THE UNITED REPUBLIC OF TANZANIA

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LAKE VICTORIA ENVIRONMENTAL MANAGEMENT PROJECT (LVEMP)

INTEGRATED SOIL AND WATER CONSERVATION (ISWC) FINAL REPORT ON LESSONS LEARNT

By

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EXECUTIVE SUMMARY

Introduction
The Lake Victoria Basin represents a good scenario of environmental problems related to human activities on land. Land degradation in the lake basin is of major concern, not only for the healthy of the lake, but also for food and livelihood security of its rapidly expanding population. The multiple livelihood activities undertaken by local communities have contributed to degradation of the lake environment. Soil erosion is evident in many parts of the lake basin, exacerbated by poor land and water management. These environmental concerns are among the issues that are addressed by the Lake Victoria Environmental Management Project (LVEMP).

About this Consultancy
Tanzania has been implementing the Lake Victoria Environmental Management Project (LVEMP) in the lake basin since 1997/98. The fundamental objective of the Project is to restore a healthy, varied lake ecosystem that is inherently stable and can support, in a sustainable way, the many human activities in the catchment and in the lake itself. In order to achieve its objectives ten components were established and implemented under LVEMP, one being the Integrated Soil and Water Conservation (ISWC). Implementation of the ISWC project activities in the pilot areas during Phase One was however, achieved with varying degrees of success and encountered various challenges. Before expanding the component activities to cover the whole of Lake Victoria basin, these strengths, weaknesses and gaps need to be identified. The objective of this consultancy was therefore to prepare a Lessons Learnt Report in relation to the Integrated Soil and Water Conservation activities.

The Integrated Soil and Water Conservation
The overall objective of this component was to improve land use management of the lake catchment for sustainable utilization of Lake Victoria Basin resources. The implementation of activities during Phase One under the ISWC component focused on selected pilot areas. The pilot areas for ISWC are located in Simiyu River Catchment in Magu District and Mwitore Catchment in Tarime District. The ISWC component has two sub-programmes namely Soil and Water Conservation and Agro-chemicals Management. The consultancy focused on the Soil and Water Conservation sub-programme. The Agro-chemicals Management sub-programme was addressed under Water Quality Management for production of Synthesis Report.

Methodology
A variety of approaches and methods were employed in order to address the issues outlined in the Terms of Reference. These included literature review, field visits, and interviews with key informants and villagers. Most of the activities were done in collaboration with ISWC component staff. Interview data collected from farmers were coded and tabulated. The tabulated responses were then analysed using frequencies, ranges and percentages of respondents that reported a particular concern. Further analysis was done using Excel Software to calculate averages, for example of crop yields. The various responses from interviews were then integrated with information obtained from the documented data sources (e.g. of various project document) together with information obtained from the consulted institutions.

Findings from the Assessment
The ISWC component has made substantial achievements during the project time in relation to the objectives set. These achievements include survey and mapping of land use/cover and soil erosion hazard. This work was completed and the maps produced provide important baseline data in relation to land use management in the lake basin. The maps have facilitated prioritisation of areas for interventions related to soil and water conservation. Training and extension services have also been undertaken in the pilot areas for various technical packages. The approaches used in these trainings include conventional (individual approach) and catchment approach. Appropriate intervention measures for arresting land degradation were employed in various areas within the pilot areas. These included: contour bund farming, rainwater harvesting, agro-forestry, in-situ conservation, gully

control, conservative tillage, ridging and tie-ridging. The ISWC component staff also provided support to community services such as on the use of improved springs to improve supply of water and introduction of energy saving stoves so as to reduce deforestation. Dissemination and documentation activities were also given due weight so as to sensitize stakeholders and for information sharing. Monitoring of activities was also undertaken from time to time and this resulted into production of various reports produced quarterly and annually.

Challenges, Lessons Learnt and Emerging Issues

Extent to which the ISWC Component has achieved its Objectives

During the implementation of ISWC activities several lessons of experience have been learnt, some need to be adopted for future expansion of component's activities and some need to be improved in order to enhance sustainability. The overall objective of the component was to improve land use management of the lake catchment. The objective has been realized in the pilot areas. The number of farmers adopting various soil and water conservation measures has been increasing since year 1999. Although the ISWC component has realized several successes in the pilot areas, several challenges remain to be addressed. Land degradation is still a serious threat to larger parts of the Lake Victoria basin and therefore land conservation measures need to be enhanced and expanded to cover other parts. Inadequate extension services contribute to poor support in promotion of soil and water conservation.

A Review of Approaches

A review of approaches and methods used by the ISWC component show that the catchment approach was more effective as compared to the individual approach, which was tedious and time consuming. The catchment approach appears to be more suitable taking into consideration of limitation of adequate and appropriate manpower to undertake soil and water conservation (SWC) activities together with farmers. Furthermore, Participatory Rural Appraisal (PRA), which implies involvement of stakeholders in planning, implementation and evaluation of land use management activities, played a big role in ensuring sense of ownership as well as sustainability of conservation activities. Integrated catchment approach was attempted but was not very successful except for collaboration with the Catchment Afforestation component in Mwitore Catchment. More efforts are needed to enhance integration among LVEMP components for effective land management and for realization of much impact.

A Review of Soil and Water Conservation Interventions

The ISWC component used a variety of soil and water conservation measures in the pilot areas based on the merits or suitability of each intervention. The use of conservative tillage was more pronounced in Kalemela sub-catchment possibly due to more prevalence of hardpans. However, findings further show that very few farmers practice agroforestry. Results from the SWC interventions indicated that good performance was achieved from combining different conservation practices e.g. contours bund farming, tie-ridging and farmyard manure. Effectiveness of soil and water conservation can therefore be achieved by using a combination of practices. Overall, farmers involved in the soil and water conservation interventions have realized the benefits of these measures at various levels.

A Review of Methodologies Adopted

The ISWC component staff used a variety of methods so as to enhance farmers' participation in soil and water conservation measures. These ranged from Participatory Rural Appraisal (PRA), study tours, training and demonstrations. The PRA was used to understand experience of stakeholders, problems and basic causes of their problems and identifying strategies on how to combat problems related to SWC. PRA facilitated the establishment of catchment committees in the pilot areas and improved collaboration with extension officers related to ISWC component activities. The study tours were among the main reason behind motivation of farmers in participating in SWC related activities. Demonstrations in the villages increased farmers understanding of the SWC through practising in their own environments. Study tours need to be encouraged during sensitisation phases in expansion areas so that farmers can learn by seeing, whereas demonstration plots within the villages should be emphasized during implementation stages.

Impacts of the Project on the Environment and Livelihoods

The implemented soil and water conservation interventions have resulted into various benefits. As regard with impact to the environment there has been a realization of benefits such as reduced soil erosion, increase in vegetation cover, reclamation of gullies and improvement in aquifer recharge e.g. in Kwibuse Village. With regard to livelihood of local communities, farmers involved in SWC have realized various benefits such as increase in crop yield, improvement in food security and improved incomes. As a result some farmers have been able to afford sending their children to schools, building modern houses, buying livestock and some farmers have become more innovative and enterprising. Despite these benefits, factors such as labour shortage, land shortage, lack of capital, limited knowledge and skills, land tenure appear to hinder participation of some farmers in SWC practices.

Sustainability of Personnel, Equipment, Institutional Set up and Financial Issues

The aspects of personnel, equipment, institutional set up and financial issues appeared to limit smooth running of ISWC component activities in various ways. The current size of ISWC staff is inadequate to effectively undertake project activities. The ISWC component have inadequate facilities e.g. one vehicle, one old computer and lack of GIS facilities. Furthermore, the ISWC lacked adequate funds to smoothly run its planned activities. Less integration among components was experienced.

Possible Areas for Replication of Approaches and Interventions

Areas for expansion of ISWC component activities should be ones where soil erosion is evident and where erosion hazard is foreseen and expansion should cover other catchment areas. Within the Lake basin these areas include Bunda District in Mara Region and Karagwe and Ngara in Kagera Region and Sengerema in Mwanza Region. Other areas to be considered for expansion are districts where rivers draining water into Lake Victoria start e.g. in Meatu, Bariadi and Maswa. Outside the Lake Region expansion should be extended to Malagarasi River. Although Malagarasi River drains its waters into Lake Tanganyika it has tributaries in Geita where deforestation is high due to mining activities.

Areas that need Applied Research

Possible areas for applied research include issues related to water harvesting/irrigation, agroforestry/cover crops, use of agricultural inputs, assessment of soil and water resources, assessment of farming systems and research on livelihood issues such as alternative energy sources that are environmentally friendly, changes in livelihood patterns etc..

Way Forward

As a way forward, in order to enhance sustainability of the lake environment there is need for more sensitization of local communities to enhance their participation in soil and water conservation activities. The ISWC component and other LVEMP components in general should work towards more integrated efforts and improve collaboration among the components and other government and non-governmental organizations. This could ensure more realization of the intended objectives. LVEMP should try to work more closely with stakeholders at district level. This collaboration could ensure that some of the interventions are integrated in District Development plans.

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List of Abbreviations

DALDO	District Agricultural and Livestock Officer
DED	District Executive Director
DSMS	District Subject Matter Specialist
HADO	Hifadhi Ardhi Dodoma
HASHI	Hifadhi Ardhi Shinyanga
IFAD	International Fund for Agricultural Development
IPM	Integrated Pest Management
IPNM	Integrated plant Nutrient Management
IRA	Institute of Resource Assessment
ISWC	Integrated Soil and Water Conservation
KIMKUMAKA	Kituo cha Mafunzo ya Kuboresha Mazingira na Kilimo Adilifu
LVEMP	Lake Victoria Environmental Management Project
Mara-FIP	Mara Region Farmers Initiative Project
MFEC	Mogabiri Farmers Extension Project
NGO	Non Governmental Organization
PRA	Participatory Rural Appraisal
RAS	Regional Administrative Secretary
SCAPA	Soil Conservation and Agroforestry Programme Arusha
SIDA	Swedish International Development Agency
SWC	Soil and Water Conservation
UNU	United Nations University
WWF	World Wide Fund for Nature

1. INTRODUCTION

1.1 Environmental Issues and Problems of Lake Victoria Basin

Lake Victoria is the largest freshwater lake in Africa and the second largest in the world (Nyirabu, 2001). The Lake Victoria Basin represents a good scenario of environmental problems related to human activities on land. Land degradation in the lake basin is of major concern, not only for the healthy of the lake, but also for food and livelihood security of its rapidly expanding population. Soil erosion is evident in many parts of the lake basin exacerbated by poor land and water management. Consequently, soil erosion; inappropriate land use plans, inappropriate land husbandry practices, inadequate baseline data and low level of community awareness are among the key environmental issues of concern in the area (Mahuha *et al.*, 2001). These are among the issues that are addressed by the Lake Victoria Environmental Management Project (LVEMP).

1.2 The Physical Environment

1.2.1 Location

Lake Victoria is shared between Tanzania (51%), Kenya (6%) and Uganda (43%). It has a shoreline of 3,450km long. The lake basin is estimated to be 192,580km^2, with Tanzania having 115,380km^2, Kenya having 46,000km^2 and Uganda having 31,200km^2 (Nyirabu, 2001). In Tanzania, the Lake Victoria basin extends to Kagera, Mara, Mwanza, and Shinyanga regions. Appendix 1 shows the districts covered by the Lake Victoria Basin, Tanzania. The elevation and relief of the lake basin vary considerably from the hilly regions in the west and east to the flat plains in the south and southeast (Mahuha, 1998). The climate of the greater part of the lake basin is regarded as semi-arid to sub-humid.

1.2.2 Drainage Patterns

About 85% of the water entering Lake Victoria is by precipitation and the rest is through rivers such as Mara, Kagera, Grumeti, Mbalageti, Simiyu, and Mori from Tanzania; Nzoia, Sio, Yala, Kibos, Nyando, Sondu-Miriu, Kuja, Migori, Riaria and Mawa from Kenya; and Kagera, Bukora, Katonga and Sio from Uganda (Shepherd *et al.*, 2000 cited in Yanda *et al.*, 2001). In Tanzania, the Lake Victoria Basin is subdivided into twelve watersheds, namely: Mori, Mara, Baumann Gulf-Sunguy Bay and Speke in the eastern part; Simiyu-Duma, Magogo, Isanga and Bukome in the southeast; Ruiga, Kashasha, Ngono-Ikimba and

Kitengule-Busenya in the western part (Mahuha, 1998). The Kagera River is shared by Tanzania, Rwanda, Burundi and Uganda, while Mara River is shared by Kenya and Tanzania.

1.2.3 Rainfall Patterns

Rainfall intensity has a direct link with the extent to which it can enhance soil erosion in a given area. According to rainfall erosivity map developed by Moore (1979: 1540), areas around western and southern shore of Lake Victoria fall within the highest erosivity hazard zone. Magu District, one of the project pilot areas for Integrated Soil and Water Conservation (ISWC) Component of the LVEMP, has low and unreliable rainfall. It has a typical tropical dry climate which gets hot towards the end of the dry season. The District receives 800 – 1000mm of rain per year. In Tarime District, where other pilot sites are located, the annual rainfall ranges between 600-1250mm per year (lowland-midland zone). The lowest amounts are found in the Lake shore zones and rainfall amounts increase with altitude. The duration of rainfall is highly variable. Bunda District, where other pilot sites have recently been established the rainfall patterns are similar to lowland and midland zones of Tarime (Yanda *et al.,* 2001a).

