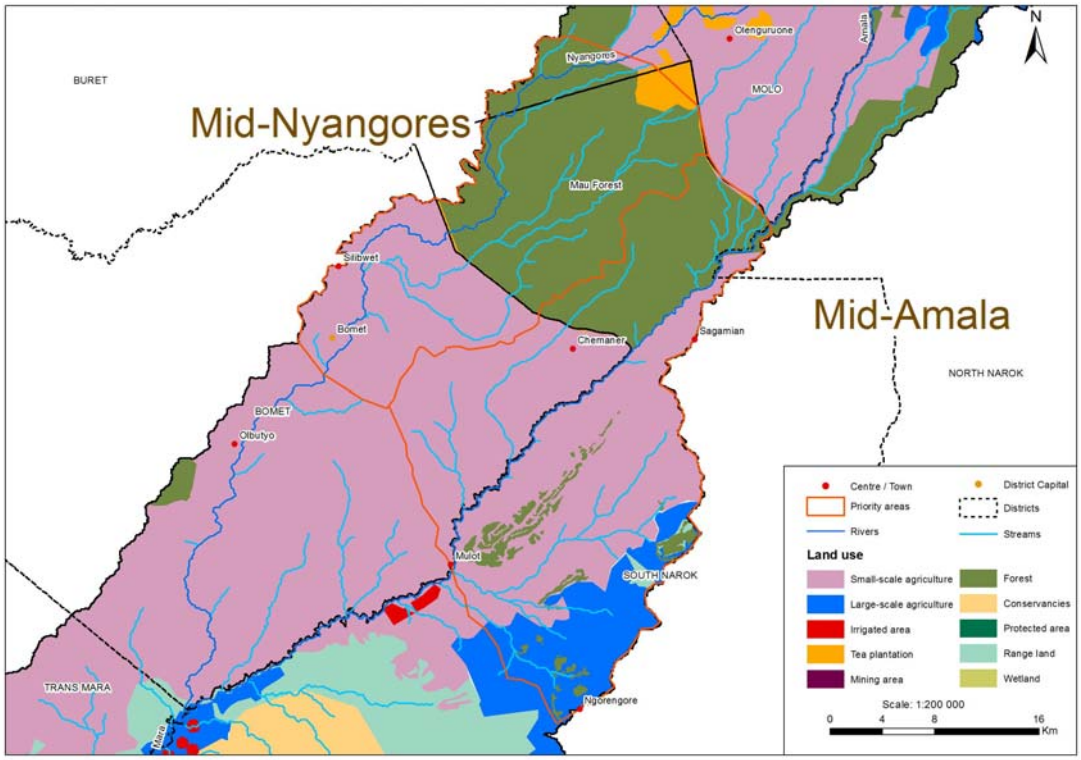

Figure 2: Land Use in Upper Basin

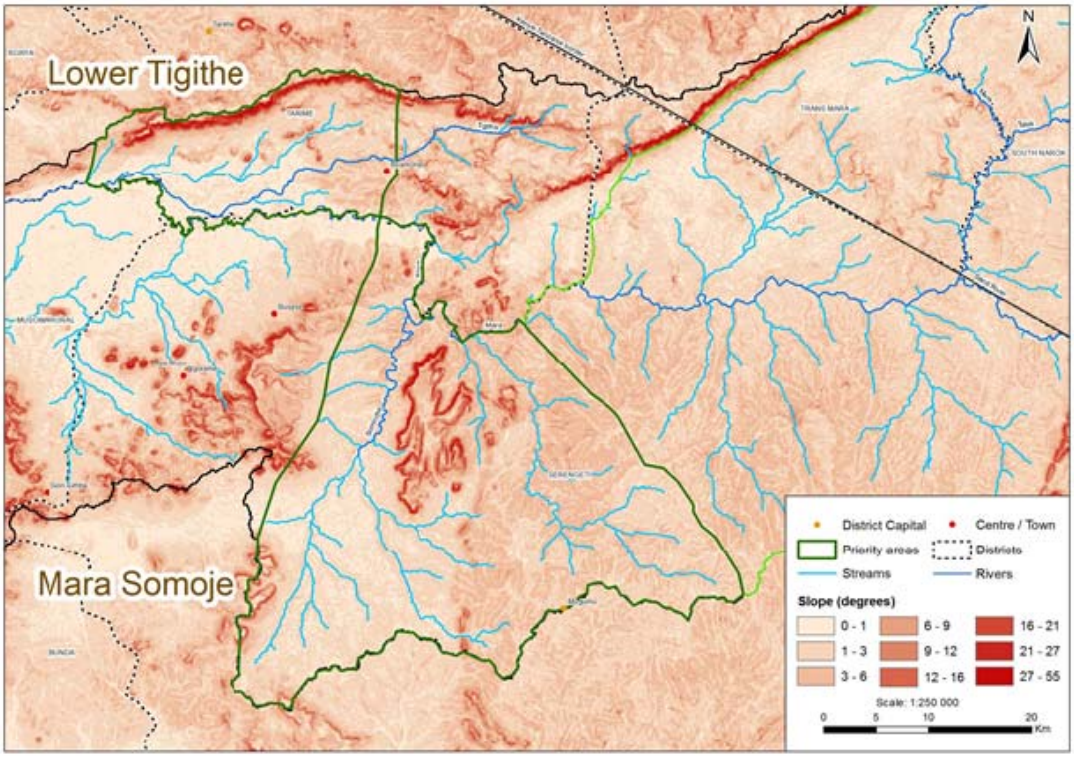

Figure 3: Slopes in Lower Basin

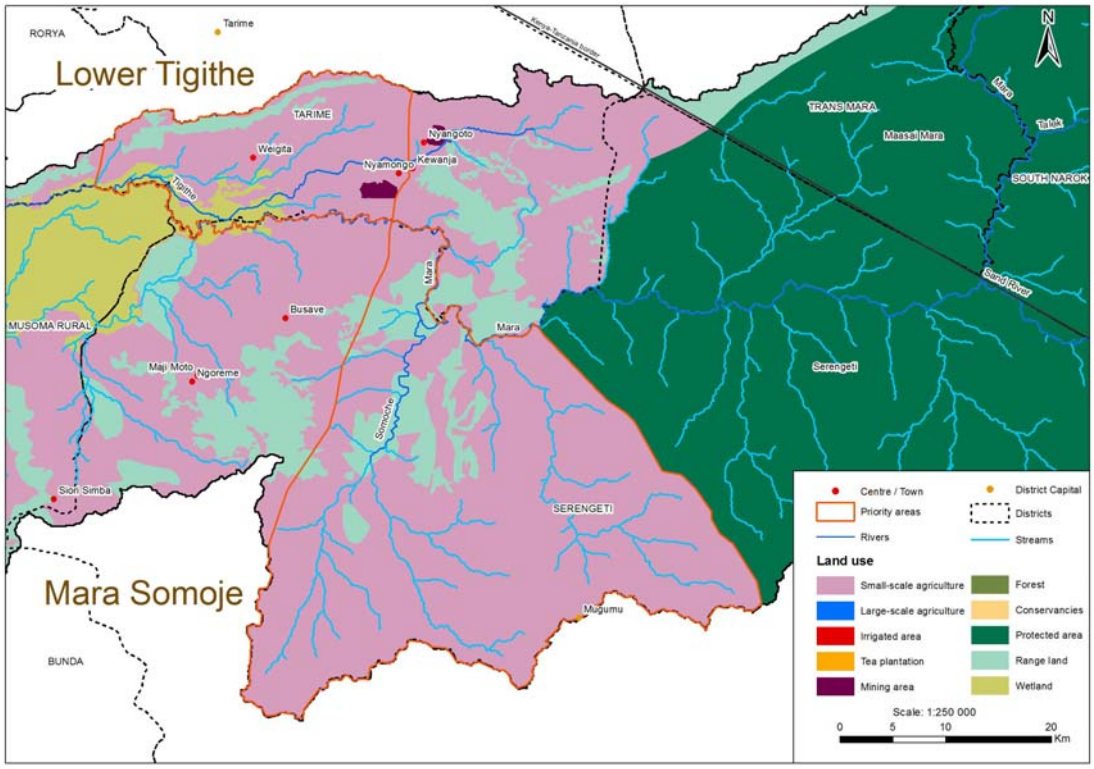

Figure 4: Land Use in Lower Basin

2.2.2. Constraints

Constraints to watershed management are in the first place related to establishing a balance between short-term production (to ensure adequate livelihood for the farmers) and long-term watershed protection (to ensure sustainability of the management measures). This balance is not only necessary from a technical point of view, but it will also be the key to receiving strong support from the farmers and local institutions. This puts again in evidence the three activity lines: watershed protection, income generation and institutional set-up, which will form the lines of an investment program with high chances of successful implementation.

A crucial point in the case of Mara River Basin is the transboundary condition. Indeed the MRB is formed in such a way that the upper basin is located in Kenya, the middle basin is found on both sides of the border, while the Mara wetland and the surrounding hills are in the Tanzanian part of the basin. Thus Tanzania cannot successfully address the issue of wetlands management on the medium and long term if Kenya has not implemented the necessary actions to reduce erosion rates and thence to obtain a certain level of stabilization of wetlands extension. This fact, considered in the framework of the Nile Equatorial Lakes Subsidiary Action Program, makes it absolutely necessary to incorporate strong watershed management actions in the program, aiming at a quick, real decrease in erosion rates.

Another issue which can become a constraint is the fact that watershed management cannot be efficient if implemented only at higher (national, district, county…) level, or by individuals; a real chance of long-term success depends on the set-up of a **community development** process. This is not true only from a social point of view – yet this aspect of common endorsement of actions is quite important – but also at technical level: actions started on a sub-watershed, even of limited extension, will yield more results than on a set of isolated plots; moreover, the chances of long-term success are increased by the peer-to-peer pressure borne by community development process.

Finally, **inadequate enforcement or application of existing laws and regulations** is a constraint in any area where natural resources are at stake, but where demographic pressure on land leaves no other option but encroachment.

3. JUSTIFICATION OF THE WATERSHED MANAGEMENT PROJECT

Watershed management is the core part of the Integrated Watershed Management Program for the Mara River Basin. It needs to be complemented by specific projects dealing with wetlands management and sanitation/waste management; but it forms the central piece of the program, and without its successful implementation the other projects and activities would not yield significant results.