1.2.4 Landscape Characteristics

The lake basin is characterized by three types of landscapes; the lowlands, midlands and highlands. Whereas the lowland ranges between 1,100 and 1,200 metres above sea level, the midland zone lies between 1,300 and 1,500 metres above sea level, and the highlands are situated at an altitude of 1,500 to 1,800 metres above sea level. The lowland and midland zones of the lake basin are characterized by gently undulating plains with occasional rock hills/ridges surrounded by pediments leading down to depressions (*mbugas*). The different landscapes have different slope characteristics. Slope is among the factors contributing to land vulnerability to soil erosion. Steep areas are potentially more vulnerable to soil erosion than flat areas (Yanda *et al.,* 2001a).

Another aspect of landscape characteristics is land use/cover. Land use/cover is among the factors normally considered in assessing potential soil erosion hazards. Different land use/cover types have different effects in protecting the soil from erosion. In Magu District, land use/cover types show the influence of human activities particularly through cultivation and grazing. As a result most of the district has been stripped off its natural vegetation except in the less accessible rocky hills and ridges and on individually and communally owned

traditional woodlots. In Tarime, cultivation is predominant in the shoreline and highland zones. Midland zone is characterized by grassland with patches of cultivation. The midland zone is mainly used for livestock grazing. In Bunda District, the vegetation cover is characterized by scattered crop cultivation. Other forms of vegetation include grasslands, woodlands, bushlands and swamp vegetation. There is high risk of soil erosion in the cultivation and the grazing areas where soil and water conservation measures are not practised (Yanda *et al.*, 2001a). An example of evidence of severe soil erosion in Bunda District can be observed in Nyamatoke village (See Figure 1.1). Expansion of the boundaries of the Serengeti National into the village's grazing lands has created enormous pressure on land resource in the village's hillslopes. Consequently the grazing of livestock in the hillslopes has resulted in accelerated soil erosion.

Figure 1.1 Evidence of severe gully erosion in Nyamatoke Village, Bunda District one of LVEMP-ISWC Expansion Areas, July 2005.

Different soils have different vulnerability to soil erosion. Knowledge of soil properties is therefore important as a key for understanding soil erodibility. Soils in Magu District, for instance, are rated as highly vulnerable to erosion. Thus, most of Magu District may therefore be considered to be potentially at risk of soil erosion. The midland and highland zones of Tarime District are characterized by heavy soils and deep red sandy loam soils. Sandy loamy and sandy soils are found in the uplands (Mahuha, 1998). The lowland zone is characterized by poor sandy soils. Most of the soils in Tarime District are ranked to be highly erodible (Yanda *et al*., 2001a).

1.3 The Socio-economic Environment

1.3.1 Population Characteristics

The Lake Victoria basin is highly populated with an estimated population of about 30 million (World Bank, 1996), growing rapidly, and heavily concentrated near the lake (Cohen *et al*., 1996). Of the total populations in the lake basin 40.7% is found in Kenya, 26% in Tanzania and 33.3% in Uganda (Nyirabu, 2001). The lake basin is characterised by high population densities, ranging from over 100/km^2 to 1200/km^2. The basin supports some of the poorest rural populations in the world (Hoekstra and Corbett, 1995; Cohen *et al*., 1996). The population growth in the lake basin is associated with two main factors, internal growth and rural-urban migration. The population growth rate of the lake basin is estimated to be at an average rate of 3% annually, while migration from rural to urban is estimated at about 11% per year (Nyirabu, 2001). Thus the population of the region is expected to double within the next two decades (World Bank, 1999). The majority of the people in the lake basin are peasants engaged in agricultural production (crops and livestock) and fishing (Nyirabu, 2001).

In many cases dense settlements are found on good agricultural land, as evidenced in Muleba, Bukoba and Biharamulo districts in Kagera region; Geita and Sengerema in Mwanza Region; and Tarime District in Mara Region (Yanda *et al.,* 2001a). In these areas both the highlands and lakeshore are densely populated. Evidence also shows a tendency of people migrating from the eastern part of the lake basin towards the western part where large forest reserves and mining activities are prevailing. Evidence from Biharamulo, Geita, Kahama and Misungwi districts shows an influx of migrants from various parts of the country, and from neighbouring countries, searching for arable land, pastures for livestock, and other income generating activities such as mining, fishing, charcoal making, hunting and beekeeping (cf. Yanda *et al.*, 2001a, Kangalawe *e. al.*, 2005; Yanda *et. al.*, 2005; Liwenga *et al.*, 2005).

1.3.2 Livelihood Activities and Environmental Implications

The main economic activities in the lake basin are agriculture (involving crop and livestock production), fisheries, mining and industrial production. Over 70% of the population in the lake basin are involved in agriculture as small-scale farmers. The Lake Victoria basin is endowed with rich and unique terrestrial and aquatic resources including forests, wildlife, fisheries and mineral resources, etc, and is an important transport corridor between Kenya, Tanzania and Uganda. The lake basin thus provides a livelihood to about one third of the

population of the riparian countries (Nyirabu, 2001). Yanda *et. al*. (2001a) noted however that although agriculture remains the backbone of the economic for the majority of the population in the lake basin, there has been not much technological advancement in the sector. Poor agronomic practices, including extensive and shifting cultivation still persist in the basin and, as a result, influence soil erosion processes.

Some of the farming systems of the lake basin are reported to facilitate land degradation and particularly soil erosion. One of the examples in the traditional practices shifting cultivation practiced in places like Ngara district in Kagera Region. This leads to extensive clearing of vegetation to open up new farms with consequent environmental degradation (Yanda *et. al.*, 2001a). Apart from extensive cultivation, other livelihood activities in the lake basin include livestock keeping, mining, fishing, lumbering, charcoal making, and large-scale fuelwood gathering for sale. These activities are considered to have destructive effects on the environment, particularly on the land cover, because of the increasing demand to meet the rapidly growing population as a result of both natural population growth and influx of refugees and other migrants (Yanda *et al*., 2001a).

The multiple livelihood activities undertaken by respective communities in the lake basin have increasingly come into conflict. The multiple activities are considered to have contributed to rendering the lake environment unstable and degraded (Nyirabu, 2001). These multiple activities, coupled with weak regulatory mechanisms have led to unsustainable use of the land, water resources and vegetation cover. This unsustainable use has consequently resulted into serious environmental impacts leading to degradation of the land, water quality in the lake and rivers, deforestation, soil erosion and sedimentation of the lake, and loss of biodiversity (Nyirabu, 2001; Yanda *et. al*., 2001a; Kangalawe *et. al*., 2005, Liwenga *et. al*. 2005).

1.4 The Concept of Integrated Land Management

The concept of integrated land/catchment management is widely accepted as the most appropriate framework for undertaking sound natural resource assessments and management. This entails a holistic consideration of the biophysical systems, socio-economic factors and management process. Most of the soil erosion, loss of biodiversity, and eventual loss of productivity occurs in marginal - but high-priority - lands. This is particularly true for "Dry Areas", those comprising arid, semi-arid and dry sub-humid regions. Sustainable

management strategies in these dry areas are needed for protection, preservation and reclamation or rehabilitation in these fragile systems and natural resources contained therein. Such strategies are closely linked to human development and quality of life in these marginal areas (UNU, 2002).

Development of integrated approaches is critical to minimizing land degradation and the related societal and economic impacts. There is a need to promote actions for building and strengthening existing institutional capacities for regional, national and basin-level agencies to effectively address and integrate cross-sectoral aspects. However, defining such integrated approaches is a complex job and the outcome would vary from region to region (UNU, 2002). In order to develop a general framework for such integrated approaches four dimensions of the problem need to be considered, namely technical dimensions, human dimensions, economic dimensions and natural resources dimensions (UNU, 2002).

2. ABOUT THIS CONSULTANCY

2.1 Objectives of the Consultancy

The objective of this consultancy was to prepare a lesson learnt report for Integrated Soil and Water Conservation sub-component activities of LVEMP. This report serves the following objectives.

- To review the approaches and interventions used during the project life of LVEMP Phase 1,
- To serve as baseline information to guide the preparation of LVEMP Phase II,
- To serve as springboard for expansion of components activities to cover the whole Lake Victoria Basin.

2.2 Scope of Work (Terms of Reference)

- To review the extent to which the component has achieved its original objective
- To review the approaches/methodology, adoption and interventions applied in achieving the above objectives
- To review the methodologies adopted in the control and achievement made
- To assess the impact of the project in relation to the Lake Victoria Basin Environment, community livelihoods and stakeholder expectations
- To assess sustainability of interventions in terms of personnel, equipment, institutional set up and financial issues;
- To review problems encountered in the implementation of component activities
- To draw lessons learnt (both positive and negative) and their underlying factors
- To propose possible areas for replication of the approaches/methodologies and interventions/technologies to other areas within or outside the Lake Victoria basin and why
- To recommend areas that need applied research.

2.3 Objectives of LVEMP

Tanzania has been implementing the Lake Victoria Environmental Management Project (LVEMP) in the lake basin since 1997/98. The fundamental objective of the Project is to restore a healthy, varied lake ecosystem that is inherently stable and can support, in a

sustainable way, the many human activities in the catchment and in the lake itself. The three main objectives of Phase One of the project were:

- To provide the necessary information to improve management of the lake ecosystem,
- To establish mechanism for cooperative management by the three East African countries (i.e. Tanzania, Kenya and Uganda),
- To identify and demonstrate practical, self-sustaining remedies, while simultaneously build capacity for ecosystem.

In order to achieve its objectives ten components were established and implemented under LVEMP, one being the Integrated Soil and Water Conservation implemented by the Agricultural Land use Planning Section of the Ministry of Agriculture and Food Security.

2.4 Phase One of ISWC-LVEMP

In Tanzania, Phase One of the project life of Integrated Soil and Water Conservation (ISWC) component activities focused on selected pilot areas. The objective of this component is to improve land use management of the lake catchment for sustainable utilisation of the Lake Victoria basin resources. In order to achieve the objectives of the component, different intervention measures and approaches were tested and implemented during the period of the project. However, implementation of the ISWC project activities in the pilot areas was achieved with varying degrees of success and encountered various challenges, with activities reflecting some strengths and weaknesses as well as gaps.

Before expanding the component activities to cover the whole Lake Victoria basin these strengths, weakness and gaps need to be identified and assessed, as a basis for effective implementation of the project activities in subsequent phases. It is important therefore to produce a report on lessons learnt for improvement of implementation of the future project. It is for this reason that LVEMP has engaged a national consultant to prepare a Lessons Learnt Report on Integrated Soil and Water Conservation activities. This report therefore presents the findings from the assessment of the lessons learnt with reference to IWSC.

3. THE INTEGRATED SOIL AND WATER CONSERVATION COMPONENT

The Integrated Soil and Water Conservation (ISWC) is among the components of the LVEMP. Specifically, this component has been addressing land use and agrochemicals management issues. The overall objective of this component is to improve land use management of the lake catchment for sustainable utilisation of the Lake Victoria basin resources. The issues being addressed by the component include: soil erosion, pollution of water bodies in the catchment, mismanagement of agrochemicals, low level of communities awareness on land management issues, and inadequate baseline information on the above in the catchment. The component has two sub-programmes, namely; Soil and Water Conservation and Agrochemicals Management. The specific objectives of the ISWC are:

- Enhancing baseline data for follow on projects in the Lake Victoria basin in form such as written documents, digital formats data and thematic maps,
- Deduction from various studies and monitoring, appropriate and effective measures on soil and water conservation and agrochemical use, and
- Acquire a comprehensive plan of action for land use management for short, medium and long-term plans.

Activities implemented by the two sub-programmes i.e. soil and water conservation and agrochemical management are as follows:

3.1 Soil and Water Conservation

- Surveying and mapping of Land Use/Cover and Soil Erosion hazards in the lake basin
- Training of farmers on soil and water conservation measures: These included contour making, rainwater harvesting techniques, ridges and tie-ridges, conservative tillage, agro-forestry technologies, tree nurseries management, tree planting, general agronomic practices and packages; and in-situ conservation. Other activities included introduction of energy saving stoves through established women groups.
- Information dissemination using various mass media e.g. leaflets, posters, booklets, radio/TV programmes, video shows, conducting awareness workshops and seminars to various levels of stakeholders, through demonstration plots.
- Monitoring of effectiveness and problems associated with various intervention measures
- Supporting of social services e.g. in improved wells in Kuruya.

3.2 Agrochemicals Management

- Carry out inventories of agrochemical used in the Lake basin
- Training of farmers on safe use and handling of agrochemicals, integrated pest management (IPM) and Organic farming

NOTE: The assessment of issues related to agrochemicals sub-programme was addressed under the Water Quality Management component, by the consultant responsible for production of synthesis report.

3.3. Pilot Areas for Soil and Water Conservation Activities

The pilot areas for the ISWC are located in Simiyu River Catchment in Magu District and Mwitore Catchment in Tarime District. Simiyu River is among rivers that drain water into the Lake Victoria; furthermore, the area is highly degraded/polluted from human activities such as trees cutting, overgrazing, crop production and poor land management practices. Turbidity (brownish water colour) of Simiyu River was another reason used to select Simiyu Catchment because this indicates that the water is highly polluted by eroded soil materials. Magu District was selected to represent other districts in Simiyu River catchment due to good accessibility of communication from Mwanza.

Kalemela and Itumbili sub-catchments were selected from Simiyu Catchment. Both Kalemela and Itumbili sub-catchments drain some of its run-off direct into the Lake Victoria via River Simiyu and Duma. These two sub-catchments were selected due to severe soil erosion with obvious adverse effects. Mwitore catchment, along one of the Mara River tributaries, was selected basing on the fact that its catchment drains water into Mara River just before the river drains its waters into Lake Victoria. This catchment was also earmarked for Integrated Watershed Management for seven components of the project, mainly, water quality management, water hyacinth control, fisheries research, fisheries management, integrated soil and water conservation, wetlands management and catchment afforestation.

4. APPROACH AND METHODOLOGY

A variety of approaches and methods were employed in order to address the issues highlighted in the Terms of Reference. These included literature review, interviews with key informants and villagers, field visits, viewing video about Soil and Water Conservation prepared by LVEMP and finally assessment of the findings was undertaken. Most of the activities were done in collaboration with LVEMP ISWC component staff. The activity-plan of how this assignment was undertaken is presented in Appendix 2.

4.1 Literature Review

Literature review involved collection and reviewing information from various relevant sources / institutions. Relevant literature was obtained from institutions such as LVEMP – IWSC Component Offices, Secretariat Office – Documentation Unit, the Institute of Resource Assessment – Documentation Unit etc.

4.2 Interviews with Key Informants

Preliminary discussions were undertaken with ISWC component staff so as to get an overview of the component activities and plan on how to undertake the assignments. As indicated earlier various projects documents were also obtained. Out of the initial discussions a number of key informants were identified for consultations. Prior to the consultations several checklists of issues were prepared to guide discussions with the various stakeholders (i.e. for farmers at village; and various institutions at regional, district and village levels). The following key informants were identified and therefore visited for further consultations in the course of undertaking the assignment.

Government Institutions:

- Ukiriguru Agricultural Research Institute
- Regional Administrative Secretary (RAS-Mara)
- District Executive Directors (DED - Magu & Musoma)
- District Agricultural and Livestock Development Officers (DALDO- Magu, Musoma, Tarime, Nyamagana)
- District Subject Matter Specialists (DSMS - Land Use, Bunda District)
- District Subject Matter Specialists (DSMS - Natural Resources - Magu)

- District Subject Matter Specialist (DSMS - Irrigation - Magu)
- Mkolani Secondary School (Mwanza)

Village level (Simiyu River & Mwitore Catchments):

- Individuals villagers in the pilot study areas
- Catchment Committee members in the pilot study areas
- Village Agricultural Extension officers

Non-governmental Institutions in Mwanza and Mara Regions:

- CARE International (Mwanza)
- Vi- Agroforestry (Mwanza and Musoma)
- WWF – (Musoma)
- SIDA – (Musoma)
- KIMKUMAKA (Farmers' training centre in Nyamagana, Mwanza)
- MFEC – (Farmers' training centre in Mogabiri, Tarime)
- IFAD (the Mara-FIP Project, Musoma)

In some of the pilot areas these institutions /organizations are also undertaking similar activities. CARE International, for instance, is operating in Magu in Mwanza and is involved with development and livelihood security activities. VI-Agroforestry operates in Mwanza and Musoma, and specifically works on increased wood resources and increased incomes of local communities through participatory agroforestry extension approaches.

4.3 Field Visits in the Pilot Areas

Field visits were made to pilot study areas in both Mwanza and Mara regions.
In Mwanza region the pilot areas include:

- Simiyu River Watershed in Magu district
    - Kalemela sub-catchment area (Chamugasa & Mayega villages)
    - Shigala sub-catchment area (Shigala & Nyamatembe villages)

In Mara region the pilot areas include (Integrated Approach Watershed Management):

- Mwitore Catchment
    - Kwibuse sub-catchment area (Kwibuse Village)
    - Kuruya sub-catchment areas (Kuruya Village)

- Nyamatoke (One of the expansion areas in Bunda District, an area with severe gully erosion); and Mwibagi Village (an expansion area in Musoma Rural District)

In addition, two other villages of Chirorwe and Buswahili in Musoma Rural district were visited in order to get more experiences related to water harvesting technologies at macro level.

In all the pilot areas, discussions with villagers were followed by field visits to the various sites so as to capture the various soil and water conservation interventions undertaken by them. These field visits also enabled observations of variations in areas where such interventions had not been employed and where such interventions were in place. Additional discussions were also carried on sites and photos were also taken. A total of 40 farmers were interviewed, of which 31 were practising different LVEMP's Soil and Water Conservation measures and the remaining 9 were not practising any of the ISWC component measures (See Table 4.1).

Table 4.1. Profile of interviewed farmers by gender in the ISWC pilot areas

Gender	Kalemela		Mwitore		Shigala		Total
	SWC	No SWC	SWC	No SWC	SWC	No SWC	
Male	9	2	6	1	7	3	28
Female	4	0	4	3	1	0	12
Total	13	2	10	4	8	3	40

NB: SWC, implies farmers practising soil and water conservation, whereas, No SWC, implies farmers not practising soil and water conservation

4.4. Data Analysis and Report Production

Interview data collected from the various stakeholder institutions and farmers were coded and tabulated. The tabulated responses were then analysed using frequencies, ranges and percentages of respondents that reported a particular concern. Further analysis was done using Excel Software to calculate averages, for example of crop yields. The various responses from interviews were then integrated with documented data sources from literature review (e.g. of various project document, etc.). Such integration enabled the understanding of lessons learnt based during report production, as well as a means to compare documented work with field observations regarding SWC.

5. FINDINGS FROM THE ASSESSMENT

5.1 LVEMP Approaches/Methods in ISWC

5.1.1 Community Participation

Community participation was given high priority in all stages of activity execution. Important tool used was participatory rural appraisal (PRA) whereby stakeholders were involved fully in diagnostic, planning and facilitation in implementation and evaluation stages. More efforts were done in the pilot areas to raise their awareness through visiting various institutions like Prisons (at Magu Township), Schools, and Government leaders at all levels; and other influential people like councillors. Also sensitisation or mobilization workshops for integrated soil and water conservation in Magu and Tarime were conducted (Mang'ombe *et al*., 2004).

Among the achievements under community participation included: the initiation of enforcement groups within the area to foster environmental conservation activities. Four groups were formed in Kalemela sub-catchment, two of which were women groups. One of the important activities executed was making of energy saving stoves from clay soils. The project assisted where the community could not effect with their limited resources. Activities undertaken included construction of contour bunds, management of tree nurseries for agro-forestry, construction of rainwater harvesting basins and channels as well as mobilizing meetings. A sense of ownership was promoted through community involvement, which is an important aspect for sustainability.

The importance of working with groups cannot be overemphasized. In the past researchers and extensionists selected some individual farmers in each recommendation domain. These target farmers were often reluctant to share information with other farmers and distanced themselves from their colleagues. One of the changes in methodology after 1990s has been that researchers started working with farmers' groups (Mavendzenge *et al*., 1999). Many observers have noted the advantages of working with groups of farmers in agricultural interventions. Groups improve dialogue amongst farmers and with researchers and facilitate the organisation of field days. They also result in a more efficient use of scarce resources (cf. Norman *et al*., 1988: cited in Mavendzenge *et al*., 1999:11). Working in groups also builds farmers' collective confidence which they need when evaluating trials/interventions and to

get their needs taken into account by experts. Groups also facilitate the reaching of consensus positions (TARP II, 2004, Mavendzenge *et al*., 1999).

5.1.2 Stakeholder Training on Soil and Water Conservation Measures

Training of stakeholders was used to impart knowledge and raise awareness among stakeholders. Beneficiaries were given the theoretical background about the measures before starting the physical work. On farm training and extension services were conducted concurrently on beneficiaries' need. Two approaches namely, conventional and catchment, were tested for all technological packages delivered. Stakeholders were trained on various effective and appropriate measures of soil and water conservation. Formal training of farmers included the use of simple survey equipment such as line levels, A-Frame, and Contour triangle. Several informal farm visits, seminars and workshops were conducted.

5.1.3 Integrated Watershed/Catchment Management

The ISWC component of the Lake Victoria Environmental Management Project adopted the catchment/watershed approach in addressing soil and water conservation issues in the lake basin. A catchment is used to indicate a physical and geographical area having a common drainage. FAO (1987, cited in Mahuha, 1998) defines watershed as topographically delineated area that is drained by a river/stream system. It is further defined as a hydrological unit that can be used as a biophysical and socio-economical unit for planning and management of natural resources.

Kwibuse-Kuruya Catchment Area in Tarime District was earmarked for Integrated Watershed management of seven components in the project, namely water quality management, soil and water conservation, water hyacinth, fisheries research, fisheries management, wetlands management and catchment afforestation. This was aimed at monitoring the impact of these components working together in the same area. However, this goal was not attained due to variations in approaches used by different components. However, there was some collaboration between the ISWC and Catchment Afforestation (CA) components during implementation of project activities. Nevertheless, it was learnt that currently there are efforts by both ISWC and Cathment Afforestation to ensure more collaboration.

5.2 Outcomes of Different ISWC Activities

The Integrated Soil and Water Conservation Component has been implementing a number of interventions in the selected pilot areas for the purpose of testing effective and appropriate technical packages as well as approaches before covering the whole lake basin. The pilot areas selected as mentioned earlier are Kalemela, Shigala and Itumbili sub-catchments of Simiyu River in Magu District, and Kuruya and Kwibuse in Mwitore Catchment in Tarime District. The ISWC Component has made a number of achievements during the project time in relation to the objectives set. The following is an outline of outcomes of the different activities undertaken.

5.2.1 Mapping of Land Use/Cover and Soil Erosion Hazard

Effective decision making in land uses consist of three steps namely data collection, land evaluation and implementation of land use plans and soil conservation (Mahuha *et. al*., 2001). Survey and mapping of land use/cover and soil erosion hazard was an attempt to accommodate the first two steps. Due to high demand for application of remote sensing and GIS in the work, recruitment of either consultant or collaborator was sought. The Institute of Resource Assessment (IRA) was recruited as a collaborator since it was potential for both professionals and equipment for the work. The survey and mapping of present land use/cover and soil erosion hazard in the whole Lake catchment has been completed and subsequently a report and maps have been produced. Completion of this work presents two out of three steps in effective decision on sustainable land use management to the land degradation problems (Yanda *et al.,* 2001a).

The maps generated during the survey and mapping of land use/cover provide important baseline data as well as other issues like appropriate land use plans and land management practices and prioritisation of interventions in the Lake Victoria Basin. For instance, areas around Lake Victoria shores have been indicated to be among the problematic areas in terms of slope indices (although aggregation of other factors such as soil, land cover, socio-economic, rainfall could lead into different conclusion). The acquired data could further be used by various stakeholders in the basin (i.e. district agricultural departments, external and internal investors, community based organizations, non-governmental organizations, land husbandry related program and government institutions) including some LVEMP components to prepare action plans for interventions in other hot spot areas of the lake Victoria Basin.

5.2.2 Training and Extension Services to Stakeholders

a) Training Methods/Approaches

Training and extension services activities were executed in pilot areas to test the strength and weaknesses of approaches and adoption of various technical packages. Two approaches namely: Conventional (individual) and Catchment (committee) were tested in two different localities. The Conventional approach involved individual farmers and training them on how to apply soil and water conservation measures, whereas the catchment approach involved approaching groups of farmers and training them.

The findings indicate that the adoption rate was excellent with catchment area where there was full community participation. Stakeholders were trained on various effective and site specific measures of soil and water conservation. These training avenues included: training farmers on how to use simple surveying equipment such as line levels, contour triangle and A-frames. These equipments were fabricated and made available to farmers. Workshops were conducted with various stakeholders, at district level and participatory rural appraisal workshops at village level. Additionally, seminars were conducted at village level and several meetings were held at village level. Undertaking Study visits/tours to other projects in the country and several informal farm visits.

Interviews with farmers during field visits for this assignment indicated that among those practicing SWC, 58% have attended workshops and seminars, and found them to be useful on several accounts. For example, awareness creation on SWC, improve knowledge on SWC, exchange knowledge particularly on benefits with associated SWC. About 71% reported to have attended study tours related to SWC, and found those tours very useful. Explanations given are similar to the workshops/seminars. None of the farmers not practicing SWC reported to have attended any workshop/seminars or study tours.

Consultations with relevant institutions in the lake basin indicated that some of them have participated in SWC related seminar/workshops (50%) and study tours (50%). Majority (71%) of the consulted institutions reported to have received various publications from LVEMP. Discussion with different institutions has shown that LVEMP should increase their collaboration with the various institutions operating in the lake basin, particularly the district councils so that the SWC interventions can be integrated in the district development plans.

Consultation with DALDO's office in Nyamagana District Mwanza indicated that by being aware LVEMP activities, the Nyamagana District council (in 2003) allocated some funds to LVEMP to support organisation of a study tour to Kalemela by extension staff, farmers and some religious institutions. This implies that there is need to enhance awareness creation on LVEMP's activities among government and non-governmental institutions to enhance collaboration and join hands in management of the resource base in the lake basin.

b) Soil and Water Conservation Interventions

The appropriate remedial measures and interventions for arresting degradation process were practiced in various areas within the pilot areas. These included contour bund farming, rainwater harvesting, agro-forestry, indigenous knowledge (*Ngitiri* - for in *situ* conservation), conservative tillage (sub-soiling and ripping), stop wash-lines, ridging and tie ridging farming and cut-off drains.