The Watershed Management Project is therefore central in the progress towards the general objective of the programme, which is poverty reduction on the short, medium and long term. This result will be obtained through the three main lines:

- Watershed protection and conservation: all actions directed towards improvement of environmental conditions and a more reasonable use of natural resources will have positive effect on the total production of the watershed and the sustainability of that production;

- Income generation: specific efforts to increase agricultural, forest and animal production within the framework of watershed protection will be developed, as well as additional income generation activities compatible with and supported by the basic economic activities;

- Watershed management: management structures and institutional organization will help set up a framework for orderly development and long term sustainability; this improved management will be supported by a strong Capacity Building effort with an initial external input followed by peer-to-peer training along the Farmers Field Schools (FFS) model.

Each individual sub-project, to be acceptable and efficient, will need to present facets covering the three lines above:

- Income generation is necessary to gain people's support to the project, with short term benefits to be proved early;

- Watershed protection brings benefits on a longer term basis, and satisfies the environmental requirements;

- Watershed management cannot be evaluated in benefits terms and will present costs only, but those costs are necessary to ensure a smooth operation of Income generation and Watershed protection activities.

4. OVERALL PROJECT PRESENTATION

4.1. PROJECT OVERALL OBJECTIVE

The Overall Objective of the Watershed Management Plan (WMP) is to «*improve the living conditions of people while protecting the environment*».

In this it is crucial that watershed management activities are focused on the communities involved and that they in turn are willing contributors to the activities. A Watershed Management Plan needs to be supported, to a large extent, by a community development plan.

The main outcomes of the WMP could be:

- To halt or mitigate the erosion process;
- To halt encroachment of forested areas;
- To improve the quality of water flowing downstream;
- To reach enhanced rural production through environmental good practices;
- To develop alternative sources of livelihood;
- To ensure capacity building for Community to implement proposed alternative livelihood options.
- To improve technical resources and extension services
- To improve structure for planning and monitoring catchment rehabilitation activities, and for sensitization, training and mobilization of communities

4.2. PROJECT SPECIFIC OBJECTIVES

The specific objectives of the WMP are the followings:

- Promote afforestation and agro-forestry;
- Implement sustainable practices in watershed utilization, for agriculture and livestock farming;
- Operationalize mechanisms and tools for community driven watershed management;
- Improve farmer's access to service delivery and inputs;
- Support farmers in implementation of alternative sources of livelihoods for improved income and food security;
- Enhance farmers networking to promote best practices in watershed management.

4.3. KEY OUTPUTS

The project key outputs are the followings:

A. Watershed management groups are identified or created at village/community level, and they are open to women participation at all levels;

B. FFS are established and operational at requested decentralized level;

C. GIS facilities and training are provided at the district level;

D. Extension staff are equipped and trained to organize, facilitate and provide on-going support to operational FFS and apply participatory extension approach for watershed development. Research institutes are identified and involved in specific supportive tasks;

E. Local manufacturers and retail sector are able to supply and maintain tools and equipment suitable for new techniques and practices, such as biomass briquettes and stoves, and biogas digesters

F. Nurseries are operational and seedlings available for agroforestry

G. Revolving funds / micro-credit mechanisms is established and accessible to farmers (and specifically to women) for new investment in agriculture, handicraft and eco-tourism activities

H. Farmers adopt and apply promoted new activities, techniques and practices like fruit orchard, woodlots, honey, composting, wood waste briquettes, biogas digesters…

I. Community-private partnerships for products commercialization (example for honey production) are created and farmers have access to market for their cash production

J. New Eco-tourism or handicraft production activities and small scale enterprises are developed in the watershed

K. Knowledge networks for exchanging experiences are established at local and transboundary levels

4.4. SUB-PROJECTS

The Watershed Management Project integrates a wide set of activities; for clarity sake, it will be presented split into four sub-projects:

- Afforestation/reforestation
- Soil and Water Conservation and Agroforestry
- Sustainable Agriculture practices
- Riverbank and Spring protection

These sub-projects are indeed complementary to one another, but also strongly inter-related. In each project site, different sub-projects may be present simultaneously: promotion of Sustainable agriculture does not exclude Afforestation or River bank protection in the same area, specific Erosion control measures and works will be proposed for community action in most areas, as well as Sustainable Agriculture actions at individual plot level – just as the Transversal activities presented in the Main Report will also coincide with Watershed or Wetlands Management projects.

5. PROVISIONAL PROJECT BENEFITS

5.1. ENVIRONMENTAL CONSERVATION

Watershed conservation: The process for watershed conservation is based on the protection of the full cycle of water within the considered basin or sub-basin. Conservation of the Mara river basin aims at creating benefits through:

- Sustained soil fertility by developing erosion control works to avoid loss of soil and nutrients; the bunds and terraces must also be provided with useful plants (either as fodder, or as cash crops like vetyver)
- Afforestation or reforestation of sensitive areas such as the hill tops and the river banks,
- Selection and promotion of soil covering plant species that can be associated with current crops to bring an added value;

In particular, the project takes as a priority the monitoring and control of the upstream limit of forested areas, to avoid further encroachment of the Mau Forest, which acts currently as the guarantee for good and stable water flow in the upstream reaches of Nyangores and Amala rivers.

Ecological functions: Increasing the diversity of crops and trees in the watershed is associated with positive environmental outcomes because of the role trees and plants play in larger ecosystem functions. Trees, if correctly selected, can improve soil quality in various ways: root systems prevent soil erosion, leguminous species fix nitrogen and improve nutrient recycling, and detritus from trees increases the organic content of soil. Focus on native species (trees and crops) against exotic ones, as frequently as possible, will also tend to strengthening of natural ecosystems.

Climate Change adaptation: Global climate models forecast changes in rainfall pattern and temperature leading to shorter rains of higher intensity, with drought spells of similar duration or frequency with the current ones, but more intense. To adapt to such conditions, the recommendations brought by the project will act positively:

- more varied set of income sources for each household based on diversification of crops and other activities;
- rain water harvesting to mitigate the direct effects of droughts, covering part of human and animal requirements.

5.2. INCOME GENERATION

Poverty reduction: Sustainable Agriculture practices can reduce poverty directly by providing higher yields for most products, in a highly significant level, with progressive efficacy. Development of non-agricultural activities such as beekeeping, production of aromatic and medicinal plants, production of raw material for briquettes, access to alternative energies, will also act in favor of poverty reduction. These activities, moreover, can be handled mostly by women.

Reducing vulnerability: Crops diversification is a strong argument towards reducing the vulnerability. Development of Rain water harvesting and Sustainable agriculture techniques through improvement of soil moisture during longer periods is also a resource against climate change.

Access to micro credit for new investments and development of complementary income generating activities will also participate in facilitating initiatives from persons or groups currently less favored.

Diversification of products and source of income: The WMP project, while increasing yields will also contribute to introducing new products, cash crops and IGAs. Enlargement of the production and source of income will contribute to secure livelihoods.

Market access: Agroforestry contribution to poverty reduction is dependent on people's access to product markets. Market access can be improved through construction of roads, development of farmer organizations to increase the bargaining power of producers, or with direct support establishing contact between producers and traders – in particular taking advantage of a secure consumers' market in the neighbour tourism areas of Maasai Mara and Serengeti National Parks.

5.3. INSTITUTIONAL STRENGTHENING

Access to technical advice and professional network: The double capacity building process intended for the WMP program is expected to give good results in term of professional advice. First at community level group through the Farmer Field School process, and then at coordination level promoting exchanges among the different groups.

Promotion of local activity groups: under the FFS model, local groups will be supported, each group working on a definite type of activity such as: dairy products, food crops improvement, cash crops development, production of briquettes, bee keeping and honey production, food processing…

6. INTERVENTION AREAS

Although watershed management is a concern for the whole basin, the investment strategy will be focused on definite areas included in the priority sites presented in the Situation Analysis Report, for a better efficiency. These priority intervention areas, meant for a first implementation phase of five years, are:

- The medium basins of Nyangores and Amala Rivers, from the limit of Mau Forest around Olenguruone down to the main road crossing Mulot and Bomet. These areas produce most of the sediments transported by the rivers and are ultimately responsible for siltation of the Mara wetlands complex. They also bear a very dense and fast growing population, which forces attention to mitigate now the social and environmental impacts of demographic pressure on natural resources that may result soon in unstoppable degradation.
- The parts of the lower Mara River Basin characterized as Mara Somoche and Lower Tigithe. These areas have a lighter population density, and therefore a lower pressure on land use. Yet watershed management has also an important role there for different reasons:
    - Soils in the flat areas not affected by flooding are mostly sandy clay, of poor cohesivity and high sensitivity to erosion, creating local gullies;
    - In some areas, the need to produce more food to support the growing population translates into a need for better use of the land, and good land management is required for that;
    - The steep slopes on the rim of the river basin are subject to heavy erosion rates, contributing to siltation of the wetlands;
    - Seasonal flooded areas turning progressively into wetlands must be properly managed for optimal results.

7. SUB-PROJECTS DESCRIPTION

In order to address the above issues in the respective zones of the watershed, four complementary sub-projects have been designed, with the following activities:

7.1. AFFORESTATION/REFORESTATION

This sub-project addresses specifically the trend to deforestation in some areas, and the demand for wood and charcoal throughout the Mara River Basin, with an approach through community groups to lead the actions in the medium and long term.

7.1.1. Specific Objectives

The specific objectives of the sub-project are the following:

- Mechanisms for community management and sustainable valorization (timber and non timber products) of forests and woodlots are settled and operational;
- Farmers professional environment is operational: farmers are organized and have access to technical advices, techniques, tools and seedlings;
- Farmers professional network is operational: farmers are included in the decision making process for woodlands and forests management;
- Awareness towards usefulness of sustainable forest management is improved;
- Gazetted forests are protected in the watershed.

7.1.2. Sub-project activities

Component 1: Community awareness and capacity building for reforestation project and forest management

- Identification of CFAs/CFUGs, training sessions, workshops and visits, and production and dissemination of technical and communication support. The capacity building will target institutional and community capacities and information on: improved forest rehabilitation and management practices, tree nursery establishment and management, forest governance.

Component 2: Development of village nurseries to support forestry

- Preliminary selection, collection and propagation of tree species for regeneration and reforestation purposes; including native seeds form indigenous forests and procurement of high quality seed for planted forests and enrichment planting;
- Technical and financial support to the development of community-level nurseries (village nurseries) for forest species production and the use of appropriate technological methods for the production of seedlings

Component 3: Governmental natural forests and hills rehabilitation interventions

- Forest rehabilitation plans will be produced and will include preliminary erosion control and run-off water management techniques,
- Implementation of reforestation programmes and management plan in natural governmental forests.

Component 4: Community support for reforestation and sustainable management in forestlands

- Provide assistance to farmer groups to apply forestry/agroforestry practices within their land: technical advice, improvement of organizational capacities (for farmers and government extension agencies) and seeds/seedling supply, according to the specific needs and the promotion of government-community partnerships in forest management. This component will provide assistance to farmer groups to apply forestry/ agroforestry practices within their land but focusing on landscape scale rather than individual farmers.