- *Contour bund farming*: Contour bund farming involves the construction of contour bunds in the field for the purpose of soil and water conservation (see Figure 5.1). Contour bunds are like extra –large closed-end channel terraces with a storage capacity, which is normally sufficient to impound all the surface runoff and hold it until it infiltrates. This intervention was introduced at Kalemela, Itumbili, Shigala, Kuruya and Kwibuse. Among the benefits associated with intervention is reduced run-off, moisture conservation and hence increase in crop yields.

Figure 5.1. Contour bunds used for soil and water conservation at Kalemela. The bunds have been reinforced with trees and grass.

- *Rainwater harvesting*: Water harvesting is the collection and concentration of water run-off for the production of crops, fodder, pasture or trees for livestock or domestic water supply or other productive purposes. As a soil and water conservation practice, this aims at preventing surface flow of excess rainwater and prolonging time available for infiltration. This intervention was introduced in Kalemela and Itumbili sub-catchments. This includes deviation of run-off from road sides or natural waterways to fields or farms for crop production; and harvesting water from the hills and tapping into micro basins or bunded rice fields (*majaruba*) through a technology known as micro-catchment water harvesting (Figure 5.2).

Figure 5.2. Micro-catchments water harvesting - bunded rice fields (*majaruba*) in Chamugasa village

Agro-forestry: This is a collective name for land use systems in which woody perennials (trees, shrubs etc.) are grown in association with herbaceous plants (crops, pasture) and or livestock in a special arrangement, a rotation or both, and in which both ecological and economic interactions between the tree and non-tree components of the system (Young, 1989). In agro-forestry technologies, multipurpose tree species are commonly used. Different tree species have been used for agroforestry in the pilot areas. Seedlings of various species including fruits, indigenous and exotic have been raised and distributed. Examples of successful agroforestry practices have been observed in Kalemela sub-catchment, whereby farmers grow papaws, mangos, avocado, grevillea and eucalyptus trees in their fields in addition to annual crops like maize. Fruits were reported to find ready market in the nearby tourist hotels. One pawpaw sells at 200-300 Tanzania shillings. Thus depending on the number of trees, papaws can be a good source of income to the farmer.

- *Promotion of indigenous knowledge* (*in-situ conservation*): This has been achieved through in-situ conservation e.g. *Ngitiri* (see Figure 5.3) whereby vegetation is preserved and used for woodlot and rangeland improvement.

Figure 5.4. A traditional woodlot (*Ngitiri*) in Magu District

This practise has essentially involved putting of land under fallow in order to encourage natural regeneration of trees, grasses and shrubs. *Ngitiri (*Sukuma language*)* is an example of in-situ conservation being promoted in the pilot areas.

- *Promoting conservation tillage*: Soil tillage is one of the most important conservation tillage, which creates favourable soil structure for plant growth. Several practices or systems of conservative tillage include zero or no tillage, minimum tillage, disc hallowing, chisel ploughing, and breaking hardpan. In the pilot areas e.g. Kalemela, animal driven implements known as sub-soiler and Magoye ripper brought from Babati District, in Arusha Region were introduced. These implements have done some ameliorative measure for developed soil crusts and compaction by raindrops and hardpan due to nature of particular soils e.g. hardpan soils locally known as "*Itogolo*" (in Sukuma language). The practice has been impressive to farmers due to a number of benefits e.g. improvement in soil structure and increasing water infiltration therefore reduced soil erosion.

- *Ridging and tie-ridging farming*: Ridging is a land preparation practice of making earth bunds along the contours. Tie-ridges consist of covering the whole surface with closely

spaced ridges in two directions at right angles so that the ground is formed into a series of rectangular depressions. In Sumaland, contour ridging and bunding have been commonly used to control erosion and conserve water. The practice was implemented at Kalemela, Itumbili, Kuruya, Kwibuse, Lumeji, Mayega, Chamugasa and Shigala. Use of both open and tie ridges have been emphasized in the pilot areas as the best measures.

- *Gully control*: A gully is a deep, narrow channel cut into the soil by erosion. Gully control is essential because it reduces land for agriculture and cause damage to roads and other structures. Methods of gully control were implemented in Kalemela, Itumbili, Chamugasa, Kwibuse and Kuruya. Such methods include brushwood, planting of vegetation such as sisal and encouragement of natural regeneration. Similar methods have been earmarked for expansion areas such as Nyamatoke village in Bunda District.

- *Energy saving (fuel saving) stoves*: This measure was introduced in one of the pilot areas, that is, Kalemela, after the villagers had a study tour to Hifadhi Ardhi Shinyanga (HASHI Project), in Shinyanga Region. Over 150 energy-saving stoves were made by women group in the catchment as a way to curb deforestation and the problems of fuelwood in this area.

The number of villagers in the pilot areas that are involved in various SWC activities, as the interviewed during this assignment, is presented in Table 5.1. Experience has shown that farmers use a combination of SWC interventions due to complementary benefits attained from the various interventions. Many farmers are involved in SWC particularly in the Kalemela sub-catchment where the ISWC interventions started (see Figure 5.4). The total areas covered by the different SWC interventions in Kalemela sub-catchment are presented in Figure 5.5.

The findings show further that more farmers have been involved in contour bund farming, use of tie-ridges and ridges, and use of manure. The study in the catchments by Ngazi *et al.* (2004), has shown that contour farming can increase crop yields for over 80 percent especially in the second season after construction of contour bunds in the agricultural land. For example, average yield of maize and cotton planted in contours for three seasons were 1512 and 1964kg/ha respectively, while the average yield for maize and cotton planted without contour bunds in the same seasons were 437 and 889kg/ha respectively.

Table 5.1. Number of Respondents Undertaking SWC Activities in The Pilot Areas

Type of Intervention	Kalemela	Mwitore	Shigala	Total
Contours bunds	10	7	5	22
Tie-ridges and ridges	6	7	6	19
Application of farmyard and compost	8	0	2	10
Agroforestry	7	2	0	9
Conservative tillage	6	0	0	6
Proper land husbandry	1	0	4	5
Rainwater harvesting	4	0	0	4
Gully control	3	1	0	4
Woodlots	1	1	1	3
Energy saving stoves	3	0	0	3
Improved water source	0	3	0	3

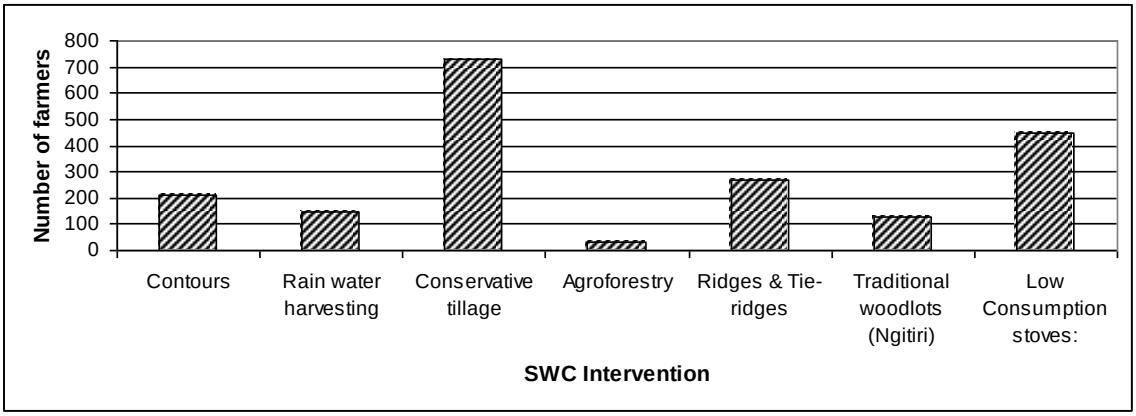

Figure 5.4. Number of farmers involved in various SWC interventions in the Kalemela sub-catchment. Source: Field report by Shalale, Juma - ISWC Field Team Leader, Kalemela & Shigala (01.08.2005).

More benefits have been realized by those farmers using a combination of measures. The integration of different practices of soil and water conservation has therefore been emphasized for sustainable land management. The use of conservative tillage was more pronounced in Kalemela sub-catchment possibly due to more prevalence of hardpans. Findings further show that very few farmers practice agroforestry (see Figure 5.6) possibly because of the longer time needed to realize the benefits from this intervention. More detailed socio-economic studies are needed to establish factors behind farmers' participation in different SWC interventions.

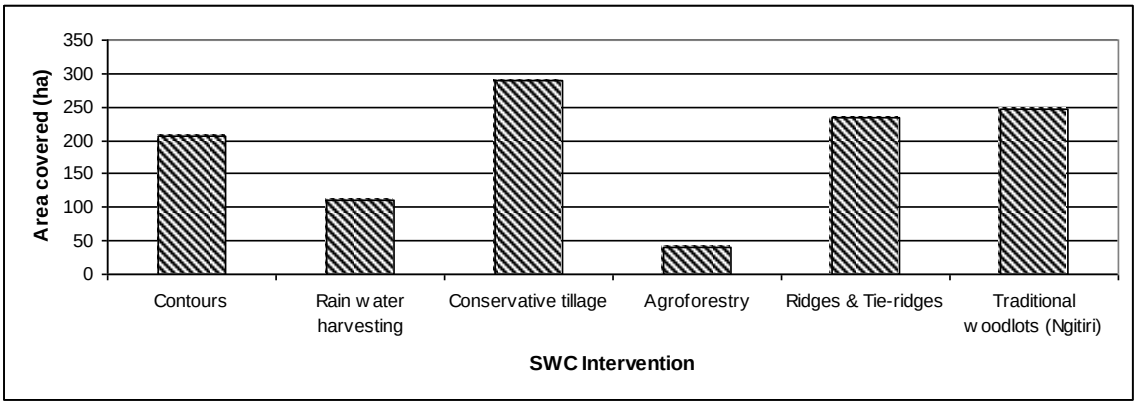

Figure 5.5. Areas covered by the different SWC interventions in Kalemela sub-catchment. Source: Field eport by Shalale, Juma - ISWC Field Team Leader, Kalemela & Shigala (01.08.2005).

A number of reasons were mentioned by farmers regarding the their involvement in various SWC activities, including: increased crop yields, moisture retention, improved soil fertility, improved incomes, environmental conservation, soil erosion control, food security, easy weeding and, firewood production. Many of the interviewed farmers in Kalemela sub-catchment and Mwitore catchments started the SWC activities between 1999 and 2000, with a few starting between 2001 and 2005. In Shigala most of the respondent farmers started SWC activities in 2003. The variations in the starting dates in the different catchments can be explained by the fact that the ISWC component activities expanded gradually with time, starting with Kalemela sub-catchment.

Most of the farmers (84%) practicing SWC measures reported to have acquired the conservation knowledge from LVEMP staff, whereas the remaining 14% learnt from Village catchment committees. This shows over dependence on LVEMP staff on training of issues related to soil and water conservation at village. The capacity of the catchment committees needs to be enhanced so that they are more able to motivate and train other villagers.

5.2.3 Information Documentation and Dissemination

Dissemination and documentation activities were also given due weight so as to sensitise stakeholders and for information sharing. The following are among the different products/materials prepared for disseminated to various stakeholders: One poster (400 copies) illustrating various appropriate soil and water conservation measures was produced and distributed in the village offices, various institutions and farmers' exhibitions. Still pictures were taken and kept in album for record; video cassettes were recorded covering various

events in relation to SWC; radio programmes were recorded for broadcasting; several articles were produced to provide information on activities of the component to various media; booklets and leaflets were also produced particularly for use by farmers.

An assessment of the education levels of villagers based on interviews with farmers in the pilot areas indicates that majority (87.5%) have attained primary education (Table 5.2). This implies that they are able to read the various publications distributed by the ISWC, particularly the Swahili versions. Among the farmers practicing SWC in the pilot areas, 71% reported to have received booklets and brochures from LVEMP. According to these respondents, the publications they had received were very useful in several aspects. They helped them to make reference during implementation of SWC measures; facilitated application of the different measures; acquiring new knowledge; and impart SWC knowledge to other farmers. Among those who not practicing SWC only one reported to have received LVEMP booklet but has not made use of it. It was noted however that very few copies of the publications are being distributed to the villages, not meeting the demand by the villagers, both practicing and not practicing SWC.

Table 5.2. Education Levels of Respondents in the ISWC Pilot Areas

Level of education	Kalemela		Mwitore		Shigala		Total
	SWC	No SWC	SWC	No SWC	SWC	No SWC	
No formal education	0	0	1	0	0	1	2
Primary education	11	2	9	3	8	2	35
Secondary education	2	0	0	1	0	0	3
Total	13	2	10	4	8	3	40

5.2.4 Monitoring Aspects

Monitoring of the ISWC component activities is normally undertaken from time to time, and accordingly various reports are produced quarterly and annually. The review missions used to be at interval of 12 months, however, currently is after every six months. The World Bank professionals are the ones undertaking these reviews. The outcome or recommendations from the review and monitoring exercises usually serve as inputs for future plans of ISWC component's activities. The studies undertaken in the area included: the benefits of soil and water conservation measures, the effects of soil and water conservation measures on crop production and field implementation of integrated soil and water conservation activities in terms of approaches, success and constraints.

During the mid-term review mission of the World Bank in 1999, for instance, some of the activities that could lead into some of the stipulated outputs were halted. Only prioritised activities that could be accomplished in two years time were carried forward. Important activities such as establishment of soil loss, sediment loads and nutrient transport in relation to land use types were dropped out. That led into refocusing the objectives as well as stipulated outputs. It was further learnt that the review mission consisted of only external experts. This calls for a need to rethink in terms of the team composition. For effective monitoring and feedback on project activities there is need to incorporate local experts who are conversant with the local environment in the lake basin when undertaking the monitoring activities.

6. CHALLENGES, LESSONS LEARNT AND KEY EMERGING ISSUES

During the implementation of Integrated Soil and Water conservation activities in the project pilot areas several lessons of experience have been learnt, some need to be adopted for the future expansion of these activities and some need to be improved in order to enhance the implementation and sustainability in future. The lessons learnt include the following:

6.1 Extent to which the ISWC Component has achieved its Original Objectives

The overall objective of this component is "to improve land use management of the lake catchments for sustainable utilization of the Lake Victoria basin resource for the benefit of communities surrounding the Lake Victoria." Specifically, this component enhanced collection of baseline data, training and strengthening of soil and water conservation measures and preparation of action plan on land use management.

A number of achievements have been made including survey and mapping of land use/cover and erosion hazard, training and strengthening of extension services on soil and water conservation measures and documentation and information dissemination in the pilot areas. A more elaborate discussion on the outputs realized since year 1997 to year 2005 has been presented in Section 5.2. The performance of the component based on selected key indicators is presented in Table 6.1.

Table 6.1: Performance of ISWC Component

Type of indicator	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
Number of farmers that adopted various SWC measures	-	-	54	108	438	530	462	434	139	2065
Length of contour bunds & ridges	-	-	8000	16,260	23,494	33,800	14,615	3,380	3400	102,949

Source: LVEMP (2005).

It can be seen from Table 6.1 that the number of farmers adopting various soil and water conservation measures has been increasing from year 1999 up to 2002. The length of contour bunds and ridges has been increasing during the same time period. However, participation of farmers in SWC was influenced by unfavourable climate, where farmers were reported not engage in SWC activities in seasons with drought. This explains the fluctuation in the number of farmers practicing SWC presented in Table 6.1. The agricultural crop yields have also been fluctuating, possibly because of unfavourable climatic conditions.

As far as the expansion of component activities is concerned, the component in collaboration with district councils has developed action plans for expanding component activities in three districts of Karagwe, Sengerema and Bunda and these action plans have been included in respective district agricultural development programs. Other hotspot areas to be considered for expansion of ISWC component activities are the districts where rivers raining water into Lake Victoria start e.g. Meatu, Bariadi and Maswa within the Simiyu Catchment and areas within Kagera River catchment.

Challenges met during implementation of ISWC activities

Although the Integrated Soil and Water Conservation (ISWC) Component has recorded considerable success in the pilot areas in terms of soil and water conservation measures, several issues and challenges need to be further addressed. These challenges need to be taken into consideration while planning implementation of SWC activities in subsequent phases of the project. The main challenges include:

- Land degradation is still a serious threat to the larger parts of Lake Victoria basin therefore land conservation measures need to be enhanced (e.g. in Nyamatoke village, in Bunda District). The multiple livelihood activities in the basin (e.g. farming, livestock keeping, mining, etc.) without proper land use and management plans are responsible the observable land degradation.
- Farming practices in the marginal lands of the Lake Victoria basin are still poor, for example cultivation along slopes without any SWC measure, and therefore there is an urgent need to come up with land management strategies that can be exploited in order to improve land use.
- Inadequate extension services need to promote and enhance soil and water conservation. The ISWC component has very few staff and normally depends on extension officers available in the villages/wards. This may affect the awareness creation efforts in the villages and the execution of the component activities because those extension officers have other obligations in their respective workplaces.
- Rural-urban migration particularly of youths reduces the availability of workforce necessary for implementation of SWC activities.

6.2 A Review of Approaches/Methodologies

During the implementation of Integrated Soil and Water Conservation (ISWC) activities in the pilot areas, two approaches have been used i.e. the individual approach and the catchment approach. Initially, the ISWC component staff started with the conventional approach i.e. by approaching individual farmers and training them on how to apply soil and water conservation measures. The Ministry of Agriculture previously had used this approach. This approach however, proved to be tedious and time consuming because it needs more time to advice a substantial number of stakeholders. This situation was aggravated by insufficient manpower/staff available with ISWC component as compared to the numbers of farmers to be reached in each of the pilot villages. The catchment approach was found to be more effective as compared to individual (conventional) approach (Peter *et al*., 2000).

On the basis of difficulties with the Individual Approach, the ISWC component staff decided to embark on participatory approaches whereby they worked closely together with communities and prepared an action plan on how to apply the soil and water conservation measures through catchment committees. Experience with catchment approach and the use of participatory rural appraisal (PRA) indicated that the involvement of stakeholders from the beginning of any developmental activity helped to clear doubts that could have otherwise arose if stakeholders were not fully involved from the beginning.

During the field visits in the Pilot Areas, it was leant that the process of establishing the catchment committees involved conducting village meetings whereby component's aims and objectives were clarified. During these meetings, the villagers were asked to nominate twelve persons to be included in the catchment committees based on agreed criteria such as a person should be hard working. The villagers then selected persons to form the catchment committee comprising of both males and females. The selected individuals (committee members) met thereafter to select leadership (comprising the Chairman, Secretary, etc.) The members of the committee were the ones trained by ISWC component staff through various means e.g. seminars and study tours and thereafter started employing the soil and water conservation measures in close collaboration with Village Agricultural Extension workers. The committee members serve as both contact farmers and are supposed to share their knowledge with other farmers.

The catchment approach appears to be more suitable taking into consideration of limitations of appropriate manpower to undertake SWC activities together with farmers. Community involvement in planning, implementation and evaluation of any land use management activities play a big role in ensuring the sense of ownership as well as sustainability of conservation activities. However, this approach needs integration with relevant institutions/staff working in the area e.g. village agricultural extension staff so that activities are carefully planned and there is harmonization of the different packages provided to farmers to avoid confusions and conflicts.

6.3 A Review of Soil and Water Conservation Interventions

The ISWC component used a variety of soil and water conservation measures in the pilot areas based on their suitability. These included construction of contour bunds, ridges and tie ridges, gully control measures, conservative tillage, rain water harvesting, agro-forestry technology, in-situ conservation, use of a combination of soil and water conservation practices, and energy saving stoves. Many farmers in the pilot areas have realized advantages after the introduction of soil and water conservation measures. Observations based on a study undertaken by Ngazi *et al*., (2004), indicate that highest seed cotton yield was observed in the third cropping season compared to other years (i.e. from 1999 – 2001). Furthermore, farmers that practised a combination of contours + conservative tillage + Farmyard manure had the highest seed cotton yields (1,891kg/ha) compared to other SWC measures practised (e.g. contours or tie-ridge alone). This implies that the effectiveness of soil and water conservation can therefore be achieved by using a combination of practices, hence ensuring sustained agricultural production and land management. Discussions with farmers during field visits confirmed the achievements so far realized by farmers using a combination of SWC measures.

6.4 Methodologies Adopted and Achievements

The ISWC component staff used a variety of methods and approaches so as to enhance farmers' participation in soil and water conservation measures. These ranged from participatory rural appraisal (PRA), study tours, training and demonstrations. PRA was used for instance; in for the first time in 1999 after realizing that there were doubts associated to stakeholders' engagement in the ISWC project activities. PRA was therefore used to understand experience of stakeholders, problems and specific/basic causes of their problem, in identifying strategies how to combat problems related to SWC, clarify on the aims of

LVEMP and train different village extension officers on PRA approach. The PRA methods helped in providing an understanding of the ISWC component objectives. Furthermore, this also facilitated the establishment of catchment committees in the pilot areas; and increased the responsibility of extension officers in activities related to ISWC component.

Another method used to enhance farmers' participation in SWC was the use of study tours. Initially study tours were conducted to areas practicing soil and water conservation measures. One was made to SCAPA Project in Arusha Region with the specific aim of sensitising people of Kalemela sub-catchment committee in order to facilitate their adoption of soil and water conservation practices. Another tour was made to HASHI Project in Shinyanga Region by stakeholders from Kalemela and Itumbili sub-catchments. The objective of this study tour was to learn and share experience with Shinyanga farmers under the HASHI Project. The idea was to learn through observations of activities being implemented such as agroforestry, tree nursery establishment, rangeland management, and soil and water conservation including improved methods of livestock management (zero grazing). Experience based on discussions with farmers indicate that this was among the major motivations for them to be interested in SWC, this was due to realization of the benefits in the visited areas. The current pilot areas could also be used as sites for these tours since those reflect the actual influence/impact of LVEMP's activities.

The catchment committee members for the villages in the pilot areas were also trained on how to use simple tools in construction of conservation structures e.g. A-Frame, Contour Triangle, and Line spirit level. These working tools were purchased and provided to the committee members so as to enhance accessibility of working tools to stakeholders. Also the committee members were trained on the use of sub-soilers and Magoye Ripper (both are animal driven implements). Among the constraints regarding the use of such tools is that of limited availability. These implements are not locally produced in the Lake Victoria basin and have to brought from Arusha. The lack of the availability of these implements in local markets hinders their effective utilisation. The few units (3 magoye rippers and 3 sub-soilers) provided by the project are not enough for all villagers, and waiting for someone's turn to come causes untimely land preparation during the season. This implies that LVEMP should ensure that technological innovations go hand in hand with the availability of necessary implements.

6.5 Impacts of the Project on Environment and Livelihoods

Impacts to Environment

The introduced soil and water conservation interventions indicated positive effect and many benefits on soil erosion control, increase in vegetation cover, improvement in aquifer recharge e.g. in Kwibuse and Kuruya villages, reclamation of gullies and many other environmental benefits. Discussion with farmers during this assignment revealed similar observations. Although there are indications of reduced sediment flows to the Lake more detailed studies are needed to ascertain the reduction in sediment load entering the lake from the catchment. Many farmers have adopted several measures (see Appendix 3 and 4) that are beneficial to the environment.

Community livelihoods

Many farmers in the pilot study areas have realized the many advantages associated with employment of soil and water conservation measures. In general the realized benefits which have direct implications on community livelihood include: increased crop yields and therefore improvement in food security, improved incomes through sales of agricultural crops and tree products, and easy access to fuelwood for domestic use and for burning of mud bricks for construction of modern houses. The obtained income has also helped some of the parents to afford education for their children. The improved incomes from the various activities have therefore contributed to livelihood security. These achievements are in line with the Tanzania's National Strategy for Growth and Reduction of Poverty - NSGRP or *MKUKUTA* in Swahili (URT, 2005). Additionally, farmers have become more innovative and enterprising through the use of various SWC measures e.g. by practising small scale irrigation for production of horticultural crops such as tomatoes and through sales of tree products.

The majority (94%) of interviewed farmers indicated that crop production has increased by double amount. This has been associated with reduced soil erosion, increase in soil fertility and moisture retention as result of SWC measures. Figure 6.1 shows the patterns of maize yield before and during the SWC interventions. It is evident from Figure 6.1 that in all the pilot villages maize yields more than doubled with the implementation of SWC interventions. Similar improvements in crop yields were reported by farmers for cotton (Figure 6.2). The two examples provided here demonstrate how beneficial the interventions have been in enhancing agricultural production. Similar patterns of crop performance were reported Ngazi

et al. (2004) for same as well as other crops. Even the interviewed farmers who did not involve themselves in SWC acknowledged that those practicing SWC obtain better crop yields compared to non-practitioners. The reported increases have an implication on the improvement of people's livelihoods. Further consultation with farmers during this assignment indicated that the livelihoods of people involved in SWC have improved in a number of ways. The list of ways in which livelihoods have improved is presented in Table 6.2 whereby improved household economy and food security appears to have scored high.

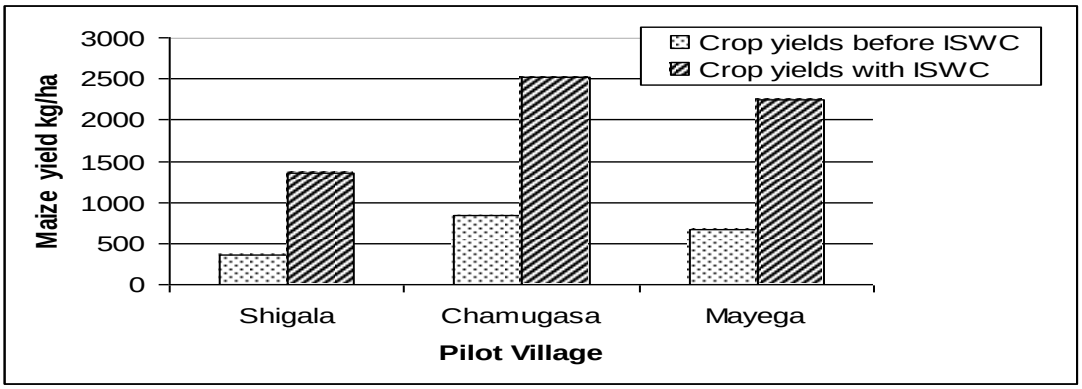

Figure 6.1. Maize yields in selected pilot villages before and during the SWC interventions

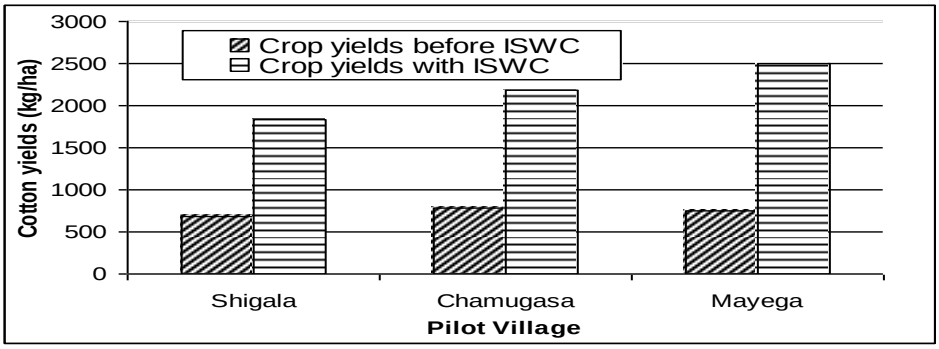

Figure 6.2. Cotton yields in selected pilot villages before and during the SWC interventions

Table 6.2. Impacts of SWC on Livelihoods of Local Communities in Pilot Areas

Type of livelihood improvement	Catchment			Total
	Kalemela	Mwitore	Shigala	
Improved household economy	7	6	5	18
Improved food security	2	6	1	9
Bought Buy livestock	3	0	4	7
Built modern houses	3	0	4	7
Sending children to school	0	0	2	2
Ability to purchase medicines and clothes	0	2	0	2
Increased availability of water for domestic and horticultural production	0	1	0	1

Stakeholders Expectations

Through engagement in soil and water conservation measures, some of the stakeholders' expectations appeared to have been met. During discussion with farmers, several explanations were provided regarding their involvement in SWC (see Section 5.2.2). Among the direct benefit from the project is the gain in knowledge on how to conserve soil and water, which was achieved through various means such as seminars, study tours, booklets, films etc. Indirectly, the improvement of household incomes and livelihoods through their own agricultural production has been a way of realizing the benefits of the project activities.