The project will finance campaigns for communities to plant forest trees but also multi–purpose and nitrogen fixing trees in communal and private woodlots, schools and along roadsides. The aim is also to undertake reforestation of severely damaged areas already identified, on hilltops and other areas where viable agricultural practices are or have become more or less impossible. Community participation will be crucial in achieving this. The envisaged assistance will comprise technical advice, improvement of organizational capacities (for farmers and government extension agencies), supply of seeds/seedling and other inputs needed for reforestation, according to the specific needs and the promotion of government-community partnerships in forest management.

7.2. SOIL CONSERVATION/EROSION CONTROL AND AGROFORESTRY

This sub-project comprises of actions directed towards soil and water conservation and development of agroforestry, specifically as actions undertaken by communities and local groups (and not through individuals); they are designed for group actions addressing common preoccupations.

7.2.1. Specific Objectives

The specific objectives of the sub-project are the following:

- Erosion process is stabilized in the intervention areas
- Farmer's professional environment is operational: farmers have access to technical advices, suitable tools, service hiring, inputs supply and revolving funds for their investments and access to market for their products trading
- Soil and water conservation practices are adopted by farmers; livelihood productivity is increased and better secured
- Farmer's income are diversified and increased and food security is improved
- Existing infrastructures for water harvesting and small irrigation and other purposes are restored and operational
- Farmer's professional network is operational and farmers are included in the decision making process

7.2.2. Sub-project activities

Component 1: Community awareness and capacity building for Soil conservation project

- Creation of Soil Conservation Committees, integration in stakeholders forum, training sessions, workshops and visits, and production and dissemination of technical and communication support

Component 2: Development of village nurseries to support agro-forestry and biological erosion control techniques

- Preliminary selection, collection and propagation of species for agroforestry purposes (nitrogen fixing trees etc…) and erosion control biological structures
- Technical and financial support to the development of community-level nurseries (village nurseries)

Component 3: Community support for soil conservation techniques and practices

- Provide assistance to committees to apply agroforestry practices and biological techniques within their own land: technical advice, improvement of organizational capacities (for farmers and government extension agencies) and access to revolving funds for farmer's investments
- The project will finance rehabilitation and erosion control interventions on community degraded sites.

7.3. SUSTAINABLE AGRICULTURE

Complementary to the Soil Conservation and Forestry sub-project above, this sub-project is directed towards farmers, and comprises of field actions expected to give direct benefit to the land owners (be it on private land as in Kenya, or community land as is usual in Tanzania). This includes both soil preparation and conservation (tilling, individual plot bunds and their vegetation, minor water retention works…), and agronomic aspects (type of crops, crop combination, crop sequencing…). Part of the activities under this sub-project may be similar to those proposed under Soil Conservation and Forestry, but the implementation model will be clearly different because of the focus on plot level action.

7.3.1. Specific Objectives

The specific objectives of the sub-project are the following:

- Target intervention areas are identified and techniques to be promoted are selected and disseminated
- Farmer's professional environment is operational: farmers have access to technical advices, suitable tools, service hiring, inputs supply and revolving funds for their investments and access to market for their products trading
- SA-techniques practices, treatments and cash-crops are adopted by farmers in the watershed; Livelihood productivity is increased and better secured
- Farmer's income and food security are improved

- Farmer's professional network is operational and Farmers are including in the decision making process

7.3.2. Sub-project activities

Component 1: Community awareness and capacity building for Sustainable Agriculture project

- Identification or creation of FFS, integration of stakeholders forums; training sessions, workshops and visits, and production and dissemination of technical and communication support

Component 2: Community support for implementation of Sustainable agriculture improved techniques and practices

- Provide assistance to FFS to apply conservative agriculture practices within their member's land: technical advice, improvement of organisational capacities (for farmers and government extension agencies)
- Support access to marketing of products
- Revolving funds for farmer's investment/operation

Component 3: Support of suppliers, providers of local hire services and manufacturers of tools and machinery

- Identification of target suppliers and providers; building networks; introduction of new tools
- Revolving funds for suppliers or providers

7.4. RIVERBANK AND SPRING PROTECTION

This sub-project is directed to limiting sediment load in the river caused by river bank erosion, and to protect springs against human and animal action; these activities are meant for implementation at community or other local group level.

7.4.1. Specific Objectives

The specific objectives of the sub-project are the following:

A. Awareness and capacities of communities and technical officers towards riverbank and spring protection and restoration have increased

B. Representatives pilot areas are restored for sensitization and promotion of good practices

7.4.2. Sub-project activities

Component 1: Community awareness and capacity building

- Identification of individual owners or concerned communities
- Promotion of existing laws and regulations, particularly about buffer zones

- Identification and delineation of spring areas needing protection
- Training sessions, workshops and visits, and production and dissemination of technical and communication support

Component 2: Implementation of Pilot intervention

- Rehabilitation plans and budgets, management plan for operation and maintenance
- Implementation of works

7.5. MEANS

7.5.1. Afforestation/Reforestation

The Afforestation sub-project will be concerned with afforestation activities on gazetted forest land and community or private woodlands. Afforestation would be organized and coordinated by forestry district officers (KFS) in Kenya and their equivalent in Tanzania.

Labour for land preparation and plantation will be recruited from local communities.

The project will fund settlement and equipment of community or private nurseries to allow an easy access to seedlings for afforestation operations.

The project will fund seedlings and inputs fro plantation on private and community woodplots

7.5.2. Soil Conservation and Agroforestry

Activities will be undertaken within Soil Conservation (SC) units including both private lands and communal lands and through the creation of SC committees.

The project will fund directly:

- Preliminary investigations and consultancies needed to produce the land stabilization plans (for each SC unit);
- Civil works, tools and equipment and inputs needed for stabilization of major erosion figures;

Committees will provide labour for stabilization biological techniques;

Applying of agroforestry and other agricultural practices promoted will be implemented by individuals farmers on their own plots. Specifically, river bank areas will be suggested for fruit tree planting, with a double result as bank protection and alimentation/income improvement.

Farmers will have access to revolving funds for their investment (tools, seeds, service hiring…)

Funding for local water development activities would be requested by individual farmers, farmer collectives, villages, or WRUAs. Because of its relevance for IWMP, it is recommended to create a Local Water Development Fund, to be managed by the Project Management Unit office (Financial Manager)

7.5.3. Sustainable Agriculture

The project will promote further introduction of Sustainable Agriculture as a relatively new agricultural technology to smallholder farming systems in the corresponding districts of Kenya and Tanzania with the aim of raising agricultural productivity and using scarce natural resources in a more sustainable and efficient way.

The project will build on the momentum in Sustainable Agriculture development created by previous projects, like in Bungoma in Kenya. Where necessary, it will revitalize and consolidate the network of knowledgeable persons in this field, at the level of:

- district government line agencies,
- research and training institutions (KARI in Kenya and the different Agricultural Research Institutes of Tanzania),
- Agricultural Development Training Centers,
- Farmer Field Schools and local communities (trained farmers from previous projects),
- Members of the African Conservation Tillage (ACT) Network, FAO/GTZ SARD program.

A workshop will be organized in each participating country to discuss previous experiences and lessons learnt, with regard to technologies propagated and to procedures of contacting communities, creating new farmer field schools (FFS), and methods of upscaling. “Long lists” of technologies will be compiled that appear most relevant to the project and prevailing agro-climatic conditions.

Main elements of project design are:

- Promotion of Sustainable Agriculture with the three key principles: i) minimum soil disturbance, ii) soil cover (with mulch, or cover crops, preferably legumes) and iii) crop rotation or association.
- Support to farmer groups via Farmer Field Schools (FFS).
- Encouragement and support of service providers such as local hire services for no-till farming operations and national manufacturers of machinery (sub-soilers, rippers, and direct seeders).

A project SA Officer, trained by the project’s SA specialist, will be appointed in each district (10 in total), to assist in the work of trained farmers from previous projects (SA Facilitators) and government extension staff or project staff (2 per district). Trained farmers (SA facilitators) and extension staff will receive follow up training by the project’s SA specialist, in cooperation with the African Conservation Tillage Network and national research institutes (KARI and Tanzanian ARIs). A well designed training curriculum exists for this purpose, formulated by the previous projects, and comprehensive and well designed training material is available.

The SA facilitators and extension staff will promote, and assist in creation of, new FFS for conservation agriculture. Trained farmers act as facilitators to new FFS. Exchange visits to existing FFS will add to the acceptance on new sites.

7.5.4. Riverbank and spring protection

Preliminary surveys will be implemented by consultancy services provided by riverbank protection experts. They will monitor then supervise the implementation process all along the 5-years of the project. Implementation of field activities will be managed by 4 technical field officers with an agroforestry or forestry background, based in each of the districts targeted for riverbank protection activities:

- Serengeti and Tarime in Tanzania,
- Bomet and Narok in Kenya.

Activities will begin in the priority areas. In those areas, a stage of mobilization and awareness of population will seek to reach community support of the project and to ensure that land owners or users in the areas will actively respect and contribute to protect the rehabilitation areas.

7.6. QUANTITIES

The Watershed Management Plan is expected to be implemented on the priority areas. Out of satellite imagery, the Consultant has made a calculation of the areas at different slopes for different types of land use, to derive from there the areas to be targeted by each sub-project; this is presented in Table 1.

Table 1: Distribution of priority areas into slope and land use categories

Priority area		**< 9°**	**9 - 12°**	**12 - 16°**	**16 - 21°**	**> 21 °**	**Total**
Total area (ha)							
Mid Nyangores	Forest	9 749	5 957	5 609	2 950	788	25 053
41 984	Agriculture	9 633	3 457	2 632	1 082	127	16 932
	Rangeland	-	-	-	-	-	-
Mid Amala	Forest	2 815	2 056	2 872	2 440	803	10 985
63 158	Agriculture	41 540	4 423	3 136	1 667	648	51 413
	Rangeland	733	22	5	-	-	760
Mara Somoche	Forest	-	-	-	-	-	-
122 672	Agriculture	104 086	1 133	808	424	236	106 687
	Rangeland	12 256	1 157	1 050	836	687	15 986
Lower Tigithe	Forest	-	-	-	-	-	-
28 433	Agriculture	24 204	436	285	225	197	25 346
	Rangeland	861	306	384	513	1 022	3 086
Total	Forest	12 564	8 014	8 481	5 389	1 591	36 038
256 248	Agriculture	179 463	9 448	6 861	3 398	1 207	200 378
	Rangeland	13 849	1 485	1 439	1 349	1 709	19 832

The Consultant proposes to define as target areas for the initial 5 years of implementation the following quantities (admitting that in average 20% of the area in each category is not available for implementation of works: settlements, streams, road and tracks, rock…):

- For Afforestation: working on Agriculture and Rangeland parts, 80% of the area above 21°, 20% of the 16-21° area, and 5% of the rest,, which amounts to 13,910 ha;
- For Soil Conservation and Agroforestry: working on Agriculture and Rangeland parts, 60% of the 16-21° area and 20% of the 12-16° area, which is 4,508 ha;
- For Sustainable Agriculture: 55% of the 12-16° area, 10% of the 9-12° area and 5% of the rest, or 25,974 ha.