Among the unexpected benefits from ISWC component activities include diversification of livelihood activities. Through improvement of incomes, knowledge obtained during study tours, villagers in the pilot areas have been able to undertake a number of livelihood activities such as poultry business, establishing woodlots e.g. with various tree species such as fruits, engaging in horticultural activities. One farmer in Kalemela provides a good example with a well-managed horticultural orchard with fruit trees and agroforestry trees. The agricultural products from the farm particularly are reported to have an immediate market in the nearby Serengeti National Park. Similar experiences were reported for tomato growers also in Kalemela sub-catchment. The good profits accrued from horticultural crops have attracted some youths formerly practicing only fishing into agriculture. Another unexpected benefit from the implementation of soil and water conservation activities is the formation of credit gargets by farmers (locally known as *Ifogong'ho*).

6.6 Sustainability of Personnel, Equipment, Institutional Set up and Financial Issues

Discussions with ISWC component staff indicated that there are a number of limitations with regard to personnel, equipment, institutional set up and financial matters, which have affected smooth running of the project activities and therefore sustainability of the ISWC component activities as, explained below:

Personnel:

It was learnt that the current staff with ISWC component is inadequate to effectively undertake project activities The ISWC component served with 4 staff; this is not enough to cater for the area under LVEMP activities. The limited number of staff directly limits the expansion of project activities and monitoring of various activities related to soil and water conservations. There is therefore need to increase in number of staff and provide them

appropriate training as a way of enhancing capacity building in terms of quantity and quality of manpower. Limited personnel can also be overcome by strengthening collaboration with relevant stakeholders e.g. the agricultural extension staff operating in the project areas.

Equipment:

The current facilities available for the ISWC staff are inadequate. These facilities include one old computers, one vehicle and inadequate farm implements related to Soil and Water Conservation. There is lack of GIS facilities, and furthermore, the ISWC component has only One 4 wheel drive, pick-up single cabin to cater for component activities. All these factors limit smooth running of project activities.

Institutional set-up:

The current institutional set-up does not provide much room for integration of project activities with other LVEMP components. LVEMP lacks premises whereby the relevant components could have opportunity for close collaboration (the LVEMP component offices are scattered and located in the respective ministries). Thus LVEMP is urged to acquire its own premises that will house all the components together. In addition, there is need for establishing discussion forums such that relevant component staff could share experience and design their strategies together as an attempt for integrated efforts, unlike now where each component appears to work on its own. Another aspect related to institutional set up is the lack of documentation centre within the lake Zone. The current centre is with the Project Secretariat Offices based in Dar es Salaam. This limits sharing of information with other stakeholders operating in the lake zone.

Financial issues: Initially the project emphasis was on water quality and fisheries research. Thus other components, including the ISWC component, experienced inadequacy of funds to smoothly run their planned activities.

6.7 Problems Encountered in Implementation of Component Activities

Despite the fact that there was a good achievement towards the project objectives, several problems have been encountered and somewhat hampered the implementation of soil and water conservation during LVEMP I. These problems can be broadly categorised into three major groups, namely, farmer oriented, institutional/professional-oriented problems and problems associated with natural/physical factors.

a) Institutional/Professional-Oriented Problems

Unclear land tenure system:

Land tenure system could hinder the adoption of sound soil and water conservation practices by peasant farmers in the basin. Most of peasant farmers have no title deeds, lack of which deed could make it difficult for individuals and community to manage or to invest on land properly. Where a farmer does not have a permanent title to a piece of land, he/she may feel very reluctant to adopt soil and water conservation practices by fearing that her/his land could be appropriated by other people or institutions (Mang'ombe *et. al*., 2004; Ngazi *et. al*., 2004). Similarly in a situation that no clear land tenure systems exist there is a feeling among communities that the land is "a no man's land" and may not be motivating for individuals to engage in soil and water conservation. As such land degradation remains to be a concern of anybody though it causes negative consequences to every body (Peter *et. al*., 2000).

Many of the stakeholder institutions consulted as part of this exercise, indicated that lack of secure land tenure system can highly contribute to poor involvement is soil and water conservation practices. Hired or borrowed land does not get enough attention in terms of soil and water conservation, because the right of occupancy may not be guaranteed. It is thought that soil and water conservation activities are more properly applied in privately owned lands. Some stakeholders were of opinion that land tenure in the lake basin has limited influence on soil and water conservation, but what is important is to improve community participation in the conservation activities. Despite all these arguments there is need to sensitise farmers to acquire title deeds.

Inadequate Enforcement of By-laws and Acts

In the basin, environmental management by-laws and acts exist but are not effectively enforced. Inadequate enforcement of by-laws and acts on environmental conservation contribute very much on destruction of conservation structures as well as environmental degradation. For example, it has been reported that by-laws are not fully enforced to minimise conflicts between farmers and livestock owners (Ngazi *et. al*., 2004). Frequent reconstruction of destroyed structures due to livestock damage was the main problem experienced due to non-effectiveness of the present by-laws and acts. Consultations with stakeholders during this evaluation task also support the need to have appropriate by-laws and regulations that can be enforced to enhance ISWC at village level.

Limited Logistical Support

It is documented that there has been limited logistical support for the ISWC. Peter *et al* (2000:7) pointed out that the ISWC component lacks the resources needed for smooth implementation of the planned activities. These resources included limited budgets and transport facilities. The component has only one 4-wheel drive pick-up single cabin, catering for both agrochemical assessments and soil and water conservation. This is considered to limit smooth implementation of the component activities especially when both sub-components have to work out of station.

b) Farmer-Oriented Problems

Interviews with various institutions and farmers as part of this exercise established several constraints limiting farmers' involvement in soil and water conservation, as follows:

Labour Shortage

Undertaking of some of the interventions measures such as contours and tie ridges is cumbersome. There is limited use of machinery; farmers normally use hand hoes, and to a small extent ox-ploughs. This situation therefore limits the extent to which SWC can be applied in the fields. This is particularly the case for households with few members (see Table 6.3). Findings from interviewed farmers indicate that more than 50% of the respondents not practicing SWC had households with 1-5 members, implying that labour could be a constraint.

Table 6.3. Household sizes of the respondents in the ISWC pilot areas

Household sizes	Kalemela		Mwitore		Shigala		Total	
	SWC	No SWC	SWC	No SWC	SWC	No SWC	SWC	No SWC
1-5	3	1	5	3	1	1	9	5
6-10	6	1	4	1	4	2	14	4
11-15	3	0	1	0	3	0	7	0
Above 15	1	0	0	0	0	0	1	0
Total	13	2	10	4	8	3	31	9

Furthermore, experience from field surveys indicates that 44.4% of the respondents not practicing SWC are youths (20-30 years) and 33.3% are elderly people above 60 years (see Table 6.4). For the elderly their limited participation in SWC is more related to old age.

However, discussions with these elderly people indicated that they are interested in SWC. Majority of respondents practicing SWC (61.3%) were in the middle age group (31-50 years).

Table 6.4. Age range of respondent farmers

Age Range	Kalemela		Mwitore		Shigala		Total	
	SWC	No SWC	SWC	No SWC	SWC	No SWC	SWC	No SWC
20-30	1	1	2	3	3	0	5	4
31-40	3	1	4	1	2	0	9	2
41-50	6	0	2	0	2	0	10	0
51-60	2	0	1	0	0	0	3	0
Above 60	1	0	1	0	1	3	3	3
Total	13	2	10	4	8	3	31	9

Discussions with the District Agricultural Officials in Mwanza associated labour constraint to the rural-urban migration of the youths, leaving behind the elderly people who cannot afford making conservation structures like contour ridges. Further, these youths seem to be not adequately motivated to involve themselves in soil and water conservation, as they are mostly engaging themselves in other businesses such as fishing. Thus the ISWC component should put more efforts to sensitise youths so that they are involved more in SWC.

Land Shortage

There are contrasting arguments regarding the influence of land shortage in promoting or hindering soil and water conservation. On one hand, some of the stakeholders consulted during this assignment pointed out that land shortage promote more appropriate use of the available land to enhance its productivity. This argument is further supported by findings from other parts of East Africa (cf. Tiffen *et. al*., 1994). On the other hand land shortage is seen as one of the factors limiting farmers' involvement in SWC as mentioned by consulted stakeholders and some farmers. Experience from interviews with farmers during this exercise supports both arguments as shown in Table 6.5.

The findings indicate that nearly 50% of farmers practicing soil and water conservation have small farm sizes, ranging from 1-5 acres. Similarly the majority (67%) of farmers not practicing SWC have small farm sizes, ranging from 1-5 acres. Additionally, it was learnt that a large number of farmers particularly the youths, do not own land. The ones with large farms are within the old age group.

*Table 6.5. Farm sizes (acres) of the interviewed farmers in the ISWC pilot areas**

Farm sizes (acres)[1]	Kalemela		Mwitore		Shigala		Total	
	SWC	No SWC	SWC	No SWC	SWC	No SWC	SWC	No SWC
1-5	5	1	9	4	1	1	15	6
6-10	2	0	0	0	5	1	7	1
11-15	4	1	1	0	2	0	7	1
16-20	0	0	0	0	0	0	0	0
Above 20	2	0	0	0	0	1	2	1
Total	13	2	10	4	8	3	31	9

Lack of Financial Resources

It has been reported by the consulted institutions that construction of some of the soil conservation structures needs a lot of money, particularly where household labour is not sufficient. It has been noted further that many farmers are constrained in terms of financial resources for various SWC interventions. This was attributed to the lack of facilitation of farmers to get credits for agricultural activities. Farmers cannot buy implements to enable them construct contours, break hardpans and make tie-ridges and other conservation structures, etc. To enhance community participation in SWC farmers need to be further trained on farm economics so that they understand the usefulness of investing in these soil and water conservation measures. They should also be facilitated to establish saving and credit gargets (*ushirika wa kuweka na kukopa*). There should be a means of empowering farmers, for example through farmer groups.

Limited Knowledge and Skills

This is another problem mentioned by consulted stakeholders to hinder participation in soil and water conservation activities that are implemented by LVEMP. It was noted that very few organizations working in the basin deal with agricultural issues for the farmers. As such many farmers are not aware of the various soil and water conservation requirements in their lands. The numbers of village extension workers are very few and therefore it is difficult to reach all farmers.

Climate

Climate is considered by both farmers and consulted institutions as a major problem influencing the implementation of SWC activities. It is mainly attributed to inadequate and unreliable rainfall (and drought). Drought negatively influences activities such as tree

[1] *1 ha = 2.54 acres (i.e. 1acre = 0.4ha).

planting as one of the SWC measures. Drought spells also affect agricultural production. Peter *et. al*. (2000) reported that the ISWC pilot areas experienced long dry spell between1998 and 2000. Drought could be make realisation of expected benefits of SWC very difficult. Drought was mentioned as a major problem by majority (85%) of the respondent farmers.

Soils

There is a perception among the farmers and consulted institutions that majority of soils are very hard. The hardness of soils was attributed to compaction through use of same type of ox-ploughs, shallow cultivation and trampling by livestock. Interviews with farmers in Shigala and Chamugasa villages in Magu District indicated that as a result of ploughing using ox-ploughs and trampling by animals the soils have been compacted and need special equipment to break the hardpan to enhance water infiltration. This is particularly the case for the clayey soils. The problem is currently being addressed by the ISWC component through the introduction and use of magoye ripper and chisel plough (sub-soilers) to break the hard pan. However, due to the limited number of implements (3 magoye rippers and 3 sub-soilers) the employment of these techniques is so far not very efficient (limited).