It needs to be highlighted that the relatively low figure considered for Soil Conservation and Agroforestry is due to the fact that all works undertaken directly by owners are excluded here, and are considered only under Sustainable Agriculture – even if they can be seen as soil conservation efforts.

The precise location, and the schedule to cover the extension, will appear as the result of the participative process with the local communities.

The Riverbank Protection Project is supposed to start with a first phase with duration of 5 years. This is considered as a minimum period where tangible outputs can be expected, given the gradual take off of implementation and the innovative character of suggested measures. Since programs of this kind are generally having an impact growing substantially only after longer period, a donor should preferably be prepared to a longer term commitment.

A tentative estimation of progress in river bank protection over a five years period, shows that a total of over 25 km of river length including several different type of degradation addressed, can be protected on the basis of 4 000 to 6 000 meters each year. Total width could be at least 60 m (30 m on each bank), for a total area of 30 ha per year, 150 ha in total

A similar area for spring protection can be expected.

8. IMPLEMENTATION FRAMEWORK

The project is planned to start with a first phase of five years, anticipating that donors see the necessity of longer term commitment to achieve tangible impacts on watershed conditions.

The project will be carried out from Kenya IWMP coordination office since most watershed management activities are located there.

The following full time staff members will be posted in the two IWMP coordination offices

- A Watershed Management specialist in Bomet
- A liaison officer in Tanzania
- 1 district officer per district (4 persons), working with 2 mobilization officers per district (8 persons)

Inputs will be provided by

- Consultancies of International and national specialists (wetland management, ecotourism …);
- GIS specialists (from the PMU office and the two coordination offices) and GIS trainers, ensuring the setting up and operation of a GIS network, and providing training to staff of line agencies
- Training/Extension specialist.

Some capacity will be reserved for unforeseen ad-hoc consultancies (10 months), for example for a short study of eco-tourism potential.

For the introduction of new technologies, contacts will be made with specialized organizations in the respective field, and contributions to the project will be effectuated on the basis of signed agreements.

In all technical, administrative or financial matters, the project will directly report to the PMU through technical reports, consultancy reports, progress reports, and monitoring reports. Funding lines will be directly from the PMU to the project; or be directly from the PMU to a partner institution providing services to the project, on the basis of agreements that are also approved by the PMU

8.1.1. Afforestation

For the Afforestation/Reforestation sub-project, activities, intervention will be implemented directly with already existing or newly created Community Forest Associations (CFAs) or Community Forest Users Groups (CFUGs).

The implementing agency will be MFW-KFS in Kenya and MNRT in Tanzania;

Second governmental agencies involved are NEMA in Kenya and NFA and District local governments (TFS) in Tanzania

Scientific research institutes, namely KEFRI in Kenya and TAFORI in Tanzania, will be involved in part of the activities, to support innovative techniques and species identification, seed collection and treatment/conservation.

Project-employed project facilitators (3 per district) will work with 1 assigned forest officer per district or sub-county.

8.1.2. Soil and Water Conservation and Agroforestry

The Soil and Water Conservation Project will be coordinated and guided by the project officers of the 2 country offices, with specialists to strengthen extension activities, planning capabilities and operational implementation capacities both of Community-based Organizations (CBO, SC Committees) and technical and extension staff at district/division level.

Assistance at community level will be provided by Community Mobilisation Officers, providing assistance to community organization and mobilization, and in general planning.

Technical assistance in planning, implementation and monitoring, to extension officers (2 per district) and community members/groups will be provided by District Technical Officers (2 per district) and short term experts. Communities will actively participate in the formulation of the land Stabilization Plans for each of the SC units.

Arrangements for cooperation will, among others, be made with:

- NALEP and TASDP, the principal partners for extension services;
- KFS and TFS-FBD, for knowledge transfer regarding the establishment of private nurseries, production and tending of fruit trees, marketing of agroforestry produce; production of specialized planting material
- Other line agencies concerned with environmental protection (NEMA, District Water and Livestock Offices);
- Newly created WRUAs and equivalent future organizations in Tanzania, for integration of catchment rehabilitation activities into the wider perspective of integrated watershed management. WRUAs can also request for funding from a special Trust Fund created for watershed management;
- NGOs, both working on technical aspects (for example VI) and aspects of community support (case of World Vision);
- National and international institutes responsible for research and knowledge transfer (ICRAF)
- Existing information exchange networks: Agroforestry Network, Forest Action Network…
- Individuals and institutions already promoting conservation agriculture, such as the ATCs in Western province of Kenya;

The system of FFS is frequently meant to reach individual farmers. The Soil Conservation project will use this system for promotion of technical measures in a framework wherein local communities as a whole are contacted, sensitized and organized, as to plan interventions for a larger contiguous area (village area, micro-catchments SC unit…).

Commitment of communities is to be raised on the basis of livelihood models providing increased productivity as well as environmental protection. Wherever possible, productive biological measures (contour hedges, agro-forestry measures) would be given preference instead of mechanical measures. This would gradually entail a transition from a mono-cropping model to a multi cropping agro-forestry model.

The Community Mobilization Officers will make the first contacts with communities in priority areas, after introduction by the responsible Frontline Extension Officer to the area. They will undertake sensitization

activities and assist in community mobilization/ organization. They will identify and contact existing CBOs in the area to this regard.

The Technical officers would join in at an early stage, for technical aspects, to familiarize with the community and community-based approach. Their main task will be to guide field implementation activities. Technical Officers will as much as possible work in close cooperation with the Extension Officers.

In case of new technologies, representatives of partner organizations will be responsible for training/demonstration during initial implementation in the field, after which this will be taken over by the Technical Field Officers.

Close cooperation will also be sought with WRUAs when these are created in the areas concerned, because of considerable overlap in interest and target groups.

Conditions of cooperation with partner organizations in catchment rehabilitation activities will be stipulated in a Memorandum of understanding.

Institutional networking

Institutional networking will take place at two levels, notably at the level of community-based institutions, and at the level of supporting institutions.

At the level of the community, when a group of community members decides to embark on catchment rehabilitation, they will create an institution for this purpose or choose an existing CBO through which they have undertaken community activities before. Focus will be on existing Farmer Self Help groups, Forestry Resource User Group, Land Committees, Environment Committees and others CBOs engaging in natural resource management, and Farmer Field Schools who are already practicing improved and profitable land husbandry models. Representative(s) of such groups could be contracted as “model farmers” or “demonstration farmers” to assist in sensitization/extension. Networking between these CBOs will be promoted by organizing exchange visits and local level stakeholder meetings.

At the level of supporting institutions, emphasis will be put on institutional networking, as:

- To make use of all knowledge, experience and capacity available in the area on the subjects concerned, and
- To mobilize multiple resources and encourage a stronger focus for implementation in the priority intervention areas.

Transboundary aspects

- The PMU and country coordination team would see to an equitable attention to interests on either side of the border.
- All general planning efforts will be carried out as a joint effort of representatives from relevant line agencies in both partner countries.
- Implementation will be effectuated by Community Mobilisation Officers and Technical Field Officers in cooperation with line agency staff on either side of the border.
- Agreements with implementation partners will follow a format agreed by both partner countries.
- Agreements regarding local environmental regulations and commitments will be formulated through mutually agreed upon bylaws being in compliance with legislation in both partner countries. It is important that locally formulated bylaws are approved at the district level.

8.1.3. Sustainable agriculture

The sub-project will be coordinated by the project's SA coordinator based in Bomet for Kenya and the liaison officer based in Musoma coordination office for Tanzania.

For training/extension matters, the project will be supported by a Training/Extension specialist.

If availability of governmental district staff is too low, NGOs in the area will be contracted to provide staff to perform as SA project facilitators (2 per district), who will be stationed in the respective districts, and will work from there with SA district officers (1 per district). They will receive regular visits from the project's SA specialist (from IWMP office in Bomet and/or its liaison officer from IWMP office in Musoma).

The sub-project will strongly build on good cooperation with network partners: national research organizations, local Agricultural Development Training Centers, government line agencies at different levels, the FAO CA-SARD program, donors like GTZ, credit facilitators, local manufacturers. Cooperation will be formalized in the form of Cooperation Agreements.

The central project office may be located in Bomet in Kenya, and a liaison officer (for accounts and logistics) for the entire project be stationed half time in one of the main project districts in Tanzania.

The use of Farmer Field Schools (FFS) has proven to be an effective extension mechanism to reach individual farmers for simple agricultural improvements, which could be further upgraded by inclusion of more integrated approaches towards cropping, specifically including erosion control. In similar areas, large-scale up scaling of sustainable agricultural production is feasible, requiring only minimal support for FFSs for the development of a FFS curriculum and training of trainers. FFSs should cover a range of potentially suitable techniques (including agricultural modernization and diversification options), which farmers can test and adjust to their farming environments.

8.1.4. Riverbank and spring protection

One Agroforestry Field Officer would be deployed in each of the 4 districts, to manage the pilot river bank and spring protection works. Even if the number of springs is expected to be higher in the Kenya priority areas, capturing good quality water in the Tanzanian lower basin needs to be carefully addressed.

The river bank rehabilitation works will be implemented on river length from 4 000 meter to 6 000 meters each year during 5 years.

Spring protection will be established in the small flat swamp-like areas which form the springs of the streams; the area to be protected from most activities (and particularly from cattle) will need to be defined in each case.

Workshops, meetings and field visits, dissemination of technical material, organized by technical officers will be the support of riverbank promotion and public awareness.

9. PROJECT MONITORING

9.1. INDICATORS

Performance indicators have been proposed to reflect the progress of the sub-project implementation and impacts of activities undertaken under the different components of the sub-project.

The Performance indicators for sub-project progress and outcomes are presented below in Table 2.

9.2. SCHEDULE

According to the general schedule proposed for monitoring and evaluation, indicators will be informed to allow drafting of semi-annual and annual reports.

Table 2 – Performance indicators

KEY OUTPUTS	PERFORMANCE INDICATOR SUB-PROJECT PROGRESS/OUTCOMES	PERFORMANCE INDICATOR SUB-PROJECT IMPACTS
AFFORESTATION		
A Intervention areas to be rehabilitated are identify and characterized, management mechanisms are proposed and this basic information is disclosed and discussed with communities	▪ Number of agreements between communities and administration for forest management ▪ Awareness and information ensured	
B. Community associations (CFAs, CFUGs…) are identified and members are trained; extension staff are equipped and trained to organize, facilitate and provide on-going support to community associations; Research institutes are identified and involved in specific supportive tasks.	▪ Number of operational CFAs and CFUGs and active members ▪ Number of Training sessions/visits/workshops and persons trained ▪ List of Research institutes involved	▪ Understanding of reforestation techniques and community management mechanisms by technical staff, local government representatives and farmers
C. Nurseries are operational and seedlings available for reforestation operations	▪ Number of nurseries created and operational ▪ Number of seedlings produced for forestry	▪ Diversification of income sources for population
D. Knowledge networks for exchanging experiences are established at local and transboundary levels	▪ Stakeholder forums operational	

KEY OUTPUTS	PERFORMANCE INDICATOR SUB-PROJECT PROGRESS/OUTCOMES	PERFORMANCE INDICATOR SUB-PROJECT IMPACTS
E. Farmers are undertaking reforestation operations on private plots and community areas	▪ Hectares of community/ private reforested areas	▪ Forest cover in the watershed (ha; %) ▪ Availability of fuel wood ▪ Carbon storage
F Reforestation operations are carried out in governmental forests	▪ Hectares of governmental reforested areas	▪ Forest cover in ha and in % ▪ Increase of Carbon storage
SOIL CONSERVATION & AGROFORESTRY		
A. Identification of SC intervention areas and mapping; project design for stabilization and production of stabilization plans for each SC areas	▪ Number of stabilization plans edited, disclosed and agreed by SC committees members	
B. Major erosion figures (Lavakas, major gullies and landslides) are treated in the intervention areas; Maintenance of works is organized	▪ Hectares treated for erosion control in the targeted areas ▪ Number of maintenance agreements signed	▪ Stabilization of the treated areas ▪ Sediment loads in the water bodies
C. SC Committees are identified, FFS are created and members are trained; Extension staff are trained to organize, able to facilitate and provide on-going support to committees; Research institutes are identified and involved in specific tasks	▪ Number of committees and FFS established and operational ▪ Number of training sessions/visits/workshops and persons trained ▪ Terms of reference for research institutes involvement	▪ Extension staff and farmers familiar with FFS methodology ▪ Understanding of SC practices
D. Equipment and tools are available (Owners of draught animal power (DAP) and tractors are able to offer hire-services to other farmers + Local manufacturers and retail sector are able to	▪ Trained operators and animals available for each farmer group ▪ Access to SC equipment and maintenance for each	▪ Sustainability of SC practices

KEY OUTPUTS	PERFORMANCE INDICATOR SUB-PROJECT PROGRESS/OUTCOMES	PERFORMANCE INDICATOR SUB-PROJECT IMPACTS
supply tools and equipment suitable for conservation agriculture practices to farmers)	farmer group	
E. Revolving funds/micro-credit mechanisms is established and accessible to farmers	▪ Number of beneficiaries	▪ Financial capacities of farmers for investments ▪ Farmers income
F. Farmers adopt and apply good practices for soil erosion control and agroforestry; Rational use of fertilizers and other agricultural inputs has improved;	▪ Number of individual farmers applying SC practices ▪ Hectares/linear treated with new SC techniques	▪ Soil fertility ▪ Level of pression on marginal lands and forest for croplands settlement
G. Farmers have access to market for their cash crop production and other products	▪ Agricultural yields are increasing ▪ Increasing of annual volumes of cash crops and other products ▪ Identification of marketing channels for new products	▪ Farmer's income and food security
H. Local water funds are established and operational Targeted infrastructures are identified, works are planned and implemented, operation and maintenance framework is established	▪ Number of sites restored and operational ▪ Number of operation and maintenance agreements	▪ Capacity of water harvesting
I. Knowledge networks for exchanging experiences are established at local and transboundary levels	▪ Stakeholders forums are operational	▪ Progress in transboundary exchanges and land management
SUSTAINABLE AGRICULTURE		
A. Target intervention areas and techniques to be promoted are identified	▪ Guidelines for SA implementation is produced	▪ Knowledge on SA is disseminated
B. Extension staff are equipped and trained to	▪ Number of training, visits and workshops	▪ Extension staff and farmers familiar with FFS

KEY OUTPUTS	PERFORMANCE INDICATOR SUB-PROJECT PROGRESS/OUTCOMES	PERFORMANCE INDICATOR SUB-PROJECT IMPACTS
organize, facilitate and provide on-going support to operational SA-FFS and apply participatory extension approach for SA development		methodology ▪ Understanding of SA practices
C. SA equipment and tools are available (Owners of draught animal power and tractors are able to offer hire-services in SA practices to other farmers + Local manufacturers and retail sector are able to supply tools and equipment suitable for conservation agriculture practices to farmers)	▪ Trained operators and animals available for each farmer group ▪ Access to SA equipment and maintenance for each farmer group	
D. Revolving funds / micro-credit mechanisms is established and accessible to farmers	▪ Number of beneficiaries	▪ Financial capacities of farmers for investment in new technologies are improved
E. Farmers adopt and apply conservation agriculture practices Rational use of fertilizers and other agricultural inputs has improved	▪ Number of SA-FFS established and operational ▪ Number of individual farmers applying SA-practices ▪ Surfaces dedicated to SA practices ▪ Quantity of fertilizers and other inputs used by farmers members of the SC Committees	▪ Livelihood productivity ▪ Level of pressure on marginal lands and forest fro cropland settlement ▪ Soil fertility
F. Farmers have access to market for their cash crop production	▪ Volume of cash crops trade on local markets	▪ Farmers income
G. Knowledge networks for exchanging experiences are established at local and transboundary levels	▪ Stakeholders forums are operational	▪ Level of Farmers solidarity and decision power
RIVERBANK AND SPRING PROTECTION		
A. Guidelines for riverbank and spring protection are produced, printed and disseminate	▪ Number of printed and disseminated guidelines for riverbank protection and restoration	▪ Level of awareness regarding riverbank restoration usefulness and techniques

KEY OUTPUTS	PERFORMANCE INDICATOR SUB-PROJECT PROGRESS/OUTCOMES	PERFORMANCE INDICATOR SUB-PROJECT IMPACTS
B. Community awareness, knowledge of laws and capacities towards riverbank and spring protection are increased	▪ Number of private owner involved in pilot actions ▪ Number of training sessions/workshops and visits organized	▪ Public awareness level
C. Identification and mapping of pilots areas Implementation of promoted techniques on pilot areas	▪ Number of treated pilot areas. ▪ Linear of stabilized and vegetated river banks	▪ PMU GIS database ▪ Sediment loads in the rivers ▪ Carbon storage ▪ Public awareness level

10. ROUGH COST ESTIMATES

Based on the project and sub-project definition presented in the previous chapters, the investment costs for the different sub-projects are presented below. Detailed cost calculations are presented in successive tables for each sub-project.

Sub-project	**Cost ('000 USD)**
Afforestation	9,097
Soil conservation and Agroforestry	4,359
Sustainable Agriculture	5,553
Riverbank and Spring protection	2,602
Total	21,612

Cost estimate for Sub-project 1A: Afforestation

Activity	Unit	Quantities						Unit Cost	Totals USDx'000					
		year 1	year 2	year 3	year 4	year 5	Total	($x'000)	year 1	year 2	year 3	year 4	year 5	Total
1A. Afforestation Project														
1 Field staff costs														
Project Forestry officers /extension staff 1 per district / 3 districts	pmonth	36,00	36,00	36,00	36,00	36,00	180,00	2,00	72,00	72,00	72,00	72,00	72,00	360,00
facilitators 2 persons / district /3 districts	pmonth	72,00	72,00	72,00	72,00	72,00	360,00	2,00	144,00	144,00	144,00	144,00	144,00	720,00
Subtotal 1									216,00	216,00	216,00	216,00	216,00	1 080,00
2 Equipment/Material														
Equipement set for staff	unit	9,00					9,00	1,20	10,80	0,00	0,00	0,00	0,00	10,80
Subsidiary fund for CFA equipement	Lumpsum	10,00	10,00	10,00	10,00	10,00	50,00	1,00	10,00	10,00	10,00	10,00	10,00	50,00
Motorbikes	unit	9,00			4,00		13,00	3,00	27,00	0,00	0,00	12,00	0,00	39,00
Planting material (for labour team / CFA CFUG)	lumpsum	10,00	10,00	10,00	10,00	10,00	50,00	3,25	32,50	32,50	32,50	32,50	32,50	162,50
Equipement for Nursery establishement	Lumpsum	10,00	30,00	30,00	30,00		100,00	1,00	10,00	30,00	30,00	30,00	0,00	100,00
Subtotal 2									90,30	72,50	72,50	84,50	42,50	362,30
3 Workshops & meetings														
Workshops and meetings	lumpsum	3	3	3	3	3	15	1,75	5,25	5,25	5,25	5,25	5,25	26,25
farmers visits costs by FFS	lumpsum		6	6	6	6	24	0,50	0,00	3,00	3,00	3,00	3,00	12,00
Subtotal 3									5,25	8,25	8,25	8,25	8,25	38,25
4 Transport & other operation costs														
Transportation of seedlings	lumpsum	20	20	20	20	20	100	0,50	10,00	10,00	10,00	10,00	10,00	50,00
Transboundary traveling	lumpsum	3	3	3	3	3	15	2,00	6,00	6,00	6,00	6,00	6,00	30,00
Motorbikes operating costs (9 motorbikes)	month	108	108	108	108	108	540	0,05	5,40	5,40	5,40	5,40	5,40	27,00
Subtotal 4									21,40	21,40	21,40	21,40	21,40	107,00
5 Consultancies														
Preliminary survey and implementation plan	pmonth	6					6	10,00	60,00	0,00	0,00	0,00	0,00	60,00
Training extension specialist	pmonth	3	3	3	2	2	13	6,00	18,00	18,00	18,00	12,00	12,00	78,00
Subtotal 5									78,00	18,00	18,00	12,00	12,00	138,00
6 Funds and Revolving funds														
Fund for rehabilitation intervention (3000 ha)	ha	1900	3000	3000	3000	3000	13 900,00	0,50	950,00	1 500,00	1 500,00	1 500,00	1 500,00	6 950,00
Revolving fund for nursery operation	unit	10	30	40	60	60	200,00	1,00	10,00	30,00	40,00	60,00	60,00	200,00
Subtotal 6									960,00	1 530,00	1 540,00	1 560,00	1 560,00	7 150,00
7 Environmental and social monitoring														
Subtotal 7	percent							2,50%	34,27	46,65	46,90	47,55	46,50	221,89
Subtotal 1A: Afforestation									1 405,22	1 912,80	1 923,05	1 949,70	1 906,65	9 097,44