6.8 Summary of key Lessons of Experience both Positive and Negative

i) Area Coverage:

The area covered by the ISWC in phase one can be considered sufficient for the pilot phase. However, in subsequent phases efforts should be made to take into consideration other catchments draining their waters into Lake Victoria. This would ensure that all communities in the lake basin get involved in conservation activities. Consequently this would increase the impact of the project.

ii) Approaches of the ISWC:

The ISWC component used two types of approaches in promoting soil and water conservation, which are the individual and catchment approaches. The individual approach proved to be tedious and time consuming because it needs to advice a large number of farmers. Thus the catchment approach has proved more success than individual approach. Also PRA has been an effective means before implementation of any activities. The approaches with more positive outcomes need to be enhanced.

iii) Methods and Achievements in Pilot Areas:

In the project areas there are notable achievements in terms of implementation of soil and water conservation interventions. More benefits have been realized with a combination of SWC measures. These achievements are reflected in the generally improved vegetation cover, healing of gullies and improved livelihoods of community members involved in project activities resulting from improved agricultural productivity.

iv) Stakeholders' participation in ISWC:

Farmers and various stakeholders are positive about the project. It appears that there is an increasing farmer involvement in soil and water conservation activities implemented by the ISWC component of LVEMP. However, not all community members in the pilot villages have adopted the various SWC interventions. This implies that more efforts are needed by the component to increase the awareness and the level of participation in soil and water conservation among community member. More efforts are need in awareness creation and information dissemination.

v) Constraints

- *Lack of Office Space and Equipments*: Among the problems affecting the smooth implementation of the project was that of logistical support, for example, limited budgets and transport facilities (the component has only one 4-wheel drive pick-up single cabin, catering for both agrochemical assessments and soil and water conservation). It appears that the one vehicle is not enough for the component activities. To ensure smooth running of component activities additional transport facilities should be considered. At the same time the office space seems to be rather squeezed. For convenience, and to ensure efficiency particularly in duties that require deskwork, more office space needs to be secured.

- *Personnel*: There is a need to increase the project personnel to cater for potential expansion of project activities and ensure monitoring of ongoing activities. This implies expansion of the capacity of staff both qualitatively and quantitatively for effective implementation of soil and water conservation measures.

vii) Component Coordination:

Currently two components (ISWC and Water Hyacinth) are coordinated by one person. It is the view of the consultant that for a more effective implementation of the LVEMP activities

each of the components should have it own coordinator, based on their areas of specialisation. This will ensure that all the challenges associated with all components are adequately addressed and represented in various project coordination forums. In addition, coordination of project activities is undertaken in Dar es Salaam where the headquarters are located. It is the view of the consultant, and perhaps the project staff in the field, that efficient implementation of the LVEMP activities would have been achieved if all coordination offices were located within the Lake Basin instead of Dar es Salaam.

viii) Collaboration with other institutions/components:

- *LVEMP and other institutions:*

There exists some collaboration between LVEMP's ISWC component and several institutions operating in the lake basin at various levels. However there is need to enhance this collaboration for effective implementation of SWC. Collaboration should be particularly enhanced with the district councils so that SWC issues are integrated in the district development plans for more effective participation of local governments and execution of the SWC measures.

- *ISWC and other LVEMP Components*

Whereas LVEMP has been envisaging for integrated catchment management approach, it has been realised that there has been inadequate collaboration between the different related LVEMP components. This could reduce the extent to which the impacts of interventions from the different components are felt. Some kind of collaboration for instance, has existed between ISWC and the Catchment Afforestation Component, more efforts are needed for planned integration of the ISWC and other land use related components such as the Catchment Afforestation component.

6.9 Possible Areas for Replication of Approaches and Interventions

Currently the integrated soil and water conservation (ISWC) component of LVEMP uses the Catchment Approach and thus focuses on few selected catchments. It is the opinion of various stakeholders consulted that ISWC activities need to be expanded to all the hotspot areas within the catchments. The baseline information for the lake basin (Yanda *et al*., 2001) should be used in setting priorities for the ISWC interventions. The land use maps and areas with soil erosion hazard in Simiyu Catchment for instance, are shown in Appendices 5 and 6.

- Within the Lake Zone, the ISWC should expand its activities to other districts where rivers draining water into Lake Victoria start e.g. in Meatu, Bariadi, Maswa and Ngara. In pilot districts, such as Magu, Bunda and Tarime, the project should expand to cover other villages where soil erosion is evident and soil erosion hazards can be foreseen. The ISWC component staffs have already developed action plans for expansion of component activities with district councils in Karagwe, Sengerema and Bunda. Expansion of ISWC component activities should consider even villages far from the Lake Victoria basin where human activities are likely to negatively affect the lake environment. Water flowing from such areas may cause siltation of the lake from the eroded materials being transported down slope. In addition, since various catchments contribute to the conditions of the lake in different ways, all catchments in the basin should be taken on board while addressing ISWC so as to ensure that similar project impacts are realised for the whole lake basin.
- For areas outside the Lake Victoria Zone, the project should consider Malagarasi River and its catchment area. Although Malagarasi River drains its waters into Lake Tanganyika, it has its tributaries in Geita (within Lake Victoria basin) where deforestation is serious due to mining activities. Other areas for expansion should include Rwanda and Burundi, which constitute the catchment areas for Kagera River.
- It is the opinion of some stakeholders that the LVEMP's ISWC activities should concentrate more on areas where they are currently operating, document the good practices, share information with other stakeholders and ensure the acquired experiences trickle down to the surrounding communities before they can expand activities in new areas. In this regard the established sites are expected to act as permanent training/learning centres of ISWC activities.
- Monitoring should be undertaken continuously to track the performance of different conservation of activities so as to guide implementation of SWC, and where necessary facilitate change of conservation strategies. It is suggested that for a more effective monitoring, the monitoring missions of LVEMP should in addition to the World Bank, consist of relevant local experts conversant with the Tanzania's situation and environmental management needs and priorities in the lake basin.

6.10 Areas that need Applied Research

There are several issues that need applied research as identified by consulted stakeholder institutions and farmers. They include the following: Water harvesting/Irrigation; Agroforestry/cover crops; Agricultural inputs; Assessment of soil resources, Farming systems and alternative energy sources.

Water harvesting/Irrigation

- Research is needed on how to enhance agricultural production under smallholder irrigation and SWC interventions.
- Research on sustainable rainwater harvesting techniques that ensure ecosystem balance and minimises water use conflicts (e.g. to facilitate irrigation schemes, large and small scale). Other projects working in the lake basin, e.g. Mara-FIP introduced a macro-catchment water harvesting technology that can be used for irrigation by small-scale farmers in Buswahili and Chirorwe villages in Musoma Rural District (see Figure 6.3). There is however a need to assess the impacts of such irrigation, for example, in terms of health and environmental aspects. Experience from Buswahili village indicate that as result of water harvesting structures there are plenty of mosquitoes that find breeding grounds in the impounded water. Also people complained of rampant bilharzias as a result of spending much time in the irrigation water. Further to ensure that the water retaining structures do not silt up, there is need to also conserve the catchment areas where the harvested water comes from.

Figure 6.3. Paddy fields under irrigation using macro-catchment water harvesting technology.

Agroforestry/cover crops

- Development of appropriate agro-forestry techniques in catchments with rivers draining water into the Lake Victoria.
- Evaluation of the relevance of already approved technologies such as improved fallows, rotational woodlot system and mixed intercropping. This aspect should include determination of appropriate tree species (multipurpose) that can be used in agroforestry and other related soil conservation measures.
- Assessment of the effect of different tree species, leguminous plants, and cover crops in improving the improving soil fertility, through nitrogen fixation and/or organic matter deposition. Studies should also be undertaken to determine the level of organic matter under different soil and water conservation interventions.

Agricultural inputs

- Use of improved seeds adapted to the semiarid and other agro-ecological conditions of the lake basin
- Research on use of agrochemical, including fertilizers, herbicides and pesticides, and the best ways to manage them.

Assessment of soil and water resources

- Research to determine rates of soil erosion and nutrient depletion in different farming systems, and soil load in the water systems.
- Assessment of aquifer recharge as influenced by SWC interventions e.g. through determining length of water flow in seasonal rivers.

Farming systems

- Research on best ways to integrate crop farming, livestock keeping and soil conservation.
- Research to assess the suitability/performance of different crops under different soil and water conservation measure.

Research on farming systems could be undertaken in close collaboration with the Ukiriguru Agricultural Research Institute.

Indigenous knowledge

- Identification and documentation of indigenous knowledge related to soil and water conservation in the Lake Victoria basin.

Livelihood issues

- Research on alternative sources of energy so as to reduce dependence on wood fuel and manure.
- Research on implications of livelihood patterns of local communities as influenced by SWC intervention e.g. shifts from fishing to agriculture.
- Rural-urban migration and influence on adoption of SWC interventions in the lake zone.

7. CONCLUSIONS

In this assignment various aspects related to the implementation of the Soil and Water Conservation Component of LVEMP has been examined. This has involved examination of the entire process/approaches, achievements, challenges and problems that have been encountered during the implementation process. Generally it can be concluded that the component has considerably achieved it objectives with notable levels of success. Detailed conclusions are grouped into four key categories, namely, the technical dimensions, the human dimensions, economic dimensions, and natural resources dimensions. This has been done so as to capture how holistic ISWC has been.

Technical Dimensions:

- The ISWC component has addressed issues related to soil and water conservation, in farmlands of selected pilot areas through the various SWC interventions. The combination of diverse set of interventions (such as contour ridging, tie-ridging, water harvesting, tree planting, etc.) has increased the possibilities for realising the intended objectives i.e. controlling soil erosion and improving land management. Thus technically, it can be concluded that the project has been a success story in soil and water conservation and its activities and approaches are worth replicating in other areas.
- However, ISWC component had pilot areas in parts of catchments close to the lake, and did not consider areas where rivers draining into the lake starts. Thus the entire catchments should be considered so that activities taking place in watersheds in the beginning of rivers through to the outlet into the lake can be addressed.
- Currently the activities of the ISWC seem to have been more concentrated in the semiarid parts of the lake basin, mainly in the south-eastern parts of the lake. The project should consider all the various agro-ecological zones that characterise the Lake Victoria basin so that at the end of the project a wide conservation experience can be drawn from all the agroecological zones within catchments.

Human Dimensions

- An important consideration in resource management interventions is the impacts on livelihoods of local people. It can be concluded that in the pilot areas the soil and water conservation activities have to a great extent improved the people's livelihood through increased agricultural productivity where soil conservation measures have

been applied. Improved livelihood through increased agricultural production and household economies is in line with the Tanzania's National Strategy for Growth and Reduction of Poverty (NSGRP).

- While the ISWC component has been successful in introducing new techniques for soil and water conservation, for example tree planting, use of Magoye rippers and sub-soilers to break hardpans, relevance of indigenous knowledge practices on natural resource management, both positive and negative, should be considered. The positive ones, such as the traditional woodlots (*Ngitiri*) should further be promoted.
- It has been seen that land ownership and land tenure aspects are often critical in conservation of resources, as they influence community participation in the various conservation interventions. Sensitisation of farmers to acquire land title deeds should also be undertaken.

Economic Dimensions

- Many people in the lake basin lack the financial resource to invest in soil and water conservation interventions, some of which being labour and time consuming. The only way to ensure that communities allocate their resource into conservation would be to ensure that they understand the economics of conservation. Evaluation of the economic benefits of various ISWC interventions need to be undertaken in a participatory way, e.g. using PRAs to engage farmers so that they understand the economics associated with conservations activities.
- Communities in pilot sites seem to be over dependent on the project on certain aspects such as the implements used to break the hard pans (*magoye* rippers and sub-soilers). To ensure sustainability of the interventions they should be encouraged and motivated to cover on their own part, the capital investments needed for implementing conservation measures.

Natural Resource Dimensions

- The ISWC component has shown a great impetus in the rehabilitation of degraded lands particularly in the farmlands. However, for such an integrated programme, and for more efficient ecosystems management even non-agricultural lands would need to be considered.

8. WAY FORWARD AND RECOMMENDATIONS FOR FUTURE

As a way forward towards addressing and/or solving some of the constraints associated with soil and water conservation in the Lake Victoria basin need to be considered. These include the following:

- To sustain the ISWC component activities there is need to ensure elevation of this sub-component to a full component; this should go together with increase in necessary facilities/equipment such as GIS unit, allocation of adequate funds and timely disbursement of fund to ensure smooth running of its intended activities and expansion of intervention to other areas.
- To enhance the sustainability of the lake environment people should be made to realise and feel that the lake basin is their own, and for their own benefits. This is an aspect of behavioural change among the local communities. This aspect needs more sensitisation and increased community participation in soil and water conservation activities. Sensitization should be a continuous process to all relevant stakeholders.
- The integrated resource management approach has not been adequately used in LVEMP I. LVEMP should ensure that collaboration and integration is enhanced among components e.g. ISWC and Catchment Afforestation; and between LVEMP and governmental and non-governmental organizations. Linkage mechanisms with various institutions/components need to be established e.g. through discussion forums to ensure harmonisation of strategies and management plans.
- There is need to ensure that each district in the lake basin has elaborate land use plans that promote conservation of the lake environment and livelihood of local communities. Development activities need to be guided by land use plans such that suitable arable lands with high agricultural potential, for example are not used for settlement or urbanisation.
- Regarding soil fertility problems, an integrated soil fertility management approach should be used, for example through use of farmyard manure, agroforestry and cover crops to promote natural soil fertility regeneration. A new approach of Integrated Plant Nutrient Management (IPNM) could be adopted.
- Regarding soil erosion associated with high livestock numbers; LVEMP in collaboration with villagers and other stakeholders could in a participatory way consider interventions such as reducing livestock number in areas were signs of

severe erosion are evident. Lessons learnt from one of the soil and water conservation project, the HADO (Hifadhi Ardhi Dodoma) could be useful.