Cost estimate for Sub-project 1B: Soil Conservation - Agroforestry

Activity	Unit	Quantities						Unit Cost	Totals USDx'000					
		year 1	year 2	year 3	year 4	year 5	Total	($x'000)	year 1	year 2	year 3	year 4	year 5	Total
1B. Soil Conservation - Agroforestry Project														
1 Field staff Cost														
Gov SC district officers /extension staff 2 per district	pmonth	96,00	96,00	96,00	96,00	96,00	480,00	2,00	192,00	192,00	192,00	192,00	192,00	960,00
SC Project officer 1 per district	pmonth	48,00	48,00	48,00	48,00	48,00	240,00	2,00	96,00	96,00	96,00	96,00	96,00	480,00
Community mobilisation officers 2 per district	pmonth	96,00	96,00	96,00	96,00	96,00	480,00	1,50	144,00	144,00	144,00	144,00	144,00	720,00
Subtotal 1									432,00	432,00	432,00	432,00	432,00	2 160,00
2 Equipment/Material														
Upgrading district division GIS facilities (computer, software, digitizer table, printer…)	Lumpsum	4,00					4,00	2,50	10,00	0,00	0,00	0,00	0,00	10,00
Equipement set for staff (GPS, clinometers, cell. Phones, computers…)	unit	16,00					16,00	1,20	19,20	0,00	0,00	0,00	0,00	19,20
Procurement seeds selected planting material	Lumpsum	5,00	10,00	10,00	10,00	10,00	45,00	3,25	16,25	32,50	32,50	32,50	32,50	146,25
Nursery equipement by Nursery	unit	5,00	10,00	10,00	10,00	10,00	45,00	1,00	5,00	10,00	10,00	10,00	10,00	45,00
Subsidiary fund for CBO equipement (including small implementing equipement)	Lumpsum	5,00	10,00	10,00	10,00	10,00	45,00	1,00	5,00	10,00	10,00	10,00	10,00	45,00
Motorbikes	unit	16,00			4,00		20,00	2,50	40,00	0,00	0,00	10,00	0,00	50,00
Subtotal 2									95,45	52,50	52,50	62,50	52,50	315,45
3 Workshops & meetings														
Workshops and meetings	lumpsum	4	4	4	4	4	20	1,75	7,00	7,00	7,00	7,00	7,00	35,00
Farmers visits costs by CFA/CBO/FFS	lumpsum	30	30	30	30	30	150	0,50	15,00	15,00	15,00	15,00	15,00	75,00
Subtotal 3									22,00	22,00	22,00	22,00	22,00	110,00
4 Transport & other operation costs														
Transboundary traveling	lumpsum	10	10	10	10	10	50	3,00	30,00	30,00	30,00	30,00	30,00	150,00
Motorbikes operating costs (16 motorbikes)	month	240	96	96	96	96	624	0,05	12,00	4,80	4,80	4,80	4,80	31,20
Subtotal 4									42,00	34,80	34,80	34,80	34,80	181,20
5 Consultancies														
Community mobilization/capacity builidng trainer/adviser (national)	pmonth	3	2	1	0	0	6	6,00	18,00	12,00	6,00	0,00	0,00	36,00
Training extension trainer/adviser	pmonth	3	2	1	0	0	6	6,00	18,00	12,00	6,00	0,00	0,00	36,00
National soil conservation/agroforestry trainer/adviser	pmonth	3	2	1	1	1	8	6,00	18,00	12,00	6,00	6,00	6,00	48,00
IWM adviser (international expert)	pmonth	3		2			5	18,00	54,00	0,00	36,00	0,00	0,00	90,00
Unspecified consultancies national	pmonth	3	2	2	2	1	10	6,00	18,00	12,00	12,00	12,00	6,00	60,00
Unspecified consultancies international	pmonth	2	1	1	1	1	6	18,00	36,00	18,00	18,00	18,00	18,00	108,00
Subtotal 5									162,00	66,00	84,00	36,00	30,00	378,00
6 Revolving funds														
Development fund	lumpsum	1	1	1	1	1	5,00	200,00	200,00	200,00	200,00	200,00	200,00	1 000,00
Revolving fund for CBO operation	lumpsum	120,00	240,00	240,00	240,00	240,00	1 080,00	0,10	12,00	24,00	24,00	24,00	24,00	108,00
Subtotal 6									212,00	224,00	224,00	224,00	224,00	1 108,00
7 Environmental and social monitoring														
Subtotal 7	percent							2,50%	24,14	20,78	21,23	20,28	19,88	106,32
Subtotal 1B: Soil & Water Conservation									989,6	852,1	870,5	831,6	815,2	4 359,0

Cost estimate for Sub-project 1C: Sustainable Agriculture

Activity	Unit	Quantities						Unit Cost	Totals USDx'000					
		year 1	year 2	year 3	year 4	year 5	Total	($x'000)	year 1	year 2	year 3	year 4	year 5	Total
1C. Sustainable Agriculture Project														
1 SA Field staff = current cost														
Gov SA officers /extension staff 6 persons = 1 per district	pmonth	72,00	72,00	72,00	72,00	72,00	360,00	2,00	144,00	144,00	144,00	144,00	144,00	720,00
Project SA officers /extension staff 12 persons = 2 per district	pmonth	144,00	144,00	144,00	144,00	144,00	720,00	2,00	288,00	288,00	288,00	288,00	288,00	1 440,00
Advanced farmers/ FFS leaders = 1 per 1 FFS 10% time	pmonth	150,00	450,00	750,00	1 050,00	1 350,00	3 750,00	0,10	15,00	45,00	75,00	105,00	135,00	375,00
Subtotal 1									447,00	477,00	507,00	537,00	567,00	2 535,00
2 Equipment/Material														
Equipement set for staff (18 persons) / GPS, cellphones, laptop…	unit	18,00					18,00	1,20	21,60	0,00	0,00	0,00	0,00	21,60
Subsidiary fund for FFS equipement	Lumpsum	150,00	300,00	300,00	300,00	300,00	1 350,00	1,00	150,00	300,00	300,00	300,00	300,00	1 350,00
Motorbikes	unit	18,00			4,00		22,00	2,50	45,00	0,00	0,00	0,00	0,00	45,00
Subtotal 2									216,60	300,00	300,00	300,00	300,00	1 416,60
3 Workshops & meetings														
Workshops and meetings	lumpsum	10	10	10	10	10	50	1,75	17,50	17,50	17,50	17,50	17,50	87,50
Farmers exchange visits costs by FFS	lumpsum	150,00	300,00	300,00	300,00	300,00	1 350	0,50	75,00	150,00	150,00	150,00	150,00	675,00
Subtotal 3									92,50	167,50	167,50	167,50	167,50	762,50
4 Transport & other operation costs														
Transboundary traveling	lumpsum	10	10	10	10	10	50	3,00	30,00	30,00	30,00	30,00	30,00	150,00
Motorbikes operating costs (18 motorbikes)	month	216	216	216	216	216	1080	0,05	10,80	10,80	10,80	10,80	10,80	54,00
Subtotal 4									40,80	40,80	40,80	40,80	40,80	204,00
5 Consultancies														
Unspecified consultancies (international)	pmonth	2	2	1	1		6	18,00	36,00	36,00	18,00	18,00	0,00	108,00
Unspecified consultancies (national)	pmonth	3	3	2	1	1	10	6,00	0,00	0,00	0,00	0,00	0,00	0,00
Training extension specialist (national consultant)	pmonth	3	2	2	1	1	9,00	6,00	18,00	12,00	12,00	6,00	6,00	54,00
Subtotal 5									54,00	48,00	30,00	24,00	6,00	162,00
6 Revolving funds														
Revolving fund for Farmers operation	lumpsum	3 750,00	7 500,00	7 500,00	7 500,00	7 500,00	33 750,00	0,01	37,50	75,00	75,00	75,00	75,00	337,50
Subtotal 6									37,50	75,00	75,00	75,00	75,00	337,50
7 Environmental and social monitoring														
Subtotal 7	percent							2,50%	22,21	27,71	28,01	28,61	28,91	135,44
Subtotal 1C: Sustainable Agriculture									910,6	1 136,0	1 148,3	1 172,9	1 185,2	5 553,0

Cost estimate for Sub-project 1D: Riverbank and spring protection

Activity	Unit	Quantities						Unit Cost	Totals USDx'000					
		year 1	year 2	year 3	year 4	year 5	Total	($x'000)	year 1	year 2	year 3	year 4	year 5	Total
1D. Riverbank & spring protection														
1 Field staff costs														
Project Forestry officers /extension staff 1 per district / 6 districts	pmonth	72,00	60,00	60,00	60,00	60,00	312,00	2,00	144,00	120,00	120,00	120,00	120,00	624,00
Subtotal 1									144,00	120,00	120,00	120,00	120,00	624,00
2 Equipment/Material														
Equipement set for staff	unit	6,00					6,00	1,20	7,20	0,00	0,00	0,00	0,00	7,20
Subtotal 2									7,20	0,00	0,00	0,00	0,00	7,20
3 Workshops & meetings														
Workshops, meetings and field visits	lumpsum	5	5	5	5	5	25	1,80	9,00	9,00	9,00	9,00	9,00	45,00
Subtotal 3									9,00	9,00	9,00	9,00	9,00	45,00
4 Transport & other operation costs														
Transboundary traveling	lumpsum	1	1	1	1	1	5	2,00	2,00	2,00	2,00	2,00	2,00	10,00
Subtotal 4									2,00	2,00	2,00	2,00	2,00	10,00
5 Consultancies														
Preliminary survey and implementation plan	pmonth	6	2	2	2	2	14	10,00	60,00	20,00	20,00	20,00	20,00	140,00
Subtotal 5									60,00	20,00	20,00	20,00	20,00	140,00
6 Funds and Revolving funds														
Fund for river bank rehabilitation intervention	ml	2000	5000	6000	6000	6000	25 000,00	0,05	100,00	250,00	300,00	300,00	300,00	1 250,00
Fund for spring protection	unit	10	20	20	20	20	90,00	5,00	50,00	100,00	100,00	100,00	100,00	450,00
fund for editing and dissemination of technical and promotion support material	lumpsum	1,00	1,00	1,00	1,00	1,00	5,00	2,50	2,50	2,50	2,50	2,50	2,50	12,50
Subtotal 6									152,50	352,50	402,50	402,50	402,50	1 712,50
7 Environmental and social monitoring	percent							2,50%	9,37	12,59	13,84	13,84	13,84	63,47
Subtotal 7														
Subtotal 1D: Riverbank & spring protection									384,1	516,1	567,3	567,3	567,3	2 602,2

APPENDIX: AGRICULTURAL COMPONENT OF MARA RIVER BASIN

1. CURRENT CONDITIONS

1.1 CLIMATE AND SOILS OF STUDY AREA

The study area focus in Kenyan side of the Mara River Basin falls within the mid-Nyangores and mid Amala sub-basins in Kenya and lower Tigithe and Mara Somoche sub-basins in Tanzania. The main districts covered in Kenya are Bomet, Oloolunga, Chepalungu and Narok South while in Tanzania Tarime and Serengeti districts are covered. They are vast districts which cut across four sub-basins in the region excluding the Sand-river sub-basin. In Tanzania, Serengeti and Tarime districts are found in the Lower-Mara sub-basin. Based on GIS analysis by use of a DEM (Digital Elevation Model) the Mara river system was divided into six sub-basins namely: Amala, Nyangores, Mid-Mara, Talek, Sand River and the Lower Mara sub-basins. Each of these sub-basins has distinctive climatic conditions.