- To address the problem of lack of staff, it is recommended that LVEMP recruits more field staff to work with farmers on integrated soil and water conservation. Farmers' field schools approach could also help in awareness creation by using farmers as trainers. ISWC component staff should also ensure more collaboration with other institutions/organizations (both government and NGOs) to complement efforts and avoid duplication of activities.
- Component Coordination - Currently two components (ISWC and Water Hyacinth) are coordinated by one person. It is recommended that for a more effective implementation of the LVEMP activities each of the components should have it own coordinator, based on their specific areas of specialisation.
- Concerning the land tenure issue, LVEMP could assist in awareness creation in relation to importance of having title deeds and the associated procedures.
- LVEMP should ensure that continuous monitoring of its activities is undertaken as a way of getting feedback on the impact of project's activities. The review missions should consist of both World Bank and relevant local experts.
- LVEMP should consider establishing a documentation centre in the lake zone so as to enhance sharing of project information and experiences with other stakeholders operating within the lake basin.
- Development of exit strategy plan need to be introduced early enough during planning and the implementation of the project activities, rather than at the end of the Project Phase. This will ensure sustainability and smooth handover of project activities at the end of project.

9. ACKNOWLEDGEMENT

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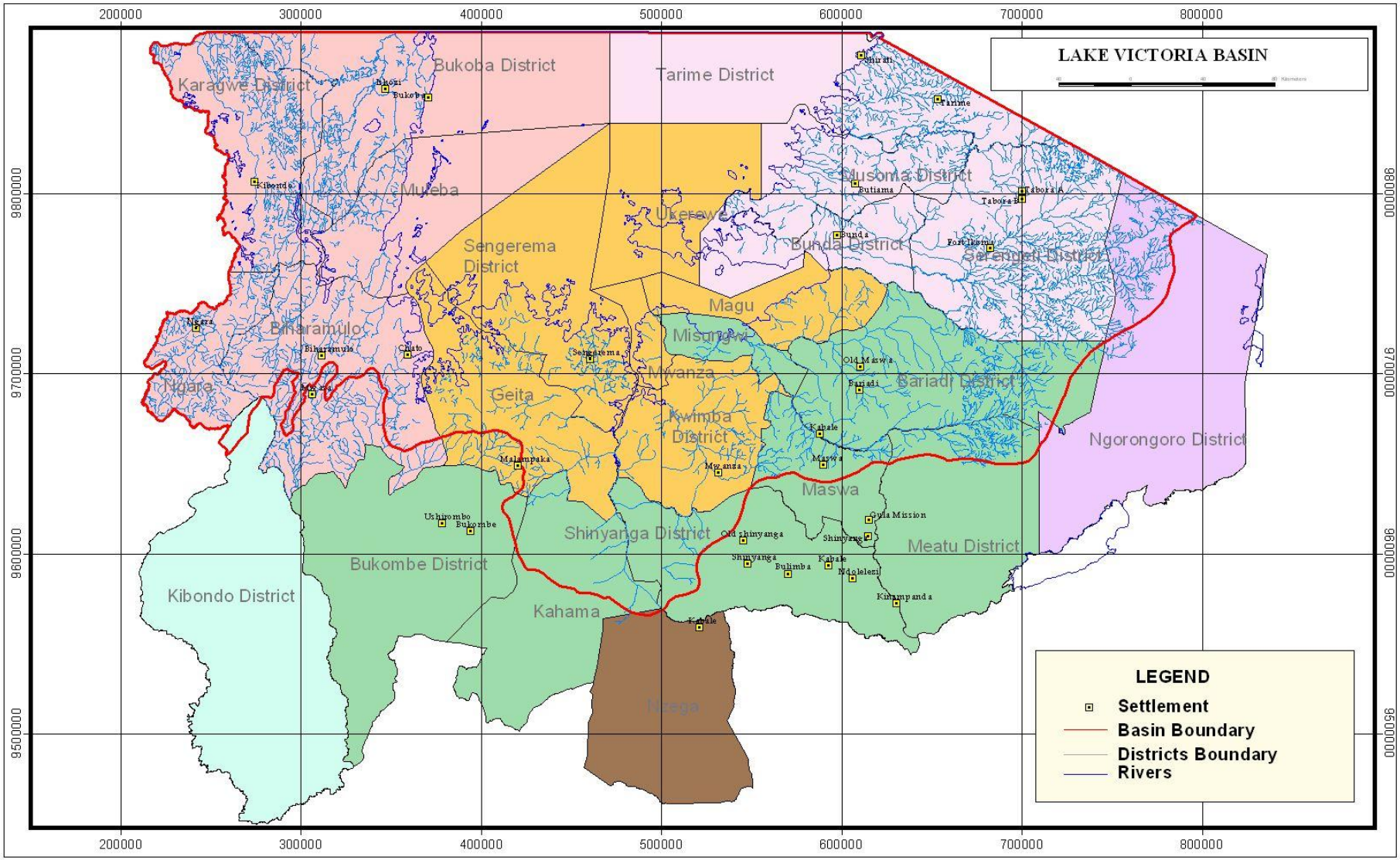
APPENDICES

Appendix 1: Districts Covered by the Lake Victoria Basin, Tanzania. (Source, Yanda et al., 2001)



Appendix 2: Action Plan for the LVEMP ISWC Consultancy

Activity	Timeframe (dates)	Duration (days)	Location
Consultation with Project secretariat	17th June 2005	1	Dar es Salaam
Inception workshop	18th June	1	Mwanza
Literature review / Discussions with ISWC Component Staff	19-26 June	8	Dar es Salaam /Mwanza
Literature review/ Preparation of research tools	27th June - 4th July	8	Dar es Salaam
Interviews with Key informants, Field visits in Pilot areas with ISWC Component staff	5th July – 14th July	10	Mwanza & Mara
Data Compilation and Report Writing	15-20th July	6	Dar es Salaam
Production of Draft Report (First Draft)	21-27th July	7	Dar es Salaam
Consultations with Lead Consultant/ISWC Component Staff/Field Visits	28th July-3rd August	7	Mwanza/Mara
Production of Country Report/Preparation for Presentation	4th –10th August	7	Dar es Salaam
National Workshop	11th 12th August	2	Mwanza
Revision of draft final report	13th 26th August	24	DSM/Mwanza
Regional meeting to harmonise and produce regional component report	29-31st August	3	Jinja, Uganda
Total		**84**	

Appendix 3: Number of farmers practicing SWC measures in the Simiyu Catchment

CONSERVATION MEASURES, NUMBER OF FARMERS AND AREA CONSERVED IN KALEMELA & SHIGALA

NUMBER OF FARMERS IN SWC

No.	CONSERVATION MEASURES	YEAR/SEASON (Shigala Ward Started 2002/2003)					
		1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
1	Contours	54	22	27	38	46	22
2	Rain water harvesting	2	6	13	30	35	60
3	Conservative tillage	4	9	39	176	204	300
4	Agroforestry	2	3	4	4	8	10
5	Ridges & Tie-ridges	19	21	23	53	70	80
6	Traditional woodlots (Ngitiri)	4	9	11	14	40	50
7	Agrochemical assessment (IPM)	10	30	100	400	700	500
8	Nursery tree planting	54	22	27	38	46	22
9	Low Consumption stoves:	0	63	90	190	105	0
9a	Low Consumption stoves -Chamugasa	0	63	90	150	40	0
9b	Low Consumption stoves -Mayega	0	0	0	40	65	0
10	Total length of contour bunds and ridges constructed (m)	8000	16260	23494	33800	14615	13380

AREA CONSERVED - UNDER SWC

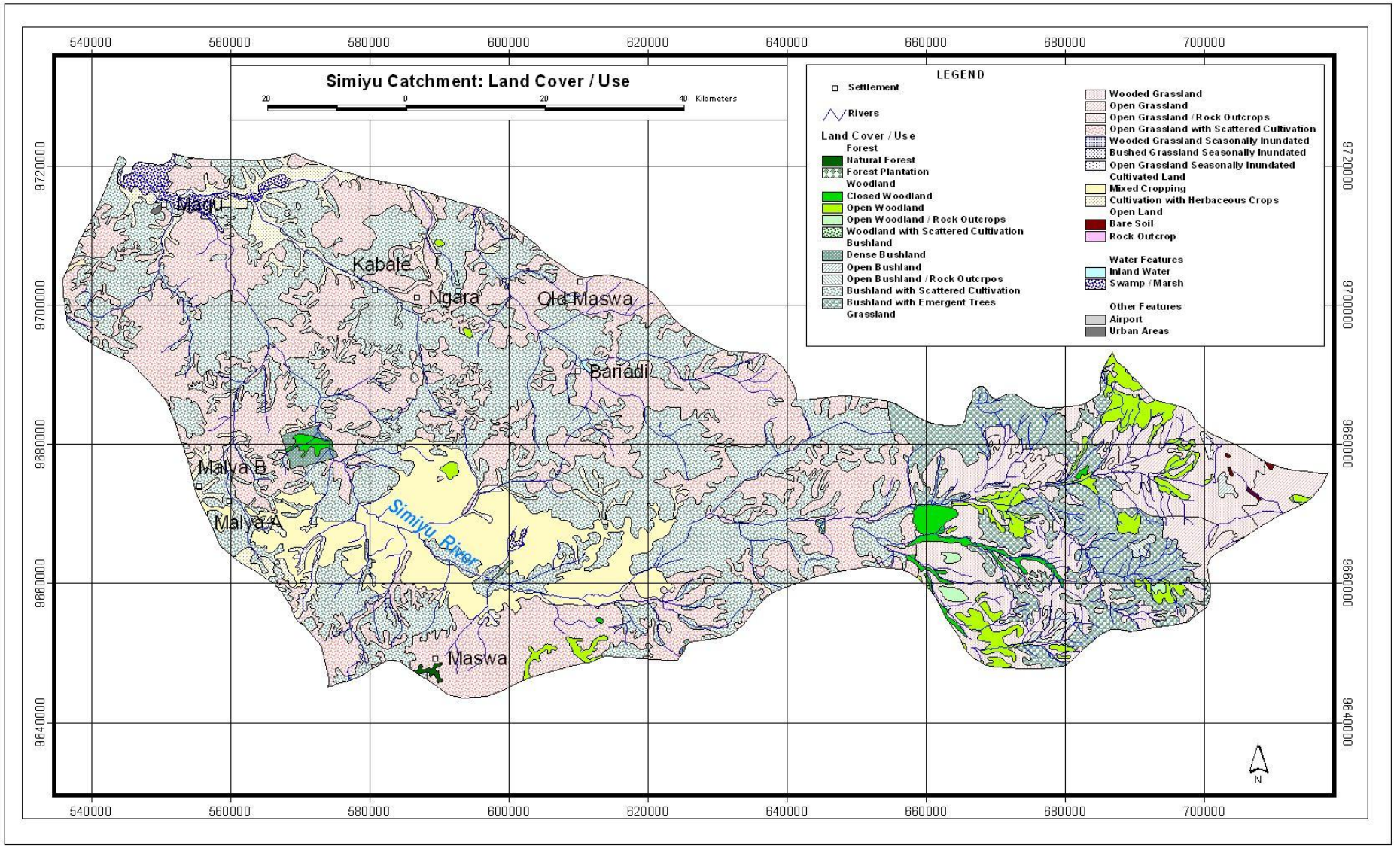
No.	CONSERVATION MEASURES	YEAR/SEASON (Shigala Ward Started 2002/03)					
		1999/0	2000/01	2001/02	2002/03	2003/04	2004/05
1	Contours	34,4	31,8	35,2	40,2	47,5	17,5
2	Rain water harvesting	2,6	7,4	8,8	22,3	24,5	45,6
3	Conservative tillage	2,4	6,4	11,8	70,4	78,5	120
4	Agroforestry	4	5,5	6,5	6,5	7,5	9,5
5	Ridges & Tie-ridges	11,6	12,6	30	45,5	60	75,5
6	Traditional woodlots (Ngitiri)	5,6	15,5	29,8	52	63,5	80,5
7	Agrochemical assessment (IPM)	15	35	65,5	165,6	205,7	162,4
8	Nursery tree planting	34,4	31,8	41,7	50,5	58,5	35,2
	NB: Shigala Ward Started in 2002/2003						
	Source: Report by Shalale, Juma (2005 Aug 01). ISWC Field Team Leader, Kalemela & Shigala						
No	**Pilot Villages in Kalemela/Shigala**	**Households**					
1	Chamugasa	815					
2	Mayega	450					
3	Shigala	705					
4	Nyamatembe	315					
5	Lwange	202					
6	Ihayabuyaga	430					
	Total	**2917**					
	NB: an average household = 5 members						

Appendix 4: Number of farmers practicing SWC measures in the Simiyu Catchment

Conservation measure	Farmers adopted (Numbers)	Area Covered (ha.)	Length (m.)	Remarks
Ridges and tie ridge	86	62	N/A	Used in cassava and sweet potatoes
Contour bunds	24	34	8764	Commonly used in cereals
Gully control	12	N/A	1822	Reclaimed gullies
Cover crops	2	1.8		Wild legumes used
Mulching	6	4		Used in vegetable growing
F.Y.M. application	8	14		Used in vegetable gardens
Improvement of existing traditional springs (in Kuruya)		1		Under catchment committee of Kuruya Village

N.B.
Most farmers have applied more than one soil and water conservation measures.

Appendix 5: L**and Use/Cover in the Simiyu Catchment**



Appendix 6: Soil Erosion Hazards in the Simiyu Catchment