1.1.1 TEMPERATURE AND RAINFALL

The Amala sub-basin has relatively cool temperatures throughout the year, with the mean annual figures ranging from 12°C to 16°C. This area receives between 1500 to 1800 mm of rainfall annually which is considered to be high. The rainfall is bimodal: the long rains come between March and May and the short rains are between October and December. There are 200 days of rain on average yearly. In the Nyagores sub-basin the rainfall is bimodal and high; mean annual figures of between 1500 to 1800 mm of precipitation. There is no clearly marked dry season in the Nyagores sub-basin. The Mid-Mara sub-basin has a main dry spell between June and October, with a bimodal pattern of rain where the long rains come between March and May and the short rains occur between November and December. The climate here is classified as semi-humid to semiarid climate with mean annual rainfall of between 600 to 1100 mm of precipitation. The average minimum temperatures of this region are in the range of 10 to 14°C whereas the mean maximum temperatures range from 22 to 26°C.

The Tarime and Serengeti districts of Tanzania are in the Mara region. This region is divided into three major climatic zones namely;

- the northern zone which falls within the MRB in highland area covering Tarime and part of Serengeti districts. This zone receives an average rainfall of between 1250 and 2000 mm per year and it has two rainy seasons; a short one from September to January, and a long rainy season from February to June. This zone favors the growth of different annual and permanent crops including beans, maize, banana, sweet potato, vegetables and coffee respectively;

- the central zone which covers much of Musoma district and eastern parts of Serengeti districts. The zone receives between 900 and 1300 mm of rainfall per year and it favors the growth of different crops including rice, maize, sorghum and many others.

- The Lower-Mara sub-basin gets annual mean rainfall of about 1500 to 1800 mm in the North-West of the basin; this is similar to the occurrences in the Mau escarpment in Kenya. The East side of the area is dry though, receiving a mean of 700 mm of precipitation. The rainfall

regime here is bimodal, where the long rains come between March and May and between October and December as short rains.

1.1.2 SOILS

The soil types of a region determine significantly the type of agricultural activities taking place, the population density and the drainage of the area. The wide range of soil types in the Mara basin has the fertility levels of the region varying considerably. The Amala and the Nyangores sub-basins have similar kinds of soils which are mainly Mollic Andosols that were derived from tertiary volcanic materials. The steepest slopes of this region have Cambisols whereas in the Northern regions, Humic Nitisols are included. These two regions have high capacity for agriculture because of well drained soils, which have a high water holding capacity, with fine texture and high natural fertility. These factors have led to high population density in the region which is rapidly increasing. Bomet central has densities reaching 470 persons per km². In the Mid-Mara sub-basin, the soils are generally rocky, sandy and are shallow. This region is dominated by brown clay soils which are waterlogged seasonally. Weakly alkaline volcanic phonolitic tuff could be found to the North, whereas, water courses and river beds have deposits of sand, gravel and silt.

The Mara region's soils have been formed by weathering of granite rocks resulting into a wide range of soil types. Generally, soils vary from course and light to heavy and fine textured soil. Other soil inclusions include light sandy loams, grey clays particularly in the valley bottoms and in wetlands and black calcareous soils referred to as mbuga soils. The latter are located in the lower part of the basin and are naturally very fertile supporting the growth of different crops. The main soil types are ferralsols in the Savannahs in the Serengeti and Somoche sub-catchment areas. Black cotton soils derived from fine volcanic material could be found on the hilly parts in Tigithe sub-catchment while alluvial soils are found in the swamps and wetlands. This region supports high population densities.

1.2 LAND USE

Small-scale farming in the dominant land use of the Mara River Basin accounting for 31% (4210 km²) of the total land use. The other big chunk of land is taken up by protected areas 23% (3118 km²) and range lands 29% (3974 km²) of the total land use. The Kenyan part of the Mara River Basin has the range lands as the dominant land use in the area, taking up 40% (3309 km²) of the land. Small scale agriculture is the major land use of arable land in both Tanzania and Kenya accounts for 49% (2582 km²) and 20% (1629 km²) respectively of the total land use whereas large-scale agriculture takes up 3% (277 km²) in Kenya. Forested land area in the Kenyan side of the Mara accounts for 6% (532 km²), the conservancies take up 11% (934 km²) and the protected area covers 19% (1526 km²). In Tanzania, the protected area covers another 30% of the Mara, the rangelands take up 13% (665 km²) and the wetlands account for 8% (396 km²) of the total land use. Tea plantations and mining areas cover very small land areas which are not very significant. Continued fragmentation of land into very small farm sizes is not viable in the long run, this may lead to negative impacts on agriculture, where the yields would not be enough to support livelihoods, leading to food insecurity and low social welfare, and consequently there would be limited investments in land improvement. Agricultural development is mainly in areas where rainfall is reliable close to the forest areas, wetlands and where irrigation can be carried out. The land use map, Figure 1 shows the various areas where irrigation is done. In terms of distribution it is estimated that cultivation alone and mixed farming occupy about the same area (Table 1).

Land Use	Kenya (%)	Tanzania (%)
Cultivation	48	80
Grazing	1	2
Farming and grazing	51	18
No answer		1.3
Total	100	100

Source: Stakeholder consultations, Albinus et al., 2008

Table 1: Major Land Use in the Mara river catchments.

1.3 FARM SIZES

1.3.1 MID MARA SUB-BASIN

Small-scale farming in the dominant land use of the Mara River Basin accounting for 31% (4210 km²) of the total land use. The other big chunk of land is taken up by protected areas 23% (3118 km²) and range lands 29% (3974 km²) of the total land use. Over the years, there has been rapid conversion of forest land into agricultural and grass lands due to dense human populations settling in the upper reaches of the Mau escarpment. In the mid-Mara region of Amala and Nyangores, 60% of the households are small holder farmers, with farm sizes ranging from 0.25 to 2 ha. The main crops grown are tea, maize, potatoes, beans, coffee, wheat and pyrethrum in the upper region while maize, beans, horticultural crops, sweet potato, millet, wheat, cassava and sorghum are grown in the mid and lower areas. The land under irrigation in this region is very small with a majority of farmers irrigating small (<1/4 acre or 0.1 ha) vegetable gardens along the river basin. Most of the agricultural and most people are dependent on rain fed agriculture. However, with expansion of irrigation larger areas are targeted as schemes. Large scale wheat and maize fields are only found in Amala sub-basin where commercial farmers produce wheat and maize from several hundreds of hectares.

1.3.2 LOWER MARA SUB-BASIN

Rainfed agriculture is dominated by small-scale subsistence farming and approximately 85% of the arable land is used by smallholder farmers and traditional agro-pastoralists. The land holdings are getting smaller due to population pressure leading to land sub-division. Farmers have adopted indigenous technologies for water harvesting. Examples of indigenous strategies include traditional water harvesting techniques (which include, among others, the excavated bunded basins locally called Majaluba for rice production, raised broad basins locally called Vinyungu and water storage structures locally called Ndiva (NAPA, 2007). The land holdings are slightly larger than the Kenyan side with

farmers producing on an average of 12– 5 ha. The major constraint to production is lack of rainfall and farm equipments especially tractors for land preparation.

1.4 AGRICULTURE AND LIVESTOCK

1.4.1 CROP PRODUCTION PATTERNS

Crop production skills and knowledge depends on the target farmers are the area under cultivation as well as the production objective. Tea, coffee, wheat and pyrethrum are commercial crops whereas maize, beans and potatoes could be for subsistence or for commercial purposes depending on the scale of production. Maize growing is the major farming enterprise and it is usually intercropped with legumes. In the Lower-Mara sub-basin, the main crops grown are maize, beans, cotton, banana, sweet potato, cassava, and tobacco is also grown in certain areas. Small-scale irrigation goes on in this region but no major irrigation developments have been implemented thus far.

The cropping patterns are closely inter-related to the rainfall patterns. During the long season, (November – May) almost 100% of the farm families go into cropping as compared to 50% - 60% of farm families who go into cropping during the short season (June – October). The community's feeding habits are heavily skewed towards a higher intake of carbohydrates in the form of Maize and its products. Posho (Ugali), Porridge, Milk and local vegetables are the main diet components for most households in the region. Because of this, the bulk of annual farm yields and percentage area coverage is taken by Maize at about 20%%.

The cropping patterns can be divided into two production systems: mono-cropping and multiple cropping. Mono-cropping is mainly carried out on large scale production of cash crops such as sugarcane, coffee, sisal, cotton and tobacco. Mixed cropping is on small holder farms where farmers practice several crop combinations with the following being the most common:

1). Maize, beans in most areas of the basin, 2). Coffee, banana and vegetables; 3). Maize and beans (other pulses); 4). Banana and vegetables in irrigated areas in the uplands.

A number of factors were found to influence overall cropping intensity of any selection of crops that farmers considered when formulating cropping patterns. These include:-

- Soil constraints – nutritional levels, texture and topography – farmers, through experience are able to allocate certain crops to certain areas within their farms where they feel the crops will perform best.

- Water availability - inefficient utilization and high wastage of water would be a constraint. Where there is water available, farmers if not well trained can over irrigate leading to increase in waterlogging cases and poor crop performance.

- Cropping calendars – Water availability will determine the cropping calendar. In rainfed agriculture planting dates were closely related to onset of rains across the study sites.

- Rotational constraints –Some farmers do not practice crop rotation because of lack of knowledge and also due to small land sizes. Rotation is important in the reduction of risk of pests and diseases and to maintain soil fertility. Farmers need to be trained on good crop rotation programmes

- Crop relative profitability – Farmers who are producing for commercial purposes consider crops that are profitable. Gross margins are generally related to a unit of land. The small irrigated farms observed had high value horticultural crops such as tomato and kales.

• Labour availability – Farmers indicated that they produce crops which do not give them problems during major peaks in labour requirements such as weeding and harvesting. The large scale farms use machinery and herbicides to handle this problem. Family labour is the main tillage practice in all study areas of the upper Mara, mid-Mara and lower Mara. Land preparation is by use of hoes and ox-plough is used on small farms while tractors are used in the large scale farms.

• Food security – Farmers consider food security as the first on the crop priority list and will opt for cropping patterns that satisfy their food needs and sell surplus produce.

The main cropping method practiced in the Nyangores, Amala, Tigithe and Somoche sub-basins is single cropping among large scale farmers and mixed cropping among small scale farmers. Fallow is virtually not practiced in all river Su-basins. The very few farmers who practice fallowing do not change to other crops then fallow. The widespread use of fire to clear land for farming and land management is also recorded as a common farming practice. There is also burning of the crop residue and very few of farmers make use of it as animal feed, for cooking or distributing it on the land as manure. The use of crop residues to improve soil fertility should be encouraged.

In order to increase food production, various challenges facing agriculture in the Mara River Basin must be addressed and these include:

1. Chronic food insecurity due to unreliable weather conditions especially in the dry lower zones,
2. Inappropriate agriculture practices,
3. Over dependency on a few crops,
4. Over-reliance on rain fed agriculture due to unreliability rainfall,
5. Postharvest management practices as there are high postharvest losses,
6. Use of inappropriate varieties and uncertified seeds
7. High cost of farm inputs
8. Poor marketing of agricultural produce
9. Lack of access to farmer friendly credit
10. Uncoordinated Stakeholders activities
11. Inadequate extension service
12. Inadequate infrastructure

1.4.2 LIVESTOCK FARMING

Grazing is another important land use practice. The major types of livestock kept are cattle, goats and sheep. Communities in Mara sub-catchment keep large sizes of cattle and over-grazing is common. This often leads to land degradation and soil erosion. The average size of the livestock is more than 10 in Mara River basin among pastoral communities and these could be up to 50 heads of cattle. The farming communities have fewer cattle of better quality and mainly dairy cows especially in Bomet and Oloolunga districts in Kenya. Due to this large size of livestock there is acute shortage of pasture. The critical months of pasture shortage are July to December, characteristically the dry season. During pasture shortage most livestock keepers move their livestock for grazing from one place to another or graze along the river banks. This can lead to conflict with farmers who practice irrigation along the rivers. For those with a small size of livestock teeter them with ropes to control movements in the homesteads. The rivers are also the main livestock watering point in all study sites.

Other livelihood strategies observed were bee keeping and fishing. The livestock reared includes poultry, dairy cattle, goats, and sheep. These are kept throughout the region of the Mara river basin. The range lands at the Nyangores and Somoche allow for more cattle keeping though there are no

rangelands in the Amala and Tigithe regions. Aquaculture is practiced at the Lower Mara due to presence of wetlands and high rainfall that can support this activity.

1.4.3 SOIL FERTILITY MANAGEMENT

There is high population density of up to 470 persons/km² on the Amala and Nyangores sub-basins. This has led to increased pressure on the forests and soils which are barely able to support these people. The land under agriculture has increased by over 31% in the last thirty years. Consequently, there are wide ranges of environmental problems including deforestation, unsustainable farming methods where fertilizer and manure use are insufficient to maintain the required soil fertility. People plough along the river beds and there is overgrazing leading to increased soil erosion. Forests are being cleared to generate more land for agriculture, settlement, charcoal burning, grazing and timber lumbering hence land degradation. All these lead to high loads of sediments being deposited in the Mara River, loss of biodiversity, increased pollution and eutrophication. In the Lower Mara there is intense deforestation pressure from the local community due to high demand for charcoal and firewood which are sold to the nearby towns or even exported to Kenya. It is estimated that the two towns of Musoma and Tarime consume 160,000 tons of wood annually.

If assured of return to investment, then farmers would be more likely to adopt better soil management practices. By use of both inorganic and organic manure, zero tillage, creation of fallows, agro forestry, and planting trees to replace those that are cut, can equip farmers with insufficient resources to be able to increase their yields both in quality and quantity. Their income will improve and they will be able to curb the problems of soil degradation. These could also be used with other soil conservation measures such as growing of cover crops, crop rotation, ploughing along contours and leaving crop residues on the ground.

1.5 EXTENSION SERVICE PROVISION

For extension services in this region to be successful, they need to be demand driven. They have to focus on key issues such as subsistence and commercial crops, soil and water conservation and improvement of livestock productivity. Extension agents need to be distributed across the region and be easily accessible to the local population.

Three main extension methods were used; the training and visit system, Farming systems research and extension and Commodity-based approach. Through these methods extension messages and capacity building of farmers are conducted in various areas. Some of these areas are: Training on appropriate technologies on crop production, post-harvest management and value addition; Market studies and linking farmers to markets, fostering the public and private sector partnership (PPP); Training of WUA management committee on O&M, water management, irrigation scheduling; Training of extension staff of crop selection, cropping patterns, crop rotations, input use and safety, soil management; Strengthening of farmer organizations for more efficient management of the schemes, post-harvest management and crop marketing and value addition.

The main weaknesses that need to be addressed to improve extension services are:

- Poor extension facilities especially in the Lower Mara
- Weak research – extension – farmer linkages where messages from research are not readily available
- Low educational status for the frontline extension workers at village level
- Poor funding of extension programmes

- Low manpower to cover producing areas due to expansiveness of the areas
- Poor information flow even among extension staff from various departments
- Poor logistical support
- Poorly motivated staff

Emphasis needs to be placed on extension's capacity to mobilize and support farmers groups and organization with regard to access to inputs and provision of marketing advice. The issue of gender should be brought into the mainstream of design and implementation of research projects. There are opportunities to address these weaknesses in order to strengthen extension service provision therefore improve agricultural productivity in the basin, hence more efficient utilization of water resources. These include:

- Proposal for direct sourcing for funds for extension programmes from donors and development partners
- Strengthen linkages between research – extension – farmers
- Higher involvement of farmers in extension planning through organized for a and farmer groups and cooperatives
- Increased supervision, monitoring and evaluation of extension programmes
- Potential for public and private sector partnerships (PPP) in extension service provision
- Improve on motivation of public extension staff through better enumeration, training opportunities and
- provision of resources
- Expansion in the use of ICT
- Initiation of agricultural products value addition initiatives
- Promotion of agricultural programmes for the youth

There are several risks that need to be recognized in addressing these opportunities and these include; Weak response in implementing of programme by stakeholders especially the government; No political good will to make the changes; Political goodwill will enable the programme to be given priority in funding and implementation; Lack of funding to implement the programme. There is need for collaborative effort by stakeholders to source for funding to support the programme for it to succeed as government funds are never sufficient.

2 CURRENT ACTIVITIES TO ADDRESS LAND DEGRADATION

- Afforestation and on farm soil and water conservation (Farm terracing)

This is an activity carried out by the Ministry of Agriculture that trains farmers on agro-forestry practices and soil conservation practises. There is also a component on livelihood e.g. dairy goats project in Longisa, Bomet that was initiated and Funded by WWF. This project is complete but it is in the process of being up scaled.

- Spring protection and fish farming activities are funded by various stakeholders in order to provide the local communities with safe drinking water. In Longisa location, the Mara WRUA is heavily involved in this activity. The fish ponds are supported through the Economic Stimulus Programme).

- CIP (International Potato centre) –CFC (Common Funds for Commodity) –are some of the stakeholders in the Mara river basin targeting farmers who grow Irish potatoes. The farmers are trained on seed production, storage and marketing and there is a storage ware-house in Molo in the upper MRB. This is a livelihoods activity that can be up-scaled to the uplands within the basin.

- Rocket stoves (energy saving Stoves) and fireless cookers (Private Sector Development in Agriculture Program. Organized self-help groups are the target. These groups are trained and they in-turn assist in training other groups and installing the stoves in community members' homes at a fee.

- BIOGAS (Energy saving stoves) being promoted by KENFAP this is being promoted through CBOs, Self-help groups and also individual farmers. The objective of the project is to utilize animal manure to generate green energy – biogas, and to use the spent manure for soil fertility management and improve crop production. KENFAP is an Umbrella farmers organization made up of farmer groups and commodity specific associations that federate together to form semi-autonomous Area Branches at the district level in Kenya. Each Area Branch is coordinated by a district coordinator with guidance of a provincial/regional coordinator and under the leadership of the area branch committee which is elected by community members. The capacity of these leaders and the field staff is built continuously to ensure they effectively manage and sustain the area branches. KENFAP is one of the founding members of the Kenya Climate Change Working Group, a consortium of civil society involved in climate change activities.

- Techno Serve-train youth on entrepreneurship towards using raw materials from farm. The youth are at the moment being trained and are yet to look at production and marketing

- Waterlines – This is an organisation that supports the community in rain water harvesting and spring protection for individual farmers, institutions, CBOs and self Help Groups. The Community is expected to contribute towards the project especially during implementation to ensure ownership and sustainability.

- Constituency Development Fund (CDF) This is a community fund from the government of Kenya allocated to each constituency for community development activities. This fund has been used to assist groups in spring protection, construction of cattle troughs, and construction of earth dams (water pans). Dams which have been constructed by CDF are: Chesungurut water Spring in merigi; Mwokiot/Ndabibi dam in Kipreres, Cheboror dam in Kipreres and Kures dam in Kiplabotwa (all these areas are within the Mara basin- in the project area) Note: CDF has assisted and is continuing to assist groups in the area and institutions. In Bomet county on the MRB, most of the assistance has been on water projects, health facilities and dairy cooling plants.

- Kaboson Irrigation Project- Kaboson location, Sigor division: The objectives of the project are to increase food production, increase household income levels, and create employment. The activities

carried out include capacity building on irrigation and drainage development and to construct one weir, construct 5 km pipeline and construct distribution systems (GOK funded)

- Water Supply in Bomet Water Supply- Bomet Central division: Activities include rehabilitation & expansion of water facilities for domestic water supply and its GOK funded.

- Sigor water supply –Sigor division: This project is to supply safe drinking water to consumers at affordable rates. Activities include completion of filtration unit, extension of Olokyin line and rehabilitation of distribution lines and intakes (GOK funded)

- Chepalungu water supply- Singiroi division: This project aims to rehabilitate and expand the existing old water supply to serve more consumers. Activities include transferring of suction from direct suction from the clear water tank and general rehabilitation of existing distribution lines (GOK funded)